

Federal Reserve Bank of New York
Staff Reports

A Primer on the GCF Repo[®] Service

Paul Agueci
Leyla Alkan
Adam Copeland
Isaac Davis
Antoine Martin
Kate Pingitore
Caroline Prugar
Tyisha Rivas

Staff Report No. 671
April 2014
Revised May 2014



This paper presents preliminary findings and is being distributed to economists and other interested readers solely to stimulate discussion and elicit comments. The views expressed in this paper are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System. Any errors or omissions are the responsibility of the authors.

A Primer on the GCF Repo[®] Service

Paul Agueci, Leyla Alkan, Adam Copeland, Isaac Davis, Antoine Martin, Kate Pingitore, Caroline Prugar, and Tyisha Rivas

Federal Reserve Bank of New York Staff Reports, no. 671

April 2014

Revised May 2014

JEL classification: E42, E58, G23, G28

Abstract

This primer provides a detailed description of the GCF Repo[®] Service, a financial service provided by the Fixed Income Clearing Corporation. The primer is composed of an introductory note and two separate papers.

The first paper focuses on the clearance and settlement of GCF Repo. These financial plumbing details are especially important because the settlement of GCF Repo has been and will continue to be impacted by the current reforms to the tri-party repo settlement platform. In particular, the authors lay out the various ways that intraday credit was used pre-reform to facilitate the settlement of GCF Repo and why this use of credit is problematic. They also describe the reforms that are planned or in effect already, and consider how these reforms affect the use of intraday credit.

The second paper examines how dealers use the GCF Repo Service. The authors first describe the various strategies that dealers employ when trading GCF Repo and then use empirical analysis to quantify the predominance of these strategies.

Although they focus on different aspects of the GCF Repo Service, the two papers are complementary. This is because the strategies that dealers follow in trading GCF Repos are influenced by the clearance and settlement procedures in place. Furthermore, when gauging the risks of potential changes to the clearance and settlement of GCF Repo, it is important to take into account how GCF Repos are traded. Consequently, the papers are presented jointly so as to encourage readers to become familiar with both aspects of the GCF Repo Service.

Key words: GCF Repo, tri-party repo reforms, financial intermediation

Corresponding author: Copeland: Federal Reserve Bank of New York (e-mail: adam.copeland@ny.frb.org). The views expressed in this paper are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.

Part 1: Introduction to the GCF Repo[®] Service¹

by Adam Copeland

Repurchase agreements, or repos, are widely used by financial entities to access money markets. Primary dealers, for example, reported using repos to finance \$1.9 trillion in securities on July 31, 2013.² This primer focuses on a particular type of repo, the General Collateral Finance Repo Service (GCF Repo[®]) introduced in 1998 by the Fixed Income Clearing Corporation (FICC).³ GCF Repo was originally designed to be used among securities dealers, providing a cost-effective way for them to exchange securities and cash among themselves (Fleming and Garbade 2003).

The two papers in this primer concentrate on different aspects of GCF Repo. The first paper, Part 2, by Kate Pingitore, Paul Agueci, Caroline Prugar, Leyla Alkan, Tyisha Rivas, and Adam Copeland focuses on how GCF Repo trades are cleared and settled, and describes how current reforms to the settlement of repos relate to this service. In particular, the authors lay out the various ways that intraday credit was used pre-reform to facilitate the settlement of GCF Repo trades, and why this use of credit is problematic. They then describe the reforms that have been or are plan to be implemented and the effect of these reforms on the use of intraday credit.

The second paper, Part 3, by Adam Copeland, Isaac Davis, and Antoine Martin, focuses on how dealers use this financial service. After describing the various strategies that dealers may employ, the authors quantify the predominance of these strategies. For example, the article describes the types of dealers seeking funding through GCF Repo and the amount of cash typically borrowed. The authors also describe how dealers use GCF Repo in conjunction with their other repo transactions, in normal times and during periods of stress.

Although focusing on different aspects of the GCF Repo service, the papers are complementary. This is because the strategies that dealers may follow in trading GCF Repos are influenced by the clearance and settlement procedures in place. Furthermore, when gauging the risks of potential changes to the clearance and settlement of GCF Repo, it is important to take into account how GCF Repos are traded.

Both papers rely upon a basic understanding of the GCF Repo service, which this introduction hopes to impart (see also Ingber (2003)). We begin by broadly describing repurchase agreements and then focus on the institutional details of GCF Repo. We end by summarizing the main benefits of the GCF Repo service.

¹ The views expressed herein are those of the author and do not necessarily represent the views of the Federal Reserve Bank of New York or the Federal Reserve System.

² See the August 8, 2013, release of the [Primary Dealer Statistical Releases](#), published by the Federal Reserve Bank of New York.

³ GCF Repo[®] Service (hereinafter, “GCF Repo”) is a registered service mark of the Fixed Income Clearing Corporation.

1. Repurchase Agreements

Repos are essentially a pair of transactions between two entities: an agreement to buy a security now (which constitutes the opening leg of the repo), joined with an agreement to sell back the same security in the future at a specified price (the closing leg).⁴ Apart from their different treatment under bankruptcy, repos often resemble collateralized loans, where the difference in the price of the security across the two legs of the repo transaction translates into an interest rate. Adopting the view of a repo as a collateralized loan, we designate the entity purchasing (and then re-selling) the securities as the cash investor. The other entity is labeled the collateral provider.

Negotiating which securities can be posted as collateral, then, as well as the total value of securities to be posted as collateral are important parts of a repo agreement. When repos are used for funding, which is the more usual case, industry practice is for the value of collateral to exceed the amount of cash.⁵ This difference is called the margin, and it measures the amount by which a repo is over-collateralized. The margin protects the cash investor in case the collateral provider defaults, by providing a buffer against fluctuations in the value of the securities posted as collateral as well as a loss in value associated with the quick liquidation of securities.⁶

In Chart 1.1, we present a repo between a collateral provider and a cash investor. The trade terms are a loan of \$1 billion, secured by U.S. Treasuries, of overnight maturity with an interest rate of 10 basis points and a margin of 2 percent. In settling this repo, the collateral provider delivers \$1.02 billion in U.S. Treasuries to the cash investor at date t in exchange for \$1 billion in cash. Then at date $t+1$, the investor releases the Treasuries back to the collateral provider in return for \$1,000,002,777.78 in cash (where $\$2,777.78 = \$1 \text{ billion} * 1/360 * 10 \text{ basis points}$)).

Repos are flexible enough that cash investors can specify that a particular security be posted as collateral. It is common, however, for a cash investor to specify only that the security underlying the transaction belong to a general asset class (as in the example in Chart 1.1). In these *general collateral* repos, the cash investor agrees to lend cash against a class of securities, such as U.S. Treasuries, agency debentures, or investment-grade corporate bonds.

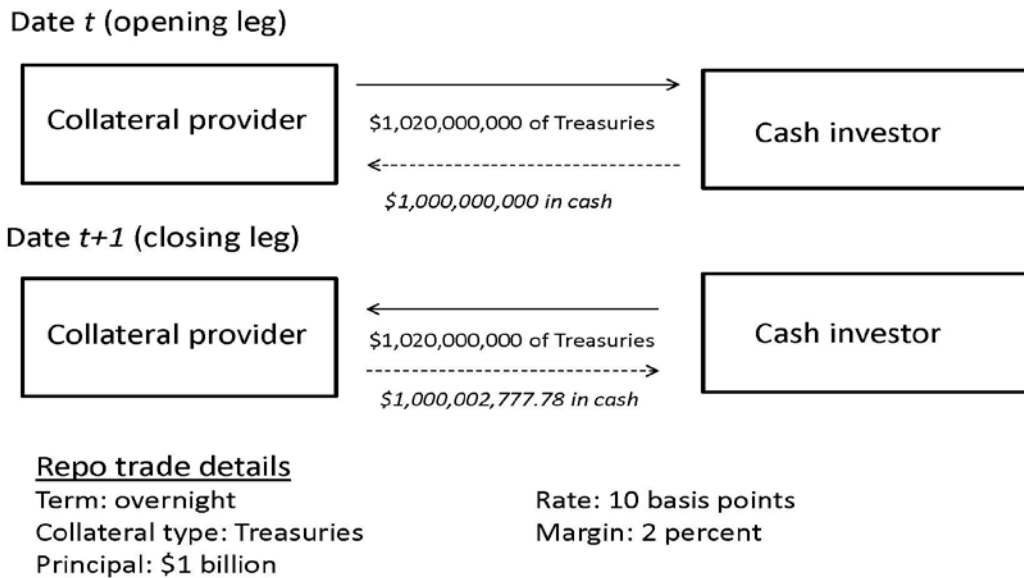
In the United States, repo trades typically settle in two ways. The first is on a bilateral basis. In this case, the collateral provider and cash investor negotiate the repo agreement, agreeing to the principal amount, interest rate, margin, term, and class of acceptable collateral. Here, each entity needs to have procedures in place to ensure proper settlement.

⁴ Technically, under the master agreements for repos, the requirement is to repurchase the same or equivalent securities, where “equivalent” means fungible.

⁵ Repos can also be used to access the collateral markets. In these cases, industry practice in setting margins and interest rates is different than what is described in this article, reflecting the different motivation driving the transaction (see Garbade (2006)).

⁶ Cash investors cannot make gains when selling these securities. Proceeds from their sale above the principal amount of the repo are returned to the trustee managing the estate of the defaulted dealer. Furthermore, if the proceeds from the sale does not cover the principal, the cash lenders get an unsecured claim on the estate of the defaulted dealer.

Chart 1.1: Settlement of a Repo



Note: $\$1,000,002,777.78 = \$1,000,000,000 + (\$1,000,000,000 * 1/360 * 10 \text{ basis points})$.

In particular, on the opening repo leg, the cash investor has to ensure that the collateral provider sent the securities in the agreed-upon asset class and that the value of the securities satisfies the margin requirement. If cash investors are active in the repo market, tracking and valuing the securities posted as collateral is a major task, especially given the multitude of securities.⁷

Partially in response to these sizable settlement costs, a second way to settle repos was developed, the tri-party repo platform. As suggested by the name, tri-party repos involve a third party--a clearing bank. Both large clearing banks, JP Morgan Chase (JPMC) and Bank of New York Mellon (BNYM), offer tri-party repo services. Just as in the bilateral case, tri-party repos are negotiated between the collateral provider and the cash investor. Once the terms are agreed upon, the settlement details are transmitted to the clearing bank. The clearing bank then settles the repo agreement on its books, taking care to ensure that the details of the repo agreement are met. In particular, the clearing banks track and value the securities used as collateral and ensure that the proper margining requirements are fulfilled when settling a trade. We emphasize that the

⁷ For example, according to statistics provided to the author by the Federal Reserve Bank of New York, there were over 1 million mortgage-backed securities outstanding and almost 10,000 agency debt securities outstanding in the Fedwire[®] Securities Service as of December 2012.

clearing banks do not broker transactions or help negotiate the terms; their role is limited to the clearance and settlement of these trades.⁸

Tri-party repos are almost always general collateral repos and are used by securities dealers to raise funds from cash investors, such as money market mutual funds and investment managers.⁹ According to market participants, tri-party repos are one of the main tools through which dealers fund themselves. Indeed, the amount of collateral posted for tri-party repo trades was over \$1.6 trillion on July 10, 2013.¹⁰

The GCF Repo service exists alongside, but dependent upon, the tri-party repo platform. In the next section we describe the institutional details of this financial service. We then circle back and discuss the tight connection between GCF Repo and tri-party repo trades.

2. The GCF Repo® Service

GCF Repo differs from standard repos along a number of dimensions. It is offered by the Fixed Income Clearing Corporation, and as such, only institutions deemed eligible by FICC can negotiate GCF Repo trades.¹¹ While GCF Repo could potentially involve different types of participants, currently it is mostly used by securities dealers. For expositional clarity, then, we refer to institutions trading GCF Repos as securities dealers, or dealers. GCF Repos are negotiated through interdealer brokers (IDBs) on a blind basis.¹² Dealers, then, tell an IDB the terms under which they are willing to borrow or lend cash (or, alternatively, buy and sell securities). The IDB then tries to broker a trade, while maintaining each dealer's anonymity. Once a trade has been brokered, the IDB submits the trade details to FICC, which, acting as a central counterparty, interposes itself and becomes the legal counterparty to both sides of the repo transaction. In summary, GCF Repo provides a way for dealers to anonymously negotiate repos among themselves. Furthermore, dealers do not face counterparty risk from each other, because of FICC's role as a central counterparty.

To protect itself against the risk of a dealer default, FICC, in addition to having eligibility requirements, requires dealers trading GCF Repo to post collateral into a clearing fund.¹³ Because dealers post collateral to the clearing fund and because of the guarantee provided by the FICC, GCF Repo trades do not include a margin requirement. Rather, the value of securities posted as collateral is equal to the amount of cash lent.

⁸ See Copeland, Martin, and Walker (forthcoming) for more details on tri-party repo.

⁹ See Alkan et al (2013) for more information on cash investors.

¹⁰ The Federal Reserve Bank of New York publishes aggregate statistics on tri-party repo and GCF Repo trades on the [Tri-Party Repo Infrastructure Reform](#) web page.

¹¹ Visit <http://www.dtcc.com/about/subs/ficc.php> for more information about FICC.

¹² In December 2012 there were 120 entities eligible to trade GCF Repos. A list of the financial entities eligible to participate in GCF Repo can be found at http://www.dtcc.com/customer/directories/ficc/ficc_gov.php. Look for those members with the "Repo Netting/GCF" service designation. The IDBs are also listed. Look for those members with "Broker account" tags next to their name.

¹³ The formula used to determine how much collateral a dealer needs to deliver into the clearing fund is laid out in the FICC's government securities division rulebook, which is posted on its [Rules and Procedures](#) web page.

To improve liquidity for these trades and to simplify settlement, FICC standardizes GCF Repo trades by defining the acceptable classes of securities used as collateral. Dealers negotiating a GCF Repo transaction are limited to 10 general asset classes for collateral (see Table 1.1). Currently, however, there are only 9 collateral classes traded, because there are no longer any securities which fall into the FDIC Guaranteed Corporate Bonds collateral class.¹⁴

In Chart 1.2, we provide an example GCF Repo between dealer A and dealer B, to highlight the differences with the standard repo described in Chart 1.1. In the first step, the dealers negotiate, anonymously, through an IDB. The IDB then sends settlement instructions to FICC, which novates the trade, becoming the legal counterparty to both dealer A and dealer B. In this example, at date t , dealer A sends \$1 billion in U.S. Treasuries to FICC in return for \$1 billion in cash. FICC then sends the \$1 billion in U.S. Treasuries to dealer B in return for \$1 billion in cash. On date $t+1$, these flows are reversed, with the U.S. Treasuries being returned to dealer A and the cash plus interest being returned to dealer B, with FICC acting as intermediary. This example is highly stylized; the details of GCF Repo settlement are provided in Part 2 (by Pingitore, Agueci, Prugar, Alkan, Rivas, and Copeland).

In addition to assuming counterparty risk, FICC provides netting services. At the end of each trading day, FICC computes for each dealer and each of the general collateral categories the amount of securities the dealer has promised to deliver and the amount that has been promised to the dealer. The difference between these two amounts, the net position of a dealer in a collateral category, is settled.

Table 1.1: General Collateral Classes in GCF Repo

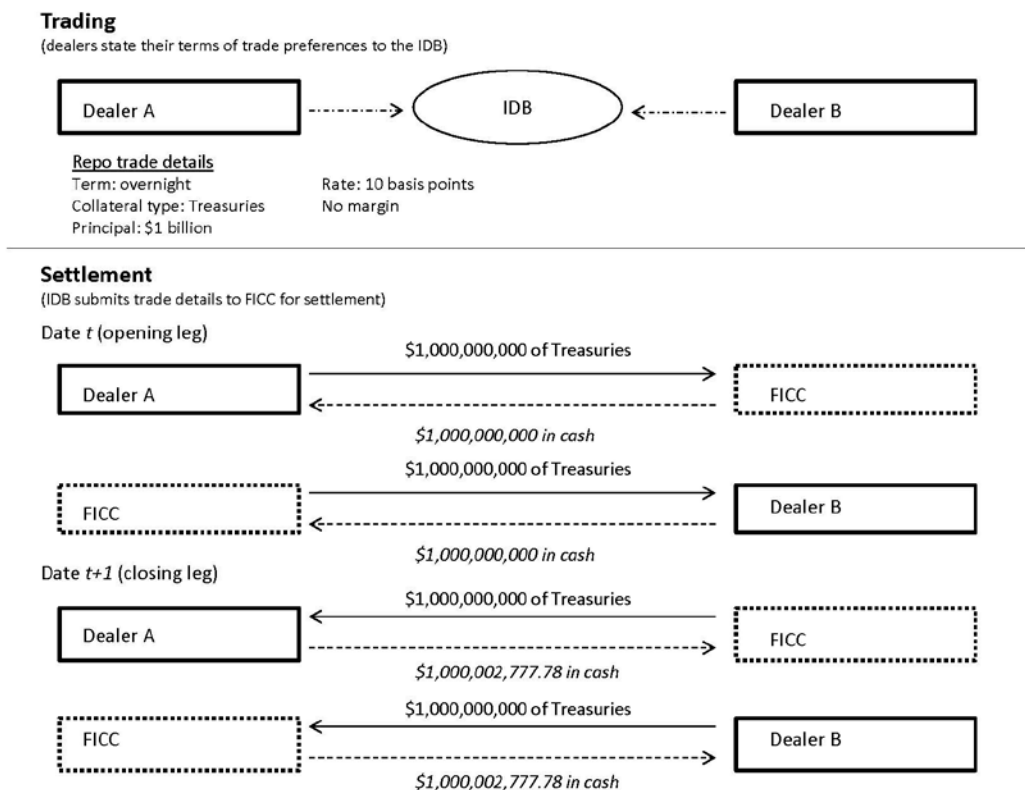
Fannie Mae and Freddie Mac adjustable-rate MBS
Fannie Mae and Freddie Mac fixed-rate MBS
FDIC guaranteed corporate bonds*
Ginnie Mae adjustable-rate MBS
Ginnie Mae fixed-rate MBS
Non-MBS U.S. agency securities
U.S. Treasuries with maturities of ten years or less
U.S. Treasuries with maturities of thirty years or less
U.S. Treasury inflation-protected securities
U.S. Treasury STRIPs

Notes: MBS is mortgage-backed securities; FDIC is Federal Deposit Insurance Corporation; STRIP is separate trading of registered interest and principal. An example of a non-MBS U.S. agency security is agency debentures.

* FDIC guaranteed corporate bonds are no longer a collateral class in GCF Repo.

¹⁴ The Federal Deposit Insurance Corporation's Debt Guarantee Program, developed during the recent financial crisis, generated this special class of corporate bonds. This program is no longer active. For more information, see <http://www.fdic.gov/regulations/resources/TLGP/>.

Chart 1.2: Trade Negotiation and Settlement of a GCF Repo



Note: IDB is independent broker dealer and FICC is the Fixed Income Clearing Corporation. $\$1,000,002,777.78 = \$1,000,000,000 + (\$1,000,000,000 * 1/360 * 10 \text{ basis points})$.

