

Repo Market Intermediation: Dealer Cash and Collateral Flow Management across the U.S. Repo Market

by Samuel J. Hempel, R. Jay Kahn, Robert Mann, and Mark E. Paddrik¹

The U.S. repurchase agreement (repo) market plays a pivotal role in the U.S. financial system. This brief provides an in-depth look into how repo dealers manage cash and collateral flows across the market. Using a unique combination of data, this analysis shows that dealers relend 65% of what they receive as collateral in other transactions. This finding highlights the U.S. financial system's reliance on collateral circulation. Dealers are exposed to counterparty, collateral, and maturity risk in providing this service. However, they are compensated for these risks through the net interest margin that they earn. Dealers receive higher compensation when collateral is less liquid and when they borrow from more creditworthy counterparties than those they lend to.

Short-term funding is critical for the daily functioning of the U.S. financial system and economy, of which repurchase agreements (repos) provide over \$4 trillion. Repos are short-term, often overnight, loans of cash secured by collateral. Repo dealers play a pivotal role as go-betweens, or intermediaries, for borrowers and lenders in this market. They provide value by passing cash from lenders to borrowers. They also relend collateral acquired from borrowers, an act known as *rehypothecation*.² Dealer intermediation enables collective cash and collateral flows, and this function helps maintain stable short-term funding in the United States. However, constraints on lending or increased counterparty or collateral risk, like those during the 2007-09 financial crisis, can cause short-term funding to suddenly evaporate.³ This brief uses a unique combination of datasets to provide one of the first comprehensive views of dealer activity in every segment of the U.S. repo market.

Through this unique mix of data, this brief captures the entire repo portfolio from nine dealers, totaling more than \$2 trillion. The data covers contract terms, including volume, rates, counterparties, and specific collateral, that determine where and how dealers conduct their repo transactions. With this detail, one can better understand how a specific security is reused as collateral and how dealers manage repos on their balance sheets.

The brief finds that dealers rehypothecate 65% of the collateral they receive, emphasizing the U.S. financial system's reliance on collateral circulation. This intermediation activity is not risk free though. Dealers must manage their exposure to counterparty, collateral, and maturity risk. This risk is reflected in the compensation repo dealers earn from lending at a higher rate than they borrow. The compensation for this service is notably higher when the

collateral is less liquid, as well as when dealers borrow from counterparties that are more creditworthy than those they lend to. Dealers also lend at different maturities than they borrow, although their compensation for this risk transformation is less clear.

Repo Dealer Intermediation

By allowing participants to borrow cash against securities pledged as collateral, the repo market’s functions are pivotal to the U.S. financial system.⁴ **Figure 1** illustrates the central role a repo dealer performs between a repo borrower and lender. The dealer borrows cash in a repo secured with collateral. It then lends cash in a reverse repo, which is the other side of a repo, against that same collateral used in the repo.

Figure 1. Repo Dealer Intermediation



Note: This figure illustrates a simple example of how a dealer intermediates cash and collateral (X) between counterparties A and B. In the flow diagram, the dealer borrows cash in a repo transaction with counterparty A on the left. On the right, it lends cash against that same piece of collateral in the reverse repo with counterparty B.

Source: Authors’ creation.

Notably, dealers’ intermediation of cash through the repo market shares similarities with traditional banks who intermediate cash from depositors to small business owners and homebuyers. By doing so, banks generate profits by issuing shorter maturity instruments (e.g., demand deposits) to lenders while making longer maturity loans to borrowers. Additionally, because dealers have a central position in the repo market, they implicitly take on counterparty risk. Though, the consequences of default are less since the repo is secured.

Repo dealers face an additional challenge that traditional banks do not. Repo is collateralized by securities, and dealers must manage cash and collateral to meet the constraints of their opposing counterparties. As a result, dealers may not be able to match cash borrowers with lenders that want that specific collateral because of certain characteristics like liquidity, for example. On the other hand, dealers may provide value by accepting collateral that customers want to borrow against and providing other customers with collateral that they have a more immediate use for, like collateral they want to short sell.

