Primary Dealers during the 2007-08 Crisis: Assessing Risks and Vulnerabilities*

Marco Macchiavelli†

July 19, 2019

Abstract

We study key vulnerabilities of the U.S. Primary Dealers during the 2007-08 financial crisis. Dealers' exposure to risky assets drives the repo run; importantly, repos become sensitive to counterparty risk only at the height of the crisis. Further, the way in which dealers use repo funding exposes them to several risks: financing illiquid assets with overnight repos exposes dealers to significant fire-sale risk; dealers are also exposed to rollover risk due to the maturity mismatch they take when intermediating credit to clients. Finally, we show how quickly illiquidity can spread across dealers, via chains of settlement fails.

JEL classification: G01, G10, G20.
Keywords: Financial Intermediation, Dealers, Financial Crisis, Repos.

*We thank Sebastian Infante, Valentina Galvani (discussant), Ben Munyan (discussant), and participants at the Federal Reserve Board, MFA 2018 San Antonio, and SEC Fifth Annual Conference on Financial Market Regulation for helpful comments. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Board of Governors or the Federal Reserve System.

†Federal Reserve Board, email: marco.macchiavelli@frb.gov, phone: 202-815-6316.

1 Introduction

While many market participants and policymakers recognized by late 2006 that the U.S. housing market was overheated and expected a correction, nobody quite anticipated the extent to which the bursting of the U.S. housing bubble would spread to the broader financial system, catapulting it to the brink of collapse (FCIC (2011)). The main reason why most were blindsided by this widespread contagion was the underappreciation of the fragility of the shadow banking system that fueled the mortgage market (Brunnermeier (2009)). At the core of the shadow banking system were broker-dealers, such as Lehman Brothers and Bear Stearns, active in a wide set of functions, including originating, securitizing, and financing of mortgage-related products, making markets in fixed-income instruments, and providing secured financing to hedge fund clients (Duffie, 2010). At the same time, dealers operated with high leverage, financing themselves mostly with short-term repurchase agreements (repos).

A decade after the crisis, there are still many unanswered questions about the fragility of broker-dealers, partly due to the scarcity or lack of appropriate data. In this paper, we use confidential weekly data on the largest broker-dealers operating in the U.S. (the Primary Dealers) during the 2007-08 crisis, and shed light on some vulnerabilities that can amplify and propagate shocks through the system. One way in which stress originating in the mortgage market gets amplified is through the funding of broker-dealers; we indeed show that repo funding backed by safe collateral is affected by the dealer's own exposure to these mortgage-related risky assets (counterparty risk). As a result, exposure to risky assets produces a drop in funding backed by even the safest collateral.[1] However, repo runs are not a source of risk per se. What makes runs destabilizing depends on what dealers use repo funding for—a key issue still unexplored in the literature. With a repurchase agreement, a dealer raises cash against the pledge of a basket of securities as collateral. These can be part of the dealer's

[1] The Basel III Liquidity Coverage Ratio rule effectively underestimates this scenario, by assuming a zero percent run rate on Treasury repos.

own inventory of securities, in which case the dealer is financing its own securities on the repo market; alternatively, the collateral pledged in the repo transaction can consist of the very same securities that have been posted as collateral to the dealer by its clients. In the latter case, the dealer is repledging the clients' collateral on the repo market (a process also known as rehypothecation), and the cash raised on the repo market is then channeled back to the clients.

We estimate two main activities undertaken by dealers that ultimately make them vulnerable once funding dries up: fire-sale risk, and rollover risk in the intermediation of credit to clients (see Appendix B and Figure 1). Dealers financed a sizable portion (around 40%) of their inventories of risky assets by rolling over short-term repos, mostly overnight. As a result, even a short-lived disruption of repo funding can force the dealer to sell the underlying illiquid collateral at fire-sale prices in order to pay back the repo lenders. As Figure 2 (bottom-right chart) shows, the precrisis buildup of risky asset was substantially financed in the repo market, and as these repos backed by risky collateral started to dry up, dealers had to drastically shrink their inventories of such assets.

Secondly, broker-dealers provide secured funding to their clients (such as hedge funds and smaller dealers) by rehypothecating the collateral received from them. If the dealer matches both collateral and maturity of the funding it receives and provides (matched book), there is little or no risk involved for the dealer: once the repo funding dries up, the dealer can simply stop rolling over the secured funding (reverse repo) to the client. However, dealers provide significant maturity transformation, by funding between 30% and 60% of term reverse repos via overnight repos. Maturity mismatch ultimately exposes dealers to rollover risk once their funding evaporates. In addition to maturity transformation, we document another service provided by dealers to their clients, namely collateral transformation. In particular, a small but significant portion of Treasury securities coming in (through reverse repos or sec borrowing) is associated with Agency debt and corporate debt going out (through repos or

sec lending). This suggests that clients pledged Treasury collateral to short sell agencies and corporate securities.[2]

Playing a central role in the market-making and intermediation of securities, dealers borrow and lend securities to one another. In this context, illiquidity can quickly propagate through chains of settlement fails, which occur when, upon failing to receive a security, a dealer fails to deliver the same security to another dealer (see Appendix C and Figure 3). We estimate that dealers pass fails-to-receive into fails-to-deliver almost one-to-one. This very strong propagation of settlement fails has the potential to create systemic illiquidity. Indeed, market groups and policymakers have historically been aware of the negative consequences of protracted chains of settlement fails.[3] Ultimately, on May 1, 2009, the Treasury Market Practices Group introduced a three percent fails charge for Treasury securities in an attempt to prevent future disruptions in liquidity, such as those experienced after Lehman's collapse, shown in Figure 4, with fails reaching almost $2.75 trillion on a cumulative weekly basis. Prior to May 2009, there was no explicit penalty for not delivering securities on time, other than the opportunity cost of the delay in receiving the cash, which is usually proxied for by the overnight Treasury repo rate. We empirically show that the May 2009 implementation of the fails charge for Treasury securities significantly dampened the dealer-specific incentive to pass-through settlement fails, reducing the propagation of fails across dealers.

Few empirical papers have studied different subsets of the repo market during the recent financial crisis: Gorton and Metrick (2012) study the behavior of interdealer bilateral repos, Copeland et al. (2014) focus on triparty repos, and finally Krishnamurthy et al. (2014) consider repo transactions between money market funds and repo borrowers, obtained from

[2]See Adrian et al. (2013) for an overview of repo and sec lending markets.

[3]See for instance the January 1992 Joint Report on the Government Securities Market, page 10: "In contrast to temporary shortages, an acute, protracted shortage can cause lasting damage to the marketplace", and "Dealers may be more reluctant to establish short positions in the future, which could reduce liquidity and make it marginally more difficult for the Treasury to distribute its securities without disruption". See also Fleming and Garbade (2005), and Garbade et al. (2010).

quarterly SEC filings. Moreover, Acharya et al. (2017) document that dealers in worse financial conditions borrow more from lender-of-last-resort facilities during the crisis.[4] Few examples of how dealers' stress propagates to other players are Di Maggio et al. (2017) and Aragon and Strahan (2012). All in all, we lack a full picture of how dealers manage assets and liabilities both in normal times and when facing financial stress; importantly, we also lack the understanding of which risks they take and what the resulting vulnerabilities are.

In this paper we shed light on these issues: first, we show that dealers' exposure to risky assets drives the repo funding squeeze, and find evidence in favor of the counterparty risk view of repo runs—against a pure collateral risk view. Second, we show that dealers use short-term repos to finance part of their illiquid inventories, exposing themselves to fire-sale risk. Dealers also use repos to finance reverse repos (and economically similar trades), as a way to intermediate funding and securities to their clients. Dealers take significant maturity mismatch while intermediating funding, which exposes them to rollover risk; they also offer collateral transformation services to their clients to facilitate short selling. Third, we show how illiquidity can propagate through chains of settlement fails. To be clear, the crisis highlighted many other vulnerabilities in the broker-dealer system, which we do not discuss in this paper (see Duffie (2010) for an overview). Some of them, including the extensive use of intraday credit for triparty repos, and the lack of central clearing and margining for derivatives, have been addressed by regulators and market groups postcrisis.

[4]On related topics, Covitz et al. (2013) document the run on Asset-Backed Commercial Paper, and McCabe (2010), Kacperczyk and Schnabl (2013), Strahan and Tanyeri (2015), and Schmidt et al. (2016) analyze the behavior of Money Market Mutual Funds during the crisis. Hu et al. (2015) analyze haircut and pricing in the triparty repo market. Gorton and Muir (2016) link settlement fails to the scarcity of safe debt.

2 Data

We use confidential data from the FR2004 Primary Government Securities Dealers Reports, forms A and C from January 1, 2007 to January 1, 2009.[5] These reports collect weekly positions, financing and fails data of the Primary Dealers (reporting data as of each Wednesday at close of business). Data is reported for the "legal entity that functions as the primary dealer, including any subsidiaries that it consolidates in its regulatory reports", and thus does not include data from unconsolidated subsidiaries of the same holding company. For instance, Lehman Brothers Holding Inc. consisted of many subsidiaries, among which Lehman Brothers Inc., the U.S. primary dealer for which we have data, and Lehman Brothers Inc. Europe, the London broker-dealer, and other subsidiaries for which we do not have data.

Form A reports positions, long and short, at fair (market) value. Long and short positions "in the same issue should be reported net by CUSIP", while long and short positions "in different issues should be reported gross". Reportable positions include outright transactions, new positions taken at auction or as part of an underwriting syndicate, forward contracts, when-issued positions and dollar rolls involving TBA securities; other derivatives are not included. Positions are broken down by asset class (U.S. Treasuries, Agency Notes and Coupons, Agency MBS and Corporate Securities) and residual maturity buckets, which vary asset-by-asset. Corporate Securities include private-label MBS and ABS, corporate bonds, commercial paper and privately placed securities.

Form C reports financing and fails. Financing refers to the actual funds delivered or received and is divided in "Securities In" (funds are delivered and collateral comes in) and "Securities Out" (funds are received and collateral goes out). "Securities In" refers to agreements by which securities are received from a counterparty; these include reverse repos (dealer lends cash and receives a security as collateral), securities borrowed (reporting the

[5] See the FRBNY website.

cash that is lent or the fair value of the securities if securities are exchanged or pledged as collateral), securities received from a counterparty as collateral for margin calls or for other derivatives.