GCF Repo is tightly connected to tri-party repo because both types of trades are settled on the tri-party repo settlement platform. Further, both types of trades are almost always settled on the same day (e.g., not $t+1$) and settled late in the day. These features allow dealers to easily integrate their tri-party repo and GCF Repo trading strategies. For example, collateral obtained in GCF Repo is often immediately rehypothecated into tri-party repo trades.

3. Benefits of GCF Repo

We conclude with an enumeration of the benefits of the GCF Repo Service. While it has not been rigorously shown, our understanding is that an important benefit of this financial service is

its enhancement of intermediation. As described in more detail in Part 3 (by Copeland, Davis, and Martin), dealers use GCF Repo to intermediate between cash investors and other dealers. In particular, dealers which can access funding at a low cost may borrow more than they need from cash investors and then sell these extra funds in GCF Repo to dealers with a high cost of funding, taking advantage of the services FICC provides as a central counterparty.

This intermediation is beneficial because it lowers the cost of funding for those dealers which investors are reluctant to lend to directly. Without this intermediation, the high-cost-of-funding dealers would otherwise need to raise funds through other (more expensive) means, or delever. A lower cost of funding makes dealers more competitive and likely results in lower prices of financial services for households and nonfinancial firms.

An additional benefit of this intermediation occurs in times of stress. Market wisdom is that a stressed dealer should rely more upon GCF Repo as a source of funds. GCF Repo may act as a safety valve because stressed dealers can take advantage of FICC acting as a central counterparty and raise funds using GCF Repo. As described in more detail in Part 3 (by Copeland, Davis, and Martin), the available data confirms this story. It is important to note that this benefit, which relies heavily on FICC's service of acting as a central counterparty, depends crucially upon FICC managing its risk appropriately.

Two other general benefits associated with GCF Repo are the reduction in transaction costs and the enhancement of liquidity in the interdealer repo market.¹⁵ As described in Fleming and Garbade (2003), relative to standard bilateral repo arrangements, the design of GCF Repo provides these benefits by allowing for 1) both legs of the repo to be netted, 2) the repo dealer to decide which collateral to deliver fairly late in the day, and 3) easy substitution of collateral. The combination of these benefits should spill over and enhance the liquidity of the larger dealer-customer market.

¹⁵ Ingber (2003) provides a longer and more detailed list of benefits provided by GCF Repo.

Bibliography

- Alkan, L, V. Chakrian, A. Copeland, I. Davis, and A. Martin. 2013. “Magnifying the Risk of Fire Sales in the Tri-Party Repo Market.” Liberty Street Economics, July 13. (<http://libertystreeteconomics.newyorkfed.org/2013/07/magnifying-the-risk-of-fire-sales-in-the-tri-party-repo-market.html>).
- Copeland, A., A. Martin, and M. Walker. (forthcoming). “Repo Runs: Evidence from the Tri-party Repo Market.” *Journal of Finance*.
- Fleming, M., and K. Garbade. 2003. “The Repurchase Agreement Redefined: GCF Repo[®].” Federal Reserve Bank of New York *Current Issues in Economics and Finance* 9, no. 6 (June).
- Garbade, K. 2006. “The Evolution of Repo Contracting Conventions in the 1980s.” Federal Reserve Bank of New York *Economic Policy Review* 12, no. 1: 27-42.
- Ingber, J. 2003. “Gets Confusing Fast: A Review of the GCF Repo[®] Service.” *The RMA Journal*, May 2003: 46-51.

Part 2: The Financial Plumbing of GCF Repo[®] Service¹⁶

by Kate Pingitore, Paul Agueci, Caroline Prugar, Leyla Alkan, Tyisha Rivas, and Adam Copeland

The General Collateral Finance Repo (GCF Repo[®]) is a popular, well-established service for securities dealers.¹⁷ Its structure provides a way for dealers to exchange government securities for cash among themselves in an anonymous way. Further, the GCF Repo service has the following advantages: The Fixed Income Clearing Corporation, which offers the service, both provides netting services and serves as a central counterparty. These benefits have led dealers to trade GCF Repo in large quantities; for example, in the first quarter of 2013 average daily trading was almost \$500 billion and average daily net settlement exceeded \$250 billion.

GCF Repo trades are cleared and settled using the tri-party repo settlement platform run by the two large clearing banks, JPMorgan Chase and Bank of New York Mellon. During the 2007-09 financial crisis, weaknesses were revealed in the tri-party repo settlement procedures. After the financial crisis, regulators and market participants formed the Tri-Party Repo Reform Task Force, with the aim of identifying and making recommendations to improve the stability of the tri-party settlement platform (Task Force (2010)).¹⁸

Most of the Task Force's recommendations focused on reducing the reliance on intraday credit to settle trades on the tri-party repo settlement platform. In the pre-reform system, the tri-party repo settlement system was heavily reliant on unlimited intraday credit in order to be able to function. One of the main goals of the reforms is to develop a settlement system where much smaller amounts of intraday credit are provided and in a less discretionary way.

The pre-reform system was worrisome for two reasons. First, as long as a dealer had securities at the clearing bank to serve as collateral the clearing bank was willing to extend intraday credit to that dealer to settle tri-party repo trades. Given the size of the larger dealers (with a tri-party book of easily more than \$100 billion), there was potential for the clearing banks to extend enormous amounts of intraday credit relative to their capital base. This situation raised the risk that a clearing bank that could not absorb the impact of a failing dealer would itself be destabilized, leading to an interruption of funding and payment services for all of its other clients. The Task Force recommended that clearing banks limit their intraday credit extensions to no more than 10 percent of the value of a dealer's total tri-party book. With these limits in place,

¹⁶ We would like to thank Vic Chakrian, Antoine Martin, and Denise Schmedes for their comments. The views expressed herein are those of the authors and do not necessarily represent the views of the Federal Reserve Bank of New York or the Federal Reserve System.

¹⁷ GCF Repo[®] Service (hereinafter, "GCF Repo") is a registered service mark of the Fixed Income Clearing Corporation.

¹⁸ For more details on the Task Force and its work, see http://www.newyorkfed.org/banking/tpr_infr_reform.html

market participants and regulators can be more confident that a clearing bank can handle a large dealer defaulting on its tri-party repo obligations.

Second, the discretionary nature of the clearing banks' extension of credit was problematic. In times of stress, a clearing bank may be unwilling to take on the risk of extending intraday credit to a troubled dealer. Such a move, however, effectively pushes that dealer into bankruptcy because its tri-party repo trades will not settle and that dealer will lose access to planned-for funds. The Task Force recommended removing this discretion. With the reforms, clearing banks' credit extensions will be committed, capped and collateralized.

Although the clearing banks have made progress on reducing dealers' reliance on intraday credit, most of these improvements have been aimed at the settlement of tri-party repo trades, and not GCF Repo trades. Specifically, GCF Repo trades are still settled under a system that heavily relies upon unlimited intraday credit in order to be able to function.

In this article we describe in detail the settlement of GCF Repo and its reliance on intraday credit. We begin by describing how GCF Repo trades were settled as of the first quarter of 2012, the pre-reform state. Since the first quarter of 2012, however, a number of changes have been made to the settlement process as part of the aforementioned reforms to tri-party repo. Then in Section 2 we describe the current settlement process. We start with the pre-reform settlement process because it is important to understand the former process to appreciate how and why the settlement process is changing with the reforms.

The Task Force also raised concerns about the risk of fire sales. Fire sales are the rapid sale of securities in amounts large enough to cause temporary decreases in their market prices. Fire sales are particularly problematic because of the externalities they impose on other dealers. A dealer that is forced to sell its securities in a fire sale must confront the problem of its actions causing temporary decreases in the price of the securities, reducing their liquidity value. However, other dealers may also be affected if the securities' price declines force those dealers to mark down securities on their balance sheets (for example, through mark-to-market accounting practices) or provide more securities as collateral. Such actions may even lead these dealers to raise capital by selling securities, further depressing prices and reinforcing the fire-sale effect. Little progress has been made on this issue within tri-party repo, however, reflecting both the focus on other objectives and the difficulty in mitigating this risk.¹⁹

In Section 3, we use the framework presented in Begalle, Martin, McAndrews, and McLaughlin (2013) to discuss the risks of fire sales in GCF Repo. We argue that fire-sale risks in GCF Repo are substantially mitigated by the role of FICC as the central counterparty. An important assumption underlying this argument, however, is the ability of FICC to adequately manage dealer defaults.

¹⁹ See the February 13, 2014 Statement, "[Update on Tri-Party Repo Infrastructure Reform](#)" by the Federal Reserve Bank of New York.

1. Overview of GCF Repo

In brief, repos are essentially a pair of transactions between two entities: an agreement to buy a security now (which constitutes the opening leg of the repo), joined with an agreement to sell back the same security in the future at a specified price (which constitutes the closing leg of the repo). Often, repos effectively serve as collateralized loans, where the difference in the price of the security across the two legs of the transaction translates into an interest rate.

GCF Repo is a service offered by the Fixed Income Clearing Corporation (FICC) and used by dealers which are netting members of FICC's Government Securities Division. The GCF Repo differs from a typical repo in that the trade is completed on a blind-brokered basis, where dealers negotiate their trades through interdealer brokers (IDBs) and thus preserve their anonymity. These repos are general collateral repos, meaning that dealers agree that the securities to be posted as collateral are required to only be part of an asset class, as opposed to be specific securities. As detailed in the Introduction to this volume, FICC defines 10 collateral classes which can be used by dealers, the most popular of which are U.S. Treasuries with maturities of thirty years or less, and Fannie Mae and Freddie Mac fixed-rate mortgage backed securities (see Table 1.1).

FICC also provides two additional types of services for those dealers trading GCF Repos. First, it acts as a central counterparty, absorbing all counterparty risk in these trades. Second, it provides netting services, allowing dealers to offset their repo and reverse repo positions for trades where the securities posted as collateral are of a similar type.²⁰ These features make the GCF Repo service attractive to dealers, compared to a standard bilateral repo (Fleming and Garbade 2003).

Below we describe how GCF Repo trades are negotiated and cleared. The details of settlement are then discussed in Sections 2 (the pre-reform state) and 3 (the current state).

1.1 How Dealers Trade through IDBs

At a high-level, dealers enter into a trade by working through an IDB to negotiate with one another anonymously (see the top panel of Chart 2.1, "Trading"). Dealers state their trading terms to the IDB, which then helps a dealer execute a trade by finding another dealer willing to take the other side, all the while masking dealers' identities. IDBs offer two basic platforms to help execute trades: electronic and voice.

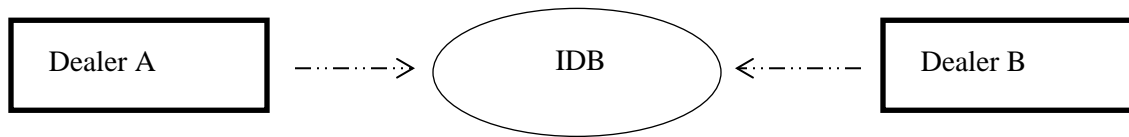
An electronic platform allows a dealer to see and accept the bid/offer rates that dealers have posted that day according to collateral class and tenor. Further, these platforms have a variety of features that help dealers keep their positions hidden or manage large orders. Typically, these platforms are used to execute trades quickly on a take-it-or-leave-it basis.

²⁰ Repos are trades in which the dealer has promised to deliver securities against cash, while reverse repos are trades in which the dealer has promised to deliver cash against securities.

Chart 2.1: Overview of GCF Repo Clearance and Settlement

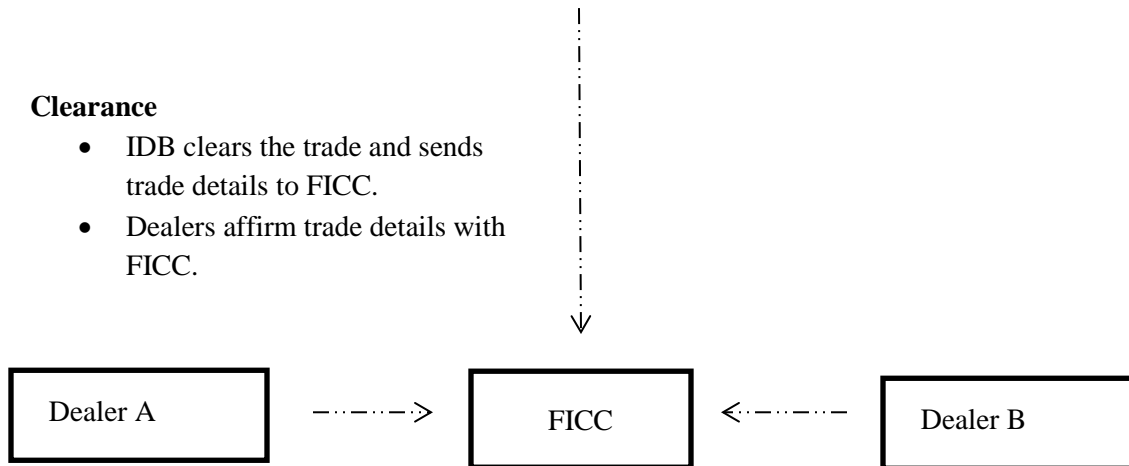
Trading

- Dealers state their terms or trade preferences to the IDB.
- IDB matches dealers.



Clearance

- IDB clears the trade and sends trade details to FICC.
- Dealers affirm trade details with FICC.



Settlement

- After the market closes, FICC nets dealers' trades by collateral class and then novates the trade.
- FICC sends settlement instructions detailing each dealer's net position to the clearing banks.
- Clearing banks settle dealers' positions on their books.



A voice platform involves communicating with a person, a broker, at an IDB. While dealers still may be able to see information about other dealers' bid/offer rates, executing a trade on the voice platform requires going through a broker. An advantage of the voice platform over its electronic counterpart is the ability for a dealer, through a broker, to negotiate the terms of trade. The disadvantage, of course, is the slower speed at which trades are executed. Market participants report that electronic platforms are typically used in the morning when most of the GCF Repo trading occurs and trade-execution speed is highly valued. Voice platforms are typically used in the afternoon, when there is less trading overall and dealers value the ability to negotiate terms.

1.2 The Clearance of Trades

Once two dealers have booked a trade, the IDB becomes the legal counterparty to each dealer. The IDB also begins the clearance process by reviewing and confirming the trade details with the dealers (see the middle panel of Chart 2.1, "Clearance"). The IDB, for example, corrects data entry errors that are identified through the confirmation process. The next step involves sending the trade details to FICC and the two dealers. FICC accepts GCF Repo trade details between 7 a.m. and 3 p.m. (eastern time).

Once FICC receives the trade details from an IDB, FICC guarantees the trade, limiting the risk faced by the IDB as the legal counterparty to the trade. The IDB remains the counterparty to both sides of the trade until the netting process is completed and the trades are novated, after which FICC becomes the legal counterparty to each dealer. A final step in the clearance process involves each dealer affirming the details of the trade to FICC. After a trade is affirmed, changes to that trade can be made only if both dealers agree to cancel and rebook the trade.

After two dealers agree to a trade, it usually takes an IDB only ten minutes to clear a trade and send the trade details back to the dealers and FICC. In contrast, dealers may take much longer to affirm a trade to FICC. Typically, IDBs will contact dealers if trades are not affirmed within two hours. Dealers can delay only so long; after 3 p.m., FICC automatically affirms all trades it has received from IDBs.²¹

After 3 p.m., when FICC stops accepting trade details from the IDBs, FICC nets down each dealer's position. This netting process computes each dealer's overall position conditional on the collateral class of the trade. As a consequence of netting, a dealer that promised to deliver and receive securities within the same collateral class over the day only has to settle its net position at the end of the day. FICC then sends settlement instructions to the clearing banks (see the lower panel of Chart 2.1, "Settlement"). Finally, dealers' net positions are settled on the books of the clearing banks at the end of the day.

²¹ FICC encourages dealers to affirm trades before the 3 p.m. deadline.

2. Settlement of GCF Repo Trades--Pre-Reform

In this section, we describe the GCF Repo settlement process as of the first quarter of 2012, or the pre-reform state. We focus on two main processes; the end-of-day settlement and the morning unwind. The end-of-day settlement is the usual process where all outstanding GCF Repo positions are settled. The morning unwind is a process whereby the clearing banks return the securities held as collateral for all GCF Repo positions to the repo dealers and return the cash amount to the reverse repo dealers. An advantage of the morning unwind is that it provides dealers full and unimpeded access to their securities during the business day.

As described above, the clearing banks receive instructions from FICC to settle dealers' net positions, where the net position is the difference between the amount of repos and reverse repos that a dealer has traded for a particular collateral class. Dealers have either a zero or non-zero net position for each collateral class. For the non-zero net positions, the dealer has an obligation to either deliver securities that fall within the acceptable class of collateral to FICC and receive cash, or deliver cash and receive securities.

The clearing banks begin the settlement process by creating shells, which specify dealers' net repo position for each of the collateral classes in the GCF Repo service. From the dealer's perspective, a repo shell represents an obligation to deliver securities against cash.

With the creation of these shells, the collateral allocation process begins. In the following section, we describe this process under the simplifying assumption that both dealers involved in the GCF Repo settlement process use the same clearing bank. For this intrabank case, both the securities and cash payments are moving on the books of a single clearing bank. We then detail the extra steps needed to settle GCF Repo allocations which are interbank (settlement across two clearing banks) in a separate section.

It is important to re-emphasize that the settlement processes described below and illustrated on the accompanying charts are the pre-reform case (or, as of March 2012). With the tri-party reforms, the clearing banks have instituted some changes to their settlement processes of GCF Repo trades. These changes are described in Section 3.

2.1 Intrabank GCF Repo Settlement—Pre-reform

We begin by describing how GCF Repo positions are settled when both the repo and the reverse repo dealers use the same clearing bank. We break the settlement process into two parts. First, there is the end-of-day settlement on day t , when the securities are delivered in exchange for cash. Second, there is the morning unwind on day $t+1$ when the cash and collateral are returned to the reverse repo and repo dealers, respectively. For overnight trades, end-of-day settlement is the opening leg of the repo and the morning unwind is the closing leg (see Chart 1.2 in Part 1). For trades of longer maturity, the unwind is a mechanism which allows dealers easy and unconstrained access to their securities during the business day. From the perspective of the

clearing banks, the term of the GCF Repo trade is irrelevant because all trades are unwound in the morning.

End-of-Day Settlement

At the end of the trading day, the clearing banks receive instructions from FICC detailing how to settle dealers' net positions in GCF Repo. This settlement process begins with the clearing bank informing dealers of their GCF Repo obligations and creating the appropriate repo shells. The repo dealers then start to allocate collateral from their securities accounts at the clearing bank to the repo shells (see Chart 2.2 for a schematic of this process).²² A repo shell is said to be "filled" once a dealer has allocated enough securities to fulfill its collateral obligations for that shell. Once all dealers have filled their GCF Repo shells for a specific collateral class—say, Treasuries with a maturity of thirty years or less—the clearing bank moves all these allocated securities to FICC's securities account at that clearing bank.²³ Simultaneously, the clearing bank credits the relevant dealers' cash accounts and debits FICC's cash account. Because FICC does not typically have cash in its account at the clearing bank, the clearing bank extends intraday credit to FICC to enable this leg of the settlement process, backed by the securities posted as collateral for the GCF Repo positions (see Stage 1 in Chart 2.2).

