

AN EMPIRICAL ANALYSIS OF THE GCF REPO[®] SERVICE

1. INTRODUCTION

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.¹ GCF Repo plays an important role in the tri-party repo market, a market that is essential to the funding of large broker-dealers in the United States. But because of a paucity of available data, knowledge about participants' GCF Repo trading strategies is mostly anecdotal. Market participants report that GCF Repo can play several roles: For some dealers, GCF Repo is a main source of their repo funding. For other dealers, GCF Repo can be used to perform collateral swap trades, allowing them to acquire Treasury securities, the highest quality collateral, in exchange for agency mortgage-backed securities (MBS), which are of lesser quality. GCF Repo is also said to serve as a "buffer" for some dealers, making it possible for them to obtain more funding or more collateral, if they are affected by an unexpected shock. Using newly available data on the universe of GCF Repo activity, we aim to quantify the behavior of dealers that enter into GCF Repo contracts to see if that behavior is consistent with the anecdotal evidence.

¹ GCF Repo[®] is a registered service mark of the Fixed Income Clearing Corporation.

Understanding the role of GCF Repo, and its interactions with the tri-party repo market, is important as the repo market evolves. The tri-party repo market has been affected by the reforms of its settlement process (see the first article in this volume, "The Financial Plumbing of the GCF Repo Service"), which are likely to shape the costs of settling GCF Repo transactions. In addition, Basel III reforms, and in particular the supplementary leverage ratio, are having an effect on the costs of repo activity for broker-dealers. By examining dealers' behavior before the reforms were implemented, we provide a benchmark that can be used to understand how reforms might influence GCF Repo activity over time.

In this article, we provide three sets of results on the strategies dealers pursue when entering into GCF Repo contracts. First, we describe daily activity by looking at end-of-day settlement and documenting which groups of dealers use GCF Repo for funding. We find considerable variety among dealers, but, on average, those dealers that are not part of a bank holding company (BHC) consistently borrow cash (against securities) in this market. For some of these dealers, GCF Repo appears to be a main source of repo financing.

Second, we examine activity in the GCF Repo market using two different measures of dealers' net and gross activities. We infer that, on average, 1) 23 percent of dealers use GCF Repos to raise funds, 2) 20 percent of dealers use GCF Repo to source collateral or conduct collateral swaps, and 3) the remaining 57 percent of dealers follow a variety of strategies

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when entering into GCF Repos, including acting as liquidity providers to other participants. We also look at whether dealers engage in collateral transformation—for example, swapping agency MBS for U.S. Treasury securities. Although this type of activity has been increasingly talked about in recent years, we find only modest evidence of collateral swaps in the GCF Repo market.

Third, we examine whether dealers’ strategies for entering into GCF Repo and tri-party repo contracts are related. We find 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 services as substitutes at the margin. In other words, GCF Repo appears to play the role of a “buffer” when a dealer experiences an unexpected shock.

2. GENERAL DESCRIPTION

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

2.1 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 that are executed through interdealer brokers (IDB), where one dealer is putting cash into the deal and 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 asset class. FICC defines ten collateral classes that can be used by dealers.² Only institutions deemed eligible by FICC are able to trade GCF Repo. In December 2012, 120 entities were eligible to trade GCF Repos.³

² A list of the collateral classes is provided in Table 1.

³ Almost all of the financial entities in this market can be considered securities dealers, so for expositional clarity we refer to all GCF Repo participants as securities dealers or simply dealers. A list of eligible financial entities can be found at <http://www.dtcc.com/client-center/ficc-gov-directories>. Look in the “FICC GSD Member Directory” for those members with the “Repo Netting” and “GCF” service designations.

GCF Repos are negotiated on a blind-brokered basis, where a dealer relies on an IDB to match it with an anonymous counterparty. FICC guarantees settlement once the trade has been compared, which occurs upon FICC’s receipt of the trade data from the IDB, in the case of GCF Repo trades.

FICC provides netting services for GCF Repo. 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.

FICC also novates the net settlement position and becomes the legal counterparty to both sides of a GCF Repo contract for settlement purposes. Thus, each dealer now has FICC as a counterparty, rather than another dealer. Because of the guarantee that FICC provides, GCF Repo trades are not overcollateralized (unlike most repos). Specifically, they do not include a “haircut.” Rather, the market price of securities posted as collateral is equal to the amount of cash lent. Nevertheless, to protect itself against financial loss owing to a potential default, FICC, in addition to its eligibility requirements, requires dealers entering into GCF Repo contracts to post collateral and cash in FICC’s government securities division clearing fund.