"Securities Out" similarly refers to agreements to deliver securities to counterparties, including repos (dealer borrows cash and deliver securities as collateral), securities lent (reporting the cash that is borrowed or the fair value of the securities if securities are exchanged or pledged as collateral), securities delivered to a counterparty as collateral for margin calls or for other derivatives. Securities In and Out are broken down by asset class (Treasuries, Agency Debt, Agency MBS, and Corporate Securities) and maturity (overnight and continuing, and term). During the period under consideration (Jan'07 to Dec'08), a subset of Securities In and Out is reported separately: overnight repos, term repos, overnight reverse repos and term reverse repos. These repos and reverse repos include bilateral, GCF (inter-dealer), and tri-party GC agreements; while Securities In and Out are broken down by collateral type, repos and reverse repos are summed across collateral types.

Finally, Form C also reports settlement fails, at principal value. Both fails to deliver or receive securities are broken down by security class (Treasuries, Agency Debt, Agency MBS, and Corporate Securities). Fails are reported on a cumulative basis within the reporting period, which ends every Wednesday at close of business: "[f]ailed transactions that are outstanding two days or more should be summed each day they are outstanding during the reporting period". Moreover, fails include the principal value of the securities that were not delivered (received) for outright sales (purchases) and the amount that was to be paid or received as part of a financing transactions.[6] For more details on settlement fails see Fleming

[6]In the start leg of a repo, the dealer sends securities out and in the end leg it receives securities back; a dealer may fail to receive securities back in the end leg of the repo, in which case it does not return the cash and essentially starts borrowing at zero percent until it receives the securities back. Conversely, in the start leg of a reverse repo the dealer receives securities, and in the end leg it sends securities back; a dealer's failure to deliver securities can occur in the end leg, at which point the dealer essentially starts lending at zero percent until it delivers the securities back. Notice that in May 2009 a three percent fails charge was applied to Treasuries settlement fails, and in February 2012 to Agency Debt and Agency MBS fails.

and Garbade (2005).

Table 1 defines the main variables and Table 2 displays the summary statistics across the two main sub-periods, namely before and after Bear Stearns' collapse. As also evident from Figure 2, net positions in Treasuries are hovering around zero in aggregate, while net positions in Corporate Debt securities are very pro-cyclical. Furthermore, while net positions in Treasuries and Agencies are small relative to their respective repo books, net positions in Corporate Debt represent a larger share of corporate repos. Also noteworthy, corporate repos are relatively more tilted towards the overnight tenor than other repo books. For the list of dealers in the sample, see Appendix A.

3 Empirical Strategy and Results

In this section we first study repo runs and determine whether they were driven by counterparty or collateral risk. Then, we show how repos are used to finance inventories and reverse repos; in doing so, we also provide evidence of maturity and collateral transformation services provided by dealers. Finally, we study how settlement fails are propagated across dealers, and provide evidence that the 3% fails charge effectively dampened the propagation of fails.

3.1 Repo Runs

Next, we study the degree to which the run on dealers' secured funding can be attributed to collateral risk (a loss in the collateral value backing the repo) or to counterparty risk (troubled dealers lose funding secured by even the safest collateral). To this regard, we measure the dealer-specific exposure to risk, named Risky Exposure, by taking the ratio of net positions in corporate securities to the sum of long and short positions in all reported securities (Treasuries, agencies and corporates); the denominator measures the size of dealer's intermediation and market-making activities across all reported securities. Corporate secu-

rities include private-label MBS and ABS, corporate bonds, commercial paper and privately placed securities. Among them, private-label MBS held by Lehman were considered largely overvalued and thus a source of risk for Lehman (see Ball (2016) and FCIC (2011)). We start by showing that risky exposures indeed drove the secured funding squeeze: in Tables 3 and 4, we run a set of panel regressions, such as

$$Y_{i,t} = (\alpha_0 Risky_{i,t} + \beta_0 LEH_i \cdot Risky_{i,t}) \cdot PRE_t + (\alpha_1 Risky_{i,t} + \beta_1 LEH_i \cdot Risky_{i,t}) \cdot POST_t + (\alpha_2 Risky_{i,t} + \beta_2 LEH_i \cdot Risky_{i,t}) \cdot LAST_t + \mu_t + \varepsilon_{i,t}, \quad (1)$$

where Y is the weekly percentage change in one of several variables, such as repos or securities out, PRE equals one for each week between January 1, 2007 and March 14, 2008 (the pre-Bear's collapse period), POST refers to either the period between Bear's collapse and Lehman's demise (Panel A), or the weeks post-Bear's collapse up until a month prior to Lehman's bankruptcy (Panel B), and LAST refers to the weeks between August 15, 2008 and September 15, 2008 in Panel B. Finally, μ_t is a set of week fixed effects. We stop the analysis with Lehman's default because shortly after that Monday, a wide set of emergency programs, rescues and guarantees are put in place, or witness a significant increase in usage.

First of all, Table 3 shows that indeed, right after Bear's collapse, dealers' Risky Exposure starts to be correlated with the weekly change in secured funding, significantly more so for Lehman (last two rows in Panel A, or last four rows in Panel B). After Bear's collapse and especially during Lehman's last month, the sensitivity of repos to risky exposures increases in absolute value for all dealers, and especially for Lehman. The dependent variable in the first column is the weekly percentage change in repo financing, in the second column is the weekly percentage change in securities out, and in the last column is the weekly "change" in

net financing.[7] Net financing is the difference between securities out and securities in, and it measures the amount of funding raised through repos and sec lending that is not channeled out to clients through reverse repos and sec borrowing. Net Financing is therefore a measure of the additional funding raised by a dealer for its own use.[8]

Coefficients in the last two rows of column (2) suggest that for the average dealer, a 10% increase in Risky Exposures is associated with a 1% weekly drop in secured funding (Securities Out) during Lehman's last month, while it is associated with a 7% weekly drop ($9.3\% + 61.6\% = 70.9\%$ pass-through) in secured funding for Lehman itself. Overall, dealers' risky exposures seem to drive the run on their funding, more and more so as the crisis intensifies. We end the sample after Lehman files for bankruptcy because, after that, the fear of a financial meltdown pushes both regulators to increase the size of their interventions and financial institutions to rely significantly more on emergency facilities (Carlson and Macchiavelli (2018)). We acknowledge that a moderate use of emergency funding from the Federal Reserve took place before Lehman's collapse, even if it significantly dropped over the summer, just before Lehman filed for bankruptcy. If any, the use of some emergency funding by the riskier dealers induces some attenuation bias, which works against U.S. in finding a significant effect.

It is worth pointing out that the association between Risky Exposures (net positions in corporates over total longs and shorts across assets) and drops in repo financing can also be due to the active choice of the dealer to sell liquid assets (decreasing longs in the denominator of Risky Exposures) in order to deal with the decline in repo funding. This way, the dealer monetizes liquidity pools to pay back the repos that are not rolling; doing so increases its

[7] We divide the weekly dollar change in net financing (securities out minus securities in) by the lagged value of securities out. We do not use the lagged value of net financing as the denominator, since it can be either positive or negative and thus can alter the direction of the weekly change in net financing at the numerator.

[8] A way to raise net financing in a matched book trade is to apply a higher haircut to the reverse repo than to the associated repo.

share of illiquid net positions.[9] This source of bias is however unlikely to affect the relative sensitivity of Treasury and corporate repos, which is central to the next test.

3.2 Repo Runs: Collateral vs Counterparty Risk

While Table 3 shows that Lehman's funding is more sensitive to Risky Exposure than other dealers, we still cannot say whether it is due to Lehman using riskier collateral to back its funding or whether secured funding still carries remarkable counterparty risk. Table 4 addresses the crucial issue of whether the run on repo was mainly a run on some repos backed by risky collateral (*collateral risk*) regardless of the borrower's creditworthiness, or if cash lenders run on riskier counterparties regardless of the type of collateral backing the repo (*counterparty risk*), or possibly a mix of the two explanations.

During our sample period, FR2004–Form C does not break down repos by collateral, while it does so for Securities Out (which mostly includes repos and sec lending). Thus, when investigating the collateral vs counterparty risk question, we use the weekly percentage change in Securities Out broken down by collateral type; specifically we focus on the safest collateral (which is even appreciating during the crisis), namely Treasuries, and the riskiest collateral at the root of the crisis, namely Corporate Securities, which include private-label MBS, and ABS.

Under the hypothesis that the run was due only to collateral risk, we should not see any negative association between Risky Exposure and changes in funding backed by Treasuries, while observing a significant and negative association between Risky Exposure and changes in funding backed by risky collateral. Under the alternative hypothesis of counterparty risk, we

[9] A more subtle point is that the association between risky exposures and repo funding (a liability of the dealer) may come through the asset side of the dealer. Indeed, it is possible that asset managers that left considerable collateral in the custody of risky dealers would decide to pull their collateral away from the risky dealer at a certain point. The dealer would then have to stop financing that very same collateral it had in custody, and as a result shrink its repo books. For an overview of the different ways in which a dealers could fail, see Duffie (2010).

should observe a negative and significant correlation between Risky Exposures and changes in funding, almost regardless of the collateral used. Essentially, the crucial observation that would allow U.S. to disentangle the two hypotheses is whether funding backed by Treasuries is significantly negatively associated with Risky Exposure.

Table 4 provides backing for the counterparty risk hypothesis. Indeed, for the average dealer and much more so for Lehman, Risky Exposure is negatively associated with changes in funding backed by Treasuries. This result is inconsistent with a pure collateral risk hypothesis; on the contrary, it suggests that funding secured by safe assets dries up for the dealers that are more exposed to riskier and more opaque assets–counterparty risk. In Panel A we split the sample in two sub-periods, pre- and post-Bear Stearns' near default; risky exposures are not significantly associated with changes in funding backed by either Treasuries or corporate securities prior to Bear's demise. However, after Bear Stearns' near default, dealers' exposures to risky and opaque assets become a much greater concern and markets start to wonder which dealer will collapse next. In this volatile post-Bear period, dealers' risky exposures become significantly associated with declines in funding backed by Treasuries, for the average dealer (-6.25**) and especially for Lehman, which is thought to be the next in line to default (-23.73***). In Panel A, the coefficients are negative and significant for Lehman in the post-Bear period; for the average dealer in the post-Bear period, they are negative albeit significant only for Treasury collateral. Similar results hold in Panel B, where the post-Bear is further divided in two sub-periods.[10] The results in Tables 3 and 6 are robust to controlling for lagged changes in dealer's equity price, as shown in Table 5.