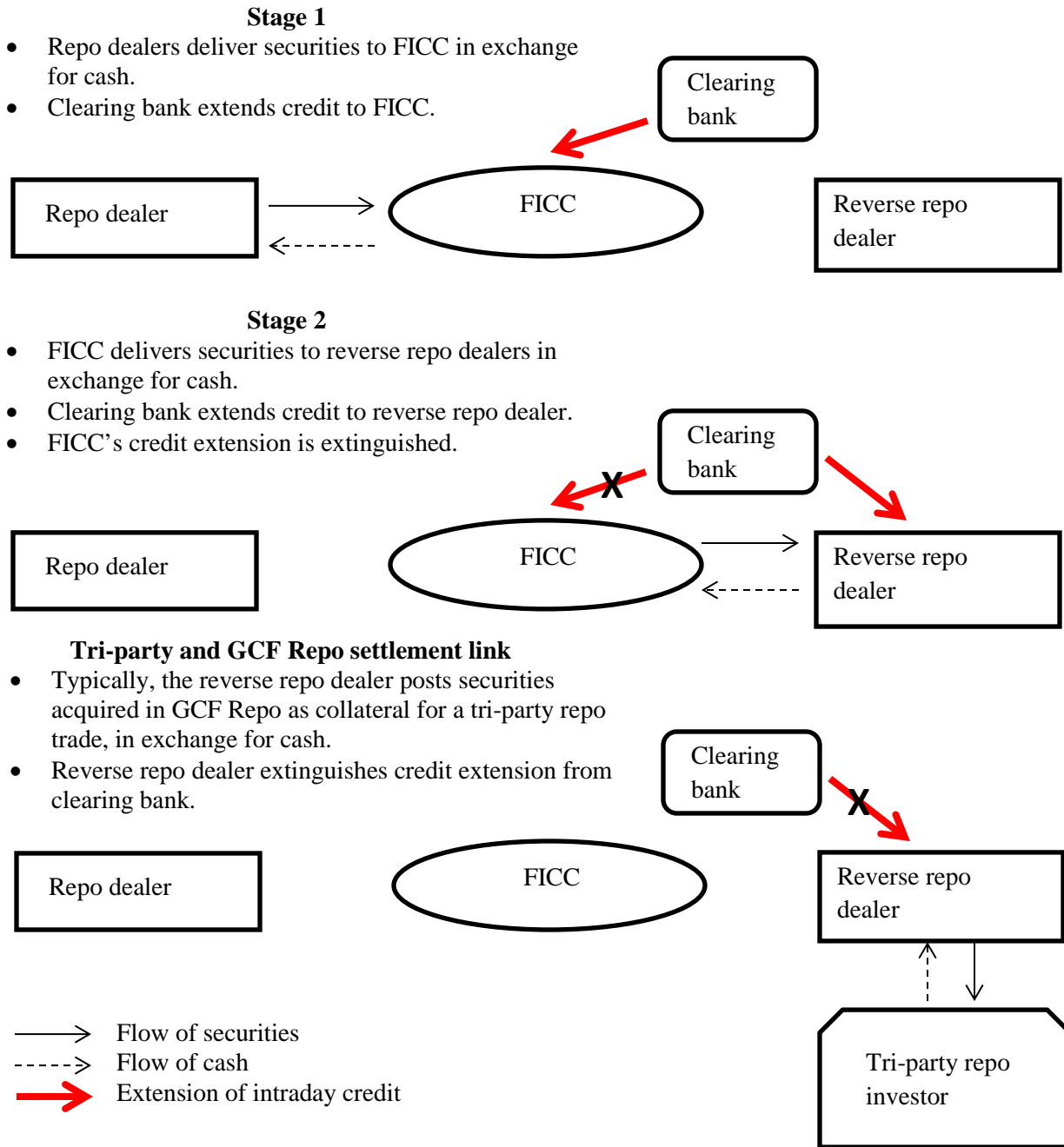
The clearing bank then allocates this set of securities from FICC's securities account into the repo shells characterizing FICC's obligations to deliver collateral to the reverse repo dealers. Note that because of the netting process, there is no pre-ordained allocation of these securities. Simultaneously, the clearing bank credits the FICC cash account and debits the reverse repo dealer's cash account (see Stage 2 in Chart 2.2). To enable this leg of the settlement process, the clearing bank extends intraday credit to the reverse repo dealer. This credit extension is backed not only by the GCF Repo-related securities posted as collateral, but also by all the unencumbered securities a reverse repo dealer holds at the clearing bank.

The flow of cash from the reverse repo dealer to FICC allows FICC to extinguish its credit extension from the clearing bank. The end result of this process is that securities have moved from the repo dealers' account to the reverse repo dealers' account, through FICC's account. Simultaneously, there is a corresponding reverse flow of cash. While the movement of securities and cash through FICC's account is a crucial step in the settlement process, typically neither the securities nor cash reside in FICC's account for a significant amount of time.

²² Copeland, Duffie, Martin, and McLaughlin (2012) provide details of how dealers allocate collateral to tri-party repo trades. The same methods can be used to allocate collateral to GCF Repo trades, because both types of trades are settled on the same tri-party repo settlement platform.

²³ Both clearing banks have the operational capability to move the allocated securities from the dealer to FICC on a shell by shell basis. For operational efficiency, however, the clearing banks wait until all the dealers have filled their GCF Repo shells for a specific collateral class, and then move these allocated securities to FICC's account.

Chart 2.2: Intrabank GCF Repo End-of-Day Settlement



Note: This chart describes the pre-reform settlement process.

This settlement process requires the extension of credit by the clearing bank to both FICC and the reverse repo dealer. We label the extension of credit to FICC as *frictional*, because it is extinguished once the end-of-day settlement leg of the GCF Repo position is settled. In comparison, the extension of credit to the reverse repo dealer is extinguished only after this dealer sources funds elsewhere—for example, from an investor in the tri-party repo market (see the bottom right-hand corner of Chart 2.2).²⁴

Morning Unwind

Every morning, at approximately 6:30 a.m., the clearing banks begin to unwind all GCF Repo positions, returning collateral to the repo dealer and cash to the reverse repo dealer. Unwinding a GCF Repo position essentially follows the same steps as the end-of-day settlement, but in reverse order. Hence, the first step to the unwind is to ensure that all GCF-related securities are back with the reverse repo dealer (see Chart 2.3 for a schematic of this process). If these securities have been used as collateral in other transactions (for example, rehypothecated to tri-party repo), then the clearing bank extends credit to the reverse repo dealer and recalls the GCF Repo-related securities by substituting cash in place for the desired securities (see ‘preparing for the morning unwind’ at the top of Chart 2.3). With the securities back in the reverse repo dealers’ account, the clearing bank begins unwinding the GCF Repo positions. Intraday credit is extended to FICC and the securities are sent to FICC’s account in exchange for cash (see Stage 1 of Chart 2.3). With this transfer, the clearing bank’s extension of credit to the reverse repo dealer is extinguished (except for the possible differences in margin requirements).

Once the securities are in FICC’s account, the clearing bank extends credit to the repo dealer. The securities are then returned to the repo dealers in exchange for cash. The cash is used to extinguish the clearing bank’s credit extension to FICC (see Stage 2 of Chart 2.3).

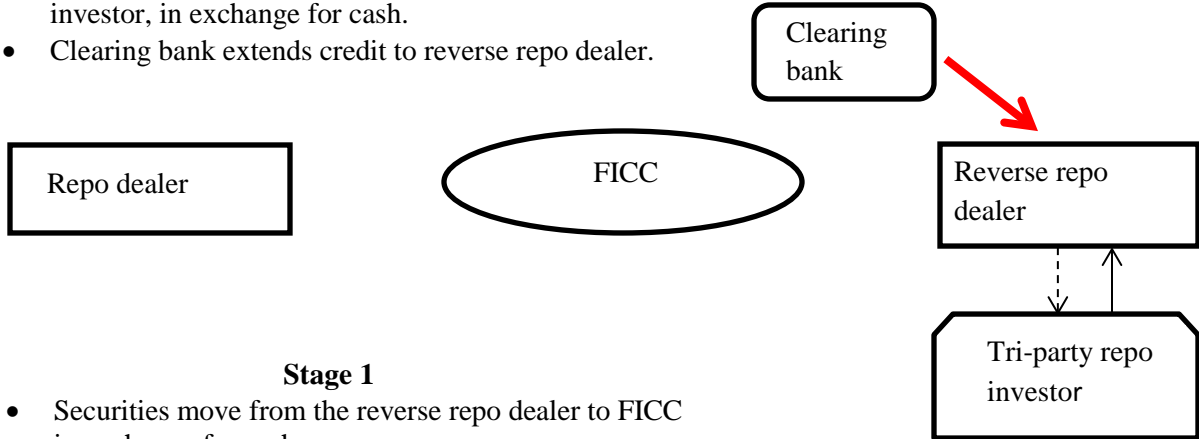
At the end of the unwind, collateral and cash have been returned to the repo and reverse repo dealers, respectively. Dealers now have full access to their portfolio of securities, which they can use for regular trading purposes. In facilitating this unwind, the clearing bank extended intraday credit to both FICC and the repo dealer. As in the end-of-day settlement case, the extension of credit to FICC is frictional. In contrast, the clearing bank extends intraday credit to the repo dealer for the duration of the day. (See Appendix 2.A on net free equity for more details on how the clearing banks manage their credit risk to dealers.) Usually, the dealer waits to extinguish this credit extension until the end of the day, when the dealer is settling all its trades. A straightforward way to extinguish this credit extension at the end of the day is to simply execute an offsetting GCF Repo or tri-party repo trade.

²⁴ The rehypothecation of GCF Repo-obtained collateral into a tri-party repo trade will not, by itself, generate enough cash to fully pay off the clearing bank’s credit extension to the reverse repo dealer, because there are margin requirements for tri-party repo trades. The dealer, then, would need to post more collateral in a tri-party repo trade in order to acquire the necessary amount of cash.

Chart 2.3: Intrabank GCF Repo Morning Unwind

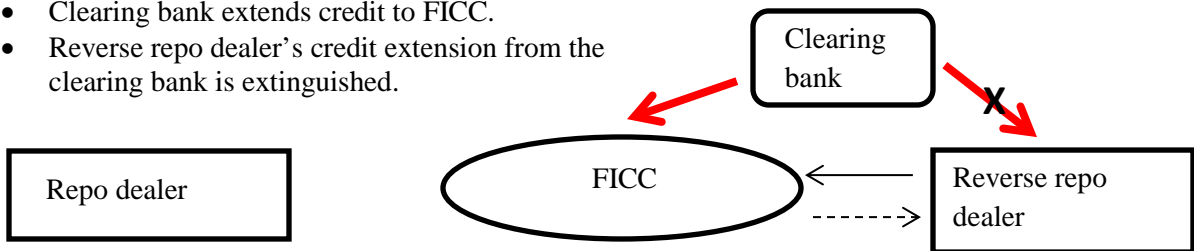
Preparing for the morning unwind

- When they have been rehypothecated, GCF Repo securities are unwound from the tri-party repo investor, in exchange for cash.
- Clearing bank extends credit to reverse repo dealer.



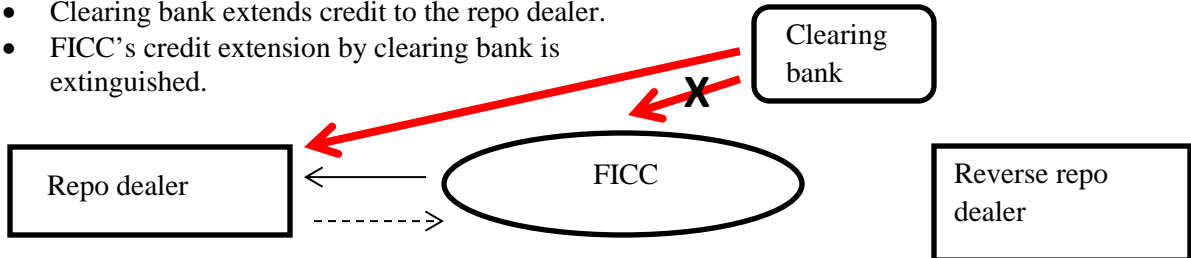
Stage 1

- Securities move from the reverse repo dealer to FICC in exchange for cash.
- Clearing bank extends credit to FICC.
- Reverse repo dealer's credit extension from the clearing bank is extinguished.



Stage 2

- Securities move from FICC to repo dealer in exchange for cash.
- Clearing bank extends credit to the repo dealer.
- FICC's credit extension by clearing bank is extinguished.



- > Flow of securities
- - - -> Flow of cash
- (red) Extension of intraday credit

Note: This chart describes the pre-reform settlement process.

2.2 Interbank GCF Repo Settlement—Pre-reform

We now extend the above description for the case where the repo and reverse repo dealers use different clearing banks. A key feature of interbank GCF Repo settlement is that the securities posted as collateral by the repo dealer never leave the books of that dealer's clearing bank. This feature forces the clearing banks to coordinate their settlement processes to ensure all cash flows and credit extensions are properly collateralized. The securities remain on the repo dealer's clearing bank because the main system of transferring government securities between institutions, Fedwire[®] Securities Service, closes mid-afternoon, before GCF Repo settlement begins.²⁵ Furthermore, it would not be operationally efficient to move securities back and forth across the clearing banks when they unwind every morning.

End-of-Day Settlement

Mirroring the intrabank case, we begin with end-of-day settlement. Suppose that there is a repo dealer at clearing bank 1 (CB1) and a reverse repo dealer at clearing bank 2 (CB2). As in the intrabank case, the repo dealer starts the settlement process by allocating securities to its GCF Repo shell. Once the repo dealer has filled its GCF Repo shell for a specific collateral class, clearing bank 1 moves these securities to FICC's account, extends credit to FICC, and deposits cash into the repo dealers' accounts. These securities are then moved to a segregated account, which serves as FICC's CB2 account on the books of clearing bank 1. Because it is secured by the underlying securities, clearing bank 1's credit extension is now also directed to this segregated account.

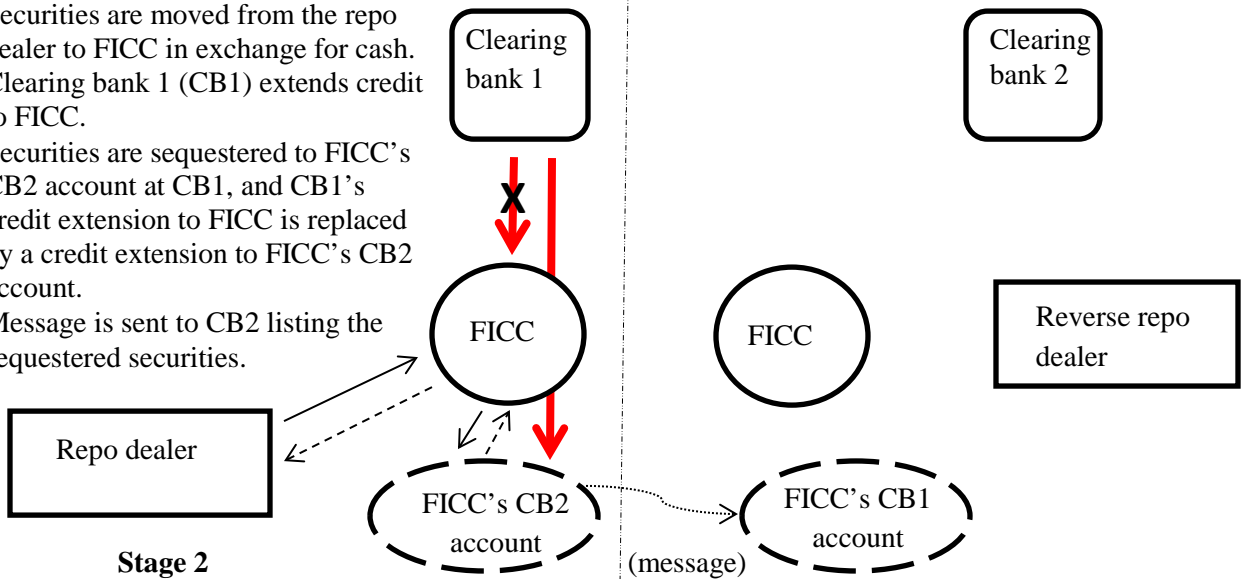
A message is then sent from clearing bank 1 to clearing bank 2 listing the securities in this segregated account (see Stage 1 of Chart 2.4). Clearing bank 2 then creates copies of these securities, called *securities clones*, in FICC's CB1 account at clearing bank 2 and a cross-clearing bank lien is placed on the securities residing in FICC's CB2 account on the books of clearing bank 1 (ensuring that these securities are not used elsewhere). On clearing bank 2's books, these securities clones are then allocated to FICC's account. To facilitate this transfer, clearing bank 2 extends credit to FICC and deposits cash into FICC's CB1 account at clearing bank 2. The clones are then allocated to the repo shells characterizing FICC's obligations to deliver collateral to the reverse repo dealers. Clearing bank 2 extends credit to the reverse repo dealer and the credit extension to FICC is extinguished (see Stage 2 of Chart 2.4). At this point, FICC has received an intraday credit extension from clearing bank 1 (secured by the securities residing in FICC's CB2 account at clearing bank 1) and has a positive cash balance at clearing bank 2 (residing in FICC's CB1 account at clearing bank 2). To extinguish the credit extension

²⁵ Fedwire is a registered service mark of the Federal Reserve Banks.

