What Drives Repo Haircuts? Evidence from the UK Market

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Abstract

Using a regulatory transaction-level dataset of the UK repo market, we examine the determinants of haircuts. We find that transaction maturity and collateral quality is of a first order importance in determining haircuts. We also find that counterparties matter in determining haircuts. Hedge funds as borrowers receive a significantly higher haircut even after controlling for observable measures of counterparty risk. We find that larger borrowers with higher ratings receive lower haircuts, but this effect can be overshadowed by collateral quality. Bilateral relationships are also important: Banks charge higher haircuts when they transact with non-bank institutions; and some borrowers receive consistently lower haircuts when interacting with certain counterparties. We find evidence in favour of an adverse selection explanation of haircuts, but little evidence in support of lenders' liquidity position or default probabilities affecting haircuts. Finally, we observe that banks with higher network centrality measures charge and pay lower haircuts.

Keywords: repurchase agreement, systemic risk, repo market, margin, haircut, network analysis.

1 Introduction

The repurchase agreement (repo) market is a major tool for short-term funding of financial institutions. Although there is no definitive data about the size of this market, the International Capital Market Association suggests that the value of the global commercial market can be up to €15 trillion (2013). During the recent financial crisis repo markets

experienced various disruptions and potentially contributed to the severity of the crisis. For example Copeland et al. (2010) show that, during the days prior to bankruptcy, the amount of collateral Lehman Brothers financed in tri-party repo fell drastically. Gorton and Metrick (2012) argue that the repo market experienced a run during the crisis, manifested in a rise of haircuts, which exacerbated the crisis.

Given the importance of the repo market and its contribution to the systemic risk of the financial system—especially in the wake of the recent 2008 crisis—there is ample interest in better understanding and monitoring it from academics, policy makers and members of the public. However, due to the over-the-counter nature of repo transactions, repo contract terms are rarely disclosed. Adrian et al. (2013) provide an overview of the sources that provide information for the US repo market and conclude that, though some sources provide data on interest rates and notional values used in repo trades, very little is known about haircuts, collaterals and counterparties.

The systemic importance of the repo market and the shortage of micro-data prompted the UK regulator to require banks to disclose transaction-level data on their repo books. We were given the opportunity to work with this unique regulatory dataset to analyse the structure of the UK repo market. We have access to all at trade level repo data such as notional value, maturity, counterparty, collateral, and haircut, except for repo rates. To our knowledge, this is the only database that covers transaction-level haircut information for a rich set of different collaterals and counterparties. Given the importance of haircuts and the fact that they control the amount of inside liquidity generated by the shadow banking system, we try to answer the question of what factors drive their magnitude using transaction-level data. Furthermore, we examine the structure and attributes of the repo market network and assess whether it has influences haircuts.

A priori it might appear puzzling why repo loans feature both interest rate and haircut. Recent theoretical work such as Ozdenoren et al. (2018) show that while both repo rates and haircuts are affected by the demand and supply for funding liquidity, riskiness of repo loans drives the former and the severity of adverse selection that lenders face influences the latter. Our survey of several trading houses in London has revealed that while repo rates are determined at the trading desk, haircuts are set at the credit department of the corresponding firm. The observation of the separate roles played by rates and haircuts motivates us to formulate testable hypotheses to study haircut determinations in details empirically.

In particular, we build testable hypotheses based on the existing theoretical work on collateralised borrowing and repo runs. The theoretical work on collateralised borrowing

can be categorised into two streams. One is based on the difference of opinion approach in a general equilibrium setting (eg., Geanakoplos (1997) and Simsek (2013)). The other is based on contractural and/or information frictions (eg., Gottardi et al. (2017); Dang et al. (2013); Dang et al. (2011); and Ozdenoren et al. (2018)). The run literature focuses on coordinations either extending Diamond and Dybvig (1983) to the repo setting (Martin et al. (2014)), short-term borrowing (Acharya et al. (2011)), or endogenous information acquisition (Gorton and Ordonez (2014)), or to adverse selection and inter-temporal coordination mechanism (Ozdenoren et al. (2018)).

In our empirical investigation, we find that transaction maturity has a first order importance in setting haircuts. Haircuts are also increasing in the VaR of collaterals and collateral concentration. This set of findings indicates that collateral quality and liquidity are important determinants of haircuts. We also find that counterparties matter in haircut determinations: one or two banks in our sample receive a significant share of repo trades with zero haircuts, hedge funds are charged at higher haircut, larger borrowers with higher ratings receive lower haircuts. However, we do find that collateral quality can overshadow counterparty characteristics. Furthermore, there is evidence that borrowers with lower ratings use higher quality collateral to receive a lower haircut. Hence the influence of counterparty attributes is concealed.

We also find that bilateral relationships matter in haircuts. We also find banks charge higher haircuts when they transact with non-bank institutions. This is supportive with the difference-of-opinion explanation of haircut since it is likely that banks and non-bank financial institutions have different valuation models about collateral. However, it may also support the adverse selection explanation of haircut since the information frictions between different types of business might exist. Furthermore, we find significant pairwise borrower-lender relationships: some borrowers receive consistently lower haircuts when interacting with certain counterparties and a few bilateral pairs conduct a large portion of zero haircut trades in our sample. This is unlikely to be due to the difference-of-opinion theory since these bilateral pairs are often from different lines of business. They are supportive of the adverse selection theory since relationship banking lowers information frictions.

We find little evidence that lenders' liquidity position or default probabilities affect haircuts, indicating that the traditional bank run mechanism cannot explain repo runs. This lends support to the inter-temporal feedback/coordination explanations of repo runs.

Finally, we examine the structure and attributes of the repo market network and assess if the network structure has an influence over haircuts. We observe that the banks with

higher centrality measures ask for lower haircuts on reverse repos and pay lower haircuts on repos. We interpret this set of findings as supportive of the demand-and-supply theory for funding liquidity since the unique market position of central network players affect the terms of bilateral repo contracts.

The rest of this paper is organised as follows. In Section 2 we provide a brief description of repurchase agreements and summarise the relevant literature. Section 3 outlines the main hypotheses that we test in the data. Section 4 describes the data. Section 5 analyses the determinants of haircuts and presents the testable hypotheses. Section 6 concludes.

2 Background Information on Repurchase Agreements and Related Literature

2.1 Background Information on Repurchase Agreements

A repurchase agreement is the simultaneous sale and forward agreement to repurchase of securities at a specific price, at a future date (Duffie, 1996). In effect a repo is a collateralised loan, where the underlying security serves the collateral role. The party who borrows cash and delivers collateral is said to be doing a repo, and the party who lends cash and receives collateral is doing a reverse repo. The difference between the original loan value and the repayment specifies the repo rate. The haircut or margin on the other hand is determined by the difference between the loan and the collateral value. Usually the borrower has to post collateral in excess of the notional amount, and the haircut is defined as $h = 1 - F/C$ with collateral value C and notional amount F (Krishnamurthy et al., 2014). For example, if a borrower receives \$98 against \$100 value of collateral, the haircut is 2%.

In Europe, the legal title to the collateral is transferred to the cash lender by an outright sale. In the US this is not the case, but the repo collateral is not subject to an automatic stay and can be sold by the lender should the borrower defaults (International Capital Market Association, 2013).

Repurchase agreements are broadly classified in two categories. Tri-party repo is a transaction for which post-trade services like collateral management (e.g. selection, valuation, and verifying eligibility criteria), payment, margining, etc. are outsourced to a

third-party agent which is a custodian bank.[1] A tri-party agent settles the repos on its book, but in a bilateral repo settlement usually occurs on a delivery versus payment basis, and the cash lender must have back-office capabilities to receive and manage the collateral (Adrian et al., 2013).

A growing number of repos are cleared via central (clearing) counterparties (CCPs). CCPs place themselves between the two sides of a trade, leading to a less complex web of exposures (Rehlon and Nixon, 2013). They provide benefits such as multilateral netting and facilities to manage member defaults in an orderly manner, but can also pose systemic risks to the financial system. CCPs always receive a haircut, whether in a reverse repo or repo. So banks doing a reverse repo with a CCP will need to give a haircut, which amounts to a negative value for haircut.

2.2 Related Literature

The financial crisis rekindled interest in the theoretical and empirical study of the short-term funding market. The theoretical work on collateralised borrowing can be categorised into two streams. One is based on the difference of opinion approach in a general equilibrium setting such as (Geanakoplos, 1997) (1997; 2001; 2002; 2003); Fostel and Geanakoplos (2012); and Simsek (2013). The other is based on contractural and/or information frictions such as Gottardi et al. (2017); Dang et al. (2013); Dang et al. (2011); and Ozdenoren et al. (2018). We will discuss the theoretical literature in details when forming testable hypotheses in the next section of the paper. There is also a literature that models crisis and runs in the repo market. One approach is based on the classical setting in Diamond and Dybvig (1983) extending to the repo setup as in Martin et al. (2014). In this setup, the liquidity needs of the lender, the capital position of the borrower, and the market microstructure of the repo market play important roles in determining the magnitude of the run. Acharya et al. (2011) model freezes in the market for short-term financing in form of sudden collapse in debt capacity of collateral in an information-theoretic framework. Gorton and Ordonez (2014) focus on the information in-sensitivity of debt contract and how a sudden switch of information environment might trigger a deep discount and collateral crisis. Ozdenoren et al. (2018) emphasize the inter-temporal feedback of (expected) future asset price and today's borrowers' and lenders' decisions. Dynamic mis-coordination might lead to a run in the repo market.

[1]There are two tri-party agents in the US, Bank of New York Mellon and JP Morgan. In Europe, the main tri-party agents are Clearstream, Euroclear, Bank of New York Mellon, JP Morgan, and SegaInterSettle.

The empirical studies of repurchase agreements have been mostly focused on the US repo market. Several papers have studied developments in this market during the financial crisis. Broadly speaking two distinct phenomena can be identified in the US bilateral and tri-party repo markets. In the bilateral market, as argued by Gorton and Metrick (2012), a run occurred in form of rapid increases in haircut levels. This is further supported by multiple hedge funds failing due to margin calls (Adrian et al., 2013). Adrian and Shin (2010) empirically show that repo transactions have contributed the most to the procyclical adjustments of the leverage of banks. From this perspective, rapid increase of haircuts in bilateral repos during the crisis can also be viewed as (forced) deleveraging of broker-dealers (Adrian et al., 2013). In contrast, in the tri-party market haircuts moved very little and the amount of funding remained fairly stable, but instead, lenders refused to extend financing altogether to the most troubled institutions—namely Bear Stearns and Lehman Brothers (Copeland et al., 2010). Krishnamurthy et al. (2014) argue that there indeed was a run in the tri-party market but only for non-agency MBS/ABS, which constituted a relatively small and insignificant part of the short-term debt market. In the tri-party market, tension seemed to affect specific institutions rather than the broad collateral classes, except maybe the private-label securitised assets (Adrian et al., 2013). Martin et al. (2014) relate the differences between the behaviour of these two markets to their microstructure: In the tri-party market, haircuts are fixed in custodial agreements that are revised infrequently, but this is not the case in the bilateral market.

There are limited empirical studies on repos. Most US studies on repos are on tri-party repos starting with Copeland et al. (2014); Krishnamurthy et al. (2014) and Hu et al. (2012). They generally find that the market is quite segmented and market power, collateral concentration and fund families might play important roles. Empirical studies on bilateral repos are rare. Therefore the work by Gorton and Metrick (2012) using a proprietary database is important for the understanding of repo transaction where various types of collaterals and counterparties are present. The repo studies in the European area are mostly conducted on general collateral repos or through CCPs where regulations play a very important role (Mancini et al. (2016)). To the best of our knowledge, the repo haircut database used in this paper is the only one that covers a significant part of a bilateral repo market.

3 Testable Hypotheses on Haircuts

Collateralised borrowing is an ancient financial institution. It serves an important economic function and has been used for a long time, and under very different institutions. For example, pawnshop loan records from China circa 662-689 A.D show that silk garments were used as collateral (Goetzmann and Rouwenhorst (2005)). The popularity of collateral-backed lending is often attributed to its abilities to mitigate information frictions. In practice, producing information about borrowers or their actions can be very costly (which needs credit registries, monitors, courts etc.) Collateral allows the flow of credit while economising on costly information acquisition with the haircut. However, according to the pawn shop logic, the haircuts on collateral should be determined by the quality of collaterals only, not by the identity of the borrowers. Intuitively, the volatility or the illiquidity of the collateral asset matters in determining the amount of loan extended because in the event of default, the lender may not be able to recover the full market price (valued at the initial lending date) of the collateral. This leads to our first testable hypothesis.

Hypothesis 1 (collateral quality): The repo haircut is larger when the collateral is of lower quality and/or illiquid.

Collateral quality can be measured using VaR, maturity, rating, or asset types. Transaction maturity should matter since as the maturity of repo debt is longer, the loss from worsening collateral quality is greater. We use data from Bloomberg to calculate VaR based on the time series of prices before the date when the asset was used as a collateral in the repo/reverse repo contract. VaR (for 5-10 days) is used because most financial intermediaries need a certain holding period when finding a trading counterparty.