Dealers’ intermediation is complicated. U.S. repo activity is divided into four major market segments that differ in two dimensions: (1) whether the trades are settled bilaterally or through a tri-party custodian and (2) whether the trades are centrally or non-centrally cleared (see **Figure 2**). Each of these segments serves different clientele with disparate constraints on funding and lending objectives. As a result, the rates on repo and reverse repo can vary across segments even for the same collateral.

Dealers stand between all four segments, connecting borrowers and lenders within and across segments. Their intermediation is valuable as it helps correct differences in the supply and demand for cash or collateral in each segment. Dealer intermediation is also critical because some participants have counterparty limitations (e.g., money market funds cannot lend directly to hedge funds) or cannot access certain segments.

To assess the factors that drive intermediation decisions, and the compensation dealers receive for performing risk transformations, this brief relies on three datasets. Two of the series are from current collections that the OFR and Federal Reserve Bank of New York perform. These series provide daily information on transactions and

Figure 2. The Four Main Segments of the U.S. Repo Market

		Settlement	
		Tri-party	Bilateral
Clearing	Centrally Cleared	Fixed Income Clearing Corporation (FICC) GCF Repo (GCF) <ul style="list-style-type: none"> Centrally cleared by FICC Settled on BNY's Tri-party platform General collateral repo only 	FICC DVP Service (DVP) <ul style="list-style-type: none"> Centrally cleared by FICC No central custodian Specific collateral repo possible
	Non-Centrally Cleared	Bank of New York Mellon (BNY) Tri-party <ul style="list-style-type: none"> No central counterparty Settled on BNY's Tri-party platform General collateral repo only 	Non-centrally Cleared Bilateral Repo (NCCBR) <ul style="list-style-type: none"> No central counterparty No central custodian Specific collateral repo possible

Source: Hempel, Kahn, Mann, and Paddock (2023)

outstanding repos performed in the Tri-Party, DVP, and GCF segments. The third series is from the OFR's 2022 Non-Centrally Cleared Bilateral Repo (NCCBR) pilot data collection, which captured outstanding transactions that occurred on June 15, 22, and 30, 2022, from nine voluntary, participating U.S. dealers.⁵ These three data sources combined reveal outstanding repo positions across all four segments for each of the nine dealers.

While our sample has only three days, these nine dealers make up a sizeable share of the U.S. market. The dealers account for 17% of Tri-Party repo, 12% of DVP repo, and 21% of GCF repo. Even though the precise size of the NCCBR segment is unknown, prior work estimates of approximately \$2 trillion imply that these nine dealers comprise about 40% of that segment.⁶

Collateral Intermediation and Transformation

Cash can be easily reused across segments and counterparties, but collateral cannot. In general, securities received by a dealer as collateral through a reverse repo can be rehypothecated. Thus, the securities can facilitate the dealer's cash borrowing (see **Figure 1**). As shown in **Figure 3**, the outstanding volume of dealers' repo and reverse repo activity is \$1,355 billion and \$927 billion, respectively. However, given the differences in the types of securities that each segment uses as collateral, how much *collateral intermediation* that occurs from these transactions is not obvious. By performing a collateral *offsetting* exercise (subtracting outstanding securities delivered from securities received), dealers reuse \$607 billion, or 65%, of the collateral received through reverse repo in their repo transactions.⁷ Conversely, 44% of outstanding repo collateral are from reverse repo transactions.