Chart 2.4: Interbank GCF Repo End-of-Day Settlement

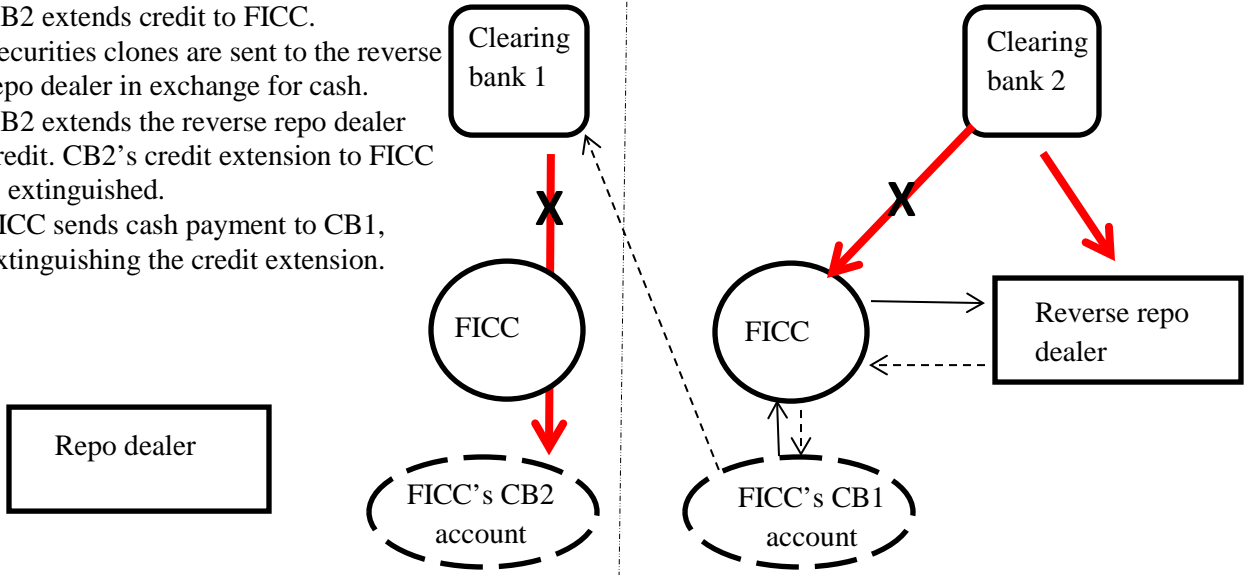
Stage 1

- Securities are moved from the repo dealer to FICC in exchange for cash. Clearing bank 1 (CB1) extends credit to FICC.
- Securities are sequestered to FICC's CB2 account at CB1, and CB1's credit extension to FICC is replaced by a credit extension to FICC's CB2 account.
- Message is sent to CB2 listing the sequestered securities.



Stage 2

- Securities clones are created in FICC's CB1 account at CB2. These clones are moved to FICC, in exchange for cash. CB2 extends credit to FICC.
- Securities clones are sent to the reverse repo dealer in exchange for cash.
- CB2 extends the reverse repo dealer credit. CB2's credit extension to FICC is extinguished.
- FICC sends cash payment to CB1, extinguishing the credit extension.



- > Flow of securities
- - - -> Flow of cash
- Extension of intraday credit

Note: This chart describes the pre-reform settlement process.

from clearing bank 1, FICC requests that clearing bank 2 wires the cash from FICC's CB1 account at clearing bank 2 to clearing bank 1, using the Fedwire[®] Funds Service (which is open until 6:30 p.m.). With this cash movement, FICC is once again flat, in that neither clearing bank is extending intraday credit to it.

At the end of this process, securities (or their clones) have moved from the repo dealer to the reverse repo dealer through FICC, with cash flowing in the opposite direction. Similar to the intrabank case, the clearing banks have extended intraday credit to FICC and the reverse repo dealer to facilitate settlement. The credit extension to FICC is frictional although complicated, owing to its reliance on cross-clearing bank liens. The reverse repo dealer is left with an intraday credit extension from clearing bank 2. As before, this dealer can extinguish this credit extension in a number of ways, including using the securities it received through GCF Repo to obtain cash in tri-party repo.

While the above example considers one repo dealer at a clearing bank and one reverse repo dealer at the other clearing bank, in reality there are often a number of interbank allocations with repo dealers (i.e. dealers obligated to deliver securities and receive cash) at both clearing banks. This means that in practice the clearing banks send information to one another about the securities being delivered by repo dealers. A crucial component of the interbank GCF Repo settlement system is this flow of information. In the pre-reform process, the clearing banks communicate with one another once in the settlement cycle. Specifically, only after repo dealers have filled their GCF Repo shells for all securities classes, and these securities have been allocated to the other clearing bank's FICC account, does a clearing bank send a message to the other clearing bank with the details necessary to complete settlement of the GCF Repo trades.

Having repo dealers at both clearing banks obligates FICC to send cash payments from JPMC to BNY Mellon and vice versa. For operational efficiency, however, FICC sends only one payment between the clearing banks, where this payment is equal to the net flow of cash between the two clearing banks.

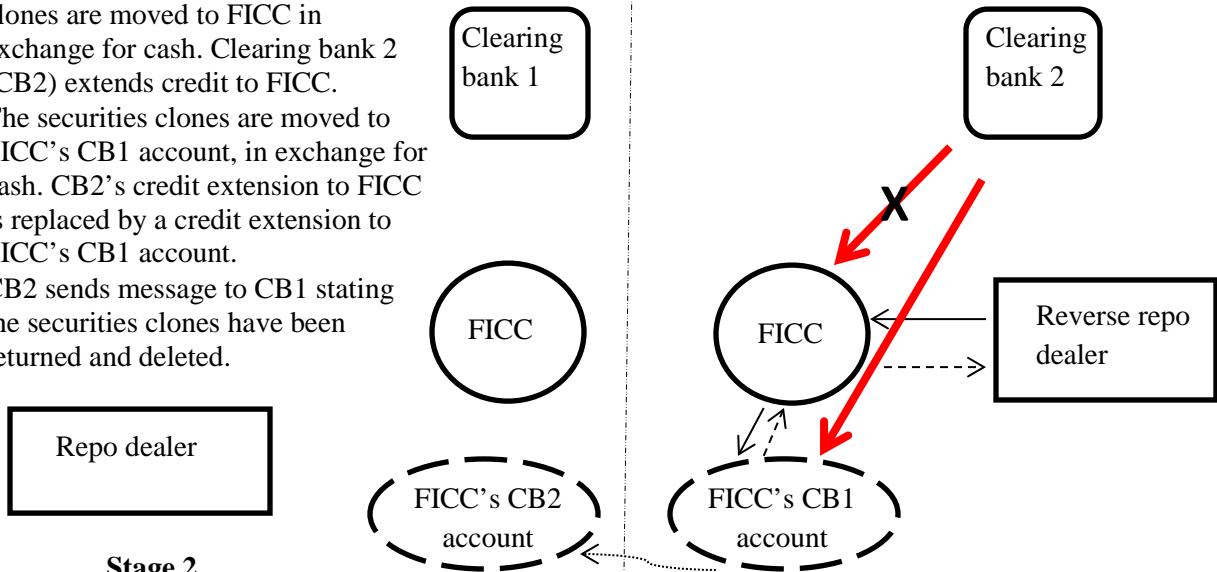
Morning Unwind

We now turn to the interbank GCF Repo unwind (see Chart 2.5). Continuing from the example above, suppose the repo dealer is at clearing bank 1 and the reverse repo dealer is at clearing bank 2. Recall that the actual securities reside on the books of clearing bank 1, in a segregated account (FICC's CB2 account at clearing bank 1) and clearing bank 2 uses clones of these securities on its books.

Chart 2.5: Interbank GCF Repo Morning Unwind

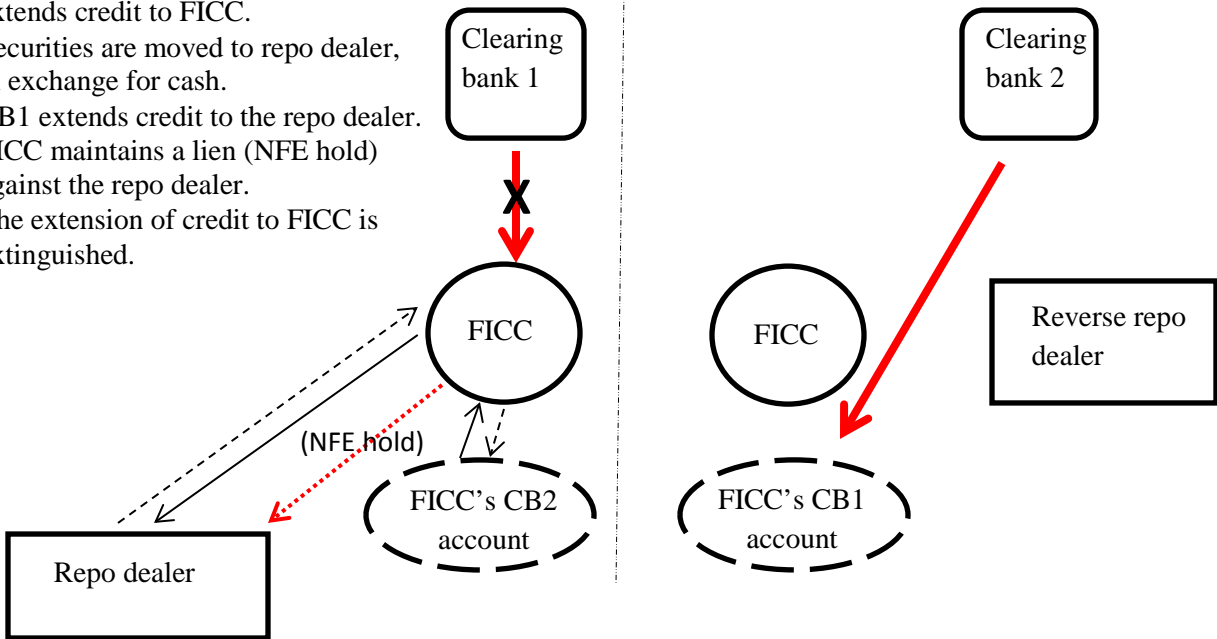
Stage 1

- Reverse repo dealers' securities clones are moved to FICC in exchange for cash. Clearing bank 2 (CB2) extends credit to FICC.
- The securities clones are moved to FICC's CB1 account, in exchange for cash. CB2's credit extension to FICC is replaced by a credit extension to FICC's CB1 account.
- CB2 sends message to CB1 stating the securities clones have been returned and deleted.



Stage 2

- CB1 releases securities from FICC's CB2 account into FICC's regular account, in exchange for cash. CB1 extends credit to FICC.
- Securities are moved to repo dealer, in exchange for cash.
- CB1 extends credit to the repo dealer. FICC maintains a lien (NFE hold) against the repo dealer.
- The extension of credit to FICC is extinguished.



- > Flow of securities
- - - -> Flow of cash
- (red) Extension of intraday credit

Note: This chart describes the pre-reform settlement process.

In most cases, clearing bank 2 begins the unwind by first extending credit to the reverse repo dealer and pulling back all GCF-related securities that have been rehypothecated using a securities-for-cash substitution mechanism (not shown in Chart 2.5).²⁶ Clearing bank 2 then extends credit to FICC and moves the securities from the reverse repo dealer to FICC's account. The corresponding movement of cash from FICC to the reverse repo dealer enables this dealer to extinguish the credit extension from the clearing bank (ignoring possible differences in margin requirements). The securities are then moved to FICC's CB1 account at clearing bank 2, and the credit extension to FICC's account is extinguished and replaced by an extension to FICC's CB1 account, which is secured by the underlying securities in FICC's CB2 account at clearing bank 1.

Clearing bank 2 then sends a message to clearing bank 1 that it has deleted the clones of the GCF Repo-related securities from its books, and clearing bank 1 is free to unwind the securities from FICC's CB2 account on clearing bank 1's books (see Stage 1 in Chart 2.5).

After receiving the message, clearing bank 1 moves the securities from FICC's CB2 account (the special segregated account) to FICC's account. Concurrently, clearing bank 1 debits FICC's account and credits FICC's CB2 account. The securities are then moved from FICC to the repo dealer. To facilitate this movement, clearing bank 1 extends credit to the repo dealer, where this credit extension is secured by a lien that FICC maintains on the repo dealer's unencumbered securities residing at clearing bank 1. This lien, or the net free equity (NFE) hold, is explained further in Appendix 2.A.

At the end of the unwind, then, the securities have been fully unwound to the repo dealers, which are then able to use these securities for other purposes. The repo dealers at clearing bank 1 have granted FICC a security interest in the unencumbered securities in its account, known as the NFE hold. Clearing bank 2 has also extended intraday credit to FICC, which is secured by its cross-claim on the credit balance in FICC's CB2 account at clearing bank 1. FICC is liable for extinguishing the credit extension at clearing bank 2. In the event the repo dealer fails to repay FICC, FICC would liquidate the NFE hold collateral to meet its obligation to clearing bank 2. The intraday credit extension to FICC and to the repo dealers at clearing bank 1 is not frictional but rather lasts throughout the day, until the end-of-day settlement process.

The repo dealer extinguishes the credit extension from clearing bank 1 (and so lifts FICC's lien on the repo dealer's securities) at the end of the day, while settling all of its trades. As mentioned before, it is straightforward for the dealer to raise the necessary cash through another GCF Repo trade. The credit extension by clearing bank 2 to FICC is also extinguished during the end-of-day settlement of interbank GCF Repos.

²⁶ If the reverse repo dealer has not rehypothecated the securities, then this step is not necessary.

2.3 Review of the Chronology of GCF Repo Trading, Clearance, and Settlement--Pre-reform

To facilitate a better understanding of the interactions between trading, clearance, and settlement, in this section we illustrate the chronological flow of activity throughout the day. For GCF Repo, the day starts with the morning unwind, where collateral and cash are returned to the repo and reverse repo dealers, respectively, beginning at around 6:30 a.m. (see Chart 2.6). FICC begins accepting trade details from IDBs at 7:00 a.m.

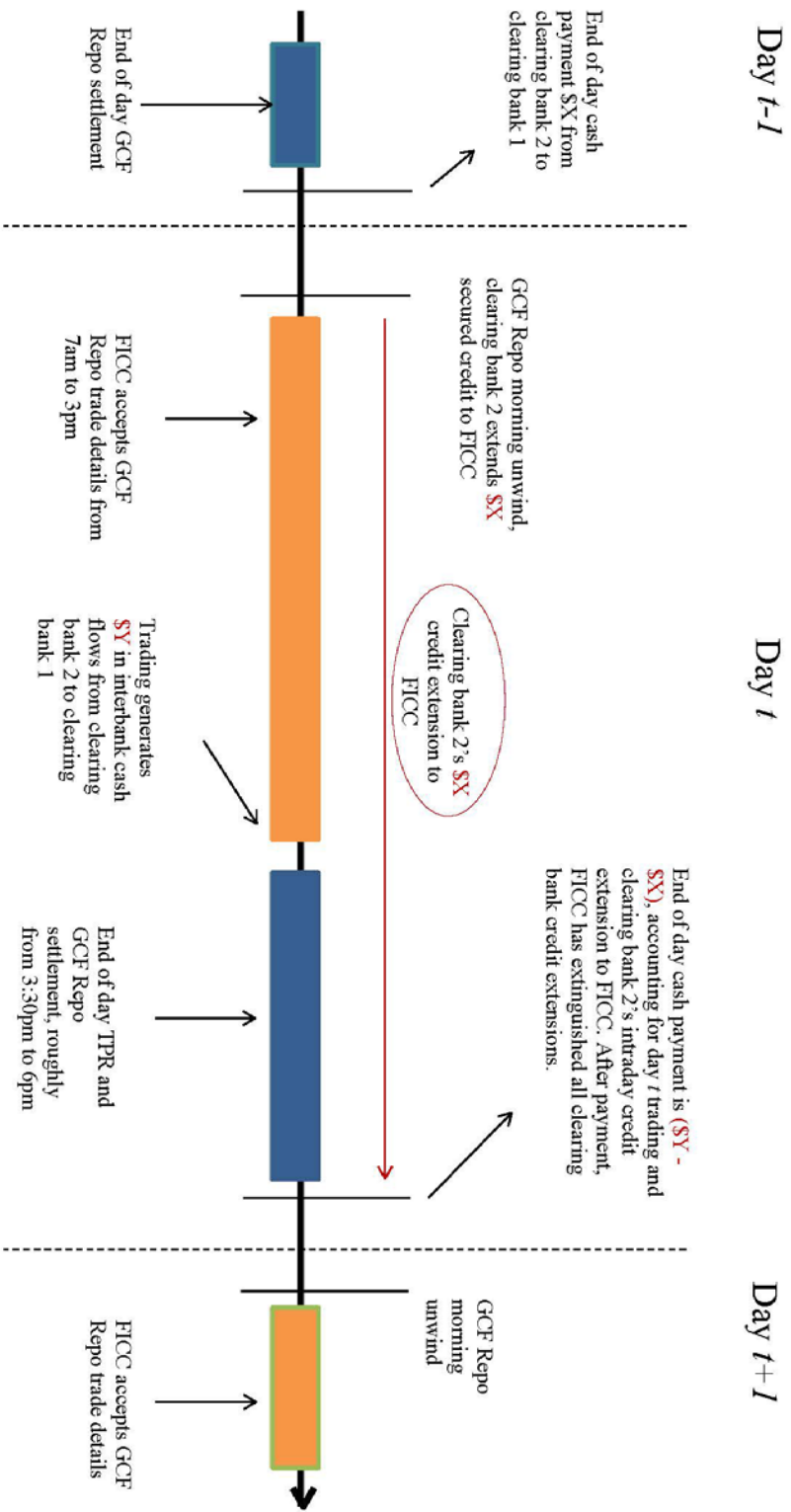
The majority of trading is completed in the morning, with more than half of trades (in terms of volume) being completed within the first hour of trading. By 10 a.m. on a typical day, three-quarters of trading has been completed. FICC stops accepting trades from IDBs at 3 p.m., and shortly thereafter FICC begins the netting process. Roughly speaking, dealers' net positions in GCF Repo are typically settled between 3:30 p.m. and 5:30 p.m.

Chart 2.6 illustrates the clearing banks' credit extensions to FICC that facilitate the unwinding of interbank GCF Repo positions. Suppose that, at the end of day $t-1$, dealers' trading strategies have resulted in dealers at clearing bank 1 sending, on net, $\$X$ of securities to dealers at clearing bank 2 in exchange for cash. Consequently, for the morning unwind on date t , clearing bank 2 needs to extend $\$X$ of intraday credit to FICC (see stage 1 on Chart 2.5). As illustrated in Chart 2.6, this extension of credit by clearing bank 2 to FICC lasts throughout the day (roughly 9 hours).

Now suppose that, in day t , trading results in dealers at clearing bank 1 sending, on net, $\$Y$ of securities to dealers at clearing bank 2 in exchange for cash. Rather than deal with the $\$X$ and $\$Y$ credit extensions separately, FICC and the clearing banks settle the net amount $(\$Y - \$X)$. To see how this works, consider when $\$X = \Y . To settle the $\$Y$ in net trading for this interbank case at the end of the day, FICC needs to deliver $\$Y$ in cash (in exchange for securities) to the group of date t repo dealers at clearing bank 1. Because $\$X = \Y , this cash is completely supplied by the group of date $t-1$ repo dealers at clearing bank 1, which need to extinguish the credit extension from clearing bank 1 (and so release FICC's lien on the $t-1$ repo dealers' securities). (Recall that these dealers received their collateral back in the morning of date t .) FICC then delivers the securities from the date t repo dealers at clearing bank 1 to the group of reverse repo dealers at clearing bank 2, in exchange for cash. The $\$Y$ in cash that FICC receives is then used to extinguish clearing bank 2's $\$X$ credit extension (because $\$X = \Y) from that morning's unwind process.

For the special case of $\$X = \Y , no payments need to be made between the two clearing banks. When $\$Y$ is not equal to $\$X$, however, FICC will end up with a credit at one clearing bank and an offsetting debit at the other clearing bank. In this case, a payment needs to be sent between the clearing banks to extinguish FICC's debit at the end of the day.