However, the pawnshop logic stops short in explaining the impact of counter-party quality and relationship banking on the magnitude of the haircuts in repo contracts. The empirical evidence has shown that the former matters. For example, Dang et al. (2011) have shown that repo by hedge fund borrowers on average have higher haircut than bank borrowers. There are mainly two strands of the recent theory developments that study collateralized borrowing and hence have implications for haircuts on repo contracts: those based on belief disagreement in a general equilibrium framework, those based on contractual and/or information frictions. Geanakoplos (2003) is the first to propose a general equilibrium framework with difference in opinion to study leverage constraints and hence haircuts on repos. The mechanism works as follows: optimists borrow

from pessimists to speculate on the collateral. Since pessimists do not value the collateral as much as optimists do, they are reluctant to lend, which constrains optimists' ability to borrow and results in a haircut, which means that the face value of the loan is lower than the market value of the asset. Simsek (2013) emphasises that only the belief disagreement about the probability of the downside states has a significant effect on haircut and asset prices. Since it is difficult to measure difference in opinion, we conjecture that when borrowers are from a different line of business from lenders, the potential belief disagreement is larger. This leads to our second testable hypothesis.

Hypothesis 2 (counterparty types): The repo haircut is larger when the counterparties in the contracts are from different lines of business.

The second strand of the literature uses the principal-agent models of borrowing constraints. As demonstrated in Simsek (2013), there is an equivalence of the principal-agent framework and the general equilibrium framework proposed by Geanakoplos (2010) as long as the optimistic borrowers have all the bargaining power. The principal-agent framework can be extended to include frictions other than belief disagreements such as costly state verification, moral hazard or adverse selection (eg. Dang et al. (2011); Ozdenoren et al. (2018)). In these cases, the credit quality of the counterparty matters rather than the difference in types. This leads to our third testable hypothesis.

Hypothesis 3 (counterparty's quality): The repo haircut is larger when the default probability (credit quality of borrower) is higher (lower), or when the borrower is better privately informed about the quality of the collateral.

Finally, there is a strand of literature, that models coordinations and runs, which has implications for repo haircuts. Gorton and Ordonez (2014) find that endogenous information acquisition can cause a sudden increase in haircut and a collateral crisis, hence, lenders' characteristics might matter. Similarly, in a dynamic sequential trade model, Dang et al. (2011) find that the haircut size is increasing in the liquidity needs of the lender, and in the default probability of the lender in a subsequent repo transaction. Similarly, in a series of dynamic Diamond and Dybvig (1983) models with a asset collateral market, Martin et al. (2014) find that collateral and liquidity constraints matter and hence, the liquidity of lenders matters in the haircut determination. This leads to our fourth testable hypothesis.

Hypothesis 4 (lender's quality and liquidity): The repo haircut is larger when the default probability and/or liquidity need of the lender is higher.

In contrast, Ozdenoren et al. (2018), in a dynamic adverse selection model, do not find that lenders' credit quality or liquidity constraints matters in haircut. They find instead that the severity of adverse selection matters. This indicates that the bilateral relationship between borrower and lender should matter in haircut since it lowers the information friction. This leads to our our fifth testable hypothesis.

Hypothesis 5 (bilateral relationship): Haircuts are lower for bilateral parties with banking relationship.

Ozdenoren et al. (2018) also show that there are other ways to lower adverse selection. For example, a portfolio of collateral assets will have a larger borrowing capacity if it includes some safe asset. The idea is that the safe collateral convinces the lender to fund the borrower to invest in the risky collateral assets since the lender can recover the loan backed by the safe collateral. This initial investment, in turns, increases the prices of risky assets, allows borrowers to borrow more against their risky collaterals, creating an unravelling effect and generating more liquidity. This leads to our last testable hypothesis.

Hypothesis 6 (portfolio repos): Risky assets in a portfolio repo with safe assets have lower haircut than purely risky asset repos.

We turn next to the description of the data, empirical strategy, and present hypotheses test results.

4 Overview of the Data

The regulatory dataset is a snapshot of the repo books of six banks that are major players in the UK repo market. The total size of their repo books—the sum of repos and reverse repos—is around £511 billion (including CCP transactions) as at the end of 2012.[2] According to Financial Stability Board (2013) the UK-resident deposit-taker banks hold around £2.1 trillion in gross repo activity on their balance sheets, hence our data set accounts for around 24% of the total repo activity in this market. The majority of this activity is with non-UK resident banks, including the activity between UK and foreign branches of the same consolidated group, and is highly concentrated (Financial Stability Board, 2013).

[2]The actual reporting periods differ slightly across the banks but all are toward the end of 2012.

Each of the six banks reports its outstanding repo transactions as at the end of 2012, including the gross notional, maturity, currency, counter-party, haircuts and collaterals. We have supplemented this dataset with additional data about securities, counter-parties, and the reporting banks from Datastream and Bloomberg. In what follows we report information and results for reverse repos (REVR) and repos (REPO) separately. This classification is from the point of view of the reporting banks, so *in a reverse repo the reporting bank is lending* to a counter-party, and in a repo the reporting bank is borrowing money from a counter-party.

Tables 1 and 2 present an overview of our dataset in terms of key variables. They show the breakdown of the data along four categories: maturity, currency, counterparty type, and collateral type (Panels A, B, C, and D, respectively). The breakdown is only for the deals that have no missing information on haircut. For each category we report the sum of the notional amounts of deals for each subcategory in Table 1 and the weighted average of haircuts for each subcategory in Table 2. Table 1 also shows the percentage of each category in terms of the notional values. The average haircuts in Table 2 are weighted by the gross notional of transactions. Both values and haircuts are reported for reverse repos and repos separately. Since repo indicates bank borrowing, we denote the repo values with negative numbers.

By comparing the values of reverse repos and repos, we find that the reporting banks are net borrowers in the repo market (See the row labeled “Total" in Table 1). Panel A of Table 1 shows that most of the borrowing and lending transactions for these reporting banks have maturities less than three months. While borrowing exceeds lending for overnight contracts, lending is larger for transactions with maturities of less than three months. This observation suggests that the reporting banks conduct maturity transformation to some extent. However, for maturities longer than one year they are still net borrowers. Panel B of the same table shows that the reporting banks in our sample borrow more in GBP and Euro followed by US dollar. They lend mostly in GBP followed by Euro and US dollar as well. In net terms, they borrow mostly in GBP and lend in currencies such as EUR, USD, GBP, JPY followed by Japanese Yen.

Panel C of Table 1 shows that the reporting banks, in aggregate, borrow from counterparties such as central banks and governments, other banks, money-market funds and broker-dealers, and lend to counter-parties such as CCPs, other asset managers, insurance companies and pension funds. This is line of our general understanding of the money flow pattern in the wholesale funding market.[3] Finally, Panel D in Table 1 shows the

[3]The first row in Panel C describes the values when counter-party is the reporting banks. The reporting

breakdown based on collateral types. It shows that when the six banks borrow, only a small percent of their repo collaterals is US government bonds. Hence, it appears that the reporting banks use relatively worse collaterals when borrowing than lending in the repo markets. They intermediate in (and borrow against) relatively worse collaterals such as securitisation products and corporate debt. UK government bonds are the most common collateral used both in repo and in reverse repo contracts.

Inspecting the maturity-currency relationship (Figures 1 and 2), we see that the data is dominated by Euro and Dollar denominated transactions followed by Pound and Yen. Most of the contracts have maturity less than 3 months across all currency groups and only a very small fraction of the contracts have maturity more than half a year within each currency category. The Pound has relatively higher fraction of reverse repo contracts within 3 to 6 months, compared to other currencies. REPO and REVR transactions in Yen and Other currencies happen almost exclusively with maturity less than 1 month.

Panel A of Table 2 shows that, except for very long maturities, the reporting banks are able to borrow at slightly lower haircuts than they lend. This observation means that they can use the collateral they receive in a reverse repo to obtain more funding. A similar pattern exists for different currencies as shown in Panel B.

Panel C makes it clear that the above-mentioned haircut advantage for reporting banks arises from trades with hedge funds, other asset managers and, to a lesser extent, with other banks and broker-dealers. In the transactions with these counter-parties, the banks can receive funding at significantly lower margins. This advantage disappears when they trade with central banks and government agencies, insurance and pension funds and other reporting banks.

Finally, Panel D in Table 2 shows the breakdown based on collateral types. It displays how margins depend on the quality of collaterals. For example, both repos and reverse repos for German government bonds have a low average haircut, while haircuts for corporate debt and securitisation are higher. The numbers also show that the six reporting banks are able to borrow at a lower haircut compared to the one they charge for the same type of collateral. This is true for all collateral types, except securitised debt. Note that the UK government collateral commands a relatively high haircut, but this largely due to the longer maturity of the collateralised assets.

banks report on a UK consolidated basis, but counter-parties are reported on a global basis. Therefore, there may be discrepancies between the reverse repos and repos with the reporting banks.

4.1 Zero haircut contracts

There are a lot of zero haircuts in the data as illustrated by the histogram of haircuts in Figure 3: over 35% of the whole sample. Some of these zero haircuts are due to the way haircuts are reported in CCP trades as explained in Section 4 below, but even excluding CCP trades, zero-haircut trades are still quite common. This finding is not surprising and has been confirmed by other data collections done at the global level. A summary of the zero-haircut trades trades is presented in Table 3. The table shows that the vast majority of contracts are with other banks and are denominated in Euro. Most of the zero-haircut contracts are overnight (84% for the repo sample, 72% for the reverse repo sample), as shown in Figure 4.

The network graphs in Figures 5 and 6 illustrate the topology the zero-haircut trades. The size of each node reflects the number of counterparties with which it has at least one zero-haircut deal. Edge widths show the total number of zero-haircut trades between two given nodes. The figures show that the zero haircut observations from the repo and the reverse repo samples are generated mostly by one or two entities. In the repo market, one of the banks (bank A in Figure 6) receives more than 98% of all the zero-haircut trades. This borrower has 89 counterparties who are willing to lend at zero haircut, but it does most zero haircut borrowing with one particular counterparty (24% of all trades) – C697 in Figure 6. In the reverse repo market, another bank (bank B in Figure 6) is involved in 95% of all the zero-haircut trades. The top 10 counterparties account for 68% of all zero-haircut repo trades and 71% of all zero-haircut reverse repo trades, which shows that a small number of counterparties contribute to the majority of zero-haircut observations. These facts suggest that there are important borrower-lender relationships among the determinants of the zero-haircut trades, supporting our fifth testable hypothesis highlighted above. We investigate the role of bilateral relations further in later sections.

5 The Determinants of Haircuts

We now analyse what explanatory variables govern haircuts and in what ways these variables affect them. For this purpose we run multiple regressions on reverse repo and repo data separately, with different specifications as described below.

For the most part of the regression analysis, we focus on the sample excluding the trades with CCPs. In practice, CCPs often calculate haircuts (or initial margin requirements) on a portfolio basis. That is, the over-collateralisation of repo positions is calcu-

lated at the portfolio or netting set level, without applying haircuts on individual transactions. In our dataset, firms still report a transaction-level haircut, but this is often zero given that the 'true' haircut is applied at the portfolio level. In such cases, it is not meaningful to look at haircuts on individual transactions that are centrally cleared. In addition, there is basically only one CCP in our sample, which uses a fixed schedule of haircuts. Therefore, we focus on the sample that excludes CCP transactions.

In order to make sure that the multitude of zero haircuts do not distort our results, in addition to the ordinary least square regressions, we perform two sets of additional regressions. We use the Tobit model with truncation at zero, and use the logit transform to generate more variation in haircuts and to run logistic regression.

We split the data and consider separately repo and reverse repo transactions since they are different samples: one has reporting banks as borrowers and the other has the reporting banks as lenders. Moreover, we observe heterogeneity in the counterparties in the two types of transactions which allows us to conduct a more detailed analysis of the haircut determinants.

Table 4 presents all the explanatory variables used in different regressions. We have dummy variables for currencies, collateral types, counterparty types, bank-counterparty pairs and a dummy for collateral bundled in a portfolio with a very safe asset. Other than dummy variables we use trade-specific variables, collateral rating and maturity, and counterparty characteristics. We also have two measures for counterparty and collateral concentration. Counterparty concentration measures the share of transactions with a specific counterparty in total, evaluated using the notional amount of transactions. It represent how systemically important that counterparty is to the bank. Similarly, collateral concentration is measured by the share of transactions against a specific collateral in total, evaluated using the notional amount of transactions. We also include an interaction term between collateral rating and counterparty rating. The logic behind this term is to find whether counterparty and collateral quality can compensate for each other as a conditional effect.

Table 5 shows summary statistics for haircuts and non-dummy explanatory variables for the sample used in the baseline regressions. Except collateral and counterparty ratings which are categorical, other variables in this table are continuous. The summary statistics are represented separately for reverse repos and repos in Panels A and B respectively, given that haircut practices can potentially differ significantly between the two instruments. Variables have been winsorised at 0.5% level.

Even though haircuts can have as high value as 46%, the weighted average of hair-

cuts is about 6% for reverse repos and about 2% for repos. Notional values are log-transformed. Maturity values, both for transactions and collateral, are in year. The weighted average of maturity for the transactions is about 22-29 days, while the mean is around 26-29 days. Average collateral maturity used is between 7.5 and 12 years. Collateral and counterparty ratings are modified into numeric scale from 1 to 20, with 20 being the highest rating. The average collateral quality in this scale is about 14, while the average counterparty rating is between 14 and 15.

The summary statistics for counterparty return on assets (RoA), leverage, CDS spread, and cash ratio are also presented in Table 5, and the respective definitions are in Table 4. The logic for including RoA is to see how profitability of the counterparty can affect haircuts, and the cash ratio is intended to proxy for liquidity needs. Overall the summary statistics for reverse repos and repos are not significantly different.