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

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

The strategy of raising funds with GCF Repo 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 borrow

cheaply from tri-party repo investors could borrow more than they need and lend 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 enter into GCF Repo contracts 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 can be useful when dealers are seeking securities to fill other general collateral repos, such as tri-party repos.⁴ Market participants claim that GCF Repo plays a crucial role in allowing dealers to alter their stock of securities at the end of the day, balancing investor 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, the dealer can simply obtain the requisite amount of Treasuries with a reverse repo.⁵ Alternatively, the dealer could execute a collateral swap if it has other unencumbered securities, such as agency MBS. A collateral swap requires negotiating two GCF Repo trades. The dealer agrees to 1) deliver agency MBS (borrow cash) and 2) accept Treasuries (lend 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 enter into GCF Repo contracts to pursue 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.” Many of these alternative strategies take advantage of the funding and transactional liquidity in this interdealer market. For example, dealers may experience fails in securities purchases and as a result seek to reverse in similar securities overnight. Or dealers may want to accommodate cash investors that are seeking to lend more than expected on a particular day; dealers may then place the extra amount of cash in GCF Repo. In both these examples, dealers are leveraging the funding liquidity of this interdealer market to accommodate unexpected inflows or outflows of securities or cash from other types of trades. Another strategy

⁴ Indeed, the ten predefined general asset classes for GCF Repo match up closely with the asset classes generally accepted by cash investors in tri-party repo.

⁵ 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.

that falls into this category is the provision of transactional 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. Finally, dealers use GCF Repo to implement arbitrage strategies, taking advantage of the transactional liquidity in this market.

2.2 Data Description

Our analysis relies on confidential data from the FICC collected by the Federal Reserve Bank of New York, which contains the universe of GCF Repo activity 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).⁶

Over the sample period, the daily average total value of GCF Repo trades is \$493 billion (see Table 1).⁷ There are ten collateral classes traded in our sample, but two collateral classes dominate in terms of gross value traded: Fannie Mae and Freddie Mac fixed-rate MBS, and U.S. Treasuries with maturities of thirty years or less (see Table 1 for a list of the collateral classes and note that 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 nine collateral classes traded, because there are no longer any securities that fall into the FDIC-guaranteed corporate bonds collateral class.⁸

In our sample, there are sixty-five securities dealers active in the market. Of those sixty-five dealers, thirty-three entered into GCF Repo contracts every day of our sample, and forty did so on at least 90 percent of the days. In general, the infrequent participants are much smaller in terms of

⁶ Although our sample covers a year-and-a-half of activity, it may be the case that trends highlighted in this data are not representative of activity before 2011 or after 2012.

⁷ Every trade creates a repo and a reverse repo transaction. When considering aggregate statistics, we add up only repo transactions to avoid double-counting.

⁸ 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/>.

TABLE 1

Collateral Classes in GCF Repo

Asset Type	Mean Daily Gross Collateral (Billions of U.S. dollars)	Percentage of Total
Fannie Mae and Freddie Mac fixed-rate MBS	209.72	42.55
U.S. Treasuries with maturities of thirty years or less	199.93	40.56
Non-MBS U.S. agency securities	33.66	6.83
Ginnie Mae fixed-rate MBS	27.74	5.63
Fannie Mae and Freddie Mac adjustable-rate MBS	13.97	2.83
U.S. Treasuries with maturities of ten years or less	2.65	0.54
U.S. Treasury inflation-protected securities	2.98	0.60
FDIC-guaranteed corporate bonds ^a	1.30	0.26
U.S. Treasury STRIPs	0.78	0.16
Ginnie Mae adjustable-rate MBS	0.16	0.03
Total	492.89	100.00

Sources: Confidential Fixed Income Clearing Corporation (FICC) data; authors' calculations.

Notes: 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 and 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.