Chart 2.6: GCF Repo timeline (pre-reform)



In recent history, settling the net amount has resulted in FICC making payments that, typically, are small relative to the net amount of GCF Repos settled in the interbank case. Nevertheless, it is not uncommon for this net payment to be quite large. For example, when the net flow of cash across the clearing banks changes direction, a payment equal to the absolute value of X plus the absolute value of Y is required to extinguish the intraday credit extension to FICC.

3. Tri-party Repo Settlement Reforms and GCF Repo

Having described the clearance and settlement of GCF Repo (as of the first quarter of 2012), we now turn to concerns with this financial plumbing. We focus on two potential areas of concern, the heavy reliance on intraday credit to settle GCF Repo positions, including the unwind, and fire-sale risks related to this financial service.

3.1 Use of Intraday Credit to Settle GCF Repos

As discussed in the introduction, a main focus of the tri-party repo reforms is to move the clearing banks from a settlement system where unlimited and uncommitted intraday credit is extended, to a settlement system where intraday credit is capped and committed.

The concerns over clearing banks extending unlimited and uncapped credit continue to exist with the settlement procedures of GCF Repo.²⁷ During end-of-day settlement, the clearing banks are extending credit to the reverse repo dealers in both the intrabank and interbank cases (see Charts 2.2 and 2.4). Further, for the intrabank case, the clearing banks extend intraday credit to the repo dealer to facilitate the morning unwind (see Chart 2.3).

The clearing banks also extend intraday credit to FICC to settle GCF Repo positions. For the end-of-day settlement in the intrabank and interbank cases, as well as during the morning unwind for the intrabank case, the clearing banks extend frictional credit to FICC. In Charts 2.2, 2.3, and 2.4, the frictional aspect of this credit extension is illustrated by the extinguishing of the credit extension to FICC at the end of that particular settlement process. The clearing banks also extend credit to FICC that is non-frictional---this is done during the morning unwind in the interbank case (see Chart 2.5).

Alongside the tri-party repo reforms, the FICC and the clearing banks have implemented (or plan to implement) changes that will reduce the amount of credit extended by the clearing banks to facilitate settlement of GCF Repo positions. We start by reviewing these changes in the settlement process and explaining the consequent reduction in the amount of credit extended by the clearing banks. We then highlight points in the settlement process that still require the clearing banks to extend large amounts of intraday credit.

²⁷ See the February 13, 2014 Statement [“Update on Tri-Party Repo Infrastructure Reform”](#) by the Federal Reserve Bank of New York.

Updates to GCF Repo for the intrabank case

For the intrabank case, FICC and both clearing banks are in the process of making changes to GCF Repo that will reduce the amount of credit extended to dealers on typical days. An already implemented improvement to the settlement process is the delay of the morning unwind from 6:30am to 3:30pm (mirroring the tri-party repo reforms implemented in August 2011). The advantage of delaying the unwind is that credit extensions to the repo dealer, while still large, are for a much shorter length of time. This is because the credit extensions are extinguished with the end-of-day settlement process which begins shortly after the unwind is completed.

Along with the delay of the morning unwind from 6:30 a.m. to 3:30 p.m., the clearing banks implemented intrabank collateral-substitution mechanisms that enable dealers to access and substitute out their securities held as collateral. Recall that one of the main economic impetuses of the morning unwind is to allow dealers unimpeded access to their securities during the business day. With the collateral-substitution mechanism, dealers can continue to access their securities despite the lack of a morning unwind.²⁸

A planned improvement is rolling dealers' positions in GCF Repo, or switching to a "Net-of-Net" settlement process. Rolling positions requires the calculation of the net change from one day to the next for each dealer's position in each collateral class. The clearing bank then only settles the daily difference (see Appendix 2.B for a detailed explanation of the rolling position settlement process). If dealers net GCF Repo positions do not change much from day-to-day, this process could significantly reduce the amount of securities and cash that are required to flow among dealers to settle positions. FICC reports that fully implementing the new Net-of-Net process would result in an average reduction of 76 percent in amount settled.²⁹

This proposed change in settlement would be both operationally efficient and also beneficial in reducing the amount of intraday credit required to settle positions. A note of caution, however, is that if dealers change their trading strategies with the consequence that their net positions fluctuate considerably, then the benefits of rolling positions in reducing the amount of credit necessary to settle trades would be somewhat lessened.

Updates to GCF Repo for the interbank case

Relative to the intrabank case, less progress has been made on the interbank case. The current settlement system for interbank GCF Repo positions still requires the extension of non-frictional credit to FICC. Reducing or eliminating the extension of intraday credit to settle these positions

²⁸ The delay of the morning unwind and the concurrent introduction of collateral-substitution mechanism mirror what was done for tri-party repo trades as part of its reforms. A description of the delay in the unwind and new collateral-substitution mechanisms can be found in FICC's proposed rule change to the Securities Exchange Commission, [SR-FICC-2011-05](#).

²⁹ See the [DTCC Newsletter article](#) "DTCC Improves GCF Repo® End-of-Day Processing to Mitigate Risk and Enhance Efficiencies," by Randy Spencer on September 17, 2013.

requires active engagement from the clearing banks, FICC, and the set of dealers which use the GCF Repo service.

For these interbank cases, a planned improvement with regard to settlement is to partially, rather than fully, unwind in the morning.³⁰ Under the pre-reform system, securities are unwound to the repo dealers, and cash is returned to the reverse repo dealers. Under the new proposed arrangement, securities will be unwound to FICC and the repo dealer will access its securities through a collateral-substitution mechanism.

This proposed settlement change impacts the nature of the intraday credit extended by clearing banks, but not the amount. Specifically, the pre-reform, full, unwind is facilitated by the reverse repo dealer's clearing bank extending credit to FICC and FICC maintaining a NFE hold on the other clearing bank's repo dealer (see stage 2 in Chart 2.5 for an illustration of this credit extension). The total amount of credit extended equals the total net position of all interbank GCF Repo trades (see Chart 2.6).

Under the proposed settlement changes the clearing banks would continue to extend intraday credit to FICC. Now, however, the credit would be secured by cross-clearing bank liens. These liens would be against specific securities or cash residing in FICC's account at the repo dealer's clearing bank. Importantly, the size of the credit extension would not be changed with these updates to the settlement system.

Where does that leave us?

The GCF Repo settlement process remains overly reliant on intraday credit extensions by the clearing banks. As detailed above, these credit extensions are to dealers and FICC. Below we analyze the current state of these credit extensions for the intrabank and interbank cases, laying out the difficulties in determining a solution.

Intrabank case

For the intrabank case, the proposed rolling dealers' positions process will require the clearing banks to extend relatively small amounts of credit to dealers under normal circumstances. As previously mentioned, as part of the tri-party repo reforms, the clearing banks plan to establish committed intraday credit lines to dealers. These facilities could be used to provide credit to repo dealers in the GCF Repo interbank case. A potential problem however, is that these credit extensions are capped and may be insufficient.³¹

³⁰ The details of this proposed settlement change are given in FICC's proposed rule change to the Securities and Exchange Commission, [SR-FICC-2011-05](#). In particular, see section II.B.4, "Substitution on Interbank GCF Repos," on pages 10-11.

³¹ See <http://www.jpmorgan.com/pages/jpmorgan/is/products/clearing/bds/resourcecenter/finishline> for mention of JPMC's plan to set up a committed and secured credit facility.

Intrabank settlement also requires frictional credit to FICC. Compared to dealers, extending credit to FICC involves different counterparty risks. Specifically, FICC is a financial market utility that has been designated as systemically important. How the clearing banks will handle extending intraday credit to FICC has not yet been determined. But it is important to not have a system in which dealers are provided with capped and committed lines of credit to facilitate settlement and FICC has unlimited and uncommitted credit. Such asymmetry in treatment could provide incentives to shift the costs of providing intraday credit from the dealers to FICC. For example, for end-of-day settlement dealers obligated to deliver securities to GCF Repo could perform this action first, and receive cash from FICC, where this cash would be the result of an extension of credit from the clearing banks to FICC. Furthermore, dealers obligated to deliver cash to FICC could delay until the end of the end-of-day settlement process. As a consequence, there would be an infusion of cash into dealers' accounts which could then be used by dealers to facilitate the settlement of their tri-party repo trades.³² This result, however, effectively shifts the costs of providing intraday credit to settle tri-party repo and GCF Repo trades from dealers to FICC, a result which does little to enhance the stability of the tri-party repo settlement platform in times of stress.

There are many options available to the clearing banks. Two potential ideas seek to side-step this issue by eliminating the extension of credit to FICC for the intrabank case. One approach is simply to require the reverse repo dealers to provide the necessary cash up front. A second approach would be for the clearing bank to explicitly link the flows of securities and cash between the repo and reverse repo dealers, and so treat the movement of cash and securities through the FICC account (which stands between the repo and reverse repo dealers) as a temporary and intermediary step. With this second approach, the securities would only leave the repo dealer's account when the clearing bank had already verified that the reverse repo dealer could provide the necessary amount of cash. With this settlement procedure, credit would not need to be extended to FICC to settle the trade.

Interbank case

For the interbank case, clearing banks extend credit to FICC to unwind all interbank GCF Repo positions. The proposed settlement change outlined earlier does not address this basic issue. There are two unusual aspects to this intraday credit extension to FICC. First, the amount of the credit necessary to unwind these transactions is equal to the total net amount of interbank GCF Repo, which can be quite large. In recent history, this amount has been quite variable and occasionally reaches the tens of billions of dollars. Second, the amount of credit extended to FICC is not a result of FICC's actions, but rather of dealers' trading. Consequently, any

³² This type of strategic behavior with respect to minimizing the costs of intraday credit can be seen with financial institutions using Fedwire Securities. In this security settlement system, the institution sending the security (and receiving cash) initiates the transaction. Given the obligation to deliver a security on a particular day, institutions may send the security early in the day in order to build up their cash balance at the Federal Reserve and so lower the probability incurring intraday liquidity charges (see Mills and Nesmith 2008).

restrictions on the amount of credit extended to FICC could only be enforced if constraints are placed on dealers' trading behavior. How the clearing banks will handle the intraday credit extensions to FICC to settle interbank GCF Repo trades has not been determined.

3.2 Fire-Sale Risks

A main objective of tri-party repo settlement reforms is to reduce the risk of fire sales in tri-party repo (Task Force (2010)). Little progress has been made on this issue within tri-party repo, however, reflecting both the focus on other objectives and the difficulty in mitigating this risk. Following the terminology of Begalle, Martin, McAndrews, and McLaughlin (2013), regulators are concerned about two types of fire sales in tri-party repo.

First, there is the pre-default risk of fire sales. Stressed dealers may face difficulties raising funds in tri-party repo because investors may be uncomfortable with the counterparty risk. Losing funding in tri-party repo will cause stressed dealers to de-lever, selling securities in a bid to raise funds and meet their obligations. The sale of securities likely causes prices to drop, increasing the difficulty to the stressed dealer of raising enough cash to cover its obligations. Further, the fall in prices will impact the entire dealer community through mark-to-market accounting. In particular, the clearing banks use the latest set of prices to value the securities used as collateral in tri-party repo trades. Falling prices will force all dealers to post more collateral in order to raise the same amount of cash. Enough of a price decline may cause more dealers to become stressed.

Second, there is post-default risk. When a dealer defaults in tri-party repo, its investors receive the securities posted as collateral. Given their large number and wide variety, investors are unlikely to coordinate their sale of securities. Instead, investors as a group will likely try to sell the securities quickly—and this disorderly rush to sell securities will likely lead to a fire sale.

Fortunately, the role of FICC as a central counterparty in GCF Repo should in theory mitigate both types of fire-sale risk. Pre-default risk arises because the entity lending cash is uncomfortable with counterparty risk. But GCF Repo trades are blind-brokered with FICC standing in as the legal counterparty. With GCF Repo, then, the entities lending cash are not bothered by the possibility of trading anonymously with a stressed dealer.³³

An important caveat to the above discussion is that dealers must remain confident in FICC and its ability to absorb the default of the stressed dealer. Conditional on FICC properly managing its counterparty risk (and dealers perceiving that FICC is doing so), there is no pre-default fire-sale risk associated with the GCF Repo service.

³³ In the second article of this volume, Copeland, Davis, and Martin document that stressed dealers increase the amount of cash they raise using GCF Repo trades, perhaps taking advantage of FICC's absorption of counterparty risk.

Post-default fire-sale risk is also likely to be less of a factor with GCF Repo compared to tri-party repo. This is because the structure of the GCF Repo service means that only one entity, FICC, will liquidate the collateral received from a defaulting dealer. Hence, unlike in the tri-party repo market, where cash investors will likely sell the securities held as collateral in an uncoordinated fashion, FICC has the potential to liquidate collateral in an orderly fashion. This control does not completely neutralize the risk of post-default fire-sale risk, however, because FICC faces constraints to quickly sell the securities held as collateral. Our point here is that the risk is lower relative to the tri-party repo case (all else equal) because FICC could potentially sell its securities in a coordinated way.

4. Conclusion

Given the popularity and widespread use of the GCF Repo service among securities dealers, it is important for market participants, regulators, and academics to fully understand the financial infrastructure underpinning it. This article provides a detailed look at the clearance and settlement of GCF Repo trades, as well as highlights the risk of a heavy reliance on intraday credit to settle GCF Repo trades and discusses how FICC's role as a central counterparty reducing the risks of fire-sale associated with this product.

Both clearing banks have committed to putting into place a new settlement system for tri-party repo trades by the end of 2014.³⁴ Some of these planned changes may also affect the settlement of GCF Repo trades, possibly further reducing some of the reliance on intraday credit. There are, however, open issues regarding how GCF Repo trades will settle, in particular for the interbank case. The clearing banks and FICC need to further improve the settlement of interbank GCF Repo trades to minimize the use of intraday credit. Furthermore, whether and how the clearing banks extend intraday credit to FICC to facilitate settlement needs to be decided. These financial plumbing decisions are important because they will likely influence how much dealers' rely on intraday credit from the clearing banks and perhaps impact dealers' ability to conduct interbank GCF Repo trades. As such, all parties--the clearing banks, FICC, and the dealers which use GCF Repo--need to remain actively engaged in these financial plumbing issues.

³⁴ Links to each clearing bank's plans can be found on the Tri-Party Repo Infrastructure Reform webpage: http://www.newyorkfed.org/banking/tpr_infr_reform.html.

Bibliography

- Begalle, B., A. Martin, J. McAndrews, and S. McLaughlin. 2013. “The Risk of Fire Sales in the Tri-party Repo Market.” Federal Reserve Bank of New York *Staff Reports*, no. 616, May.
- Copeland, A., D. Duffie, A. Martin, and S. McLaughlin. 2012. “Key Mechanics of the U.S. Tri-Party Repo Market.” *Journal of Finance*.
- Fleming, M., and K. Garbade. 2003. “The Repurchase Agreement Redefined: GCF Repo[®].” Federal Reserve Bank of New York *Current Issues in Economics and Finance* 9, no. 6, June.
- Mills, D. C., and T. Nesmith. 2008. “Risk and Concentration in Payment and Securities Settlement Systems.” *Journal of Monetary Economics*, 55(3), p. 542-553.
- Tri-Party Repo Infrastructure Reform Task Force. 2010. “Task Force on Tri-Party Repo Infrastructure: Report.” Payments Risk Committee, sponsored by the Federal Reserve Bank of New York. Available at <http://www.newyorkfed.org/banking/tpr_infr_reform.html>.

Part 2 Appendix

Appendix 2.A: How the Clearing Banks Manage the Risk Associated with Their Intraday Credit Extensions (Pre-Reform)

Net free equity (NFE) is a risk management tool used by both clearing banks to ensure that the extension of intraday credit to dealers is secured by collateral to which the clearing bank has a right of offset in the case of default. A dealer's NFE is the difference between the value of cash and collateral it holds in various accounts at the clearing bank, taking into account haircuts, and the amount of intraday credit (overdrafts) the clearing bank is currently extending to it.

Not all dealers' accounts are included in its NFE; for example, a dealer's segregated client accounts are excluded. Thus NFE refers to the total value of cash and collateral to which a dealer has title and which is unencumbered by existing obligations to the clearing bank. As part of their risk management, clearing banks continuously monitor a dealer's NFE and ensure its extension of intraday credit to the dealer does not push the dealer's NFE below zero.

GCF Repo allocations between two dealers operating out of different clearing banks create two main risk management challenges for FICC and the clearing banks. The first risk management obstacle occurs with the end-of-day settlement of GCF Repo, and the second occurs with the GCF Repo morning unwind. The solutions to these two risk management problems are different.

Starting first with end-of-day settlement, the underlying problem is that the securities posted as collateral are not transferred across the clearing banks. This is because the Fedwire Securities system closes at 3 p.m., about when the GCF Repo settlement process begins. Even if Fedwire Securities were to remain open, it is operationally inefficient to move large numbers of securities across the two clearing banks every day.

As illustrated in Chart 2.4, the difficulty lies in that one clearing bank (clearing bank 2 in the chart) has to extend credit to the reverse repo dealer in order to facilitate settlement of the reverse repo leg of the transaction. This securities-for-cash exchange, however, relies on securities residing on the books of the other clearing bank (clearing bank 1 in the chart).

The solution is to create a cross-clearing bank lien, whereby the relevant securities were placed in a segregated account on clearing bank 1's books (labeled "FICC's CB2 account" on the books of clearing bank 1 in Chart 2.4). Clearing bank 2 then creates copies of its securities (called securities clones) that serve as proxies for the securities sequestered in FICC's CB2 account at clearing bank 1. Under this arrangement, clearing bank 2 can now execute, on its books, the securities-for-cash exchange between FICC and the reverse repo dealer.

The second risk management problem occurs with the GCF Repo morning unwind. Recall that the goal of the unwind is to return securities to the repo dealer so that these dealers can use the

Table 2.A: Example calculation of the NFE Hold (pre-reform)Clearing Bank 1 Dealers' GCF Repo Positions on Day *t*

Dealer	Total Repo Amount (\$ Billions)	Percent (%)	Total Reverse Repo Amount (\$ Billions)	Net Position (Repo – Reverse Repo) (\$ Billions)
A	2	7	6	(-4)
B	4	14	3	1
C	9	32	1	8
D	7	25	7	0
E	6	21	0	6
F	0	0	5	(-5)
Total	28	100	22	6

Clearing Bank 1 Dealers and the NFE Hold on the Morning of Day *t+1*

Dealer	NFE Hold
A	\$428,571,429
B	\$857,142,857
C	\$1,928,571,429
D	\$1,500,000,000
E	\$1,285,714,286
F	\$0
Total	\$6,000,000,000

Note: The “NFE hold” is equal to the dealer’s repo amount as a percent of total repo activity on the clearing bank multiplied by the net amount of interbank funds (\$6 billion, in this example).

securities throughout the trading day for other transactions. To facilitate the unwind, the reverse repo dealer’s clearing bank (clearing bank 2 in Chart 2.5) extends intraday credit to FICC so that FICC can deliver cash to the reverse repo dealer in return for the securities collateralizing the GCF Repo position.