In Tables 6–11 we present the main results of the paper. These tables show regression results to understand what factors might determine haircuts. The dependent variable is haircut in all tables and explanatory variables are listed in second column. We have classified explanatory variables into several categories. These categories are shown in the first column. The columns that are labeled with numbers display regression coefficients for different sets of explanatory variables. All continuous explanatory variables are standardized in order to simplifies the comparison of coefficients for different variables. Standard errors, which are not reported, are clustered at the reporting bank level. One and two stars denote 10% and 5% significance levels respectively. The tables present the results for Tobit, OLS, and Logistic regressions for reverse repos and repos.

The results in Tables 6–8 are for reverse repo transactions. In these transactions the reporting bank lends cash and receives collateral, and the counterparty borrows money and delivers collateral to the bank. Hence, counterparty characteristics correspond to borrower characteristics in these transactions. Table 6 presents the outcome of the Tobit regression, and Tables 7 and 8 show the OLS and Logistic regressions respectively. The main results that we emphasise below are robust to the choice of models.

We present analogous results for repos in Tables 9–11. In these transactions the reporting bank borrows cash and delivers collateral, and the counterparty lends money and receives collateral. Hence, counterparty characteristics correspond to lender characteristics in these transactions.

Column (1) in all these tables reports the result when the smallest set of explanatory variables is used. In this column, we include currency dummies, notional and maturity of transaction, collateral characteristics (rating and maturity) and collateral type dummies,

and dummies for counterparty type, but we leave out counterparty characteristics. In column (2) we add counterparty characteristics and concentration measures for counterparties and collateral. Columns (3) and (4) are similar to column (1), but they also include network centrality measures described in Section 5.2. Analogously, columns (5) and (6) are similar to column (2) but include network centrality measures.

In columns (1) and (2) we do not include the reporting bank characteristics, instead we look for haircut determinants by assessing the effects of explanatory variables within transactions conducted by each reporting bank. This is achieved by including reporting bank fixed effects in the regressions. To account for special relationships in the repo and reverse repo samples, we add a set of dummies for each bank-counterparty pair. We describe the results for these dummies in the next section.

The next section elaborates on the main results presented in Tables 6–11 in light of the six hypotheses formulated in Section 3.

5.1 Tests of hypotheses

Test 1 (collateral quality): The repo haircut is larger when the collateral is of lower quality and or illiquid.

As mentioned before, collateral quality can be measured using VaR, maturity, rating, and/or asset types. Transaction maturity is also a proxy as the longer the maturity, the riskier the underlying collateral becomes. Furthermore, when the collateral concentration ratio increases, the collateral portfolio pool becomes riskier. To test hypothesis 1, we include VaR of each asset, collateral rating, maturity, asset types in terms of corporate debt, securitisation products or not, transaction maturity, collateral concentration, notional value in all baseline regressions. We compute the VaR using two approaches. First, the measure is obtained using the historic approach, i.e. using the quintiles of the historical return distribution. We calculate simple returns and take the 5-days, 5% VaR as our main measure.[4] Second, we also computed VaR using the parametric approach (i.e., using the deciles of the normal distribution). The results are largely similar to the ones obtained using the historic approach. In the main text, we provide the results with the historic VaR.

The results from Tables 6–11 show that VaR has a positive impact on the haircut both in the repo market, and in the reverse repo market. Table 7 shows that one standard

[4]Using 1% or 10 days produces similar results.

deviation increase in the 5-day, 5% VaR leads to 9 bps increase in the repo haircut and to 5 bps increase in the reverse repo haircut. The estimates from the Logit and Tobit regressions confirm the positive and statistically significant results. The effect is robust to adding different controls – the estimates in columns 1-6 barely change.

Similar results are obtained for transaction maturity and securitisation products. Transaction maturity has a significant positive and robust effect on haircuts across all specifications: one standard deviation rise in maturity causes haircut to increase by 83-103 bps for reverse repos and by 24-47 bps for repos. Securitised collateral increases haircut by 20-64 bps when the reporting banks are lending, and by 9-14 bps when the same banks are borrowing. The notional value of transactions also increases haircuts: one standard deviation increase in notional leads to 4-9 bps rise in haircuts for reverse repo transactions, and to 4-5 bps rise in repos.

For the repos, higher collateral concentration – another measure for the riskiness of the collateral portfolio – increases the haircut. Therefore our reporting banks are charged significantly higher haircut when borrowing relatively large sums against the same collateral. On the other hand, collateral concentration measures do not exhibit notable effect on haircuts in reverse repo transactions. This might reflect the fact that our reporting banks are larger relatively than their counterparties and able to absorb large amount of the same collateral when trading with these smaller counterparties.

Other results on collateral quality and liquidity depend on whether the tests are done with the reverse repo or repo sample, that is, whether banks are lending via reverse repo repo or borrowing via repo. When banks are lending, they lower the haircut if the collateral rating is higher. When they are borrowing, their lenders require higher haircuts when collateral is of longer maturity and corporate debt. This might reflect the fact that banks in our sample use predominantly corporate debt as collateral assets to borrow.

In general, there is strong evidence that collateral quality and liquidity variables are important determinants of repo haircuts.

Test 2 (counterparty types): The repo haircut is larger when the counterparties in the contract are from different lines of business.

To test hypothesis 2, we define a dummy variable for all non-bank counterparties in our sample (broker-dealers, hedge funds, asset managers, insurance companies, pension funds, central banks, governments and all others). Since all these counterparties are from different lines of business compared to the six reporting banks, the point estimate on the dummy shows the effects on haircut when the counterparties are from different business

types. In order to see how haircuts applied between a bank and a non-bank entity differ from the haircuts between two banks, we run analogous regressions to the ones in Tables 6–11, except that there is only one dummy variable for counterparty type which takes value of 1 if the counterparty is not a bank, and 0 otherwise. The results from Tables 17 and 18 in the Appendix show that haircut increases both in the repo market, and in the reverse repo market. For contracts where banks deal with non-bank counterparties, the haircut increases by 9-13 bps in the reverse repo market and by 6-7 bps in the repo market. The estimates from the Logit and Tobit regressions (excluded for brevity) confirm the positive and statistically significant effects.

These results show that when banks trade with institutions similar to themselves, they charge lower haircuts, controlling for all observables (counterparty or collateral rating, maturity, etc.). This observation might support the argument that when the two parties in a repo contract disagree on the collateral value, charging a higher haircut might be a tool to mitigate the disagreement. Similar institutions use comparable models and therefore it is more likely that two banks have less disagreement than two completely different entities, say a bank and a hedge fund, hence the higher haircuts for non-bank counterparties in our sample. This might also due to the fact that there is lower information frictions and hence adverse selection between counterparties of similar types. This evidence supports the hypothesis developed based on the difference in opinion framework started with Geanakoplos (1997) as well as the adverse selection framework as in Ozdenoren et al. (2018).

Test 3 (counterparty's quality): The repo haircut is larger when the default probability (credit quality of borrower) is higher (lower), or when the borrower is better privately informed about the quality of the collateral.

To test hypothesis 3, we use the rating and the leverage ratio of the borrower in the reverse repo sample. The results from Tables 6–8 show that higher-rated (lower default probability) borrowers are charged a lower haircut: one unit increase in rating leads to 8-21 bps decrease in haircut. However, the coefficient is less statistically significant in the Tobit and the Logit regressions and sometimes switches sign, especially in the specifications including network centrality measures. A possible reason for this is the collinearity between the counterparty rating and the centrality measures: the correlation between the two variables is close to 40%.

Using counterparty's leverage ratio produces more robust results. The coefficients are positive and significant, which shows that riskier counterparties are charged a higher

haircut. The OLS estimates show that one standard deviation increase in leverage leads to 53-79 bps increase in haircut, which is a massive increase. The coefficients from the Tobit and Logit specifications confirm the positive effects.

Removing the bank-counterparty interaction dummies from the regressions shows that the coefficient on rating is more statistically significant and negative across all specifications. Higher-rated counterparties receive a lower haircut in these regressions which shows that some of the rating effects are absorbed by the bank-counterparty interaction dummies. These results are excluded from the paper for brevity. Overall, there is evidence that riskier borrowers are charged a greater haircut.

Tables 6–11 show that among the counterparty types, hedge funds receive massively higher haircuts in all specifications, relative to the baseline haircut received by banks: they are charged 99-157 bps higher haircut, on average. When banks borrow from hedge funds, there is no significant change in the charged haircut as seen from the coefficients for the repo sample. Broker-dealers both receive and charge a lower haircut in most specifications. Similar effects are observed for central banks and government agencies. Other asset managers are charged higher haircuts, but give lower ones in a contract with the reporting banks. Insurance companies and pension funds charge massively higher haircuts as a lender (90-103 bps more) but receive lower haircuts as a borrower (23-26 bps less).

The results in columns (2), (5), (6) of Tables 6–8 show that larger counterparties receive lower haircut: one standard deviation increase in size massively reduces the haircut by 93-193 bps. The results for the repo sample are less significant and indicate that larger lenders charge a higher haircut. Higher counterparty CDS increases the haircut both for repos and for reverse repos, but the effect is less significant. Counterparties with missing data on size, rating, CDS, etc. charge a higher haircut as lenders but receive a lower haircut as borrowers. The majority of these counterparties are small banks and some hedge funds. For reverse repos, there are relatively more other asset managers and less broker-dealers with missing data on size, rating, CDS, etc. compared to the general sample.

An important question about haircuts is how collateral risk and counterparty risk interact. There is a significant and positive coefficient on the interaction term between counterparty and collateral rating for the reverse repos. Excluding this interaction term from the regression weakens the magnitude and significance of the effect of counterparty characteristics. This observation means that collateral quality can overshadow counterparty characteristics. It seems that borrowers with lower ratings try to use higher quality collateral to receive a lower haircut, and as a consequence the influences of counterparty

attributes are concealed. After accounting for this interaction we can observe that larger counterparties and borrowers with higher ratings receive lower haircut. The interaction term between counterparty and collateral rating for the repos is negative and five times smaller in magnitude compared to the reverse repos sample.

Test 4 (lender's quality and liquidity): The repo haircut is larger when the default probability and/or liquidity need of lenders is higher.

We use lender's rating to account for default probability in the repo sample. To proxy for liquidity needs, we use lender's cash ratio. The evidence from Tables 9–11 is mixed. The estimates for rating are only marginally significant and positive, which goes against the hypothesis. The estimates for cash ratio are also insignificant but negative, which supports the hypothesis. Overall, there is mixed evidence in favour of this hypothesis.

Test 5 (bilateral relationship): The repo haircuts is lower for bilateral parties with banking relationship.

Table 13 shows the percentage of significant bank-counterparty interaction dummies in column (2) of tables 7 and 10. Figures 8 and 9 present a network graph of all the bank-counterparty interaction dummies, significant at the 1% level. Red colour means the interaction coefficient is negative (lower haircut if the given two nodes form a contract). Blue colour means the coefficient is positive, i.e. higher haircut if the two nodes form a contract. Thickness of the edge between two nodes shows the magnitude of the coefficient on the interaction dummy. The size of each node reflects the number of significant interactions involving the node. The figures are consistent with the hypothesis that relationships matter in haircut determination. The effect is particularly pronounced for the reverse repo market, where one of the banks (E on the figure) receives significantly lower haircuts from most of its counterparties. In the reverse repo market two other banks (B and F) also pay lower haircuts in deals with a subset of counterparties. On the other hand, another bank (D on the graph) is consistently charged a higher haircut.

Test 6 (portfolio repos): Risky assets in a portfolio repo with safe assets have lower haircut than purely risky asset repos.

To implement this test, we define a dummy equal to one if an asset is a part of portfolio which contains at least one highest-rated asset (AAA). The coefficient on the dummy for collateral bundled in a safe-asset portfolio from Tables 6–8 shows that lower-rated assets

in a portfolio with a safe asset have a lower haircut compared to the same assets in a standalone arrangement. The estimates from Table 7 show that combining lower-rated asset in a portfolio with a high-rated asset reduces the haircut on average by 5-16 bps. A more detailed analysis of the safe-asset portfolios shows that lower-rated counterparties are more likely to bundle assets in such portfolios. Hedge funds are the counterparties with the largest fraction of portfolios bundled with a safe asset.

5.2 Network Effects

The financial crisis has shown the importance of the interconnectedness of the banking system and the need to analyse risk not by looking at individual institutions in isolation, but by assessing network structure and interplay between institutions. As a result various studies have used network analysis tools to study the interbank and inter-dealer markets (e.g. Denbee et al. (2014) and Li and Schürhoff (2012)).

In this part we try to examine the network structure of the UK repo market using our dataset. We use network centrality measures borrowed from the literature on network analysis and employed by Li and Schürhoff (2012). Table 12 provides summary statistics of these measures (for definitions see Li and Schürhoff (2012)).

Figure 7 displays the repo market network plot. The network plot shows the reporting banks in yellow and size of the nodes is proportional to total degree measure. In order to see if network structure affects haircuts in the repo market, we use principal component of the unweighted and weighted centrality measures in the explanatory regressions. The results are presented in columns (3)–(4) and columns (5)–(6) of Tables 6–11 for reverse repos and repos. These columns are similar to column (1), and column (2), respectively, in their corresponding tables, but they include the principal component of either unweighted (pcu) or weighted (pcw) centrality measures. We see that the banks with higher centrality measures ask for less haircuts on reverse repos and also pay lower haircuts on repos. The results using weighted or unweighted measures are virtually the same.