The rehypothecation of collateral across market segments is shown in **Figure 4**. In this table, the columns and rows display the respective volume of repo outstanding and reverse repo outstanding. The volumes show the amount of collateral that goes from one segment through reverse repo to another. In other words, this is the amount that is reused on a security-by-security basis. To generate these estimates, it is assumed that collateral is offset within the same market segment before the remainder is sent to other market segments. If dealers borrow across multiple segments, the within-segment amount is first offset, and the remaining amount borrowed is prorated across the other segments the dealer participated in. This way, the dealer sends a proportional amount of the collateral to each of the remaining segments. While an assumption is necessary for allocating quantities, the results are not qualitatively dependent on this approach.⁸

For example, \$44.59 billion of DVP reverse repo collateral received is rehypothecated and delivered into NCCBR as collateral for the dealers' repo. Additionally, in **Figure 4**, the *balance* column and row show collateral that is

Figure 3. Cash and Collateral Flows by Repo Market Segment (\$ billions)

	Dealer Collateral Inflow (from reverse repo)	Dealer Collateral Outflow (to repo)
Treasury	802.75	952.01
Non-Treasury	124.68	402.62
Total Collateral	927.43	1,354.63

	Dealer Cash Inflow (from repo)	Dealer Cash Outflow (to reverse repo)
DVP	255.04	346.04
GCF	18.48	37.38
NCCBR	374.60	544.01
Tri-Party	706.52	0.00
Total Cash	1,354.63	927.43

Note: Outstanding volumes are for the nine pilot participants averaged across the June 15, 22, and 30, 2022, sample dates. The collateral value is post haircut, assessed for securing the repo. The blue shading (left column on the top table and right column on the bottom table) represents reverse repo activity from the dealer’s perspective; conversely, the green shading (right column on the top table and left column on the bottom table) represents repo activity.

*Market segments are not broken out for non-Treasury collateral due to data confidentiality restrictions.

Sources: 2022 OFR NCCBR Pilot Collection, OFR Cleared Repo Collection, Federal Reserve Tri-Party Repo Collection, Authors’ analysis.

secured in respective repo or reverse-repo transactions but not rehypothecated. For instance, \$120.79 billion of DVP reverse repo involves collateral that is not rehypothecated into a repo. Also, \$118.07 billion of NCCBR involves collateral that is not sourced from reverse repo activity. Dealers may fund securities on their balance sheets through a repo, and the value of these securities will appear in the repo column.

Figure 4 highlights several features of the repo market and cross-segment intermediation volume. First, note that the GCF and Tri-Party rows are zero, except for the balance, as these segments do not allow the reuse of collateral. Instead, the dealer uses these segments to fund itself through repos using collateral from DVP, NCCBR, or existing balance sheet collateral (i.e., *Balance* in the bottom row). Second, within-segment activity is generally the

Figure 4. Rehypothecated Collateral Flows by Repo Market Segment (\$ billions)

		Collateral Delivered (Repo)				
		GCF	DVP	NCCBR	Tri-Party	Balance
Collateral Received (Reverse Repo)	GCF	-	-	-	-	37.38
	DVP	1.07	109.33	44.59	70.26	120.79
	NCCBR	4.27	58.10	211.93	107.42	162.29
	Tri-Party	-	-	-	-	-
	Balance	13.14	87.61	118.07	528.84	

Note: Outstanding volumes for the nine pilot participants are averaged across sample dates of June 15, 22, and 30, 2022. The blue shading (rows) represents reverse repo activity from the dealer’s perspective; conversely, the green shading (columns) represents their repo activity.

Sources: 2022 OFR NCCBR Pilot Collection, OFR Cleared Repo Collection, Federal Reserve Tri-Party Repo Collection, Authors’ analysis.

most popular place to reuse DVP and NCCBR collateral, as \$109 billion and \$212 billion outstanding is reused, respectively. On aggregate, about half of the collateral is sent to the other segment—\$116 billion for DVP and \$170 billion for NCCBR—relative to that which remains within the segment.

