# Tri-Party Repo Pricing

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### December 10, 2014

## Abstract

Taking advantage of the recently available N-MFP reports filed by U.S. money market funds to the SEC, we construct a complete sample of tri-party repo transactions between MMFs and dealer banks from November 2010 to August 2013. The data is unique in that it contains security-level collateral information, which enables us to investigate the key determinants of tri-party repo haircuts and spreads, focusing in particular on their sensitivity to collateral quality. We find a large heterogeneity in haircuts among repos collateralized with equities and corporate bonds. Surprisingly, this large heterogeneity is mainly driven by differences across various money market fund families. Controlling for the fund family, most fund families assign uniform haircuts to all of their repos, with the exception of a few fund families that calibrate haircuts to the quality of the collateral and the identities of the dealers. Repo spreads are mainly determined by the maturity, and are in general insensitive to the collateral and counter-party risks. By contrast, repos backed by treasuries are priced homogeneously, with little variations in both haircuts and spreads, regardless of the fund family.

# 1 Introduction

Repurchase agreements (repos) are considered to be the largest and most important short-term financing channel for a variety of financial institutions.[1] For such institutions, loss of access to the repo market could be a big threat to their survival. Moreover, there exists a strong spillover effect due to the highly interconnected structure of the repo market. As we experienced in the recent financial crisis, disruptions in the repo market could impose a great risk to the broad financial sector, adversely affecting not only repo market participants but also other investors holding similar assets.

Despite of its systemic importance, the repo market remains opaque to most market participants, including even the regulators. Because no official data on repos exists, questions as basic as the overall size of the market are difficult to answer, let alone finding information on the market structures and repo pricing. Lack of a data is the main reason why empirical work lags behind theoretical discussions in this field.

We construct a novel data set of tri-party repos from the recently available N-MFP reports on US money market funds' investment portfolios.[2] Tri-party repos are an important form of secured short-term investment vehicle for money market funds. Money market funds are always cash lenders, and dealer banks are always cash borrowers in our sample. Collectively, money market funds account for around one-third of the total lending in the tri-party repo market. Through their monthly N-MFP filings, we construct a large sample of tri-party repo transactions with key information on counter-parties, amount, haircut, rate, tenor and collateral.

The main advantage of our tri-party repo data is that it contains details of the underlying collateral including descriptions of issuer names, coupons, maturity date, and type of securities. Using these descriptions, we hand match the collateral to the relevant databases,

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[1]Because repo deals are transacted over-the-counter, the exact size of the aggregate repo volume is unknown. Several papers, including Gorton and Metrick (2010), Gorton and Metrick (2012) and FRBNY (2010), estimate the total outstanding amount to be approximately $10 trillion in the U.S. before the 2008 financial crisis.

[2]Money market funds are generally regarded as safe investments because they can only hold short-term, high-quality and high-liquidity assets. The weakness of industry was revealed by the Reserve Primary Fund's "breaking the buck" event in September 2008 and the subsequent "run" on money market funds. In the wake of the crisis, money market funds in the U.S. went through a major regulatory reform in 2010, which aims to strengthen the regulatory requirement for the industry and better protect investors. Under the new rules, all US money market funds need to disclose the details of their portfolio holdings with the SEC, through the monthly N-MFP filings.

security by security. The entire collateral pool covers a wide range of asset classes, but we focus on matching equities, corporate bonds and treasuries because these securities have standard and publicly accessible databases. For equity securities, we match them to the Compustat/CRSP database according to the issuer names, and then use the historical returns to calculate volatiles and obtain other firm-level information such as size and industries. For corporate bonds, we match them to the Mergent FISD database by a combination of issuer names, maturity dates and coupons. For the matched bonds, we obtain the bond-level characteristics including ratings, issuance size, age and maturities. Similarly, for treasury securities, we match them to the CRSP database according to the maturity dates and coupons.

To our best knowledge, this level of granular collateral information has never been collected and studied before. There are only two existing data sets on tri-party repos that we are aware of.[3] The one most related to ours is discussed in Krishnamurthy, Nagel, and Orlov (2012), which is based on the top 20 money market fund families' old quarterly filings (N-CSR, N-CSRS and N-Q) before the 2010 reform. Since money market funds disclose only the general asset classes in their quarterly filings, their repo data doesn't have the collateral information at the security level. Our data is more comprehensive in the sense that we know exactly what securities are posted as collateral, which is especially important for studying repos in the same asset class. Our data also has the advantage of covering repo transactions of all US money market funds, totaling 751 individual funds from 160 fund families. In addition, the repo transactions in our data are observed on more frequent monthly intervals.

Another set of tri-party repo data is collected by the Federal Reserve Bank of New York, as discussed in Copeland, Martin, and Walker (2014). Their data contains aggregate quantity numbers across lender-dealer pairs for various collateral asset classes. Due to the aggregation, transaction-level repo information is lost. Hence the authors focus on the average haircuts faced by each dealer in each collateral asset class. Our data has the advantage of having the transaction-level repo deals. As a result, we are able to exam variations in haircuts at a much finer level.

Taking advantage of our unique data, we focus in this paper on investigating the determinants of prices, namely, haircuts and interest rates, in the tri-party repo market. We are particularly interested in how theoretically important factors, such as the collateral charac-

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[3]In Gorton and Metrick (2010) and Gorton and Metrick (2012), the authors use a private repo data provided by an anonymous dealer. However, the data covers only bilateral repos in the interbank market, different from the tri-party repos that we discuss in this paper.

teristics, counter-party risk, lending relationship and credit market conditions, affect repo prices. Our repo data is ideal for these pricing tests because the collateral details make it possible for us to quantify the risk of the collateral pool and thereby exam the repo price sensitivity with regards to the collateral. Moreover, we are able to control the collateral characteristics when examining the relations between repo prices and other potential factors such as counter-party risk. This is important because results would be inconclusive if the collateral characteristics are left uncontrolled. That is, it would be difficult to rule out the possibility that the observed relations are simply driven by variations in the collateral itself. The two databases discussed above offer valuable insights of the tri-party repo market during the crisis period, especially on the time-series variations of the average levels of margins and the total volume of financing. However, without collateral details, they are not suitable for our tests on the pricing of tri-party repos.

We find that there is a large heterogeneity in the haircuts of repos backed by private-sector securities. For equity repos, the standard deviation of haircuts is 1.96%; the interdecile range is 3.92%. In corporate bond repos, the variations in haircuts are similarly large. The standard deviation and interdecile range are 1.40% and 4.00%, respectively. Moreover, these variations are mainly cross-sectional variations as our sample period covers a relatively calm post-crisis period that has no significant time-series movement in haircuts.[4] The large cross-sectional dispersions in haircuts are contrary to the conventional wisdom that tri-party repo is "general collateral" financing, meaning that a repo lender cares about the asset class of the posted collateral, but not about the specific securities. In fact, we find that only repos backed by treasury securities show little variations in haircuts. The ninth decile of haircuts for treasury repos is 2.05%, only slightly higher than the first decile of 2.00%.

Surprisingly, the large heterogeneity in the haircuts of equity and corporate bond repos is mainly driven by differences across various money market fund families. Money market funds from the same fund family behave very similarly, while different fund families adopt different strategies on haircuts. In the equity repo market, Fidelity funds assign haircuts mainly according to the dealers' identities, regardless of the underlying equity securities. By contrast, Bank of America funds calibrate the haircuts to the risk of the securities in the collateral pool, including volatility, collateral concentration, and the portion of financial firms. However, most of the fund families fix their haircuts to a constant level, regardless

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[4]According to tri-party repo statistics compiled by SIFMA, the median haircuts for all asset categories remain very stable during our sample period from November 2010 to August 2013.

of the dealers and the collateral. In short, a money market fund family plays a key role in the designation of haircuts. For this reason, in our next analysis on haircuts, we exam the relations with collateral and counter-parties separately for each fund family.

Fidelity, the top lender in the equity repos, assigns repo haircuts mainly according to the identities of the counter-parties. Between its top two borrowers, J.P. Morgan and Credit Suisse, Fidelity demands higher haircuts for repos borrowed by J.P. Morgan. This differential treatment in haircuts can not be explained by the collateral quality or the counter-party default risk, as the equity collateral posted by J.P. Morgan and Credit Suisse have similar risk, and J.P. Morgan's average five-year CDS spreads are actually approximately 30 bps lower than Credit Suisse's during our sample period. Within Fidelity's repos with a given dealer, haircuts don't seem to differentiate the risk profile of the underlying equity securities. Hence, Fidelity's haircut strategy is mainly dealer-specific, and not sensitive to the underlying collateral.

By contrast, Bank of America's equity repo haircuts are strongly associated with the risk profile of the underlying collateral securities. It demands higher haircuts for collateral concentrated in a few stocks, collateral with higher volatility and collateral with high percentage of financial firms. That is, Bank of America demands higher haircuts for riskier equity collateral pools. This strategy is consistent with the theory that haircut serves as a safety check in the event that a counter-party defaults and hence should be calibrated to the risk of the underlying securities. However, aside from Bank of America, other money market funds' repo haircuts are not sensitive to the underlying equity securities.

Most of the fund families fix their haircuts to a constant level, regardless of the securities in the collateral pool and the dealer's identity. State Street and Goldman Sachs money market funds ask for an 8% haircut, Morgan Stanley and Charles Schwab money market funds ask for 5%, and Federated Investment money market funds asks for a mere 2%. Moreover, the different levels of haircuts can not be justified by the differences in the risk of the posted collateral. The equity collateral accepted by the five fund families show similar daily price volatility, within a narrow range from 1.18% to 1.77%. Nor can the differences in haircuts be explained by different counter-parties. In fact, State Street, Morgan Stanley and Federated Investment all lend to Credit Suisse in our sample of equity repos. Therefore, we think the levels of haircuts, to a certain extent, reflect different fund families' risk tolerance. Federated Investment is the most aggressive one, by charging haircuts at approximately two times

the daily price volatility of the underlying equity securities. Other fund families are more conservative and set a larger buffer in haircuts.

The pricing in the corporate bond repo market is similar. The cross-sectional variations in the haircuts are mainly driven by different money market fund families. Controlling for the fund family, repo haircuts are generally not sensitive to the underlying corporate bonds' characteristics including bond ratings. The only outlier is Morgan Stanley, which charges approximately one percentage point higher haircuts for investment grade than non-investment grade corporate bonds. However, a majority of the fund families' haircuts are not sensitive to any bond characteristics. This type of money market funds includes those of Goldman Sachs and Federated Investment, which also appears as lenders in our sample of equity repos.[5] It is worth pointing out that the majority of the lenders in our sample do accept both investment grade and non-investment grade bonds as collateral. Nevertheless, they treat the collateral bonds equally in terms of haircuts.

Our results that most corporate bond repo haircuts show no relationship with bond ratings are surprising, since it is commonly believed that the market participants in the tri-party repo market view investment grade and non-investment grade corporate bonds as separate asset categories, and hence demand different haircuts. For example, according to the tri-party repo statistics compiled by SIFMA, the median haircut is 5% for investment grade corporate bonds, versus 8% for non-investment grade corporate bonds. The differences may arise from the fact that Fidelity, a large lender in the corporate bond repo market, is not included in our sample of corporate bond repos.[6] Nevertheless, our results do point out that many fund families in the corporate bond repo market don't differentiate bond ratings and assign equal haircuts for both investment grade and non-investment grade bonds.

In both equity and corporate bond repos, we don't find a relationship between haircuts and dealers' credit risk, measured as the dealers' five-year CDS spreads. In the example of Fidelity's equity repo deals, the differentiated treatment in haircuts across the two dealers, J.P. Morgan and Credit Suisse, can not be explained by the default risk of the counter-parties, at least not by their credit spreads. It seems to indicate that money market funds make a

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[5]Bank of America also has little variations in its its haircuts, but this is because a majority of its corporate bond repos are investment-grade.

[6]This is because Fidelity's money market funds do not report the maturity information in their N-MFP filings and therefore we can't match its corporate bond securities. Fidelity accounts for 73% of the total corporate bond repos, according to our subsample of repos based on money market funds' quarterly filings from September 2009 to September 2010.

simple yes or no decision about whether transact with a dealer, and do not use the haircut as a tool to manage the counter-party risk. This is in line with the findings in Copeland, Martin, and Walker (2014), in which the authors find that the tri-party repo lenders reduced funding volume precipitously, not by raising haircuts, when they faced heightened dealer s' default risk during the 2008 financial crisis.

The overall picture painted by the evidence is that haircuts are mainly set by the money market fund families in the tri-party repo market. The fund family determines, for all of their affiliated money market funds, the levels of haircuts and the group of creditworthy dealers with which to transact.[7] There is a great deal of heterogeneity in the haircuts set by different money market fund families. These money market fund families often lend to the same dealers that post similar securities as collateral, yet they choose to set very different haircuts. Once we fix the family-dealer pair, we observe that repo haircuts in general depend only on the asset class and are not sensitive to the individual securities. This flat haircut policy within fund families can probably be explained by the fact that many money market funds rely on the clearing banks to manage collateral, and may not have systems granular enough to evaluate the risk of individual securities. Dealers, as cash borrowers, behave more like price-takers in the tri-party repo market. Their main goal seems to be securing stable funding with money market funds by establishing long-term relationships, rather than shopping around different money market funds for the most lenient haircuts.

In the hindsight, our results may seem obvious and straight-forward. After all, the informaation of the individual collateral securities does not matter for the repos by a given pair of money market fund family and dealer. However, without matching collateral, it would be difficult to pin down the driving factors for the heterogeneity in the haircuts of repos in the same asset class. The haircut variations across money market fund families could potentially because various fund families accept collateral with different qualities. Similarly, for a given money market fund family, various haircuts applied to different dealers could just

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[7]Technically speaking, it should be the fund managers who set the haircut policy for the money market funds in the same family. Without this information, we rely on the investment adviser company's information provided by the money market funds to determine its affiliation. The investment adviser companies belong to different subsidiaries of a holding company are manually grouped together. The only exception is BlackRock Fund Advisors (Sec no. 801-22609). This investment company was formerly known as Barclays Global Fund, and became a subsidiary of Blackrock after Barclays sold its fund unit to Blackrock in 2009. Our data shows that this fund family behaves very differently from other Blackrock money market funds, probably due to historical inheritance of Barclays' trading desks. As a result, we treat this fund family as a stand-alone Barclays money market fund family.

because dealers provide different securities as collateral. Controlling for the collateral at the security level, our results tease out potential biases related to the collateral risk and point out clearly that it is the money market fund families that drive the dispersions in haircuts.

Next, we study the interest rate on tri-party repos. Repo rates have not been the focus in previous studies. However, as tri-party repos are essentially collateralized loans, an important pricing variable, in addition to haircuts, is the interest rates charged on these loans. Because interest rates on tri-party repos follow short-term interest rates closely, our main interest rate variable is repo spread, calculated as the repo interest rate in excess of the Fed Fund Rate. Repo spreads are determined mainly by the maturity, which is not surprising given the term structure effect of interest rates. For one standard deviation increase in maturity, or 29 business days in the case of equity repos, spreads increase by 4.9 bps. For one standard deviation increase in maturity, or 15 business days in the case of corporate bond repos, spreads increase by 3.8 bps. The maturity effect is not significant for treasury repos, as the vast majority of treasury repos are over-night.

We find no substitution effect between spreads and haircuts for repos in the same asset class. In fact, repo spreads, very much akin to repo haircuts, are not sensitive to most collateral characteristics or counter-party risk. None of the stock characteristics can explain the repo spreads in the equity repo market. In the corporate bond repo market, only corporate bond ratings are marginally related to repo spreads. In addition, a majority of the fund families don't tie interest rates on repo deals to the credit risk of the counter-parties. We find only one fund family, Charles Schwab, that charges higher interest rates in the equity repo market for dealers with higher credit spreads.

In contrast to the wide dispersions in haircuts and spreads among equity and corporate bond repos, the pricing on repos backed by treasuries is much more homogeneous. The treasury repo market is very much like a mundane funding utility, where the haircuts are unanimously set at 2% and the repo rates follow closely with the Fed Fund Rates. Neither haircuts nor spreads is sensitive to the securities in the collateral pool or the counter-party.

The two papers that are most related to ours are Krishnamurthy, Nagel, and Orlov (2012) and Copeland, Martin, and Walker (2014). Both papers focus on the behavior of the tri-party repo market during the financial crisis. They find that the levels of haircuts and the funding amount were relatively stable compared with disruptions in the bilateral dealer-to-dealer or dealer-to-hedge fund repo market, as documented in Gorton and Metrick (2010) and Gorton

and Metrick (2012). Our paper differs by focusing on the cross-sectional variations among tri-party repos, taking advantage of our unique deal-level data with collateral information. In addition, while previous research document interesting facts during the crisis period, our results help shed light on how the repo market works under the normal market conditions post crisis.

Our observation of large cross-sectional variations in risky repos' haircuts is consistent with Copeland, Martin, and Walker (2014). We contribute to the literature by identifying that the main determinant in haircuts is the money market fund family. The demands made by different fund families, not by dealers, cause the wide variations in haircuts. In fact, a dealer could face very different haircuts if it borrows from multiple fund families, even with similar collateral.

Our work is also related to the literature on money market funds. McCabe (2010) and Kacperczyk and Schnabl (2013) find large cross-section differences in money market fund risk profiles, and riskier funds suffered more from runs of investors during the financial crisis. In their results, the fund family, whether or not associated with a financial conglomerates, plays an important role in money market funds' risk-taking behaviors. Chernenko and Sunderam (2012) and Strahan and Tanyeri (2012) find that the lending between MMFs and dealer banks is more relationship-based, rather than arm's-length lending which can be easily replaced. We focus on MMFs' pricing policies on tri-party repos, an important component of money market funds' portfolios. We find that the pricing is largely determined by the money market fund family. Money market funds from different fund families show various attitudes toward collateral risk, counter-party risk and credit market conditions.

The rest of paper is organized as follows. Section 2 describes how we collect the repo data and match individual securities. Section 3 investigates the determinants of haircuts and spreads for repos backed by equities. Section 4 studies the corporate bond repos, and Section 5 studies the treasury repos. Section 6 concludes the paper. In the Appendices, we discuss the tri-party repo market before November 2010.

# 2    Data

## 2.1    The Repo Market

A repurchase agreement is a spot sale of securities coupled with a forward agreement to buy back the same securities in the future with interest. In its simplest form, a repurchase

agreement is very much like a short-term collateralized loan between two counter-parties, a lender who originally buys the securities and a borrower who uses its securities for a secured cash loan. There are two major types of repos used in the market: specified delivery and tri-party.[8] In a specified delivery repo (also commonly referred as bilateral repo), the collateral and cash are exchanged directly between two counter-parties at both the onset and the maturity of the repo transaction. Tri-party repos use a third-party bank, which acts as both custodian and clearing agent for the two counter-parties in a repo deal. The third-party bank, either JP Morgan Chase or Bank of New York Mellon in the U.S., handles all the administrations of the repo transaction, including receiving and delivering securities and cash, marking securities to market and etc. Counter-party risk is alleviated in tri-party repos because both collateral and cash are deposited at the third-party's account. The clearing service provided by the third-party bank also helps minimize the operational burden of the lenders, especially those who don't have personnel or techniques to handle complicated collateral posted by the borrowers.

Besides differences in the settlement arrangement, these two forms of repos also have very different clienteles. Bilateral repos are commonly used by dealers to provide funding for their hedge fund clients, or among dealers to redistribute cash and certain securities. In a tri-party repo market, dealers are usually cash borrowers and lenders are cash-rich investors such as money market funds (MMFs), security lenders, and sovereign funds. In the U.S., the tri-party repo market has grown fast in recent years. It is believed to dominate the use of bilateral repos now, accounting for around two-thirds of the total repo market. Most importantly, unlike bilateral repos whose transaction details are seldom disclosed to the public, recently available filings of money market funds provide an unique opportunity for us to study the tri-party repo market empirically.

## 2.2 Repo Data After November 2010

Our main data source of tri-party repurchase agreements comes from monthly portfolio holdings of money market funds since November 2010. Following the Securities and Exchange Commission's money market fund reforms in 2010, money market funds in the U.S. are required to file their detailed portfolio information, at individual security level, with the SEC

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[8]Another type of repo is held in custody, wherein the collateralized securities are hold by the borrower throughout the duration of the repo trade. Due to the high counter-party risk faced by the lender, this form of repos have became relatively rare.

through N-MFP forms. The N-MFP forms reflect money market funds' portfolio holdings on the last business day of each month and must be filed before the fifth business day in the following month. The SEC then makes the monthly N-MFP data public accessible after a 60-day delay.

We download all N-MFP forms available on the SEC's EDGAR website for the period from November 2010 to August 2013, and then parse these text files to extract information for each item on these forms.[9] Our main interest is money market funds' repurchase agreement holdings.[10] Compared with other reports filed by money market funds before the 2010 reforms, the new N-MFP forms require money market funds to report not only basic information about their repurchase agreements such as the counter-party dealer, maturity, amount, haircut and interest rate, but also all securities details underlying each repurchase agreement. For each underlying security, money market funds need to report the security type, name of the issuer, maturity date, coupon or yield, principal amount and collateral value. However, to avoid extremely lengthy filings, the SEC does allow a fund to simply select the range for the number of the securities from one of the four categories: 51-100, 101-500, 501-1000 or more than 1000, instead of listing all the collateral security by security.[11] Some money market funds adopt this practice, but we do observe many cases in our data where money market funds routinely report the full list of collateral even when the number of the underlying securities exceeds 50.

## 2.3 Collateral Matching

Although money market funds describe the underlying securities in the N-MFP forms, the descriptions required by the SEC doesn't include security identifiers such as CUSIP or ISIN

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[9]Our data covers 751 money market funds in the U.S., sponsored by 160 unique fund families. Among all the money market funds, there are 310 prime funds, 131 government/agency funds, 80 treasury funds, 121 single state funds and 109 tax-exempt funds.

[10]The SEC requires money market funds to categorize their investment into 16 groups in the item 31 of the N-MFP form: Treasury Debt Government Agency Debt, Variable Rate Demand Note Other Municipal Debt, Financial Company Commercial Paper, Asset Backed Commercial Paper, Other Commercial Paper Certificate of Deposit, Structured Investment Vehicle Note Other Note, Treasury Repurchase Agreement, Government Agency Repurchase Agreement Other Repurchase Agreement, Insurance Company Funding Agreement Investment Company, or Other Instrument. If the investment type falls into repurchase agreements, i.e., Treasury Repurchase Agreement, Government Agency Repurchase Agreement and Other Repurchase Agreement, the details of the underlying securities backing the repurchase agreements need to be reported in the item 32.