[10] Also, notice that using Securities Out underestimates the sensitivity of repos to risky exposures, because an increase in margin/collateral calls on a dealer would require it to post more collateral to keep certain positions, thus increasing the amount of securities pledged, or going out, at the same time as repos are shrinking.

3.3 Inventory Financing and Intermediation of Securities

Now we turn the attention to understanding how dealers intermediate credit to clients and finance their own inventories (net positions) over time.[11] To this purpose, we run a set of panel regressions (Tables 6 to 10), such as

$$\begin{aligned}\Delta SecOut_{i,t} = &(\alpha_0 \Delta SecIn_{i,t} + \beta_0 \Delta NetPos_{i,t}) \cdot PreBear_t \\ &+ (\alpha_1 \Delta SecIn_{i,t} + \beta_1 \Delta NetPos_{i,t}) \cdot PostBear_t \\ &+ (\alpha_2 \Delta SecIn_{i,t} + \beta_2 \Delta NetPos_{i,t}) \cdot PostLehman_t + \mu_t + \varepsilon_{i,t}, \end{aligned} \tag{2}$$

where $\Delta SecOut$ and $\Delta SecIn$ are the first difference in securities out and securities in, respectively; recall that Securities Out records the cash obtained by the dealer against collateral, and similarly Securities In measures the cash provided by the dealer against collateral. Finally, $\Delta NetPos$ is the first difference in the dollar value of net positions in a certain asset class. PreBear refers to the weeks from January 1, 2007 to March 14, 2008, PostBear goes from March 15 to September 15, 2008, and PostLehman refers to the September 16 to December 31, 2008 period. We include the post-Lehman period to show how intermediation and financing change after Lehman files for bankruptcy; indeed, at that juncture, dealers rely much more heavily on two emergency liquidity facilities operated by the Federal Reserve and targeted to Primary Dealers. As a result of their reliance on emergency liquidity offered at 4-week terms, they appear to strengthen their structure. Carlson and Macchiavelli (2018) study in detail how dealers used the Fed's emergency lending facilites.

For each collateral type (Treasuries, Agency MBS, Agency Debt, and Corporate Debt), Tables 6 to 10 estimate what repo funding is used for; namely, either to finance the dealer's own inventory of securities (Net Positions) or to extent secured funding to clients (Securities

[11] For an introduction to dealers' activities, see Kirk et al. (2014), and Adrian and Fleming (2005).

In). In Table 6, the first three rows in column (2) suggest that about 90% of the Treasuries received as collateral by clients are repoed out (rehypothecated); in other words, most of the lending to clients secured by Treasury collateral is funded by repledging the same collateral on the repo market. Next, the last three rows in column (2) show that precrisis about 60% of Treasury inventories are financed in the repo market; in particular, overnight repos (not term repos) are used for financing Treasuries—shown in the last three rows in columns (3) and (4). In the post-Lehman period, this relationship breaks down, with Treasury inventories no longer funded on the repo market. The move away from repo financing suggests that these Treasury securities are now unencumbered (not pledged to a third party), therefore adding to the dealer's liquidity pools. In other words, dealers seem to replenish part of their liquidity pools in the wake of Lehman's default, while they also ramp up usage of the Fed's emergency liquidity programs (see Carlson and Macchiavelli (2018)).

The main example of maturity mismatch in the intermediation of credit comes from rows seven to nine in columns (3) and (4): for instance, in the pre-Bear period, about 30% of the Treasury collateral coming in from a term reverse repo (or term sec borrowing) was pledged in an overnight repo; if an overnight repo used to fund a term reverse repo does not roll, the dealer is exposed to rollover risk for the residual duration of the term reverse repo. After Bear's near-default, dealers on average reduce the degree of maturity mismatch, meaning that term reverse repos are funded less overnight and more at comparable maturities: about 75% of the Treasury collateral from a term reverse repo is pledged in a term repo (as opposed to only 60% prior to Bear's near-default).

There is also a significant amount of negative maturity mismatch in the Treasury space–rows four to six in column (4). Prior to the collapse of Bear Stearns, about 25% of the Treasuries coming in overnight are repoed out at term; this suggests that clients are interested in borrowing a specific security to take a short position, and the dealer lends the security at term,

while borrowing the same security overnight or with an open term.[12]

Table 7 performs a similar exercise with Agency MBS collateral: many dynamics are similar to those documented in Table 6 for Treasuries. An interesting new correlation appears in the second row: out of $100 of Treasuries coming in as collateral, $11 go out in agency MBS collateral. This may be part of clients' strategies to short sell Agency MBS: to execute the strategy, a hedge fund can borrow Agency MBS from the dealer in exchange for a pledge of Treasuries as collateral. The hedge fund would then sell the borrowed security, only to buy it back at a later date (hopefully at a lower price), at which point the Agency MBS is delivered back to the dealer, and the collateral is returned. Shorting agencies at that time made sense, as these government sponsored enterprises came under considerable stress, ultimately resulting in the conservatorship of Fannie and Freddie. Table 8 repeats the exercise of Table 7, this time with Agency Debt (notes and coupons), and displays similar patterns.

Tables 9 and 10 focus on the intermediation of corporate debt securities; in line with previous regressions, Table 9 estimates average effects across all Primary Dealers, while Table 10 singles out the U.S. dealers (usually more involved in intermediating corporate debt), to show that the main effects are even stronger for them. The third row point to the fact that post Lehman, asset managers may have been actively shorting corporate securities, borrowing them from dealers against Treasury collateral. On average, 2-to-3% of Treasuries coming in were used as collateral in exchange for corporate securities.

Also, there seems to be a high degree of maturity mismatch in the intermediation of corporate securities–rows ten to twelve: throughout the sample, between 60% and 100% of term reverse repos are funded with overnight repos. Interestingly, this maturity mismatch increases as the crisis progresses. Also, prior to Lehman's default, between 25% and 43% of corporate inventories are on average financed by overnight repos–rows thirteen and fourteen

[12]Both parties in an open repo can close it at any time. Since open trades are effectively overnight, they are reported jointly with overnight trades in the FR2004 data collection – specifically called "overnight and continuing".

in columns (2) and (3); this percentage is higher for U.S. dealers (shown in Table 10). Financing increasingly illiquid and long-term assets with overnight repos exposes dealers to fire-sale losses, in the event that such overnight repos are not rolled over. In that event, unless the dealer deploys internal cash towards paying back the repos that did not roll, the dealer is forced to sell the collateral.[13]

The bottom two rows in Tables 9 and 10 suggest that, after Lehman's collapse, dealers drastically change the way they finance corporate inventories. While before Lehman's default 40% to 55% of corporate inventories were funded with overnight repos, in the following months they stop using overnight repos and fund about 90% of these inventories with term agreements. As confirmed in Carlson and Macchiavelli (2018), this is due to the fact that after Lehman files for bankruptcy, dealers rely much more heavily on emergency liquidity from the Federal Reserve to finance illiquid securities. Specifically, dealers use the Term Securities Lending Facility (TSLF) that swaps illiquid collateral (such as corporate securities and private-label MBS) for easier to finance Treasuries, for a term of 28 days (Acharya et al. (2017)).

Across the different collateral types, there is also evidence of dealers carrying out standard matched book activities (no maturity transformation), mostly in the overnight space for Treasuries, Agency Debt and Corporate Securities: in Tables 6, 8 and 9, the pass-through from overnight Securities In to overnight Securities Out (rows ten to twelve in column (3)) is always significant and hovering between 50% and 100%. The simplest form of matched book activity entails obtaining a security with an overnight reverse repo, while repoing the same security out overnight, leaving the dealer with zero net exposure to the security.

[13] Among other things, internal cash refers to cash available either from retained earnings, net financing (including charging higher haircuts on reverse repos than on repos, and then repoing out the extra collateral to raise cash), or by issuing unsecured debt.

3.4 Settlement Fails

A chain of settlement fails (called daisy chain) can occur when a dealer, failing to receive a security that was lent (or pledged) to a counterparty, ends up failing to deliver the same security to the third party it borrowed the security from. For more details on settlement fails, see Appendix C. If collateral rehypothecation is widespread, the chain of fails can cause a market-wide deterioration of liquidity: agents that are supposed to receive a security are unable to obtain it within the agreed upon timeline. We analyze the pass-through of settlement fails by running a set of panel regressions such as

$$\begin{aligned}\Delta FTD_{i,t} = &(\alpha_0 \Delta FTR_{i,t} + \beta_0 \Delta NetPos_{i,t} + \gamma_0 \Delta SecIn_{i,t}) \cdot Pre_t \\ &+ (\alpha_1 \Delta FTR_{i,t} + \beta_1 \Delta NetPos_{i,t} + \gamma_1 \Delta SecIn_{i,t}) \cdot Post_t + \mu_t + \varepsilon_{i,t}, \end{aligned} \tag{3}$$

where ΔFTD is the first difference in the dollar value of securities that a dealer fails to deliver, and ΔFTR is the analogous for fails to receive. Each regression focuses on a certain class of securities, from Treasuries to corporate debt. Net Positions and Securities In match the asset class pertaining to the settlement fail. In principle, a fail to receive a security that is promised to a third party can be cured if the dealer either purchases (increasing net positions) or borrows (increasing securities in) the needed security.

Table 11 shows that settlement fails are indeed systemic events: the dealer-specific and collateral-specific pass-through from fails to receive to fails to deliver is around 90% to 100% across collateral types and time periods. Moreover, it seems that the average dealer does not buy securities outright, nor does it borrow them to cure the chain of settlement fails: the coefficients of $\Delta NetPos$ and $\Delta SecIn$ are not significant–not shown in the table.

Since the opportunity cost of a fail to deliver is the overnight repo rate, which after Lehman's collapse is essentially zero, dealers had little to no incentive to cure settlement

fails; as a result, market participants and regulators made an effort to introduce a penalty of failing to deliver securities. The Treasury Market Practices Group, a group of market participants and regulators, strongly encourages market participants to apply a three percent fails charge for Treasuries settlement fails, starting on May 1, 2009. Importantly, on May 1, 2009 no penalty is introduced for Agency MBS fails: the Agency fails charge is introduced only later in February 2012. See Garbade et al. (2010) for more details.