In unreported regressions we use the entire sample including the CCP deals. None of the results mentioned above changes significantly, with two notable exceptions. Firstly, with CCP transactions, the two network measures are not significant in any case, so we do not observe any meaningful network effect when CCP transactions are included. Furthermore, including CCP transactions attenuates the impact of counterparty concentration on increasing the haircuts. Overall, given the issues described in Section 5, it seems

that including CCP transactions introduces some noise in the way that the architecture of the market affects haircuts and it is to be expected that the results related to the network measures and counterparty concentration become less significant.

6 Conclusion

In this study we analyse the structure of the UK repo market using a novel dataset collated by the UK regulator. We examine the maturity structure, collateral types and different counterparty types that engage in this market and test six theoretical hypotheses of haircut determination. We try to answer the question of what variables determine haircuts using transaction-level data. We find that collateral quality measured by transaction maturity and VaR has a first order importance in setting haircuts. Banks charge higher haircuts when they transact with non-bank institutions. In particular, hedge funds as borrowers receive a significantly higher haircut even after controlling for measures of counterparty risk. Larger borrowers with higher ratings receive lower haircuts, but this effect can be overshadowed by collateral quality, because weaker borrowers try to use higher quality collateral to receive a lower haircut. Finally, we examine the structure and attributes of the repo market network to assess if the network structure has an influence over haircuts. We find evidence of important borrower-lender relationships. We also observe that the banks with higher centrality measures ask for more haircuts on reverse repos and pay lower haircuts on repos.

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Figures

Figure 1: Currency vs maturity of the contracts for the sample of reverse repos. The area of each rectangle represents the fraction of contracts within a particular maturity-currency group. The area of the entire square is 100%.

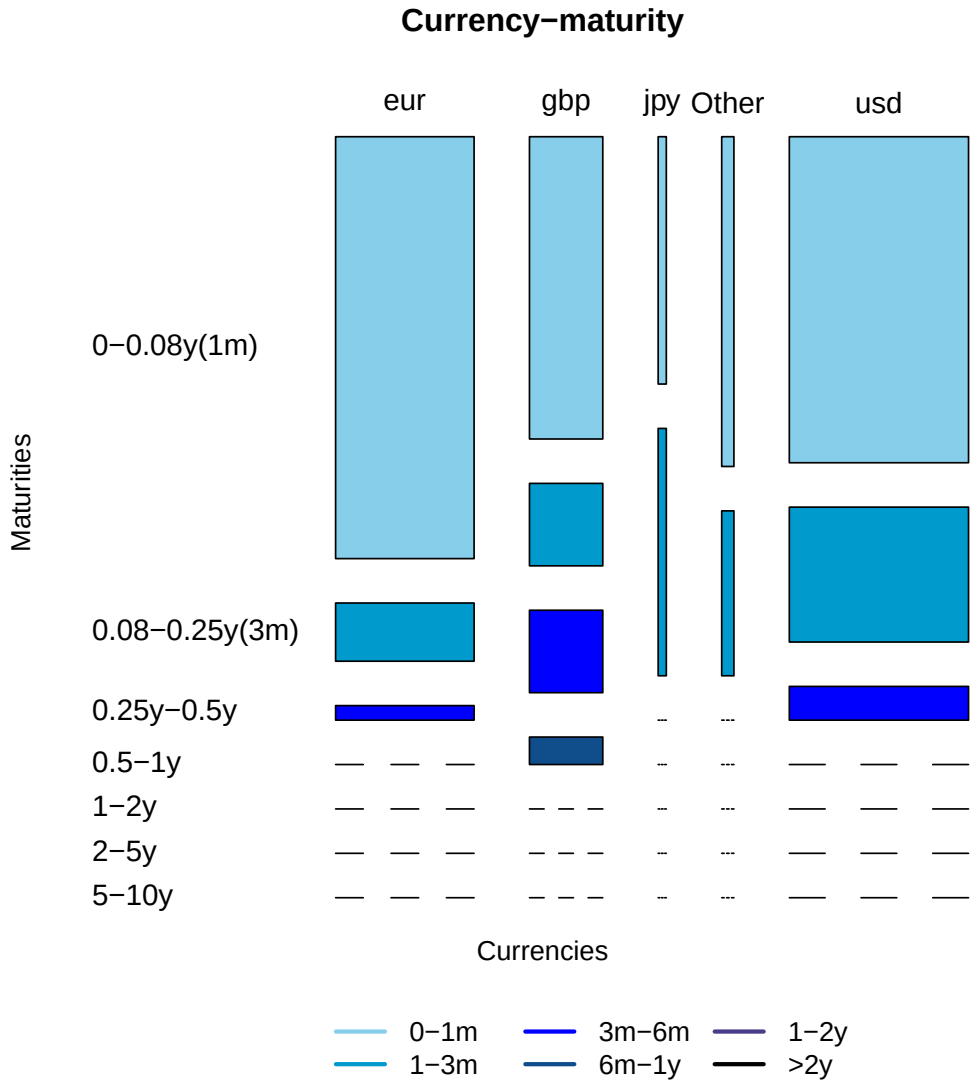


Figure 2: Currency vs maturity of the contracts for the sample of repos. The area of each rectangle represents the fraction of contracts within a particular maturity-currency group. The area of the entire square is 100%.

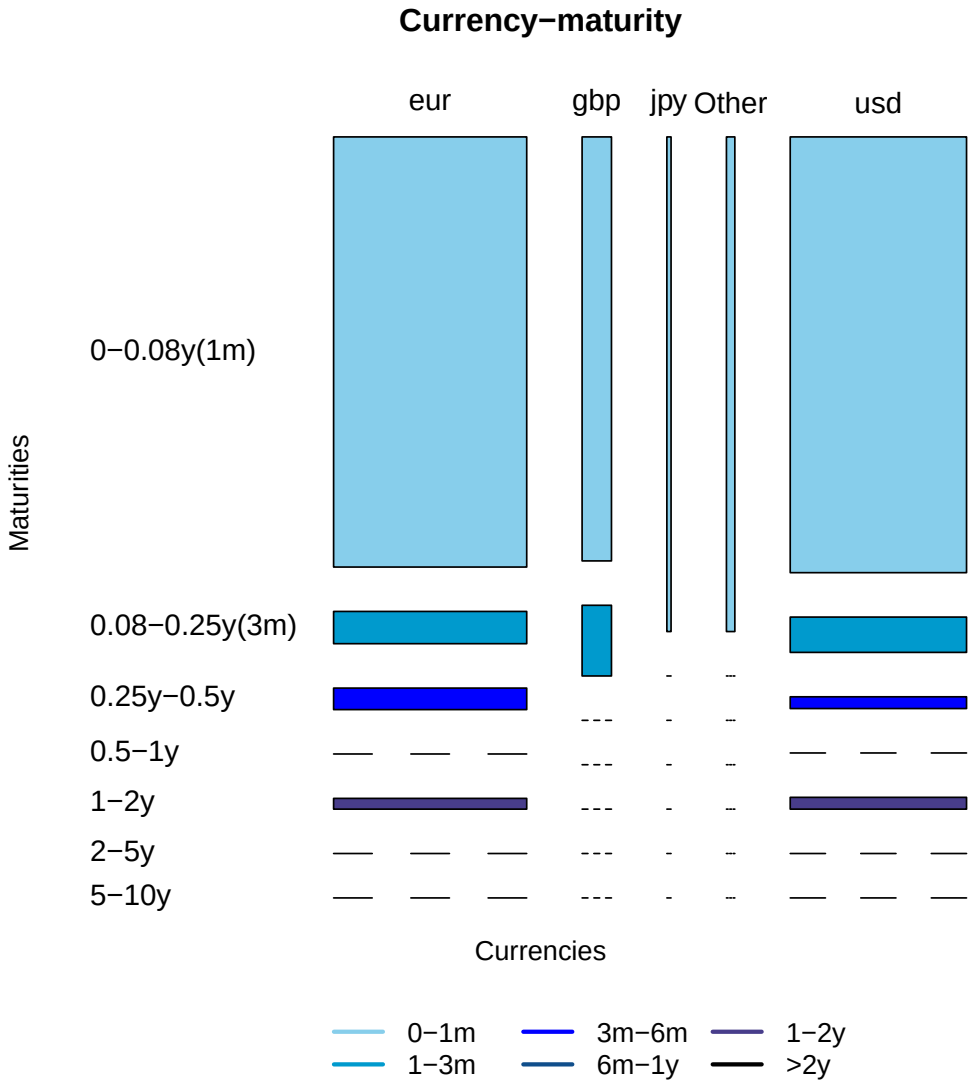


Figure 3: Histogram of haircuts . The figure shows the density of haircuts.

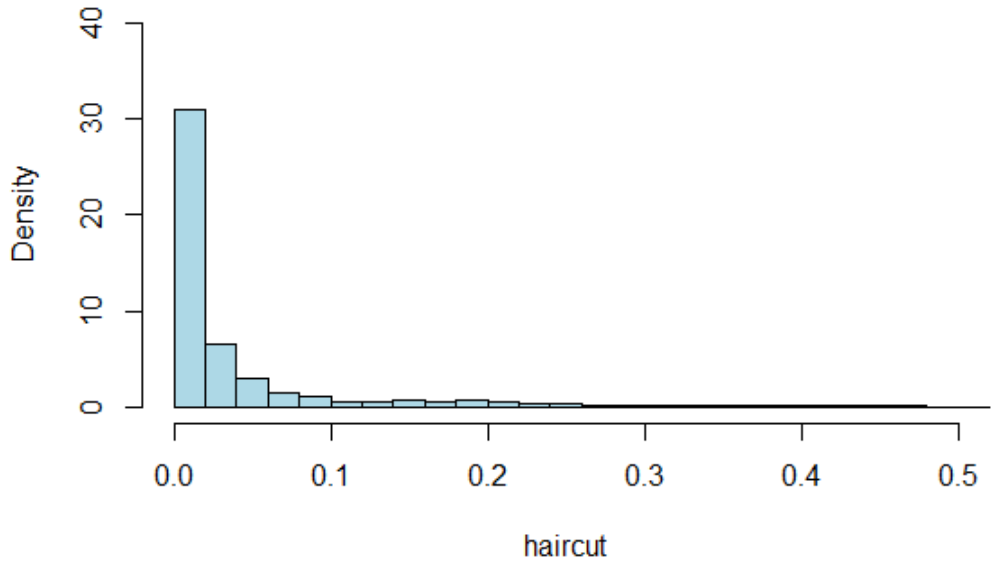


Figure 4: Zero-haircut sample. Contract maturities. The figure shows the number of zero-haircut contracts for each maturity. The top panel shows the distribution of reverse repos, the bottom – of repos.

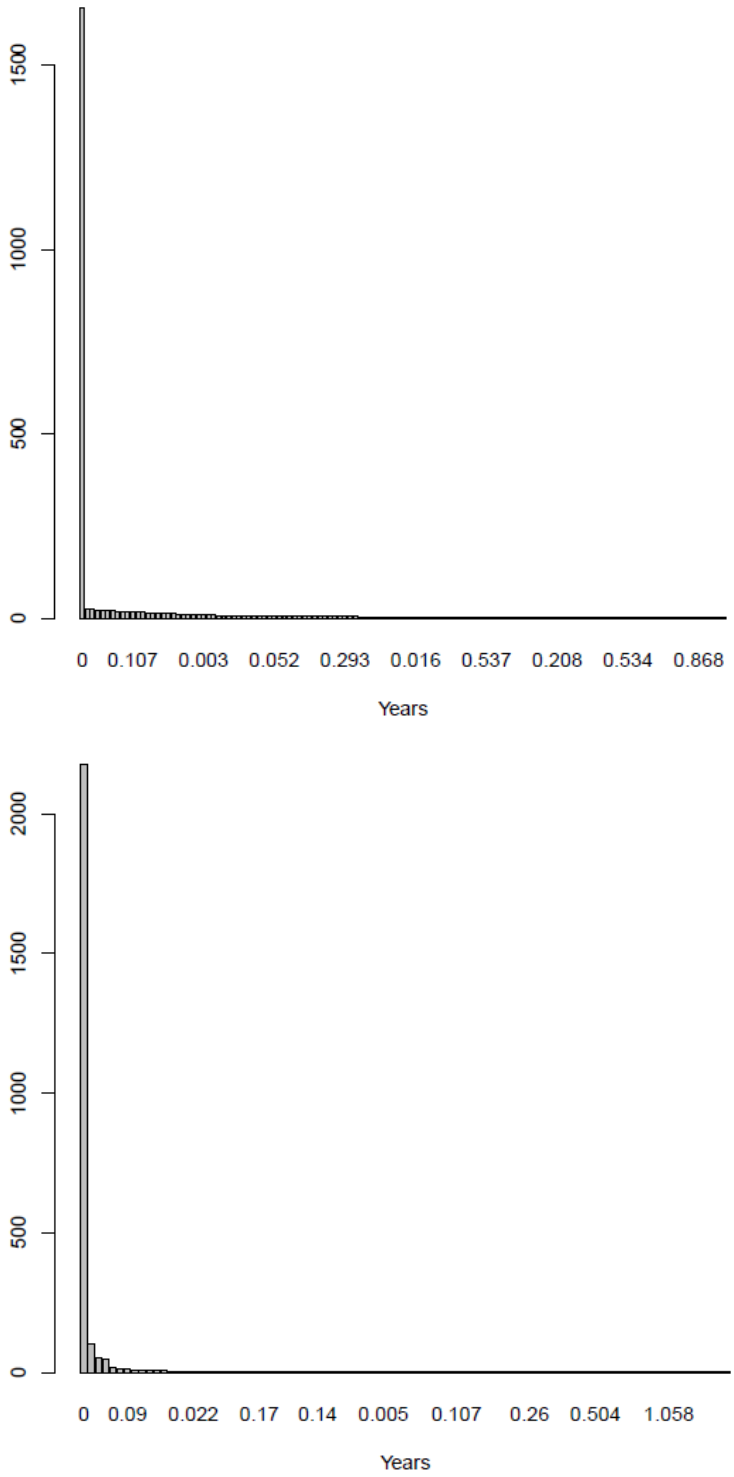


Figure 5: Zero-haircut network for reverse repos. The size of each node reflects the number of counterparties with which it has at least one zero-haircut deal. Edge widths show the total number of zero-haircut trades between two given nodes.