^aFDIC-guaranteed corporate bonds are no longer a collateral class in GCF Repo.

their mean daily repo activity (on days 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 with \$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, and those that are not. This distinction is economically important because independent dealers (those not part of BHCs) rely solely on capital markets for funding. Dealers that are part of BHCs, in contrast, can also obtain funding from their parent company. Turning to the forty-four dealers that are part of a BHC, we find a wide variety in their size. Defining size as the value of U.S. dollar assets held by the associated BHC, the range of asset holdings is \$13 billion to \$2.3 trillion.⁹ We pick a cutoff value of \$500 billion to differentiate between dealers that 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 that are not part of a BHC (which we label non-BHC dealers).

⁹ Information on the value of U.S. dollar assets at the BHC level comes from the Federal Reserve Y-9C regulatory filings. For detailed information on these filings, see <http://www.federalreserve.gov/apps/reportforms/default.aspx> and select Form FR Y-9C.

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

3. DAILY NET ACTIVITY

We begin by looking at dealers' daily net activity across all collateral classes. This measure can give us a sense of whether a dealer uses the GCF Repo market mainly to borrow or to lend cash. 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:

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

TABLE 2

Distribution of Net Cash Positions
Billions of U.S. Dollars, except Where Noted

	10th percentile	25th percentile	Median	75th percentile	90th percentile	Mean	Number of Observations
All	-13.0	-2.2	0.2	3.7	9.7	0	20,836
Large BHCs	-14.9	-8.2	-0.3	2.8	9.7	-1.8	3,943
Small BHCs	-15.5	-4.2	-0.1	1.6	8.7	-2.3	9,935
Non-BHCs	0	0.13	1.9	6.2	20.8	4.3	6,958

Sources: Confidential Fixed Income Clearing Corporation (FICC) data; authors' calculations.

Notes: Dealers are categorized as belonging to a large BHC, belonging to a small BHC, or not being part of a BHC (non-BHCs). 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.

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, dealers' net cash positions range from roughly -\$30 billion to \$40 billion. We also look at the net cash position conditional on dealers being associated with large or small bank holding companies (see the second and third rows of Table 2). Although there is still considerable heterogeneity among dealers in each category, we find that the mean net cash position of dealers that are part of BHCs is negative. As a group, then, dealers associated with bank holding companies typically lend cash using GCF Repo. The average dealer that is part of a large BHC typically lends \$1.8 billion every day. The average dealer that is part of a small BHC lends slightly more—\$2.3 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 \$4.3 billion.

Although dealers vary widely in their net cash positions, they are quite consistent in their strategies regarding borrowing or lending cash using GCF Repo. We find that a dealer that borrows cash today will continue to borrow cash tomorrow with 96.0 percent probability (see the first row of Table 3). Similarly, a dealer that lent cash today will continue to lend cash tomorrow with 95.1 percent probability (see the second row of Table 3).

To gain a better sense of the aggregate flow of cash among dealers, we compute the daily net cash position for each group of dealers. In Chart 1, we plot the monthly average net cash position for each of these three groups. As illustrated by the

chart, dealers that are not part of BHCs consistently raise cash. The funding raised by non-BHC dealers has doubled over the sample period, from around \$40 billion to \$80 billion each day. As a group, dealers that are part of small BHCs are often the source of the majority of these funds.

With the flow of cash from dealers associated with BHCs to those that are not, there must be a flow of collateral going in the other direction. To understand the movement of collateral among the three groups of dealers, we focus on the two collateral classes that account for the vast majority of GCF Repo contracts: Fannie Mae and Freddie Mac fixed-rate MBS (henceforth, FFR MBS) and U.S. Treasuries with maturities of thirty years or less. For each of these two collateral types, we compute each dealer group's net position (that is, total repos minus total reverse repos) for each day. We then compute the average position for the month and plot the results in Chart 2, panels A and B.

From this aggregate viewpoint, we see that non-BHC dealers provide both U.S. Treasuries and FFR MBS as collateral for their repo trades. Toward the end of the sample, however, non-BHC dealers increasingly post FFR MBS securities as collateral. Strikingly, dealers associated with small BHCs differ markedly from those that are part of large BHCs. Small BHC-affiliated dealers reverse in U.S. Treasuries each day (Chart 2, panel A). These U.S. Treasuries are delivered to them by both non-BHC-affiliated and large BHC-affiliated dealers. For FFR MBS securities, we observe that small BHC-affiliated dealers switched from delivering these securities in the beginning of the sample to reversing in these securities at the end of the sample (Chart 2, panel B). In contrast, large BHC-affiliated dealers consistently reverse in these securities. Looking at the behavior of large

TABLE 3
Transition Probabilities
Percent

<i>t</i> -1	<i>t</i>	
	Net Borrower	Net Lender
Net borrower	96.0	4.0
Net lender	4.9	95.1

Sources: Confidential Fixed Income Clearing Corporation (FICC) data; authors' calculations.