As dealers’ cash borrowing is often *general collateral* in which cash lenders are secured with a broad basket of securities, dealers have more flexibility to borrow cash against different collateral than they receive from lending. Adding the balances in **Figure 4**, \$320 billion of collateral is held on dealer balance sheets (sum of *Balance* column) while \$748 billion comes from another part of dealers’ activities to secure their own borrowing (sum of *Balance* row). This implies that dealers are short \$320 billion on one set of collateral and long on a different set. Also, only 28% of gross repo volume involves exchanging collateral, which is somewhat surprising as dealers frequently swap collateral with the same counterparty (e.g., hedge funds in a relative value trade), accepting less desirable collateral in exchange for more highly sought collateral.⁹

This *collateral transformation* is in the minority of dealer transactions. This small volume implies that the dealer is typically able to take collateral from one counterparty and pass it to another counterparty willing to accept it. Two potential explanations exist, which are not mutually exclusive. One is that the cash lenders that receive collateral from dealers are indifferent about the exact collateral they receive (e.g., Tri-Party). Alternatively, the cash lender may be willing to accept specific collateral because their beliefs or trading needs regarding specific collateral are different than those of the ultimate cash borrower.

Examining a dealer’s compensation for intermediating repos within and across market segments provides a coarse estimate for the value that collateral intermediation and transformation provides to its clients. **Figure 5** presents the spreads obtained by dealers for offsetting collateral between the repo market segments.¹⁰ For example, dealers are paid 8 basis points on average for intermediating collateral from DVP reverse repo and delivering it into NCCBR repo. These cross-segment values indicate that dealers generally receive a positive spread for intermediation, with DVP to Tri-Party being the only exception. The annualized return for collateral intermediation based on the three-day average is 6 basis points, or \$384 million (excluding GCF) in net interest margin across the transactions. In contrast, for the balance columns and rows, the weighted average rate is given for the repo and reverse repos that cannot be matched to another transaction. Annualizing the returns on collateral transformation (i.e., the overall balance reverse repo rate minus balance repo rate) is 3 basis points, or \$97 million in net interest margin based on the difference in rates presented in the balances.

Figure 5. Rehypothecated Spreads and Rates across the U.S. Repo Market Segments (percent)

		Collateral Delivered (Repo)				Balance
		GCF	DVP	NCCBR	Tri-Party	
Collateral Received (Reverse Repo)	GCF					
	DVP		0.05	0.08	-0.13	1.12
	NCCBR		0.05	0.13	0.08	1.23
	Tri-Party		-	-	-	-
	Balance		1.12	1.08	1.31	

Note: The values presented for the three segments (DVP, NCCBR, and Tri-Party) represent the weighted average spread on repos where the collateral is offset through a dealer. Balance (italics) represents the weighted average rate on repo (row) and reverse repo (column) collateral that cannot be matched with another market. Spreads and rates are the weighted average values from the nine pilot participants across the sample dates of June 15, 22, and 30, 2022. The spreads and rates are presented as the annualized percentage return, where 0.01% represents 1 basis point.

Sources: 2022 OFR NCCBR Pilot Collection, OFR Cleared Repo Collection, Federal Reserve Tri-Party Repo Collection, Authors’ analysis.

The importance of collateral transformation differs by collateral type. About 91% of offsetting collateral volume is generated from repos secured with Treasuries. Of all Treasury backed reverse repos, 69% of these securities are rehypothecated while 58% of repo collateral is from securities that dealers receive through a reverse repo transaction. In contrast, substantively less non-Treasury collateral is reused. Even though 45% of reverse repo non-Treasury collateral is rehypothecated, only 14% of non-Treasury repo collateral is from what dealers receive through a reverse repo transaction. This fact emphasizes the relative difficulty of reusing non-Treasury collateral for funding. Thus, this collateral is more likely to reside on dealer balance sheets.

What dealers receive for exchanging collateral through their balance sheet provides perspective on the value proposition of intermediating varying types of securities. **Figure 6** presents the spreads secured with offsetting Treasury and non-Treasury collateral. For single-sided balance transactions, the given rates are based on Treasury and non-Treasury collateral.