[11]For more information on the SEC's regulation of the N-MFP filings, readers can check the SEC's website http://www.sec.gov/divisions/investment/guidance/formn-mfpqa.htm.

codes. Thus the biggest challenge in our data processing procedure is to identify these securities through the text descriptions provided by money market funds. We focus on matching securities in three asset classes (equities, corporate bonds and treasuries) because only these securities have standard and public accessible databases on their issuance and historical prices. Our collateral matching procedure follows two major steps: First, we select potential equity, corporate bond and treasury collateral according to the security type, maturity and coupon. Next, we manually compare the collateral names listed on the N-MFP forms with the official names in the corresponding database to get individual collateral's unique CUSIP number.

After we find collateral's CUSIP codes, we consider a repurchase agreement as an equity repo if more than 85% of its collateral can be identified as equities. Similarly, if more than 85% of collateral can be matched as corporate bonds, we classify this repurchase agreement as a corporate bond repo.[12] For a treasury repurchase agreement, we require all of its collateral matched to treasury securities to eliminate noises in pricing due to non-treasury securities in the collateral pool. This bottom-up approach allows us to determine a repurchase agreement's collateral asset class by examining its collateral pool security by security, more accurate than previous studies which rely on self-reported repo types.

In total, we have 3,348 equity repos, 1,289 corporate bond repos and 15,421 treasury repos with matched collateral information from November 2010 to August 2013. Compared with the statistics compiled by SIFMA, our matched sample accounts for 14% to 20% of the tri-party repos in these three asset classes during our sample period.[13] The smaller sample size is due to several reasons. First, our sample covers only tri-party repos by U.S. money market funds, which accounts for approximately one third of the entire tri-party repo market. Other repo lenders, such as security lenders, are not in our sample of tri-party repos. Second, not all securities have descriptions clear enough to establish an unique match. In equities, we are able to match 97% in terms of collateral numbers and 49% in terms of collateral value. Most of the unmatched cases are because money market funds only disclose the collateral

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[12]Since mixed collateral categories are common in tri-party repurchase agreements, especially for non-government repos, we choose the 85% threshold to balance between the sample size and the potential biases caused by collateral in different asset classes. Our main results do remain robust if we choose higher thresholds such as 90% or 100%.

[13]According to the statistics released by SIFMA, the total tri-party repo market has 243,624 deals with total repo value of $59 trillion for the 34 months from November 2010 to August 2013. Among which, the total numbers of equity, corporate bond and treasury repos are 17054, 9014 and 85268, respectively.

numbers, not the specific issues. The matching is much noisier in corporate bonds because more information is needed to pin down an unique bond. As a result, some repos are not in our sample because we couldn't match the securities in the collateral pool. In addition, we consider only repos consisting primarily of securities from the same asset class and discard those with mixed categories. Nevertheless, we do have a reasonable large repo sample with collateral from various asset classes. More importantly, the matched securities cover a great range of securities in each asset class. The granular security-by-security collateral information enables us to examine the determinants of repo prices at a much finer scale than general asset categories.

### Matching Equity Collateral

We consider a security a potential equity collateral if the item 32.d in the N-MFP form contains the following keywords: COMMON, STOCK, STOCK OR ETF, EQUITY, SHARES, DEPOSITORY RECEIPT and GLOBAL DEPOSITORY RECEIPT. In addition, the collateral needs to have null coupon (item 32.c) and maturity date (item 32.b). We then manually match the collateral names (item 32.a) with the official company names in the CRSP/Compustat database. When there are multiple matches, we choose the parent company's CUSIP and assign it to the collateral security.

For the 34 months from November 2010 to August 2013, we classify 80,354 collateral as potential equity securities, with total collateral value around $505 billion. Among which, we are able to match 78,114 collateral with a total worth of $340 billion. In other words, we are able to match more than 97% of the collateral by their names, but the remaining 3% carry a significant value of $165 billion. The reason is that there are 273 unmatched cases where the issuer names fall into the categories of 51-100, 101-500, 501-1000 or more than 1000. These cases represent $156 billion, or 96% of the value of the unmatched securities. The remaining 1,967 unmatched cases, worth $9 billion in value, are only a tiny fraction of our pool of potential equity securities. Overall, our procedure does a good job in matching collateral by their descriptions in the N-MFP forms.

### Matching Corporate Bonds

For potential corporate bond collateral, we check whether the item 32.d in the N-MFP form contain the following keywords: BOND, CBND, CORP, CORPORATE, OTHER NOTE and FIXED INCOME. To rule out non-corporate bonds, we also require that the issuer names

don't contain keywords such as TREASURY, MORTGAGE, FNMA, STRIP, TIPS and etc.[14] We then manually match the collateral name (item 32.a) with the official corporate bond issuer names in the Mergent FISD database. If we find a match in the issuer's name, we check the maturity date (item 32.b) and coupon (item 32.c) of all bonds issued by the issuer to see whether we can find an unique match. If there are multiple matched bonds, we choose the most recently issued bond. If there is no match, we relax the condition and match only on the maturity date as money market funds sometimes report null or bond yields for the bond coupon item (item 32.c) in the N-MFP forms. In addition, we exclude all convertible bonds.

For the period from November 2010 to August 2013, we classify 257,347 collateral as potential corporate bond securities, with total collateral value at approximately $824 billion. Among which, we are able to match 166,809 collateral with total collateral value of $329 billion. For the remaining 90,538 unmatched collateral, most of the cases are due to poor data quality, such as missing or null issuer names, maturity or coupons. For example, 30,408 of the unmatched corporate bond collateral are by Fidelity money market funds, all due to the reason that the maturity date information is missing in the original N-MFP forms. As a result, we don't have Fidelity money market funds' corporate bond repos in our matched sample even though Fidelity is a large lender in the corporate bond repo market.[15]

### Matching Treasury Bonds

For potential treasury bond collateral, we check whether the item 32.d in the N-MFP forms contains the following keywords: UNITED STATES, TREASURY, TREAS, NOTE, BILL, BOND, NTS, BDS and NOTY. In addition, we rule out collateral which have keywords suggesting the bonds are likely to be agency bonds, Strips, Tips, or corporate bonds. The collateral must also have valid coupon (item 32.c) and maturity date (item 32.b). We then search the CRSP Treasury database to find treasury securities with the exact same coupon

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[14]The full list of keywords include FNMS, FXMS, FGHF, FGPC, FMCC, FMHS, FMPC, FRPC, FNAR, FXAR, FGAR, FMPA, FRAR, FMAR, FNMA, GNMA, GMAC, MORTGAGE, ASSOCIATION for agency bonds; TINT, TPRN, PRIN, PMT, INT, STRIP, TRPX for treasury STRIPS; TIPS, INF, IX, USTIIN, USTIIB, TRIN, TRIB for treasury inflation protected bonds; TREASURY, UNITED STATES, TREAS, NOTE, BILL, NTS, BDS and NOTY for treasury bonds.

[15]An example is the filing of a Fidelity fund (EDGAR series id: S000004822) on June 2013. The fund has a $17 million corporate bond repo with BNP Paribas Securities Corp. However, the fund doesn't report the maturity date information for all the underlying bonds, even though it classifies all collateral as CORPORATE and reports their coupons correctly.

and maturity date. For collateral that can be matched, the matching is always unique as there exists no two treasury securities with the same coupons and maturity dates.

We are able to match 128,782 collateral, or 92% of the total 139,544 potential treasury collateral. In terms of collateral value, the matched collateral account for 89% of the total pool. Judging by the reported numbers for the item 32.c in the N-MFP forms, most of the unmatched cases are because money market funds report yields instead of coupons for the collateral. Since it is very common for multiple treasury securities to mature on the same date, we don't relax the criteria to match solely on the maturity date as it often gives multiple matches in the case of treasury collateral.

## 2.4  Repo Data Before November 2010

Since the N-MFP filings are implemented only after the 2010 reform, we rely on the annual (N-CSR), semi-annual (N-CSRS) and quarterly (N-Q) filings of money market funds to obtain the tri-party repo data before November 2010. In these reports, money market funds list the basic information for their repurchase agreement holdings such as the counter-party, amount, collateral value, haircut, interest rate and maturity date. However, they are not required to report the details of the underlying securities. Nevertheless, in many cases, money market funds do describe the collateral asset classes for their repo positions.

Unlike the standard text format used by N-MFP filings, the N-CSR, N-CSRS and N-Q filings don't have a standard format and some times not even in text files. Thus, most of the data have to be manually collected. We download the N-CSR, N-CSRS and N-Q filings for the top 50 prime funds, the top 25 agency funds and the top 25 treasury funds during the period from January 2005 to September 2010. The rank is determined by money market funds' average fund size from November 2010 to August 2013. Since money market funds from the same fund family occasionally file their reports in one form, we end up checking 129 unique money market funds, among which 102 funds have repurchase agreement holdings from January 2005 to September 2010.

In total, we collect 18,070 repo transactions with total repo value of approximately $7.8 trillion. Based on the collateral asset classes reported by the money market funds, we classify these repurchase agreements into the following categories: treasury, agency, equity, corporate bond and others. In the sample we collected, there are 5,012 treasury repos with total value of $2.4 trillion, 3,415 agency repos with a total value of $1.7 trillion, 567 equity repos with

a total value of \$156 billion and 1,873 corporate bond repos with a total value of \$409 billion. The rest are repurchase agreements with either no collateral asset class information, collateral with mixed asset classes, or collateral in other asset classes such as structural finance products, commercial papers, municipal bonds and etc.

## 2.5 Data Summary

### Time-Series Trend of the Tri-Party Repo Market

The growth of the tri-party repo market is illustrated as the time series plots in Figure 1. The solid lines aggregate the repo transactions of all U.S. money market funds from November 2010 to August 2013; the dotted lines aggregate the repos by a sub-sample of 102 large funds for which we manually collect the quarterly data from 2005 Q1 to 2010 Q3. Since money market funds' quarterly filings are usually reported at different calendar months, the total tri-party repo numbers and value before November 2010 are added up for every calendar quarter and reported at the quarterly frequency. As a comparison with the full sample, we also plot the sub-sample funds' monthly repo positions from November 2010 to August 2013. The 102 large funds in our sub-sample account for a majority of the total repo lending by money market funds, approximately 60% in numbers and 85% in value. Repos of the full sample and the sub-sample also show similar time-series trend after November 2010, suggesting that the 102 large funds are indeed a representative sub-sample of the money market fund lenders in the tri-party repo market.

Both the total number and the value of tri-party repos show a steady growth before 2008 Q1. Money market funds reduce their lending following the collapse of Bear Stearns and throughout the 2008 financial crisis, but the contraction is small and recovers quickly. At the last quarter of 2008, the worst period of the 2008 financial crisis, the total number of repo deals is 627, approximately 34 percentage points lower than one year ago in 2007. Though a big reduction in the number of deals, the total loan value shrinks only by \$57 billion to \$400 billion, a mere 12 percentage points decrease. One year later at 2009 Q4, the tri-party repo market bounces back to 1,033 deals of \$424 billion, similar to the pre-crisis levels. This observation is consistent with Krishnamurthy, Nagel, and Orlov (2012), in which the authors also document a relative moderate contraction of the tri-party repo market during the 2008 financial crisis.

After the financial crisis, the tri-party repo market continues to grow and peaks at the

end of 2012. The upward trend is then reversed in 2013, as the total deal value declines approximately 30% from the peak by the end of August 2013. According to the statistics complied by SIFMA, the entire tri-party repo market, including other lenders, such as security lenders and sovereign funds, has 7,792 repo deals with a value of $1,630 billion in August 2013. Therefore, our sample of repos by the U.S. money market funds, as a whole, represents approximately 30% of the total lending in the tri-party repo market.

**Cross-Sectional Variations in Pricing**

Table 1 summarizes the repo characteristics for the three classes of repos that we constructed using the matched methods discussed before. We divide the period from January 2005 to August 2013 into four intervals: pre-crisis period from 2005 Q1 to 2008 Q2, crisis period from 2008 Q3 to 2009 Q2, post-crisis period from 2009 Q3 to 2010 Q3 and the most recent period from November 2010 to August 2013. The cross-sectional distributions of haircuts and spreads are also graphically presented as time-series plots in Figure 2.

It is apparent that the levels of haircuts and spreads in the tri-party repo market depend very much on the underlying collateral's asset classes. At all times, including both crisis and non-crisis periods, the median haircuts and spreads for riskier equities and corporate bonds are always above safe treasuries.

More interestingly, repos backed by different asset classes exhibit different cross-sectional variations in haircuts and spreads . For the 3,348 equity repos during the period from November 2010 to August 2013, the first decile of haircuts is 5.00% and the ninth decile of haircuts is 8.92%. The interdecile range is a striking 3.92%. Considering the median haircut of 8.01%, this variation is not only large in magnitude but also important economically. Similarly, for the 1,289 corporate bond repos, the interdecile range is a significant 4.00%. Conversely, haircuts on treasury repos are much more homogenous. The interdecile range is only 0.05%. The trend is similar in repo spreads, as evident in the larger dispersions in the spreads of equity and corporate bond repos. In the following sessions, we investigate the main determinants of the cross-sectional variations in haircuts and spreads for risky equity and corporate bond repos, focusing on the monthly sample from November 2010 to August 2013 for which we have collateral information at the security level.

The size of the dispersions in haircuts and spreads also vary across time. We focus on the equity and the treasury repos, because dispersions in corporate bond repos may be driven by different rating categories. While treasury repos always have narrow dispersions in haircuts

throughout the sample period, the variations in the equity repo haircuts go through several phases. The inter-decile range in equity repos' haircuts is close to zero before the 2008 financial crisis, stays narrow during the crisis period, and only shows up largely post the crisis starting from the end of 2009. The time-series pattern appears to suggest that there is a structural shift in how the equity tri-party repo market sets haircuts post the financial crisis. Lastly, the dispersions in repos spreads peak around the time Lehman Brothers filed for bankruptcy, and have since returned to the pre-crisis levels post the financial crisis.

# 3   Equity Repos

In this section, we exam the pricing in the equity tri-party repo market. Equities, as a whole, constitute $90 billion in dollar value or approximately 5% of the total collateral posted in the tri-party repo market.[16] As a comparison, the average daily trading volume is around $40 billion for the New York Stock Exchange in 2013.[17] Therefore, equity tri-party repos, albeit only a fraction of the entire tri-party repo market, serve as an important channel for dealers to finance their securities holdings and meet their clients' trading needs in the stock market.

Our matched equity tri-party repo sample consists of 3348 deals between money market funds and dealer banks during the 34-month period from November 2010 to August 2013.[18] We start our analysis by examining the major market participants and the posted equity securities. Taking advantage of the security-level collateral information, we then focus on investigating whether the pricing in the tri-party repo market depends on the collateral quality and the counter-parties.

## 3.1   Major Market Players

It is clear that the equity tri-party repo market is highly concentrated, dominated by a few money market fund families and dealer banks. On the lender side, Fidelity is the largest player. Money market funds under the complex of Fidelity have 2,168 equity repo deals with a total amount of $179.6 billion, representing 62.8% of all the equity repo deals from

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[16]The numbers are based on the average tri-party repo market statistics from November 2010 to August 2013, provided by The Securities Industry and Financial Markets Association (SIFMA).

[17]The trading volume data of NYSE is provided by NYXDATA.

[18]During the same period, there are in total 17,054 equity tri-party repo deals, as estimated by SIFMA.

November 2010 to August 2013.[19] The second largest lender is Morgan Stanley. Two money market funds in the Morgan Stanley fund family have 254 equity repo deals with total amount of $42.6 billion.[20] Fidelity and Morgan Stanley, together, account for 77.8% of the total equity repos in our matched sample. The remaining five lenders are money market funds sponsored by Charles Schwab, Bank of America, Federated Investment, State Street and Goldman Sachs.

The picture is similarly concentrated on the borrower side. J.P. Morgan, as the largest borrower, has 1,151 repo deals with $122.3 billion in dollar value. J.P.Morgan borrowed from three MMF fund families, Fidelity, Morgan Stanley and Bank of America, but its major lender is Fidelity, with which it has 1,068 deals. The second largest borrower in our sample is Credit Suisse, which has 732 repo deals with a total value of $85.9 billion. Similar to J.P.Morgan, Credit Suisse's largest lender is also Fidelity, with which it has 465 deals. J.P. Morgan and Credit Suisse together represent 72.9% of the total borrowing of in our matched sample of equity tri-party repos. The remaining 13 dealers have 1,468 equity repo deals, but account for only 21.1% of the total borrowing. Among these 13 dealers, Deutsche Bank, Goldman Sachs and Mizuho Financial Group are the three dealers that borrow above $10 billion.

The lender-borrower relationship in the equity tri-party repo market is graphically presented as a map in the panel (a) of Figure 3. The two largest lenders, Fidelity and Morgan Stanley money market funds, lend to almost every dealer. Fidelity lends to 12 dealers; Morgan Stanley lends to 10 dealers. On the borrowers' side, large dealers borrow from both large and small money market fund families, while small dealers mainly borrow from the two largest money market fund families, i.e., Fidelity and Morgan Stanley.

## 3.2   Collateral Characteristics

The 3,348 equity tri-party repos are backed by 65,849 underlying collateral, among which we are able to identify 64,546 equity securities issued by 3,941 unique firms. The top 20 securities used as equity repo collateral are listed in Table 3. Most of these stocks are large company stocks, covering major industries such as manufacturing, technology, finance, and pharmaceutical etc.

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[19]In our sample, there are 42 unique money market funds sponsored by Fidelity, among which 11 funds have equity repo deals from November 2010 to August 2013.

[20]There are in total 20 unique money market funds in the fund family of Morgan Stanley.

For each equity tri-party repo, we calculate the percentage of collateral that can be matched as equities (matched), the number of collateral (#cols), the value-weighted number of collateral (#cols (vw) ), the value-weighted firm size (size), the volatility of a value-weighted portfolio of the underlying collateral (port vol), the value-weighted average volatility of the underlying collateral (avg vol), and the percentage of financial firms (fin). We have two volatility measures: the portfolio volatility and the average volatility. The first measure treats the collateral pool of a repo as a value weighted portfolio, weighted by the collateral value of individual securities. The portfolio volatility is the standard deviation of daily portfolio returns in the one-year window before the repo date. The second measure is the average volatility of the individual stocks, value weighted by the collateral value. Each individual stock's volatility is calculated using its daily returns in the same one-year window preceding the repo date. Therefore, the difference of the two volatility measures depends on the cross-correlations between the underlying securities in a repo's collateral pool. We are also interested in the percentage of financial firms because of potential wrong-way risk - collateral risk is adversely correlated with the credit quality of the counter-party, which is usually a dealer bank in our sample of tri-party repos.

The characteristics of the underlying securities are summarized in Table 4. It is apparent that most of the collateral for the equity repos in our sample is matched. Though the lower-bound is set at 85%, majority of the repos are fully matched. The average percentage of matched securities is close to 100%, with a tiny standard deviation of 0.01%. The equity collateral are usually large-capitalization firms. The average size is from 9.44 to 10.97, or $13 billion to $58 billion on a dollar basis. On average, 17% to 23% of the collateral are financial company stocks.

The most striking difference across various money market funds' equity collateral is in the collateral concentration. Collateral accepted by Fidelity money market funds have on average 7.17 securities, or 3.82 securities if taking into account the differences in collateral value. Similarly, State Street's repos have on average 21.35 number of securities, equivalent to 6.98 number of evenly-weighted securities. The collateral pools for the rest five money market funds' are much more diversified. The numbers of collateral range from 30.34 to 71.48 and the value-weighted numbers of securities range from 12.24 to 39.83. As a result of the more concentrated collateral, the average portfolio volatilities for the repos lent by Fidelity and State Street are the highest, 28.08% and 29.61%, respectively, while the rest

are from 18.70% to 22.05%.

## 3.3 Haircuts

The equity tri-party repo haircuts are largely determined at the money market fund family level. The haircut statistics reported in Table 2 show that money market funds in various fund families require drastically different haircuts for their equity tri-party repos. Fidelity, Bank of America, State Street and Goldman Sachs money market funds ask for haircuts around 8%; Morgan Stanley and Charles Schwab money market funds ask for 5%; Federated Investment money market funds ask for only 2%. In other words, the large heterogeneity in the equity repo haircuts is largely a result of the variations across different money market fund families.

Controlling for the fund family, haircuts are much more homogeneous. For the largest lender, i.e., Fidelity money market funds, the standard deviation of haircuts is only 0.89% and the inter-quartile range is 0.82%. Both numbers are significantly smaller than the standard deviation and inter-quartile range of the full sample. Similarly, for the second largest lender, Morgan Stanley, the standard deviation of haircuts is a mere 0.46% and the inter-quartile range is close to zero, at 0.01%. For the remaining five money market fund families, four of them have inter-quartile ranges in haircuts less than 0.1%. In fact, the only money market fund family that has a wide variation in its haircuts is Bank of America, with the standard deviation at 2.19% and the inter-quartile range at 3.01%.

Compared with the relative similar haircuts charged by funds within the same fund family, haircuts faced by a dealer are much more dispersed, especially when the dealer borrows from multiple fund families. For the top three dealers in the equity repo market, the inter-quartile range in haircuts is 0.17% for J.P. Morgan, 2.96% for Credit Suisse and 3.00% for Deutsche Bank. The large dispersions in Credit Suisse and Deutsche Bank's repo haircuts are results of distinct haircuts charged by money market funds from different fund families. Credit Suisse borrows from money market funds from five fund families: Fidelity, Morgan Stanley, Bank of America, Federated Investment and State Street. Deutsche Bank borrows from four money market fund families: Fidelity, Morgan Stanley, Charles Schwab and Bank of America. The only exception is J.P. Morgan, which faces a small variation in its haircut as a dealer. But this is because 1,068 of its equity repo deals are with Fidelity and only 83 deals are with Morgan Stanley and Bank of America. Therefore, this small variation in haircuts

is due to the fact that J.P. Morgan borrows mainly from only Fidelity, and Fidelity assigns similar haircuts for all of J.P. Morgan's equity repos.