Initially, this credit extension is secured by the securities underlying the GCF Repo position (which are sequestered at FICC’s CB2 account on the books of clearing bank 1). The goal of the unwind, however, is to transfer these securities back to the repo dealer. To accomplish this, while still maintaining a secured intraday credit extension from clearing bank 2 to FICC, FICC and the clearing banks implement a lien called the “NFE hold.” The NFE hold is a legal arrangement whereby FICC has a lien on dealers’ NFE at each clearing bank, in this case the repo dealer at clearing bank 1. This means that FICC has a lien on all of a dealer’s unencumbered securities in various accounts at the clearing bank.³⁵ The total amount of the lien is equal to the previous day’s interbank net funds borrowed. The lien is placed only on those dealers residing at the net borrowing clearing bank and is allocated proportionately based on these dealers’ net repo amounts. Consider the example laid out in Table 2.A.

³⁵ FICC’s lien is on all of a dealer’s unencumbered securities, a set of assets which includes securities which are not eligible for GCF Repo.

In this example, the clearing bank 1 dealers have borrowed \$6 billion more than they have loaned (see the last row of the upper panel of Table 2.A). This cash comes from clearing bank 2 dealers and is the amount of interbank GCF Repo on date t . With the unwind on the morning of day $t+1$, FICC will impose a NFE hold on dealers A through E, proportionate to their total repo activity. The NFE hold on dealer A, for example, is equal to $(2/28)*6,000,000,000 = \$428,571,429$.

As explained in Section 3.1, there is a proposal to replace the NFE hold with a cross-lien legal arrangement as part of a series of reforms aimed at improving the settlement of GCF Repo positions.

Appendix 2.B: How does the settlement process of rolling dealers' positions (a.k.a. Net-of-Net settlement) work?

Consider the case where a dealer increases its net position from \$10 to \$11 billion in GCF Repo backed by Treasuries with maturities of 30 years or less. With the rolling position process, the dealer is obligated to deliver only \$1 billion in Treasuries to complete the end-of-day settlement process. Recall that under the previous system, the clearing bank would unwind the entire \$10 billion GCF Repo position in the morning and then settle \$11 billion later that day. To unwind the position in the morning, the clearing bank would need to extend \$10 billion in intraday credit.

Rolling positions dramatically reduces the reliance on intraday credit, for most cases. Dealers only need credit when they reduce a repo position or they increase a reverse repo position. In both these instances, the dealer will receive securities from FICC, against which the dealer must deliver cash.

Importantly, for these two instances, the dealer only needs credit for the change in their net position (hence the net-of-net label). Historically, dealers have maintained similar net positions from day to day, which suggests that rolling positions will dramatically reduce the amount of intraday liquidity needed to settle GCF Repo positions. When there are large changes to a dealer's net position, however, this rolling process does not significantly improve upon a complete unwind and rewind of a dealer's position, from the perspective of the use of intraday credit. In particular, if a dealer switches from being a net lender to a net borrow (or vice versa) for a particular collateral class in GCF Repo, then rolling positions uses the same amount of intraday credit as a full unwind and rewind approach.

Part 3: An Empirical Analysis of the GCF Repo[®] Service³⁶

by Adam Copeland, Isaac Davis, and Antoine Martin

The General Collateral Finance Repo (GCF Repo[®]) is a financial service that allows securities dealers to exchange government securities for cash among themselves on an anonymous basis.³⁷ Knowledge about participants' trading strategies of GCF Repo, however, is anecdotal. Using newly available data, we aim to quantify the behavior of dealers which trade GCF Repo. The data, of course, allows us to only observe participant's behavior, not their motivations. Given this limitation, we define stylized strategies and measure the degree to which these strategies are pursued by dealers which trade GCF Repos.

In this article, we provide three sets of results on the strategies dealers pursue when trading GCF Repos. First, we describe daily activity by looking at end of day settlement. We document which groups of dealers use the GCF Repo for funding. We find there is a lot of variety among dealers, but that, on average, those dealers that are not part of a bank holding company consistently borrow cash (against securities) in this market.

Second, we examine activity on the GCF Repo market using two different measures of dealers' net and gross activities. We infer that on average, (i) 23 percent of dealers use GCF Repos to raise funds, (ii) 20 percent of dealers use GCF Repo to source collateral or conduct collateral swaps, and (iii) the remaining 57 percent of dealers follow a variety of strategies when trading GCF Repos, including acting as liquidity providers to other participants.

Third, we examine if dealers' strategies for trading GCF Repo and tri-party repo are related. We find that in normal times, there is a negative correlation between daily changes in the amount of cash a dealer raises using tri-party repo and daily changes in the amount raised using GCF Repo. This correlation suggests that dealers view these two financial products as substitutes. We then consider how dealers trade both GCF Repo and tri-party repo in times of crisis. Market wisdom is that a stressed dealer should look to increase the amount of funds it raises using GCF Repo, because FICC, acting as a central counterparty, absorbs counterparty risk. The available data confirms this story.

³⁶ We would like to thank Paul Agueci, Leyla Alkan, Michele Braun, Vic Chakrian, and Kate Pingitore for their comments and, more generally, sharing their knowledge of the GCF Repo service and the data used in this analysis. The views expressed herein are those of the authors and do not necessarily represent the views of the Federal Reserve Bank of New York or the Federal Reserve System.

³⁷ GCF Repo[®] Service (hereinafter, "GCF Repo") is a registered service mark of the Fixed Income Clearing Corporation.

1. General Description

We begin by providing a general overview of the GCF Repo product, followed by a description of our data.

1.1 Institutional details

The Fixed Income Clearing Corporation (FICC) introduced the GCF Repo Service in 1998. GCF Repo trades are general collateral repurchase agreements between eligible dealers which are executed through interdealer brokers (IDB), where one dealer is putting cash into the deal while the other dealer is providing securities. (These agreements closely resemble collateralized loans.) These trades are called *general collateral* because the institution providing securities is not required to provide a specific security, but rather any security within a fairly large class. As detailed in the introduction of this volume, FICC defines 10 collateral classes which can be used by dealers (see Table 1.1 in Part 1). Only institutions deemed eligible by FICC are able to trade GCF Repo. In December of 2012, there were 120 eligible securities dealers.³⁸

GCF Repos are traded on a blind brokered basis, where a dealer relies on an IDB to match the trade with another dealer. FICC guarantees settlement when the trade is compared. For locked-in trades, such as GCF Repo trades, the comparison of the trades is deemed to occur upon FICC's receipt of the trade data from the IDB. At the end of the day, when the trades are netted, FICC novates the trade and becomes the legal counterparty to both sides of the transaction. Because FICC interposes itself between the two dealers, the counterparty risk shifts from the dealer to FICC. To protect itself against the financial loss due to a default, FICC, in addition to its eligibility requirements, requires dealers trading GCF Repo to post collateral and cash in FICC's government securities division clearing fund. Because of the guarantee that FICC provides, GCF Repo trades are not over-collateralized (unlike most repos). Specifically, they do not include a "haircut". Rather, the value of securities posted as collateral is equal to the amount of cash lent.

In addition to assuming the counterparty risk for any GCF Repo trade, FICC also provides netting. At the end of each trading day, FICC computes for each dealer and each collateral category, the amount of securities the dealer has promised to deliver and the amount that has been promised to the dealer. The difference between these two amounts, the net position of a dealer in a collateral category, is then settled.

In our data there are 5 IDBs which participate in brokering GCF Repo trades. The objective of IDBs is to execute and match dealers' trades while preserving each dealer's anonymity. According to market participants, a dealer selects an IDB based on liquidity, rates offered, personal relationships, time of day and the IDB's niche. All IDBs offer voice platforms and 3

³⁸ Almost all of the financial entities in this market can be considered securities dealers, and so for expositional clarity we refer to all GCF Repo participants as securities dealers or simply dealers. A list of the financial entities currently eligible to participate in GCF Repo can be found at http://www.dtcc.com/customer/directories/ficc/ficc_gov.php. (Look for those members with the "Repo Netting/GCF" service designation.)

IDBs also offer electronic trading platforms. With a voice trading platform, a human intermediary, the voice broker, will match buyers and sellers, while maintaining anonymity on both sides. Electronic trading platforms allow dealers to find their own matches while preserving dealers' anonymity. Such a platform provides a dealer with a user interface through which it can submit its own trades, and find matching buyers or sellers through an automated algorithm built into the platform. These electronic trading platforms can be used to process large volumes of trades very quickly, whereas on a voice trading platform a person finds and matches buyers with sellers for each individual trade. An advantage of the voice trading platform, though, is that it allows dealers, through the broker, to negotiate the terms of trade.

There are a variety of security dealers which trade GCF Repo. In the empirical section that follows, we provide statistics describing these dealers. In general however, there are both domestic and foreign-based dealers. A majority of dealers are part of bank holding companies (BHC) and there are a few instances where different legal entities of the same bank holding company trade in this market. For example, both the broker dealer and the commercial bank entities of the same bank holding company may actively trade GCF Repos. In addition, there are a few legacy entities that have not been consolidated. We assume there is an economically meaningful reason why a bank holding company would have more than one entity trading on GCF Repo, and so we treat each entity separately. Finally, most, but not all, dealers also trade tri-party repos.

Dealers use the GCF Repo product to redistribute cash and eligible securities among themselves. In general, dealers negotiate GCF Repo trades for three purposes: raising funds, sourcing collateral, or leveraging liquidity (of this interdealer market). We consider each in turn, but note here that the third purpose is a catch-all category which incorporates a large variety of different trading strategies.

The strategy of raising funds with GCF Repo trades reflects the reality that dealers, which present different risks as counterparties, face a range of interest rates when seeking to raise funds from the money markets. These differences in rates provide an opportunity for dealers to intermediate funds among themselves. For example, dealers that can cheaply borrow from tri-party repo investors could borrow more than they need, lending the extra cash through GCF Repo. GCF Repo is an effective tool for dealers to intermediate cash among themselves because FICC, acting as a central counterparty, absorbs counterparty risk.

Dealers also negotiate GCF Repo trades to source collateral. Dealers cannot, of course, source specific securities through GCF Repo because of its general collateral design. Rather, dealers can source types of securities. Such transactions are useful when dealers may be seeking securities to fill other general collateral repos, such as tri-party repos.³⁹ Market participants claim that GCF Repo plays a crucial role in allowing dealers to alter their stock of securities at the end of the

³⁹ Indeed, the 10 predefined general asset classes for GCF Repo match up closely with the asset classes generally accepted by cash investors in tri-party repo.

day, balancing investor's demands that a dealer borrow a consistent amount over time against the dealer's profit-making activity of purchasing and selling securities over the business day. For example, a dealer may need to post U.S. Treasuries as collateral to a tri-party repo investor, but not have enough Treasuries at the end of the day. Using GCF Repo, though, the dealer can simply reverse repo in the requisite amount of Treasuries.⁴⁰ Alternatively, the dealer could execute a collateral swap if it has other unencumbered securities, such as agency mortgaged backed securities (MBS). A collateral swap requires negotiating two GCF Repo trades. The dealer agrees to 1) deliver agency MBS (borrowing cash) and 2) accept Treasuries (lending cash). By executing these two trades, the dealer can meet the demands of its investor rather inexpensively--the cost of these two GCF Repo trades is roughly the difference in rates across the two transactions.

Dealers also negotiate GCF Repo trades for a variety of strategies that do not fit neatly into either the raising funds or sourcing collateral categories. We group these remaining strategies into a third category, called "leveraging liquidity". This label reflects that many of these alternative strategies take advantage of the liquidity in this interdealer market. For example, dealers may experience fails in securities sales and as a result seek to repo out these securities overnight. Another example is dealers wanting to accommodate cash investors which are seeking to lend more than expected on a particular day. Dealers then may place the extra amount of cash in GCF Repo. In both these examples, dealers are leveraging the liquidity of this interdealer market to accommodate unexpected inflows or outflows of securities or cash from other types of trades. Finally, another strategy that falls into this category is the provision of liquidity. Because a dealer's GCF Repo position for a given collateral class is netted at the end of the day, it is inexpensive for a dealer to buy and sell securities within one of the ten predefined collateral classes throughout the day. Some dealers take advantage of this netting service and act as liquidity providers to other dealers seeking to raise funds or source collateral.

1.2 Data description

Our analysis mainly relies on confidential data covering GCF Repo from March 1, 2011 to September 30, 2012. The data are collected daily and aggregated by dealer and collateral class. For each collateral class, we observe the gross value of securities the dealer has committed to deliver (the total repo amount) as well as the gross value of securities the dealer will receive (the total reverse repo amount).

Over the sample period, the daily average total value of GCF Repo trades is \$493 billion (see the last row of Table 3.1).⁴¹ There are 10 collateral classes traded in our sample but two collateral classes dominate in terms of gross value traded, U.S. Treasuries with maturities of 30 years or less and Fannie Mae and Freddie Mac fixed rate mortgage-backed securities (MBS) (see Table

⁴⁰ Repos are trades in which the dealer has promised to deliver securities against cash, while reverse repos are trades in which the dealer has promised to deliver cash against securities.

⁴¹ Every trade creates a repo and a reverse repo transaction. When considering aggregate statistics, we add up only over repo transactions to avoid double-counting.

3.1 and note these classes are not mutually exclusive). In our sample these two collateral classes account for 83 percent of all GCF Repos. Currently there are only 9 collateral classes traded, because there are no longer any securities which fall into the FDIC Guaranteed Corporate Bonds collateral class.⁴²

Table 3.1: Collateral Classes in GCF Repo

Asset Type	Mean daily gross collateral (\$ bil)	Percent of Total
Fannie Mae & Freddie Mac Fixed Rate MBS	209.72	42.55
US Treasuries with maturities of 30 years or less	199.93	40.56
Non-MBS US agency securities	33.66	6.83
Ginnie Mae Fixed Rate MBS	27.74	5.63
Fannie Mae & Freddie Mac Adjustable Rate MBS	13.97	2.83
US Treasuries with maturities of 10 years or less	2.65	0.54
US Treasury Inflation Protected	2.98	0.60
FDIC Guaranteed Corporate Bonds	1.30	0.26
US Treasury STRIPs	0.78	0.16
Ginnie Mae Adjustable Rate MBS	0.16	0.03
Total	492.89	100.00

Note: The mean daily gross collateral is the average value of all repo trades conducted in each day of the sample. Asset types are ranked from largest to smallest as a percent of the total. MBS is mortgage-backed securities, GNMA is Ginnie Mae, and FDIC is the Federal Deposit Insurance Corporation. STRIP stands for separate trading of registered interest and principal. An example of a non-MBS US agency security is agency debentures.

In our sample, there are 65 securities dealers active in the market. Of those 65 dealers, 33 traded GCF Repos every day of our sample, and 40 traded on at least 90 percent of the days. In general, the infrequent participants are much smaller in terms of their mean daily repo activity (on days for which they are active) than the frequent participants. In our sample, frequent participants conduct an average of \$24 billion in trades on every day they are active, compared to \$2.4 billion for infrequent participants.

While dealers are fairly heterogeneous in their activity, we find it useful to classify them into two groups: those that are part of a bank holding company (BHC), and those that are not. This distinction is economically important because independent dealers (those not part of BHCs) solely rely on capital markets for funding. Dealers which are part of BHCs, in contrast, can also access capital held within the BHC. Turning to the 44 dealers which are part of a BHC, we find there is a wide variety in their size. Defining size as the value of USD assets held by the associated BHC, the range of asset holdings is \$13 billion to \$2.3 trillion.⁴³ Following a natural

⁴² The Federal Deposit Insurance Corporation's Debt Guarantee Program, developed during the recent financial crisis, generated this special class of corporate bonds. This program is no longer active. For more information, see <http://www.fdic.gov/regulations/resources/TLGP/>.

⁴³ Information on the value of USD assets at the BHC level come from the Federal Reserve Y-9C regulatory filings. For detailed information on these filings, go to <http://www.federalreserve.gov/apps/reportforms/default.aspx> and look up form FR Y-9C.

break in this distribution, we pick a cutoff value of \$500 billion to differentiate dealers which are part of large and small BHCs. Overall then, dealers fall into three groups: those associated with large BHCs, those associated with small BHCs, and those who are not part of a BHC (which we label non-BHC dealers).

The remainder of this paper uses the above data to both compute to what degree dealers seek to raise funds, source collateral, or leverage liquidity with GCF Repo trades as well as describe which types of dealers are more likely to use each strategy.

2. Daily net activity

We begin by looking at dealers' daily net activity across all collateral classes. For each day, we compute each dealer's net cash position. This position is equal to the sum of the difference between repos and reverse repo amounts across all collateral categories. Formally, dealer j 's net cash position at day t is given by:

$$netcash_{jt} = \sum_{i=1}^{10} (repo_{ijt} - reverse_{ijt}), \quad (1)$$

where $repo_{ijt}$ and $reverse_{ijt}$ are dealer j 's repo and reverse repo position, respectively, in collateral group i at date t . A positive net cash position means that the dealer is receiving cash at the end of the day, after accounting for the dealer's activity across all collateral classes. A negative number means that the dealer is lending cash. In our sample, the net cash position ranges from, roughly, -\$30 billion to \$40 billion. We also look at the net cash position for dealers associated with large and small bank holding companies (see the second and third rows of Table 3.2). While there is still a lot of heterogeneity among dealers in each category, for those dealers which are part of BHCs, the mean net cash position is negative. As a group, then, dealers associated with bank holding companies typically lend cash using GCF Repo. The average dealer which is part of a large BHC typically lends \$1.1 billion every day. The average dealer which is part of small BHC lends slightly more, \$1.6 billion each day. This flow of cash can also be seen by noting that the average dealer not associated with a bank holding company (labeled non-BHC) typically has a positive net cash position of \$3.4 billion.

While dealers vary widely in their net cash positions, they are quite consistent in their strategies regarding borrowing or lending cash using GCF Repo (in normal times). We find that a dealer who borrows cash today will continue to borrow cash tomorrow with 96.0 percent probability (see the first row of Table 3.3). Similarly, a dealer who lent cash today will continue to lend cash tomorrow with 95.1 percent probability (see the second row of Table 3.3).

Table 3.2: Distribution of Net Cash Positions (billions of dollars)

	10 th percentile	20 th percentile	Median	75 th percentile	90 th percentile	Mean	Num Dlrs
All	-8.2	-2.0	0.2	2.5	7.2	0.1	65
Large BHCs	-11.2	-4.1	-0.2	0.8	7.2	-1.1	14
Small BHCs	-10.8	-2.7	-0.0	1.8	7.5	-1.6	30
Non-BHCs	-2.8	0.2	0.7	5.3	6.6	3.4	21

Note: Dealers are categorized as those belonging to a large bank holding company (BHC), a small BHC, or as not being part of a BHC (Non-BHCs). Num Dlrs is the number of dealers. Net cash position is the amount of dollars a dealer is delivering (if negative) or has been promised (if positive) at the end of the day, after accounting for trading activity across all collateral classes.