Notes: 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. The cell entries show 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.

BHC-affiliated dealers in both panels of Chart 2, we infer that this group of dealers is pursuing, on the whole, a strategy of delivering Treasuries and receiving FFR MBS securities, a collateral downgrade strategy, throughout the sample.

4. 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 that are mainly employing liquidity-leveraging or collateral-swapping strategies from those that 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 of the value of all repos and reverse repos a dealer trades in a day, and is thus 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_{ijt}*, defined earlier). Formally, for dealer *j* at date *t*, the net-to-gross ratio is equal to:

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

where *i* indexes the collateral groups traded in GCF Repo.

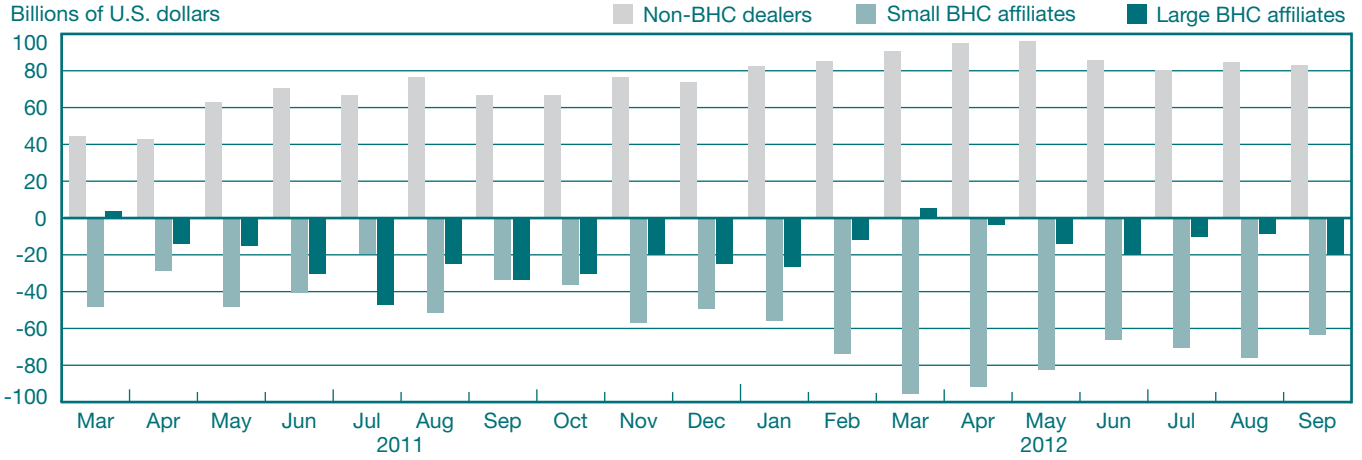
The net-to-gross ratio is positive if the dealer is receiving cash at the end of the day, and negative if the dealer is delivering cash. By construction, this ratio is always between -1 and 1, and is equal to 0 when the dealer's net position is exactly offsetting (that is, the dealer is receiving equal 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 conduct only 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 conduct only reverse repo transactions. Finally, when the ratio is closer to zero, substantial netting is occurring. This could mean that dealers are mostly providing transactional liquidity, conducting repo and reverse repo transactions within the same collateral class. Alternatively, dealers could be seeking to manage their inventories by exchanging collateral (for example, collateral upgrade or downgrade). 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 over the whole sample (Chart 3, panel A) highlights the diverse set of strategies followed by dealers. The histogram illustrates that on a typical day in the sample, about 23 percent of dealers conduct only repos (the net-to-gross ratio is equal to 1) and thus use GCF Repo to effectively raise funds. Further, almost 10 percent of dealers conduct only reverse repos (the net-to-gross ratio is equal to -1), using this market to acquire securities.¹⁰ Finally, on a typical day, 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, however, reveals stark differences in strategies pursued by each group. Confirming the results from the previous section, we find that the vast majority of non-BHC dealers have positive net-to-gross ratios and thus receive cash at the end of the day (Chart 3, panel B). Indeed, on a typical day, non-BHC dealers conducted only repo trades almost 35 percent of the time. But not all non-BHC dealers

¹⁰ We also examined histograms for subsets of the sample, and did not find any interesting variation in the distribution of net-to-gross ratios over time.