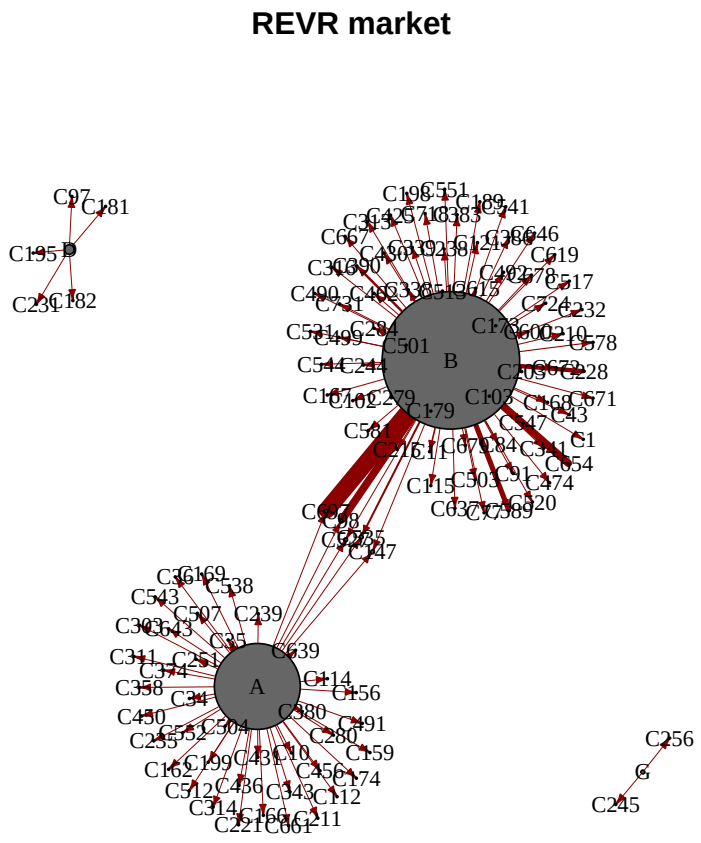


Figure 6: Zero-haircut network for repos. The size of each node reflects the number of counterparties with which it has at least one zero-haircut deal. Edge widths show the total number of zero-haircut trades between two given nodes.

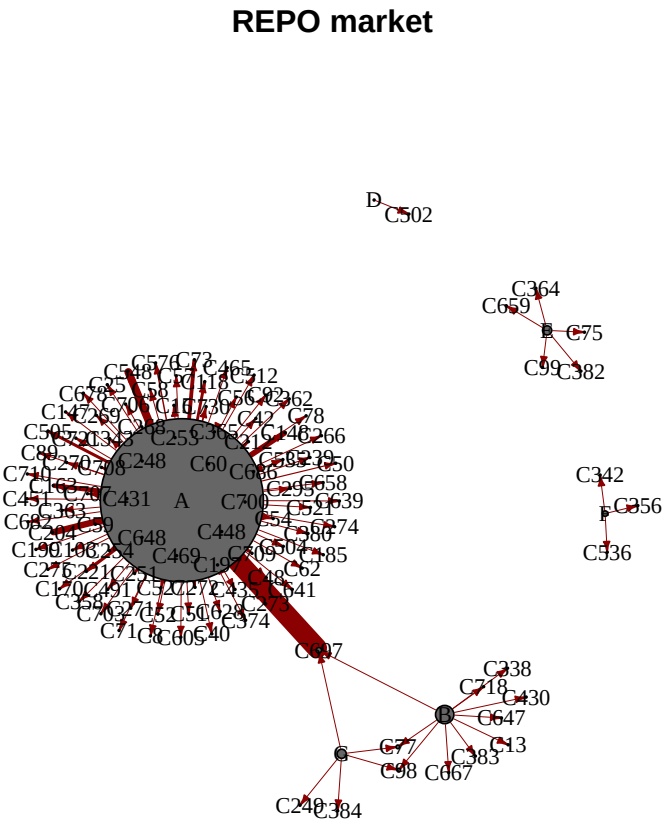


Figure 7: Network flows plot . The figure shows the flow of money for the sample of 6 reporting banks

Figure 8: Significant relationships in the reverse repo market. The figure shows the significant bank-counterparty interaction dummies at the 1% significance level from the OLS regression specification. Red colour means the interaction coefficient is negative (lower haircut if the given two nodes form a contract). Blue colour means the coefficient is positive, i.e. higher haircut if the two nodes form a contract. Edge width shows the absolute magnitude of the coefficient on the interaction dummy. The size of each node reflects the number of significant interactions involving the node.

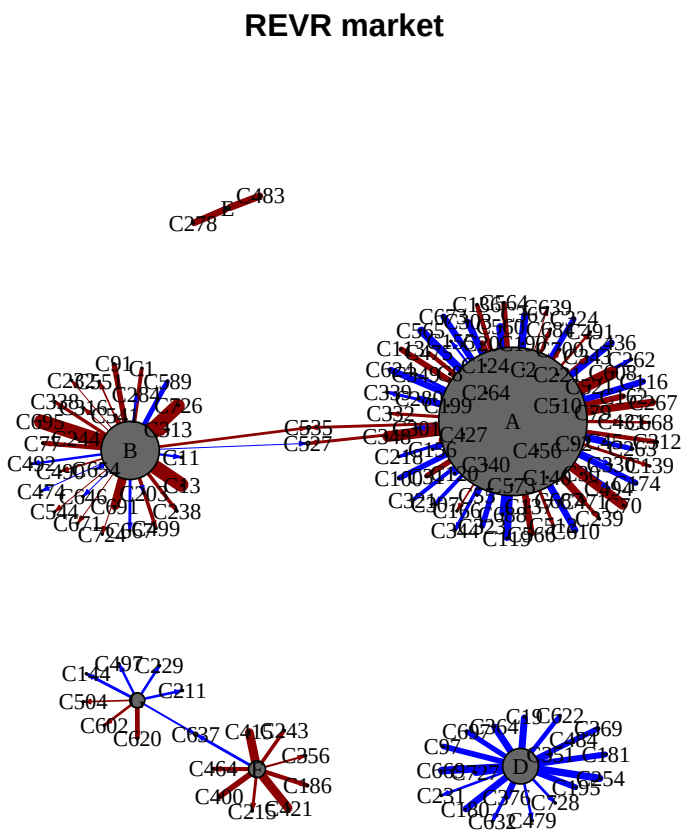
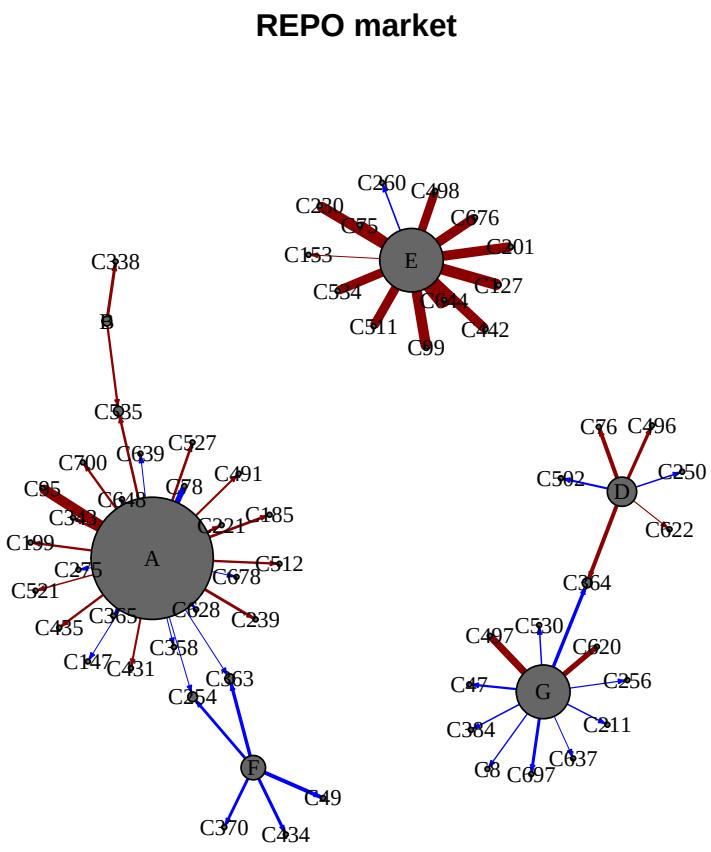


Figure 9: Significant relationships in the repo market. The figure shows the significant bank-counterparty interaction dummies at the 1% significance level from the OLS regression specification. Red colour means the interaction coefficient is negative (lower haircut if the given two nodes form a contract). Blue colour means the coefficient is positive, i.e. higher haircut if the two nodes form a contract. Edge width shows the absolute magnitude of the coefficient on the interaction dummy. The size of each node reflects the number of significant interactions involving the node.



Tables

Table 1: The breakdown of value of contracts (in £bn) by maturity, currency, counterparty type, and collateral type

	REVR		REPO		
	Value	Percent	Value	Percent	Net
A. Maturity					
o/n	23.5	9.6%	-39.1	14.7%	-15.6
<3m	140.7	60.0%	-130.7	48.6%	10.0
3m-1y	65.8	26.9%	-78.1	29.2%	-12.3
1y-5y	8.0	3.3%	-18.5	6.9%	-10.5
5y+	0.0	0.0%	-1.7	0.6%	-1.6
Total	244.2	100.0%	-267.0	100.0%	-22.8
B. Currency					
GBP	110.2	45.1%	-149.8	56.1%	-39.6
EUR	90.6	37.1%	-86.7	32.5%	4.0
USD	30.5	12.5%	-26.8	10.0%	3.7
JPY	6.0	2.5%	-1.6	0.6%	4.4
Other	6.9	2.8%	-2.1	0.8%	4.8
Total	244.2	100.0%	-267.0	100.0%	-22.8
C. Counterparty type					
Another reporting bank [a]	8.2	3.4%	-10.2	3.8%	-2.0
Other banks	29.3	12.0%	-43.6	16.3%	-14.3
Broker-dealer [b]	15.0	6.1%	-15.8	5.9%	-0.8
Hedge fund	15.1	6.2%	-15.5	5.8%	-0.4
MMFs	0.0	0.0%	-1.9	0.7%	-1.9
Other asset managers [c]	11.5	4.7%	-8.3	3.1%	3.2
CCP	145.5	59.6%	-131.3	49.3%	10.4
Insurance and pension	9.5	3.9%	-8.5	3.2%	1.0
Central bank and government	5.5	2.3%	-28.6	10.7%	-23.0
Other [d]	4.4	1.8%	-2.8	1.0%	1.6
Total	244.2	100.0%	-266.6	100.0%	-26.3
D. Collateral type					
US govt	10.9	6.0%	-5.4	2.9%	5.5
UK govt	83.1	45.8%	-111.7	59.1%	-28.6
Germany govt	25.5	14.0%	-19.1	10.1%	6.4
France govt	16.9	9.3%	-7.2	3.8%	9.7
GIIPS [e]	4.1	2.2%	-4.4	2.3%	-0.3
Other sovereign	31.6	17.4%	-16.0	8.4%	15.7
Corporate debt	7.5	4.1%	-11.7	6.2%	-4.2
Securitisation	2.0	1.1%	-13.5	7.1%	-11.5
Other	0.0	0.0%	0.0	0.0%	0.0
Total	181.6	100.0%	-188.9	100.0%	-7.3

The table presents the breakdown of the deals by maturity, currency, counterparty type, and collateral type (Panels A, B, C, and D respectively). For each category, it shows the value of the trades in billion Pounds and the percentage of total trades for the reverse repos and repos respectively. The total values in Panels A, B, C and D are based on the data from the six reporting banks that report haircut and collateral information.

[a] The reporting banks report on a UK-consolidated basis, but counterparties are reported on a global basis. Therefore there may be discrepancies between the reverse repos and repos with the reporting banks.

[b] Broker-dealers are mostly securities firms that are subsidiaries of large banks. [c] Non-leveraged non-MMF mutual funds—asset managers that are not hedge fund or MMF. [d] Includes corporations, schools, hospitals and other non-profit organisations. [e] Greece, Italy, Ireland, Portugal, and Spain government bonds.

