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# TRI-PARTY REPO PRICING

Grace Xing Hu
Jun Pan
Jiang Wang

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## ABSTRACT

In this paper, we examine the pricing determinants in the systemically important tri-party repo market. Taking advantage of the recently available N-MFP reports filed by money market funds, we construct a novel dataset that contains tri-party repo transactions between money market funds and dealer banks. We find a large cross-sectional heterogeneity in repo pricing, reflected most significantly in the haircuts of repos backed by equity and corporate bonds. Surprisingly, it is the fund families, not bank dealers, who are the dominant factor in determining the pricing. Moreover, the repo market exhibits significant segmentation, with fund families adopting three different pricing schemes: counter-party sensitive, counter-party and collateral sensitive, and uniform. Most fund families use uniform haircuts by fixing a constant haircut, which itself varies across families, for all repos within each asset class, regardless of the quality of collateral or counter-party. Investigating further on the lending/borrowing relationship between fund families and dealers, we find that, when faced with such a rich pricing pattern, dealers do not shop around for a better haircut and are inclined to maintain a stable relationship with their lenders. Finally, for repos backed by Treasury securities, there is little variation in both haircuts and spreads, regardless of the fund family.

Grace Xing Hu
818 K.K.Leung
University of Hong Kong
Hong Kong
gracexhu@hku.hk

Jun Pan
MIT Sloan School of Management
100 Main Street, E62-624
Cambridge, MA 02142
and NBER
junpan@mit.edu

Jiang Wang
MIT Sloan School of Management
100 Main Street, E62-614
Cambridge, MA 02142
and NBER
wangj@mit.edu

# 1 Introduction

Repurchase agreements (repos) are considered to be the largest and the most important short-term financing channel for a variety of financial institutions.[1] For these institutions, the loss of access to the repo market could be devastating. 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 structure, activity and pricing. Lack of data is the main reason why empirical work lags behind theoretical discussions in this area.[2]

Using the recently available N-MFP reports filed by U.S. money market funds (MMFs), we construct a novel data set that contains a large sample of monthly tri-party repo transactions with key information on counter-parties, amount, haircut, rate, tenor and collateral. Tri-party repos, with details discussed in Copeland, Duffie, Martin, and McLaughlin (2012), are an important segment of the repo market.[3] The main advantage of our tri-party repo data is that the information is at the transaction-level and contains details of the underlying collateral, including descriptions of issuer names, types of securities, coupons and maturity dates. Using these descriptions, we hand match the collateral to the relevant databases, security by security. The entire collateral pool covers a wide range of asset classes, but we

[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]The theoretical discussions include Brunnermeier and Pedersen (2009), He and Xiong (2012), Martin, Skeie, and Thadden (2014), Zhang (2014), Lee (2015), among others.

[3]Tri-party repos are an important form of secured short-term lending 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. 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 U.S. money market funds need to disclose the details of their portfolio holdings with the SEC, through the monthly N-MFP filings.

focus on matching repos on equities, corporate bonds and Treasuries, which have standard and publicly accessible databases.[4]

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.[5] The one most related to ours is discussed in Krishnamurthy, Nagel, and Orlov (2014), which is based on the top 20 money market fund families' quarterly filings (N-CSR, N-CSRS and N-Q) before the 2010 MMF 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. The focus on only the top 20 fund families also raises the question of how representative these repo transactions are. By contrast, our data covers the repo transactions of all U.S. money market funds, totaling 751 individual funds from 160 fund families. 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.

Taking advantage of our unique data, we investigate the determinants of tri-party repo pricing, namely, haircuts and interest rates. We are particularly interested in how theoretically important factors, such as the collateral characteristics, 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 examine the repo price sensitivity with regards to the collateral. Moreover, we are able to control the collateral characteristics when investigating the relations between repo prices and other potential factors such as counter-party risk. This is important because results would be inconclusive and potentially misleading if the collateral characteristics are left uncontrolled.

[4]For the equity securities, we match them to the Compustat/CRSP database according to the issuer names, and then use the historical returns to calculate volatilities and obtain other firm-level information such as size and industry. For the 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 the Treasury securities, we match them to the CRSP database according to the maturity dates and coupons.

[5]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.

We find that there is a large heterogeneity in repo pricing, reflected most significantly in the haircuts of repos backed by equity and corporate bonds. For example, over our main sample period from November 2010 through August 2013, which falls under the relative calm of post crisis, the median haircut of equity repo remains stable at around 8.01%. By contrast, the haircuts at the 10th and 90th percentiles are 5.00% and 8.92%, respectively. This large variation in haircuts, which is driven mainly by cross-sectional dispersion, is contrary to the conventional wisdom that repo pricing is determined almost exclusively by asset class. Unlike repos for equity or corporate bond, however, Treasury repos exhibit highly homogeneous pricing: haircuts at the 90th percentile is 2.05%, only slightly higher than the 10th percentile of 2.00%. This indicates that the pricing of repos backed by risky assets such as equity and corporate bonds involves more complexity.

In order to understand the large variation in equity repo pricing, we consider important characteristics including collateral quality, transaction size, counter-party risk, and lending relationship. Surprisingly, we find that the large heterogeneity in the haircuts of equity and corporate bond repos is driven mainly by differences across various money market fund families.[6] For example, haircuts demanded by Fidelity funds, the largest fund family in terms of repo lending, range between 8% and 9%, while haircuts demanded by other fund families vary from 2% to 8%. For corporate bond repos, there are also substantial differences in the level of haircuts demanded by different fund families. On the other side of the repo transactions are dealers, who act as cash borrowers. They behave simply like price-takers: when a dealer borrows from multiple fund families, it faces different haircuts even though the collateral of their repos are very similar. Overall, our evidence seems to suggest that it is the fund families, not the dealers, that determine the haircuts.

In addition to the difference in the level of repo pricing, fund families are also different in their pricing schemes. We observe three pricing schemes adopted by different fund families: counter-party sensitive, counter-party and collateral sensitive, and uniform. Fidelity, the

[6]Within each fund family, all funds behave very similarly. This could be due to the fact that repo transactions are usually negotiated by an asset manager responsible for all money market funds within the same family. We rely on the investment adviser information provided by the money market funds to determine its affiliated family. The investment advisers belonged 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 fund family.

top lender in equity repos, assigns haircuts mainly according to the identities of the counter-parties. It demands higher haircuts for repos with JP Morgan relative to other counter-parties. The median haircut of JP Morgan's repos is 8.81% and the inter-quartile range, across all transactions over our sample period, is only 0.18%. By comparison, all the rest of the eleven counter-parties of Fidelity enjoy a median haircut of 8.01% and the inter-quartile range is 0.08%. This higher haircut demanded for JP Morgan cannot be explained by the collateral quality of its repo transactions. In fact, the equity collateral posted by JP Morgan and other dealers has similar risk. Neither can this pricing differential be explained by the potential counter-party risk associated with JP Morgan, whose average five-year CDS spreads are actually lower than several of Fidelity's other couter-parties during our sample period. The size of its repo transactions with Fidelity is also on a par with that of Credit Suisse, another counter-party of Fidelity.

Money market funds in the Bank of America family use a pricing scheme that is sensitive to both the dealer and the risk of the underlying collateral. In addition to charging different haircuts for different dealers, Bank of America funds also consider the risk of the collateral posted by these dealers.[7] They demand higher haircuts for collateral that are concentrated in a few stocks and collateral with higher volatility. That is, Bank of America demands higher haircuts for repos backed by riskier equity securities. This pricing scheme is consistent with the theory that a 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.

All of the remaining five fund families in the equity repo market use a uniform pricing scheme. These fund families fix their repo haircuts to a constant level, regardless of the counter-parties or the collateral quality. This constant level, however, varies from family to family. For example, State Street and Goldman Sachs funds ask for a 8% haircut, Morgan Stanley and Charles Schwab funds ask for 5%, and Federated Investors money market funds ask for 2%. Since these fund families often accept collateral with similar quality and lend to the same dealers, the variation across fund families is not related to collateral and counter-party risk.

These rich pricing patterns show a clear segmentation by fund families in the equity repo market. Moreover, none of the two theoretical important variables, collateral and counter-party risk, can explain this segmentation. Instead, we find that the market concentration

[7]Though different counter-parties face different haircuts with Bank of America funds, this difference is not related to the counter-parties' default risks, which are measured using their CDS spreads.

is a potential reason why fund families follow different pricing. The lending in the equity repos is highly concentrated, with Fidelity funds alone accounting for approximately 70% of the market. The second and third largest lenders, Morgan Stanley and Federated Investors, account for another 17%. As the single dominant lender, Fidelity's choice of asking for the highest haircuts could be a rational decision to protect its large exposure in the equity repos. Fidelity funds can also afford the high haircuts because dealers with large demand of equity repos have no choice but to trade with Fidelity, due to the limited financing capacity of the other fund families. Smaller lenders such as Morgan Stanley and Federated Investors funds, on the other hand, have to ask for lower haircuts in order to stay competitive in the market.

This naturally raises the question of the dealers' incentives and behaviors in this market. In particular, when faced with such variations in pricing and pricing schemes, should dealers shop around to minimize their haircuts and maximize their use of leverage? Under this hypothesis, it should first borrow from non-Fidelity funds that charge low haircuts and then fulfill the rest from Fidelity funds. As a result, we should observe a more stable relationship between the dealer and its non-Fidelity counter-parties. The empirical evidence is, however, somewhat mixed. We do find that JP Morgan maintains a more stable relationship with its non-Fidelity counter-parties (Morgan Stanley funds), while managing the variation of its monthly borrowing mainly by adjusting its repo amount with Fidelity funds. But we do not observe this kind of behavior in other dealers, who split their borrowing from Fidelity and non-Fidelity funds by a stable proportion over time.[8] It is possible that dealers are not sensitive to haircuts during the relative calm and liquid post-crisis sample period. Dealers might also care more about maintaining a stable relationship with their lenders. Indeed, dealers do tend to trade consistently with the same set of counter-parties across time, suggesting that their relationship with the lenders is important for them. Overall, it is clear that pricing is not the only factor that determines dealers' behavior in the tri-party repo market.

The pricing in the corporate bond repo market is similar to the equity repo market. Fund families dominate the repo pricing, and most fund families use the uniform haircut pricing scheme. Among the uniform pricing schemes, there is also substantial variation in the levels of haircuts chosen by different fund families. For example, Blackrock funds assign a 7% haircut for most of their corporate bond repos, approximately 5 percentage points higher than the 2% haircut demanded by the Federated Investors funds. It is worth noting that

[8]These examples include Credit Suisse and Barclays, which are the largest- and the third-largest dealers in the equity repo market.

most of the fund families in our sample do accept both investment grade and non-investment grade bonds as collateral. Nevertheless, fund families that use the uniform pricing scheme assign the same haircuts across all repos, regardless of the underlying corporate bonds.

Besides the uniform pricing scheme, some fund families use a collateral sensitive pricing scheme. But this pricing scheme is sensitive only to the broad rating category, investment grade or high-yield, of the underlying corporate bonds. Within each rating category, however, the haircuts are uniform and are not sensitive to any bond characteristics. Morgan Stanley funds, for example, assign an approximately 5% haircut for repos with investment-grade corporate bond collateral and an approximately 6% haircut for repos with high-yield corporate bond collateral. We don't find any fund family that uses the counter-party sensitive pricing scheme in the corporate bond repo market.[9]

Since a tri-party repo is essentially a collateralized loan, an additional important pricing variable is the interest rate. 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 overnight 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, the spread increases by 4.9 bps. For one standard deviation increase in maturity, or 15 business days in the case of corporate bond repos, spread increases by 3.8 bps. Repo spreads are not sensitive to collateral and counter-party risk. We also don't find any substitution effect between spreads and haircuts for tri-party repos.

In addition to the fund family and the dealer, another important player in the tri-party repo market is the third-party clearing bank, either JP Morgan Chase or Bank of New York Mellon. Due to the daily unwind arrangement, the large intra-day exposure of the two clearing banks is an important risk factor for the overall financial system, and can potentially affect the pricing in the tri-party repo market. To address these concerns, we look at the time-series variations in our sample, which luckily covers a period during which the unwind procedure went through several major changes. During the early part of our sample period, the unwind happened between 8:00 and 8:30 in the morning; since August 22, 2011, the unwind has moved to 3:30 in the afternoon; and at the end of 2012, JP Morgan

[9]Unfortunately, Fidelity funds, which adopt the counter-party sensitive pricing scheme in the equity repo market, do not show up in our corporate bond repo data because of a reporting error in the funds' N-MFP filings. Fidelity represents approximately 30% to 40% of the lending in the corporate bond repos

Chase stopped intra-day lending on non-maturing repo transactions. Despite these changes, the distributions of haircut and spread remain stable across time during our sample period. Moreover, we find no fund family adjusts its pricing scheme with respect to the changes in the unwinding time. Overall, the concerns for the clearing banks' intra-day exposure are not reflected in the repo pricing during our sample period.

In relation to the existing literature, the two papers that are most related to ours are Krishnamurthy, Nagel, and Orlov (2014) and Copeland, Martin, and Walker (2014). We complement Krishnamurthy, Nagel, and Orlov (2014) by focusing on the cross-sectional variations of haircuts, taking advantage of our unique deal-level data with collateral information. We also add to Copeland, Martin, and Walker (2014) by identifying that the main determinant of repo pricing is the fund family. The demands made by different fund families, not by dealers, cause the wide variation in haircuts. Both papers document interesting facts during the crisis period, but our results help shed light on how the repo market works under normal market conditions in the post crisis period. Our work is also related to the literature on money market funds. This strand of literature includes McCabe (2010), Kacperczyk and Schnabl (2013), Chernenko and Sunderam (2012), Strahan and Tanyeri (2012), among others. Our focus is on money market funds' tri-party repos, which are an important component of their investment portfolios.

The rest of paper is organized as follows. Section 2 describes how we collect the repo data and match the 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: bilateral repos and tri-party repos.

In a 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 the custodian and the 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 helps minimize the operational burden of the lenders, especially those who don't have personnel or technologies to handle complicated collateral posted by the borrowers. The third-party bank also acts as the intra-day financier for the cash borrower during the time gap associated with the unwinding of repos. Copeland, Duffie, Martin, and McLaughlin (2012) provides a detailed discussion of the role of the clearing banks in tri-party repo transactions.

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, security lenders, and sovereign funds. Most importantly, unlike bilateral repos whose transaction details are seldom disclosed to the public, recently available filings of money market funds provide a 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 after 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 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 publicly 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.[10] Our main interest is money market funds' repurchase agreement holdings.[11] 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 the security 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.[12] 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 don't include security identifiers such as CUSIP or ISIN 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 publicly accessible databases on their issuance and historical prices. Our collateral matching procedure follows two major steps: First, we

[10]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.

[11]The SEC requires money market funds to categorize their investment into 16 groups in 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 item 32.

[12]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.

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 matched 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.[13] 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, a more accurate approach than those of previous studies that rely on self-reported repo types.