Figure 6. Rehypothecated Collateral Spreads and Rates by Treasury / Non-Treasury Collateral (percent)

		Collateral Delivered (Repo)				
		GCF	DVP	NCCBR	Tri-Party	Balance
Collateral Received (Reverse Repo)	GCF					
	DVP		0.05 / -	0.08 / -	-0.13 / -	1.12 / -
	NCCBR		0.06 / -	0.10 / 0.54	-0.10 / 0.29	1.18 / 1.34
	Tri-Party		- / -	- / -	- / -	- / -
	Balance		1.12 / -	1.09 / 1.03	1.25 / 1.34	

Note: The values presented between the three segments, DVP, NCCBR, and Tri-Party, represent the weighted average spread versus the values associated with balance (either in the rows or columns), as well as the weight average rate (italics). Values on the left of the backlash are for Treasuries and on the right are for non-Treasuries. Spreads and rates for the nine pilot participants are averaged across the sample dates of June 15, 22, and 30, 2022. The spreads and rates are presented as the annualized percentage return, where 0.01% represents 1 basis point.

Sources: 2022 OFR NCCBR Pilot Collection, OFR Cleared Repo Collection, Federal Reserve Tri-Party Repo Collection, Authors' analysis.

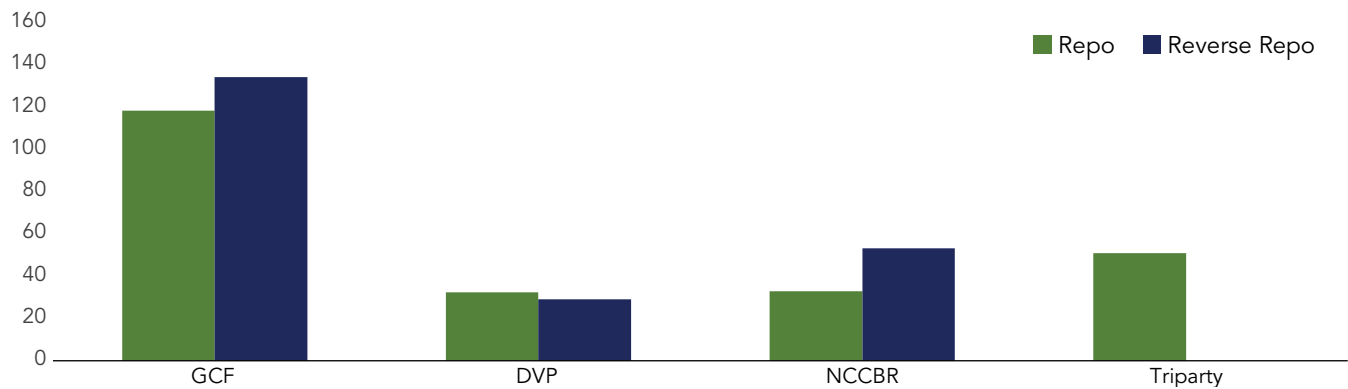
Figure 6 shows two notable facts about spreads across market segments. First, the rehypothecation of Treasury collateral from DVP or NCCBR into Tri-Party has a negative spread on average. As Tri-Party transactions are *general collateral* transactions, what the cash lenders in this segment generally value is the specific collateral they are promised less. Thus, the negative spread may represent dealers' Treasury positions held as part of their firms' secondary market activity in Treasury markets or collateral borrowed in the other repo segments. This reflects a cost associated with managing collateral.

Second, for those segments in which both types of collateral are intermediated, non-Treasury collateral spreads are wider. Despite the low volume of intermediation in this collateral segment, the wider spreads, or net interest margin, suggest that non-Treasury collateral can generate as much gross profits as Treasury collateral. **Figure 6** suggests that dealers potentially receive \$175 million for Treasury and \$209 million for non-Treasury in net interest margin across the transactions with offsetting collateral. If net interest margins reflect risk, then, on a volume-weighted basis, dealers take relatively similar quantities of risk. Thus, non-Treasury collateral is riskier to intermediate on a per dollar basis.