Table 2: The breakdown of average haircuts by maturity, currency, counterparty type, and collateral type

	REVR	REPO
A. Maturity		
Overnight	1.9%	0.7%
<3m	3.2%	1.4%
3m-1y	0.6%	0.5%
1-5y	0.0%	0.7%
5y+	0.0%	0.0%
B. Currency		
GBP	1.4%	0.8%
EUR	1.5%	1.4%
USD	2.6%	0.9%
JPY	0.1%	0.0%
Other	0.2%	0.1%
C. Counterparty type		
Another reporting bank [a]	0.1%	0.2%
Other banks	1.9%	1.4%
Broker-dealer [b]	0.9%	0.6%
Hedge fund	1.4%	0.1%
Other asset managers [c]	1.0%	0.1%
Insurance and pension	0.3%	0.5%
Central bank and government	0.0%	0.3%
Other [d]	0.3%	0.0%
D. Collateral type		
US govt	0.4%	0.0%
UK govt	1.0%	0.4%
Germany govt	0.1%	0.1%
France govt	0.1%	0.1%
GIIPS [e]	0.2%	0.1%
Other sovereign	1.1%	0.2%
Corporate debt	1.1%	0.6%
Securitisation	0.5%	0.8%
Other	0.0%	–
Overall average	1.2%	0.7%

The table presents the breakdown of the deals by maturity, currency, counterparty type, and collateral type (Panels A, B, C, and D respectively). For each category, it shows the average haircut for the reverse repos and repos respectively. The averages are weighted by the gross notional of the transactions. The haircuts are based on the data from the six banks that report haircut and collateral information.

[a] The reporting banks report on a UK-consolidated basis, but counterparties are reported on a global basis. Therefore there may be discrepancies between the reverse repos and repos with the reporting banks.

[b] Broker-dealers are mostly securities firms that are subsidiaries of large banks. [c] Non-leveraged non-MMF mutual funds—asset managers that are not hedge fund or MMF. [d] Includes corporations, schools, hospitals and other non-profit organisations. [e] Greece, Italy, Ireland, Portugal, and Spain government bonds.

Table 3: Summary of the zero-haircut sample excluding deals with CCPs

Category	Subcategory	REVR	REPO
Currency	GBP	33.6%	6.3%
	USD	22.1%	40.0%
	EUR	40.5%	51.0%
	JPY	1.6%	0.9%
	Other	2.2%	1.9%
Counterparty type	Another reporting bank	4.3%	2.2%
	Other banks	53.4%	68.7%
	Broker-dealer	6.1%	9.5%
	Hedge fund	0.9%	0.0%
	Other asset managers	6.4%	16.0%
	Insurance and pension	11.6%	1.4%
	Central bank and govt	2.2%	1.6%
	Other	15.2%	0.5%
Collateral type	Sovereign	36.7%	44.2%
	Corporate debt	63.0%	43.9%
	Securitisation	0.3%	11.9%
	Other	0.0%	0.0%

The table presents breakdown of deals by currency, counterparty and collateral type, and collateral maturity, for the sample of deals with zero haircut, excluding the deals with CCPs. The sample only includes the six banks that provided data on haircuts and collateral. The percentages represent frequency of deals.

Table 4: Description of the explanatory variables

Variable	Description
gbp	Dummy variable = 1 if transaction is in GBP.
eur	Dummy variable = 1 if transaction is in EUR.
jpy	Dummy variable = 1 if transaction is in JPY.
othercurrency	Dummy variable = 1 if transaction is not GBP, EUR or JPY.
notional	Log notional of the transaction in million Pounds.
maturity	Maturity of the transaction in years.
collrating	Rating of the collateral: 20 is highest and 1 is lowest.
collmaturity	Maturity of the collateral in years.
corpdebt	Dummy variable = 1 if collateral is corporate bond.
securitisation	Dummy variable = 1 if collateral is securitisation.
VaR	Historical 5-day, 5% Value-at-Risk of the asset.
asset in safe portf	Dummy variable = 1 if the asset is in a portfolio with at least one asset rated AAA.
brokerdealers	Dummy variable = 1 if counterparty is broker-dealers.
hedgefund	Dummy variable = 1 if counterparty is hedge fund.
othermanager	Dummy variable = 1 if counterparty is other asset managers.
ccp	Dummy variable = 1 if counterparty is CCP.
insur&pension	Dummy variable = 1 if counterparty is insurance company or pension fund.
cb&govt	Dummy variable = 1 if counterparty is central bank or government.
other	Dummy variable = 1 if counterparty is other type.
nonbank	Dummy variable = 1 if counterparty is a bank or broker-dealer.
cptysize	Log size of the counterparty in million Pounds.
cptyroa	RoA of the counterparty.
cptyrating	Rating of the counterparty: 20 is highest and 1 is lowest.
cptyleverage	Leverage ratio of the counterparty (RWA over equity).
cptycds	CDS spread of the counterparty.
cptycashratio	Cash ratio of the counterparty (cash over short-term debt).
nocptydata	Dummy variable = 1 there is no counterparty data.
cptycon	Concentration of the counterparty measured by the share of transactions with that counterparty in total: higher number indicates more concentration.
collcon	Concentration of the collateral measured by the share of transactions against that collateral in total: higher number indicates more concentration.
cpty&collrating	Interaction term between counterparty rating and collateral rating
pcu	Principal component of the network centrality measures for unweighted network.
pcw	Principal component of the network centrality measures for weighted network.

Table 5: Summary statistics for the sample excluding deals with CCPs

Variable	Obs	Mean	Std dev	Min	Max	Average [a]
			A. REVR			
Haircut	8754	6.25%	10.13%	0.00%	46.15%	6.15%
Notional	10435	6.25	0.86	3.45	8.32	6.25
Maturity	10435	0.07	0.14	0.00	3.00	0.06
Collateral maturity	7085	11.88	10.42	0.22	43.18	12.01
Collateral rating	5729	14.54	4.83	3.00	20.00	14.60
Ctpy size	6512	5.17	0.70	3.57	6.25	5.16
Ctpy RoA	6506	0.29	0.41	-1.26	1.98	0.29
Ctpy leverage	6469	5.56	1.33	2.97	11.00	5.56
Ctpy CDS	5593	0.01	0.01	0.01	0.04	0.01
Ctpy cash ratio	6484	-0.01	5.48	-81.44	4.37	-0.03
Ctpy rating	6495	14.59	1.28	8.00	20.00	14.60
			B. REPO			
Haircut	7386	2.37%	5.82%	0.00%	46.15%	2.36%
Notional	11896	6.18	0.79	3.45	8.32	6.21
Maturity	11905	0.08	0.35	0.00	3.00	0.08
Collateral maturity	8993	7.50	7.81	0.22	43.18	7.50
Collateral rating	8629	14.34	4.99	3.00	20.00	14.33
Ctpy size	8380	5.37	0.62	3.57	6.25	5.37
Ctpy RoA	8367	0.36	0.39	-1.26	1.98	0.36
Ctpy leverage	7300	5.87	1.42	2.97	11.00	5.86
Ctpy CDS	5908	0.02	0.01	0.01	0.04	0.02
Ctpy cash ratio	8160	0.01	6.63	-81.44	4.37	0.01
Ctpy rating	8445	15.19	1.94	8.00	20.00	15.19

The table shows the summary statistics of variables used in the regressions excluding the deals with CCPs, for repo and reverse repo transactions. The sample only includes the six banks that provided data on haircuts and collateral. Variables have been winsorised at 0.5% level. Rating scale is 1–20, with 20 being the highest rating.

[a] Average is weighted by the gross notional of transactions.

Table 6: Reverse repo Tobit regressions excluding CCPs

Category	Variable	(1)	(2)	(3)	(4)	(5)	(6)
Deal var	notional	0.009**	0.006*	0.015**	0.018**	0.016**	0.019**
	maturity	0.157***	0.146***	0.150***	0.098***	0.147***	0.097***
Collateral var	collrating	-0.012***	-0.015***	-0.011***	-0.011***	-0.013***	-0.013***
	collmaturity	-0.0004	0.003	-0.002	-0.0003	-0.001	0.001
	corpdebt	-0.010*	-0.014**	-0.024**	-0.027**	-0.027**	-0.030**
	securitisation	0.037***	0.013	0.099***	0.088***	0.086***	0.074***
	VaR	0.004***	0.004***	0.006***	0.004***	0.005***	0.005***
	asset in safe portf	-0.009*	-0.010**	-0.037***	-0.035***	-0.037***	-0.035***
Cpty type	brokerdealers	-0.008	-0.005	-0.048***	-0.049***	-0.026**	-0.042***
	hedgefund	0.126***	0.065***	0.177***	0.176***	0.175***	0.174***
	othermanager	0.030**	-0.011	0.038**	0.043**	0.046**	0.053***
	insur&pension	0.011	-0.022*	-0.072***	-0.063***	-0.063***	-0.051***
	cb&govt	-0.019	-0.001	-0.092***	-0.079***	-0.131***	-0.110***
	other	0.033***	-0.006	-0.062***	-0.043***	-0.053***	-0.032***
Cpty var	cptysize		-0.166**			-0.208**	-0.216**
	cptyroa		-0.006			-0.041***	-0.036***
	cptyrating		-0.025**			0.015**	0.010**
	cptyleverage		0.127***			0.078***	0.075***
	cptycds		0.001			0.018**	0.018**
	cptycashratio		0.005			-0.016**	-0.009
	nocptydata		-0.230**			0.081	-0.040
Misc	cptycon		0.014***			0.009	-0.010
	collcon		0.005			0.009	0.008
	cpty&collrating		0.001***			0.0004***	0.0004***
Network var	pcu			-0.017***		-0.020***	
	pcw				-0.060***		-0.064***
	Bank FE	Yes	Yes	No	No	No	No
	Bank-Cty FE	Yes	Yes	Yes	Yes	Yes	Yes
	Currency FE	Yes	Yes	Yes	Yes	Yes	Yes
	Obs	3,925	3,907	3,925	3,925	3,907	3,907
	Pseudo R^2	2.89	2.95	2.89	2.89	2.95	2.95

The table shows Tobit regression results for reverse repos excluding deals with CCPs, where the Tobit model with truncation at zero is used. The dependent variable is haircut and explanatory variables are listed in the second column. The first column shows the category of explanatory variable. The columns that are labeled with numbers display regression coefficients for different explanatory variables. All quantitative variables (notional, maturity, collmaturity, VaR, cptysize, cptyroa, cptyleverage, cptycds, cptycashratio, cptycon, collcon, cpty & collrating, pcu and pcw) are standardized. Standard errors (not reported) are clustered at reporting bank level. One, two and three stars denote 10%, 5% and 1% significance levels respectively.

Table 7: Reverse repo OLS regressions excluding CCPs

Category	Variable	(1)	(2)	(3)	(4)	(5)	(6)
Deal var	notional	0.003	0.004**	0.006**	0.007**	0.009**	0.009***
	maturity	0.095***	0.103***	0.090***	0.083***	0.097***	0.091***
Collateral var	collrating	-0.008***	-0.012***	-0.008***	-0.007***	-0.011***	-0.011***
	collmaturity	-0.001	0.002	-0.0004	0.001	0.002	0.004**
	corpdebt	-0.008*	-0.009*	-0.013*	-0.011*	-0.015*	-0.012*
	securitisation	0.036***	0.020**	0.064***	0.057***	0.052***	0.046***
	VaR	0.005**	0.005***	0.005**	0.005*	0.005**	0.005**
	asset in safe portf	-0.005*	-0.006**	-0.015***	-0.015***	-0.016***	-0.016***
Cpty type	brokerdealers	0.003	0.007	-0.020***	-0.024***	-0.014**	-0.027***
	hedgefund	0.139***	0.099***	0.157***	0.134***	0.140***	0.111***
	othermanager	0.022**	0.009	0.028**	0.023**	0.031**	0.022**
	insur&pension	0.006	-0.003	-0.026***	-0.032***	-0.023***	-0.033***
	cb&govt	0.008	0.019**	-0.024***	-0.023***	-0.017***	-0.012*
	other	0.017***	0.005	-0.009*	-0.003	-0.009	-0.006
Cpty var	cptysize		-0.093**			-0.139**	-0.134**
	cptyroa		-0.003			-0.017***	-0.010***
	cptyrating		-0.021***			-0.008***	-0.011***
	cptyleverage		0.079***			0.065***	0.053***
	cptycds		-0.003			0.006**	0.006**
	cptycashratio		0.006**			0.001	0.007***
	nocptydata		-0.164***			-0.129***	-0.195***
Misc	cptycon		0.005			-0.001	-0.003
	collcon		0.002			0.004	0.005
	cpty&collrating		0.001***			0.001***	0.001***
Network var	pcu			-0.021***		-0.023***	
	pcw				-0.028***		-0.028***
	Bank FE	Yes	Yes	No	No	No	No
	Bank-Cty FE	Yes	Yes	Yes	Yes	Yes	Yes
	Currency FE	Yes	Yes	Yes	Yes	Yes	Yes
	Obs	3,925	3,907	3,925	3,925	3,907	3,907
	R^2	0.615	0.650	0.637	0.633	0.664	0.658

The table shows OLS regression results for reverse repos, excluding deals with CCPs. The dependent variable is haircut and explanatory variables are listed in the second column. The first column shows the category of explanatory variable. The columns that are labeled with numbers display regression coefficients for different explanatory variables. All quantitative variables (notional, maturity, collmaturity, VaR, cptysize, cptyroa, cptyleverage, cptycds, cptycashratio, cptycon, collcon, cpty & collrating, pcu and pcw) are standardized. Standard errors (not reported) are clustered at reporting bank level. One, two and three stars denote 10%, 5% and 1% significance levels respectively.