Table 3.3: Transition Probabilities

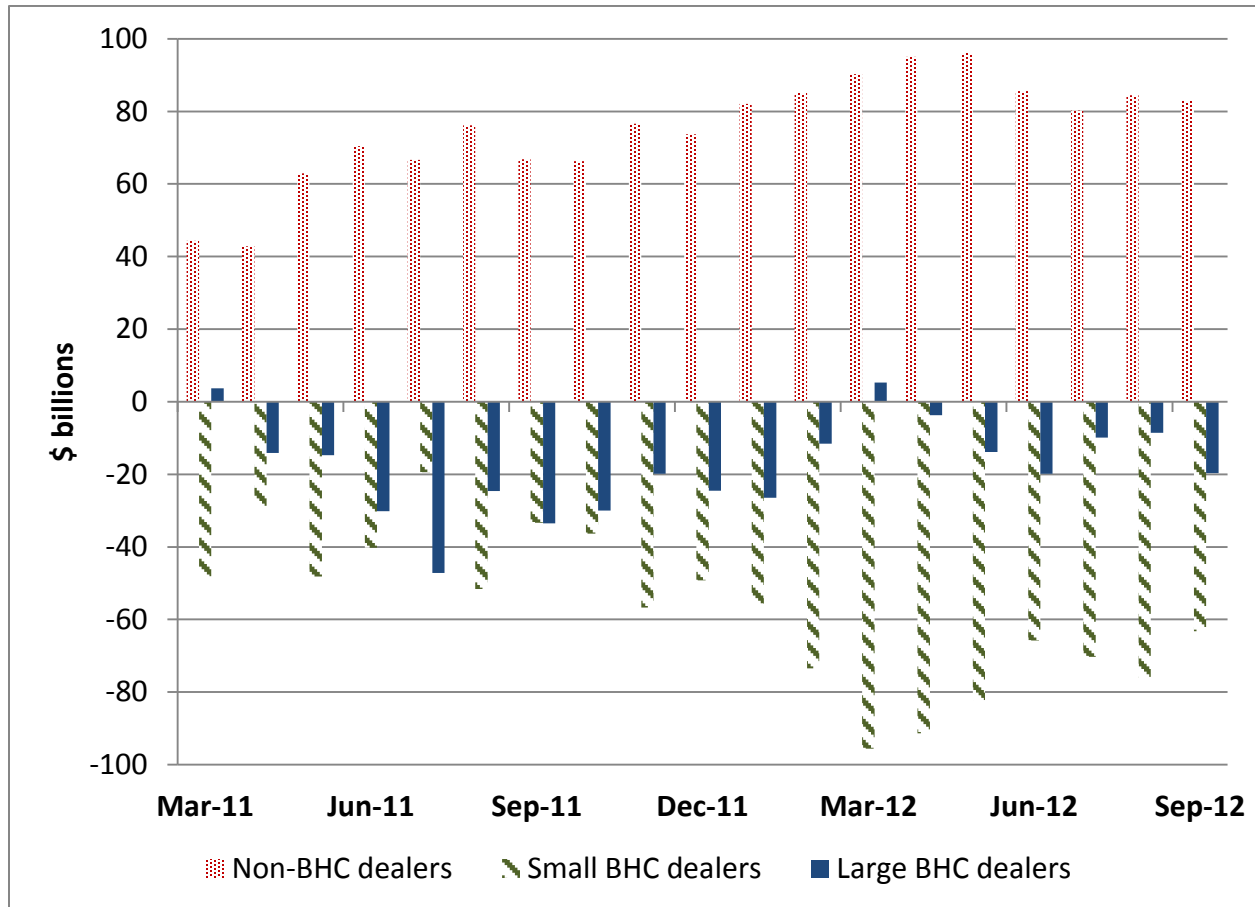
t-1	t	
	Net Borrower	Net Lender
Net Borrower	96.0%	4.0%
Net Lender	4.9%	95.1%

Note: A net borrower is a dealer whose net cash position is positive. A net lender is a dealer whose net cash position is less than or equal to 0. A cell entry provides the probability of transitioning from a net borrower or lender in GCF Repo at time $t-1$ to being a net borrower or lender at time t . Each row sums to 100 percent.

To gain a better sense of the aggregate flow of cash among dealers we computed the daily net cash position for each group of dealers. In Chart 3.1, we plot the monthly average net cash position for each of these three groups. As illustrated by the chart, the group of dealers which are not part of BHCs consistently raises cash. The funding raised by non-BHC dealers has doubled over the sample period, from around \$40 to \$80 billion each day. As a group, dealers who are part of small BHCs often are the source of the majority of these funds.

With the flow of cash from dealers associated with BHCs to those who are not, there must be a flow of collateral going the other direction. To understand the movement of collateral among the three groups of dealers, we focus on the two collateral classes which account for the vast majority of GCF Repo transactions: US Treasuries with maturities of 30 years or less and Fannie Mae and Freddie Mac fixed rate MBS (henceforth abbreviated as FFR MBS). For each of these two collateral types, we compute each dealer group's net position (i.e. total repos minus total reverse repos) for each day. We then compute the average position for the month, and plot the results in Charts 3.2A and 3.2B.

Chart 3.1: Daily Net Cash Position by Dealer Group, Monthly Average



Note: Dealers are categorized as those belonging to a large bank holding company (BHC), a small BHC, or as not being part of a BHC (Non-BHCs). A positive position means that the group of dealers receives cash, on net, each day. A bar represents the daily net cash position for a dealer group averaged over a month.

From this aggregate viewpoint, we see that non-BHC dealers provide both US Treasuries and FFFR MBS as collateral for their repo trades. Towards the end of the sample, though, non-BHC dealers increasingly post FFFR MBS securities as collateral. Strikingly, dealers associated with small BHCs markedly differ from those which are part of large BHCs. Small BHC affiliated dealers reverse in about \$20 to \$30 billion of U.S. Treasuries each day (see Chart 3.2A). These U.S. Treasuries securities are delivered to them by both non-BHC affiliated and large BHC affiliated dealers. Large BHC affiliated dealers reverse in FFFR MBS securities over the sample period (see Chart 3.2B). Small BHC dealers, on the other hand, switched from delivering FFFR MBS securities in the beginning of the sample to reversing in these securities at the end of the sample. Looking at the behavior of small BHC affiliated dealers in both Charts 2A and 2B, the data suggests this group of dealers is pursuing, as a whole, a collateral upgrading strategy throughout the sample.

Chart 3.2A: Daily Net U.S. Treasury Position by Dealer Group, Monthly Average
 (U.S. Treasuries with maturities of 30 years or less)

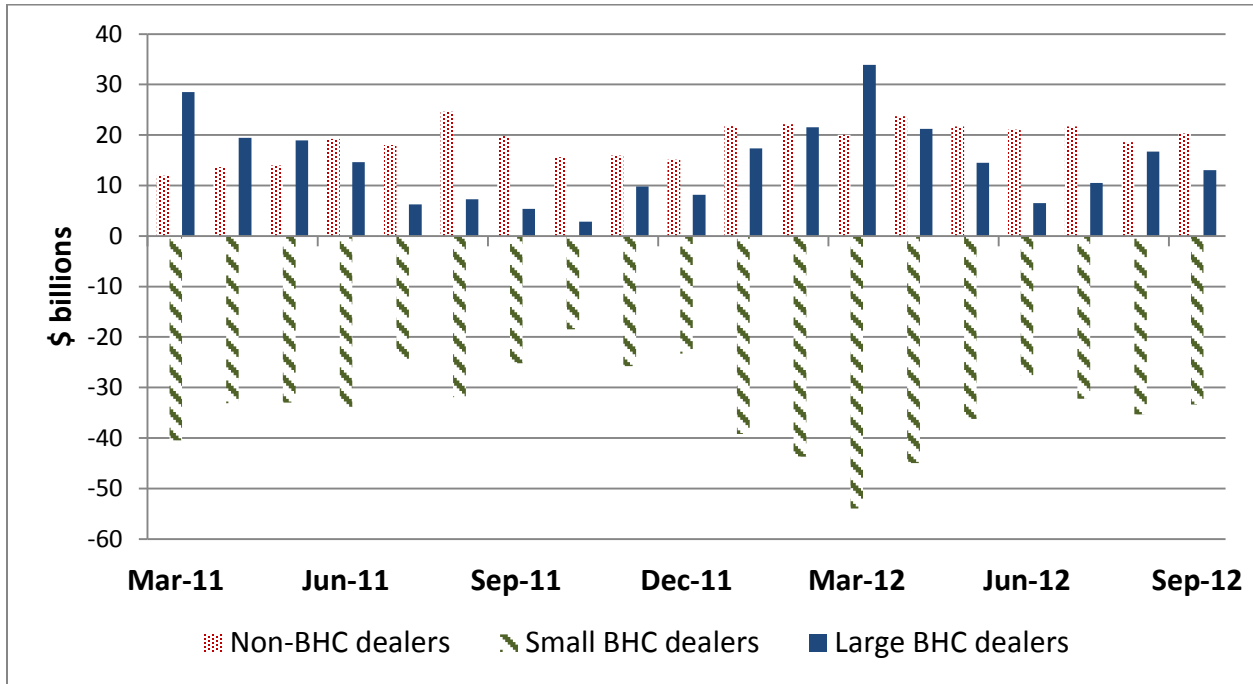
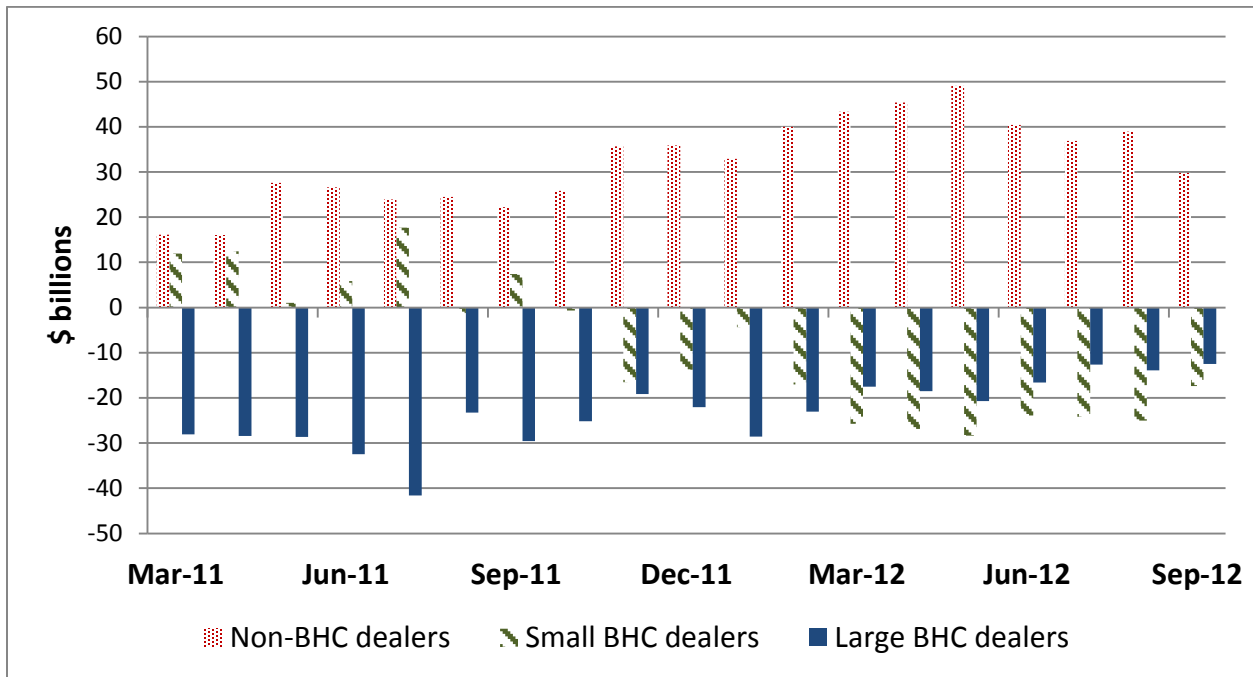


Chart 3.2B: Daily Net Fixed Rate Agency MBS Position by Dealer Group, Monthly Average
 (Fannie Mae and Freddie Mac fixed rate MBS)



Note: Dealers are categorized as those belonging to a large bank holding company (BHC), a small BHC, or as not being part of a BHC (Non-BHCs). A positive position means that the group of dealers has promised to deliver these securities, on net, each day. A bar represents the daily net position for a dealer group averaged over a month.

Overall then, these aggregate statistics demonstrate that the non-BHC affiliated group of dealers use GCF Repo as a source of funding. Further, the statistics suggest that the small BHC affiliated group of dealers pursue both leveraging liquidity and collateral up-grading strategies in the market, and the large BHC affiliated dealers mostly use leveraging liquidity strategies.

3. Comparing gross and net activity

We now analyze gross and net activity to further distinguish the degree to which dealers pursue various strategies. We start by considering dealers' net-to-gross ratios. This ratio allows us to differentiate dealers which are mainly employing leveraging liquidity or collateral swapping strategies from those which are mainly pursuing funding or securities acquiring strategies. We then consider another statistic, a swap ratio, which measures how much dealers swap collateral each day.

We begin by constructing a dealer's net-to-gross ratio for each day in the sample. Because we want to account for activity across collateral classes, we construct this measure based on cash activity. The "gross" part of this ratio is the sum over the absolute value of all repos and reverse repos a dealer trades in a day, and so is a measure of the totality of a dealer's activity. The "net" part is the sum across all collateral classes of the difference between a dealer's total repo and total reverse repo position (see $netcash_{jt}$ defined earlier). Formally, for dealer j at date t , the net-to-gross ratio is equal to:

$$NtG_{jt} = \frac{\sum_{i=1}^{10}(repo_{ijt} - reverse_{ijt})}{\sum_{i=1}^{10}(repo_{ijt} + reverse_{ijt})} = \frac{netcash_{jt}}{\sum_{i=1}^{10}(repo_{ijt} + reverse_{ijt})},$$

where i indexes the collateral groups traded in GCF Repo.

The net-to-gross ratio is positive if the dealer is receiving cash at the end of the day, and negative if the dealer is delivering cash. By construction, this ratio is always between -1 and 1, and is equal to 0 when the dealer's net position is exactly offsetting (i.e. the dealer is receiving equal amounts of cash and collateral). When the ratio is close to 1, the dealer's predominant strategy is to obtain cash in this market. For the ratio to be equal to 1, the dealer must only conduct repo transactions. Similarly, if the ratio is close to -1, the dealer's predominant strategy is to obtain securities for cash. For the ratio to be equal to -1, the dealer must only conduct reverse repo transactions. Finally, when the ratio is closer to zero, substantial netting is occurring. This could mean dealers are mostly providing liquidity, conducting repo and reverse repo transactions within the same collateral class. Alternatively, dealers could be seeking to manage their inventories by exchanging collateral (e.g. collateral upgrading). In these cases, dealers would be conducting repo transactions in one collateral class and conducting reverse repo transactions in another collateral class.

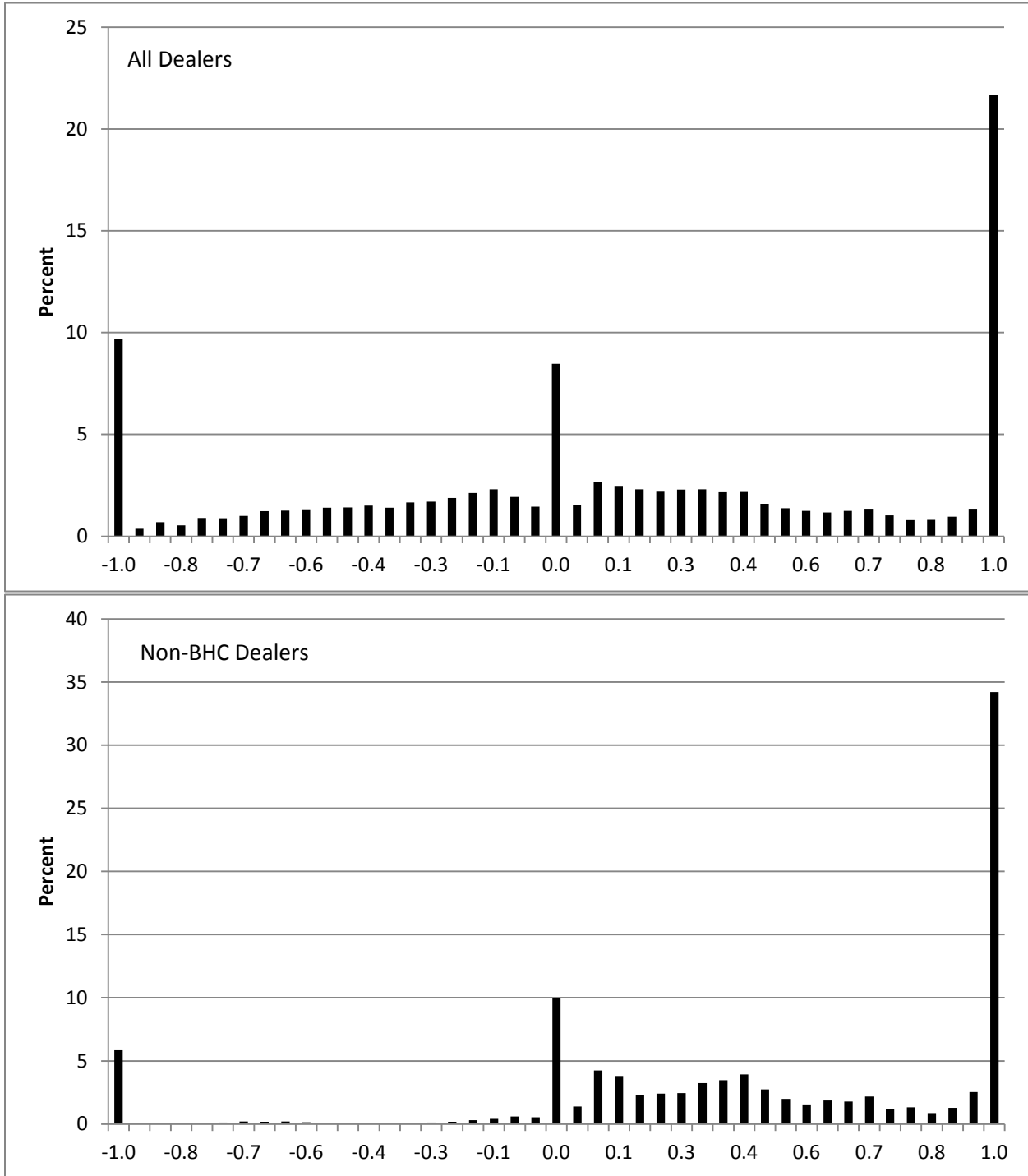
We begin by analyzing the net-to-gross distribution for all dealers and then examine each dealer group separately. The histogram of net-to-gross ratios for all dealers (the upper panel of Chart 3.3A) highlights the diverse set of strategies followed by dealers. About 23 percent of dealers conduct only repos (the net-to-gross ratio is equal to 1) and so use GCF Repo to effectively raise funds. Almost 10 percent of dealers conduct only reverse repos (the net-to-gross ratio is equal to -1), using this market to acquire securities. The remaining 57 percent of dealers are executing both repo and reverse repos, with a substantial number of dealers offsetting their repo and reverse repo trades so as to have net positions close to zero (about 8.5 percent of dealers). Dealers with net-to-gross ratios between -1 and 1 most likely pursue a mixed set of strategies, and it is difficult to disentangle dealers' propensity to rely on one strategy more than another without a more formal analysis.