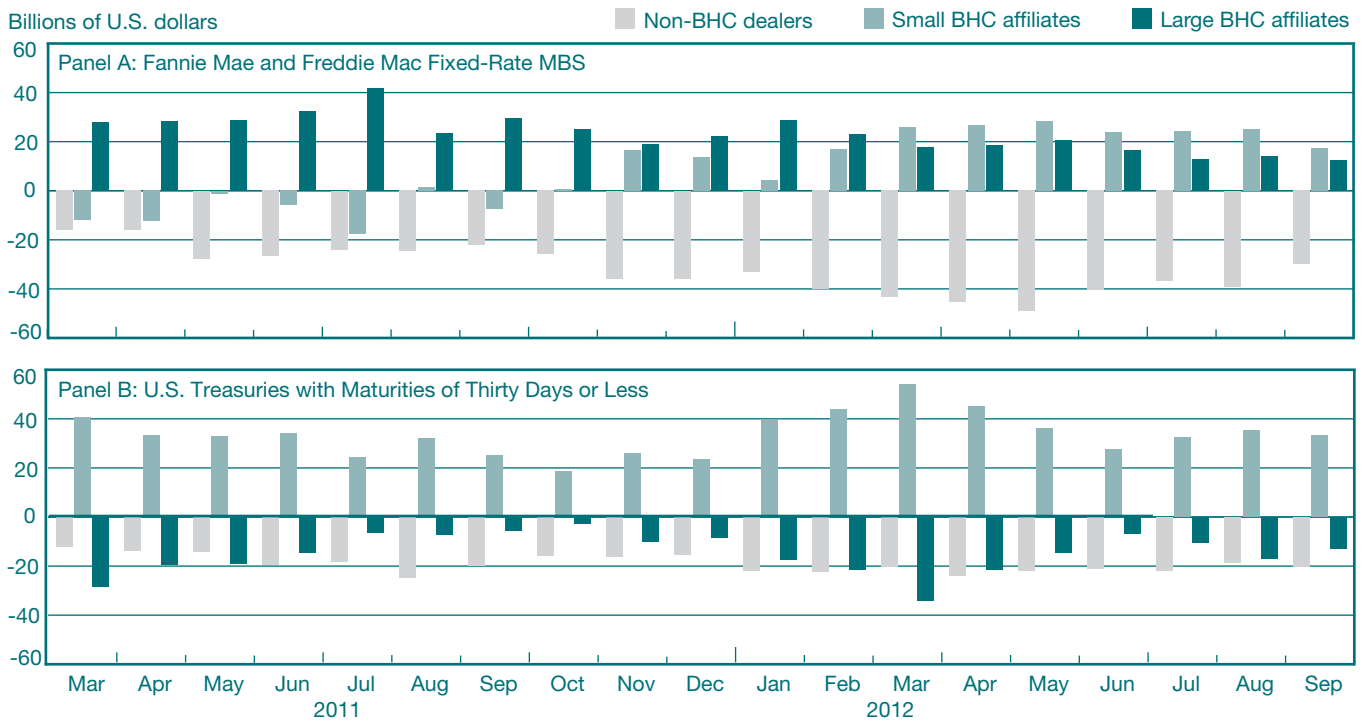
CHART 1
Daily Net Cash Position by Dealer Group, Monthly Average



Sources: Confidential Fixed Income Clearing Corporation (FICC) data; authors' calculations.

Notes: Dealers are categorized as belonging to a large BHC, belonging to a small BHC, or 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.