Table 8: Reverse repo Logistic regressions excluding CCPs

Category	Variable	(1)	(2)	(3)	(4)	(5)	(6)
Deal var	notional	0.084*	0.049	0.006**	0.165**	0.146**	0.155***
	maturity	1.480***	1.201***	0.090***	1.181***	1.002***	1.060***
Collateral var	collrating	-0.134**	-0.144**	-0.008**	-0.119**	-0.133**	-0.123***
	collmaturity	0.059*	0.065*	-0.0004	0.104***	0.064*	0.110***
	corpdebt	-0.009	-0.032	-0.013**	-0.081	-0.131*	-0.085
	securitisation	0.336**	0.132	0.064***	0.805***	0.681***	0.705***
	VaR	0.030***	0.033**	0.005**	0.027**	0.027**	0.027**
	asset in safe portf	-0.134**	-0.130**	-0.015***	-0.344***	-0.318***	-0.338***
Cpty type	brokerdealers	-0.123	-0.275	-0.020***	-0.758***	-0.561**	-0.751***
	hedgefund	1.485***	0.779***	0.157***	1.392***	1.921***	1.270***
	othermanager	0.459***	-0.154	0.028***	0.413***	0.585***	0.367***
	insur&pension	0.106	-0.467*	-0.026***	-1.235***	-1.033***	-1.304***
	cb&govt	-1.021***	-1.361***	-0.024***	-1.944***	-2.253***	-2.305***
	other	0.654***	0.024	-0.009*	-0.089	-0.063	-0.131
Cpty var	cptysize		-2.252**			-2.826**	-2.556**
	cptyroa		-0.111			-0.383***	-0.215***
	cptyrating		-0.318***			0.104**	0.035
	cptyleverage		1.619**			1.364**	0.991**
	cptycds		0.082			0.214**	0.206**
	cptycashratio		0.159**			-0.018	0.041
	nocptydata		-4.268***			-0.614	-1.697
Misc	cptycon		0.205***			-0.008	0.027
	collcon		0.133**			0.134*	0.136
	cpty&collrating		0.004***			0.003**	0.003***
Network var	pcu			-0.021**		-0.446**	
	pcw				-0.374**		-0.368**
	Bank FE	Yes	Yes	No	No	No	No
	Bank-Cty FE	Yes	Yes	Yes	Yes	Yes	Yes
	Currency FE	Yes	Yes	Yes	Yes	Yes	Yes
	Obs	3,925	3,907	3,925	3,925	3,907	3,907
	R^2	0.582	0.617	0.595	0.590	0.643	0.638

The table shows Logistic regression results for reverse repos, excluding deals with CCPs. The dependent variable is logit-transformed haircut and explanatory variables are listed in the second column. The first column shows the category of explanatory variable. The columns that are labeled with numbers display regression coefficients for different explanatory variables. All quantitative variables (notional, maturity, collmaturity, VaR, cptysize, cptyroa, cptyleverage, cptycds, cptycashratio, cptycon, collcon, cpty & collrating, pcu and pcw) are standardized. Standard errors (not reported) are clustered at reporting bank level. One, two and three stars denote 10%, 5% and 1% significance levels respectively.

Table 9: Repo Tobit regressions excluding CCPs

Category	Variable	(1)	(2)	(3)	(4)	(5)	(6)
Deal var	notional	0.004**	0.002*	0.005**	0.007**	0.003**	0.006**
	maturity	0.047**	0.027**	0.042**	0.052**	0.020**	0.034**
Collateral var	collrating	−0.001***	0.001	−0.002***	−0.002***	0.001	0.001
	collmaturity	0.002	0.002	0.003**	0.003**	0.003	0.003
	corpdebt	0.004	0.009***	0.005	0.006*	0.010**	0.010***
	securitisation	0.008	0.011**	0.015***	0.018***	0.019**	0.022**
	VaR	0.011***	0.011***	0.008**	0.009***	0.008**	0.009**
	asset in safe portf	0.011	0.010	0.010	0.010	0.011	0.011
Cpty type	brokerdealers	−0.044***	−0.038***	−0.038***	−0.044***	−0.031**	−0.039**
	hedgefund	−0.020	−0.015	0.014	0.007	0.015	0.011
	othermanager	0.003	−0.008	−0.035***	−0.028***	−0.045**	−0.036**
	insur&pension	0.122***	0.121***	0.114***	0.098***	0.118**	0.107**
	cb&govt	0.007	−0.005*	−0.012**	−0.014**	−0.021*	−0.022*
	other	−0.002	−0.012	−0.056	−0.040	−0.062	−0.044
Cpty var	cptysize		0.008			0.018	0.004
	cptyroa		0.008***			0.008**	0.009**
	cptyrating		0.003			0.003	0.003
	cptyleverage		−0.049**			−0.012	−0.003
	cptycds		−0.003			0.002	0.006
	cptycashratio		0.005			−0.005	−0.003
	nocptydata		−0.091			0.025	0.005
Misc	cptycon		0.017***			−0.002	−0.002
	collcon		0.009***			0.011**	0.010**
	cpty&collrating		−0.0003***			−0.0003**	−0.0003**
Network var	pcu			−0.021***		−0.022**	
	pcw				−0.023***		−0.023**
	Bank FE	Yes	Yes	No	No	No	No
	Bank-Cty FE	Yes	Yes	Yes	Yes	Yes	Yes
	Currency FE	Yes	Yes	Yes	Yes	Yes	Yes
	Obs	3,028	2,915	3,028	3,028	2,915	2,915
	Pseudo R^2	-0.97	-0.93	-0.97	-0.97	-0.93	-0.93

The table shows Tobit regression results for reverse repos excluding deals with CCPs, where the Tobit model with truncation at zero is used. The dependent variable is haircut and explanatory variables are listed in the second column. The first column shows the category of explanatory variable. The columns that are labeled with numbers display regression coefficients for different explanatory variables. All quantitative variables (notional, maturity, collmaturity, VaR, cptysize, cptyroa, cptyleverage, cptycds, cptycashratio, cptycon, collcon, cpty & collrating, pcu and pcw) are standardized. Standard errors (not reported) are clustered at reporting bank level. One, two and three stars denote 10%, 5% and 1% significance levels respectively.

Table 10: Repo OLS regressions excluding CCPs

Category	Variable	(1)	(2)	(3)	(4)	(5)	(6)
Deal var	notional	0.005***	0.004***	0.005***	0.006***	0.004***	0.005***
	maturity	0.047***	0.029***	0.043***	0.049***	0.024***	0.033***
Collateral var	collrating	-0.001	0.001	-0.0001	-0.0002	0.001*	0.001*
	collmaturity	0.002	0.002	0.003*	0.003**	0.003**	0.003**
	corpdebt	0.004	0.008***	0.006**	0.007**	0.009***	0.009***
	securitisation	0.002	0.004	0.009**	0.012***	0.012***	0.014***
	VaR	0.009**	0.009***	0.007*	0.008**	0.007**	0.007**
	asset in safe portf	0.003	0.003	0.003	0.003	0.003	0.003
Cpty type	brokerdealers	-0.012***	-0.005	-0.014***	-0.018***	-0.006	-0.011***
	hedgefund	-0.005	-0.001	0.0004	-0.003	-0.0004	-0.002
	othermanager	-0.009	-0.015*	-0.045***	-0.039***	-0.049***	-0.042***
	insur&pension	0.096***	0.099***	0.099***	0.090***	0.103***	0.097***
	cb&govt	-0.009	-0.016*	-0.023***	-0.023***	-0.028***	-0.028***
	other	0.003	-0.005	-0.046	-0.034	-0.050	-0.037
Cpty var	cptysize		0.023**			0.024**	0.017
	cptyroa		0.002			0.001	0.001
	cptyrating		0.006***			0.006***	0.006***
	cptyleverage		-0.025***			-0.004	0.003
	cptycds		0.0001			0.005	0.007**
	cptycashratio		0.001			-0.006*	-0.005
	nocptydata		0.041			0.123***	0.109***
Misc	cptycon		0.014**			-0.001	-0.001
	collcon		0.006**			0.008***	0.008***
	cpty&collrating		-0.0002***			-0.0002***	-0.0002***
Network var	pcu			-0.013***		-0.014***	
	pcw				-0.017***		-0.016***
	Bank FE	Yes	Yes	No	No	No	No
	Bank-Cty FE	Yes	Yes	Yes	Yes	Yes	Yes
	Currency FE	Yes	Yes	Yes	Yes	Yes	Yes
	Obs	3028	2915	2915	3028	2915	2915
	R^2	0.572	0.589	0.572	0.572	0.589	0.589

The table shows OLS regression results for repos, excluding deals with CCPs. The dependent variable is haircut and explanatory variables are listed in the second column. The first column shows the category of explanatory variable. The columns that are labeled with numbers display regression coefficients for different explanatory variables. All quantitative variables (notional, maturity, collmaturity, VaR, cptysize, cptyroa, cptyleverage, cptycds, cptycashratio, cptycon, collcon, cpty & collrating, pcu and pcw) are standardized. Standard errors (not reported) are clustered at reporting bank level. One, two and three stars denote 10%, 5% and 1% significance levels respectively.

Table 11: Repo Logistic regressions excluding CCPs

Category	Variable	(1)	(2)	(3)	(4)	(5)	(6)
Deal var	notional	0.320***	0.242***	0.005***	0.397***	0.266***	0.321***
	maturity	0.505***	0.262*	0.043***	0.419***	0.143	0.242*
Collateral var	collrating	-0.043***	-0.020	-0.0001	-0.027*	-0.012	-0.003
	collmaturity	0.138**	0.143**	0.003*	0.167***	0.163***	0.164***
	corpdebt	0.482***	0.663***	0.006**	0.553***	0.687***	0.676***
	securitisation	0.380**	0.449**	0.009**	0.748***	0.759***	0.857***
	VaR	0.331***	0.335***	0.007*	0.303***	0.273**	0.287**
	asset in safe portf	0.101	0.139	0.101	0.101	0.139	0.139
Cpty type	brokerdealers	-1.026***	-0.901***	-0.014***	-1.146***	-0.666***	-0.815***
	hedgefund	-0.108	-0.116	0.0004	-0.027	0.011	-0.083
	othermanager	-0.030	-0.174	-0.045***	-1.182***	-1.313***	-1.333***
	insur&pension	1.440***	1.219***	0.099***	1.301***	1.329***	1.167***
	cb&govt	-0.145	-0.404	-0.023***	-0.707***	-0.794**	-0.839***
	other	0.133	-0.062	-0.046	-1.839	-2.124	-1.988
Cpty var	cptysize		0.301			0.715	0.427
	cptyroa		0.090			0.039	0.040
	cptyrating		0.033			0.160*	0.165*
	cptyleverage		-0.500			0.009	0.192
	cptycds		0.107			0.236*	0.268**
	cptycashratio		0.112			-0.141	-0.115
	nocptydata		-0.609			4.105***	3.748***
Misc	cptycon		0.273***			0.004	0.040
	collcon		0.104***			0.122***	0.125***
	cpty&collrating		-0.006***			-0.005***	-0.005***
Network var	pcu			-0.013***		-0.298***	
	pcw				-0.276***		-0.240***
	Bank FE	Yes	Yes	No	No	No	No
	Bank-Cty FE	Yes	Yes	Yes	Yes	Yes	Yes
	Currency FE	Yes	Yes	Yes	Yes	Yes	Yes
	Obs	3028	2915	2915	3028	3028	3028
	R^2	0.641	0.658	0.641	0.641	0.658	0.658

The table shows Logistic regression results for repos, excluding deals with CCPs. The dependent variable is logit-transformed haircut and explanatory variables are listed in the second column. The first column shows the category of explanatory variable. The columns that are labeled with numbers display regression coefficients for different explanatory variables. All quantitative variables (notional, maturity, collmaturity, VaR, cptysize, cptyroa, cptyleverage, cptycds, cptycashratio, cptycon, collcon, cpty & collrating, pcu and pcw) are standardized. Standard errors (not reported) are clustered at reporting bank level. One, two and three stars denote 10%, 5% and 1% significance levels respectively.

Table 12: Centrality measures summary

Network type	Measure	Mean
Unweighted	in degree	6.60E+01
	out degree	6.70E+01
	eigenvector centrality	-2.23E-01
	betweenness	1.57E+04
	closeness out	1.87E-01
	closeness in	4.81E-02
	kcore in	3.67E+00
	kcore out	4.17E+00
	clustering coefficient	4.12E-02
Weighted	in degree (trade number)	1.51E+02
	out degree (trade number)	1.93E+03
	in degree (value)	4.09E+09
	out degree (value)	3.86E+10
	eigenvector centrality (trade number)	-2.68E-01
	eigenvector centrality (value)	-2.40E-01

Table 13: Percentage of significant interactions in the REVR and REPO OLS regressions

Significance level	REVR	REPO
10%	68.1%	57.0%
5%	60.6%	50.6%
1%	49.7%	34.2%

The table presents the percentage of significant bank-counterparty interaction dummies in the OLS specification.

7 Appendix

Table 14: The breakdown of value of contracts (in £bn) by maturity, currency, counterparty type, and collateral type. Sample of six banks excluding CCPs.