Maturity Transformation

Repo maturity, or tenor, varies heavily by participant needs and the collateral used. This leads to variation in the average tenor of repo and reverse repo activity in each segment (see **Figure 7**).¹¹ Notably, DVP predominately has

Figure 7. Average Tenor by Repo Market Segment (days)



Note: Tenor is based on the nine pilot participants weighted average repo maturity across the sample dates of June 15, 22, and 30, 2022.

Sources: 2022 OFR NCCBR Pilot Collection, OFR Cleared Repo Collection, Federal Reserve Tri-Party Repo Collection, Authors' analysis.

shorter-term transactions relative to other segments while GCF has longer-term transactions. This may be from the prevalence of agency mortgage-backed security (MBS) collateral in GCF as non-Treasury secured repo has generally longer terms intended to reduce funding rollover risk.

Since different market participants and market segments have distinct tenor requirements, dealers can perform maturity transformation within their repo portfolio. **Figure 8** presents four tenor classifications for the rehypothecated collateral aggregated across repo market segments that are overnight, one week (2-7 days), one month (8-30 days), and long term (greater than 30 days). For example, \$48.68 billion of reverse repo collateral with a one-month tenor is rehypothecated and delivered into overnight repo as collateral.

The diagonal values (in white) display the total volume of tenor-matched repo. These values imply that 60% of overall offsetting reverse repo and repo transactions are closely matched. However, when tenors cannot be matched and maturity transformation is performed, dealers in the sample offset a higher proportion of longer-term reverse repo with shorter-term repo transactions (in orange) than vice versa at a ratio greater than 2:1.¹²

Figure 8. Rehypothecated Collateral Volumes by Repo Tenor (\$ billions)

		Collateral Delivered (Repo)			
		Overnight	Week	Month	Long-Term
Collateral Received (Reverse Repo)	Overnight	244.76	9.56	12.23	24.68
	Week	19.61	10.86	3.77	4.09
	Month	48.68	6.25	30.17	17.95
	Long-Term	79.01	7.88	11.50	73.33

Note: Outstanding volumes represent the matched collateral rehypothecated within and across repo market segment for the nine pilot participants, averaged across the sample dates of June 15, 22, and 30, 2022. Each group is binned into overnight (1 day), week (2-7 days), month (8-30 days), and long term (greater than 30 days).

Sources: 2022 OFR NCCBR Pilot Collection, OFR Cleared Repo Collection, Federal Reserve Tri-Party Repo Collection, Authors' analysis.

Dealer repo and reverse repo transactions with mismatched maturities are exposed to interest rate risk (e.g., if short-term rates rise or fall faster than long-term rates) and rollover risk (e.g., if short-term repo funding becomes scarce before dealers’ longer-term reverse repos are repaid). These risks are not hypothetical: on June 16, 2022, one day after the sample date in the data, the Federal Reserve raised policy rates by 75 basis points, and overnight repo rates rose in lockstep.

As repo investors are forward-looking, term rates reflect the expectations of future central bank policy rate decisions. As a result, on June 15, term repo rates for new trades were higher than overnight rates. A few days later, on the second day of our sample, June 22, some outstanding term agreements that were struck on June 15 were also below the overnight rate. The reason is that this agreement partly reflected a lower policy rate prior to June 16. This reinforces the risk that dealers face in maturity transformation because an unexpected tightening will result in a term rate that may not provide compensation for the higher overnight rate.

Figure 9 Panel A shows the average spreads between repos at different tenors in which collateral used in a reverse repo at one tenor is delivered into a repo at a similar or different tenor. Along the table’s diagonal, where the repo and reverse repo tenors are matched (see **Figure 8**), dealers receive a larger spread for longer-term offsetting repo and reverse repo. This finding aligns with the longer-term transactions that are generally more costly to offset. The spreads are positive for offsetting longer-term reverse repo transactions with shorter-term repo transactions (in orange) and shorter-term reverse repo transactions with longer-term repo transactions (in grey). This suggests that dealers were generally prepared and forward-looking in managing maturity risk.