Tables 12 and 13 measure the efficacy of the fails charge introduction for Treasuries settlement fails. An incentive to cure the chain of settlement fails would be embodied in a lower pass-through from fails to receive to fails to deliver. We indeed show that the introduction of the 3% Treasury fails charge in May 2009 reduces the pass-through of settlement fails. Table 12 runs separate regressions for Treasury and Agency MBS fails. However, the drawback of this approach is that we cannot say whether the divergence in pass-throughs after the introduction of the fails charge is significant or not. Therefore, in Table 13 we reshape the panel from a dealer-week level to a dealer-collateral-week level, and run the following diff-in-diff-style regression:

$$\begin{aligned}\Delta FTD_{i,t} = {} & \alpha_0 \Delta FTR_{i,t} + \beta_0 \Delta NetPos_{i,t} + \gamma_0 \Delta SecIn_{i,t} \\ & + (\alpha_1 \Delta FTR_{i,t} + \beta_1 \Delta NetPos_{i,t} + \gamma_1 \Delta SecIn_{i,t}) \cdot Treasury \\ & + (\alpha_2 \Delta FTR_{i,t} + \beta_2 \Delta NetPos_{i,t} + \gamma_2 \Delta SecIn_{i,t}) \cdot Post \\ & + (\alpha_3 \Delta FTR_{i,t} + \beta_3 \Delta NetPos_{i,t} + \gamma_3 \Delta SecIn_{i,t}) \cdot Treasury \cdot Post + \mu_t + \varepsilon_{i,t}, \quad (4)\end{aligned}$$

where Treasury equals one for Treasury collateral, and Post equals one after the 3% Treasury fails charge is introduced on May 1, 2009; the omitted collateral type is Agency MBS. Of interest is the additional post-charge effect for Treasury fails, namely α_3. As shown in Table 13, the 3% Treasury fails charge significantly reduces the pass-through of Treasury fails

relative to Agency MBS fails, the omitted group. This suggests that the reduced Treasury fails pass-through is not part of any other market-wide trend that would cure all settlement fails, but can be attributed to the staggered introduction of fails charges for different asset classes.

4 Conclusion

The business model of broker-dealers, which were at the core of the 2007-08 financial crisis, is different from that of standard commercial banks (Duffie (2010)), and not very broadly understood. In this paper we take advantage of confidential weekly data on dealers' positions and financing to shed light on some of the vulnerabilities induced by their peculiar business model. First, we show that dealers' exposure to risky assets drives their deleveraging during the crisis. We also find evidence that repo runs are in part due to counterparty risk: dealers more exposed to risky assets experience a larger drop in repos backed by even the safest assets. While repos are specifically designed to avoid counterparty risk (the default of the borrower), this seems not to be achieved in practice. Some institutional and behavioral factors can explain this, including the inability of money market funds to repossess most of the repo collateral (since it may exceed the maximum allowed maturity), and headline risk. Also, risk considerations may have led asset managers to pull their collateral away from the custody of risky dealers, forcing the latter to deleverage.

Second, we identify some vulnerabilities in the way dealers intermediate and finance securities. In particular, significant reliance on overnight repos to finance illiquid inventories exposes dealers to fire-sale risk in case these repos do not roll. Also, dealers provide significant maturity transformation to clients: a dealer can finance a one-week secured loan to a client by rehypothecating the same collateral in an overnight repo that needs to be rolled over daily. Maturity mismatch is pervasive among dealers and exposes them to rollover risk.

Finally, we show how illiquidity in fixed-income securities can easily propagate across dealers through chains of settlement fails: a dealer that fails to receive $100 worth of Treasury securities, on average fails to deliver about $90 to $100 worth of Treasuries–an almost-complete pass-through. Illiquidity can therefore spread very quickly among dealers, suggesting a high degree of collateral rehypothecation. Also, we find evidence that the introduction in May 2009 of a three percent charge on Treasury fails reduced the pass-through of fails to receive into fails to deliver, thereby attenuating the spreading of illiquidity in the Treasury space.

References

Acharya, Viral V, Michael J Fleming, Warren B Hrung, and Asani Sarkar, 2017, Dealer financial conditions and lender-of-last-resort facilities, *Journal of Financial Economics* 123, 81–107.

Adrian, Tobias, Brian Begalle, Adam Copeland, and Antoine Martin, 2013, *Repo and securities lending* (University of Chicago Press).

Adrian, Tobias, and Michael J Fleming, 2005, What financing data reveal about dealer leverage, *Current Issues in Economics and Finance* 11.

Aragon, George O, and Philip E Strahan, 2012, Hedge funds as liquidity providers: Evidence from the lehman bankruptcy, *Journal of Financial Economics* 103, 570–587.

Ball, Laurence, 2016, The fed and lehman brothers: Introduction and summary, *NBER Working Paper* .

Brunnermeier, Markus, 2009, Deciphering the liquidity and credit crunch 2007-2008, *Journal of Economic Perspectives* 23, 77–100.

Carlson, Mark A, and Marco Macchiavelli, 2018, Emergency collateral upgrades and the broker of last resort, *Available at SSRN 3233661* .

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

Covitz, Daniel, Nellie Liang, and Gustavo A Suarez, 2013, The evolution of a financial crisis: Collapse of the asset-backed commercial paper market, *The Journal of Finance* 68, 815–848.

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

Duffie, Darrell, 2010, *How big banks fail and what to do about it* (Princeton University Press).

FCIC, 2011, *The Financial Crisis Inquiry Report* (U.S. Government Printing Office).

Fleming, Michael J, and Kenneth Garbade, 2005, Explaining settlement fails, *Current Issues in Economics and Finance* 11.

Garbade, Kenneth, Frank M Keane, Lorie Logan, Amanda Stokes Kirby, and Jennifer Wolgemuth, 2010, The introduction of the tmpg fails charge for us treasury securities, *Economic Policy Review* 16.

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

Gorton, Gary, and Tyler Muir, 2016, Mobile collateral versus immobile collateral, *NBER Working Paper* .

Hu, Grace Xing, Jun Pan, and Jiang Wang, 2015, Tri-party repo pricing, *NBER Working Paper* .

Kacperczyk, Marcin, and Philipp Schnabl, 2013, How safe are money market funds?, *The Quarterly Journal of Economics* 128, 1073–1122.

Kirk, Adam, James McAndrews, Parinitha Sastry, and Phillip Weed, 2014, Matching collateral supply and financing demands in dealer banks, *Economic Policy Review* .

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

McCabe, Patrick, 2010, The cross section of money market fund risks and financial crises, *working paper* .

Schmidt, Lawrence, Allan Timmermann, and Russ Wermers, 2016, Runs on money market mutual funds, *American Economic Review* 106, 2625–57.

Strahan, Philip E, and Başak Tanyeri, 2015, Once burned, twice shy: Money market fund responses to a systemic liquidity shock, *Journal of Financial and Quantitative Analysis* 50, 119–144.

Appendix A: List of Primary Dealers (2007-2008)

The Primary Dealers in our sample usually operate through their New York branch, and they are part of either domestic or foreign bank holding companies. During our sample period, this is the list of Primary Dealers: Bank of America, Barclays, Bear Stearns, BNP Paribas, CIBC, Cantor Fitzgerald, Citigroup, Countrywide, Credit Suisse, Daiwa, Deutsche Bank, Dresdner Kleinwort, Goldman Sachs, HSBC, JP Morgan Chase, Lehman Brother, Merrill Lynch, Mizuho, Morgan Stanley, Nomura, Royal Bank of Scotland, and UBS.

Appendix B: Inventories Financing and Matched Book Trades

Dealers finance short-term reverse repos, securities borrowing (economically equivalent to reverse repos) and inventories of securities with short-term repos, securities lending (economically equivalent to repos), and other internal sources of cash, such as cash coming from the issuance of commercial paper. Most importantly, a good part of dealers' intermediation is carried out through matched book activities, which allow the dealer to intermediate securities (and earn a spread) without taking any position in the security: if a hedge fund wants to borrow cash from a dealer in exchange for a security, the dealer can enter such reverse repo while repoing out the same security for cash (rehypothecation). Therefore, the dealer is able to raise cash from the repo transaction and pass it along to the hedge fund, without taking exposure to the collateral. The dealer can earn a spread in various non-mutually exclusive ways: it can pay a smaller repo rate than the reverse repo rate it charges; it can charge a higher reverse repo haircut than the repo haircut, thus being able to use the residual free collateral to raise cash for itself (net financing). In addition, the dealer can enhance its return by rolling over an overnight repo to finance a term reverse repo – earning a term premium

for the maturity transformation service. Dealers can also intermediate securities through internalization (see Kirk et al. (2014)): if two clients of the same dealer want to take the opposite position in the same security the dealer can match those positions internally, without having to source the security externally. An advantage of internalization is that it does not take up dealers' balance sheet space; the result of this, however, is that we cannot measure the extent of internalization in our dataset. At the moment, the size of internalization is unknown. Figure 1 displays the two main uses of repos by dealers: net positions financing (left panel) and matched-book trades (right panel). In the left panel, the dealer starts with \$20 in cash raised by issuing long-term debt. In the first transaction (T1), the dealer buys a security worth \$1,000. Being short of \$980, the dealer pledges the security as collateral (repoing it out) in an overnight repo transaction with a 2% haircut, thus raising the needed amount of cash (T2). If the overnight repo does not roll over, the dealer may have to sell the underlying collateral in order to pay the amount owed to the repo lender. The right panel shows a matched book trade. Suppose that client A wants to pledge a certain security to raise \$1,000 from a dealer while the latter does not want to be exposed to the security. What the dealer can do is to provide \$1,000 in cash to client A in exchange for collateral (T1) while raising the same amount of cash by repoing out the same security pledged by client A (T2). The final column shows the net balance-sheet effect of this matched book trade in which the dealer intermediates securities without taking any position: the security pledged by client A in the reverse repo goes out as collateral for the associated repo. This type of trade is technically referred to as a matched book trade when the collateral reversed in is the same collateral being repoed out, and when the term of the reverse repo matches the term of the repo, leaving the dealer fully insulated from price movements in the underlying collateral or any rollover risk. The dealer can also earn a term premium by reversing in a security at term while repoing it out overnight.