The above observation is confirmed in Figure 6, which compares equity tri-party repos' haircuts against the underlying collateral's volatility, a common risk measure for equity securities. We plot repos of the top four fund families that have more than 100 repo deals, i.e., Fidelity, Morgan Stanley, Charles Schwab and Bank of America. As a comparison, we also plot the repos of the top two dealer banks: J.P. Morgan and Credit Suisse. Clearly, when a dealer borrows from multiple money market funds families, its haircuts can be very different levels even though the repos are backed by collateral with similar volatility. For example, for the same dealer J.P. Morgan, Fidelity money market funds charge haircuts in a narrow range between 8.5% to 9%, while Morgan Stanley money market funds charge haircuts mostly at the 5% level, regardless of the underlying collateral's volatility. The pattern is similar for the repos borrowed by Credit Suisse.

Given the strong role played by money market fund families in setting equity repos, we examine the determinants of repo haircuts for each money market fund family separately. Our main focus is two fund families: 1) Fidelity, the largest lender in the equity repo market and 2) Bank of America, the lender whose haircuts show a wide variations. The remaining market market fund families all adopt a more or less flat policy on haircuts, That is, their equity repo haircuts are set around fixed levels, regardless of the counter-party identities and the underlying collateral qualities.

### Fidelity

Fidelity is the largest lender in the equity tri-party repo market. It has 2,106 repo dealers with 12 counter-parties. Fidelity's largest two counter-parties are J.P. Morgan and Credit Suisse. For its 1,068 repo deals with J.P. Morgan, the average repo haircut is 8.83% and the standard deviation is a mere 0.15%. In fact, most of the repos between Fidelity and J.P. Morgan have haircuts between the 8.70% (the 1st decile) and 9.00% (the 9th decile). Similarly, among the 465 repo deals between Fidelity and Credit Suisse, 431 repo haircuts are within a narrow band around 8.00%, ranging from 8.00% to 8.34%; the remaining 34 repo haircuts are around 5.00%, ranging from 5.00% to 5.26%.

It appears that Fidelity adopts a dealer-specific policy on haircuts. Between its two dealers, J.P. Morgan and Credit Suisse, Fidelity demands higher haircuts for J.P. Morgan than Credit Suisse. This differential treatment in haircuts is unlikely to be explained by the

collateral quality or the counter-party risk. The equity collateral provided by J.P. Morgan and Credit Suisse have similar risk: the average collateral portfolio volatility is 31.4% for J.P. Morgan and 30.6% for Credit Suisse. In terms of the counter-party risk, J.P. Morgan's average five-year CDS spreads is 99 bps, actually lower than the average five-year CDS spreads of 126 bps for Credit Suisse. One possible explanation could be the counter-party concentration risk, as J.P. Morgan is Fidelity's largest counter-party and accounts for almost half of Fidelity's equity repo deals.

We formally test Fidelity's haircut policy on equity tri-party repos in a set of regressions. The results are summarized in Table 5.[21] The regression results confirm our conjecture that money market funds in the Fidelity fund family set haircuts mainly according to the identities of the counter-party dealers. Variables such as repo size, repo maturity and dummy variables for time explains 10.6% of the total variations in haircuts. In contrast, adding dummy variables for dealers significantly increases the R-square by 24.5 percentage points to 35.1%. None of the collateral variables nor the dealers' CDS spreads is significant in the regressions, whether used alone or in combinations. Not surprisingly, collateral variables and dealers' CDS spreads also don't help improve the R-squares.

**Bank of America**

Bank of America, though it has only 146 equity tri-party repos, is the only fund family that shows a wide dispersions in the haircuts. The inter-quartile range is a 3.01%, the largest among all fund families. Bank of America's largest equity repo counter-party is Credit Suisse. The two have 79 repos worth $7.6 billion, around half of Bank of America's all repo deals. The average haircut of repos between Bank of America money market funds and Credit Suisse is 6.99%, with a standard deviation of 0.85%. Most of the haircuts are below 8%, as the 1st decile is 5.94% and the 9th decile is 7.87%. Compared with Fidelity which demands above 8.00% haircuts for most of its repos with credit Suisse, Bank of America money market funds ask for lower haircuts for repos with Credit Suisse. Bank of America's next largest counter-party is Deutsche Bank, but with only 24 equity tri-party repos in our sample. The remaining four counter-parties are ABN AMRO, J.P. Morgan, Barlcay and BNP Paribas, ranked by the number of equity repos.

We pool together all of Bank of America's equity tri-party repos and run a battery of

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[21]Since we don't have CDS data for Mizuho Financial Group, the 197 equity repos between Mizuho and Fidelity are not included in the tests.

regressions in Table 6. Similar to Fidelity, the dealer fixed effect is strong in Bank of America's equity repo haircuts too. Adding dealer dummies significantly improves the R-square of the regressions by 35.5 percentage points. Repo size, repo maturity, fixed dummies for time and dealers together explain 79.2% of the total variations in Bank of America's equity repo haircuts. The credit risk of counter-parties, as measured by dealers' CDS spreads, is not a determinant of repo haircuts.

The most interesting observation is that Bank of America assigns higher haircuts for equity repos backed by riskier collateral. Collateral concentration (#cols and $col (vw)), collateral volatility (port vol and avg vol), and the percentage of financial firms in the collateral pool (fin) are all statistically significant and can help explaining the variations in repo haircuts.

Bank of America accepts lower haircuts for repos backed by more diversified securities. An increase of one standard deviation in the number of collateral lowers repo haircuts by 0.36 percentage point; one standard deviation increase in the value-weighted number of collateral lowers repo haircuts by 0.56 percentage point. Regarding volatility, Bank of America requires higher haircuts for equity repos backed by more volatile securities. An increase of one standard, or 6.85 percentage points, increase in the collateral portfolio volatility raises the repo haircuts by 1.44 percentage points. Similarly, an increase of one standard deviation, or 6.49 percentage points, increase in the securities average volatility raises the repo haircuts by 0.66 percentage point. Moreover, Bank of America demands higher haircuts for repos backed by more financial company stocks. An increase of 10 percentage points in the financial stocks' percentage in the collateral pool increases the haircuts by 0.18 percentage point. Among all the collateral variables, the collateral portfolio volatility is the one with the largest economic impact and the one with the most significant t-value. The strong explanatory power of the collateral portfolio volatility is also reflected in the eight percentage points increase in the R-square of the regressions on repo haircuts.

### Other Fund Families

Aside from Fidelity and Bank of America, money market funds in the rest fund families apply more or less fixed haircuts on equity repos. The haircuts levels required by these funds are approximately 5% for Morgan Stanley and Charles Schwab, 2% for Federated Investment and 8% for State Street and Goldman Sachs. It is not obvious why different money market fund families chose different levels of haircuts as they all accept similar collateral and often lend

to the same group of dealers. The equity collateral accepted by the five fund families have similar risk. The daily price volatility of the collateral is within a narrow range from 1.18% to 1.77%. Nor because they transact with different counter-parties. In fact, State Street, Morgan Stanley and Federated Investment money market funds all lend to Credit Suisse. Therefore, we think the levels of haircuts, to a certain extent, reflect different fund families' risk tolerance. Federated Investment is the most aggressive one, by charging haircuts at approximately two times the daily price volatility of the underlying equity securities. Other fund families are more conservative and set a larger buffer in haircuts.

Controlling for the money market fund family, repo haircuts within each family exhibit small dispersions. The inter-quartile range in haircuts is from 0.01% to 0.06%. In other words, these fund families fix their haircuts to a constant level, regardless of the dealers and the collateral. Moreover, the constant haircut policy is not because these fund families only accept a certain type of collateral nor because they lend to only one dealer. In fact, these funds do accept a wide range of equity securities as collateral. The risk of the collateral pool, as measured by the number of collateral, collateral volatility and collateral concentration in financial firms, show large variations. Neither is the fixed haircut policy specific to certain dealers. These fund families have a very diversified pool of counter-parties. Morgan Stanley funds transact with 10 dealers; Goldman Sachs funds transact with 3 dealers; Charles Schwab funds transact with 2 dealers.[22] Hence, it is clear that the collateral risk and counter-party risk are not factors that affect the haircuts decisions of these funds that use the fixed-level haircut strategy.

The dominant role played by the fund families in the setting of haircuts is also evident in the regressions of Table 7, where we pool all equity repos together, but excluding those by Fidelity and Bank of America funds. Variables such as repo size, repo maturity and the time dummies explain only 21.5% of the total variations in haircuts. Adding four money market fund family dummies drastically improves the R-square by 73 percentage points to 94.5%. By contrast, including additional dealer dummies helps improve the R-square only by a marginal 1 percentage point. On the collateral side, only the number of collateral, a measure for collateral concentration, is marginally significant. But the coefficients are so small that an increase of two standard deviations in the number of collateral reduces the haircuts by less than a half basis point.

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[22]The exceptions are Federated Investment and State Street, which lend only to J.P.Morgan in our sample.

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In short, the equity repo haircuts are largely determined at the level of the money market fund families. Money market funds from the same fund family behave very similarly, while funds from different families adopt very distinct policies on haircuts. Fidelity, the top lender, assigns repo haircuts mainly according to the borrowers' identities. Bank of America takes into account the collateral qualities and assigns higher haircuts for riskier collateral pools. The remaining fund families choose more or less constant haircuts for all of their equity repos, regardless of the dealers' identities and the collateral qualities.

## 3.4  Spreads

Next, we investigate the interest rates charged on the tri-party repos. Given the strong role played by money market fund families in setting haircuts, we exam the determinants of repo interest rates not only for the full sample but also separately for Fidelity, Morgan Stanley, Charles Schwab and Bank of America funds.[23] Our main variable of interest is the interest rate spreads on equity tri-party repos, measured as the repo interest rates in excess of the fed fund rates. The results are summarized in Table 8.

The most important explanatory variable for spreads is the maturity of a repo. This is not surprising given the term structure effect of interest rates. For one standard deviation increase in repo maturity, or 29 business days, repo spreads increase by 4.90 bps. The maturity effect on repo spreads is quite robust. The coefficients on the repo maturity are positively significant for three out of the four fund families we tested, with the exception of Charles Schwab. In addition, large equity repos tend to have lower spreads - an increase of one standard deviation in repo size decreases repo spreads by -1.44 bps. But this relationship is largely driven by the equity repos of Fidelity, and not significant for the other three fund families we tested.

We also put the repo haircut on the right hand of the regressions on repo spreads. In theory, the relationship between haircuts and spreads could be negative if there is a substitution effect between haircuts and spreads. The relationship can also be positive if lenders demand higher haircuts and, at the same time, demand higher premiums for accepting riskier collateral. In practice, it is clear that the relationship is positive across different collateral asset classes. For example, haircuts on equity repos are higher than

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[23]We don't run regressions separately for Federated Investment, State Street and Goldman Sachs because these fund families have less than 100 repos.

treasury repos because equities are in general riskier than treasuries; spreads on equity repos are also higher because lenders demand higher compensation for holding riskier equity securities. However, it is unclear what the relationship should be for repos backed by the same collateral asset class. Our results show that there is no significant relation between haircuts and spreads in the full sample. Among the four fund families we tested, only repos by Fidelity money market funds show negative relation between repo haircuts and repo spreads. The substitution effect is strong - an increase of one percentage point in haircuts is coupled with a -5.66 bps reduction in repo spreads.

We find no robust relationship between borrowers' credit risk and repo spreads. In the full-sample regressions, dealers' CDS spreads are positively related with repo spreads. A 100 bps increase in a dealer's CDS spreads will raise its repo spreads by 6.70 bps. However, this positive effect is driven primarily by repos of Charles Schwab money market funds, and not significant for the other fund families. Lastly, repo spreads don't depend on the collateral. None of the three collateral variables, collateral concentration, volatility and financial firms percentage, can help explain variations in repo spreads.

# 4  Corporate Bond Repos

Corporate bonds, like equities, are a popular form of non-government securities in the tri-party repo market. The average amount of corporate bonds posted as collateral in the tri-party repo market is around $85 billion from November 2010 to August 2013, according to the statistics provided by SIFMA. Like equity repos, corporate bond repos are economically important for the financing and trading in the corporate bond market, which has a daily trading volume of approximately $25 billion in 2013.

In our matched sample, we have 1,289 corporate bond repos, around 40% of the size of equity repos. The main reason we have fewer corporate bond repos is because corporate bond securities require three types of information (issuer name, coupon and maturity date) to find a unique match, thereby making the matching process more difficult due to the limited disclosure quality in money market funds' N-MFP filings. For example, Fidelity, an important lender in the corporate bond repo market, is not in our sample because the maturity date information is missing in most of its filings. Luckily, our sample does contain repos by a wide variety of money market funds and dealers. Most importantly, the matched corporate bonds cover a broad range of securities from different rating classes and issuer

firms, which allow us to exam the repo price sensitivity to the underlying collateral.

## 4.1 Summary Statistics

In our sample of corporate bond tri-party repos, the lenders are money market funds from 17 unique fund families and the borrowers are 20 dealer banks. Similar to the equity repo market, the corporate bond repo market is also highly concentrated. Among all the money market funds, Bank of America fund family is the largest lender with 415 repos, or $35.6 billion worth. The second largest lender is Morgan Stanley, followed by Blackrock, which is ranked third. The top three lenders together represent 68% of the total lending in the corporate bond repo market. Among the dealers, J.P. Morgan is the largest borrower with 427 repos, or $26.7 billion in value. The second and third largest borrowers are Wells Fargo and BNP Paribas, respectively. Together, the top three dealers borrow $66.2 billion, accounting for 62.1% of the total repo borrowing backed by corporate bonds. The corporate bond tri-party repos are summarized in Table 9, separately by fund families and dealers. The lending relationship between the money market funds and dealer banks is plotted in the panel (b) of Figure 3.

Most of the repos in our sample are backed by a mix of investment-grade and high-yield bonds. On average, the percentage of rated bonds is 92% and the percentage of investment grade bonds is 70% in the collateral pool of a corporate bond repo. The average corporate bond rating is 8.95, between Baa1(numerical rating 8) and Baa2 (numerical rating 9). Most of the corporate bonds are old long-term bonds with large issuance size. The average age is 3.32 years; the average remaining maturity is 7.83 years; the average log issuance size is 20.38, or $709 million in value.

## 4.2 The Role Of Money Market Fund Families

Similar to the equity repos, the haircuts of corporate bond repos are also largely determined by the money market fund family. Table 9 summarizes the variations in repo haircuts for each of the top ten money market fund families. In Figure 6, we plot the corporate bond repo haircuts against the underlying collateral's average credit ratings for the top four fund families - Bank of America, Blackrock, Morgan Stanley and Federated Investment. We also report the corporate bond collateral characteristics separately for the top ten fund families at Table 10.

It is obvious that the fund families play the key role in the setting of repo haircuts. Many fund families assign uniform haircuts for all of their repos. Federated Investment funds' repo haircuts are in a narrow range around 2%, even though the fund family lends against both investment grade and non-investment grade bonds. Similarly, Blackrock gives a 7% haircut for most of its corporate bond repos. Blackrock trades with eight dealers, and accepts corporate bonds with ratings that range from Aa1 to B3. On the other hand, even though Bank of America also gives a constant 5% haircut, it accepts mostly investment-grade corporate bonds as collateral.

In contrast, some other fund families charge a wide range of haircuts for their corporate bond repos. Taking Morgan Stanely as an example, its haircuts fall into roughly two categories: 5% for repos with average collateral ratings at Baa3 or above, and 6% for repos with average collateral ratings below Baa3. This is consistent with the common belief that investment grade and non-investment grade corporate bonds are considered different asset categories in the tri-party repo market. In our following analysis on haircuts and spreads, we consider the investment grade and non-investment grade repos separately. However, it is worth emphasizing that many fund families in the corporate bond repo market don't differentiate bond ratings and assign equal haircuts for both investment grade and non-investment grade bonds.

## 4.3    Regression Analysis on Haircuts and Spreads

The majority of the repos in our sample have collateral that are a mix of investment grade and non-investment grade bonds. To deal with this, we try two methods to separate corporate bond repos into the investment grade and non-investment grade categories. The first method is by the average ratings of the collateral and the second method is by the percentages of investment grade bonds in the collateral pool. Table 11 summarizes the regressions results on haircuts; Table 12 summarizes the regressions results on spreads.

In the full sample, haircuts are strongly associated with collateral ratings. An improvement of one standard deviation in the underlying collateral's ratings will reduce the repo haircuts by 0.36 percentage point. However, the strong relationship between repo haircuts and bond ratings is driven by the differences across the two major rating categories. Within the investment grade and non-investment grade categories, average bond ratings can no longer explain the cross-sectional variations in haircuts. Neither can other collateral

variables help explaining variations in haircuts.

It is the money market fund family that plays the key role in setting corporate bond reop haircuts, similar to our observation in the equity repo market. This is reflected in the drastically improvement of R-squares. With only the month and dealer dummies, the R-square for the full-sample regression is only 38.7%. Adding fund family dummies improves the R-square by 46.3 percentage points to 84%. Within each rating category, fixed month, dealer and fund family dummies can explain over 90% of the total variations in haircuts.

The results are similar on repo spreads. Within the investment grade and non-investment grade categories, repo spreads are in general not related to collateral characteristics, including bond ratings. Repo spreads do not depend on the dealers' credit risk neither. The most robust explanatory variable for variations in the spreads is the maturity of the repo. For one standard deviation increase in repo maturity, or 15 business days, repo spreads increase approximately 4 bps.

## 5 Treasury Repos

Our main focus in this paper is the pricing of repos backed by risky collateral, i.e., equities and corporate bonds. However, it is worth emphasizing that the majority of the repos between money market funds and dealer banks are backed by government collateral, mainly treasuries and agency securities. To draw a parallel with the pricing of risky repos, we also construct a sample of treasury repos backed by the collateral that we can match as treasury securities.

Table 13 summarizes the characteristics of the repos and Table 14 summarizes the underlying treasury securities. Compared with equity and corporate bond repos, the variations in the treasury repos' haircuts and spreads are much smaller. The 1st decile in haircuts is 2.00% and the 9th decile is only slightly higher at 2.05%. Thus, the majority of the treasury repos is simply charged with a haircut at approximately 2%.

Compared with the more or less constant 2% haircut, the spreads of treasury repos show more variations, but still much more homogeneous than spreads on equity and corporate bond repos. Treasury repo spreads are also much lower in levels. The 1st decile of treasury repo spreads is -5 bps; the 9th decile is 8 bps. The spreads are lower because investors demand lower premium for holding safer treasury securities as collateral. It is also related to the shorter maturity, as the majority of the treasury repos are over night while equity and

corporate bond repos on average have maturities around one month.

Unlike the very concentrated equity and corporate bond repo markts, treasury repos involve a large number of money market funds and dealers. On the lender side, there are 93 unique money market fund families. The top two lenders are Dreyfus and Federated Investment, presenting 11.6% and 11.0% of the total repo lending backed by treasuries. In terms of market concentration, the top 10 money market fund families together account for roughly 65% of the total lending and the remaining 83 fund families split the remaining 35%. On the borrower side, there are in total 30 dealers. Barclay is the largest borrower, followed by Royal Bank of Scotland, Deutche Bank, Credit Suisse and BNP Paribas. All five are non-US European banks. In fact, Bank of America is the only US dealer in the top ten rankings. Together, the top 10 dealers borrow 77.3% and the rest 20 dealers share 22.7%. The lenders and borrowers are also more inter-connected in the treasury tri-party market. The panel (c) of Figure 3 shows a complicated and highly intertwined network, in which each money market fund family lends to multiple dealer banks and each dealer bank borrows from multiple fund families.[24]

On the collateral side, most of the treasury securities used as collateral are treasury Notes. On average, 79% of securities are treasury Notes, 15% are treasury Bonds and the remaining 6% are treasury Bills. The average age is 2.39 years. A small fraction of the collateral, around 10.8%, are on-the-run securities. The number of securities in each collateral pool is also fewer, compared with equity and corporate repos. On average, there are approximately 3.43 securities, equivalent to 2.23 equal-weighted securities, in the collateral pool of a treasury repo.

The small range in haircuts and spreads indicate that the pricing in the treasury tri-party repo market is quite flat. We formally test this hypothesis by a set of regressions on haircuts and spreads. Not surprisingly, none of the collateral variables is related with haircuts or spreads. Nor is the counter-party risk variable, which is measured as dealers' CDS spreads. For haircuts, the money market fund family dummies improve the R-square by 11.3 percentage points, from 5.3% to 16.6%. For spreads, month dummies alone can explain close to 50% of the total variations. Therefore, the variations in haircuts are likely due to small differences across various fund families, and the variations in spreads are likely due to the time-series changes in the overall credit market condition.

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[24]For simplicity, only the trading relationship between the top 20 lenders (money market fund families) and the top 20 borrowers (dealer banks) are plotted.

# 6  Conclusion

We construct a unique data set of tri-party repo transactions between U.S. money market funds and dealer banks. With the detailed information on the underlying collateral, we are able to examine the cross-sectional variations in repo haircuts and spreads, focusing in particular on the sensitivity with respect to the collateral quality.

We find that haircuts for repos backed by risky collateral, such as equity and corporate bonds, are largely decided by the associated money market fund families. Different fund families adopt very different haircut policies. Typical haircut policies include fixing haircuts to a constant level, assigning haircuts according to the borrowers' identities and calibrating haircuts to the risk of the underlying collateral securities. In comparison, haircuts on repos backed by treasury securities are much more homogeneous. Most treasury repos are charged with a 2% haircut, regardless of the collateral and the lender. Haircuts do not depend on counter-party default risk, measured as the CDS spreads of the borrower.