	REVR		REPO		
	Value	Percent	Value	Percent	Net
A. Maturity					
Overnight	18.0	18.3%	-34.0	25.1%	-16.0
<3m	51.6	52.4%	-58.6	43.3%	-7.0
3m-1y	21.8	22.1%	-27.5	20.3%	-5.7
1y-5y	1.8	1.8%	-14.5	10.7%	-12.7
5y+	0.0	0.0%	-1.7	1.2%	-1.6
Total	98.6	100.0%	-135.3	100.0%	-36.7
B. Currency					
GBP	26.9	27.3%	-41.0	30.3%	-14.2
EUR	31.4	31.9%	-65.4	48.3%	-33.9
USD	27.4	27.8%	-25.2	18.6%	2.2
JPY	6.0	6.1%	-1.6	1.2%	4.4
Other	6.9	7.0%	-2.1	1.6%	4.8
Total	98.6	100.0%	-135.3	100.0%	-36.7
C. Counterparty type					
Another reporting bank [a]	8.2	8.3%	-10.2	7.6%	-2.0
Other banks	29.3	29.7%	-43.6	32.2%	-14.3
Broker-dealer [b]	15.0	15.2%	-15.8	11.7%	-0.8
Hedge fund	15.1	15.3%	-15.5	11.5%	-0.4
Other asset managers [c]	11.5	11.7%	-8.3	6.2%	3.2
Insurance and pension	9.5	9.7%	-8.5	6.3%	1.0
Central bank and government	5.5	5.6%	-28.6	21.1%	-23.0
Other [d]	4.4	4.5%	-2.8	2.1%	1.6
Other	0.0	0.0%	-1.9	1.4%	-1.9
Total	98.6	100.0%	-135.3	100.0%	-36.7
D. Collateral type					
US govt	10.2	15.3%	-5.4	6.7%	4.8
UK govt	14.5	21.7%	-17.6	21.9%	-3.1
Germany govt	5.4	8.0%	-12.9	16.0%	-7.5
France govt	4.9	7.3%	-4.7	5.9%	0.1
GIIPS	3.9	5.8%	-3.9	4.8%	0.0
Other sovereign	18.9	28.4%	-10.8	13.4%	8.2
Corporate debt	7.0	10.5%	-11.7	14.5%	-4.7
Securitisation	1.9	2.9%	-13.5	16.8%	-11.6
Other	0.0	0.1%	0.0	0.0%	0.0
Total	66.7	100.0%	-80.4	100.0%	-13.8

The table presents the breakdown of the deals by maturity, currency, counterparty type, and collateral type (Panels A, B, C, and D respectively) for the whole sample (including deals with no data on haircuts). For each category, it shows the value of the trades in billion Pounds and the percentage of total trades for the reverse repos and repos respectively. The total values in Panels A, B, C and D are based on the data from the six reporting banks that report haircut and collateral information.

[a] The reporting banks report on a UK-consolidated basis, but counterparties are reported on a global basis. Therefore there may be discrepancies between the reverse repos and repos with the reporting banks.

[b] Broker-dealers are mostly securities firms that are subsidiaries of large banks. [c] Non-leveraged non-MMF mutual funds—asset managers that are not hedge fund or MMF. [d] Includes corporations, schools, hospitals and other non-profit organisations. [e] Greece, Italy, Ireland, Portugal, and Spain government bonds.

Table 15: The breakdown of reverse repos

	Counterparty type								
	1	2	3	4	5	6	7	8	Total
A. Maturity									
Overnight	1.4	18.8	8.0	4.0	2.0	2.1	0.0	2.2	38.4
<3m	0.81	17.5	9.3	10.1	5.6	5.5	2.6	2.2	53.9
3m-1y	0.3	1.7	0.3	0.3	2.5	1.6	0.5	0.5	7.6
1-5y	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
5y+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	2.5	38.2	17.7	14.4	10.1	9.2	3.1	4.9	100.0
B. Currency									
GBP	1.1	2.8	1.5	2.6	6.3	5.8	0.1	2.6	22.8
EUR	0.6	16.1	2.9	6.3	1.4	3.0	1.3	1.2	32.6
USD	0.7	15.6	11.1	4.0	2.2	0.2	0.7	0.9	35.6
JPY	0.0	1.5	0.9	1.3	0.3	0.0	0.0	0.2	4.0
Other	0.1	2.3	1.3	0.2	0.0	0.1	1.0	0.1	5.0
Total	2.5	38.2	17.7	14.4	10.1	9.2	3.1	4.9	100.0
C. Collateral type									
US govt	0.2	3.1	6.2	0.9	1.4	0.0	0.8	0.0	13.0
UK govt	0.1	0.6	0.9	0.3	7.4	4.9	0.2	2.4	16.8
Germany govt	0.3	1.2	0.4	0.6	0.6	0.6	1.1	0.1	4.9
France govt	0.0	1.7	0.2	0.4	0.3	1.1	0.1	0.2	4.0
GIIPS	0.0	0.2	0.0	3.6	0.1	0.2	0.4	0.0	4.6
Other sovereign	0.6	14.2	3.9	1.5	1.1	0.6	1.7	0.9	24.4
Corporate debt	1.0	10.9	3.3	4.8	1.8	1.9	0.1	2.6	26.4
Securitisation	0.1	1.7	1.4	1.4	0.2	0.4	0.1	0.5	5.5
Other	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2
Total	2.3	33.7	16.5	13.6	12.9	9.6	4.5	6.8	100.0

This table exhibits a finer breakdown of the reverse repo contracts. The numbers are in percentage points and indicate the percentage of notional value in each category. The data is double sorted by counterparty type (columns) and maturity, currency and collateral type in Panels A, B, and C respectively. The table is based on the data from the the six banks that report haircut and collateral information. Columns 1–8 refer to the following counterparty types:

1. Another reporting bank
2. Other banks
3. Broker-dealer
4. Hedge fund
5. Other asset managers
6. Insurance and pension
7. Central bank & govt and 8. Other

Table 16: The breakdown of repos

	Counterparty type								
	1	2	3	4	5	6	7	8	Total
A. Maturity									
Overnight	3.5	25.6	10.7	4.8	5.8	1.0	1.7	0.4	53.2
<3m	0.8	10.3	5.8	7.3	2.7	3.9	4.4	0.8	36.3
3m-1y	0.2	2.4	0.8	0.5	0.2	0.5	2.1	0.0	6.7
1-5y	0.3	1.7	1.5	0.0	0.0	0.3	0.0	0.0	3.8
5y+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	4.8	40.0	18.8	12.6	8.7	5.7	8.2	1.2	100.0
B. Currency									
GBP	0.6	1.9	2.2	2.3	2.3	2.8	2.2	0.4	15.1
EUR	1.4	20.9	7.3	6.8	4.5	0.9	4.9	0.5	46.9
USD	2.0	15.5	8.3	3.0	1.8	2.0	0.9	0.3	33.6
JPY	0.8	0.2	0.0	0.2	0.0	0.0	0.0	0.0	1.4
Other	0.0	1.5	1.0	0.2	0.1	0.0	0.1	0.0	2.9
Total	4.8	40.0	18.8	12.6	8.7	5.7	8.2	1.2	100.0
C. Collateral type									
US govt	0.5	1.9	0.6	0.1	0.2	0.0	0.4	0.0	3.7
UK govt	0.3	0.7	0.2	0.7	2.0	1.0	1.9	0.4	7.9
Germany govt	0.4	4.1	0.6	1.9	0.5	0.0	2.2	0.1	10.0
France govt	0.1	2.0	0.2	0.9	0.6	0.0	0.7	0.0	4.4
GIIPS	0.0	1.0	0.5	2.4	0.3	0.0	0.8	0.0	5.0
Other sovereign	2.2	8.3	4.1	2.5	0.8	0.3	2.1	0.3	20.5
Corporate debt	1.3	15.6	7.5	2.9	5.2	3.8	1.0	0.1	37.1
Securitisation	0.6	6.5	2.9	0.2	1.1	0.2	0.1	0.0	11.4
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	5.3	40.0	16.6	11.7	10.8	5.5	9.2	0.9	100.0

This table exhibits a finer breakdown of the repo contracts. The numbers are in percentage points and indicate the percentage of notional value in each category. The data is double sorted by counterparty type (columns) and maturity, currency and collateral type in Panels A, B, and C respectively. The table is based on the data from the the six banks that report haircut and collateral information. Columns 1–8 refer to the following counterparty types:

1. Another reporting bank
2. Other banks
3. Broker-dealer
4. Hedge fund
5. Other asset managers
6. Insurance and pension
7. Central bank & govt and 8. Other

Table 17: Reverse repo OLS regressions excluding CCPs with nonbank dummy

Category	Variable	(1)	(2)	(3)	(4)	(5)	(6)
Deal var	notional	0.003	0.004**	0.006**	0.007**	0.009**	0.009***
	maturity	0.095***	0.103***	0.090***	0.083***	0.097***	0.091***
Collateral var	collrating	-0.008***	-0.012***	-0.008***	-0.007***	-0.011***	-0.011***
	collmaturity	-0.001	0.002	-0.0004	0.001	0.002	0.004**
	corpdebt	-0.008*	-0.009*	-0.013*	-0.011*	-0.015*	-0.012*
	securitisation	0.036***	0.020**	0.064***	0.057***	0.052***	0.046***
	VaR	0.005**	0.005***	0.005**	0.005*	0.005**	0.005**
	asset in safe portf	-0.005*	-0.006**	-0.015***	-0.015***	-0.016***	-0.016***
Cpty type	nonbank	0.090*	0.131**	0.090*	0.090*	0.131**	0.131**
Cpty var	cptysize		-0.093**			-0.139**	-0.134**
	cptyroa		-0.003			-0.017***	-0.010***
	cptyrating		-0.021***			-0.008***	-0.011***
	cptyleverage		0.079***			0.065***	0.053***
	cptycds		-0.003			0.006**	0.006**
	cptycashratio		0.006**			0.001	0.007***
	nocptydata		-0.164***			-0.129***	-0.195***
Misc	cptycon		0.005			-0.001	-0.003
	collcon		0.002			0.004	0.005
	cpty&collrating		0.001***			0.001***	0.001***
Network var	pcu			-0.021***		-0.023***	
	pcw				-0.028***		-0.028***
	Bank FE	Yes	Yes	No	No	No	No
	Bank-Cty FE	Yes	Yes	Yes	Yes	Yes	Yes
	Currency FE	Yes	Yes	Yes	Yes	Yes	Yes
	Obs	3,925	3,907	3,925	3,925	3,907	3,907
	R^2	0.615	0.650	0.637	0.633	0.664	0.658

The table shows OLS regression results for reverse repos, excluding deals with CCPs. The dependent variable is haircut and explanatory variables are listed in the second column. The first column shows the category of explanatory variable. The columns that are labeled with numbers display regression coefficients for different explanatory variables. All quantitative variables (notional, maturity, collmaturity, VaR, cptysize, cptyroa, cptyleverage, cptycds, cptycashratio, cptycon, collcon, cpty & collrating, pcu and pcw) are standardized. Standard errors (not reported) are clustered at reporting bank level. One, two and three stars denote 10%, 5% and 1% significance levels respectively.

Table 18: Repo OLS regressions excluding CCPs with nonbank dummy

Category	Variable	(1)	(2)	(3)	(4)	(5)	(6)
Deal var	notional	0.005***	0.004***	0.005***	0.006***	0.004***	0.005***
	maturity	0.047***	0.029***	0.043***	0.049***	0.024***	0.033***
Collateral var	collrating	-0.001	0.001	-0.0001	-0.0002	0.001*	0.001*
	collmaturity	0.002	0.002	0.003*	0.003**	0.003**	0.003**
	corpdebt	0.004	0.008***	0.006**	0.007**	0.009***	0.009***
	securitisation	0.002	0.004	0.009**	0.012***	0.012***	0.014***
	VaR	0.009**	0.009***	0.007*	0.008**	0.007**	0.007**
	asset in safe portf	0.003	0.003	0.003	0.003	0.003	0.003
Cpty type	nonbank	0.080***	0.067***	0.080***	0.080***	0.067***	0.067***
Cpty var	cptysize		0.023**			0.024**	0.017
	cptyroa		0.002			0.001	0.001
	cptyrating		0.006***			0.006***	0.006***
	cptyleverage		-0.025***			-0.004	0.003
	cptycds		0.0001			0.005	0.007**
	cptycashratio		0.001			-0.006*	-0.005
	nocptydata		0.041			0.123***	0.109***
Misc	cptycon		0.014**			-0.001	-0.001
	collcon		0.006**			0.008***	0.008***
	cpty&collrating		-0.0002***			-0.0002***	-0.0002***
Network var	pcu			-0.013***		-0.014***	
	pcw				-0.017***		-0.016***
	Bank FE	Yes	Yes	No	No	No	No
	Bank-Cty FE	Yes	Yes	Yes	Yes	Yes	Yes
	Currency FE	Yes	Yes	Yes	Yes	Yes	Yes
	Obs	3028	2915	2915	3028	2915	2915
	R^2	0.572	0.589	0.572	0.572	0.589	0.589

The table shows OLS regression results for repos, excluding deals with CCPs with. The dependent variable is haircut and explanatory variables are listed in the second column. The first column shows the category of explanatory variable. The columns that are labeled with numbers display regression coefficients for different explanatory variables. All quantitative variables (notional, maturity, collmaturity, VaR, cptysize, cptyroa, cptyleverage, cptycds, cptycashratio, cptycon, collcon, cpty & collrating, pcu and pcw) are standardized. Standard errors (not reported) are clustered at reporting bank level. One, two and three stars denote 10%, 5% and 1% significance levels respectively.