Appendix C: Settlement Fails

Settlement fails are defined as the failure to deliver a securities agreed upon by contract. Fails to deliver mostly happen for two reasons: a dealer does not deliver the security a client purchased from it, or the dealer fails to deliver back the collateral once a reverse repo matures. When a dealer fails to receive some securities that it had to deliver to a client, the dealer can either borrow the security, or fail to deliver the security. The situation in which failing to receive a security is passed into failing to deliver the same security is referred to as a daisy chain. Figure 3 graphically portrays this case. In the example, Dealer A enters a matched book trade (a repo coupled with a reverse repo), borrowing a security from Dealer B to deliver to the Hedge Fund. At the closing leg of the trade, it is shown how the Hedge Fund's failure to deliver the security back to Dealer A triggers Dealer A's failure to deliver the same security to Dealer B–a daisy chain.

Appendix D: Maturity Adjustments

We want to estimate how much of the maturity shortening on the liability side is passed-through to the asset side. We assume that the source of variation is the maturity shortening on the dealers' funding side, and study how dealers adjust the maturity of their funding to clients as a result. To this purpose, we run a set of panel regressions (displayed in Table 14), such as

$$\begin{aligned} Term(SecIn)_{i,t} = \alpha_0 Term(SecOut)_{i,t} \cdot PreBear_t + \alpha_1 Term(SecOut)_{i,t} \cdot PostBear_t \\ + \alpha_2 Term(SecOut)_{i,t} \cdot PreLehman_t + \mu_t + \varepsilon_{i,t}, \end{aligned} \tag{5}$$

where Term(Sec In) is the ratio of securities in with residual maturity of more than one

business day over the total securities in; the analogous definition applies to Term(Sec Out). PreBear refers to the weeks from January 1, 2007 to March 14, 2008, PostBear from March 15 to September 14, 2008, and PostLehman from September 15 to January 01, 2009. Table 14 displays the results, which should not be interpreted causally, but merely as adjustments between assets and liabilities. Both columns display an incomplete (less than 1-to-1) pass-through of maturity adjustments from sources to uses of funding; the elasticities in column (1) indicate that a 10% drop in the share of term securities out (such as repos) is associated with a 5.5% reduction in the share of term securities in (such as reverse repos) after Bear's near-default, as opposed to 3.5% prior to mid-March 2008. This suggests that dealers try to maintain some degree of maturity transformation in normal times, partially insulating changes in the maturity of their assets from changes in the maturity of their liabilities; however, when faced with considerable stress, they increase the pass-through of maturity adjustments, from about 35% prior to mid-March 2008, to 55% after Bear's collapse. Hence, during financial turmoil dealers seem to reduce maturity transformation, aligning the maturity of securities in and out to a larger degree.

Figure 1: Two Stylized Examples of Dealers' Activities

This figure displays the two stylized uses of repos by dealers: net positions financing (left panel) and matched book trades (right panel).The top rows represent assets and the bottom rows liabilities. In the left panel, the dealer starts with $20 in cash raised by issuing long-term debt. In the first transaction (T1), the dealer buys a security worth $1,000. Being short $980, the dealer pledges the security as collateral (repo-ing it out) in an overnight repo transaction with a 2% haircut, thus raising the needed amount of cash (T2). If the overnight repo does not roll over, the dealer may have to sell the underlying collateral in order to pay the amount owed to the cash lender. The right panel shows a matched book deal. Suppose that client A wants to pledge a certain security to raise $1,000 from a dealer while the latter does not want to be exposed to such asset. What the dealer can do is to provide $1,000 in cash to client A in exchange for collateral (T1) while raising the same amount of cash by repo-ing out the same security pledged by client A to a cash lender (T2). This matched-book deal assumes the same haircut on both repo and reverse repo. If instead the haircut on the reverse repo were higher than that on the repo the dealer could raise additional cash, called net financing.

	Net Positions Financing				Matched Book Activity			
	Initial	T 1	T2	Final	Initial	T 1	T 2	Final
Cash	20	-1,000	980			-1,000	1,000	
Net Positions		1,000		1,000				
Reverse Repo						1,000		1,000
Total Assets	20			1,000				1,000
Repo			980	980			1,000	1,000
Other Debt	20			20				
Total Liabilities	20			1,000				1,000
Total Equity								

Figure 2: Net Positions, Securities In and Securities Out by Collateral Type.

These figures show aggregate data across all Primary Dealers taken from the FRBNY website. Each chart displays Net Positions (blue), Securities In (red), and Securities Out (green) for the following collateral types: Treasury, Agency Debt, Agency MBS and Corporate Debt. Variables and collateral types are defined in Table **??**.

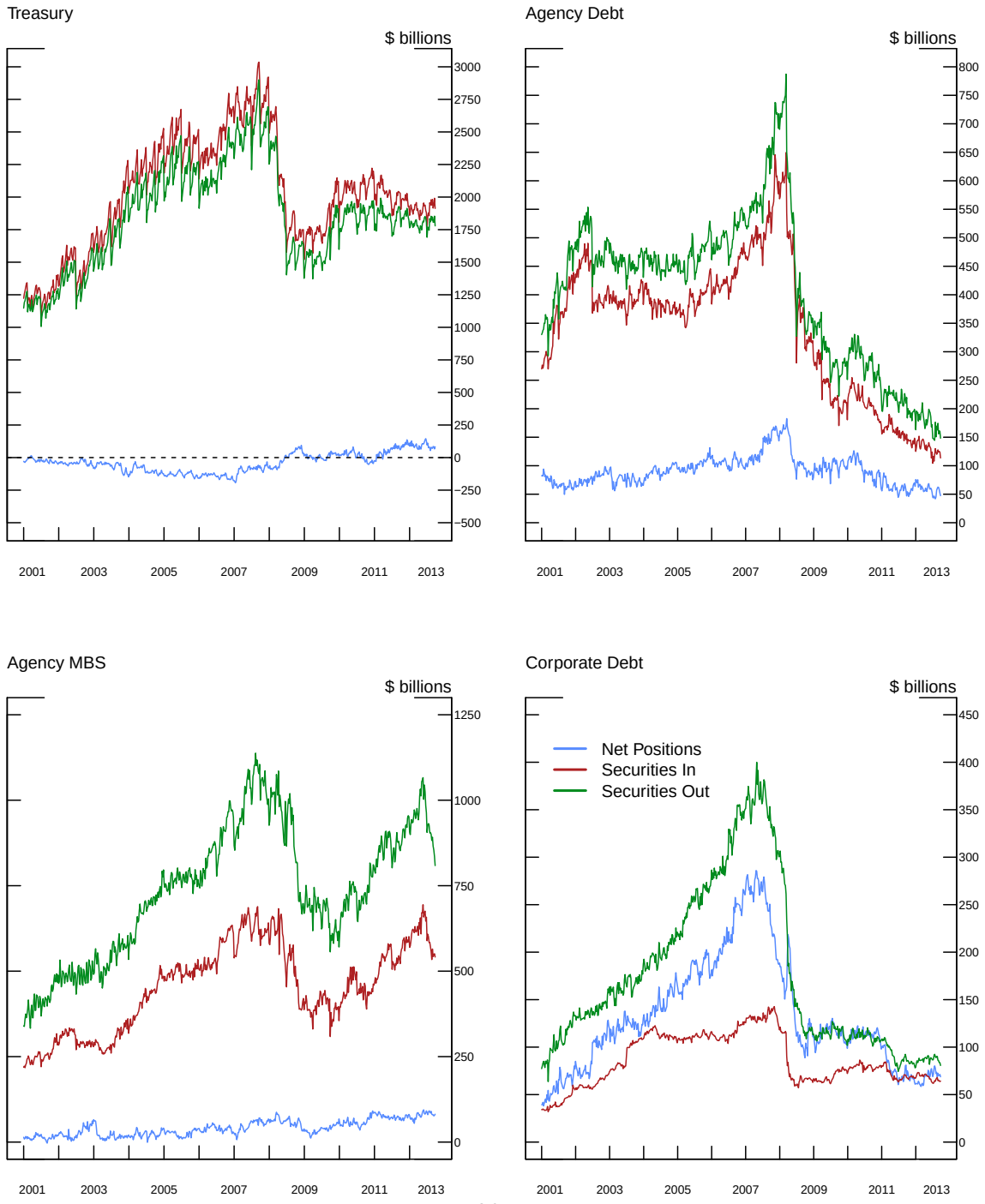

Figure 3: Example of Settlement Fails

In the opening trades (top row), a hedge fund borrows a security (yellow box) from Dealer A against cash collateral (green box); Dealer A in turn borrows the same security from Dealer B. In the closing trades (bottom row), the hedge fund fails to deliver the security back to Dealer A, which in turn fails to deliver the same security back to Dealer B. This chain of fails is commonly referred to as a daisy chain.

Figure 4: Fails to Deliver Treasuries, Agency MBS and Corporate Securities.

The chart shows the 3-week moving average of aggregate fails to deliver across all Primary Dealers taken from the FRBNY website. Fails are broken down by collateral type, and are reported as cumulative during the one-week reporting period.