In total, we have 3,350 equity repos, 1,291 corporate bond repos and 15,436 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.[14] 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 a unique match. In equities, we are able to match 98% in terms of collateral numbers and 68% in terms of collateral value. Most of the unmatched cases are because money market funds only disclose the numbers of collateral, not the specific issues. The matching is much noisier in corporate bonds because more information is needed to pin down a unique bond. As a result, some repos are not in our matched 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 asset classes. Nevertheless, we do have a

[13]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%.

[14]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 17,054; 9,014; and 85,268, respectively.

reasonably 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 item 32.d in the N-MFP form contains the following keywords: COMMON, STOCK, ETF, 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 78,466 collateral with a total worth of $341 billion. In other words, we are able to match more than 98% of the collateral by their names, but the remaining 2% carry a significant value of $164 billion. The reason is that there are 253 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 95% of the value of the unmatched securities. The remaining 1,635 unmatched cases, worth $8 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 item 32.d in the N-MFP form contains 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.[15] We then manually match the collateral name (item 32.a) with the official corporate

[15]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,

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 a 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.[16]

**Matching Treasury Bonds**

For potential Treasury bond collateral, we check whether 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 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 consider 137,804 collateral as potential Treasury securities, totaling 4.5 trillion in

USTIIB, TRIN, TRIB for Treasury inflation protected bonds; TREASURY, UNITED STATES, TREAS, NOTE, BILL, NTS, BDS and NOTY for Treasury bonds.

[16]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.

dollar value.[17] Out of which, we are able to match 128,782 collateral, 93% in terms of numbers and 91% in terms of collateral value. Judging by the reported numbers for 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 are sometimes 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 18,187 repo transactions with total repo value of approximately $7.9 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 5,947 Treasury repos with total value of $2.9 trillion, 4,285 agency repos with a total value of $2.0 trillion, 677 equity

[17] During the period from November 2010 to August 2013, 28,880 repos are reported as Treasury Repurchase Agreements by money market funds (item 31). These repos have in total 210,644 collateral. Of these collateral, we consider 72,840 securities as Strips, Tips, agency bonds, corporate bonds or with missing maturity. We exclude these securities in our matching process.

repos with a total value of $199 billion and 2,513 corporate bond repos with a total value of $557 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

### Growth of The Tri-Party Repo Market

The growth of the tri-party repo market is illustrated as the two 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 amount 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 amount. Both the full sample and the sub-sample show similar time-series trends after November 2010, suggesting that the 102 funds are a representative 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 then reduce their lending following the collapse of Bear Stearns and throughout the 2008 financial crisis. At the last quarter of 2008, the worst period of the 2008 financial crisis, the total number of repo deals drops to 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 (2014), 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 to around 500 billion 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 account for 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 securities, equities and corporate bonds, are always above safe Treasuries.

More interestingly, there is a large cross-sectional variation in the haircuts and spreads of repos backed by equities and corporate bonds. We focus on the sample period from November 2010 to August 2013, during which our sample contains repos with matched collateral information.[18] Among the total 3,350 equity repos, the first decile of haircuts is 5.00% and the ninth decile of haircuts is 8.92%. The inter-decile range is a striking 3.92%, not only large in magnitude but also important economically compared with the median haircut of 8.01%. Moreover, as the cross-sectional distribution remains relatively stable across time during this period, this variation comes mainly from the cross-sectional differences and is not from the time-series changes. The pattern is very similar for corporate bond repos. The inter-decile range of haircuts for the 1,291 corporate bond repos is a significant 4.00%. By comparison, haircuts on Treasury repos are much more homogeneous, with an inter-decile range of haircuts at merely 0.05%. For repo spreads, the cross-sectional dispersions in equity and corporate bond repos are also larger than Treasury repos.

[18]We discuss the tri-party repos before November 2010 in the appendix.

# 3 Equity Repos

In this section, we examine the pricing in the equity tri-party repo market. Equity securities, as a whole, constitute $90 billion in dollar value or approximately 5% of the entire tri-party repo market.[19] As a comparison, the average daily trading volume is around $40 billion for the New York Stock Exchange in 2013.[20] Albeit only a fraction of the entire tri-party repo market, equity tri-party repos serve as an important channel for dealers to finance their securities holdings and meet their clients' trading needs in the stock market.

Table 2 summarizes our sample of 3,350 equity repos with matched collateral during the 34-month period from November 2010 to August 2013. It is clear that the large heterogeneity in the haircuts of equity repos is largely a result of the variations across fund families. Money market funds in different fund families charge very different haircuts. Fidelity funds ask for haircuts above 8%; Bank of America, State Street and Goldman Sachs funds ask for haircuts around 8%; Morgan Stanley and Charles Schwab funds ask for 5%; Federated Investors funds ask for only 2%.

Within each 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. 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%. In fact, among the remaining five fund families, four of them have inter-quartile ranges in haircuts less than 0.1%. The only 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 each fund family, haircuts faced by a dealer are much more dispersed, especially when the dealer borrows from multiple fund families. For example, the inter-quartile range in haircuts is 2.96% for Credit Suisse and 3.00% for Deutsche Bank. These large dispersions are the results of different haircuts charged by money market funds from different fund families. Credit Suisse borrows from money market funds belonging to five fund families: Fidelity, Morgan Stanley,

[19]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).

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

Federated Investors, Bank of America, and State Street. Deutsche Bank borrows from four fund families: Fidelity, Morgan Stanley, Charles Schwab and Bank of America.

By comparison, the dispersions in haircuts are much smaller for dealers that borrow mainly from one fund family. This type of dealers include JP Morgan, Goldman Sachs and Mizuho. Take JP Morgan as an example, the inter-quartile range of haircuts is only 0.17%. This is because 1,068 of its equity repo deals are with Fidelity and only 87 deals are with Morgan Stanley and Bank of America. Therefore, the small variation in haircuts is due to the fact that JP Morgan borrows most from Fidelity, and Fidelity assigns similar haircuts for all of its equity repos with JP Morgan. Similarly, the variations of haircuts are small for Goldman Sachs and Mizuho because these dealers mainly borrow from one fund family.

The above observation is confirmed in Figure 3, which compares equity 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: JP Morgan and Credit Suisse. Clearly, when a dealer borrows from multiple money market funds families, its haircuts vary significantly even though the repos are backed by collateral with similar volatility. For example, JP Morgan's repos with Fidelity funds always have haircuts more than three percentage points higher than those with Morgan Stanley funds. The pattern is similar for the repos borrowed by Credit Suisse.

In short, it is clear that fund families dominate the pricing in the equity repo market. In our following analysis, we first examine the equity securities in the collateral pool. Then, taking advantage of the security-level collateral information, we investigate different pricing schemes adopted by different fund families. Lastly, we discuss the implications of the repo pricing on quantities and MMF-dealer relationship in the equity repo market.

## 3.1 Collateral Characteristics

The 3,350 equity tri-party repos are backed by 66,347 equity securities. Among which, we are able to identify 65,718 equity securities issued by 4,008 unique firms. Table 3 lists the top 20 securities used as equity repo collateral. Most of these stocks are large company stocks, covering major industries such as manufacturing, technology, finance, and pharmaceutical etc.

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 always a dealer bank in our sample of tri-party repos.

The characteristics of the equity securities accepted by different fund families are summarized in Table 4. Most of the collateral of our sample of equity repos are indeed matched. Even though we set the lower-bound to be 85%, the majority of the repos are fully matched. The average percentage of matched securities is close to 100%, with a tiny standard deviation of 1.47%. 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 noticeable difference across different fund families is in the collateral concentration. Equity repos by Fidelity and State Street funds have smaller number of collateral per repo and hence higher collateral concentration. For Fidelity's repos, the average number of collateral per repo is 7.17. After taking into account the relative size of the individual securities, the value-weighted number of collateral per repo drops to only 3.82. Similarly, the average value-weighted number of collateral per repo is only 7.19 for State Street's funds. By comparison, the collateral pool for the rest five fund families' repos are much more diversified. The number of collateral per repo ranges from 30.34 to 71.48 and the value-weighted number of collateral per repo ranges from 13.02 to 39.83. As a result of the more concen-

trated collateral pool, the average portfolio volatilities for Fidelity and State Street funds are among the highest, 29.61% and 28.08%, respectively. For the rest of the fund families, the average portfolio volatility is from 18.70% to 22.05%.

## 3.2 Haircuts

We find three pricing schemes in haircuts: counter-party sensitive, counter-party and collateral sensitive, and uniform. We discuss these different pricing schemes through the examples of representative fund families. In our sample, Fidelity funds use the counter-party sensitive pricing scheme; Bank of America funds use the counter-party and collateral sensitive pricing scheme. The remaining fund families use the uniform haircut scheme. However, among the uniform haircuts, there is substantial variation in the haircuts chosen by different fund families.

**Fidelity**

Fidelity is the largest lender in the equity tri-party repo market. In our sample of equity repos with matched collateral, it has 2,168 repo deals with 12 counter-parties. Fidelity's largest two counter-parties are JP Morgan and Credit Suisse. For its 1,068 repo deals with JP 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 JP 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 funds use a dealer-sensitive scheme on haircuts. Between its two dealers, JP Morgan and Credit Suisse, Fidelity demands higher haircuts for JP Morgan than Credit Suisse. This differential treatment in haircuts is unlikely to be explained by the collateral quality or the counter-party default risk. The equity collateral provided by JP Morgan and Credit Suisse have similar risk: the average collateral portfolio volatility is 31.4% for JP Morgan and 30.6% for Credit Suisse. In terms of the counter-party default risk, JP Morgan's average five-year CDS spreads is 99 bps, 27 basis points lower than the average five-year CDS spreads of Credit Suisse. The size of JP Morgan's repo transactions

with Fidelity is also comparable with that of Credit Suisse.[21]

We formally test Fidelity's haircut policy on equity tri-party repos in a set of regressions. The results are summarized in Table 5.[22] 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-parties. Variables such as repo size, repo maturity and dummy variables for time explain 10.6% of the total variation in haircuts. By comparison, adding dummy variables for the 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-square of the regressions on haircuts.

**Bank of America**

Though Bank of America has only 146 equity tri-party repos in our matched sample, it is the only fund family that shows a wide dispersion in the haircuts. The inter-quartile range is 3.01%, the largest among all fund families. We pool together all of Bank of America's equity tri-party repos and run a battery of regressions in Table 6. Similar to Fidelity, the dealer fixed effect is strong in the regression on the haircuts of Bank of America's equity repos. 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. Four out of the five dealer dummies are statistically significant at the 5% level. In short, Bank of America's haircuts are sensitive to the counter-parties.

More interestingly, Bank of America's haircuts are also sensitive to the underlying collateral. It assigns higher haircuts for repos backed by riskier collateral, which is most reflected in collateral concentration ($col (vw)) and collateral volatility (port vol). Bank of America asks higher haircuts for repos backed by more concentrated securities. A one standard deviation decrease in the value-weighted number of collateral per repo increases repo haircuts by 0.40 percentage point. Bank of America also requires higher haircuts for equity repos backed by more volatile securities. A one standard deviation, or 6.85 percentage points, increases in

[21]The total monthly equity repo transactions is on average 2.7 billion between Fidelity and JP Morgan, and 3.1 billion between Fidelity and Credit Suisse. The numbers are based on the full sample of equity repos which include those with unmatched collateral.

[22]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.

the collateral portfolio volatility raises the repo haircuts by 1.49 percentage points. 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 of the fund families use the uniform pricing scheme. The uniform haircuts required by these funds are approximately 5% for Morgan Stanley and Charles Schwab funds, 2% for Federated Investors funds and 8% for State Street and Goldman Sachs funds.

Within each fund family, repo haircuts exhibit tiny dispersions. The inter-quartile range in haircuts for the five fund families range between 0.01% and 0.06%. In other words, these fund families fix their haircuts to a constant level, regardless of the counter-parties and the collateral. More importantly, this uniform haircut scheme is not because these fund families accept only a certain type of collateral or because they lend to only one dealer. In fact, these funds do accept a wide range of equity securities as collateral and lend to multiple dealers.

It is not obvious why different fund families chose different levels of haircuts, especially given that they often lend to the same group of dealers and accept similar collateral. For example, State Street, Morgan Stanley and Federated Investors funds all lend to Credit Suisse, yet these funds choose to ask for very different haircuts. Therefore, we think the levels of haircuts, to a certain extent, reflect different fund families' risk tolerance. Federated Investors is the most aggressive one, by charging haircuts at approximately two times the average daily price volatility (1.28%) of the underlying equity securities. Other fund families are more conservative and set a larger buffer in haircuts relative to the volatility of the underlying collateral.

The dominant role played by the fund families is also evident in the regressions of Table 7, where we pool together all but Fidelity and Bank of America funds' equity repos. Variables such as repo size, repo maturity and the time dummies explain only 22.0% of the total variation in haircuts. Adding four fund family dummies drastically improves the R-square by 72.6 percentage points to 94.6%. By contrast, including additional dealer dummies helps improve the R-square only by a marginal one percentage point. Moreover, none of the collateral variables is statistically significant, confirming that these fund families' pricing

schemes are uniform and don't depend on the underlying collateral.

Besides the fund family and the dealer, another important agent in the tri-party repo market is the third-party clearing bank. Unfortunately, our repo data does not contain the identifies of the third-party banks. However, the rich pricing patterns exhibited by different fund families suggest that the pricing is unlikely to be explained by the associated third-party bank, which is either JP Morgan Chase or Bank of New York Mellon. Our sample also covers a period during which the unwind procedure of the two clearing banks went through several major changes that greatly reduced the intra-day exposure of the two banks. However, we don't observe any fund family adjusts its pricing scheme with respect to these changes. Overall, the evidence suggests that the clearing bank does not play an important role in the pricing of repos, at least not in our sample period.

## 3.3 Spreads

Next, we investigate the interest rates of the tri-party equity repos. Given the strong role played by fund families in setting haircuts, we examine the determinants of repo 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 repo spread, measured as the repo interest rate minus the over-night Fed Fund Rate. The results are summarized in Table 8.

The most important explanatory variable for spread is the repo maturity. 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 spread increases by 4.90 bps. The maturity effect on repo spread is quite robust. The regression coefficients on the repo maturity are positively significant for three out of the four fund families that we tested, with the exception of Charles Schwab funds.

In addition to the maturity effect, size is also related to spread for equity repos. Large repos tend to have lower spreads - an increase of one standard deviation in the log of repo size decreases repo spread by -1.44 bps. However, this negative relationship is largely driven by the repos of Fidelity funds, and is not significant for the other three fund families that we tested.

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

None of the three collateral variables, collateral concentration, volatility and the percentage of financial firms, can help explain the variation in repo spreads. We also find no robust relationship between borrowers' credit risk and repo spread. In the full-sample regression, dealers' CDS spreads are positively related to repo spreads. A 100 bps increase in a dealer's CDS spreads will raise its repo spread by 6.70 bps. But this positive effect is only significant for Charles Schwab funds, and not significant for the other fund families.