Repo spreads are determined mainly by the maturity and do not depend on the collateral. We find no robust relationship between the borrowers' default risk and the repo spreads. Our results help shed light on the pricing mechanism of the opaque repo market.
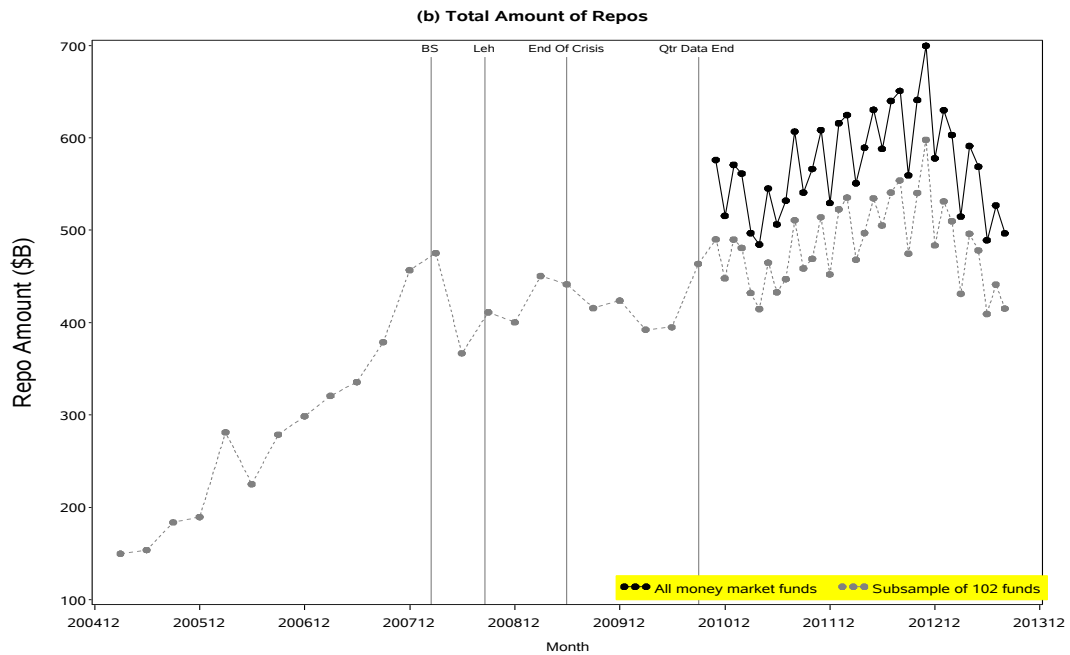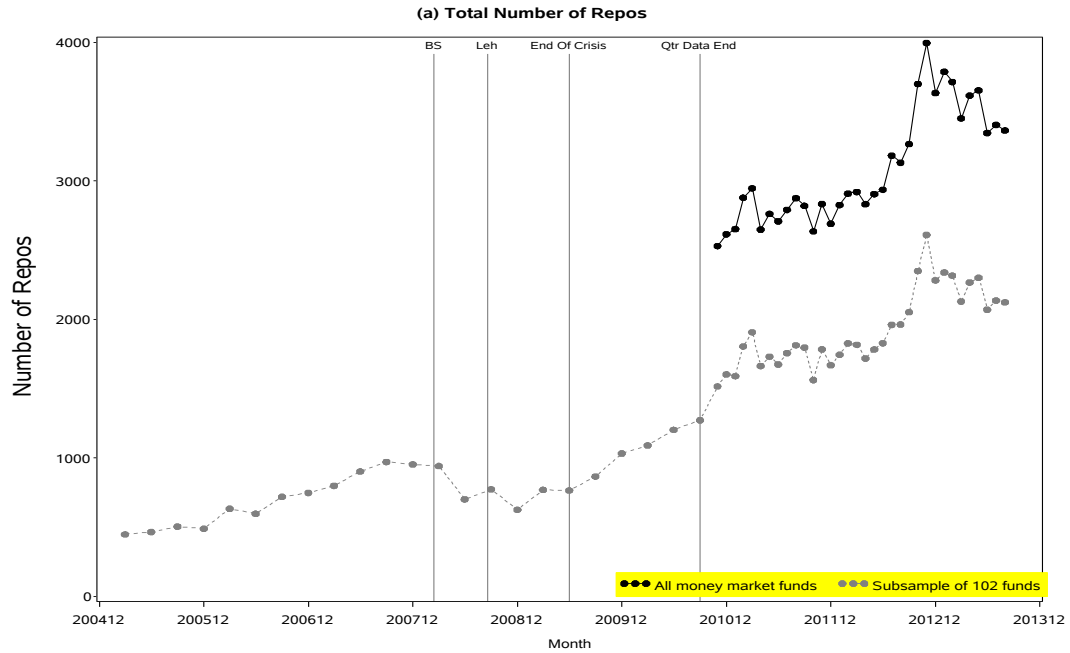
Figure 1: **Growth of the Tri-Party Repurchase Agreement Market**
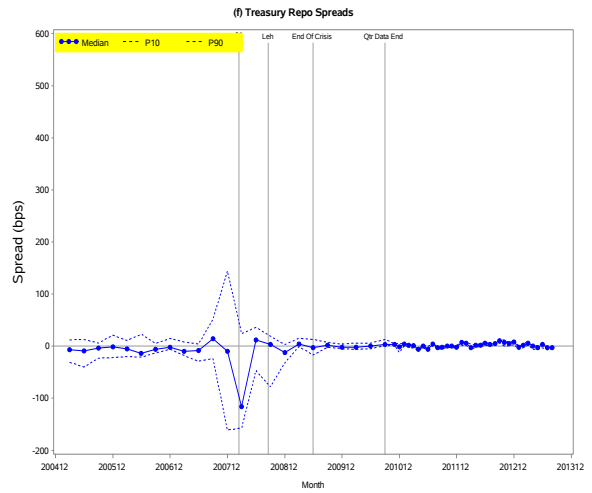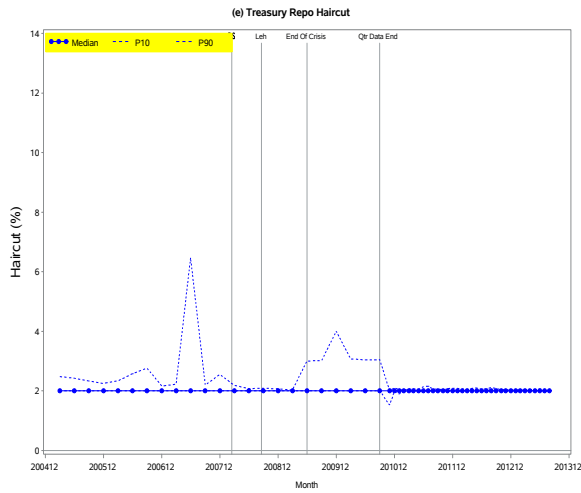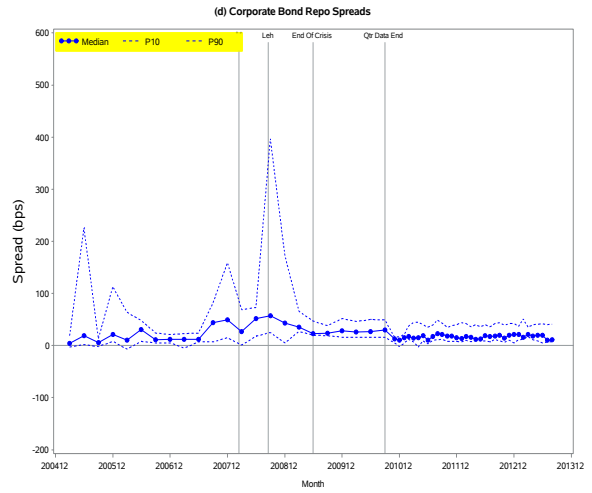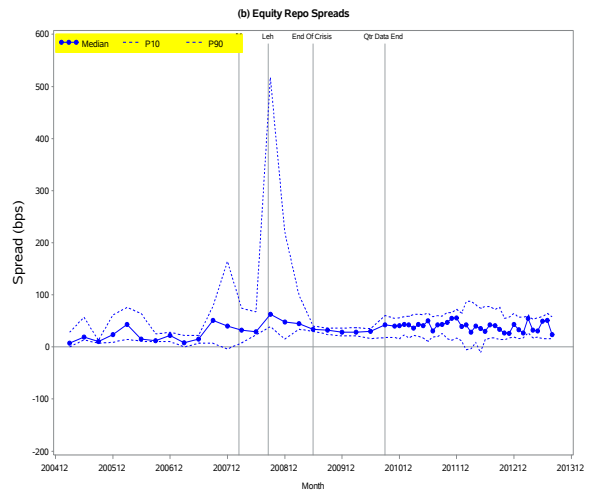
Figure 2: **Time-Series Trend of Haircuts and Spreads**

**(a) Equity Repos**
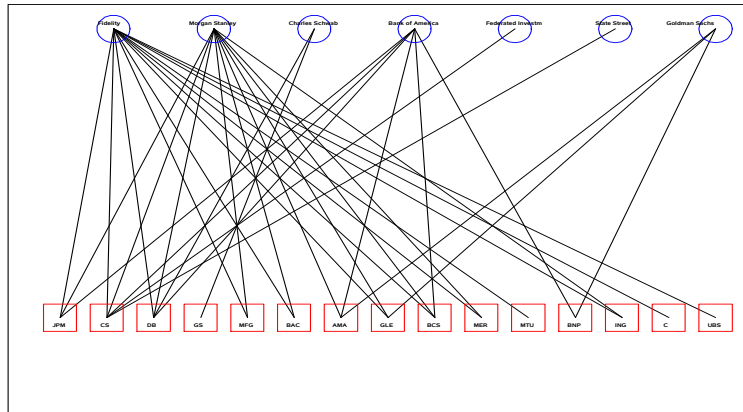
**(b) Corporate Bond Repos**
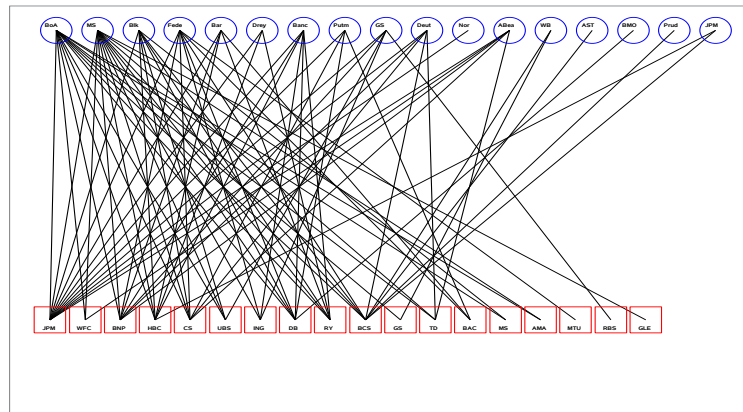
**(c) Treasury Repos**
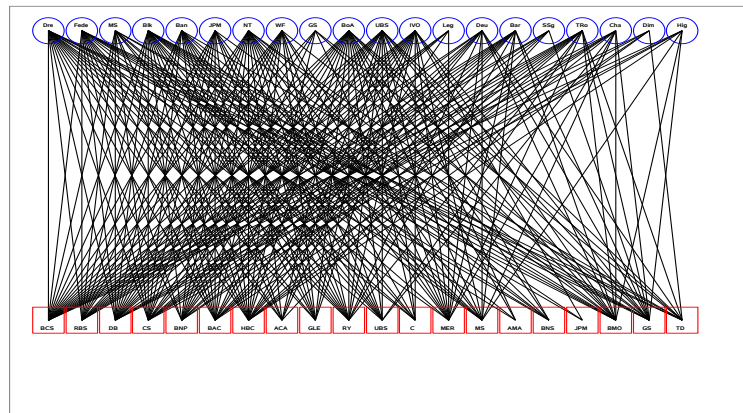
Figure 3: **Lender-Borrower Relationship in the Tri-Party Repo Market**
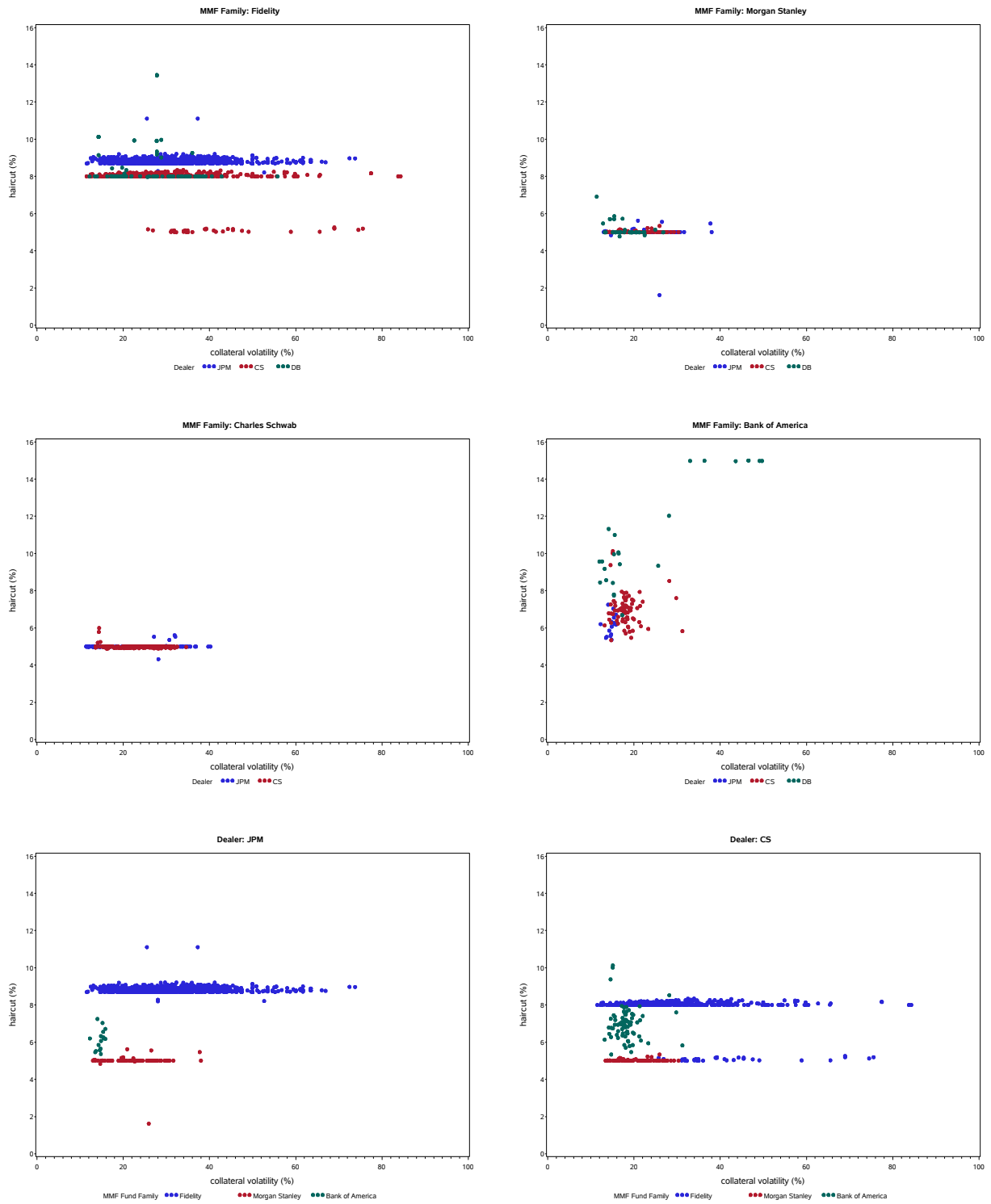
Figure 4: **Equity Repo Haircuts v.s. Collateral Volatility**
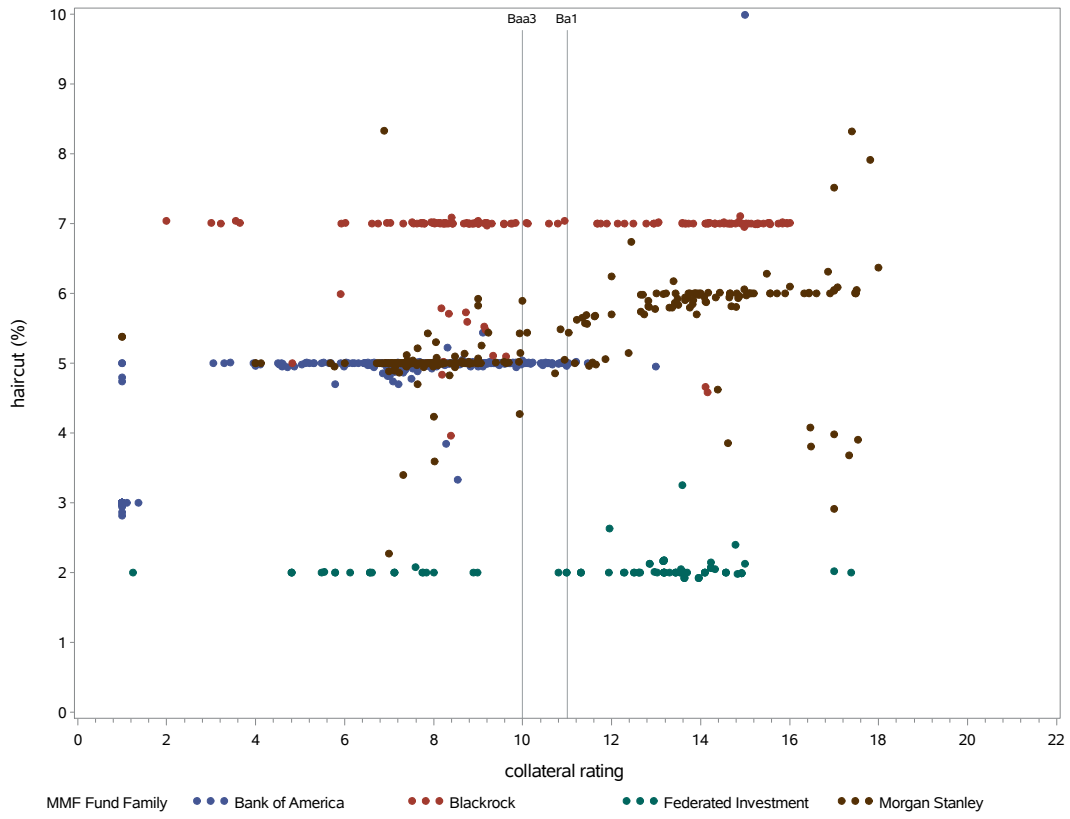
Figure 5: **Corporate Bond Repo Haircuts v.s. Collateral Rating**

Table 1: **Tri-Party Repo Summary Statistics, 2005 - 2013**

**Panel A: Equity Tri-Party Repos**

| period | #FFs | #MMFs | #dealers | #repos | amt ($B) | Repo Haircut (%) | | | | | Repo Spreads (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 |
| Jan 05 - Jun 08 | 2 | 15 | 10 | 202 | 84 | 5.05 | 0.80 | 5.00 | 5.01 | 5.07 | 29.2 | 31.3 | 8.0 | 22.0 | 65.0 | 18.3 | 30.0 | 1 | 1 | 66 | 415 | 402 | 35 | 300 | 849 |
| Sep 08 - Jun 09 | 1 | 11 | 9 | 183 | 58 | 9.10 | 2.00 | 5.03 | 10.0 | 10.2 | 77.4 | 99.1 | 28.0 | 40.0 | 176 | 15.9 | 19.9 | 1 | 1 | 43 | 316 | 459 | 8 | 94 | 987 |
| Sep 09 - Sep 10 | 3 | 17 | 10 | 292 | 57 | 8.47 | 1.89 | 5.00 | 8.05 | 10.1 | 31.4 | 9.9 | 21.0 | 30.0 | 43.0 | 26.9 | 30.3 | 1 | 20 | 64 | 196 | 349 | 5 | 64 | 497 |
| Nov 10 - Aug 13 | 7 | 36 | 15 | 3,348 | 286 | 7.39 | 1.96 | 5.00 | 8.01 | 8.92 | 38.5 | 19.1 | 16.0 | 39.0 | 62.0 | 24.1 | 29.3 | 1 | 8 | 68 | 85 | 145 | 2 | 33 | 250 |

**Panel B: Corporate Tri-Party Repos**

| period | #FFs | #MMFs | #dealers | #repos | amt ($B) | Repo Haircut (%) | | | | | Repo Spreads (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 |
| Jan 05 - Jun 08 | 9 | 28 | 22 | 1,264 | 397 | 3.65 | 1.46 | 2.00 | 3.19 | 5.18 | 28.9 | 35.6 | 4.0 | 18.0 | 66.0 | 21.0 | 36.9 | 1 | 1 | 64 | 314 | 362 | 21 | 200 | 750 |
| Sep 08 - Jun 09 | 5 | 16 | 17 | 203 | 47 | 5.01 | 0.58 | 5.00 | 5.02 | 5.21 | 81.6 | 120 | 22.0 | 41.0 | 130 | 10.9 | 13.8 | 1 | 1 | 23 | 234 | 335 | 8 | 100 | 600 |
| Sep 09 - Sep 10 | 9 | 27 | 15 | 1,039 | 110 | 6.82 | 2.02 | 5.00 | 7.00 | 8.51 | 30.3 | 13.9 | 16.0 | 27.0 | 49.0 | 39.3 | 33.5 | 1 | 58 | 64 | 106 | 223 | 2 | 31 | 250 |
| Nov 10 - Aug 13 | 17 | 53 | 20 | 1,289 | 107 | 4.87 | 1.40 | 3.00 | 5.00 | 7.00 | 20.3 | 12.9 | 7.0 | 17.0 | 40.0 | 6.7 | 15.2 | 1 | 1 | 23 | 83 | 96 | 10 | 50 | 200 |

**Panel C: Treasury Tri-Party Repos**

| period | #FFs | #MMFs | #dealers | #repos | amt ($B) | Repo Haircut (%) | | | | | Repo Spreads (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 |
| Jan 05 - Jun 08 | 17 | 67 | 33 | 3,325 | 1,524 | 2.20 | 0.78 | 2.00 | 2.00 | 2.45 | −14 | 48.0 | −60 | −6.0 | 20.0 | 13.9 | 42.1 | 1 | 1 | 41 | 458 | 593 | 27 | 250 | 1100 |
| Sep 08 - Jun 09 | 18 | 72 | 26 | 1,015 | 691 | 2.09 | 0.37 | 2.00 | 2.00 | 2.08 | −2.9 | 46.7 | −23 | −1.0 | 17.0 | 5.6 | 18.1 | 1 | 1 | 12 | 680 | 925 | 50 | 390 | 1600 |
| Sep 09 - Sep 10 | 22 | 83 | 27 | 1,606 | 717 | 2.37 | 0.80 | 2.00 | 2.00 | 3.12 | 2.0 | 8.2 | −5.0 | 1.0 | 8.0 | 11.6 | 24.1 | 1 | 1 | 54 | 446 | 542 | 29 | 250 | 1000 |
| Nov 10 - Aug 13 | 93 | 294 | 30 | 15,421 | 2,813 | 2.02 | 0.28 | 2.00 | 2.00 | 2.05 | 1.6 | 5.5 | −5.0 | 2.0 | 8.0 | 1.6 | 3.9 | 1 | 1 | 2 | 182 | 287 | 10 | 88 | 500 |

This table reports the summary statistics for haircut, spreads, maturity and size of equity, corporate bond and treasury tri-party repos. For each asset category we show summary statistics for four subperiods separately. Repos for the three periods, January 2005 to June 2008, September 2008 to June 2009 and September 2009 to September 2010 are based on the quarterly filings of a subsample of 102 U.S. money market funds. Repos for the period from November 2010 to August 2013 are based on the monthly N-MFP filings of all U.S. money market funds. For each period, we also report the numbers of fund families (#FFs), money market funds (#MMFs), dealers (#dealers), repos (#repos) and the total amount of repos in billions (amt).