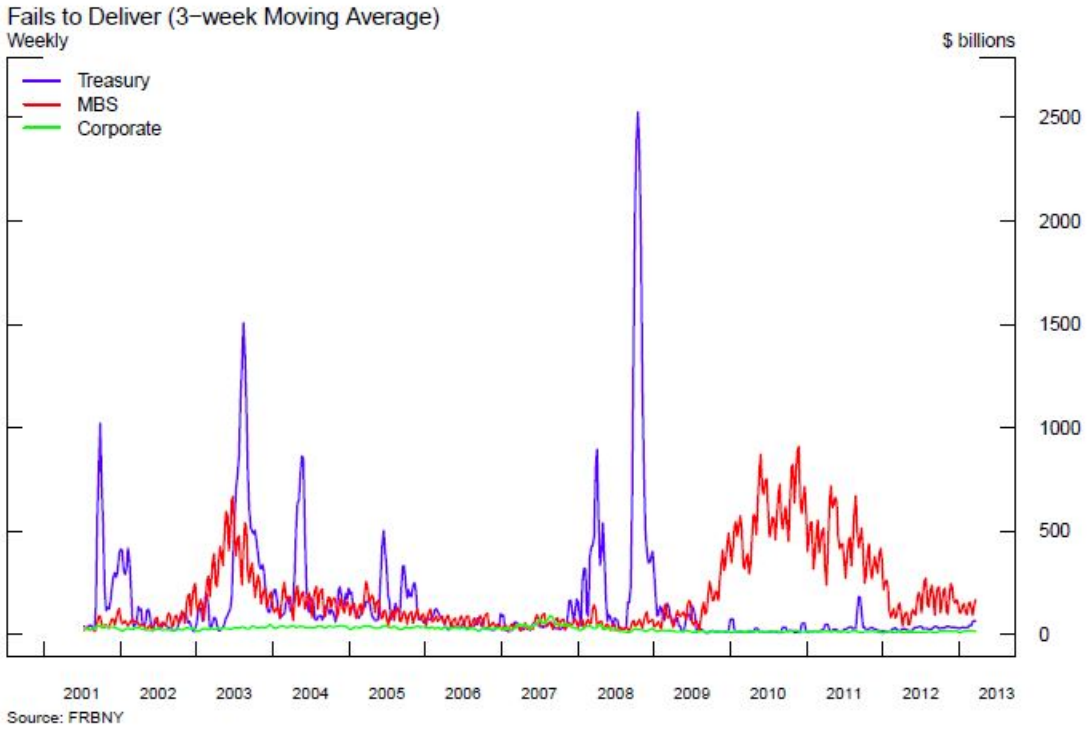

Table 1: Definitions of the main variables

Variable	Definition
Security Type	It can be one of several asset classes: U.S. Treasuries (Tsy), Agency MBS (MBS), Agency Debt (AgyDebt), and Corporate Securities (Corp). The latter includes private-label MBS, private-label ABS, corporate bonds, commercial paper, and privately placed securities, including private equities.
Securities In	For each security type mentioned above, it indicates the $ million amount of funds delivered to a counterparty as part of a secured transaction where collateral comes in. These transactions include reverse repos, securities borrowing (in case securities are swapped, the fair value of the securities pledged as collateral is reported), and securities received for counterparties as collateral for margins.
Securities In (Tenor)	For each security type, it indicates the $ million amount of Securities In at a certain tenor, which can be either overnight and open (Overnight) or with a specified tenor of more than one business day (Term).
Securities Out	For each security type, it indicates the $ million amount of funds received from a counterparty as part of a secured transaction where collateral goes out. These transactions include repos, securities lending (in case securities are swapped, the fair value of the securities pledged as collateral is reported), and securities delivered for counterparties as collateral for margins.
Securities Out (Tenor)	For each security type, it indicates the $ million amount of Securities Out at a certain tenor, which can be either overnight and open (Overnight) or with a specified tenor of more than one business day (Term).
Net Positions	For each security type, it indicated the $ million difference between long and short positions at market value. Reportable positions include outright transactions, new positions taken at auction or as part of an underwriting syndicate, forward contracts, when-issued, and dollar rolls involving TBA securities.
Risky Exposure	It is the ratio of net positions in Corporate Securities over total long and short positions in all reported securities.
Fail to Deliver	For each security type, it reports the $ million cumulative amount over the reporting period (which ends every Wednesday) of failed transactions. If a fail is outstanding for more than one day, the cumulative amount is reported. Fail to Deliver includes the principal value of securities that were not delivered for outright sales and the amount that was to be received as part of a financing transaction.
Fail to Receive	Differently from Fail to Deliver, it includes the principal value of securities that were not received for outright purchases and the amount that was to be paid as part of a financing transaction.

Table 2: Summary Statistics – variables in levels

All variables are expressed in $ millions. There are 21 Primary Dealers in the sample. Pre-Bear Stearns refers to the period between January 01, 2007 and March 14, 2008, while Post-Bear Stearns goes from March 15, 2008 to January 01, 2009. ON refers to contracts with overnight or open tenors, and Term to more-than-1-day tenors. Securities In and Out are defined in the Data section. Net Positions is long minus short positions.

Panel A: Treasury Collateral								
	Pre-Bear Stearns				Post-Bear Stearns			
	count	mean	median	st.dev	count	mean	median	st.dev
Securities In ON	1314	70110	59279	50997	786	75619	79945	47676
Securities In Term	1314	56919	45677	47582	786	56965	48011	49246
Securities Out ON	1314	68225	61511	45455	786	77291	80071	49146
Securities Out Term	1314	48479	31508	46443	786	44865	34008	40840
Net Positions	1314	-5800	-2682	8981	786	-3277	-1146	7132
Panel B: Agency MBS Collateral								
	Pre-Bear Stearns				Post-Bear Stearns			
	count	mean	median	st.dev	count	mean	median	st.dev
Securities In ON	1314	8054	2863	12740	786	10968	3887	16451
Securities In Term	1314	21304	21005	15823	786	21574	18834	17060
Securities Out ON	1314	34442	29631	26147	786	42936	34456	39415
Securities Out Term	1314	11972	6682	12933	786	10766	4750	14287
Net Positions	1314	2156	1017	3397	786	2826	1100	5514
Panel B: Agency Debt Collateral								
	Pre-Bear Stearns				Post-Bear Stearns			
	count	mean	median	st.dev	count	mean	median	st.dev
Securities In ON	1314	10519	7517	9055	786	13410	9540	12369
Securities In Term	1314	12318	8098	15530	786	15499	12409	14332
Securities Out ON	1314	17870	15780	14320	786	23152	19567	17635
Securities Out Term	1314	8319	2825	12483	786	11071	4323	13709
Net Positions	1314	3342	2030	3699	786	5047	3005	5638
Panel C: Corporate Debt Collateral								
	Pre-Bear Stearns				Post-Bear Stearns			
	count	mean	median	st.dev	count	mean	median	st.dev
Securities In ON	1314	6037	3272	6760	786	5603	3353	6148
Securities In Term	1314	4713	3872	4303	786	2874	1917	3136
Securities Out ON	1314	16871	11943	14794	786	13593	10491	12158
Securities Out Term	1314	4578	2275	6528	786	4251	1299	7354
Net Positions	1314	12274	7827	13220	786	9726	4912	11538

Table 3: Sensitivity of borrowing to risky exposures – Jan 2007 to Sep 2008

The sample goes from January 01, 2007 to September 15, 2008. Pre-Bear refers to Jan 01, 2007 to Mar 14, 2008; in Panel A, Post-Bear goes from Mar 15, 2008 to Sep 15, 2008; in Panel B, Post-Bear* goes from Mar 15, 2008 to Aug 14, 2008 and Last month goes from Aug 15, 2008 to Sep 15, 2008. Lehman equals one for Lehman Brothers. % Δ Repo is the weekly percentage change in total repos; a similar logic applies to % Δ Sec Out for total Securities Out and % Δ Net Fin for net financing, defined as the difference between Secutites Out and Securities In. Risky Exposure is the ratio of net positions in corporate securities to the sum of all long and short positions across security types. Standard errors clustered at the dealer and week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)	(3)
	%Δ Repo	%Δ Sec Out	%Δ Net Fin
Panel A: Two sub-periods			
Pre-Bear · Risky Exposure	-0.676	-0.543	-0.750*
	(1.942)	(1.885)	(0.394)
Pre-Bear · Lehman · Risky Exposure	4.437	3.420	0.367
	(3.880)	(3.773)	(0.699)
Post-Bear · Risky Exposure	-7.441**	-7.708**	-3.150*
	(3.425)	(3.427)	(1.680)
Post-Bear · Lehman · Risky Exposure	-28.524***	-28.430***	-8.877**
	(5.868)	(5.769)	(3.162)
Panel B: Three sub-periods			
Pre-Bear · Risky Exposure	-0.676	-0.543	-0.750*
	(1.943)	(1.886)	(0.395)
Pre-Bear · Lehman · Risky Exposure	4.437	3.420	0.367
	(3.883)	(3.775)	(0.699)
Post-Bear* · Risky Exposure	-7.112*	-7.492*	-2.783
	(3.850)	(3.914)	(1.935)
Post-Bear* · Lehman · Risky Exposure	-27.547***	-24.971***	-7.834**
	(6.381)	(6.176)	(3.528)
Last month · Risky Exposure	-9.700***	-9.259***	-5.672***
	(1.824)	(1.657)	(1.640)
Last month · Lehman · Risky Exposure	-37.947***	-61.601***	-18.941***
	(7.280)	(6.434)	(4.602)
N	1799	1799	1799
Week FE	Yes	Yes	Yes

Table 4: Collateral and counterparty risks – Jan 2007 to Sep 2008

The sample goes from January 01, 2007 to September 15, 2008. Pre-Bear refers to Jan 01, 2007 to Mar 14, 2008; in Panel A, Post-Bear goes from Mar 15, 2008 to Sep 15, 2008; in Panel B, Post-Bear* goes from Mar 15, 2008 to Aug 14, 2008 and Last month goes from Aug 15, 2008 to Sep 15, 2008. Lehman equals one for Lehman Brothers. % Δ Sec Out Treasury (Corporate) is the weekly percentage change in Treasury (Corporate Debt) Securities Out. Risky Exposure is the ratio of net positions in corporate securities to the sum of all long and short positions across security types. Standard errors clustered at the dealer and week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)
	% Δ Sec Out	
	Treasury	Corporate
Panel A: Two sub-periods		
Pre-Bear · Risky Exposure	-1.183	-31.421
	(2.244)	(29.021)
Pre-Bear · Lehman · Risky Exposure	-0.911	-69.547
	(3.711)	(54.470)
Post-Bear · Risky Exposure	-6.245**	-8.734
	(2.662)	(5.242)
Post-Bear · Lehman · Risky Exposure	-23.731***	-32.169***
	(8.358)	(7.077)
Panel B: Three sub-periods		
Pre-Bear · Risky Exposure	-1.183	-31.421
	(2.251)	(29.049)
Pre-Bear · Lehman · Risky Exposure	-0.911	-69.547
	(3.728)	(54.526)
Post-Bear* · Risky Exposure	-4.412	-11.495*
	(2.572)	(6.662)
Post-Bear* · Lehman · Risky Exposure	-15.328*	-26.550***
	(8.751)	(6.792)
Last month · Risky Exposure	-18.910**	9.665
	(7.885)	(10.985)
Last month · Lehman · Risky Exposure	-104.579***	-86.415***
	(14.879)	(28.686)
N	1799	1799
Week FE	Yes	Yes