Lastly, we investigate the relationship between the two pricing variables: haircut and spread. In theory, the relationship could be negative if there is a substitution effect between haircut and spread. The relationship can also be positive if lenders demand higher haircut and, at the same time, higher interest rate for accepting riskier collateral. In practice, it is clear that the relationship is positive across collateral asset classes. For example, haircuts on equity repos are higher than 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.

For three out of four fund families that we tested, haircuts are not significantly related to spreads. This is not surprising as most fund families use the uniform haircut scheme, which will result no variation in the haircuts of repos within each fund family. However, for Fidelity funds' repos, there is a strong negative relation between haircuts and spreads. This substitution effect is strong - an increase of one percentage points in haircut is couple with a 5.67 bps reduction in spread.

## 3.4 MMF-Dealer Relationship

The rich pricing patterns suggest that there is a clear segmentation in the equity repo market. More importantly, neither collateral nor counter-party default risk can explain the different pricing and pricing schemes chosen by the fund families. To further understand this market segmentation and its implication for the behavior of the lenders and borrowers, we look at the trading relationship between money market funds and dealers in the tri-party repo market.

For this part of the analysis, we don't rely on the previous repo sample with matched collateral securities. Instead, we use the full sample of repos that we can identify the asset class of the collateral. Compared with the matched repos, this sample is larger and avoids

potential bias in our matching procedure caused by inaccurate reporting by MMFs. Though without the information of the individual collateral, it better captures the complete MMF-dealer trading relationship in the repo market.

We identify a collateral's asset class by checking the keywords in the collateral type and collateral subtype (item 32.d). A repo is considered as an equity repo if more than 85% of its collateral are classified as equities; a repo is consider as a corporate bond repo if more than 85% of its collateral are classified as corporate bonds. We consider all repos reported as "Treasury Repurchase Agreement" (item 31) by money market funds as Treasury repos. In total, we have 3,840 equity repos, 5,748 corporate bond repos and 28,880 treasury repos. Table 9 summarizes the top fund families and their major borrowers in these three repo asset classes; Table 10 summarizes the top dealers and their major lenders. Figure 4 graphically present the pairs of fund families and dealers that have trading relationship in tri-party repos.

**Market Concentration**

It is clear that the repo lending in the equity repo market is dominated by a few large fund families. Fidelity fund family alone represents approximately 70% of the lending. Morgan Stanley and Federated Investors, the second and the third largest lenders, account for another 17%. The top five fund families, in total, cover approximately 95% of the lending backed by equity securities.[24]

The picture is similar on the borrowers' side. Though there are in total 16 dealers, the top five, Credit Suisse, JP Morgan, Barclays, Merill Lynch and Bank of America, account for approximately 80% of the borrowing. Credit Suisse and JP Morgan are the largest two borrowers, with average monthly repo amount ranging from 3.2 billion to 4.6 billion.

We observe a many-to-many relationship between fund families and dealers. A fund family usually lends to multiple dealers and a dealer usually borrows from multiple fund families. The two largest lenders, Fidelity and Morgan Stanley, lend to almost every dealer. The smaller fund families have few counter-parties. On the borrowers' side, large dealers usually borrow from both large and small fund families, while small dealers mainly borrow from the two largest fund families, i.e., Fidelity and Morgan Stanley.

[24]Compared with the matched equity repo sample, there are two new fund families, UBS and American Beacon Advisors. But these two fund families account for only a tiny fraction of the total lending in the equity repo market.

Though fund families and dealers have multiple counter-parties, most of their trading is concentrated with a few partners. The number of counter-parties is significantly reduced after taking the relative repo amount into account . For the largest lender, Fidelity, the value-weighted number of counter-parties at each month is only 3.4.[25] Among which, Credit Suisse and JP Morgan account for approximately 60% of Fidelity's total lending. For the rest of the fund families, the value-weighted number of dealers is typically between one and three. For dealers, the value-weighted number of fund families is also quite low, usually between one and two. This suggests that relationship could be very important for both fund families and dealers, as most of their trading is with a few fixed counter-parties. In addition, for a pair of fund family and dealer that are major trading partners, they tend to trade consistently every month in our sample period.

**Repo Pricing and Quantity**

The highly concentrated market structure could be a reason why we observe a clear market segmentation in the pricing of equity repos. Among all the major fund families, Fidelity funds ask for the highest haircuts, mostly between 8% and 9%. Given that Fidelity is the dominant lender in the equity repos, this could be a rational decision to protect its large exposure. In addition, since Fidelity is the only lender with a large financing capacity, it can afford the high haircuts as dealers with large demand of equity repos have no other choice in the equity repo market. Smaller non-Fidelity lenders such as Morgan Stanley and Federated Investors funds, due to their limited financing capacity, have to ask for lower haircuts in order to stay competitive in the market.

The natural question to ask next is: what are dealers' incentives and behaviors in this market? Because the pricing is set by fund families, dealers are basically price takers. However, a dealer can still decide its quantities with different counter-parties. A potential hypothesis is that the dealer's priority is to minimize its haircuts and maximize its use of leverage. Under this hypothesis, a dealer should shop around different fund families for the most lenient haircuts. Given the very concentrated market structure, the dealer should first borrow from non-Fidelity funds that charge low haircuts and then fulfill the rest with Fidelity funds. Therefore, we should observe a more stable relationship between the dealer

[25]The number of value-weighted counter-parties are calculated as the inverse of the Herfindahl index based on the repo amount between a fund family and a dealer. It is equivalent to the number of counter-parties with the same repo size.

and the non-Fidelity funds.

The empirical evidence is, however, mixed. We find some positive evidence supporting the hypothesis. The bottom panel of Figure 5 shows that JP Morgan has a more stable relationship with Morgan Stanley funds from November 2011 to February 2013, compared with its relationship with Fidelity funds. During this period, JP Morgan's borrowing with Morgan Stanley shows very little variations, while its borrowing with Fidelity fluctuates significantly. In other words, JP Morgan manages its monthly borrowing mainly through adjusting its repo quantities with Fidelity funds. The caveat is that we only observe this pattern for JP Morgan during a short period of time.

On the other hand, there are many dealers whose borrowing with Fidelity and non-Fidelity funds show similar variations through time. Credit Suisse, for example, reduces its borrowing significantly during our sample period. Under the hypothesis, it should first cut its borrowing with Fidelity because of the higher haircuts. However, we find that Credit Suisse splits its borrowing from Fidelity and non-Fidelity funds by a stable portion over time. Not only it cuts its borrowing with Fidelity funds, it also reduces its borrowing with Morgan Stanley and Federated Investors funds, which are two other major counter-parties that charge low haircuts. As a result, Credit Suisse's equity repo quantities between Fidelity and non-Fidelity counter-parties have similar time-series variations. Barclays, the third-largest dealer in the equity repo market, also behaves similarly like Credit Suisse.

In short, we don't find strong evidence that suggests dealers are fully optimizing their use of leverage by shopping around different fund families. Of course, given that our sample covers a period with ample liquidity and historical-low interest rates, the dealers may not be very sensitive to the cost of repo financing. Nevertheless, the results suggest that prices are not the only determining factor in the tri-party repo market. Dealers seem to also value the trading relationship with their major counter-parties.

# 4 Corporate Bond Repos

Corporate bonds are also a popular form of non-government securities in the tri-party repo market. According to the statistics provided by SIFMA, the amount of corporate bonds posted as collateral in the tri-party repo market has similar magnitude as the equities, at approximately $85 billion per month from November 2010 to August 2013.

In our sample, we have 5,748 corporate bond repos and 1,291 corporate bond repos with

matched collateral. The main reason we have fewer matched corporate bond repos is because the 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 still contains a wide variety of fund families and dealers, which allows us to investigate different pricing schemes in the corporate bond repo market. Moreover, the matched corporate bonds cover a broad range of securities from different rating classes and issuer firms. This enables us to investigate the repo price sensitivity to the underlying collateral.

## 4.1 Summary Statistics

The lending in the corporate bond repo market is also highly concentrated, but less so compared with the equity repo market. The top lender, Fidelity, has on average 5.4 billion outstanding repos at the end of every month, accounting for approximately 40% of the market. The second and the third largest lenders are Bank of America and Morgan Stanley funds. The top five fund families account for approximately 80% of the total lending. On the dealers' side, JP Morgan is the largest borrower, followed by BNP Paribas and Barclays Group. The lending relationship between the money market funds and dealer is plotted in the panel (b) of Figure 4. For the 1,291 matched sample of repos, we report the distributions of haircut, spread, maturity and size in Table 11.

Table 12 summarizes the corporate bond collateral for the matched repo sample. Most of the corporate bond repos are backed by a mixture of investment-grade and high-yield bonds. On average, a repo's collateral pool has 92% rated bonds and 70% investment-grade bonds. 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 7.84 years; the average log issuance size is 20.38, or $709 million in dollar terms.

## 4.2 The Role of Fund Families

Similar to equity repos, fund families play the dominant role in assigning haircuts for the corporate bond repos. This can be shown in Figure 6, where we plot the corporate bond

repo haircuts against the underlying collateral's average credit ratings for the top four fund families, i.e., Bank of America, Morgan Stanley, Blackrock and Federated Investors. Out of these top four, three fund families use the uniform pricing scheme. Federated Investors 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 funds give a 7% haircut for most of its corporate bond repos, though the fund family trades with eight different dealers and accepts corporate bonds with ratings that range from Aa1 to B3. Another example is Bank of America funds, which give a constant 5% haircut. However, different from the previous two fund families, Bank of America's collateral are mostly investment-grade corporate bonds.

In contrast to the uniform pricing scheme, Morgan Stanley funds use a collateral-sensitive pricing scheme, but only sensitive to the collateral's rating category - investment grade or non-investment grade. Morgan Stanley funds' 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. Within each rating category, the haircuts are not sensitive to the individual repos' collateral ratings. This is consistent with the common belief that investment grade and non-investment grade corporate bonds are considered two different asset categories in the tri-party repo market. But, it is worth emphasizing that many fund families in the corporate bond repo market don't differentiate bond ratings and assign uniform haircuts for both investment grade and non-investment grade bonds.

## 4.3 Regression Analysis on Haircuts and Spreads

In this part of the analysis, we use regressions to examine the determinants of corporate bond repo haircuts and spreads. Given that some fund families price investment grade and non-investment grade corporate bond repos differently, we also run regressions separately for these two rating categories. The majority of the repos in our sample have collateral that are a mixed pool of investment grade and non-investment grade bonds. We, therefore, try two methods to classify corporate bond repos. 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 13 summarizes the regressions results on haircuts; Table 14 summarizes the regressions results on spreads.

It is clear that fund families play the dominant role in setting corporate bond repo

haircuts, similar to the equity repo market. This is reflected in the drastic improvement of R-square of the regressions on haircuts. Controlling collateral, month dummies and dealer dummies, the R-square of the full-sample regression on haircuts is only 38.7%. Adding fund family dummies improves the R-square by 45.4 percentage points to 84.1%.[26]

For all the collateral variables, only collateral rating is significant in the full-sample regression. An improvement of one standard deviation in rating will reduce the repo haircut by 0.38 percentage point. However, this strong relationship is simply driven by the difference in haircuts across the two major rating categories. Within the investment grade only repos and non-investment grade only repos, collateral rating can no longer explain the cross-sectional variations in haircuts. In fact, none of the collateral controls is a significant determinant of the haircuts of corporate bond repos.

The results are similar for repo spread. Non-investment grade repos have higher spreads than investment grade repos. But, within the investment grade only repos and non-investment grade only repos, spreads are not related to any of the collateral characteristics, including the collateral rating. Repo spread does not depend on the dealer's credit risk either. The most robust explanatory variable for spread is the maturity of the repo. For one standard deviation increase in repo maturity, or 15 business days, repo spread increases approximately 3.8 bps.

# 5 Treasury Repos

Our main focus in this paper is the pricing of repos backed by risky corporate 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 safer government collateral, mainly Treasuries and Agency securities. To draw a parallel with the pricing of risky repos, we also investigate the pricing in the Treasury market.[27] In total we have 28,880 Treasury repos. Out of which, we are able to match the underlying Treasury securities for 15,436 repos.

Unlike the very concentrated equity and corporate bond repo markets, the treasury repo

[26]Adding fund family dummies also significantly improves the R-square of the regressions based on investment grade only repos and non-investment grade only repos.

[27]We didn't investigate the pricing in the Agency repos because there is no standard database on the prices of the Agency securities.

market is more diversified and involves a large number of fund families and dealers. On the lenders' side, there are 88 unique fund families. Fidelity remains to be the largest lender in the Treasury repo market, but it accounts for only 11.6% of the total lending. This is much less than Fidelity's market share in the equity and corporate bond repo markets. The second and third largest lenders are Federated Investors and Dreyfus. The total market share of the top five fund families is approximately 45%.

On the borrowers' side, there are in total 35 dealers. Barclays is the largest borrower, followed by Deutsche Bank, Royal Bank of Scotland, Credit Suisse and BNP Paribas. All five are non-US European banks. Together, the top five dealers borrow 47% and the rest 30 dealers split the remaining 53%. The lenders and borrowers are also more inter-connected in the Treasury tri-party market. The panel (c) of Figure 4 shows a complicated and highly intertwined network, in which every fund family lends to multiple dealer banks and every dealer bank borrows from multiple fund families.[28] Compared with the equity and corporate bond repo markets, both fund families and dealers have more counter-parties in the Treasury repos.

On the collateral's side, most of the Treasury collateral are Treasury Notes. Table 15 summarizes the underlying Treasury securities in the collateral pool. 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 10.83%, are on-the-run securities. The number of collateral per repo is also fewer, compared with the equity and corporate repos. On average, there are approximately 3.43 securities, or 2.23 equal-size securities, per Treasury repo.

Panel C of Table 1 summarizes the characteristics of the 15,436 Treasury repos that we can match the underlying collateral; Table 16 reports the summary statistics for the top ten fund families and the top ten dealers. For the haircuts, the 1st decile of haircuts is 2.00% and the 9th decile is only slightly higher at 2.05%. Thus, the majority of the Treasury repos are simply charged with a constant haircut at approximately 2%. Compared with equity and corporate bond repos, the spreads of Treasury repos have lower levels and smaller variations. The 1st decile of Treasury repo spreads is -5 bps; the 9th decile is 8 bps. The spreads are lower because investors demand lower premiums for holding safer Treasury securities as collateral. It is also related to the shorter maturity. The majority of the Treasury repos

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

are over-night, while equity and corporate bond repos tend to have maturities around one month.

The small variations 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 haircut or spread. Nor is the counter-party risk variable, which is measured as dealers' CDS spreads. For spreads, month dummies alone can explain close to 50% of the total variations. Therefore, the variations in spreads are likely due to the time-series changes of the overall credit market.