## Table 2: Equity Tri-Party Repo Summary Statistics, November 2010 - August 2013

### Panel A: All Fund Families

| MMFs Family | #repos | amt ($M) | pct | #dealers | Repo Haircut (%) | | | | | Repo Spreads (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 |
| Fidelity | 2,168 | 179,650 | 62.9 | 12 | 8.49 | 0.89 | 8.01 | 8.70 | 8.83 | 41.1 | 20.0 | 23.0 | 43.0 | 57.0 | 27.8 | 31.7 | 2 | 13 | 49 | 83 | 155 | 5 | 17 | 83 |
| Morgan Stanley | 254 | 42,643 | 14.9 | 10 | 5.13 | 0.46 | 5.00 | 5.01 | 5.01 | 24.1 | 14.6 | 15.0 | 18.0 | 30.0 | 3.2 | 8.4 | 1 | 1 | 1 | 168 | 197 | 30 | 90 | 230 |
| Charles Schwab | 604 | 25,725 | 9.0 | 2 | 4.99 | 0.08 | 4.99 | 5.00 | 5.00 | 42.2 | 15.8 | 22.0 | 46.0 | 54.0 | 27.3 | 25.5 | 1 | 21 | 50 | 43 | 41 | 12 | 30 | 65 |
| Bank of America | 146 | 13,188 | 4.6 | 6 | 8.02 | 2.19 | 6.52 | 7.26 | 9.53 | 24.1 | 6.4 | 19.0 | 24.0 | 29.0 | 16.5 | 19.8 | 1 | 2 | 29 | 90 | 74 | 45 | 57 | 120 |
| Federated Investment | 98 | 12,173 | 4.3 | 1 | 2.03 | 0.04 | 2.01 | 2.03 | 2.07 | 28.1 | 3.7 | 26.0 | 28.5 | 30.5 | 4.7 | 0.5 | 4 | 5 | 5 | 124 | 105 | 40 | 100 | 200 |
| State Street | 20 | 6,250 | 2.2 | 1 | 7.71 | 0.92 | 8.00 | 8.00 | 8.00 | 15.0 | 1.7 | 14.0 | 14.5 | 16.0 | 1.0 | 0.0 | 1 | 1 | 1 | 313 | 135 | 225 | 300 | 450 |
| Goldman Sachs | 58 | 5,950 | 2.1 | 3 | 8.28 | 0.70 | 8.00 | 8.00 | 8.01 | 28.0 | 9.9 | 22.0 | 24.0 | 39.0 | 1.2 | 0.8 | 1 | 1 | 1 | 103 | 95 | 99 | 100 | 100 |

### Panel B: Top 5 Dealers

| Dealer | #repos | #FFs | amt ($M) | pct | Dealer CDS (bps) | | Repo Haircut (%) | | | | | Repo Spreads (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | mean | std | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 |
| JPM | 1,155 | 3 | 122,355 | 42.8 | 99 | 24.4 | 8.56 | 0.98 | 8.72 | 8.79 | 8.89 | 48.1 | 17.4 | 41.0 | 53.0 | 58.0 | 43.5 | 34.2 | 13 | 38 | 66 | 106 | 180 | 7 | 27 | 132 |
| CS | 732 | 5 | 85,900 | 30.1 | 123 | 31.7 | 6.70 | 2.13 | 5.10 | 8.00 | 8.06 | 33.5 | 21.4 | 16.0 | 27.0 | 43.0 | 13.5 | 17.3 | 1 | 5 | 21 | 117 | 158 | 13 | 54 | 167 |
| DB | 302 | 4 | 19,470 | 6.8 | 131 | 37.7 | 6.42 | 2.30 | 5.00 | 5.00 | 8.00 | 21.5 | 6.7 | 17.0 | 21.0 | 22.0 | 1.6 | 1.7 | 1 | 1 | 1 | 64 | 109 | 15 | 35 | 78 |
| GS | 434 | 1 | 18,586 | 6.5 | 201 | 84.7 | 4.99 | 0.07 | 4.96 | 5.00 | 5.00 | 51.1 | 8.2 | 44.0 | 52.0 | 56.0 | 37.4 | 23.2 | 18 | 34 | 55 | 43 | 42 | 9 | 30 | 65 |
| MFG | 203 | 2 | 10,167 | 3.6 | . | . | 8.55 | 1.83 | 8.00 | 8.01 | 8.07 | 26.0 | 6.3 | 22.0 | 25.0 | 31.0 | 3.6 | 1.6 | 2 | 4 | 5 | 50 | 124 | 4 | 9 | 37 |

This table reports the summary statistics for haircut, spreads, maturity and size of the equity tri-party repos, based on the monthly repo data from November 2010 to August 2013. The Panel A shows the summary statistics by money market fund families. For each fund family, we also report the total number of repos (#repos), the total amount of repos (amt), the market share (pct) and the number of counter-party dealers (#dealers). The Panel B shows the summary statistics by dealers. For each of the top five dealers, we also report the total number of repos (#repos), the total amount of repos (amt), the market share (pct), and the number of counter-party money market fund families (#FFs). The top five dealers are J.P. Morgan (JPM), Credit Suisse (CS), Deutsche Bank (DB), Goldman Sachs (GS) and Mizuho (MFG), respectively. In addition, we report the mean and standard deviation of the dealers' 5-year CDS spreads in the Panel B. The CDS spreads data are obtained from Markit. Mizuho is not covered in our CDS data.

Table 3: **Top 20 Collateral for Equity Tri-Party Repos, November 2010 - August 2013**

| stock | amount ($M) | pct (%) | #repos | #months | #FFs | #dealers |
|---|---|---|---|---|---|---|
| Anglogold Ltd | 7392 | 2.42 | 127 | 30 | 3 | 6 |
| Bank of America Corp | 5921 | 1.94 | 354 | 33 | 4 | 10 |
| Apple Inc | 5667 | 1.86 | 234 | 33 | 5 | 12 |
| Hartford Financial Services Group Inc. (The) | 3845 | 1.26 | 103 | 29 | 4 | 9 |
| Wells Fargo & Co | 3459 | 1.13 | 209 | 31 | 7 | 12 |
| Verisign Inc | 3410 | 1.12 | 71 | 30 | 3 | 5 |
| Citigroup Inc | 3128 | 1.02 | 285 | 32 | 7 | 13 |
| Anadarko Petroleum Corp | 3055 | 1.00 | 252 | 32 | 6 | 10 |
| QUALCOMM Inc. | 2404 | 0.79 | 183 | 33 | 5 | 9 |
| SunTrust Banks Inc. | 2333 | 0.76 | 139 | 26 | 6 | 8 |
| Transocean Ltd | 2281 | 0.75 | 52 | 20 | 4 | 5 |
| JPMorgan Chase & Co | 2135 | 0.70 | 286 | 34 | 6 | 12 |
| EMC Corp | 2098 | 0.69 | 95 | 26 | 5 | 7 |
| Capital One Financial Corp. | 1990 | 0.65 | 167 | 31 | 6 | 10 |
| Nexen Inc. | 1965 | 0.64 | 127 | 18 | 3 | 5 |
| Pfizer Inc | 1896 | 0.62 | 302 | 33 | 6 | 12 |
| Alliance Data Systems Corp | 1854 | 0.61 | 65 | 31 | 2 | 4 |
| Micron Technology Inc. | 1837 | 0.60 | 94 | 25 | 5 | 6 |
| Ford Motor Co | 1793 | 0.59 | 53 | 23 | 4 | 8 |
| Virgin Media Inc | 1791 | 0.59 | 42 | 15 | 3 | 5 |

This table reports the top 20 securities in the collateral pool of all equity tri-party repos from November 2010 to August 2013. For each security, we report the total amount (amount), the share of the entire collateral pool (pct), the number of repos for which the security show up as collateral (#repos), the number of months the security is used as collateral (#months), the number of money market fund families accept the security as collatral (#FFs) and the number of dealers post the security as collateral (#dealers).

Table 4: **Collateral Characteristics of Equity Tri-Party Repos, November 2010 - August 2013**

| Fund Family | equity collaterals | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | matched | #cols | #cols (vw) | size | port vol | avg vol | fin |
| mean | | | | | | | |
| Fidelity | 1.00 | 7.17 | 3.82 | 9.77 | 29.61 | 34.24 | 0.21 |
| Morgan Stanley | 0.99 | 71.48 | 39.83 | 9.44 | 20.45 | 33.22 | 0.17 |
| Charles Schwab | 1.00 | 34.34 | 24.57 | 9.80 | 22.05 | 32.93 | 0.20 |
| Bank of America | 0.99 | 39.46 | 14.36 | 9.48 | 19.03 | 32.01 | 0.19 |
| Federated Investmen | 1.00 | 35.20 | 12.24 | 10.37 | 20.31 | 29.38 | 0.23 |
| State Street | 1.00 | 21.35 | 6.98 | 10.12 | 28.08 | 36.23 | 0.19 |
| Goldman Sachs | 0.99 | 30.34 | 16.49 | 10.97 | 18.70 | 27.24 | 0.23 |
| All | 1.00 | 19.67 | 11.24 | 9.78 | 26.61 | 33.57 | 0.20 |
| median | | | | | | | |
| Fidelity | 1.00 | 2.00 | 1.57 | 9.51 | 27.88 | 33.12 | 0.00 |
| Morgan Stanley | 1.00 | 47.50 | 37.46 | 9.45 | 20.03 | 33.18 | 0.17 |
| Charles Schwab | 1.00 | 22.00 | 21.67 | 9.80 | 22.24 | 32.99 | 0.19 |
| Bank of America | 1.00 | 27.00 | 12.54 | 9.13 | 17.66 | 31.66 | 0.17 |
| Federated Investmen | 1.00 | 32.00 | 12.22 | 10.41 | 20.13 | 29.22 | 0.23 |
| State Street | 1.00 | 15.50 | 5.58 | 10.07 | 27.88 | 36.28 | 0.18 |
| Goldman Sachs | 1.00 | 17.50 | 12.97 | 11.09 | 17.15 | 25.39 | 0.23 |
| All | 1.00 | 9.00 | 4.04 | 9.67 | 24.83 | 32.67 | 0.12 |
| standard deviation | | | | | | | |
| Fidelity | 0.01 | 10.16 | 6.14 | 1.82 | 11.07 | 11.05 | 0.33 |
| Morgan Stanley | 0.02 | 69.25 | 11.46 | 1.03 | 5.33 | 6.05 | 0.08 |
| Charles Schwab | 0.01 | 42.31 | 9.62 | 0.89 | 5.49 | 6.49 | 0.09 |
| Bank of America | 0.02 | 45.44 | 7.14 | 1.14 | 6.85 | 6.75 | 0.16 |
| Federated Investmen | 0.00 | 17.91 | 5.28 | 0.33 | 3.19 | 3.82 | 0.10 |
| State Street | 0.00 | 14.71 | 4.60 | 1.03 | 5.94 | 9.19 | 0.19 |
| Goldman Sachs | 0.02 | 31.95 | 8.83 | 0.66 | 6.02 | 6.39 | 0.10 |
| All | 0.01 | 35.20 | 13.65 | 1.58 | 10.36 | 9.72 | 0.27 |

This table reports the summary statistics for the collateral posted for the equity tri-party repos from November 2010 to August 2013, separately by each money market fund families. For every equity repo, we calculate the percentage of matched securities (matched), the number of collateral (#cols), the value-weighted number of collateral (#cols (vw)), the value-weighted firm size (size), the portfolio volatility (port vol), the value-weighted volatility (avg vol), and the percentage of financial firms (fin). All the weights are the shares of the individual security value out of the repo's total collateral value. The value-weighted number of collateral (#cols (vw)) is the inverse of the Herfindahl index based on the shares of the individual security. The mean, median and standard-deviation are calculated across equity tri-party repos of each money market fund family.

Table 5: **Determinants of Fidelity Money Market Funds' Equity Tri-Party Repo Haircuts**

| Parm | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| #cols | | | | 0.001 [0.26] | | | | | | | |
| #cols (vw) | | | | | −.005 [−1.29] | | | | | −.005 [−1.39] | −.005 [−1.06] |
| col size | | | | | | 0.008 [0.96] | | | | 0.009 [0.79] | 0.008 [0.71] |
| col port vol | | | | | | | −.002 [−0.60] | | | −.002 [−0.67] | |
| col avg vol | | | | | | | | −.001 [−0.62] | | | −.001 [−0.42] |
| col fin (%) | | | | | | | | | −.004 [−0.06] | −.028 [−0.29] | −.028 [−0.28] |
| dealer CDS | 0.003 [0.16] | | −.003 [−1.40] | −.003 [−1.40] | −.004 [−1.43] | −.003 [−1.40] | −.003 [−1.42] | −.003 [−1.41] | −.003 [−1.42] | −.003 [−1.46] | −.004 [−1.45] |
| repo size | 0.006*** [2.95] | −.006 [−0.20] | −.006 [−0.20] | −.009 [−0.39] | 0.001 [0.05] | −.006 [−0.19] | −.009 [−0.34] | −.006 [−0.20] | −.006 [−0.20] | −.002 [−0.08] | 0.001 [0.02] |
| repo mat | | −.001 [−1.00] | −.001 [−0.97] | −.001 [−0.99] | −.001 [−1.02] | −.001 [−0.94] | −.001 [−1.03] | −.001 [−1.05] | −.001 [−0.97] | −.001 [−1.03] | −.001 [−1.04] |
| month | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| dealer | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| NOBS | 1971 | 1971 | 1971 | 1971 | 1971 | 1961 | 1964 | 1964 | 1971 | 1954 | 1954 |
| R2 | 10.6 | 35.1 | 35.5 | 35.5 | 35.6 | 35.4 | 35.5 | 35.5 | 35.5 | 35.6 | 35.5 |

This table reports the OLS regressions on the haircuts of the Fidelity money market funds' equity tri-party repos from November 2010 to August 2013. The t-statistics reported in squared brackets are based on double-clustered standard errors by fund family and month.

**Table 6: Determinants of Bank of America Money Market Funds' Equity Tri-Party Repo Haircuts**

| Parm | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| #cols | | | | −.008 | | | | | | | |
| | | | | [−1.56] | | | | | | | |
| #cols (vw) | | | | | −.079*** | | | | | −.056*** | −.088*** |
| | | | | | [−2.64] | | | | | [−2.79] | [−2.71] |
| col size | | | | | | 0.139 | | | | −.354 | −.121 |
| | | | | | | [0.59] | | | | [−1.37] | [−0.51] |
| col port vol | | | | | | | 0.210*** | | | 0.218*** | |
| | | | | | | | [9.53] | | | [12.53] | |
| col avg vol | | | | | | | | 0.101 | | | 0.099** |
| | | | | | | | | [1.62] | | | [2.19] |
| col fin (%) | | | | | | | | | 1.819* | −.047 | 1.448* |
| | | | | | | | | | [1.65] | [−0.06] | [1.72] |
| dealer CDS | | | 0.026 | 0.027 | 0.014 | 0.021 | −.027 | 0.009 | 0.008 | −.024 | −.013 |
| | | | [0.63] | [0.69] | [0.39] | [0.53] | [−1.23] | [0.31] | [0.26] | [−1.24] | [−0.58] |
| repo size | −.532 | −.929*** | −.896*** | −.583** | −.329 | −.857*** | −.638*** | −.947*** | −.792*** | −.326** | −.266 |
| | [−0.76] | [−3.65] | [−4.46] | [−2.57] | [−1.49] | [−5.80] | [−5.31] | [−7.15] | [−4.08] | [−1.97] | [−1.05] |
| repo mat | −.044*** | −.009* | −.009* | −.007 | −.008* | −.008** | −.010* | −.013*** | −.009* | −.011 | −.012* |
| | [−3.15] | [−1.78] | [−1.90] | [−1.42] | [−1.66] | [−2.41] | [−1.90] | [−3.54] | [−1.65] | [−1.49] | [−1.76] |
| month | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| dealer | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| NOBS | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 |
| R2 | 43.7 | 79.2 | 79.4 | 80.1 | 81.9 | 79.6 | 87.4 | 82.2 | 80.3 | 89.0 | 85.5 |

This table reports the OLS regressions on the haircuts of the Bank of America money market funds' equity tri-party repos from November 2010 to August 2013. The t-statistics reported in squared brackets are based on double-clustered standard errors by dealer and month.

Table 7: **Determinants of Equity Tri-Party Repo Haircuts, excluding Fidelity and Bank of America**

| Parm | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| #cols | | | | −.000* [−1.67] | | | | | | | |
| #col (vw) | | | | | −.002 [−1.29] | | | | | −.002* [−1.70] | −.002* [−1.66] |
| col size | | | | | | −.033* [−1.78] | | | | −.046 [−1.61] | −.043 [−1.32] |
| col port vol | | | | | | | 0.003 [0.66] | | | −.003 [−0.44] | |
| col avg vol | | | | | | | | 0.003** [2.36] | | | −.001 [−0.17] |
| col fin (%) | | | | | | | | | −.094 [−0.53] | −.016 [−0.10] | −.025 [−0.16] |
| dealer CDS | | | | −.001 [−1.33] | −.001 [−1.42] | −.001 [−1.48] | −.001 [−1.44] | −.001 [−1.43] | −.001 [−1.47] | −.001 [−1.63] | −.001 [−1.64] |
| repo size | 0.010 [0.14] | −.028 [−1.49] | −.017 [−1.19] | −.014 [−1.07] | −.014 [−1.02] | −.015 [−1.23] | −.017 [−1.18] | −.017 [−1.17] | −.018 [−1.22] | −.010 [−0.88] | −.010 [−0.87] |
| repo mat | 0.006 [0.82] | −.000 [−0.97] | −.000 [−0.03] | −.000 [−0.44] | −.000 [−0.37] | 0.000 [0.04] | −.000 [−0.31] | −.000 [−0.21] | −.000 [−0.20] | 0.000 [0.10] | 0.000 [0.02] |
| month | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| dealer | N | N | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Fund Family | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| NOBS | 1034 | 1034 | 1034 | 1028 | 1028 | 1028 | 1028 | 1028 | 1028 | 1028 | 1028 |
| R2 | 21.5 | 94.5 | 95.5 | 95.6 | 95.6 | 95.6 | 95.6 | 95.6 | 95.6 | 95.6 | 95.6 |

This table reports the OLS regressions on the haircuts of the all equity tri-party repos from November 2010 to August 2013, excluding those by the Fidelity and Bank of America money market funds. The t-statistics reported in squared brackets are based on double-clustered standard errors by fund family and month.

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Table 8: **Determinants of Equity Tri-Party Repo Spreads**

| Parm | Fidelity | Morgan Stanley | Charles Schwab | BoA | All |
|---|---|---|---|---|---|
| #cols (vw) | 0.093* | −.020 | −.040 | 0.031 | −.138* |
|  | [ 1.78] | [−0.57] | [−1.61] | [ 0.57] | [−1.76] |
| col port vol | −.029 | −.497 | −.172 | 0.033 | 0.008 |
|  | [−0.35] | [−1.31] | [−1.36] | [ 0.50] | [ 0.13] |
| col fin (%) | −1.42 | 4.045 | 1.237 | 3.067 | −1.10 |
|  | [−0.36] | [ 0.61] | [ 0.43] | [ 1.62] | [−0.70] |
| dealer CDS | 0.055 | −.027 | 0.107*** | 0.002 | 0.067*** |
|  | [ 0.62] | [−0.42] | [ 6.11] | [ 0.05] | [ 3.44] |
| repo haircut | −5.67*** | −1.11 |  | −.313 | −2.02 |
|  | [−3.12] | [−0.22] |  | [−1.04] | [−1.15] |
| repo size | −1.56*** | −.605 | −.153* | −3.10 | −.862** |
|  | [−7.00] | [−1.15] | [−1.72] | [−1.49] | [−2.57] |
| repo mat | 0.162** | 0.745*** | 0.025 | 0.114*** | 0.169*** |
|  | [ 2.31] | [ 6.67] | [ 0.66] | [ 2.59] | [ 5.87] |
| month | Y | Y | Y | Y | Y |
| dealer | Y | Y | Y | Y | Y |
| Fund Family | N | N | N | N | Y |
| NOBS | 1964 | 248 | 604 | 146 | 3138 |
| R2 | 37.3 | 66.6 | 93.1 | 72.0 | 45.9 |

This table reports the OLS regressions on the spreads of the equity tri-party repos from November 2010 to August 2013, separately for Fidelity, Morgan Stanley, Charles Schwab, Bank of America money market funds and the full sample. For the regressions of individual fund families, the t-statistics reported in squared brackets are based on double-clustered standard errors by dealer and month. For regressions of the full sample, the t-statistics reported in squared brackets are based on double-clustered standard errors by fund family and month.