CHART 2
Daily Net Position of Asset Class by Dealer Group, Monthly Average

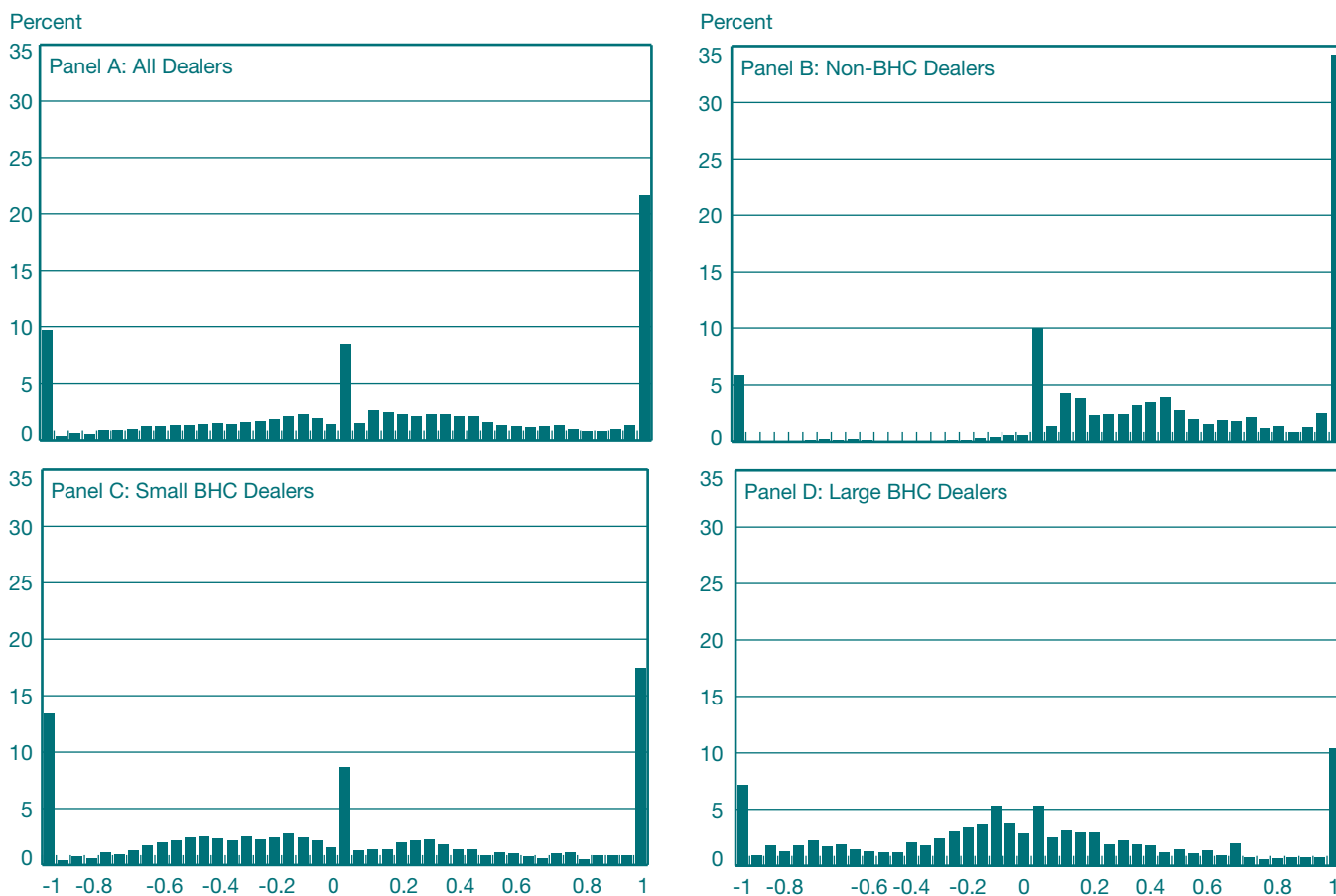


Sources: Confidential Fixed Income Clearing Corporation (FICC) data; authors' calculations.

Notes: Dealers are categorized as belonging to a large BHC, belonging to a small BHC, or 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.

CHART 3

Distributions of Net-to-Gross Ratios by Dealer and Day



Sources: Confidential Fixed Income Clearing Corporation (FICC) data; authors' calculations.

Notes: 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 that the dealer conducts only repos, whereas a ratio equal to -1 means the dealer conducts only reverse repos. There are 20,836 observations for all dealers, and 6,958 for non-BHC dealers, 9,935 for small BHC dealers, and 3,943 for large BHC dealers.

try to raise funds only. On a typical day, a little more than 5 percent of dealers perform only reverse repos, and about 10 percent have net-to-gross ratios near zero, and thus buy and sell roughly equal amounts of repo and reverse repos.