# 6 Conclusion

We collect a unique dataset of tri-party repo transactions between U.S. money market funds and dealer banks. Taking advantage of the detailed collateral information in the dataset, we examine the pricing in the tri-party repo market, focusing on the repos backed by equity and corporate bonds which have rich pricing patterns. We find that pricing relies mostly on haircuts and much less on rate spreads. Surprisingly, haircuts are largely decided by the associated fund families and not by the dealers. Some fund families use counter-party sensitive and collateral sensitive pricing schemes, but most of the fund families use uniform haircuts. Among the uniform haircuts, there is substantial variation in the levels of haircuts chosen by different fund families. Facing various pricing schemes from different fund families, dealers behave simply like price-takers and do not shop around for the best haircuts. Instead, they seem to value more about maintaining a stable relationship with their lenders. Repo spread is determined mainly by the maturity and does not depend on the collateral or the dealer's credit risk. Compared with the equity and corporate bond repos, the pricing of Treasury repos is much more homogeneous: the haircuts are unanimously set at 2% and the repo rates follow closely with the Fed Fund Rates.

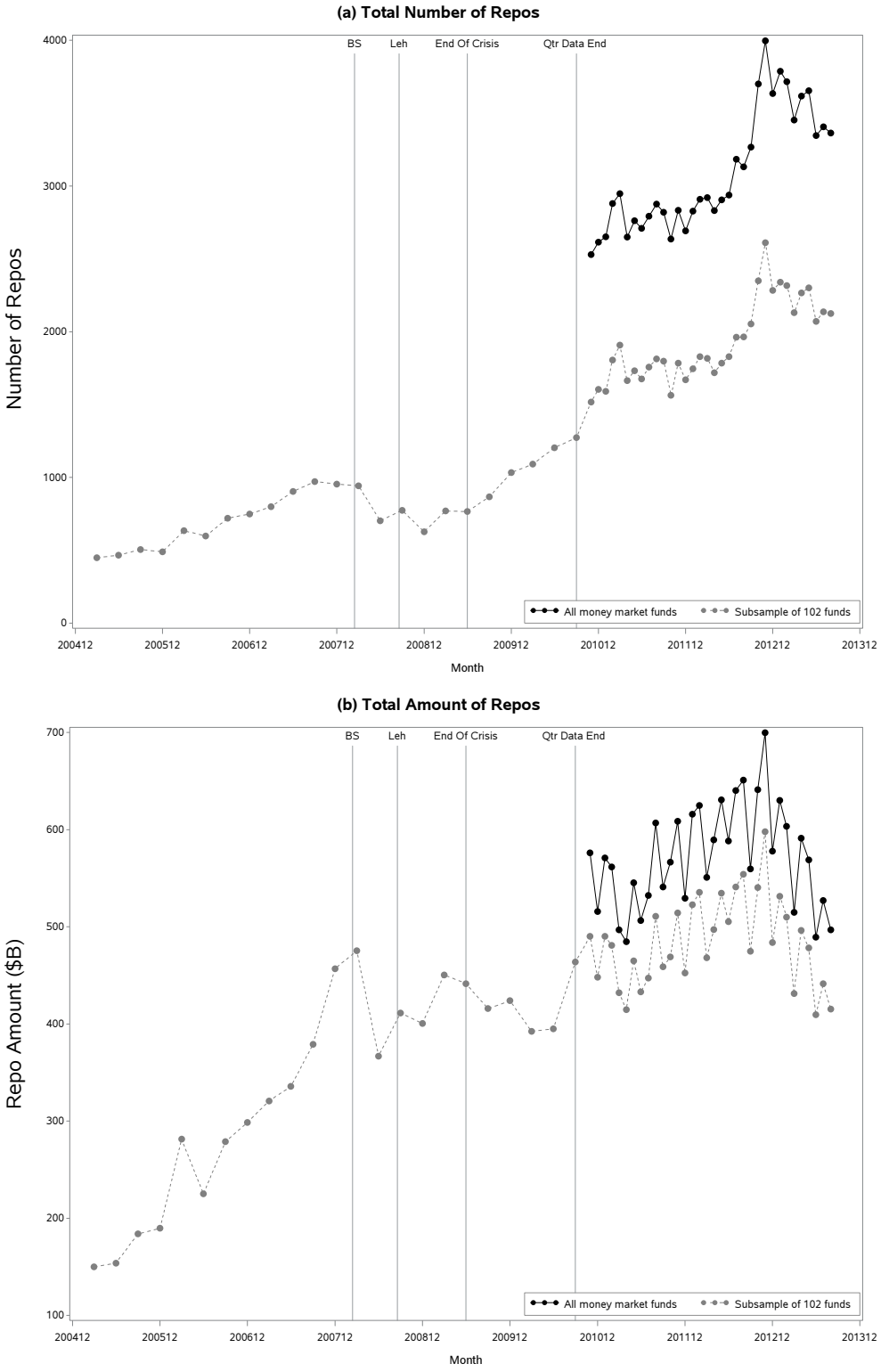


Figure 1: **Time-Series of Tri-Party Repos by U.S. Money Market Funds**

The dark line plots the repos positions of all U.S. money market funds and the gray line plots the repo positions for a sub-sample of 102 money market funds. The numbers before November 2010 are aggregated at the quarterly frequency; the numbers at and after November 2010 are at the monthly frequency.

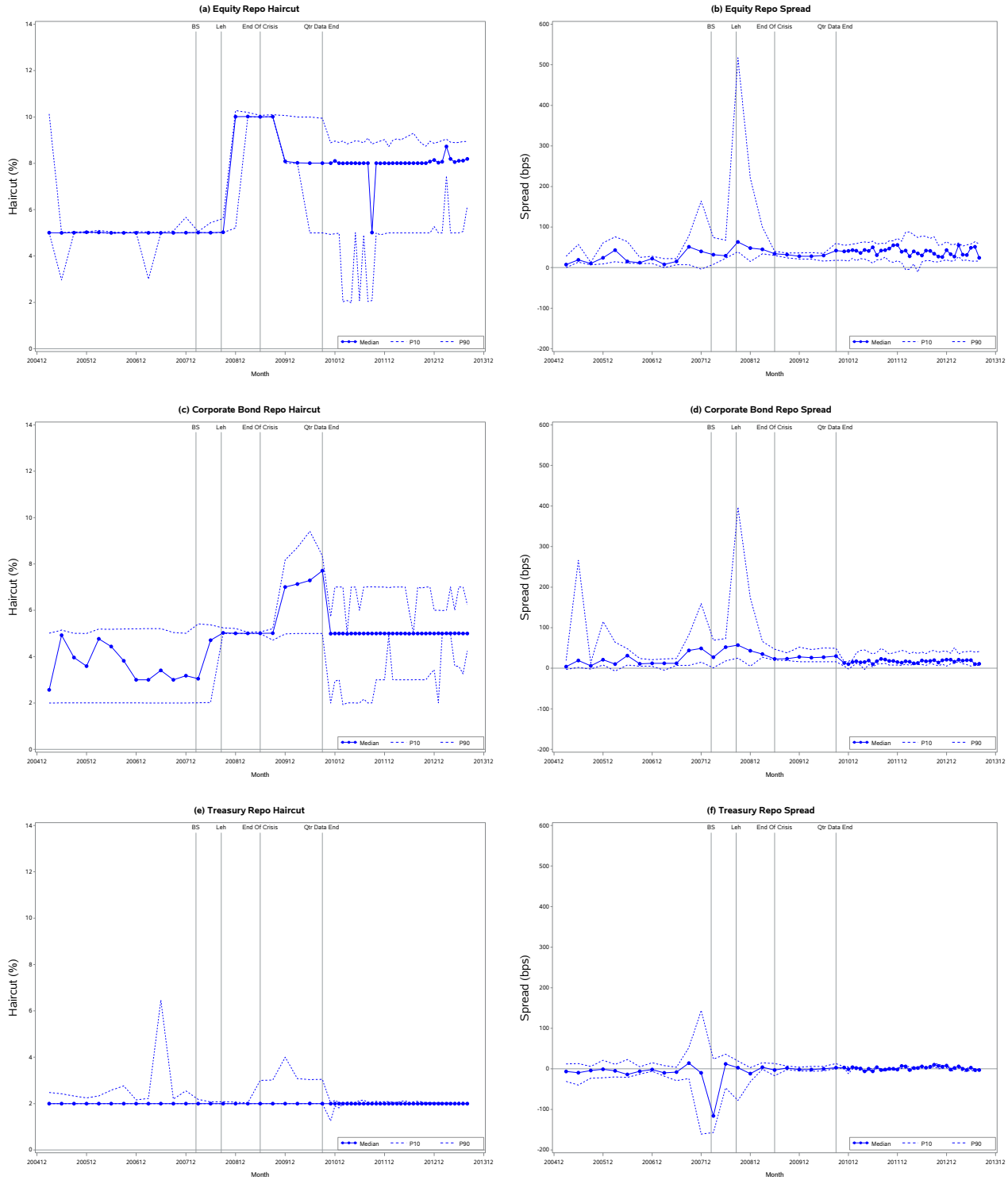


Figure 2: **Cross-Sectional Variations of Haircuts and Spreads**

The cross-sectional median, the first decile and the ninth decile of the haircuts and spreads are plotted for equity, corporate bond and Treasury repos from 2005 Q1 to November 2013.

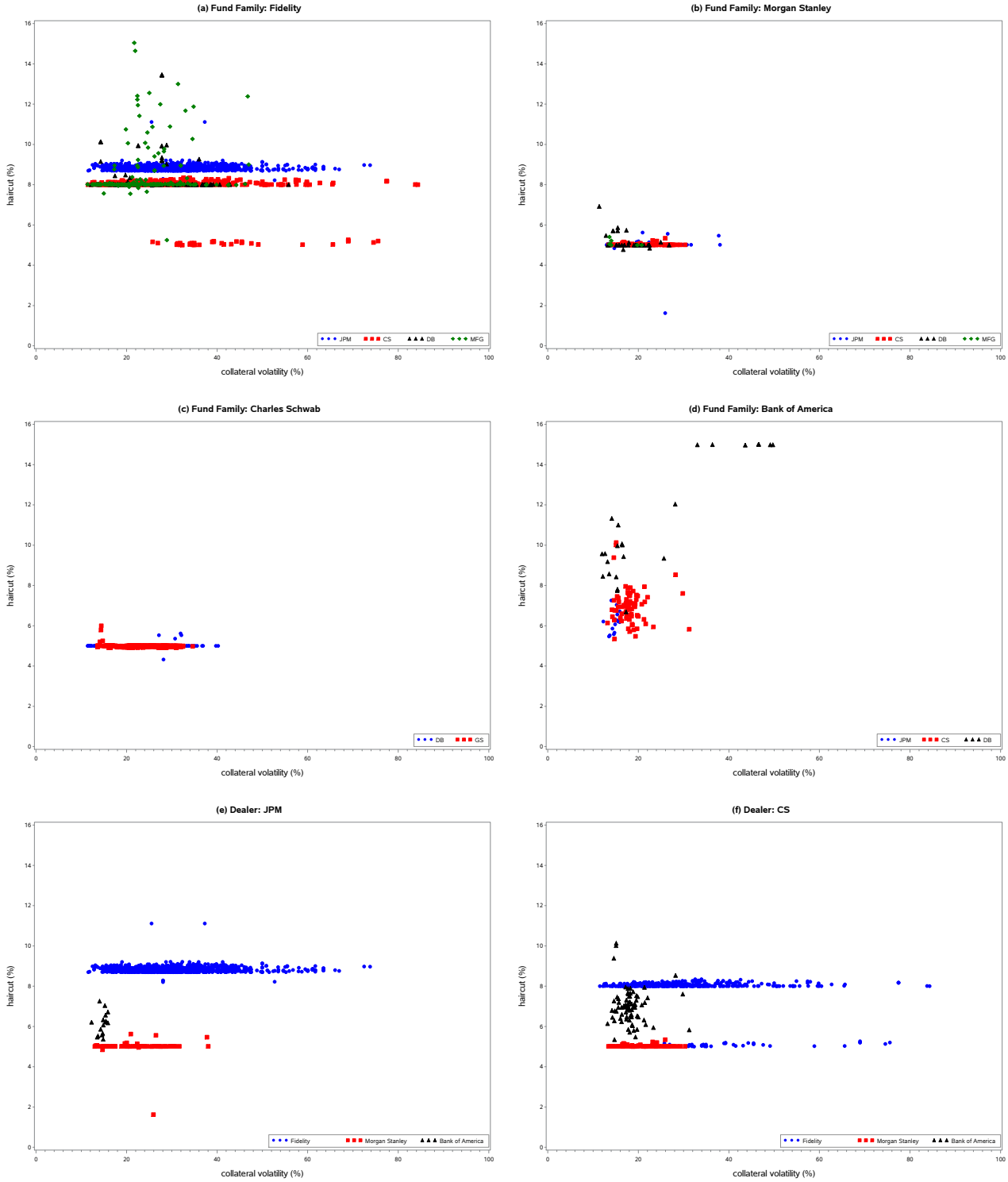


Figure 3: **Equity Repo Haircut v.s. Collateral Volatility**

Equity repos' haircuts are plotted against the underlying collateral's volatilities. For each repo, we first calculate the value-weighted daily return of all stocks in the collateral pool, weighted by the collateral value of individual securities. The collateral volatility is then calculated as the standard deviation of the daily returns in the one-year window before the repo date.