Table 9: **Corporate Bond Repo Summary Statistics, November 2010 - August 2013**

**Panel A: Top 10 Fund Families**

| MMFs Family | #repos | amt ($M) | pct | #dealers | Repo Haircut (%) mean | std | Q1 | med | Q3 | Repo Spreads (bps) mean | std | Q1 | med | Q3 | Repo Maturity (#bizdays) mean | std | Q1 | med | Q3 | Repo Size ($M) mean | std | Q1 | med | Q3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank of America | 415 | 35,607 | 33.4 | 14 | 4.63 | 0.82 | 4.95 | 5.00 | 5.00 | 18 | 11 | 9.0 | 15 | 25 | 9.6 | 15 | 1 | 1 | 11 | 86 | 70 | 36 | 63 | 121 |
| Morgan Stanley | 250 | 23,909 | 22.4 | 14 | 5.34 | 0.69 | 5.00 | 5.01 | 5.93 | 24 | 14 | 12 | 21 | 34 | 8.2 | 25 | 1 | 1 | 4 | 96 | 149 | 10 | 45 | 90 |
| Blackrock | 161 | 13,309 | 12.5 | 8 | 6.70 | 0.72 | 7.00 | 7.00 | 7.01 | 25 | 14 | 13 | 21 | 40 | 4.7 | 11 | 1 | 1 | 1 | 83 | 89 | 25 | 50 | 100 |
| Federated Investment | 91 | 9,581 | 9.0 | 8 | 2.04 | 0.16 | 2.00 | 2.00 | 2.01 | 32 | 12 | 22 | 31 | 40 | 3.3 | 6.2 | 1 | 1 | 5 | 105 | 95 | 28 | 100 | 135 |
| Barclay | 55 | 7,509 | 7.0 | 5 | 4.16 | 1.01 | 3.00 | 5.00 | 5.00 | 19 | 12 | 9.0 | 13 | 35 | 2.1 | 4.4 | 1 | 1 | 1 | 137 | 104 | 50 | 100 | 220 |
| Dreyfus | 44 | 4,489 | 4.2 | 6 | 3.69 | 0.86 | 3.00 | 3.23 | 4.88 | 12 | 1.8 | 11 | 12 | 13 | 1.0 | 0.0 | 1 | 1 | 1 | 102 | 76 | 50 | 98 | 133 |
| U.S. Bancorp | 42 | 4,295 | 4.0 | 3 | 5.00 | 0.00 | 5.00 | 5.00 | 5.00 | 13 | 4.3 | 10 | 13 | 16 | 4.9 | 7.7 | 1 | 1 | 3 | 102 | 41 | 75 | 100 | 120 |
| Putman | 128 | 2,919 | 2.7 | 4 | 5.02 | 0.32 | 4.99 | 5.00 | 5.01 | 14 | 4.7 | 11 | 12 | 18 | 7.2 | 8.5 | 1 | 1 | 16 | 23 | 17 | 6 | 18 | 38 |
| Goldman Sachs | 16 | 1,721 | 1.6 | 5 | 7.44 | 2.18 | 5.00 | 7.48 | 9.47 | 20 | 13 | 11 | 14 | 30 | 1.3 | 1.0 | 1 | 1 | 1 | 108 | 113 | 2 | 100 | 180 |
| Deutsche Investment | 36 | 968 | 0.9 | 5 | 3.84 | 1.26 | 3.02 | 3.27 | 4.59 | 13 | 11 | 5.0 | 9.0 | 22 | 4.9 | 7.8 | 1 | 1 | 8 | 27 | 54 | 2 | 12 | 25 |

**Panel B: Top 10 Dealers**

| Dealer | #repos | #FFs | amt ($M) | pct | Dealer CDS (bps) mean | std | Repo Haircut (%) mean | std | Q1 | med | Q3 | Repo Spreads (bps) mean | std | Q1 | med | Q3 | Repo Maturity (#bizdays) mean | std | Q1 | med | Q3 | Repo Size ($M) mean | std | Q1 | med | Q3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JPM | 427 | 12 | 26,739 | 25.1 | 111 | 25.8 | 5.37 | 0.99 | 5.00 | 5.00 | 5.03 | 25.0 | 11.6 | 16.0 | 22.0 | 36.0 | 10.0 | 13.9 | 1 | 2 | 15 | 63 | 58 | 22 | 44 | 87 |
| WFC | 146 | 3 | 20,156 | 18.9 | 86 | 20.8 | 5.10 | 0.28 | 5.00 | 5.00 | 5.00 | 17.7 | 7.0 | 11.0 | 16.5 | 22.0 | 4.3 | 10.6 | 1 | 1 | 3 | 138 | 178 | 30 | 81 | 160 |
| BNP | 181 | 8 | 19,309 | 18.1 | 160 | 61.0 | 3.74 | 1.85 | 2.01 | 3.00 | 5.02 | 26.7 | 16.0 | 10.0 | 29.0 | 39.0 | 3.6 | 7.0 | 1 | 1 | 5 | 107 | 105 | 25 | 75 | 160 |
| HBC | 117 | 7 | 9,564 | 9.0 | 119 | 26.5 | 4.91 | 1.48 | 3.29 | 5.00 | 6.01 | 11.3 | 3.1 | 9.0 | 11.0 | 13.0 | 1.0 | 0.0 | 1 | 1 | 1 | 82 | 59 | 43 | 70 | 108 |
| CS | 72 | 7 | 6,216 | 5.8 | 134 | 34.2 | 5.09 | 1.17 | 4.99 | 5.00 | 5.01 | 20.5 | 13.2 | 9.0 | 12.0 | 33.0 | 12.2 | 17.2 | 1 | 1 | 23 | 86 | 81 | 31 | 68 | 115 |
| UBS | 44 | 4 | 4,681 | 4.4 | 123 | 38.1 | 5.18 | 1.99 | 3.00 | 5.27 | 7.00 | 13.8 | 6.7 | 8.0 | 14.0 | 19.0 | 1.7 | 3.0 | 1 | 1 | 1 | 106 | 133 | 20 | 50 | 135 |
| ING | 48 | 4 | 4,215 | 3.9 | 138 | 28.0 | 4.51 | 1.99 | 2.46 | 5.00 | 5.01 | 15.5 | 5.8 | 12.0 | 15.0 | 18.0 | 1.0 | 0.3 | 1 | 1 | 1 | 88 | 91 | 20 | 70 | 100 |
| DB | 53 | 7 | 3,149 | 3.0 | 103 | 20.9 | 5.17 | 1.22 | 4.98 | 5.00 | 5.08 | 12.8 | 5.7 | 11.0 | 12.0 | 13.0 | 1.0 | 0.3 | 1 | 1 | 1 | 59 | 52 | 25 | 45 | 75 |
| RY | 38 | 6 | 2,450 | 2.3 | 60 | 29.9 | 5.20 | 0.35 | 5.00 | 5.00 | 5.22 | 20.3 | 18.9 | 7.0 | 11.0 | 22.0 | 25.5 | 55.6 | 1 | 1 | 7 | 64 | 53 | 20 | 51 | 100 |
| BCS | 43 | 9 | 2,371 | 2.2 | 164 | 42.0 | 4.72 | 1.66 | 4.59 | 5.00 | 6.00 | 30.4 | 17.8 | 13.0 | 28.0 | 49.0 | 11.8 | 17.7 | 1 | 2 | 14 | 55 | 51 | 12 | 26 | 90 |

This table reports the summary statistics for haircut, spreads, maturity and size of the corporate bond tri-party repos, based on the monthly repo data from November 2010 to August 2013. The Panel A shows the summary statistics by money market fund families. For each of the top ten money market fund family, we also report the total number of repos (#repos), the total amount of repos (amt), the market share (pct) and the number of counter-party dealers (#dealers). The Panel B shows the summary statistics by dealers. For each of the top ten dealers, we also report the total number of repos (#repos), the total amount of repos (amt), the market share (pct), and the number of counter-party money market fund families (#FFs). The top ten dealers are J.P. Morgan (JPM), Wells Fargo (WFC), BNP Paribas (BNP), HSBC (HBC), Credit Suisse (CS), UBS (UBS), ING (ING), Deutsche Bank (DB), Royal Bank of Canada (RY) and Barclays (BCS), respectively. In addition, we report the mean and standard deviation of the dealers' 5-year CDS spreads in the Panel B. The CDS spreads data are obtained from Markit.

Table 10: **Characteristics of Corporate Bond Collateral for the Top 10 Fund Families, November 2010 - August 2013**

| MMFs Family | matched | #cols | #cols (vw) | rated | IG | rating | age | maturity | issu. size |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | mean | | | | |
| Bank of America | 0.96 | 29.71 | 11.12 | 0.94 | 0.89 | 6.85 | 2.91 | 4.69 | 20.61 |
| Morgan Stanley | 0.94 | 70.20 | 36.89 | 0.92 | 0.55 | 10.55 | 3.32 | 9.32 | 20.25 |
| Blackrock | 0.92 | 56.93 | 27.50 | 0.88 | 0.51 | 10.53 | 3.55 | 9.47 | 20.24 |
| Federated Investment | 0.94 | 32.71 | 13.49 | 0.89 | 0.31 | 11.78 | 3.84 | 7.86 | 20.36 |
| Barclay | 0.93 | 40.78 | 16.09 | 0.90 | 0.65 | 9.10 | 3.99 | 8.28 | 20.29 |
| Dreyfus | 0.96 | 34.09 | 9.07 | 0.84 | 0.53 | 10.43 | 4.93 | 7.61 | 20.11 |
| U.S. Bancorp | 0.95 | 29.26 | 9.86 | 0.93 | 0.90 | 7.82 | 3.28 | 11.80 | 20.47 |
| Putman | 0.96 | 17.88 | 7.61 | 0.94 | 0.94 | 8.80 | 2.80 | 10.68 | 20.14 |
| Goldman Sachs | 0.92 | 28.19 | 15.04 | 0.89 | 0.65 | 8.70 | 3.56 | 7.98 | 20.65 |
| Deutsche Investment | 0.98 | 6.42 | 3.08 | 0.96 | 0.71 | 7.74 | 4.47 | 11.16 | 20.51 |
| All | 0.95 | 40.36 | 18.19 | 0.92 | 0.70 | 8.95 | 3.32 | 7.83 | 20.38 |
| | | | | | median | | | | |
| Bank of America | 0.98 | 16.00 | 6.64 | 0.97 | 0.95 | 8.00 | 2.77 | 5.16 | 20.44 |
| Morgan Stanley | 0.95 | 17.50 | 9.59 | 0.92 | 0.86 | 9.00 | 3.17 | 8.44 | 20.23 |
| Blackrock | 0.91 | 36.00 | 24.23 | 0.88 | 0.67 | 9.14 | 3.49 | 8.74 | 20.23 |
| Federated Investment | 0.94 | 31.00 | 12.08 | 0.89 | 0.12 | 13.17 | 3.69 | 6.28 | 20.36 |
| Barclay | 0.94 | 19.00 | 8.46 | 0.94 | 0.82 | 9.13 | 3.51 | 6.93 | 20.30 |
| Dreyfus | 0.98 | 25.00 | 7.57 | 0.90 | 0.53 | 10.39 | 4.94 | 7.27 | 20.03 |
| U.S. Bancorp | 0.98 | 24.00 | 7.38 | 0.97 | 0.95 | 8.05 | 3.08 | 11.07 | 20.46 |
| Putman | 0.97 | 15.50 | 4.51 | 0.96 | 0.96 | 9.90 | 2.51 | 9.46 | 20.00 |
| Goldman Sachs | 0.92 | 22.50 | 15.65 | 0.90 | 0.87 | 7.17 | 3.44 | 6.78 | 20.74 |
| Deutsche Investment | 1.00 | 4.00 | 1.60 | 1.00 | 0.97 | 6.92 | 3.99 | 8.95 | 20.37 |
| All | 0.96 | 21.00 | 8.39 | 0.93 | 0.89 | 8.83 | 3.05 | 6.82 | 20.29 |
| | | | | | standard deviation | | | | |
| Bank of America | 0.05 | 43.83 | 18.85 | 0.09 | 0.17 | 3.22 | 1.23 | 2.34 | 0.67 |
| Morgan Stanley | 0.05 | 132.27 | 76.66 | 0.10 | 0.44 | 3.63 | 1.63 | 5.93 | 0.54 |
| Blackrock | 0.05 | 83.01 | 22.95 | 0.10 | 0.41 | 3.32 | 1.54 | 4.02 | 0.34 |
| Federated Investment | 0.05 | 24.72 | 8.49 | 0.07 | 0.37 | 3.29 | 1.48 | 4.67 | 0.45 |
| Barclay | 0.05 | 64.06 | 24.75 | 0.09 | 0.37 | 2.21 | 1.65 | 3.96 | 0.41 |
| Dreyfus | 0.04 | 25.69 | 7.49 | 0.20 | 0.38 | 3.18 | 2.28 | 4.41 | 0.43 |
| U.S. Bancorp | 0.05 | 20.35 | 7.77 | 0.09 | 0.16 | 2.04 | 1.27 | 5.07 | 0.48 |
| Putman | 0.05 | 15.45 | 8.25 | 0.06 | 0.07 | 2.35 | 1.64 | 5.46 | 0.50 |
| Goldman Sachs | 0.06 | 23.91 | 11.15 | 0.09 | 0.40 | 4.55 | 1.10 | 4.30 | 0.47 |
| Deutsche Investment | 0.04 | 6.92 | 3.41 | 0.07 | 0.42 | 2.64 | 3.18 | 7.46 | 0.72 |
| All | 0.05 | 75.50 | 39.23 | 0.10 | 0.38 | 3.62 | 1.64 | 5.05 | 0.58 |

This table reports the summary statistics for the collateral posted for the corporate bond tri-party repos from November 2010 to August 2013, separately by each of the top 10 money market fund families. For every corporate bond repo, we calculate the percentage of matched securities (matched), the number of collateral (#cols), the value-weighted number of collateral (#cols (vw)), the percentage of rated obnds (rated), the percentage of investment-grade bonds (IG), the value-weighted bond rating (rating), the value-weighted age in years (age), the value-weighted maturity in years (maturity) and the value-weighted log issuance size (issu. size). All the weights are the shares of the individual security value out of the repo's total collateral value. The value-weighted number of collateral (#cols (vw)) is the inverse of the Herfindahl index based on the shares of the individual security. The mean, median and standard-deviation are calculated across corporate bond tri-party repos of each money market fund family.

Table 11: **Determinants of Corporate Bond Repo Haircuts**

| Parm | Investment Grade | | Non-Investment Grade | | | |
|---|---|---|---|---|---|---|
| | Baa3 and above | $IG\% > 85\%$ | below Baa3 | $IG\% \leq 15\%$ | All | All |
| #cols (vw) | −.006** | −.005* | −.006 | 0.012* | 0.014* | 0.000 |
| | [−2.35] | [−1.88] | [−0.67] | [ 1.82] | [ 1.91] | [ 0.26] |
| col rating | 0.101* | 0.082 | 0.064 | 0.166* | 0.050 | 0.104*** |
| | [ 1.67] | [ 1.33] | [ 1.63] | [ 1.70] | [ 1.05] | [ 3.20] |
| col age | 0.008 | 0.015 | 0.033 | −.039 | −.008 | 0.023 |
| | [ 0.65] | [ 1.15] | [ 0.78] | [−1.33] | [−0.41] | [ 0.95] |
| col maturity (%) | 0.005 | 0.003 | −.017 | 0.005 | 0.015 | 0.009 |
| | [ 0.38] | [ 0.28] | [−0.66] | [ 0.17] | [ 1.42] | [ 0.59] |
| dealer CDS | −.002 | −.002 | 0.003 | 0.008 | 0.001 | −.001 |
| | [−1.09] | [−1.47] | [ 1.51] | [ 1.47] | [ 0.57] | [−0.97] |
| repo size | 0.039*** | 0.025* | −.017 | −.031 | −.042 | −.017 |
| | [ 3.22] | [ 1.86] | [−0.40] | [−0.92] | [−0.54] | [−0.54] |
| repo mat | 0.000 | −.000 | 0.017** | 0.017* | 0.001 | 0.003 |
| | [ 0.19] | [−0.34] | [ 2.04] | [ 1.83] | [ 0.23] | [ 1.33] |
| month | Y | Y | Y | Y | Y | Y |
| dealer | Y | Y | Y | Y | Y | Y |
| Fund Family | Y | Y | Y | Y | N | Y |
| NOBS | 376 | 405 | 302 | 157 | 1015 | 1015 |
| R2 | 92.1 | 92.1 | 90.5 | 95.0 | 38.7 | 84.0 |

This table reports the OLS regressions on the haircuts of corporate bond tri-party repos from November 2010 to August 2013, separately for Investment Grade, Non-Investment Grade and the full sample of tri-party repos. We use two methods to classify Investment-Grade and Non-Investment Grade corporate bond repos. The first one is by the average ratings of the underlying corporate bonds. The tri-party repos with average ratings at Baa3 or better are considered as Investment-Grade repos; tri-party repos with average ratings below Baa3 are considered as Non-Investment Grade repos. The second method is by the percentage of investment grade bonds in the collateral pool. The tri-party repos with more than 85% investment-grade bonds in the collateral pool are considered as Investment-Grade repos; the tri-party repos with more than 85% Non-Investment Grade bonds are considered as Non-Investment Grade repos. The t-statistics reported in squared brackets are based on double-clustered standard errors by fund family and month.

Table 12: **Determinants of Corporate Bond Repo Spreads**

| Parm | Investment Grade | | Non-Investment Grade | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | Baa3 and above | $IG\% > 85\%$ | below Baa3 | $IG\% \leq 15\%$ | All | All |
| #cols (vw) | 0.022 | 0.009 | −.010 | −.064 | −.007 | −.011** |
| | [ 0.38] | [ 0.18] | [−0.23] | [−0.95] | [−0.90] | [−2.34] |
| col rating | 0.270 | 0.028 | 0.912 | −.044 | 1.593*** | 1.139*** |
| | [ 1.06] | [ 0.13] | [ 1.45] | [−0.08] | [ 3.61] | [ 5.18] |
| col age | 0.307 | 0.373** | −.162 | −.291 | 0.140 | 0.010 |
| | [ 1.46] | [ 2.11] | [−0.84] | [−0.75] | [ 0.33] | [ 0.06] |
| col maturity (%) | 0.019 | 0.030 | 0.122** | 0.378* | −.098 | −.027 |
| | [ 0.23] | [ 0.43] | [ 2.53] | [ 1.69] | [−0.63] | [−0.30] |
| dealer CDS | 0.032* | 0.038* | 0.018 | 0.020 | 0.010 | 0.025* |
| | [ 1.89] | [ 1.87] | [ 1.22] | [ 1.45] | [ 0.72] | [ 1.95] |
| repo haircut | 2.279*** | 2.457*** | 1.103*** | 0.610 | 0.985 | 1.836*** |
| | [ 5.63] | [ 3.83] | [ 2.64] | [ 1.46] | [ 0.87] | [ 3.46] |
| repo size | −1.09*** | −1.01* | 0.800*** | 1.060*** | 0.194 | −.617* |
| | [−2.69] | [−1.69] | [ 3.12] | [ 3.71] | [ 0.42] | [−1.80] |
| repo mat | 0.285*** | 0.293*** | 0.218*** | 0.188*** | 0.274*** | 0.251*** |
| | [ 4.89] | [ 5.84] | [ 4.61] | [ 4.16] | [ 6.65] | [ 6.55] |
| month | Y | Y | Y | Y | Y | Y |
| dealer | Y | Y | Y | Y | Y | Y |
| Fund Family | Y | Y | Y | Y | N | Y |
| NOBS | 440 | 465 | 409 | 243 | 1256 | 1256 |
| R2 | 68.4 | 68.0 | 74.0 | 60.1 | 57.5 | 69.3 |

his table reports the OLS regressions on the spreads of corporate bond tri-party repos from November 2010 to August 2013, separately for Investment Grade, Non-Investment Grade and the full sample of tri-party repos. We use two methods to classify Investment-Grade and Non-Investment Grade corporate bond repos. The first one is by the average ratings of the underlying corporate bonds. The tri-party repos with average ratings at Baa3 or better are considered as Investment-Grade repos; tri-party repos with average ratings below Baa3 are considered as Non-Investment Grade repos. The second method is by the percentage of investment grade bonds in the collateral pool. The tri-party repos with more than 85% investment-grade bonds in the collateral pool are considered as Investment-Grade repos; the tri-party repos with more than 85% Non-Investment Grade bonds are considered as Non-Investment Grade repos. The t-statistics reported in squared brackets are based on double-clustered standard errors by fund family and month.