Analyzing the distribution of net-to-gross distributions by dealer group, though, reveals stark differences in strategies pursued by each group. Confirming the results from the previous section, we find the vast majority of non-BHC dealers have positive net-to-gross ratios and so receive cash at the end of the day (see the lower panel of Chart 3.3A). Indeed, almost 35 percent of the time non-BHC dealers conducted only repo trades. But not all non-BHC dealers try to just raise funds. A little more than 5 percent perform only reverse repos and about 10 percent have net-to-gross ratios near zero, and so buy and sell roughly equal amounts of repo and reverse repos.

Compared to non-BHC dealers, small BHC dealers' net-to-gross ratios are more evenly distributed between -1 and 1 (see the upper panel of Chart 3.3B). Small BHC dealers are roughly equally split between borrowing or lending cash at the end of the day (the median value of net-to-gross is -0.01 for small BHC dealers). Like non-BHC dealers, however, there are significant numbers of small BHC dealers which have net-to-gross ratios roughly equal to 1, -1 and 0. Small BHCs conduct only repos 17 percent of the time, only reverse repos 13 percent of the time, and have net positions close to zero about 9 percent of the time.

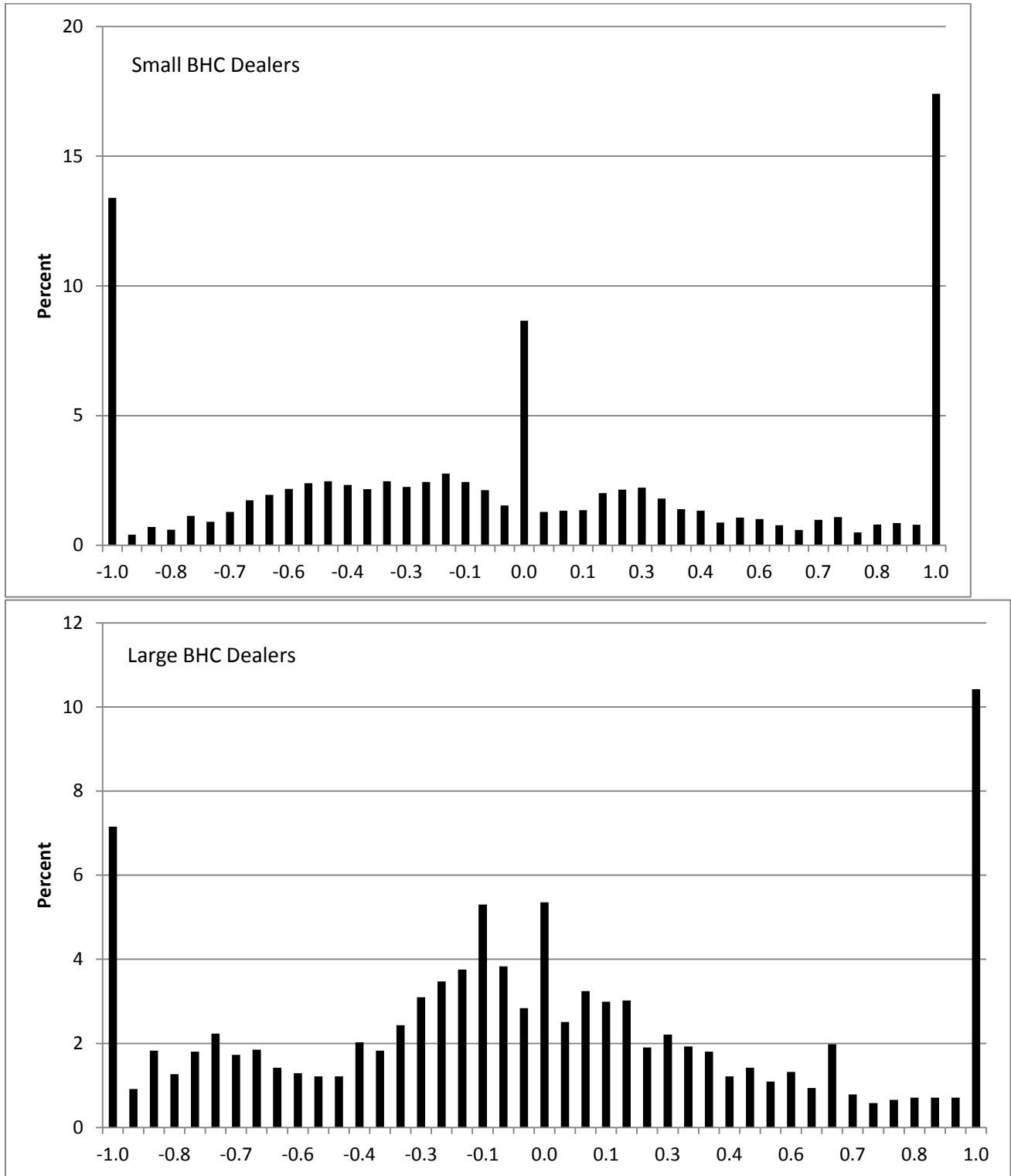
Finally, we find that large BHC dealers, relative to all other dealers, are much less likely to have net-to-gross ratios close to 1 or -1 (see the lower panel of Chart 3.3B). Rather, these dealers are much more likely to conduct both repo and reverse repos trades in the same day.

Chart 3.3A: Distributions of Net-to-Gross Ratios by Dealer and Day



Note: An observation is a dealer’s net-to-gross ratio for a particular day. The net-to-gross ratio is equal to a dealer’s net settlement activity across all collateral groups over a dealer’s total trading activity across all collateral groups in a day. A ratio equal to 1 means the dealer conducts only repos, while a ratio equal to -1 means the dealer conducts only reverse repos. There are 20,836 observations for all dealers, and 6,958 observations for non-BHC dealers.

Chart 3.3B: Distributions of Net-to-Gross Ratios by Dealer and Day



Note: An observation is a dealer’s net-to-gross ratio for a particular day. The net-to-gross ratio is equal to a dealer’s net settlement activity across all collateral groups over a dealer’s total trading activity across all collateral groups in a day. A ratio equal to 1 means the dealer conducts only repos, while a ratio equal to -1 means the dealer conducts only reverse repos. There are 9,935 and 3,943 observations for, respectively, small and large BHC dealers.

While the net-to-gross ratio reveals whether and to what degree dealers are conducting both repo and reverse repos, this statistic does not allow us to distinguish collateral swapping strategies from other strategies. For example, a net-to-gross ratio near zero can be the result of a dealer executing a repo collateralized by agency MBS alongside a reverse repo collateralized by US Treasuries. These two trades effectively constitute a collateral swap (agency MBS for US Treasuries). To measure what fraction of dealers conduct collateral swaps, we compute a swap ratio for each dealer on each day. This ratio is equal to

$$swap\ ratio_{jt} = \frac{|\sum_{i=1}^{10} repo_{ijt} - reverse_{ijt}|}{\sum_{i=1}^{10} |repo_{ijt} - reverse_{ijt}|}$$

This ratio looks at a dealer’s net positions across collateral types. When a dealer does not have any off-setting net positions across collateral types, the swap ratio is equal to 1. For example, if a dealer’s net position in every collateral position is weakly positive, then the numerator and denominator of the swap ratio are equal. But if a dealer has a positive net position in one collateral class and a negative net position in another collateral class, the denominator will be greater than the numerator. This is because in the numerator, the positive net position is summed with the negative net position, while in the denominator the absolute value of both net positions are summed. The closer the swap ratio to 0, then, the more a dealer is involved in collateral swaps. Because we do not know the true intention of the dealer, we say the dealer is effectively involved in collateral swapping.

Using our data, we compute the swap ratio for each dealer and for each day and then calculate the distribution of this statistic. We find that the median value of this ratio is equal to 1---half of the time dealers are not conducting any collateral swaps (see Table 3.4). This is consistent with the results presented in the upper panel of Chart 3.3A, where at least 33 percent of dealers conduct only repo or only reverse repo transactions. At the 25th percentile, the swap ratio is equal to 0.85. This value implies that a dealer’s effective collateral swaps are equal to 15 percent of the value of a dealer’s total net position. It is only at the 10th percentile where collateral swapping becomes a dealer’s predominant strategy (a swap ratio of 0.42 implies collateral swaps are equal to 58 percent of a dealer’s total net position).

Table 3.4: Distribution of Swap-Ratios

	5 th percentile	10 th percentile	25 th percentile	50 th percentile	75 th percentile	90 th percentile	95 th percentile
Swap Ratio	0.24	0.42	0.85	1.00	1.00	1.00	1.00

Note: A swap ratio a measure of the amount of collateral swapping that occurs for a dealer in a day. A value of 1 means there are no collateral swaps, while a value of $0 < x < 1$ implies that the total value of collateral swapped is equal to $(1-x)$ percent of a dealer’s total net position.

Overall then, this result indicates that collateral swaps do not occur frequently – a little more than 10 percent of the time collateral swapping can be said to be the dealer’s predominant

strategy. The large number of instances where a dealer's net-to-gross ratios are between 1 and -1, then, seem to be primarily driven by netting *within* a collateral group. Such trading behavior could result from dealers providing liquidity to the market by executing repos and reverse repos throughout the day. Dealers might also execute both repo and reverse repos at different times in the day while pursuing different strategies. They, for example, begin the day seeking to raise funds. However, settlement fails of other transactions may lead the same dealer to lend cash later the same day.

To further examine the amount of netting that occurs within each asset class, we construct net-to-gross ratios for each dealer, date, and asset class. Hence, the net-to-gross ratio for dealer j , on date t , for asset type i , is equal to

$$NtG_{ijt} = \frac{repo_{ijt} - reverse_{ijt}}{repo_{ijt} + reverse_{ijt}}$$

Note that this net-to-gross ratio is computed at a lower level of aggregation relative to those displayed in Charts 3.3A and 3.3B. We look at the distribution of this ratio for each asset type. In Table 3.5 we list the 10th, 25th, 50th, 75th, and 90th percentiles of these distributions, along with the number of observations in each asset type. As in Table 3.1, we list the asset types from largest to smallest, in terms of the dollar value of repos conducted. Strikingly, the vast majority of net-to-gross ratios for the four smallest asset types are equal to -1 or 1. Dealers, then, are not conducting both repos and reverse repos with these assets types. To a lesser extent, the same result also holds for the asset types of Ginnie Mae fixed rate MBS, Fannie Mae & Freddie Mac adjustable rate MBS, and US Treasuries with maturities of 10 years or less. Only for the largest three asset types do we see a substantial number of dealers conducting both repos and reverse repos, and so enjoying the netting benefits provided by the FICC for GCF Repo.

In summary, in this section we construct two measures describing each dealer's daily activity. From these measures we find that:

- On average, at least 23 percent of dealers use GCF Repo to raise funds (i.e. they conduct only repo transactions).
- On average, at least 20 percent of dealers use GCF Repo market to manage their inventory of securities. They manage inventories by following two types of strategies:
 - On average, at least 10 percent of dealers focus on purchasing securities (i.e. they conduct only reverse repo transactions).
 - On average, at least 10 percent of dealers are predominantly conducting collateral swaps.
- The remaining 57 percent of dealers conduct both repo and reverse repo GCF Repo trades for a variety of reasons, including providing liquidity to other participants.

Table 3.5: Net-to-Gross ratios by dealer, date, and asset type

Asset Type	10 th percentile	25 th percentile	50 th percentile	75 th percentile	90 th percentile	Obs
Fannie Mae & Freddie Mac Fixed Rate MBS	-1	-0.65	0.15	0.75	1	15,786
US Treasuries with maturities of 30 years or less	-0.76	-0.26	0.05	0.64	1	17,057
Non-MBS US agency securities	-1	-0.67	0.31	1	1	10,965
Ginnie Mae Fixed Rate MBS	-1	-1	0.22	1	1	7,664
Fannie Mae & Freddie Mac Adjustable Rate MBS	-1	-1	0.67	1	1	6,798
US Treasuries with maturities of 10 years or less	-1	-1	0.33	1	1	1,079
US Treasury Inflation Protected FDIC Guaranteed Corporate Bonds	-1	-1	1	1	1	2,047
US Treasury STRIPs	-1	-1	1	1	1	3,980
Ginnie Mae Adjustable Rate MBS	-1	-1	1	1	1	491
Total	-1	-0.8	0.17	1	1	67,575

Note: Obs is the number of observations. The net-to-gross ratio is equal to a dealer's net settlement activity over a dealer's total trading activity for a given collateral group in a day. A ratio equal to 1 means the dealer conducted only repos, while a ratio equal to -1 means the dealer conducted only reverse repos. MBS is mortgage-backed securities and STRIPS stands for separate trading of registered interest and principal.

Our estimate of the fraction of times dealers pursue leveraging liquidity strategies is, by construction, an upper-bound. Dealers who conduct both repos and reverse repos are likely pursuing multiple strategies at the same time. For example, a dealer could seek to raise funds using GCF Repo, while also providing liquidity to the market. More inclusive definitions of funding or inventory management strategies would necessarily lower the 57 percent estimate. Obtaining a more precise estimate of the percent of time dealers are mainly providing liquidity to the market is something we will explore in future work.

4. Connection between tri-party repo and GCF Repo

In this last section, we consider the interaction between tri-party repo and GCF Repo. We first consider how dealers trade both repo products during normal times. We then consider how dealers in distress trade both products.

4.1 In Normal Times

Tri-party repo and GCF Repo are intimately connected because they both settle on the books of two clearing banks (JP Morgan Chase and Bank of New York Mellon). As such, there is ample

opportunity for dealers to be strategic when trading both repo products. Of the dealers that we observe actively trading GCF Repo, 85 percent are also actively trading tri-party repo.⁴⁴

Table 3.6: Relationship across tri-party repo and GCF Repo trades

	Coefficient	Standard Error	Obs
All Dealers	-0.56	0.01	15,497
Non-BHC Dealers	-0.65	0.05	5,309
Small-BHC Dealers	-0.55	0.01	7,274
Large-BHC Dealers	-0.59	0.02	2,912

Note: Obs is the number of observations. Each row reports the result of a separate regression. The regression estimated the correlation between changes in a dealer's tri-party repo position and changes in the same dealer's GCF Repo position (see equation 2 in the text).

We analyze dealer's strategic behavior by first looking at the correlation in the change of a dealer's position with each product. We compute a dealer's change in funding using tri-party repo on consecutive business days using confidential settlement data from the two clearing banks. Letting tpr_{jt} denote the amount of funding a dealer receives from tri-party repo, the change in a dealer's tri-party repo funding is given by $\Delta tpr_{jt} = tpr_{jt} - tpr_{jt-1}$. Note the tpr_{jt} is always a positive number, because dealers use this product strictly for funding purposes.⁴⁵ We measure the change in a dealer's GCF Repo position as the change in the net cash position (see $netcash_{jt}$ defined in equation 1), or $\Delta GCF_{jt} = netcash_{jt} - netcash_{jt-1}$. We then regress the change in GCF Repo position on the change in tri-party repo to measure how dealers jointly alter their positions. Formally, the regression is

$$\Delta GCF_{jt} = \alpha + \beta \Delta tpr_{jt} + \varepsilon_{jt}, \quad (2)$$

where ε_{jt} is an error term. We estimate that β is negative, implying a negative correlation between a dealer's overall position across the tri-party and GCF repo markets (see Table 3.6). This negative (and statistically significant) relationship also holds when looking at all dealers or when focusing on any of the three groups of dealers.

This statistical relationship demonstrates that dealers effectively view these markets as substitutes. When a dealer experiences a loss of funding in tri-party repo from one day to the next, that same dealer increases its net cash position in GCF Repo at the same time. (Note that increases in the net cash position can mean a dealer is raising more funds or lending less cash.)

To gain a better sense of the relative magnitudes of the changes in dealers' positions across the two products, we look at the absolute value of the change in net cash position in GCF Repo over the sum of the absolute value of the change in net cash in GCF Repo plus the absolute value of the change in tri-party repo funding. Formally, for each dealer and day we compute

⁴⁴ For this analysis, dealers have been aggregated up to the bank holding company level.

⁴⁵ For more information on the tri-party repo market, see Copeland, Martin, and Walker (forthcoming).

$$\frac{|\Delta GCF_{jt}|}{|\Delta GCF_{jt}| + |\Delta tpr_{jt}|}$$

If this ratio is equal to $\frac{1}{2}$, then the change in a dealer's net cash position in GCF Repo is equal to the change in the dealer's tri-party repo funding. We compute this ratio for all days and across all dealers and find that the median value of this ratio is 0.69. The average dealer, then, has larger changes in its overall GCF Repo position than its tri-party repo position. We then look at the 25th and 75th percentiles of the distribution of this ratio and find it is equal to 0.35 and 0.96 respectively. For dealers in the upper quartile, then, the change in the GCF Repo position completely dominates, in terms of size, the change in the tri-party repo position. An interpretation of this high ratio value is dealers make almost all of their cash and securities adjustments using GCF Repo, as opposed to tri-party repo.

In normal times, then, changes in a dealer's position across these two repo products tend to offset one another. Further, the changes in GCF Repo tend to be larger than those in tri-party repo. But what happens during times of stress?

4.2 In Times of Stress

When a dealer is in distress, market wisdom is that a dealer should rely more upon GCF Repo for funding. This is due to the blind brokered nature of GCF Repo, where the counterparty risk is borne by FICC. FICC, however, does require a dealer to increase the amount of collateral it posts in its clearing fund when the dealer increases its GCF Repo activity. Further, the FICC closely monitors dealers that utilize its services.

The available data confirms that in times of stress dealers tend to increase their reliance upon GCF Repo as a source of funds. Looking at the cases of dealers under extreme stress, we observe these dealers increasing the amount of cash borrowed using GCF Repo. Strikingly, in at least one case, a distressed dealer switched from being a net lender to a net borrower.

5. Conclusion

This paper aims to quantify to what extent dealers pursue various strategies trading GCF Repo. We find that, in general, the set of dealers not associated with BHCs raise between \$40 to \$80 billion dollars a day. Looking across all dealers and all days, we find that, on average at least 23 percent of dealers focus on strategies to raise cash. At least another 20 percent of dealers focuses on managing their inventory of securities. Finally, the remaining 57 percent of dealers appear to mainly use other strategies that take advantage of the liquidity in this interdealer market. Our estimates of the percent of time focused on raising cash and managing inventories are conservative, and so should be viewed as a lower bound estimate.

We also study the dealer behavior across the tri-party repo and GCF Repo services. We find evidence that dealers view these repo services as substitutes. In particular, changes in a dealer's tri-party repo position are negatively correlated with changes in that dealer's GCF Repo position.

Bibliography

Copeland, A., Martin, A., and M. Walker. (forthcoming). "Repo Runs: Evidence from the Tri-Party Repo Market." *Journal of Finance*.