Compared with non-BHC dealers, small BHC dealers have net-to-gross ratios that are more evenly distributed between -1 and 1 (Chart 3, panel C). Small BHC dealers are roughly equally split between borrowing and lending cash at the end of the day (the median value of net-to-gross is -0.01 for small BHC dealers). As with non-BHC dealers, however, there are significant numbers of small BHC dealers that

have net-to-gross ratios roughly equal to 1, -1, and 0. On a typical day, small BHC dealers 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 (Chart 3, panel D). Rather, these dealers are much more likely to conduct both repo and reverse repos trades in the same day.

While the net-to-gross ratio reveals whether and to what degree dealers are conducting both repos and reverse

TABLE 4

Distribution of Swap Ratios

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

Sources: Confidential Fixed Income Clearing Corporation (FICC) data; authors' calculations.

Notes: A swap ratio is a measure of the amount of collateral swapping that occurs for a dealer in a day. A value of 1 means that 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.

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 U.S. Treasuries. These two trades effectively constitute a collateral swap (agency MBS for U.S. 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

$$\text{swap ratio}_{jt} = \frac{\sum_{i=1}^{10} \text{repo}_{ijt} - \text{reverse}_{ijt}}{\sum_{i=1}^{10} |\text{repo}_{ijt} - \text{reverse}_{ijt}|}$$

This ratio looks at a dealer's net positions across collateral types. When a dealer does not have any offsetting 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 values of both net positions are summed. The closer the swap ratio is 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 that 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—in other words, half of the time, dealers are not conducting any collateral swaps (Table 4). This is consistent with the results presented in Chart 3, panel A, 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).

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 transactional liquidity to the market by executing repos and reverse repos throughout the day. Dealers might also execute both repos and reverse repos at different times in the day while pursuing different strategies. For example, they 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

$$\text{NtG}_{ijt} = \frac{\text{repo}_{ijt} - \text{reverse}_{ijt}}{\text{repo}_{ijt} + \text{reverse}_{ijt}}$$

Note that this net-to-gross ratio is computed at a lower level of aggregation relative to those displayed in Chart 3.¹¹ We look at the distribution of this ratio for each asset type. In Table 5, we list the 25th, 50th, and 75th percentiles of these distributions, as well as the percentage of observations equal to -1 and 1. As in Table 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

¹¹ By construction, there will be a weakly greater share of net-to-gross ratios by asset type equal to -1 or 1 compared with net-to-gross ratios computed across asset types (and so at a higher level of aggregation).

TABLE 5

Net-to-Gross Ratios by Dealer, Date, and Asset Type

Asset Type	25th percentile	50th percentile	75th percentile	Percentage at -1	Percentage at 1	Number of Observations
Fannie Mae and Freddie Mac fixed-rate MBS	-0.65	0.15	0.75	18	19	15,786
U.S. Treasuries with maturities of thirty years or less	-0.26	0.05	0.64	7	21	17,057
Non-MBS U.S. agency securities	-0.67	0.31	1	20	32	10,965
Ginnie Mae fixed-rate MBS	-1	0.22	1	29	43	7,664
Fannie Mae and Freddie Mac adjustable-rate MBS	-1	0.67	1	40	46	6,798
U.S. Treasuries with maturities of ten years or less	-1	0.33	1	36	48	1,079
U.S. Treasury inflation-protected securities	-1	1	1	43	54	3,980
FDIC-guaranteed corporate bonds ^a	-1	1	1	41	52	2,047
U.S. Treasury STRIPs	-1	1	1	54	45	3,980
Ginnie Mae adjustable-rate MBS	-1	1	1	49	51	491
Total	-0.8	0.17	1	23	31	67,575

Sources: Confidential Fixed Income Clearing Corporation (FICC) data; authors' calculations.

Notes: Percentage at -1 (1) is the percentage of observations equal to -1 (1). 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 that the dealer conducted only repos, while a ratio equal to -1 means that the dealer conducted only reverse repos. MBS is mortgage-backed securities and STRIPs is separate trading of registered interest and principal.

^aFDIC guaranteed corporate bonds are no longer a collateral class in GCF Repo.