## Table 13: Treasury Repo Summary Statistics, November 2010 – August 2013

### Panel A: Top 10 MMFs

| MMFs Family | #repos | amt ($B) | pct | #dealers | Repo Haircut (%) | | | | | Repo Spreads (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 |
| Dreyfus | 1,374 | 327 | 11.6 | 18 | 2.00 | 0.02 | 2.00 | 2.00 | 2.01 | 1.9 | 4.5 | −5.0 | 2.0 | 7.0 | 1.0 | 0.0 | 1 | 1 | 1 | 238 | 345 | 17 | 100 | 650 |
| Federated Investment | 1,024 | 310 | 11.0 | 20 | 2.02 | 0.07 | 2.00 | 2.00 | 2.03 | 1.4 | 4.5 | −4.0 | 1.0 | 7.0 | 1.8 | 1.5 | 1 | 1 | 5 | 302 | 541 | 8 | 100 | 900 |
| Morgan Stanley | 1,177 | 189 | 6.7 | 22 | 2.07 | 0.39 | 1.87 | 2.01 | 2.26 | 2.4 | 5.4 | −3.0 | 2.0 | 8.0 | 2.2 | 5.3 | 1 | 1 | 3 | 161 | 164 | 15 | 100 | 385 |
| Blackrock | 1,213 | 185 | 6.6 | 13 | 2.00 | 0.09 | 2.00 | 2.00 | 2.02 | 1.6 | 7.1 | −5.0 | 1.0 | 8.0 | 1.4 | 2.5 | 1 | 1 | 2 | 153 | 263 | 8 | 28 | 467 |
| U.S. Bancorp | 354 | 167 | 6.0 | 15 | 2.00 | 0.00 | 2.00 | 2.00 | 2.00 | 1.2 | 4.2 | −4.0 | 1.0 | 7.0 | 1.1 | 0.6 | 1 | 1 | 1 | 473 | 427 | 97 | 300 | 1E3 |
| J.P.Morgan | 356 | 150 | 5.3 | 12 | 2.01 | 0.04 | 2.00 | 2.00 | 2.00 | 3.1 | 7.1 | −4.0 | 3.0 | 9.0 | 1.9 | 3.0 | 1 | 1 | 4 | 420 | 350 | 80 | 300 | 1E3 |
| Northern Trust | 626 | 132 | 4.7 | 14 | 1.91 | 0.45 | 1.33 | 2.00 | 2.12 | 2.3 | 4.6 | −3.0 | 2.0 | 8.0 | 1.5 | 1.8 | 1 | 1 | 3 | 211 | 250 | 9 | 100 | 600 |
| Wells Fargo Funds Managem | 426 | 132 | 4.7 | 17 | 2.00 | 0.05 | 2.00 | 2.00 | 2.00 | 2.6 | 4.7 | −3.5 | 3.1 | 9.3 | 2.3 | 12.0 | 1 | 1 | 1 | 310 | 278 | 40 | 250 | 750 |
| Goldman Sachs | 312 | 121 | 4.3 | 22 | 2.07 | 0.28 | 2.00 | 2.00 | 2.09 | 1.5 | 4.9 | −6.0 | 1.0 | 8.0 | 2.1 | 5.0 | 1 | 1 | 1 | 386 | 424 | 25 | 250 | 850 |
| Bank of America | 539 | 116 | 4.1 | 20 | 2.01 | 0.14 | 2.00 | 2.00 | 2.00 | 1.5 | 4.8 | −5.0 | 2.0 | 8.0 | 3.5 | 9.1 | 1 | 1 | 5 | 214 | 187 | 50 | 157 | 453 |
| Rest83MMFs | 8,020 | 984 | 35.0 | 27 | 2.02 | 0.32 | 2.00 | 2.00 | 2.06 | 1.2 | 5.6 | −6.0 | 1.0 | 8.0 | 1.4 | 3.0 | 1 | 1 | 1 | 123 | 198 | 6 | 60 | 298 |

### Panel B: Top 10 Dealers

| Dealer | #repos | #MMFs | amt ($B) | pct | Dealer CDS (bps) | | Repo Haircut (%) | | | | | Repo Spreads (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | mean | std | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 |
| BCS | 2,541 | 11 | 538 | 19.1 | 164 | 39.4 | 1.99 | 0.21 | 2.00 | 2.00 | 2.03 | 2.2 | 6.0 | −4.0 | 2.0 | 8.0 | 1.4 | 1.7 | 1 | 1 | 3 | 212 | 365 | 10 | 95 | 500 |
| RBS | 1,137 | 11 | 293 | 10.4 | 239 | 66.7 | 2.02 | 0.15 | 2.00 | 2.00 | 2.02 | 1.9 | 4.5 | −3.0 | 1.0 | 8.0 | 1.5 | 2.9 | 1 | 1 | 1 | 258 | 377 | 13 | 105 | 722 |
| DB | 1,505 | 11 | 245 | 8.7 | 138 | 39.7 | 1.99 | 0.24 | 2.00 | 2.00 | 2.00 | 2.5 | 4.6 | −3.0 | 4.0 | 7.4 | 1.5 | 3.6 | 1 | 1 | 1 | 163 | 236 | 14 | 80 | 450 |
| CS | 1,488 | 11 | 230 | 8.2 | 125 | 32.5 | 2.02 | 0.15 | 2.00 | 2.00 | 2.04 | 1.8 | 4.7 | −4.0 | 2.0 | 8.0 | 2.3 | 6.1 | 1 | 1 | 3 | 155 | 207 | 11 | 83 | 400 |
| BNP | 697 | 9 | 213 | 7.6 | 164 | 58.2 | 1.97 | 0.17 | 2.00 | 2.00 | 2.02 | 1.5 | 4.6 | −4.0 | 1.0 | 8.0 | 1.4 | 5.2 | 1 | 1 | 1 | 305 | 339 | 16 | 200 | 750 |
| BAC | 1,467 | 10 | 178 | 6.3 | 190 | 93.7 | 2.02 | 0.40 | 2.00 | 2.00 | 2.06 | −0.1 | 4.2 | −5.0 | −0.0 | 5.0 | 1.8 | 4.0 | 1 | 1 | 3 | 121 | 168 | 12 | 59 | 300 |
| HBC | 881 | 11 | 178 | 6.3 | 217 | 25.2 | 2.02 | 0.14 | 2.00 | 2.00 | 2.04 | 1.9 | 4.6 | −4.0 | 2.0 | 7.0 | 1.2 | 0.7 | 1 | 1 | 1 | 202 | 256 | 12 | 100 | 500 |
| ACA | 372 | 8 | 128 | 4.6 | 217 | 62.9 | 2.04 | 0.40 | 1.93 | 2.00 | 2.14 | 2.8 | 3.7 | −2.0 | 3.0 | 8.0 | 1.3 | 3.3 | 1 | 1 | 1 | 345 | 530 | 15 | 150 | 905 |
| GLE | 249 | 10 | 87 | 3.1 | 225 | 77.1 | 2.00 | 0.14 | 2.00 | 2.00 | 2.06 | 2.5 | 4.2 | −3.0 | 2.2 | 8.0 | 1.2 | 0.8 | 1 | 1 | 1 | 349 | 347 | 29 | 204 | 900 |
| RY | 322 | 8 | 86 | 3.1 | 80 | 46.3 | 2.02 | 0.11 | 2.00 | 2.00 | 2.06 | 1.7 | 5.2 | −5.0 | 1.1 | 10.0 | 1.1 | 0.6 | 1 | 1 | 1 | 267 | 348 | 15 | 131 | 800 |
| Rest20Dealers | 4,762 | 11 | 638 | 22.7 | 159 | 82.2 | 2.04 | 0.35 | 2.00 | 2.00 | 2.11 | 1.1 | 6.5 | −6.0 | 2.0 | 8.0 | 1.6 | 4.6 | 1 | 1 | 2 | 134 | 211 | 5 | 62 | 337 |

This table reports the summary statistics for haircut, spreads, maturity and size of the treasury tri-party repos, based on the monthly repo data from November 2010 to August 2013. The Panel A shows the summary statistics by money market fund families. For each of the top 10 money market fund family, we also report the total number of repos (#repos), the total amount of repos (amt), the market share (pct) and the number of counter-party dealers (#dealers). The Panel B shows the summary statistics by dealers. For each of the top 10 dealers, we also report the total number of repos (#repos), the total amount of repos (amt), the market share (pct), and the number of counter-party money market fund families (#FFs). The top ten dealers are Barclays (BCS), Royal Bank of Scotland (RBS), Deutsche Bank (DB), Credit Suisse (CS), BNP Paribas (BNP), Bank of America (BAC), HBSC (HBC), Credit Agricole (ACA), Societe Generale (GLE) and Royal Bank of Canada(RY), respectively. In addition, we report the mean and standard deviation of the dealers' 5-year CDS spreads in the Panel B. The CDS spreads data are obtained from Markit.

Table 14: **Characteristics of Treasury Collateral, November 2010 - August 2013**

| Fund Family | #cols | #cols (vw) | bill | note | bond | coupon | age | mat | duratn | outamt | vol | otr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | mean | | | | | | |
| Dreyfus | 2.67 | 1.91 | 0.08 | 0.77 | 0.14 | 2.07 | 2.16 | 6.33 | 4.99 | 42.56 | 4.96 | 10.49 |
| Federated Investment | 12.68 | 6.45 | 0.04 | 0.80 | 0.15 | 2.10 | 2.62 | 6.16 | 4.91 | 38.64 | 4.45 | 11.52 |
| Blackrock | 2.29 | 1.77 | 0.06 | 0.79 | 0.15 | 2.08 | 2.42 | 6.28 | 4.94 | 40.15 | 4.40 | 10.57 |
| Morgan Stanley | 2.27 | 1.70 | 0.05 | 0.82 | 0.13 | 1.99 | 2.80 | 5.31 | 4.32 | 38.25 | 3.74 | 11.81 |
| U.S. Bancorp | 6.35 | 3.59 | 0.10 | 0.68 | 0.22 | 2.20 | 2.55 | 7.72 | 5.76 | 42.96 | 5.40 | 9.85 |
| J.P.Morgan | 3.68 | 2.60 | 0.04 | 0.77 | 0.19 | 2.46 | 3.27 | 6.55 | 5.14 | 39.08 | 4.90 | 10.89 |
| Northern Trust | 2.18 | 1.69 | 0.02 | 0.87 | 0.10 | 2.05 | 2.14 | 6.15 | 5.05 | 40.67 | 4.69 | 10.75 |
| Wells Fargo | 3.18 | 2.54 | 0.06 | 0.81 | 0.13 | 2.05 | 2.38 | 5.69 | 4.63 | 40.24 | 4.10 | 10.43 |
| Goldman Sachs | 4.69 | 3.21 | 0.05 | 0.83 | 0.12 | 2.06 | 1.89 | 6.14 | 4.89 | 40.43 | 4.49 | 10.61 |
| Bank of America | 4.48 | 2.58 | 0.05 | 0.83 | 0.12 | 2.19 | 2.55 | 5.66 | 4.57 | 38.35 | 4.18 | 11.30 |
| All | 3.43 | 2.23 | 0.06 | 0.79 | 0.15 | 2.05 | 2.39 | 6.21 | 4.91 | 40.36 | 4.43 | 10.83 |
| | | | | | | median | | | | | | |
| Dreyfus | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.75 | 1.04 | 4.12 | 3.81 | 36.20 | 3.16 | 8.75 |
| Federated Investment | 4.00 | 2.99 | 0.00 | 1.00 | 0.00 | 1.89 | 1.97 | 4.34 | 3.98 | 35.87 | 3.34 | 10.83 |
| Blackrock | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.75 | 1.41 | 3.72 | 3.52 | 35.66 | 2.31 | 9.00 |
| Morgan Stanley | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.53 | 1.51 | 3.28 | 3.11 | 35.27 | 2.08 | 10.56 |
| U.S. Bancorp | 2.00 | 1.92 | 0.00 | 0.90 | 0.00 | 1.86 | 1.45 | 4.34 | 4.06 | 36.54 | 3.34 | 9.13 |
| J.P.Morgan | 2.00 | 1.68 | 0.00 | 1.00 | 0.00 | 2.28 | 1.87 | 4.42 | 4.03 | 35.54 | 3.40 | 9.60 |
| Northern Trust | 2.00 | 1.10 | 0.00 | 1.00 | 0.00 | 1.88 | 1.60 | 4.25 | 4.09 | 35.17 | 2.70 | 9.00 |
| Wells Fargo | 2.00 | 1.82 | 0.00 | 1.00 | 0.00 | 1.84 | 1.54 | 4.11 | 3.91 | 36.07 | 2.59 | 10.43 |
| Goldman Sachs | 2.00 | 1.72 | 0.00 | 1.00 | 0.00 | 2.02 | 1.25 | 4.02 | 3.75 | 36.31 | 2.97 | 9.44 |
| Bank of America | 2.00 | 1.35 | 0.00 | 1.00 | 0.00 | 1.90 | 1.60 | 4.07 | 3.76 | 35.25 | 2.81 | 10.60 |
| All | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.75 | 1.38 | 3.78 | 3.58 | 35.72 | 2.51 | 9.56 |
| | | | | | | standard deviation | | | | | | |
| Dreyfus | 9.50 | 3.91 | 0.25 | 0.38 | 0.32 | 1.67 | 3.42 | 7.08 | 4.44 | 22.31 | 5.06 | 8.67 |
| Federated Investment | 28.57 | 11.54 | 0.14 | 0.29 | 0.27 | 1.28 | 2.68 | 5.50 | 3.51 | 13.11 | 3.88 | 6.88 |
| Blackrock | 5.98 | 3.32 | 0.22 | 0.37 | 0.33 | 1.62 | 3.29 | 7.29 | 4.56 | 19.38 | 4.87 | 8.49 |
| Morgan Stanley | 3.28 | 1.59 | 0.19 | 0.34 | 0.30 | 1.68 | 4.01 | 6.08 | 3.90 | 17.13 | 4.34 | 8.51 |
| U.S. Bancorp | 15.75 | 5.41 | 0.25 | 0.40 | 0.36 | 1.65 | 3.32 | 8.08 | 4.94 | 20.57 | 5.50 | 7.19 |
| J.P.Morgan | 5.53 | 3.24 | 0.18 | 0.36 | 0.33 | 1.77 | 4.29 | 6.51 | 4.09 | 17.80 | 4.54 | 7.72 |
| Northern Trust | 1.67 | 1.36 | 0.14 | 0.30 | 0.27 | 1.30 | 2.50 | 6.34 | 4.04 | 16.11 | 4.80 | 8.11 |
| Wells Fargo | 2.83 | 2.47 | 0.19 | 0.32 | 0.27 | 1.41 | 3.07 | 5.78 | 3.61 | 16.26 | 4.22 | 6.93 |
| Goldman Sachs | 9.81 | 4.84 | 0.19 | 0.33 | 0.28 | 1.23 | 2.14 | 6.80 | 4.25 | 15.72 | 4.47 | 7.87 |
| Bank of America | 16.42 | 5.40 | 0.18 | 0.32 | 0.28 | 1.52 | 3.30 | 5.88 | 3.73 | 16.59 | 4.07 | 7.76 |
| All | 11.82 | 4.80 | 0.21 | 0.37 | 0.32 | 1.61 | 3.40 | 7.04 | 4.42 | 19.30 | 4.82 | 8.36 |

This table reports the summary statistics for the collateral posted for the treasury tri-party repos from November 2010 to August 2013, separately by each of the top 10 money market fund families. For every treasury repo, we calculate the number of collateral (#cols), the value-weighted number of collateral (#cols (vw)), the percentage of treasury Bills (bill), the percentage of treasury Notes (note), the percentage of treasury Bonds (bond), the value-weighted coupon in percentages (coupon), the value-weighted age in years (age), the value-weighted maturity in years (mat), the value-weighted duration (duratn), and the value-weighted outstanding amount in billions (outamt) and the percentage of on-the-run treasuries. All the weights are the shares of the individual security value out of the repo's total collateral value. The value-weighted number of collateral (#cols (vw)) is the inverse of the Herfindahl index based on the shares of the individual security. The mean, median and standard-deviation are calculated across treasury tri-party repos of each money market fund family.

Table 15: **Determinants of Treasury Repo Haircuts and Spreads**

| Parm | haircuts | | | | spreads | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| #cols (vw) | | | | −.000 | | | | −.007 |
| | | | | [−0.97] | | | | [−1.07] |
| col coupon | | | | −.009 | | | | 0.023 |
| | | | | [−1.44] | | | | [ 0.28] |
| col age | | | | 0.001 | | | | −.023 |
| | | | | [ 0.39] | | | | [−0.60] |
| col outamt | | | | 0.000 | | | | 0.002 |
| | | | | [ 0.01] | | | | [ 0.31] |
| col duratn | | | | 0.003 | | | | 0.047 |
| | | | | [ 0.79] | | | | [ 0.98] |
| col volatility | | | | −.001 | | | | −.032 |
| | | | | [−0.26] | | | | [−1.22] |
| col bill | | | | −.020 | | | | 0.077 |
| | | | | [−0.38] | | | | [ 0.08] |
| col note | | | | −.029 | | | | 0.317 |
| | | | | [−0.89] | | | | [ 0.52] |
| dealer CDS | | 0.000 | 0.000 | 0.000 | | −.002 | −.001 | −.001 |
| | | [ 0.58] | [ 0.86] | [ 0.88] | | [−1.14] | [−0.41] | [−0.60] |
| repo haircut | | | | | −.174 | 0.378 | −.021 | −.001 |
| | | | | | [−0.51] | [ 1.56] | [−0.15] | [−0.01] |
| repo size | −.014** | −.009** | −.002 | −.001 | 0.350*** | −.068 | −.013 | −.000 |
| | [−2.50] | [−2.06] | [−0.60] | [−0.38] | [ 3.51] | [−1.23] | [−0.31] | [−0.01] |
| repo mat | −.000 | −.000 | −.000 | −.000 | 0.116 | 0.117 | 0.116 | 0.112 |
| | [−1.31] | [−0.98] | [−0.73] | [−0.56] | [ 1.35] | [ 1.35] | [ 1.30] | [ 1.26] |
| month | Y | Y | Y | Y | Y | Y | Y | Y |
| dealer | N | Y | Y | Y | N | Y | Y | Y |
| Fund Family | N | N | Y | Y | N | N | Y | Y |
| NumObs | 15421 | 14841 | 14841 | 14017 | 15421 | 14841 | 14841 | 14017 |
| Adjusted R2 | 1.6 | 5.3 | 16.6 | 16.9 | 48.0 | 58.3 | 62.1 | 63.2 |

This table reports the OLS regressions on the haircuts and spreads of the treasury tri-party repos from November 2010 to August 2013. The t-statistics reported in squared brackets are based on double-clustered standard errors by fund family and month.

# Appendix

# A    Repo Pricing Before November 2010

Since our monthly data start only from November 2010, we complement it with the tri-party repo deals obtained from the annual (N-CSR), semi-annual (N-CSRS) and quarterly (N-Q) filings of money market funds with the SEC from January 2005 to September 2010. We have basic repo information including the borrowers, amount, haircuts, interest rates, maturity dates and the collateral asset classes. However, the details of the securities in the collateral pool are not reported. Without the collateral information, it is impossible to perform the same analysis as we did for the monthly repo data. Nevertheless, the data do provide some useful insights of the opaque tri-party repo market before November 2010, especially during the financial crisis period. Given the strong role played by money market funds in repo pricing, we summarize the repos' characteristics separately for each money market fund family for the three time intervals: the pre-crisis period from January 2005 to June 2008, the crisis period from June 2008 to June 2009, and the post-crisis period from June 2009 to September 2010. The equity and corporate bond repos are summarized in Table AI. The treasury repos are summarized in Table AII. In addition, the median haircuts, interest rates, spreads, and maturities are plotted in the time-series of Figure 2.

**Equity Repos**

The tri-party equity repo market went through several phases from 2005 Q1 to 2010 Q3. The median haircut is at 5% before September 2008, jumps sharply to 10% after Lehman's default, stays at the 10% level for around one year, and then returns to 8.5% at the end of 2009. Fidelity, which is the largest lender in our monthly data from November 2010 to August 2013, remains the largest lender from 2005 Q1 to 2010 Q3.

Before the financial crisis, from 2005 Q1 to 2008 Q3, the money market funds accept equity collateral come from two fund families: Fidelity and State Street. Both fund families ask for more or less similar haircuts at around 5%. The Fidelity funds have 60% of the total lending, and the State Street funds have the remaining 40%. Fidelity continues to accept equity collateral but asks for higher haircuts during the financial crisis, from September 2008 and June 2009. In contrast, the State Street funds retreat completely from the equity tri-party repo market during the crisis. When the repo market bounces back after the financial crisis, from September 2009 to September 2010, Charles Schwab and Morgan Stanley funds

start to accept equity collateral for repo lending. But in contrast to the approximately 9% haircuts demanded by Fidelity, both Charles Schwab and Morgan Stanley ask for only 5%, the same level observed in the pre-crisis period.

Therefore, similar to our observations based on the monthly repo data, setting haircuts is largely a decision made at the level of the fund families. Even in our limited sample of four fund families, policies on haircuts vary widely.

In terms of repo spreads, the overall time-series trend suggests that spreads on equity repos run up during the financial crisis period, and has returned to its normal level since late 2009.

### Corporate Bond Repos

It is difficult to draw any concrete conclusions on corporate bond repos, as money market funds often don't disclose whether the collateral are investment grade or non-investment grade. Nevertheless, the haircut distribution across fund families suggests that different families use various policies on haircuts. Interestingly, we do find some money market fund families that assign a fixed haircut for all of its repos. For example, Invesco funds charge a constant 5% haircut, irrespective of the market condition or the counter-party's identity, not to mention the collateral quality. This fixed-level haircut policy is consistent with our findings using the monthly data after November 2010.

### Treasury Repos

Consistent with the previous literature, treasury repo haircuts stay stably at around 2%, even during the 2008 financial crisis when the credit market was in turmoil. Repo spreads, on the other hand, show an interesting time-series trend. Before the financial crisis, the treasury repo spreads are usually slightly below zero as lenders view repo loans backed by high-quality treasuries safer than the uncollateralized loans in the fed fund market. At the first quarter of 2008, right after the collapse of Bear Stearns, the interest rates on treasury tri-party repos drop significantly below the fed fund rates, resulting in a huge negative basis with a median at around -120 bps. The repo spreads bounce back quickly in the next quarter and have since fluctuated within a small range around zero.