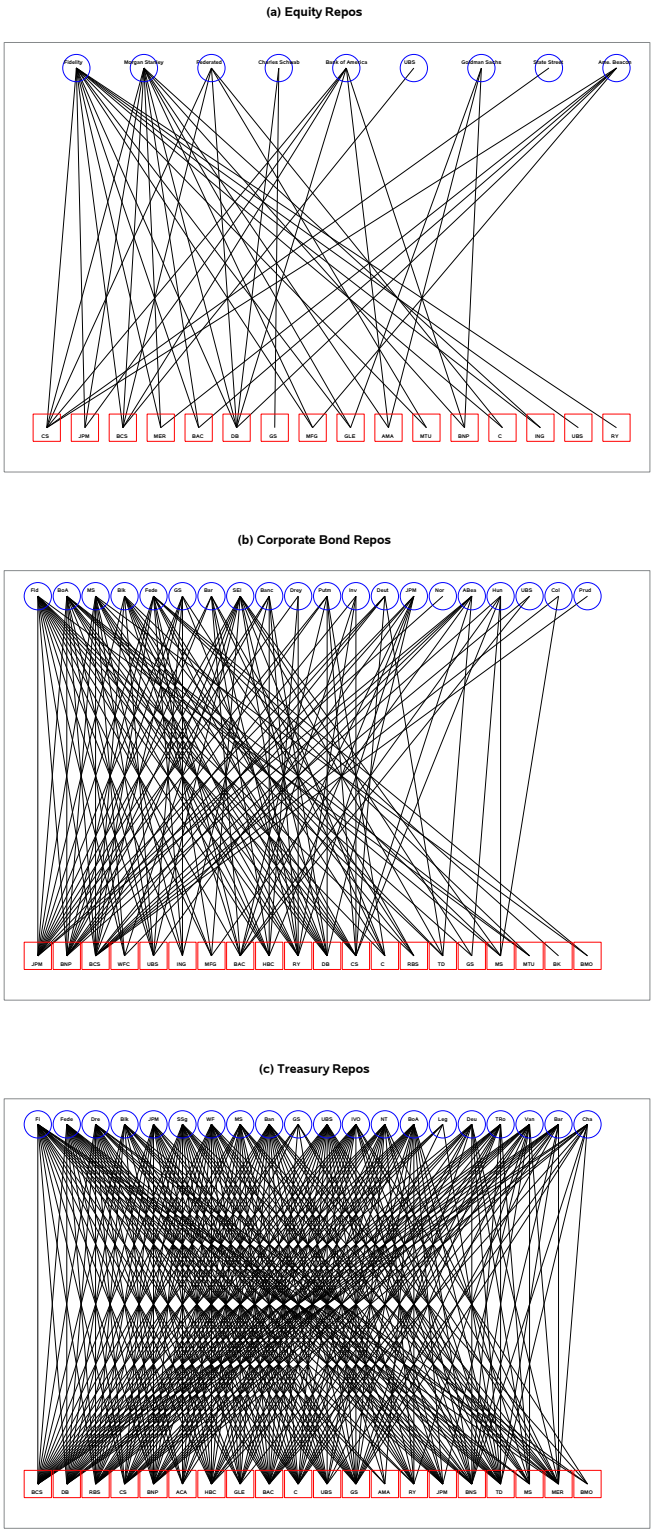


Figure 4: **MMF-Dealer Relationship in The Tri-Party Repo Market**

The blue circles represent different fund families and the red squares represent different dealers. The fund families and dealers are plotted from left to right, ranked by their total repo amount from November 2010 to August 2013. A pair of fund family and dealer are connected by a solid line if they have repo transactions during our sample period from November 2010 to August 2013. For Treasury repos, only the top 20 fund families and the top 20 dealers are plotted.

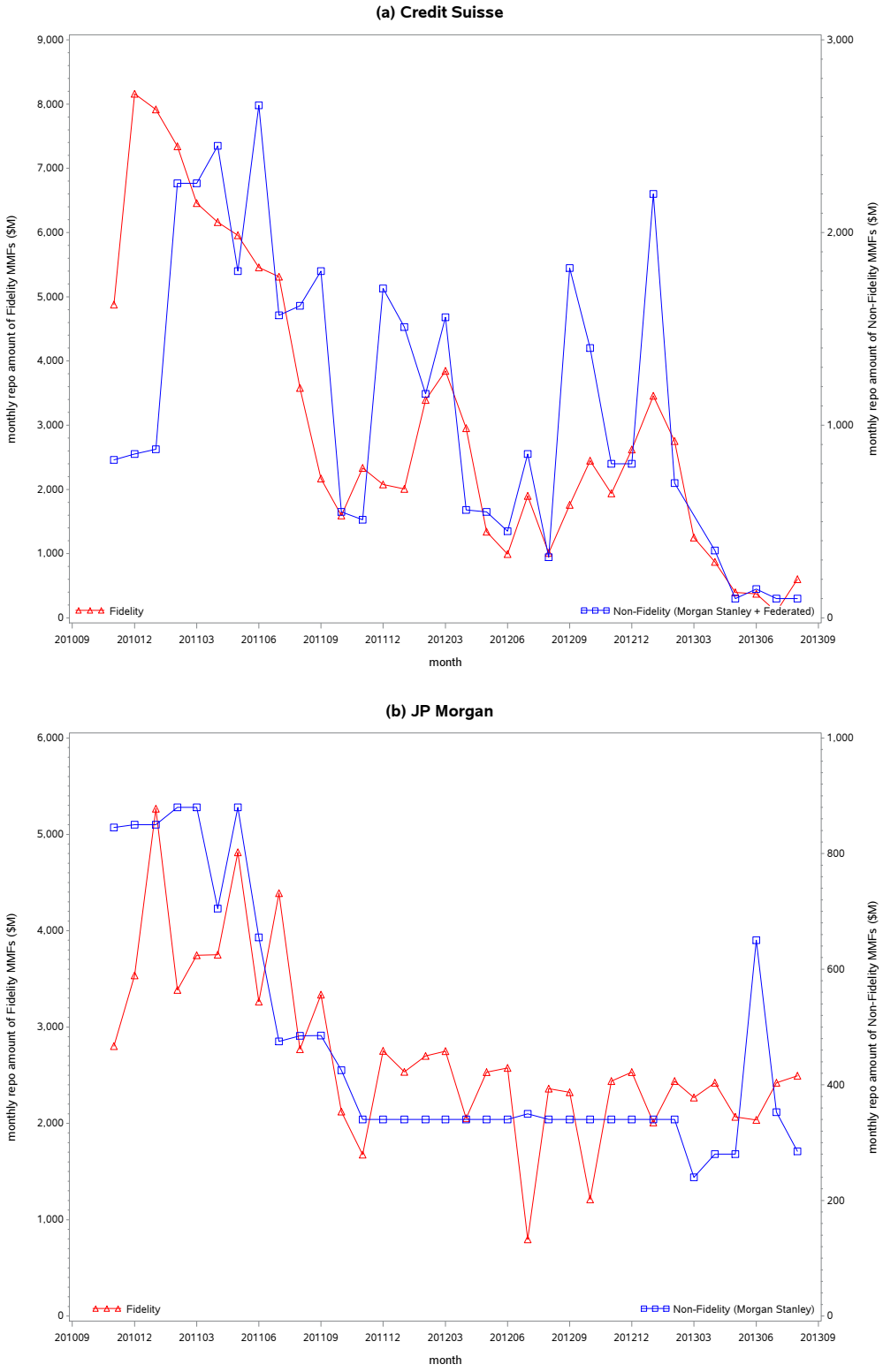


Figure 5: **Equity Repo Borrowing of Credit Suisse and JP Morgan**

The left y-axis corresponds to the monthly equity repo amount between the dealer and the Fidelity funds; the right y-axis corresponds to the monthly equity repo amount between the dealer and the non-Fidelity funds.

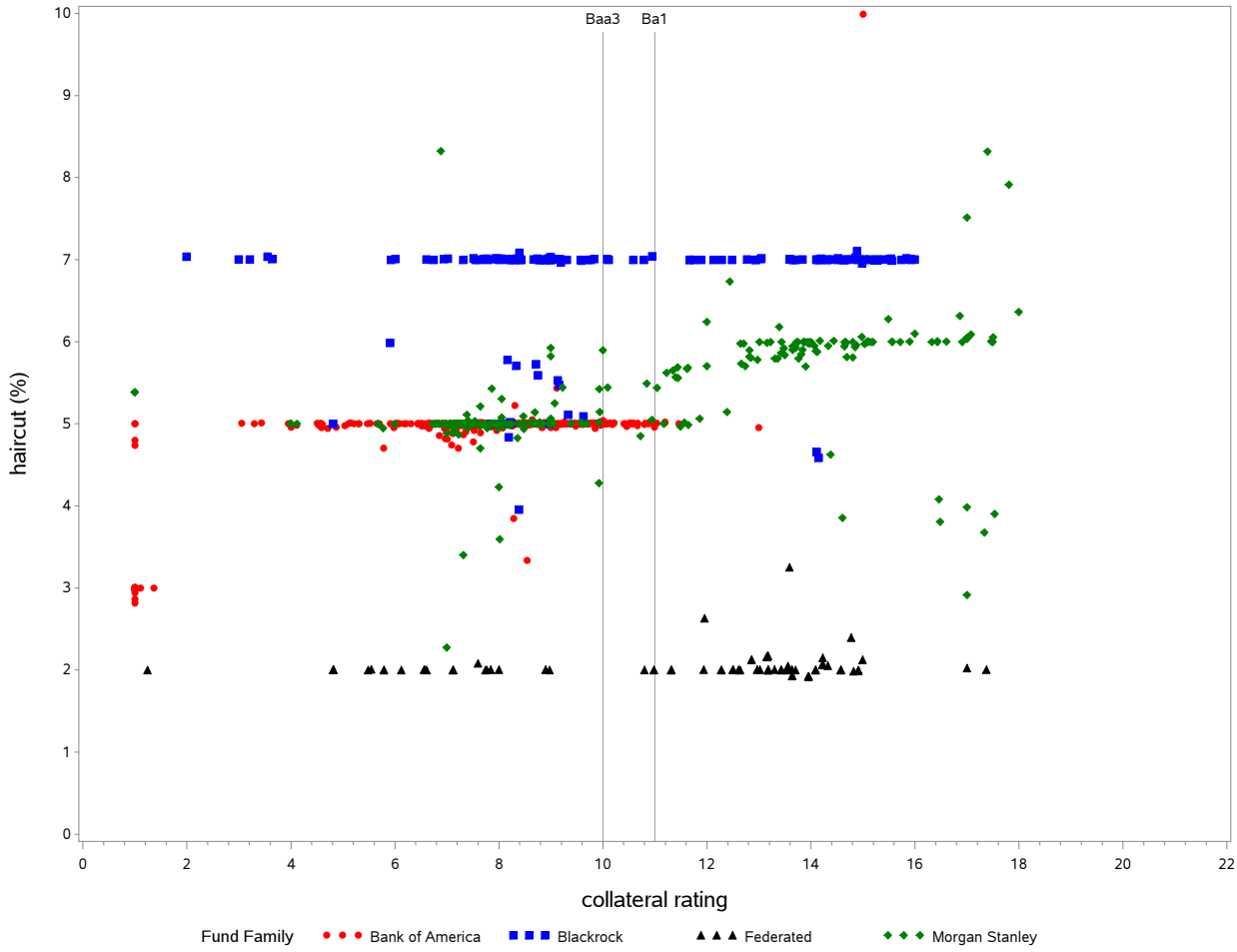


Figure 6: **Corporate Bond Repo Haircut v.s. Collateral Rating**

Corporate bond repos' haircuts are plotted against the underlying collateral's ratings. A repo's rating is calculated as the value-weighted average rating of all rated corporate bonds in the collateral pool, weighed by the collateral value of the individual securities. A corporate bond' rating is a numerical translation of Moodys rating, where 1=Aaa and 21=C.

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

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

| | | | | | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| period | #FFs | #MMFs | #dealers | #repos | amt ($B) | 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 | 3,350 | 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 | 249 |

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

| | | | | | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| period | #FFs | #MMFs | #dealers | #repos | amt ($B) | 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 | 1,271 | 399 | 3.65 | 1.46 | 2.00 | 3.21 | 5.17 | 29.2 | 36.3 | 4.0 | 18.0 | 66.0 | 28.7 | 120 | 1 | 1 | 64 | 314 | 361 | 21 | 200 | 747 |
| 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 | 1,291 | 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 | 195 |

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

| | | | | | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| period | #FFs | #MMFs | #dealers | #repos | amt ($B) | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 |
| Jan 05 - Jun 08 | 16 | 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 | 17 | 72 | 26 | 1,016 | 692 | 2.09 | 0.37 | 2.00 | 2.00 | 2.08 | −1.1 | 73.1 | −23 | −1.0 | 17.0 | 5.6 | 18.1 | 1 | 1 | 12 | 681 | 924 | 50 | 391 | 1600 |
| Sep 09 - Sep 10 | 21 | 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 | 82 | 290 | 30 | 15,436 | 2,849 | 2.02 | 0.28 | 2.00 | 2.00 | 2.05 | 1.4 | 5.0 | −5.0 | 2.0 | 8.0 | 1.6 | 3.7 | 1 | 1 | 2 | 185 | 293 | 10 | 90 | 500 |

This table reports the distributions of haircut, spread, maturity and size for equity, corporate bond and Treasury tri-party repos, from January 2005 to August 2013. The summary statistics for the period from January 2005 to June 2008, September 2008 to June 2009, and September 2009 to September 2010 are based on the repos collected from the quarterly filings of 102 U.S. money market funds. The summary statistics for the period from November 2010 to August 2013 are based on the repos with matched collateral securities, collecting from the monthly N-MFP filings of all U.S. money market funds. In addition to the distributions of repo characteristics, we also report the total number of fund families (#FFs), the total number of money market funds (#MMFs), the total number of dealers (#dealers), the total number of repos (#repos) and the total amount of repos in billions (amt) for each of the sample periods.

Table 2: **Equity Tri-Party Repos Summary Statistics, November 2010 - August 2013**

**Panel A: All Fund Families**

| | | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| fund family | #repos | amt ($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 | 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 | 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 | 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 | 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 | 100 | 12,363 | 2.03 | 0.04 | 2.01 | 2.03 | 2.07 | 28.2 | 3.7 | 26.5 | 28.5 | 30.5 | 4.7 | 0.5 | 4 | 5 | 5 | 124 | 104 | 40 | 100 | 188 |
| State Street | 20 | 6,250 | 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 | 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 Five Dealers**

| | | | Dealer CDS (bps) | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| dealer | #repos | amt ($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 | 122,355 | 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 | 733 | 85,940 | 123 | 31.7 | 6.70 | 2.14 | 5.10 | 8.00 | 8.06 | 33.5 | 21.4 | 16.0 | 27.0 | 43.0 | 13.4 | 17.3 | 1 | 5 | 21 | 117 | 158 | 13 | 54 | 165 |
| DB | 302 | 19,470 | 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 | 18,586 | 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 | 10,167 | | | 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 distributions of haircut, spread, maturity and size for the sample of equity repos with matched collateral from November 2010 to August 2013. Panel A reports the summary statistics for each of the seven fund families. Panel B reports the summary statistics for the top five dealers, ranked by the total equity repo amount. The top five dealers are JP Morgan (JPM), Credit Suisse (CS), Deutsche Bank (DB), Goldman Sachs (GS) and Mizuho (MFG). In addition to the repo statistics, we also report the time-series mean and standard deviation of the dealers' 5-year CDS spreads in Panel B. The CDS spreads data are obtained from Markit. We don't have Mizuho's CDS spreads since it is not covered by Markit.