Table 5: Robustness: Sensitivity of Borrowing to Risk Exposures

The sample goes from January 01, 2007 to September 15, 2008. Pre-Bear refers to Jan 01, 2007 to Mar 14, 2008 and Post-Bear goes from Mar 15, 2008 to Sep 15, 2008. L.%Δ Equity is the lagged percentage change in the dealer's equity price; the other variables are as defined in Tables 3 and 4. A total of 18 dealers have equity prices available, and are thus in this sample. Standard errors clustered at the dealer and week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)	(3)	(4)	(5)
	%Δ Repo	%Δ Sec Out	%Δ Net Fin	%Δ Sec Out	%Δ Sec Out
Collateral:	All	All	All	Treasury	Corporate
Pre-Bear · Risky Exposure	0.164	0.243	-0.902*	0.528	-43.882
	(2.367)	(2.375)	(0.515)	(2.437)	(37.941)
Pre-Bear · Lehman · Risky Exposure	5.729	4.955	0.863	2.769	-78.898
	(4.939)	(4.921)	(0.986)	(5.060)	(53.636)
Post-Bear · Risky Exposure	-3.703**	-3.671***	-1.648***	-2.591	-4.946
	(1.301)	(1.257)	(0.548)	(3.821)	(5.470)
Post-Bear · Lehman · Risky Exposure	-27.979***	-28.985***	-13.800***	-18.673*	-31.518***
	(3.460)	(3.052)	(1.947)	(10.455)	(2.007)
L.%Δ Equity	0.083***	0.056***	-0.016*	0.090**	0.093
	(0.019)	(0.017)	(0.008)	(0.039)	(0.240)
N	1371	1371	1371	1371	1371
Week FE	Yes	Yes	Yes	Yes	Yes

Table 6: Financing and Intermediation: Treasuries

The sample goes from January 01, 2007 to January 01, 2009. Pre-Bear refers to Jan 01, 2007 to Mar 14, 2008; Post-Bear goes from Mar 15, 2008 to Sep 15, 2008, and Post-Lehman from Sep 16, 2008 to Jan 01, 2009. Δ Tsy Out (In) is the weekly $ million change in Treasury securities going out (coming in). Overnight refers to overnight and continuing agreements. Δ Net Position Tsy is the weekly $ million change in Treasury net positions (long minus short). Standard errors clustered at the dealer and week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)	(3)	(4)
		Δ Tsy Out		
	(All)	(All)	(Overnight)	(Term)
Pre-Bear · Δ Tsy In	0.897***	0.916***		
	(0.039)	(0.039)		
Post-Bear · Δ Tsy In	0.882***	0.881***		
	(0.040)	(0.045)		
Post-Lehman · Δ Tsy In	0.887***	0.889***		
	(0.039)	(0.040)		
Pre-Bear · Δ Tsy In (Overnight)			0.661***	0.253***
			(0.023)	(0.024)
Post-Bear · Δ Tsy In (Overnight)			0.734***	0.149**
			(0.089)	(0.063)
Post-Lehman · Δ Tsy In (Overnight)			0.789***	0.052*
			(0.042)	(0.030)
Pre-Bear · Δ Tsy In (Term)			0.302***	0.617***
			(0.087)	(0.123)
Post-Bear · Δ Tsy In (Term)			0.142	0.736***
			(0.092)	(0.099)
Post-Lehman · Δ Tsy In (Term)			0.243*	0.747***
			(0.121)	(0.154)
Pre-Bear · Δ Net Position Tsy		0.586***	0.593***	-0.007
		(0.068)	(0.097)	(0.131)
Post-Bear · Δ Net Position Tsy		0.360***	0.428**	-0.067
		(0.090)	(0.155)	(0.138)
Post-Lehman · Δ Net Position Tsy		0.058	0.052	0.051
		(0.207)	(0.338)	(0.209)
N	2078	2078	2078	2078
Week FE	Yes	Yes	Yes	Yes
Sub-periods · (MBS, AgyDebt, Corp) In	Yes	Yes	Yes	Yes

Table 7: Financing and Intermediation: Agency MBS

The sample goes from January 01, 2007 to January 01, 2009. Pre-Bear refers to Jan 01, 2007 to Mar 14, 2008; Post-Bear goes from Mar 15, 2008 to Sep 15, 2008, and Post-Lehman from Sep 16, 2008 to Jan 01, 2009. Δ MBS Out (In) is the weekly $ million change in Agency MBS going out (coming in). Δ Net Position MBS is the weekly $ million change in Agency MBS net positions (long minus short). Δ Tsy In is the weekly $ million change in Treasuries coming in. Standard errors clustered at the dealer and week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)	(3)	(4)
		Δ MBS Out		
	(All)	(All)	(Overnight)	(Term)
Pre-Bear · Δ Tsy In	0.033*	0.034*	0.022	0.008
	(0.017)	(0.016)	(0.018)	(0.013)
Post-Bear · Δ Tsy In	0.112**	0.114**	0.074	0.040
	(0.051)	(0.052)	(0.048)	(0.025)
Post-Lehman · Δ Tsy In	-0.016	-0.026	-0.073	-0.031
	(0.088)	(0.099)	(0.108)	(0.019)
Pre-Bear · ΔMBS In	0.635***	0.633***		
	(0.144)	(0.151)		
Post-Bear · ΔMBS In	0.469**	0.465**		
	(0.171)	(0.172)		
Post-Lehman · ΔMBS In	0.480***	0.469***		
	(0.132)	(0.136)		
Pre-Bear · ΔMBS In (Overnight)			0.486***	0.077
			(0.130)	(0.063)
Post-Bear · ΔMBS In (Overnight)			0.352**	0.103*
			(0.152)	(0.058)
Post-Lehman · ΔMBS In (Overnight)			0.264	0.022
			(0.199)	(0.031)
Pre-Bear · ΔMBS In (Term)			0.515***	0.227
			(0.112)	(0.148)
Post-Bear · ΔMBS In (Term)			0.467*	0.039
			(0.250)	(0.122)
Post-Lehman · ΔMBS In (Term)			1.638***	0.147
			(0.514)	(0.136)
Pre-Bear · Δ Net Position MBS		0.273*	0.327*	-0.072
		(0.148)	(0.180)	(0.171)
Post-Bear · Δ Net Position MBS		0.898***	0.677***	0.247*
		(0.199)	(0.208)	(0.133)
Post-Lehman · Δ Net Position MBS		1.892	1.808	0.056
		(1.232)	(1.154)	(0.224)
N	2078	2078	2078	2078
Week FE	Yes	Yes	Yes	Yes
Sub-periods · (AgyDebt, Corp) In	Yes	Yes	Yes	Yes

Table 8: Financing and Intermediation: Agency Debt

The sample goes from January 01, 2007 to January 01, 2009. Pre-Bear refers to Jan 01, 2007 to Mar 14, 2008; Post-Bear goes from Mar 15, 2008 to Sep 15, 2008, and Post-Lehman from Sep 16, 2008 to Jan 01, 2009. Δ AgyDebt Out (In) is the weekly $ million change in Agency Debt going out (coming in). Δ Net Position AgyDebt is the weekly $ million change in Agency Debt net positions (long minus short). Δ Tsy In is the weekly $ million change in Treasuries coming in. Standard errors clustered at the dealer and week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)	(3)	(4)
		Δ AgyDebt Out		
	(All)	(All)	(Overnight)	(Term)
Pre-Bear · Δ Tsy In	0.035***	0.034***	-0.004	0.038**
	(0.011)	(0.011)	(0.015)	(0.015)
Post-Bear · Δ Tsy In	0.048*	0.047**	0.041*	0.006
	(0.025)	(0.021)	(0.020)	(0.009)
Post-Lehman · Δ Tsy In	0.066*	0.056*	0.055**	0.003
	(0.033)	(0.029)	(0.022)	(0.018)
Pre-Bear · Δ AgyDebt In	0.650***	0.651***		
	(0.117)	(0.117)		
Post-Bear · Δ AgyDebt In	0.534***	0.526***		
	(0.134)	(0.128)		
Post-Lehman · Δ AgyDebt In	0.571***	0.551***		
	(0.094)	(0.091)		
Pre-Bear · Δ AgyDebt In (Overnight)			0.563***	0.077**
			(0.095)	(0.033)
Post-Bear · Δ AgyDebt In (Overnight)			0.481***	0.032
			(0.136)	(0.033)
Post-Lehman · Δ AgyDebt In (Overnight)			0.635***	-0.048
			(0.100)	(0.083)
Pre-Bear · Δ AgyDebt In (Term)			0.549***	0.191***
			(0.100)	(0.057)
Post-Bear · Δ AgyDebt In (Term)			0.361**	0.220***
			(0.157)	(0.053)
Post-Lehman · Δ AgyDebt In (Term)			0.125	0.313*
			(0.092)	(0.165)
Pre-Bear · Δ Net Position AgyDebt		0.548***	0.659***	-0.105
		(0.074)	(0.133)	(0.073)
Post-Bear · Δ Net Position AgyDebt		0.766***	0.594***	0.177
		(0.095)	(0.125)	(0.110)
Post-Lehman · Δ Net Position AgyDebt		0.631***	0.412**	0.197
		(0.127)	(0.145)	(0.127)
N	2078	2078	2078	2078
Week FE	Yes	Yes	Yes	Yes
Sub-periods · (MBS, Corp) In	Yes	Yes	Yes	Yes

Table 9: Financing and Intermediation: Corporate Securities

The sample goes from January 01, 2007 to January 01, 2009. Pre-Bear refers to Jan 01, 2007 to Mar 14, 2008; Post-Bear goes from Mar 15, 2008 to Sep 15, 2008, and Post-Lehman from Sep 16, 2008 to Jan 01, 2009. Δ Corp Out (In) is the weekly $ million change in Corporate Debt going out (coming in). Δ Net Position Corp is the weekly $ million change in Corporate Debt net positions (long minus short). Δ Tsy In is the weekly $ million change in Treasuries coming in. Standard errors clustered at the dealer and week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)	(3)	(4)
		Δ Corp Out		
	(All)	(All)	(Overnight)	(Term)
Pre-Bear · Δ Tsy In	0.009	0.007	0.003	0.005
	(0.007)	(0.007)	(0.008)	(0.004)
Post-Bear · Δ Tsy In	-0.014	-0.014	-0.009	-0.005
	(0.014)	(0.013)	(0.012)	(0.013)
Post-Lehman · Δ Tsy In	0.026***	0.022**	0.019**	0.003
	(0.007)	(0.009)	(0.008)	(0.009)
Pre-Bear · Δ Corp In	0.730***	0.711***		
	(0.224)	(0.218)		
Post-Bear · Δ Corp In	0.925***	0.932***		
	(0.201)	(0.188)		
Post-Lehman · Δ Corp In	1.047***	1.111***		
	(0.219)	(0.174)		
Pre-Bear · Δ Corp In (Overnight)			0.555***	0.066
			(0.193)	(0.046)
Post-Bear · Δ Corp In (Overnight)			0.732***	0.111
			(0.197)	(0.103)
Post-Lehman · Δ Corp In (Overnight)			1.062***	0.095
			(0.176)	(0.095)
Pre-Bear · Δ Corp In (Term)			0.586***	0.269**
			(0.198)	(0.106)
Post-Bear · Δ Corp In (Term)			1.020***	0.009
			(0.167)	(0.123)
Post-Lehman · Δ Corp In (Term)			0.705**	0.233
			(0.263)	(0.259)
Pre-Bear · Δ Net Position Corp		0.249**	0.236*	0.010
		(0.104)	(0.116)	(0.022)
Post-Bear · Δ Net Position Corp		0.433**	0.403**	0.031
		(0.163)	(0.146)	(0.071)
Post-Lehman · Δ Net Position Corp		0.872***	0.086	0.785***
		(0.153)	(0.121)	(0.269)
N	2078	2078	2078	2078
Week FE	Yes	Yes	Yes	Yes
Sub-periods · (MBS, AgyDebt) In	Yes	Yes	Yes	Yes