Table AI: Equity and Corporate Bond Repo Summary Statistics, 2005 Q1 - 2010 Q3

**Panel A: Equity Repos**

| period | MMFs Family | #repos | amt ($M) | pct | #dealers | Repo Haircut (%) | | | | | Repo Spreads (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 |
| Jan05 - June08 | Fidelity | 143 | 50,592 | 60.3 | 8 | 5.08 | 0.80 | 5.00 | 5.00 | 5.02 | 32.0 | 31.8 | 12.0 | 22.0 | 50.0 | 11.4 | 22.1 | 1 | 1 | 1 | 354 | 415 | 60 | 200 | 500 |
| | State Street | 59 | 33,262 | 39.7 | 8 | 5.00 | 0.82 | 5.00 | 5.01 | 5.03 | 22.4 | 28.9 | 9.0 | 22.0 | 33.0 | 34.9 | 39.1 | 1 | 21 | 67 | 564 | 324 | 345 | 500 | 800 |
| Sep08 - June09 | Fidelity | 183 | 57,894 | 100 | 9 | 9.10 | 2.00 | 10.0 | 10.0 | 10.0 | 77.4 | 99.1 | 33.0 | 40.0 | 82.0 | 15.9 | 19.9 | 1 | 1 | 25 | 316 | 459 | 27 | 94 | 483 |
| Sep09 - Sep10 | Fidelity | 248 | 53,829 | 94.1 | 9 | 9.08 | 1.29 | 8.02 | 8.46 | 10.0 | 29.8 | 7.3 | 25.5 | 29.5 | 33.0 | 21.9 | 28.0 | 1 | 5 | 59 | 217 | 373 | 17 | 63 | 225 |
| | Charles Schwab | 36 | 2,201 | 3.8 | 2 | 4.98 | 0.13 | 5.00 | 5.00 | 5.00 | 44.7 | 14.2 | 30.0 | 43.5 | 59.0 | 67.0 | 11.6 | 63 | 72 | 73 | 61 | 53 | 13 | 56 | 92 |
| | Morgan Stanley | 8 | 1,190 | 2.1 | 4 | 5.01 | 0.01 | 5.01 | 5.01 | 5.01 | 21.6 | 9.0 | 17.0 | 18.0 | 22.0 | 1.0 | 0.0 | 1 | 1 | 1 | 149 | 198 | 40 | 98 | 135 |

**Panel B: Corporate Bond Repos**

| period | MMFs Family | #repos | amt ($M) | pct | #dealers | Repo Haircut (%) | | | | | Repo Spreads (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 |
| Jan05 - June08 | Fidelity | 734 | 208,495 | 52.6 | 16 | 3.68 | 1.59 | 2.00 | 3.86 | 5.01 | 30.8 | 32.3 | 11.0 | 20.0 | 49.0 | 27.2 | 32.8 | 1 | 1 | 62.0 | 284 | 393 | 40 | 143 | 396 |
| | State Street | 264 | 89,265 | 22.5 | 18 | 3.67 | 1.46 | 2.00 | 3.96 | 5.00 | 27.2 | 47.7 | 8.5 | 18.0 | 29.5 | 23.9 | 55.1 | 1 | 1 | 18.5 | 338 | 280 | 103 | 250 | 500 |
| | Dreyfus | 134 | 39,210 | 9.9 | 15 | 3.58 | 0.91 | 3.00 | 3.00 | 4.90 | 31.0 | 32.7 | 12.0 | 18.0 | 49.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 293 | 250 | 100 | 205 | 375 |
| | J.P.Morgan | 48 | 30,771 | 7.8 | 10 | 2.99 | 0.45 | 3.00 | 3.00 | 3.00 | 20.8 | 22.4 | 4.0 | 9.5 | 49.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 641 | 498 | 200 | 613 | 1100 |
| | Invesco | 23 | 11,931 | 3.0 | 4 | 4.99 | 0.07 | 5.00 | 5.00 | 5.00 | 19.1 | 20.6 | 6.0 | 10.0 | 24.0 | 1.4 | 1.9 | 1 | 1 | 1.0 | 519 | 266 | 250 | 557 | 691 |
| | Goldman Sachs | 33 | 7,945 | 2.0 | 2 | 3.65 | 0.86 | 3.00 | 3.58 | 4.26 | 22.3 | 32.1 | 11.0 | 16.0 | 26.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 241 | 124 | 175 | 225 | 310 |
| | Morgan Stanley | 17 | 6,560 | 1.7 | 7 | 2.66 | 1.34 | 2.00 | 2.00 | 3.13 | 21.5 | 17.8 | 6.0 | 19.0 | 27.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 386 | 301 | 115 | 300 | 700 |
| | Blackrock | 10 | 2,020 | 0.5 | 4 | 2.89 | 0.97 | 2.00 | 2.45 | 4.00 | 7.4 | 2.4 | 5.0 | 7.0 | 10.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 202 | 97 | 175 | 175 | 185 |
| Sep08 - June09 | Fidelity | 171 | 35,897 | 75.8 | 16 | 5.11 | 0.37 | 5.00 | 5.03 | 5.12 | 91.9 | 128 | 37.0 | 50.0 | 74.0 | 12.7 | 14.3 | 1 | 1 | 22.0 | 210 | 332 | 90 | 90 | 266 |
| | Morgan Stanley | 22 | 6,925 | 14.6 | 8 | 4.86 | 0.64 | 5.00 | 5.00 | 5.00 | 25.2 | 5.0 | 20.0 | 25.0 | 28.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 315 | 282 | 100 | 250 | 450 |
| | J.P.Morgan | 5 | 3,900 | 8.2 | 4 | 2.80 | 0.45 | 3.00 | 3.00 | 3.00 | 30.4 | 8.0 | 34.0 | 34.0 | 34.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 780 | 311 | 600 | 700 | 800 |
| | Invesco | 4 | 649 | 1.4 | 3 | 5.00 | 0.00 | 5.00 | 5.00 | 5.00 | 35.0 | 8.2 | 30.0 | 38.0 | 40.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 162 | 190 | 52 | 85 | 273 |
| Sep09 - Sep10 | Fidelity | 842 | 76,918 | 73.0 | 14 | 7.10 | 1.94 | 5.08 | 7.86 | 8.08 | 32.8 | 13.6 | 25.0 | 28.0 | 39.0 | 46.8 | 32.0 | 21 | 62 | 63.0 | 91 | 221 | 5 | 20 | 87 |
| | Blackrock | 65 | 12,050 | 11.4 | 9 | 6.73 | 0.70 | 7.00 | 7.00 | 7.00 | 19.4 | 10.1 | 13.0 | 16.0 | 19.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 185 | 293 | 50 | 100 | 175 |
| | Bank of America | 59 | 8,416 | 8.0 | 8 | 4.91 | 0.50 | 5.00 | 5.00 | 5.01 | 18.5 | 6.6 | 14.0 | 17.0 | 25.0 | 22.2 | 24.3 | 1 | 10 | 43.0 | 143 | 102 | 67 | 134 | 175 |
| | HSBC | 7 | 4,414 | 4.2 | 2 | 2.00 | 0.00 | 2.00 | 2.00 | 2.00 | 1.4 | 2.2 | 0.0 | 1.0 | 4.0 | 1.6 | 1.5 | 1 | 1 | 1.0 | 631 | 345 | 250 | 615 | 879 |
| | Dreyfus | 13 | 2,555 | 2.4 | 5 | 3.12 | 0.70 | 3.00 | 3.00 | 3.04 | 15.0 | 2.8 | 15.0 | 16.0 | 16.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 197 | 124 | 100 | 150 | 250 |
| | Invesco | 3 | 598 | 0.6 | 1 | 5.00 | 0.00 | 5.00 | 5.00 | 5.00 | 12.0 | 1.0 | 11.0 | 12.0 | 13.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 199 | 90 | 109 | 199 | 290 |
| | Goldman Sachs | 5 | 349 | 0.3 | 3 | 6.71 | 3.09 | 5.00 | 5.00 | 10.0 | 31.4 | 15.5 | 15.0 | 41.0 | 42.0 | 1.0 | 0.0 | 1 | 1 | 1.0 | 70 | 106 | 4 | 4 | 94 |

This table reports the summary statistics for haircut, spreads, maturity and size of the equity and corporate bond tri-party repos, based on the quarterly filings of a subsample of 102 US money market funds from January 2005 to September 2010. We divide the sample period into three subperiods, January 2005 to June 2008, September 2008 to June 2009 and September 2009 to September 2010. Within each subperiod, we report the distribution of repo haircut, spreads, maturity and size by each money market fund family. In addition, we also report the number of repos (#repos), the total repo amount in millions (amt), the market share (pct) and the number of dealers (#dealers) by each fund family in each subperiod.

## Table AII: Quarterly Treasury Repo Summary Statistics, 2005 Q1 - 2010 Q3

| period | MMFs Family | #repos | amt ($M) | pct | #dealers | Repo Haircut (%) mean | std | P10 | med | P90 | Repo Spreads (bps) mean | std | P10 | med | P90 | Repo Maturity (#bizdays) mean | std | P10 | med | P90 | Repo Size ($M) mean | std | P10 | med | P90 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fidelity | 267 | 271,576 | 18.0 | 19 | 2.01 | 0.13 | 2.00 | 2.00 | 2.00 | −20 | 52.7 | −114 | −8.0 | 14.0 | 2.9 | 17.6 | 1 | 1.0 | 1.0 | 1017 | 908 | 150 | 750 | 2450 |
| | Federated Investment | 423 | 243,759 | 16.2 | 26 | 2.37 | 1.02 | 2.00 | 2.00 | 3.12 | −19 | 37.0 | −40 | −10 | 1.0 | 18.3 | 54.5 | 1 | 1.0 | 56.0 | 576 | 596 | 90 | 352 | 1398 |
| | Wells Fargo | 271 | 218,127 | 14.5 | 14 | 2.00 | 0.00 | 2.00 | 2.00 | 2.00 | −14 | 47.4 | −79 | −2.0 | 24.0 | 1.6 | 2.3 | 1 | 1.0 | 3.0 | 805 | 875 | 70 | 500 | 2000 |
| | Charles Schwab | 413 | 156,016 | 10.4 | 9 | 2.06 | 0.24 | 2.00 | 2.00 | 2.16 | 14.7 | 33.5 | −7.0 | 9.0 | 49.0 | 10.0 | 21.5 | 1 | 1.0 | 38.0 | 378 | 434 | 8 | 200 | 935 |
| | J.P.Morgan | 119 | 127,664 | 8.5 | 13 | 2.10 | 0.33 | 2.00 | 2.00 | 2.99 | −40 | 58.8 | −126 | −15 | 14.0 | 1.0 | 0.3 | 1 | 1.0 | 1.0 | 1073 | 937 | 200 | 1000 | 2000 |
| | Dreyfus | 230 | 113,965 | 7.6 | 18 | 2.01 | 0.19 | 2.00 | 2.00 | 2.06 | −38 | 51.0 | −147 | −17 | −7.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 495 | 427 | 150 | 455 | 800 |
| Jan05 - June08 | Invesco | 440 | 110,750 | 7.4 | 24 | 2.13 | 0.59 | 2.00 | 2.00 | 2.01 | −15 | 42.6 | −42 | −4.0 | 14.0 | 1.7 | 5.7 | 1 | 1.0 | 1.0 | 252 | 220 | 55 | 224 | 500 |
| | Blackrock | 332 | 102,574 | 6.8 | 14 | 2.20 | 0.52 | 2.00 | 2.00 | 3.00 | −0.4 | 51.5 | −42 | −5.0 | 27.0 | 8.2 | 21.7 | 1 | 1.0 | 28.0 | 309 | 314 | 40 | 200 | 700 |
| | State Street | 251 | 58,686 | 3.9 | 19 | 2.05 | 0.26 | 2.00 | 2.00 | 2.01 | −12 | 50.9 | −96 | −7.0 | 22.0 | 5.2 | 22.1 | 1 | 1.0 | 1.0 | 234 | 305 | 37 | 100 | 600 |
| | Morgan Stanley | 224 | 41,150 | 2.7 | 13 | 2.02 | 0.08 | 2.00 | 2.00 | 2.06 | −19 | 35.7 | −66 | −6.0 | 13.0 | 25.9 | 41.9 | 1 | 1.0 | 104.0 | 184 | 293 | 5 | 40 | 565 |
| | Fidelity | 150 | 24,478 | 1.6 | 13 | 4.11 | 2.03 | 2.03 | 3.00 | 7.34 | 11.7 | 30.2 | −22 | 2.5 | 69.5 | 117 | 92.8 | 1 | 85.0 | 250.0 | 163 | 183 | 28 | 95 | 386 |
| | Passport Research Ltd | 56 | 24,100 | 1.6 | 16 | 2.45 | 0.62 | 2.00 | 2.09 | 3.35 | −1.6 | 38.8 | −14 | 1.0 | 39.0 | 9.4 | 17.4 | 1 | 1.0 | 34.0 | 430 | 268 | 170 | 397 | 850 |
| | Goldman Sachs | 81 | 13,585 | 0.9 | 9 | 2.01 | 0.16 | 1.97 | 2.00 | 2.04 | −38 | 52.2 | −110 | −39 | 10.0 | 47.8 | 70.9 | 1 | 1.0 | 165.0 | 168 | 253 | 25 | 74 | 450 |
| | Deutsche Investment | 14 | 324 | 0.0 | 7 | 2.07 | 0.12 | 2.00 | 2.01 | 2.23 | −60 | 42.1 | −87 | −54 | −15 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 23 | 25 | 1 | 19 | 55 |
| | Federated Investment | 107 | 116,015 | 17.2 | 17 | 2.03 | 0.13 | 2.00 | 2.00 | 2.07 | −8.0 | 33.3 | −12 | −3.0 | 5.0 | 8.8 | 23.5 | 1 | 1.0 | 22.0 | 1084 | 1146 | 96 | 700 | 2739 |
| | Wells Fargo | 114 | 111,459 | 16.5 | 12 | 2.00 | 0.00 | 2.00 | 2.00 | 2.00 | −7.8 | 14.3 | −25 | 1.0 | 16.0 | 1.3 | 1.1 | 1 | 1.0 | 2.0 | 978 | 1029 | 75 | 750 | 2063 |
| | J.P.Morgan | 45 | 93,449 | 13.9 | 11 | 2.00 | 0.01 | 2.00 | 2.00 | 2.00 | −7.8 | 15.7 | −32 | −3.0 | 8.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 2077 | 2287 | 219 | 1000 | 5639 |
| | Dreyfus | 87 | 67,049 | 9.9 | 16 | 2.03 | 0.22 | 2.00 | 2.00 | 2.00 | −3.8 | 6.5 | −12 | −4.0 | 3.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 771 | 647 | 200 | 588 | 1600 |
| | U.S. Bancorp | 57 | 59,617 | 8.8 | 15 | 2.02 | 0.16 | 2.00 | 2.00 | 2.00 | −4.9 | 16.1 | −32 | 2.0 | 9.0 | 11.3 | 46.7 | 1 | 1.0 | 12.0 | 1046 | 890 | 270 | 700 | 2400 |
| | Invesco | 65 | 52,145 | 7.7 | 16 | 2.03 | 0.13 | 2.00 | 2.00 | 2.00 | −4.0 | 13.2 | −30 | −1.0 | 8.0 | 2.3 | 5.0 | 1 | 1.0 | 1.0 | 802 | 708 | 100 | 750 | 2000 |
| | Blackrock | 131 | 45,065 | 6.7 | 14 | 2.06 | 0.21 | 2.00 | 2.00 | 2.00 | −7.7 | 67.0 | −28 | −0.0 | 12.0 | 4.7 | 13.4 | 1 | 1.0 | 1.0 | 344 | 295 | 90 | 250 | 775 |
| Sep08 - June09 | Charles Schwab | 126 | 34,244 | 5.1 | 7 | 2.16 | 0.61 | 2.00 | 2.00 | 2.06 | −5.2 | 17.2 | −21 | −6.0 | 12.0 | 1.1 | 0.7 | 1 | 1.0 | 1.0 | 272 | 377 | 25 | 120 | 795 |
| | Morgan Stanley | 50 | 31,215 | 4.6 | 12 | 2.06 | 0.24 | 2.00 | 2.00 | 2.00 | −10 | 6.3 | −10 | −2.0 | 9.0 | 7.6 | 25.3 | 1 | 1.0 | 5.5 | 624 | 583 | 95 | 480 | 1550 |
| | Fidelity | 94 | 27,491 | 4.1 | 11 | 2.59 | 0.66 | 2.01 | 2.34 | 3.12 | 46.7 | 88.7 | 11.0 | 30.0 | 86.0 | 24.9 | 22.2 | 1 | 22.0 | 62.0 | 292 | 314 | 9 | 196 | 796 |
| | UBS | 28 | 21,897 | 3.2 | 7 | 2.07 | 0.28 | 2.00 | 2.00 | 2.10 | −11 | 15.6 | −22 | −6.0 | 2.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 782 | 555 | 0 | 825 | 1480 |
| | Goldman Sachs | 21 | 5,270 | 0.8 | 6 | 2.01 | 0.02 | 2.00 | 2.00 | 2.03 | −61 | 84.9 | −190 | −5.0 | 1.0 | 2.8 | 6.1 | 1 | 1.0 | 2.0 | 251 | 300 | 14 | 100 | 596 |
| | Deutsche Investment | 7 | 3,185 | 0.5 | 3 | 2.02 | 0.05 | 2.00 | 2.00 | 2.14 | −63 | 87.1 | −193 | −14 | −1.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 455 | 372 | 93 | 331 | 1026 |
| | Passport Research Ltd | 5 | 2,800 | 0.4 | 3 | 2.01 | 0.01 | 2.00 | 2.00 | 2.02 | −17 | 21.1 | −32 | −32 | 8.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 560 | 288 | 200 | 500 | 900 |
| | UBS | 3 | 2,615 | 0.4 | 2 | 2.00 | 0.00 | 2.00 | 2.00 | 2.00 | −70 | 111 | −198 | −12 | −1.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 872 | 374 | 440 | 1075 | 1100 |
| | T.Rowe Price Associates | 21 | 1,063 | 0.2 | 9 | 2.00 | 0.00 | 2.00 | 2.00 | 2.00 | −0.8 | 3.8 | −4.0 | −2.0 | 3.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 51 | 34 | 50 | 50 | 60 |
| | Federated Investment | 153 | 116,471 | 18.1 | 18 | 2.02 | 0.09 | 2.00 | 2.00 | 2.02 | −0.1 | 3.5 | −4.0 | 0.0 | 4.0 | 7.2 | 15.3 | 1 | 1.0 | 22.0 | 761 | 905 | 10 | 444 | 1850 |
| | Wells Fargo | 142 | 96,464 | 15.0 | 14 | 2.26 | 0.45 | 2.00 | 2.00 | 3.00 | 1.4 | 3.4 | −3.0 | 2.0 | 5.0 | 1.2 | 0.8 | 1 | 1.0 | 2.0 | 679 | 470 | 100 | 672 | 1250 |
| | Charles Schwab | 237 | 62,189 | 9.7 | 7 | 3.46 | 1.17 | 2.00 | 4.00 | 5.00 | −0.4 | 6.5 | −6.0 | 2.0 | 7.0 | 4.5 | 6.3 | 1 | 16.0 | 16.0 | 262 | 256 | 27 | 165 | 600 |
| | Fidelity | 264 | 60,280 | 9.4 | 15 | 2.04 | 0.78 | 2.01 | 2.00 | 3.05 | 8.8 | 10.5 | 1.0 | 6.0 | 21.0 | 50.1 | 35.1 | 1 | 58.5 | 88.0 | 228 | 267 | 10 | 107 | 646 |
| | Dreyfus | 108 | 58,452 | 9.1 | 16 | 2.02 | 0.14 | 2.00 | 2.00 | 2.00 | −1.3 | 3.2 | −6.0 | −1.0 | 2.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 541 | 412 | 100 | 450 | 1100 |
| | U.S. Bancorp | 64 | 54,196 | 8.4 | 13 | 2.01 | 0.02 | 2.00 | 2.00 | 2.00 | 0.5 | 3.1 | −3.0 | 1.0 | 5.0 | 2.4 | 4.9 | 1 | 1.0 | 1.0 | 847 | 679 | 200 | 500 | 1950 |
| | Invesco | 104 | 46,274 | 7.2 | 17 | 2.00 | 0.02 | 2.00 | 2.00 | 2.00 | 0.9 | 2.9 | −3.0 | 1.0 | 5.0 | 11.4 | 17.4 | 1 | 1.0 | 43.0 | 445 | 309 | 200 | 390 | 850 |
| | Blackrock | 161 | 37,646 | 5.9 | 11 | 2.19 | 0.66 | 2.00 | 2.00 | 3.00 | 4.8 | 14.5 | −5.0 | 0.0 | 23.0 | 5.9 | 15.6 | 1 | 1.0 | 5.0 | 234 | 184 | 50 | 181 | 493 |
| Sep09 - Sep10 | State Street | 69 | 25,048 | 3.9 | 12 | 2.00 | 0.02 | 2.00 | 2.00 | 2.00 | 0.9 | 7.5 | −8.0 | 0.0 | 12.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 363 | 366 | 76 | 200 | 890 |
| | UBS | 33 | 25,047 | 3.9 | 6 | 2.39 | 1.16 | 2.00 | 2.00 | 2.83 | −5.8 | 6.8 | −17 | −2.0 | 7.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 759 | 608 | 0 | 903 | 1400 |
| | Passport Research Ltd | 18 | 21,427 | 3.3 | 8 | 2.04 | 0.15 | 2.00 | 2.00 | 2.03 | 2.9 | 3.1 | −3.0 | 4.0 | 7.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 1190 | 766 | 451 | 800 | 2455 |
| | Legg Mason | 17 | 17,325 | 2.7 | 1 | 2.00 | 0.00 | 2.00 | 2.00 | 2.00 | 2.5 | 2.2 | 1.0 | 2.0 | 6.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 1019 | 1162 | 136 | 500 | 3500 |
| | Goldman Sachs | 29 | 8,068 | 1.3 | 5 | 2.00 | 0.01 | 2.00 | 2.00 | 2.00 | 1.2 | 2.6 | −3.0 | 2.0 | 5.0 | 4.4 | 10.4 | 1 | 1.0 | 27.0 | 278 | 232 | 40 | 250 | 500 |
| | Bank of America | 29 | 7,607 | 1.2 | 13 | 2.00 | 0.00 | 2.00 | 2.00 | 2.00 | 1.7 | 3.0 | −3.0 | 1.0 | 6.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 262 | 263 | 40 | 142 | 716 |
| | T.Rowe Price Associates | 34 | 2,771 | 0.4 | 8 | 1.97 | 0.10 | 1.83 | 2.00 | 2.01 | 1.8 | 2.9 | −3.0 | 0.0 | 5.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 82 | 38 | 45 | 83 | 110 |
| | HSBC | 5 | 2,375 | 0.4 | 3 | 2.00 | 0.00 | 2.00 | 2.00 | 2.00 | −0.0 | 1.6 | −2.0 | 0.0 | 2.0 | 2.8 | 4.0 | 1 | 1.0 | 10.0 | 475 | 307 | 200 | 450 | 975 |
| | Deutsche Investment | 5 | 584 | 0.1 | 3 | 2.00 | 0.00 | 2.00 | 2.00 | 2.00 | −1.6 | 8.3 | −8.0 | −7.0 | 8.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 117 | 72 | 13 | 116 | 200 |
| | UBS | 6 | 351 | 0.1 | 2 | 2.00 | 0.00 | 2.00 | 2.00 | 2.00 | −8.5 | 3.1 | −14 | −8.5 | −5.0 | 1.0 | 0.0 | 1 | 1.0 | 1.0 | 58 | 143 | 0 | 0 | 350 |
| | Prudential | 1 | 101 | 0.0 | 1 | 2.00 | . | 2.00 | 2.00 | 2.00 | 2.0 | . | 2.0 | 2.0 | 2.0 | 1.0 | . | 1 | 1.0 | 1.0 | 101 | . | 101 | 101 | 101 |

This table reports the summary statistics for haircut, spreads, maturity and size of the treasury tri-party repos, based on the quarterly filings of a subsample of 102 US money market funds from January 2005 to September 2010. We divide the sample period into three subperiods, January 2005 to June 2008, September 2008 to June 2009 and September 2009 to September 2010. Within each subperiod, we report the distribution of repo haircut, spreads, maturity and size by each money market fund family. In addition, we also report the number of repos (#repos), the total repo amount in millions (amt), the market share (pct) and the number of dealers (#dealers) by each fund family in each subperiod.

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