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

| stock | amount ($M) | pct (%) | #repos | #months | #FFs | #dealers |
|---|---|---|---|---|---|---|
| Anglogold Ltd | 7368 | 2.78 | 121 | 30 | 3 | 6 |
| Bank of America Corp | 5772 | 2.17 | 296 | 33 | 4 | 9 |
| Apple Inc | 5616 | 2.12 | 224 | 33 | 5 | 12 |
| Verisign Inc | 3407 | 1.28 | 69 | 30 | 3 | 5 |
| Wells Fargo & Co | 3108 | 1.17 | 145 | 31 | 7 | 12 |
| Anadarko Petroleum Corp | 2816 | 1.06 | 204 | 32 | 6 | 10 |
| Citigroup Inc | 2796 | 1.05 | 230 | 30 | 7 | 13 |
| Transocean Ltd | 2269 | 0.85 | 52 | 21 | 4 | 5 |
| Hartford Financial Services Group Inc | 2119 | 0.80 | 49 | 24 | 3 | 6 |
| QUALCOMM Inc | 2084 | 0.78 | 166 | 31 | 5 | 9 |
| JPMorgan Chase & Co | 2057 | 0.77 | 268 | 34 | 7 | 12 |
| EMC Corp | 2014 | 0.76 | 78 | 26 | 5 | 7 |
| Nexen Inc | 1960 | 0.74 | 126 | 18 | 3 | 5 |
| Alliance Data Systems Corp | 1852 | 0.70 | 64 | 31 | 2 | 4 |
| Ford Motor Corp | 1781 | 0.67 | 51 | 24 | 4 | 8 |
| Microchip Technology Inc | 1594 | 0.60 | 81 | 29 | 3 | 5 |
| MGM Resorts International | 1594 | 0.60 | 79 | 25 | 4 | 5 |
| Pfizer Inc | 1575 | 0.59 | 269 | 33 | 6 | 12 |
| Cadence Design Systems Inc | 1567 | 0.59 | 38 | 26 | 2 | 3 |
| Google Inc | 1531 | 0.58 | 136 | 28 | 5 | 13 |

This table reports the top 20 securities in the collateral pool of the 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 is used as collateral (#repos), the number of months the security is used as collateral (#months), the number of fund families that accept the security as collateral (#FFs) and the number of dealers that post the security as collateral (#dealers).

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

| | equity collaterals | | | | | | |
|---|---|---|---|---|---|---|---|
| Fund Family | matched | #cols | #cols (vw) | size | port vol | avg vol | fin |
| | | | mean | | | | |
| Fidelity | 99.72 | 7.17 | 3.82 | 9.77 | 29.61 | 34.24 | 0.21 |
| Morgan Stanley | 98.98 | 71.48 | 39.83 | 9.44 | 20.45 | 33.22 | 0.17 |
| Charles Schwab | 99.63 | 34.34 | 24.57 | 9.80 | 22.05 | 32.93 | 0.20 |
| Bank of America | 98.86 | 39.46 | 14.36 | 9.48 | 19.03 | 32.01 | 0.19 |
| Federated | 99.95 | 39.48 | 13.02 | 10.34 | 20.26 | 29.41 | 0.23 |
| State Street | 99.97 | 21.35 | 7.19 | 10.12 | 28.08 | 36.23 | 0.19 |
| Goldman Sachs | 99.36 | 30.34 | 16.49 | 10.97 | 18.70 | 27.24 | 0.23 |
| All | 99.61 | 19.81 | 11.26 | 9.78 | 26.61 | 33.57 | 0.20 |
| | | | median | | | | |
| Fidelity | 100.00 | 2.00 | 1.57 | 9.51 | 27.88 | 33.12 | 0.00 |
| Morgan Stanley | 100.00 | 47.50 | 37.46 | 9.45 | 20.03 | 33.18 | 0.17 |
| Charles Schwab | 100.00 | 22.00 | 21.67 | 9.80 | 22.24 | 32.99 | 0.19 |
| Bank of America | 100.00 | 27.00 | 12.54 | 9.13 | 17.66 | 31.66 | 0.17 |
| Federated | 100.00 | 32.00 | 12.22 | 10.41 | 20.13 | 29.22 | 0.23 |
| State Street | 100.00 | 15.50 | 5.78 | 10.07 | 27.88 | 36.28 | 0.18 |
| Goldman Sachs | 100.00 | 17.50 | 12.97 | 11.09 | 17.15 | 25.39 | 0.23 |
| All | 100.00 | 9.00 | 4.06 | 9.67 | 24.83 | 32.67 | 0.12 |
| | | | standard deviation | | | | |
| Fidelity | 1.34 | 10.16 | 6.14 | 1.82 | 11.07 | 11.05 | 0.33 |
| Morgan Stanley | 1.68 | 69.25 | 11.46 | 1.03 | 5.33 | 6.05 | 0.08 |
| Charles Schwab | 1.43 | 42.31 | 9.62 | 0.89 | 5.49 | 6.49 | 0.09 |
| Bank of America | 2.39 | 45.44 | 7.14 | 1.14 | 6.85 | 6.75 | 0.16 |
| Federated | 0.51 | 46.31 | 9.45 | 0.42 | 3.18 | 3.85 | 0.10 |
| State Street | 0.14 | 14.71 | 4.56 | 1.03 | 5.94 | 9.19 | 0.19 |
| Goldman Sachs | 2.23 | 31.95 | 8.83 | 0.66 | 6.02 | 6.39 | 0.10 |
| All | 1.47 | 36.01 | 13.71 | 1.58 | 10.36 | 9.72 | 0.27 |

This table reports the summary statistics of the equity collateral for each of the seven fund families in the equity repo market, from November 2010 to August 2013. We first calculate, for each equity repo, the percentage of matched securities (matched), the number of collateral (#cols), the value-weighted number of collateral (#cols (vw)), the value-weighted log firm size (size), the portfolio volatility (port vol), the value-weighted volatility (avg vol), and the proportion of financial firms (fin). The weights are individual security's collateral value. The value-weighted number of collateral (#cols (vw)) is calculated as the inverse of the Herfindahl index based on the collateral value of individual securities. We then report the cross-sectional mean, median and standard-deviation of repos for each fund family and the full sample.

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

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

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

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

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

This table reports the OLS regressions on the haircuts of 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 the double-clustered standard errors, clustered by dealer and month.

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

| Parm | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| #col (vw) | | | | −.002 | | | | | −.003* | −.003* |
| | | | | [−1.37] | | | | | [−1.77] | [−1.74] |
| col size | | | | | −.033* | | | | −.047 | −.043 |
| | | | | | [−1.78] | | | | [−1.62] | [−1.33] |
| col port vol | | | | | | 0.003 | | | −.003 | |
| | | | | | | [ 0.67] | | | [−0.44] | |
| col avg vol | | | | | | | 0.004** | | | −.001 |
| | | | | | | | [ 2.37] | | | [−0.17] |
| col fin (%) | | | | | | | | −.093 | −.014 | −.023 |
| | | | | | | | | [−0.53] | [−0.09] | [−0.15] |
| dealer CDS | | | | −.001 | −.001 | −.001 | −.001 | −.001 | −.001 | −.001 |
| | | | | [−1.42] | [−1.48] | [−1.44] | [−1.43] | [−1.48] | [−1.63] | [−1.64] |
| repo size (log) | 0.011 | −.028 | −.017 | −.014 | −.015 | −.017 | −.017 | −.018 | −.009 | −.009 |
| | [ 0.14] | [−1.49] | [−1.18] | [−1.00] | [−1.23] | [−1.18] | [−1.17] | [−1.22] | [−0.85] | [−0.84] |
| repo mat | 0.006 | −.000 | −.000 | −.000 | 0.000 | −.000 | −.000 | −.000 | 0.000 | 0.000 |
| | [ 0.83] | [−0.97] | [−0.03] | [−0.38] | [ 0.04] | [−0.31] | [−0.21] | [−0.20] | [ 0.10] | [ 0.02] |
| month | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| dealer | N | N | Y | Y | Y | Y | Y | Y | Y | Y |
| Fund Family | N | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| NOBS | 1036 | 1036 | 1036 | 1030 | 1030 | 1030 | 1030 | 1030 | 1030 | 1030 |
| R2 | 22.0 | 94.6 | 95.6 | 95.6 | 95.6 | 95.6 | 95.6 | 95.6 | 95.7 | 95.6 |

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

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

| 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 (log) | −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 repos by Fidelity, Morgan Stanley, Charles Schwab, Bank of America money market funds and also for the full sample of repos. For the regressions of the individual fund families, the t-statistics reported in squared brackets are based on the double-clustered standard errors clustered by dealer and month. For the regression of the full sample of repos, the t-statistics reported in squared brackets are based on the double-clustered standard errors clustered by fund family and month.

Table 9: **Top Fund Families and Their Counter-Parties**

| | | | | | | | | | | | top 1 dealer | | | | | | top 2 dealer | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | repo amt | | mkt share(%) | | # dealers | | # vw dealers | | dealer | #mon | value | | ratio(%) | | dealer | #mon | value | | ratio(%) | |
| rank | fund family | #mon | mean | std | mean | std | mean | std | mean | std | | | mean | std | mean | std | | | mean | std | mean | std |
| **Panel A: Equity Repos** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Fidelity | 34 | 9,517 | 3,926 | 69.3 | 7.4 | 6.1 | 1.0 | 3.4 | 0.5 | CS | 34 | 3,100 | 1,237 | 29 | 9 | JPM | 34 | 2,722 | 680 | 31 | 9 |
| 2 | Morgan Stanley | 34 | 1,521 | 601 | 12.0 | 5.4 | 4.3 | 1.9 | 3.2 | 1.3 | CS | 32 | 516 | 260 | 34 | 16 | JPM | 34 | 469 | 86 | 34 | 13 |
| 3 | Federated | 30 | 743 | 626 | 5.4 | 4.1 | 1.9 | 0.6 | 1.4 | 0.4 | CS | 18 | 656 | 541 | 53 | 40 | BCS | 27 | 118 | 52 | 33 | 36 |
| 4 | Charles Schwab | 23 | 586 | 556 | 4.0 | 3.7 | 1.8 | 0.4 | 1.4 | 0.4 | GS | 23 | 766 | 354 | 81 | 15 | DB | 19 | 101 | 72 | 19 | 15 |
| 5 | Bank of America | 18 | 406 | 473 | 3.7 | 4.2 | 2.9 | 1.2 | 2.2 | 0.9 | CS | 16 | 468 | 326 | 56 | 29 | DB | 12 | 111 | 181 | 14 | 16 |
| **Panel B: Corporate Bond Repos** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Fidelity | 34 | 5,394 | 2,472 | 39.8 | 11.1 | 9.8 | 1.2 | 5.7 | 1.0 | JPM | 27 | 1,157 | 683 | 16 | 10 | BCS | 25 | 829 | 444 | 13 | 8 |
| 2 | Bank of America | 34 | 1,524 | 442 | 12.4 | 4.8 | 6.8 | 1.3 | 4.7 | 1.2 | JPM | 33 | 373 | 151 | 25 | 9 | RY | 32 | 329 | 160 | 22 | 11 |
| 3 | Morgan Stanley | 34 | 1,266 | 436 | 10.4 | 4.4 | 5.7 | 2.2 | 3.3 | 1.0 | WFC | 30 | 489 | 180 | 35 | 11 | JPM | 18 | 214 | 112 | 16 | 9 |
| 4 | Blackrock | 34 | 1,194 | 590 | 9.0 | 3.8 | 3.8 | 1.1 | 3.0 | 1.0 | UBS | 32 | 402 | 126 | 38 | 15 | JPM | 34 | 293 | 169 | 25 | 12 |
| 5 | Federated | 31 | 913 | 605 | 7.0 | 3.8 | 3.8 | 1.3 | 3.2 | 1.1 | BNP | 23 | 303 | 244 | 27 | 19 | C | 26 | 186 | 107 | 22 | 13 |
| **Panel C: Treasury Repos** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Fidelity | 34 | 22,348 | 5,432 | 11.6 | 2.5 | 12.4 | 2.5 | 7.5 | 2.1 | BCS | 34 | 3,520 | 1,846 | 16 | 7 | ACA | 24 | 2,751 | 1,229 | 13 | 6 |
| 2 | Federated | 34 | 21,983 | 7,083 | 11.4 | 3.2 | 14.0 | 1.7 | 7.7 | 1.8 | BCS | 34 | 5,102 | 2,380 | 22 | 6 | ACA | 34 | 2,762 | 1,116 | 13 | 6 |
| 3 | Dreyfus | 32 | 19,411 | 7,395 | 9.9 | 3.3 | 16.4 | 1.2 | 7.8 | 1.4 | AMA | 25 | 4,814 | 1,977 | 21 | 8 | HBC | 32 | 2,241 | 938 | 11 | 3 |
| 4 | Blackrock | 34 | 12,462 | 3,558 | 6.4 | 1.5 | 11.5 | 0.6 | 7.9 | 0.8 | DB | 34 | 2,206 | 743 | 18 | 4 | BCS | 34 | 1,634 | 679 | 14 | 5 |
| 5 | J.P. Morgan | 34 | 10,037 | 3,103 | 5.1 | 1.1 | 8.9 | 1.7 | 6.1 | 1.2 | BCS | 34 | 1,832 | 684 | 19 | 7 | RBS | 34 | 1,747 | 661 | 18 | 6 |

This table summarizes, for each asset class, the top five fund families and their counter-parties. The summary statistics are based on the full sample of repos from November 2010 to August 2013. The repos are classified into different asset classes according to the reported collateral type and collateral subtype. The fund families are ranked by the total amount of repo transactions during the sample period. For each fund family at each month-end, we calculate its total repo amount, market share (%), the number of counter-parties (#dealers), the value-weighted number of counter-parties (# vw dealers). The time-series mean and standard deviations are then reported in the table. We select the top two dealers for each fund family, based on the total amount of repo transactions during the sample period. For each fund family - dealer pair, we report the time-series mean and standard deviation of the repo amount (value) and the ratio out of the fund family's total repos (ratio). The dealers in the table are Credit Suisse (CS), JP Morgan (JPM), Barclays (BCS), Deutsche Bank (DB), Goldman Sachs (GS), Royal Bank of Canada (RY), Wells Fargo (WFC), UBS (UBS), BNP Paribas (BNP), Citi Group (C), Credit Agricole (ACA), HSBC Holdings (HBC), ABN AMRO (AMA) and Royal Bank of Scotland (RBS).