Table 10: Financing and Intermediation: Corporate Securities, with U.S. Dealers only

The sample goes from January 01, 2007 to January 01, 2009. Pre-Bear refers to Jan 01, 2007 to Mar 14, 2008; Post-Bear goes from Mar 15, 2008 to Sep 15, 2008, and Post-Lehman from Sep 16, 2008 to Jan 01, 2009. Δ Corp Out (In) is the weekly $ million change in Corporate Debt going out (coming in). Δ Net Position Corp is the weekly $ million change in Corporate Debt net positions (long minus short). Δ Tsy In is the weekly $ million change in Treasuries coming in. Standard errors clustered at the dealer and week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)	(3)	(4)	(5)	(6)
		All Dealers			US Dealers Only	
		Δ Corp Out			Δ Corp Out	
	(All)	(Overnight)	(Term)	(All)	(Overnight)	(Term)
Pre-Bear · Δ Tsy In	0.007	0.003	0.005	0.004	0.002	0.005
	(0.007)	(0.008)	(0.004)	(0.006)	(0.008)	(0.006)
Post-Bear · Δ Tsy In	-0.014	-0.009	-0.005	-0.015	-0.001	-0.014
	(0.013)	(0.012)	(0.013)	(0.022)	(0.013)	(0.014)
Post-Lehman · Δ Tsy In	0.022**	0.019**	0.003	0.038	0.025**	0.012
	(0.009)	(0.008)	(0.009)	(0.024)	(0.009)	(0.026)
Pre-Bear · Δ Corp In	0.711***			0.518*		
	(0.218)			(0.233)		
Post-Bear · Δ Corp In	0.932***			1.166**		
	(0.188)			(0.395)		
Post-Lehman · Δ Corp In	1.111***			1.083***		
	(0.174)			(0.155)		
Pre-Bear · Δ Corp In (Overnight)		0.555***	0.066		0.299*	0.053
		(0.193)	(0.046)		(0.151)	(0.065)
Post-Bear · Δ Corp In (Overnight)		0.732***	0.111		0.748	0.337
		(0.197)	(0.103)		(0.503)	(0.204)
Post-Lehman · Δ Corp In (Overnight)		1.062***	0.095		0.963***	0.189
		(0.176)	(0.095)		(0.175)	(0.155)
Pre-Bear · Δ Corp In (Term)		0.586***	0.269**		0.511**	0.242*
		(0.198)	(0.106)		(0.225)	(0.128)
Post-Bear · Δ Corp In (Term)		1.020***	0.009		1.121**	0.109
		(0.167)	(0.123)		(0.362)	(0.093)
Post-Lehman · Δ Corp In (Term)		0.705**	0.233		1.086***	-0.282
		(0.263)	(0.259)		(0.188)	(0.388)
Pre-Bear · Δ Net Position Corp	0.249**	0.236*	0.010	0.360***	0.369**	-0.018
	(0.104)	(0.116)	(0.022)	(0.100)	(0.114)	(0.026)
Post-Bear · Δ Net Position Corp	0.433**	0.403**	0.031	0.460***	0.551***	-0.089
	(0.163)	(0.146)	(0.071)	(0.082)	(0.110)	(0.061)
Post-Lehman · Δ Net Position Corp	0.872***	0.086	0.785***	0.944***	0.050	0.889***
	(0.153)	(0.121)	(0.269)	(0.128)	(0.120)	(0.233)
N	2078	2078	2078	986	986	986
Week FE	Yes	Yes	Yes	Yes	Yes	Yes
Sub-periods · (MBS, AgyDebt) In	Yes	Yes	Yes	Yes	Yes	Yes

Table 11: Daisy chains

The sample goes from January 01, 2007 to January 01, 2009. Pre-Bear refers to Jan 01, 2007 to Mar 14, 2008; Post-Bear goes from Mar 15, 2008 to Sep 15, 2008, and Post-Lehman from Sep 16, 2008 to Jan 01, 2009. For each panel, Fails to Receive and Deliver, Securities In and Net Position all refer to the same asset class (see panel description). Standard errors clustered at the dealer and week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)	(3)
		Δ Fail to Deliver	
Panel A: Treasuries			
Pre-Bear · Δ Fail to Receive	0.994***	0.994***	0.993***
	(0.056)	(0.056)	(0.057)
Post-Bear · Δ Fail to Receive	0.983***	0.982***	0.985***
	(0.047)	(0.048)	(0.047)
Post-Lehman · Δ Fail to Receive	0.900***	0.902***	0.901***
	(0.038)	(0.038)	(0.038)
Panel B: Agency MBS			
Pre-Bear · Δ Fail to Receive	0.956***	0.956***	0.956***
	(0.025)	(0.027)	(0.026)
Post-Bear · Δ Fail to Receive	0.991***	0.992***	0.992***
	(0.009)	(0.010)	(0.009)
Post-Lehman · Δ Fail to Receive	0.887***	0.894***	0.893***
	(0.089)	(0.084)	(0.083)
Panel C: Corporate Debt			
Pre-Bear · Δ Fail to Receive	0.944***	0.944***	0.944***
	(0.030)	(0.029)	(0.029)
Post-Bear · Δ Fail to Receive	1.008***	1.008***	1.010***
	(0.017)	(0.017)	(0.018)
Post-Lehman · Δ Fail to Receive	1.046***	1.025***	1.022***
	(0.114)	(0.097)	(0.096)
N	2078	2078	2078
Week FE	Yes	Yes	Yes
Sub-period · Net Position	No	Yes	Yes
Sub-period · Securities In	No	No	Yes

Table 12: Treasury fails charge introduction – May 01, 2009

The sample goes from January 01, 2007 to May 01, 2010. Pre-Bear refers to Jan 01, 2007 to Mar 14, 2008; Post-Bear goes from Mar 15, 2008 to Sep 15, 2008, Post-Lehman from Sep 16, 2008 to April 30, 2009, and Post-Tsy Fails Charge from May 01, 2009 to May 01, 2010. For each column, Fails to Receive Securities In and Net Position all refer to the same asset class of the corresponding Fail to Deliver. Variables are weekly changes in $ million. Standard errors clustered at the dealer and week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)	(3)	(4)
	Δ Fail to Deliver			
	Treasuries		Agency MBS	
Pre-Bear · Δ Fail to Receive	0.991***	0.991***	0.956***	0.956***
	(0.057)	(0.058)	(0.025)	(0.025)
Post-Bear · Δ Fail to Receive	0.983***	0.985***	0.991***	0.992***
	(0.047)	(0.046)	(0.009)	(0.008)
Post-Lehman · Δ Fail to Receive	0.898***	0.899***	0.938***	0.939***
	(0.039)	(0.038)	(0.067)	(0.068)
Post-Tsy Fails Charge · Δ Fail to Receive	0.817***	0.818***	1.040***	1.038***
	(0.067)	(0.066)	(0.049)	(0.049)
N	3268	3268	3268	3268
Week FE	Yes	Yes	Yes	Yes
Sub-periods · Δ Net Position	No	Yes	No	Yes
Sub-periods · Δ Securities In	No	Yes	No	Yes

Table 13: Treasury fails charge introduction – Diff-in-Diff

The sample goes from January 01, 2007 to May 01, 2010. Post refers to the period from May 01, 2009 to May 01, 2010, after the 3% fails charge is levied on Treasury fails. Treasury equals one for Treasury collateral. For each dealer-week pair, there are two observations, one for Treasury collateral and one for Agency MBS collateral. Variables are weekly changes in $ million. Standard errors clustered at the collateral-dealer and collateral-week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)
	Δ Fail to Deliver	
Δ Fail to Receive	0.969***	0.973***
	(0.054)	(0.053)
Treasury · Δ Fail to Receive	-0.033	-0.038
	(0.031)	(0.062)
Post · Δ Fail to Receive	0.161*	0.140**
	(0.081)	(0.068)
Post · Treasury · Δ Fail to Receive	-0.279***	-0.258**
	(0.090)	(0.106)
N	6492	6492
Collateral · Week FE	Yes	Yes
Collateral · Sub-periods · Δ Net Position	No	Yes
Collateral · Sub-periods · Δ Securities In	No	Yes

Table 14: Maturity adjustments

The sample goes from January 01, 2007 to January 01, 2009. Pre-Bear refers to Jan 01, 2007 to Mar 14, 2008; Post-Bear goes from March 15, 2008 to Sep 14, 2008; Post-Lehman Month goes from Sep 15, 2008 to Jan 01, 2009. Term(Sec In/RevRepo/Sec Out) is the share of either Securities In, Reverse Repos, or Securities Out with residual maturity greater than one day. Standard errors clustered at the dealer and week level in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1)	(2)	(3)	(4)
	Term(Sec In)	Term(RevRepo)	Term(Sec In)	Term(Sec In)
Collateral:	All	All	Treasury	Corporate
Pre-Bear · Term(Sec Out)	0.347***	0.391***	0.468***	0.318**
	(0.075)	(0.091)	(0.087)	(0.147)
Post-Bear · Term(Sec Out)	0.545***	0.553***	0.667***	0.131
	(0.050)	(0.059)	(0.129)	(0.241)
Post-Lehman · Term(Sec Out)	0.480***	0.445**	0.405***	0.180*
	(0.119)	(0.157)	(0.124)	(0.101)
N	2100	2100	2100	2100
Week FE	Yes	Yes	Yes	Yes
Dealer FE	Yes	Yes	Yes	Yes