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 Fannie Mae and Freddie Mac adjustable-rate MBS, and U.S. Treasuries with maturities of ten 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 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 (that is, they conduct only repo transactions).
- On average, at least 20 percent of dealers use GCF Repo 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 (that is, 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.

Our estimate of the fraction of times dealers pursue liquidity-leveraging 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 percentage of time dealers are mainly providing liquidity to the market is something we will explore in future work.

5. CONNECTION BETWEEN TRI-PARTY REPO AND GCF REPO

Tri-party repo and GCF Repo are intimately connected because they both qualify for same-day settlement on the books of the two clearing banks JPMorgan Chase and Bank of New York Mellon. GCF Repo is settled before tri-party repo, allowing dealers to easily deliver securities to tri-party repo that have been acquired from GCF Repo. Thus, 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.¹²

Given this close connection, an open question is how dealers choose their trading strategies across tri-party repo and GCF Repo. We start our analysis of dealers' strategic behavior by first looking at the correlation in the change of a dealer's position with each financial product. This correlation informs us whether, at the margin, a dealer views these two types of repos as substitutes or complements.

Drawing on confidential data collected by the Federal Reserve Bank of New York from the two clearing banks that settle tri-party repo contracts, we compute a dealer's change in funding using tri-party repo on consecutive business days. As described in Copeland, Martin, and Walker (2014), these data allow us to measure the value of collateral posted by dealers in this market on a daily basis. 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 that tpr_{jt} is always a positive number, because dealers use this product strictly for funding purposes.¹³ 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

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

where ε_{jt} is an error term. We estimate that β is negative, implying a negative correlation between a dealer's overall position in tri-party repo and GCF Repo (Table 6). This negative (and statistically significant) relationship also holds

¹² For this analysis, dealers have been aggregated up to the bank holding company level.

¹³ For more information on the tri-party repo market, see Copeland, Martin, and Walker (2014) and Krishnamurthy, Nagel, and Orlov (2014).

TABLE 6

Relationship across Tri-Party Repo and GCF Repo Trades

	Coefficient	Standard error	Number of Observations
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

Sources: Confidential Fixed Income Clearing Corporation (FICC) data; authors' calculations.

Notes: 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).

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 products as substitutes at the margin.¹⁴ The -0.56 coefficient implies that for the average dealer, a decrease of \$100 in tri-party repo is associated with a \$56 increase in that dealer's net cash position in GCF Repo. (Note that increases in the net cash position can mean that a dealer is raising more funds or lending less cash.)

To gain a better sense of the relative magnitude 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

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

If this ratio is equal to one-half, 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 in its tri-party repo position. We then look at the 25th and 75th percentiles

¹⁴ Mancini, Ranaldo, and Wrampelmeyer (2014) study the European repo market and find some substitutability between the repo market and the unsecured interbank market.

of the distribution of this ratio and find that they are 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 that dealers make almost all of their cash and securities adjustments using GCF Repo, as opposed to tri-party repo.

6. CONCLUSION

This article aims to quantify to what extent dealers pursue various strategies when entering into GCF Repo contracts. We are able to provide some stylized facts and quantify the extent to which different types of behaviors are observed in this market. For the most part, our evidence is consistent with anecdotal evidence provided previously by market participants. That said, we also find that, despite the growing attention collateral transformation has received in recent years, there is only modest evidence of such activity in GCF Repo during our sample. This article also provides a reference point for understanding how both reforms to settlement of GCF Repo contracts and regulatory reforms may influence dealer activity in the future.

We find that, in general, the set of dealers not associated with BHCs raise between \$40 billion and \$80 billion a day, and so use GCF Repo as a source of funding. Dealers associated with BHCs provide this funding. Further, large BHC-affiliated dealers, as a group, tend to deliver Treasuries to this market and receive Fannie Mae and Freddie Mac fixed-rate MBS securities.

Looking across all dealers and all days, we find that on an average day, at least 23 percent of dealers focus on strategies to raise cash. At least another 20 percent of dealers focus on managing their inventory of securities. This activity involves using GCF Repo to both exclusively source collateral (for example, for re-use in tri-party repo contracts) and perform collateral swaps. Finally, the remaining 57 percent of dealers appear mainly to use other strategies that take advantage of the liquidity in this interdealer market. Our estimates of the percentage of time focused on raising cash and managing inventories are conservative, and so should be viewed as a lower-bound estimate.

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

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