Table 10: **Top Dealers and Their Counter-Parties**

| | | | repo amt | | mkt share(%) | | # FFs | | # vw FFs | | top 1 fund family | | | | | | top2 fund family | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | MMF | #mon | value | | ratio(%) | | MMF | #mon | value | | ratio(%) | |
| rank | dealer | #mon | mean | std | mean | std | mean | std | mean | std | | | mean | std | mean | std | | | mean | std | mean | std |
| **Panel A: Equity Repos** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | CS | 34 | 4,636 | 1,782 | 32.0 | 8.4 | 3.4 | 0.9 | 2.2 | 0.6 | Fidelity | 34 | 3,100 | 1,237 | 62 | 10 | Federated | 18 | 578 | 565 | 10 | 11 |
| 2 | JPM | 34 | 3,215 | 729 | 24.7 | 6.1 | 2.1 | 0.4 | 1.4 | 0.1 | Fidelity | 34 | 2,722 | 680 | 84 | 5 | Morgan Stanley | 34 | 469 | 86 | 15 | 5 |
| 3 | BCS | 34 | 1,265 | 563 | 8.4 | 3.5 | 2.7 | 1.1 | 1.7 | 0.6 | Fidelity | 23 | 886 | 475 | 43 | 20 | UBS | 22 | 230 | 278 | 20 | 27 |
| 4 | MER | 12 | 1,085 | 1,587 | 8.5 | 11.4 | 2.3 | 0.5 | 1.1 | 0.1 | Fidelity | 12 | 3,004 | 1,798 | 97 | 3 | Morgan Stanley | 3 | 36 | 76 | 1 | 3 |
| 5 | BAC | 22 | 948 | 842 | 7.3 | 6.9 | 1.9 | 0.6 | 1.2 | 0.3 | Fidelity | 22 | 1,353 | 925 | 90 | 10 | Morgan Stanley | 5 | 96 | 92 | 8 | 8 |
| **Panel B: Corporate Bond Repos** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | JPM | 34 | 2,484 | 757 | 18.4 | 5.1 | 6.8 | 0.9 | 3.7 | 1.5 | Fidelity | 27 | 1,123 | 666 | 32 | 17 | Bank of America | 33 | 373 | 151 | 19 | 10 |
| 2 | BNP | 34 | 1,511 | 453 | 11.9 | 3.1 | 7.1 | 2.2 | 4.4 | 1.7 | Blackrock | 29 | 307 | 152 | 23 | 12 | Fidelity | 30 | 294 | 131 | 23 | 15 |
| 3 | BCS | 34 | 1,396 | 752 | 9.5 | 4.8 | 4.1 | 2.5 | 2.2 | 1.1 | Fidelity | 25 | 804 | 426 | 43 | 19 | Blackrock | 16 | 187 | 210 | 13 | 15 |
| 4 | WFC | 34 | 1,360 | 432 | 10.6 | 3.1 | 2.9 | 1.1 | 2.1 | 0.6 | Fidelity | 32 | 710 | 351 | 48 | 19 | Morgan Stanley | 30 | 489 | 180 | 38 | 15 |
| 5 | UBS | 34 | 1,236 | 416 | 9.6 | 2.9 | 3.3 | 0.7 | 2.6 | 0.5 | Fidelity | 34 | 532 | 216 | 44 | 14 | Blackrock | 32 | 402 | 126 | 33 | 15 |
| **Panel C: Treasury Repos** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | BCS | 34 | 30,856 | 7,228 | 16.3 | 3.5 | 34.8 | 2.3 | 11.7 | 1.8 | Federated | 34 | 5,102 | 2,380 | 16 | 6 | Fidelity | 34 | 3,520 | 1,846 | 12 | 6 |
| 2 | DB | 34 | 17,320 | 4,950 | 8.8 | 1.9 | 32.6 | 4.1 | 11.9 | 2.7 | Blackrock | 34 | 2,206 | 743 | 13 | 4 | Federated | 34 | 1,751 | 1,096 | 10 | 5 |
| 3 | RBS | 34 | 16,077 | 3,508 | 8.4 | 1.5 | 21.0 | 2.4 | 10.0 | 1.6 | Federated | 34 | 2,270 | 1,375 | 14 | 7 | Fidelity | 29 | 1,861 | 1,387 | 11 | 9 |
| 4 | CS | 34 | 13,208 | 4,515 | 6.7 | 2.0 | 25.5 | 2.8 | 9.2 | 1.7 | Fidelity | 27 | 2,181 | 1,648 | 14 | 8 | Federated | 31 | 1,619 | 1,332 | 11 | 7 |
| 5 | BNP | 34 | 12,953 | 3,911 | 6.8 | 1.9 | 17.0 | 2.5 | 8.4 | 1.5 | Fidelity | 34 | 2,092 | 1,398 | 15 | 7 | Federated | 34 | 1,915 | 961 | 15 | 6 |

This table summarizes, for each asset class, the top five dealers and their counter-parties. The summary statistics are based on the full sample of repos from November 2010 to August 2013. The repos are classified into different asset classes according to the reported collateral type and collateral subtype. For each dealer at each month-end, we calculate its total repo amount, market share (%), the number of counter-parties (# FFs), the value-weighted number of counter-parties (# vw FFs). The time-series mean and standard deviations are then reported in the table. We select the top two fund families for each dealer, based on the total amount of repo transactions during the sample period. For each fund family - dealer pair, we report the time-series mean and standard deviation of the repo amount (value) and the ratio out of the dealer's total repos (ratio). The dealers in the table are Credit Suisse (CS), JP Morgan (JPM), Barclays (BCS), Merill Lynch (MER), Bank of America (BAC), Deutsche Bank (DB), Wells Fargo (WFC), UBS (UBS), BNP Paribas (BNP), and Royal Bank of Scotland (RBS).

Table 11: **Corporate Bond Repo Summary Statistics, November 2010 - August 2013**

**Panel A: Top Ten Fund Families**

| | | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| fund family | #repos | amt ($M) | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 |
| Bank of America | 415 | 35,607 | 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 | 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 | 162 | 13,349 | 6.70 | 0.71 | 7.00 | 7.00 | 7.01 | 25 | 14 | 13 | 21 | 40 | 4.7 | 11 | 1 | 1 | 1 | 82 | 88 | 25 | 50 | 100 |
| Federated | 92 | 9,606 | 2.04 | 0.16 | 2.00 | 2.00 | 2.01 | 32 | 12 | 22 | 31 | 40 | 3.3 | 6.2 | 1 | 1 | 5 | 104 | 95 | 27 | 100 | 135 |
| Barclay | 55 | 7,509 | 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 | 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 | 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 | 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 | 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 | 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 Ten Dealers**

| | | | Dealer CDS (bps) | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| dealer | #repos | amt ($M) | mean | std | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 | mean | std | Q1 | med | Q3 |
| JPM | 427 | 26,739 | 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 | 20,156 | 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 | 182 | 19,334 | 160 | 61.0 | 3.73 | 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 | 106 | 105 | 25 | 75 | 160 |
| HBC | 118 | 9,604 | 119 | 26.5 | 4.92 | 1.49 | 3.29 | 5.00 | 7.00 | 11.3 | 3.1 | 9.0 | 11.0 | 13.0 | 1.0 | 0.0 | 1 | 1 | 1 | 81 | 59 | 43 | 68 | 108 |
| CS | 72 | 6,216 | 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 | 4,681 | 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 | 4,215 | 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 | 3,149 | 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 | 2,450 | 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 | 2,371 | 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 distribution of haircut, spread, maturity and size of the corporate bond tri-party repos, based on the monthly repo data with matched collateral from November 2010 to August 2013. Panel A reports the summary statistics for the top ten fund families and Panel B reports the summary statistics for the top ten dealers. The top ten dealers are JP 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). In addition to the repo statistics, we also report the time-series mean and standard deviation of the dealers' 5-year CDS spreads in Panel B. The CDS spreads data are obtained from Markit.

Table 12: **Characteristics of Corporate Bond Collateral, November 2010 - August 2013**

| MMFs Family | matched | #cols | #cols (vw) | rated | IG | rating | age | maturity | issu. size |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | mean | | | | |
| Bank of America | 95.67 | 29.71 | 11.12 | 0.94 | 0.89 | 6.85 | 2.91 | 4.69 | 20.61 |
| Morgan Stanley | 94.39 | 70.20 | 36.89 | 0.92 | 0.55 | 10.55 | 3.32 | 9.32 | 20.25 |
| Blackrock | 91.71 | 56.72 | 27.37 | 0.88 | 0.51 | 10.52 | 3.56 | 9.46 | 20.24 |
| Federated | 94.16 | 32.70 | 13.65 | 0.89 | 0.31 | 11.80 | 3.83 | 7.87 | 20.36 |
| Barclay | 93.50 | 40.78 | 16.09 | 0.90 | 0.65 | 9.10 | 3.99 | 8.28 | 20.29 |
| Dreyfus | 95.98 | 34.09 | 9.07 | 0.84 | 0.53 | 10.43 | 4.93 | 7.61 | 20.11 |
| U.S. Bancorp | 95.29 | 29.26 | 9.86 | 0.93 | 0.90 | 7.82 | 3.28 | 11.80 | 20.47 |
| Putman | 95.63 | 17.88 | 7.61 | 0.94 | 0.94 | 8.80 | 2.80 | 10.68 | 20.14 |
| Goldman Sachs | 92.13 | 28.19 | 15.04 | 0.89 | 0.65 | 8.70 | 3.56 | 7.98 | 20.65 |
| Deutsche Investment | 97.51 | 6.42 | 3.08 | 0.96 | 0.71 | 7.74 | 4.47 | 11.16 | 20.51 |
| All | 94.69 | 40.34 | 18.19 | 0.92 | 0.70 | 8.95 | 3.32 | 7.84 | 20.38 |
| | | | | | median | | | | |
| Bank of America | 97.85 | 16.00 | 6.64 | 0.97 | 0.95 | 8.00 | 2.77 | 5.16 | 20.44 |
| Morgan Stanley | 94.88 | 17.50 | 9.59 | 0.92 | 0.86 | 9.00 | 3.17 | 8.44 | 20.23 |
| Blackrock | 90.65 | 36.00 | 24.17 | 0.88 | 0.68 | 9.14 | 3.49 | 8.73 | 20.23 |
| Federated | 93.71 | 31.00 | 12.45 | 0.89 | 0.11 | 13.17 | 3.69 | 6.28 | 20.36 |
| Barclay | 94.30 | 19.00 | 8.46 | 0.94 | 0.82 | 9.13 | 3.51 | 6.93 | 20.30 |
| Dreyfus | 97.65 | 25.00 | 7.57 | 0.90 | 0.53 | 10.39 | 4.94 | 7.27 | 20.03 |
| U.S. Bancorp | 97.86 | 24.00 | 7.38 | 0.97 | 0.95 | 8.05 | 3.08 | 11.07 | 20.46 |
| Putman | 96.91 | 15.50 | 4.51 | 0.96 | 0.96 | 9.90 | 2.51 | 9.46 | 20.00 |
| Goldman Sachs | 91.84 | 22.50 | 15.65 | 0.90 | 0.87 | 7.17 | 3.44 | 6.78 | 20.74 |
| Deutsche Investment | 100.00 | 4.00 | 1.60 | 1.00 | 0.97 | 6.92 | 3.99 | 8.95 | 20.37 |
| All | 95.72 | 21.00 | 8.39 | 0.93 | 0.89 | 8.83 | 3.05 | 6.83 | 20.29 |
| | | | | | standard deviation | | | | |
| Bank of America | 4.85 | 43.83 | 18.85 | 0.09 | 0.17 | 3.22 | 1.23 | 2.34 | 0.67 |
| Morgan Stanley | 5.19 | 132.27 | 76.66 | 0.10 | 0.44 | 3.63 | 1.63 | 5.93 | 0.54 |
| Blackrock | 4.73 | 82.80 | 22.94 | 0.10 | 0.41 | 3.31 | 1.54 | 4.01 | 0.34 |
| Federated | 4.76 | 24.59 | 8.58 | 0.08 | 0.37 | 3.28 | 1.48 | 4.65 | 0.44 |
| Barclay | 5.14 | 64.06 | 24.75 | 0.09 | 0.37 | 2.21 | 1.65 | 3.96 | 0.41 |
| Dreyfus | 4.25 | 25.69 | 7.49 | 0.20 | 0.38 | 3.18 | 2.28 | 4.41 | 0.43 |
| U.S. Bancorp | 5.23 | 20.35 | 7.77 | 0.09 | 0.16 | 2.04 | 1.27 | 5.07 | 0.48 |
| Putman | 4.59 | 15.45 | 8.25 | 0.06 | 0.07 | 2.35 | 1.64 | 5.46 | 0.50 |
| Goldman Sachs | 5.54 | 23.91 | 11.15 | 0.09 | 0.40 | 4.55 | 1.10 | 4.30 | 0.47 |
| Deutsche Investment | 4.39 | 6.92 | 3.41 | 0.07 | 0.42 | 2.64 | 3.18 | 7.46 | 0.72 |
| All | 5.07 | 75.44 | 39.20 | 0.10 | 0.38 | 3.62 | 1.64 | 5.04 | 0.58 |

This table reports the summary statistics of the collateral posted for the corporate bond tri-party repos from November 2010 to August 2013. 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 proportion of rated obnds (rated), the proportion 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 collateral value of the individual securities. The value-weighted number of collateral (#cols (vw)) is the inverse of the Herfindahl index based on the collateral value of the individual securities. We then report the cross-sectional mean, median and standard-deviation for repos of each fund family and the full sample.

Table 13: **Determinants of Corporate Bond Repo Haircut**

| | Investment Grade | | Non-Investment Grade | | | |
|---|---|---|---|---|---|---|
| Parm | Baa3 and above | $IG\% > 85\%$ | below Baa3 | $IG\% < 15\%$ | All | All |
| #cols (vw) | −.006** | −.005* | −.006 | 0.012* | 0.014* | 0.000 |
| | [−2.41] | [−1.96] | [−0.68] | [ 1.81] | [ 1.89] | [ 0.15] |
| col rating | 0.101* | 0.082 | 0.064 | 0.166* | 0.050 | 0.104*** |
| | [ 1.67] | [ 1.33] | [ 1.63] | [ 1.70] | [ 1.03] | [ 3.20] |
| col age | 0.008 | 0.015 | 0.033 | −.038 | −.005 | 0.024 |
| | [ 0.64] | [ 1.15] | [ 0.79] | [−1.33] | [−0.26] | [ 0.99] |
| col maturity (%) | 0.005 | 0.003 | −.017 | 0.005 | 0.015 | 0.009 |
| | [ 0.38] | [ 0.28] | [−0.66] | [ 0.16] | [ 1.41] | [ 0.58] |
| dealer CDS | −.002 | −.002 | 0.003 | 0.008 | 0.002 | −.001 |
| | [−1.09] | [−1.47] | [ 1.51] | [ 1.47] | [ 0.69] | [−0.93] |
| repo size (log) | 0.039*** | 0.025* | −.016 | −.030 | −.042 | −.017 |
| | [ 3.21] | [ 1.86] | [−0.40] | [−0.91] | [−0.54] | [−0.53] |
| repo mat | 0.000 | −.000 | 0.017** | 0.017* | 0.001 | 0.003 |
| | [ 0.19] | [−0.34] | [ 2.04] | [ 1.83] | [ 0.23] | [ 1.34] |
| month | Y | Y | Y | Y | Y | Y |
| dealer | Y | Y | Y | Y | Y | Y |
| Fund Family | Y | Y | Y | Y | N | Y |
| NOBS | 377 | 406 | 303 | 158 | 1017 | 1017 |
| R2 | 92.2 | 92.1 | 90.5 | 95.0 | 38.7 | 84.1 |

This table reports the OLS regressions on the haircuts of corporate bond tri-party repos from November 2010 to August 2013. 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 the double-clustered standard errors clustered by fund family and month.

Table 14: **Determinants of Corporate Bond Repo Spread**

| | Investment Grade | | Non-Investment Grade | | | |
|---|---|---|---|---|---|---|
| Parm | Baa3 and above | $IG\% > 85\%$ | below Baa3 | $IG\% < 15\%$ | All | All |
| #cols (vw) | 0.020 | 0.008 | −.009 | −.062 | −.006 | −.011** |
| | [ 0.36] | [ 0.15] | [−0.21] | [−0.94] | [−0.86] | [−2.36] |
| col rating | 0.272 | 0.030 | 0.915 | −.040 | 1.596*** | 1.139*** |
| | [ 1.06] | [ 0.13] | [ 1.45] | [−0.08] | [ 3.62] | [ 5.18] |
| col age | 0.313 | 0.380** | −.166 | −.295 | 0.137 | 0.009 |
| | [ 1.52] | [ 2.18] | [−0.85] | [−0.75] | [ 0.33] | [ 0.05] |
| col maturity (%) | 0.018 | 0.029 | 0.123** | 0.382* | −.098 | −.027 |
| | [ 0.22] | [ 0.41] | [ 2.54] | [ 1.69] | [−0.63] | [−0.29] |
| dealer CDS | 0.032* | 0.038* | 0.017 | 0.020 | 0.010 | 0.025* |
| | [ 1.89] | [ 1.87] | [ 1.21] | [ 1.45] | [ 0.69] | [ 1.93] |
| repo haircut | 2.280*** | 2.460*** | 1.101*** | 0.607 | 0.981 | 1.835*** |
| | [ 5.68] | [ 3.86] | [ 2.64] | [ 1.45] | [ 0.87] | [ 3.46] |
| repo size (log) | −1.09*** | −1.01* | 0.794*** | 1.050*** | 0.186 | −.620* |
| | [−2.70] | [−1.70] | [ 3.12] | [ 3.68] | [ 0.41] | [−1.81] |
| repo mat | 0.286*** | 0.293*** | 0.218*** | 0.188*** | 0.274*** | 0.251*** |
| | [ 4.89] | [ 5.84] | [ 4.61] | [ 4.15] | [ 6.64] | [ 6.54] |
| month | Y | Y | Y | Y | Y | Y |
| dealer | Y | Y | Y | Y | Y | Y |
| Fund Family | Y | Y | Y | Y | N | Y |
| NOBS | 441 | 466 | 410 | 244 | 1258 | 1258 |
| R2 | 68.3 | 68.0 | 74.0 | 60.1 | 57.6 | 69.4 |

This table reports the OLS regressions on the spread of corporate bond tri-party repos from November 2010 to August 2013. 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 the double-clustered standard errors clustered by fund family and month.

Table 15: **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 | 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 | 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 | 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. For each Treasury repo, we calculate the number of collateral (#cols), the value-weighted number of collateral (#cols (vw)), the proportion of Treasury Bills (bill), the proportion of Treasury Notes (note), the proportion 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 collateral value of the individual securities. The value-weighted number of collateral (#cols (vw)) is the inverse of the Herfindahl index based on the collateral value of the individual securities. We then report the cross-sectional mean, median and standard-deviation for repos of each fund family and the full sample.

Table 16: **Treasury Repo Summary Statistics, November 2010 - August 2013**

**Panel A: Top Ten MMFs**

| | | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| fund family | #repos | amt ($B) | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 |
| Federated | 1,135 | 347 | 2.02 | 0.07 | 2.00 | 2.00 | 2.03 | 1.4 | 4.4 | −4.0 | 1.0 | 7.0 | 1.8 | 1.7 | 1 | 1 | 5 | 306 | 555 | 8 | 100 | 1E3 |
| Dreyfus | 1,259 | 300 | 2.00 | 0.02 | 2.00 | 2.00 | 2.01 | 1.9 | 4.6 | −5.0 | 2.0 | 8.0 | 1.0 | 0.0 | 1 | 1 | 1 | 239 | 353 | 16 | 100 | 650 |
| Morgan Stanley | 1,228 | 195 | 2.06 | 0.39 | 1.86 | 2.01 | 2.25 | 2.1 | 4.5 | −3.0 | 2.0 | 7.0 | 2.2 | 5.1 | 1 | 1 | 3 | 159 | 163 | 15 | 100 | 385 |
| Blackrock | 1,214 | 192 | 2.00 | 0.09 | 2.00 | 2.00 | 2.02 | 1.1 | 4.6 | −5.0 | 1.0 | 7.0 | 1.3 | 1.9 | 1 | 1 | 2 | 158 | 274 | 8 | 28 | 500 |
| U.S. Bancorp | 359 | 173 | 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 | 482 | 438 | 97 | 312 | 1E3 |
| J.P.Morgan | 354 | 150 | 2.01 | 0.04 | 2.00 | 2.00 | 2.00 | 2.6 | 4.7 | −4.0 | 3.0 | 8.0 | 1.6 | 1.3 | 1 | 1 | 4 | 423 | 349 | 100 | 300 | 1E3 |
| Northern Trust | 661 | 130 | 1.92 | 0.47 | 1.26 | 2.00 | 2.22 | 2.2 | 4.5 | −3.0 | 2.0 | 8.0 | 1.6 | 1.8 | 1 | 1 | 4 | 197 | 245 | 9 | 85 | 575 |
| Wells Fargo | 419 | 130 | 2.00 | 0.05 | 2.00 | 2.00 | 2.00 | 2.5 | 4.7 | −3.9 | 3.1 | 9.5 | 2.3 | 12.1 | 1 | 1 | 1 | 311 | 277 | 41 | 250 | 750 |
| Goldman Sachs | 326 | 124 | 2.07 | 0.27 | 2.00 | 2.00 | 2.03 | 1.6 | 4.8 | −6.0 | 1.0 | 8.0 | 2.1 | 4.9 | 1 | 1 | 2 | 380 | 425 | 21 | 250 | 850 |
| Bank of America | 546 | 118 | 2.01 | 0.14 | 2.00 | 2.00 | 2.00 | 1.5 | 4.7 | −5.0 | 2.0 | 8.0 | 3.7 | 9.4 | 1 | 1 | 5 | 215 | 187 | 50 | 160 | 460 |

**Panel B: Top Ten Dealers**

| | | | Dealer CDS (bps) | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| dealer | #repos | amt ($B) | mean | std | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 |
| BCS | 2,496 | 534 | 164 | 39.3 | 1.99 | 0.21 | 2.00 | 2.00 | 2.03 | 1.8 | 4.8 | −4.0 | 2.0 | 8.0 | 1.4 | 1.5 | 1 | 1 | 3 | 214 | 369 | 10 | 98 | 500 |
| RBS | 1,123 | 290 | 240 | 66.8 | 2.02 | 0.15 | 2.00 | 2.00 | 2.02 | 1.8 | 4.5 | −3.0 | 1.0 | 8.0 | 1.5 | 2.9 | 1 | 1 | 1 | 259 | 378 | 12 | 110 | 725 |
| DB | 1,506 | 252 | 138 | 39.6 | 1.99 | 0.24 | 2.00 | 2.00 | 2.00 | 2.5 | 4.6 | −3.0 | 4.0 | 7.4 | 1.5 | 3.2 | 1 | 1 | 1 | 167 | 250 | 14 | 80 | 456 |
| CS | 1,468 | 230 | 125 | 32.5 | 2.03 | 0.16 | 2.00 | 2.00 | 2.04 | 1.8 | 4.7 | −4.0 | 2.0 | 8.0 | 2.3 | 6.1 | 1 | 1 | 3 | 157 | 210 | 12 | 85 | 400 |
| BNP | 699 | 215 | 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 | 308 | 360 | 15 | 200 | 750 |
| BAC | 1,465 | 177 | 190 | 93.4 | 2.02 | 0.40 | 1.98 | 2.00 | 2.06 | −0.1 | 4.2 | −5.0 | −0.9 | 5.0 | 1.9 | 4.0 | 1 | 1 | 3 | 121 | 168 | 9 | 59 | 300 |
| HBC | 873 | 175 | 118 | 25.2 | 2.02 | 0.14 | 2.00 | 2.00 | 2.04 | 1.8 | 4.7 | −4.0 | 2.0 | 7.0 | 1.2 | 0.7 | 1 | 1 | 1 | 201 | 256 | 12 | 100 | 500 |
| ACA | 377 | 141 | 218 | 63.2 | 2.04 | 0.39 | 1.93 | 2.00 | 2.14 | 2.7 | 3.9 | −2.0 | 3.0 | 8.0 | 1.3 | 3.3 | 1 | 1 | 1 | 374 | 592 | 15 | 150 | 1200 |
| GLE | 254 | 92 | 224 | 76.5 | 2.00 | 0.14 | 2.00 | 2.00 | 2.06 | 2.4 | 4.3 | −3.0 | 2.0 | 8.0 | 1.2 | 0.8 | 1 | 1 | 1 | 363 | 361 | 29 | 223 | 1000 |
| C | 517 | 87 | 130 | 49.2 | 2.10 | 0.52 | 2.00 | 2.00 | 2.11 | 2.1 | 4.5 | −4.0 | 2.0 | 8.0 | 1.1 | 0.6 | 1 | 1 | 1 | 169 | 193 | 11 | 100 | 450 |

This table reports the distribution of haircut, spread, maturity and size of the Treasury tri-party repos, based on the monthly repo data with matched collateral from November 2010 to August 2013. Panel A reports the summary statistics for the top ten fund families and Panel B reports the summary statistics for the top ten dealers. 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 Citi Group (C), respectively. In addition to repo statistics, we also 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 17: **Determinants of Treasury Repo Haircut and Spread**

| | haircuts | | | | spreads | | | |
|---|---|---|---|---|---|---|---|---|
| Parm | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| #cols (vw) | | | | −.000 | | | | −.007 |
| | | | | [−0.96] | | | | [−1.07] |
| col coupon | | | | −.009 | | | | 0.025 |
| | | | | [−1.37] | | | | [ 0.30] |
| col age | | | | 0.001 | | | | −.024 |
| | | | | [ 0.28] | | | | [−0.63] |
| col outamt | | | | −.000 | | | | 0.002 |
| | | | | [−0.01] | | | | [ 0.30] |
| col duratn | | | | 0.002 | | | | 0.045 |
| | | | | [ 0.62] | | | | [ 1.02] |
| col volatility | | | | −.001 | | | | −.032 |
| | | | | [−0.28] | | | | [−1.22] |
| col bill | | | | −.025 | | | | 0.055 |
| | | | | [−0.48] | | | | [ 0.06] |
| col note | | | | −.032 | | | | 0.301 |
| | | | | [−1.01] | | | | [ 0.52] |
| col ontherun | | | | −.000 | | | | −.001 |
| | | | | [−0.96] | | | | [−0.13] |
| 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 (log) | −.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 |
| NOBS | 15421 | 14841 | 14841 | 14017 | 15421 | 14841 | 14841 | 14017 |
| R2 | 1.6 | 5.3 | 16.6 | 17.0 | 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 the double-clustered standard errors clustered by fund family and month.

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# Appendix

## A Repo Pricing Before November 2010

Since our monthly data starts only from November 2010, we complement it with the tri-party repo transactions obtained from the annual (N-CSR), semi-annual (N-CSRS) and quarterly (N-Q) filings of money market funds from January 2005 to September 2010. For these repo transaction, we have basic repo information including the counter-parties, amount, haircut, interest rate, maturity dates and the collateral asset class. 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 with matched collateral securities. Nevertheless, this data does 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 fund families in repo pricing, we summarize these repos' characteristics by each fund family for three different 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 reported in Table AI. The Treasury repos are reported in Table AII. The distributions of haircut, spread, size and maturity before November 2010 are also plotted in the time-series of Figure 2.

**Equity Repos**

The tri-party equity repo market went through several different phases from 2005 to 2010. The median haircut is at 5% before September 2008, jumps sharply to 10% after Lehman's default, stays at the 10% level for approximately one year, and then decreases to 8% 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 for the period before November 2010.

Before the financial crisis, only two fund families, Fidelity and State Street, accept equity as collateral for tri-party repos. Both fund families ask for more or less similar haircuts at around 5%. The Fidelity funds account for approximately 60% of the total lending, and the State Street funds account for the remaining 40%. During the financial crisis from September 2008 and June 2009, Fidelity continues to accept equity collateral but asks for higher haircuts. In contrast, 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,

Charles Schwab and Morgan Stanley funds start to accept equity collateral for repo lending. But in contrast to the high haircuts, at approximately 9%, demanded by Fidelity, both Charles Schwab and Morgan Stanley funds ask for only 5%.

In other words, fund families also play the key role in setting haircuts before November 2010. Moreover, there is substantial variations in the haircuts demanded by different fund families. This is similar to our observations for the period after November 2010. For repo spread, the overall time-series trend suggests that spread 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 different policies on haircuts. Interestingly, we do find some 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, the counter-parties and the collateral. This uniform haircut scheme is consistent with our findings based on the monthly data after November 2010.

**Treasury Repos**

Consistent with the previous literature, Treasury repo haircut stays stable at approximately 2%, even during the 2008 financial crisis when the credit market is in turmoil. Repo spread, on the other hand, shows an interesting time-series trend. Before the financial crisis, the Treasury repo spread is usually slightly below zero, probably because 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 at around -120 bps. The repo spread then bounces back quickly in the next quarter and has 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

| | | | | | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| period | fund family | #repos | amt ($M) | pct | #dealers | 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

| | | | | | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| period | fund family | #repos | amt ($M) | pct | #dealers | 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 | 20 | 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 distributions of haircut, spread, maturity and size of the equity and corporate bond tri-party repos, based on the quarterly filings of 102 U.S. money market funds from January 2005 to September 2010. We divide the sample period into three sub-periods, January 2005 to June 2008, September 2008 to June 2009 and September 2009 to September 2010. Within each sub-period, we report the repo statistics by each fund family.

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

| | | | | | | Repo Haircut (%) | | | | | Repo Spread (bps) | | | | | Repo Maturity (#bizdays) | | | | | Repo Size ($M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| period | fund family | #repos | amt ($M) | pct | #dealers | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 | mean | std | P10 | med | P90 |
| Jan05 - June08 | 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 | 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 |
| | 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 | 3.0 | 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 |
| Sep08 - June09 | Federated | 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 | −2.0 | 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 |
| | 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 | −1.0 | 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 | 20 | 50 | 60 |
| Sep09 - Sep10 | Federated | 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 | 10.0 | 4.5 | 6.3 | 1 | 1.0 | 16.0 | 262 | 256 | 27 | 165 | 600 |
| | Fidelity | 264 | 60,280 | 9.4 | 15 | 2.60 | 0.78 | 2.01 | 2.42 | 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 | −1.0 | 23.0 | 5.9 | 15.6 | 1 | 1.0 | 5.0 | 234 | 184 | 50 | 181 | 493 |
| | 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 | 0.0 | 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 | 2.01 | 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 | 2.0 | 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 distributions of haircut, spread, maturity and size of the Treasury tri-party repos, based on the quarterly filings of 102 US money market funds from January 2005 to September 2010. We divide the sample period into three sub-periods, January 2005 to June 2008, September 2008 to June 2009 and September 2009 to September 2010. Within each sub-period, we report the repo statistics by each fund family.