To isolate the economics of maturity transformation, **Figure 9 Panel B** presents an adjusted measure where the federal funds target rate is subtracted from each repo and reverse repo rate on its start date. This adjustment is intended to control for changes in central bank monetary policy during the sample period. Note that for offsetting longer-term reverse repo transactions with shorter-term repo transactions, the spreads are positive and grow

Figure 9. Rehypothecated Collateral Spread by Repo Tenor (percent)

		A. Unadjusted Spreads				B. Adjusted Spreads			
		Collateral Delivered (Repo)				Collateral Delivered (Repo)			
		Overnight	Week	Month	Long-Term	Overnight	Week	Month	Long-Term
Collateral Received (Reverse Repo)	Overnight	0.02	0.00	0.00	0.04	0.05	-0.02	-0.06	-0.47
	Week	0.15	0.09	0.23	0.37	0.16	-0.03	0.03	-0.21
	Month	0.17	0.21	0.25	0.21	0.25	0.18	0.16	-0.20
	Long-Term	0.00	0.11	0.26	0.31	0.54	0.46	0.45	0.20

Note: Spreads represent the matched collateral rehypothecated within and across each repo market segment adjusted for the midpoint of the Federal Funds Target across the nine pilot participants. These spreads were averaged across the sample dates of June 15, 22, and 30, 2022. Each group is binned into overnight (1 day), week (2-7 days), month (8-30 days), and long term (greater than 30 days). The spreads are presented as the annualized percentage return, where 0.01% represents a 1 basis point spread.

Sources: 2022 OFR NCCBR Pilot Collection, OFR Cleared Repo Collection, Federal Reserve Tri-Party Repo Collection, Authors’ analysis.

wider as the term mismatch becomes larger. In contrast, when offsetting shorter-term reverse repo transactions with longer-term repo transactions, the spreads are almost all negative and, once again, grow wider with larger term mismatches.

Economically, this provides two takeaways. First, dealers can generally earn a positive spread on matched tenor transactions because their ability to match transactions generates net interest margins with no collateral or maturity

risk. The annualized return of these activities is 9 basis points. Second, given the quantity of maturity transformation that dealers perform, dealers must be able to reliably fund their repo portfolios by lending cash for a longer term than their borrowing, much like banks do with loans and deposits. The annualized return on these activities is 39 basis points. However, when dealers reverse their maturity transformation and lend cash for a shorter term than their borrowing, they generate an annualized return of -23 basis points.

Importantly, these spreads likely depend on whether rates are trending up (a tightening cycle) or down (an easing cycle). In a tightening cycle, rates on longer tenor repo will generally fall above shorter tenor repo. This leads to high returns for maturity transformation while, in an easing cycle, the opposite generally occurs. Unfortunately, without a longer sample, it is not possible to estimate the average returns to maturity transformation as how to adjust for policy rate expectations is unclear.

Counterparty Risk Transformation

Many financial institutions have constraints on their repo counterparties. These constraints may be due to their own creditworthiness (making them relatively unattractive) or the creditworthiness of potential counterparties. By their nature, repo dealers take on this counterparty risk exposure when they place themselves between two transactions and perform. When collateral or cash is scarce, if one party defaults, the dealer could suffer a loss and may further suffer meaningful liquidity strain on its balance sheet while it attempts to rebalance its funding.

Dealers mitigate their counterparty risk through various methods, such as evaluating and monitoring the health of the financial institutions they trade with. By managing counterparty risk, intermediaries can protect against potential losses to ensure the smooth functioning of short-term funding markets. For a sense of how different counterparty types use repo and how dealers price risk, **Figure 10** provides an overview of dealers' activities by counterparty type. The counterparties for which data exist are grouped by commercial banks (BNK); repo brokers

Figure 10. Overview of Counterparty Activity

Counterparty Type	Collateral Delivered (Repo)	Collateral Received (Reverse Repo)
BNK		
Outstanding	\$99.01 billion	\$27.60 billion
Rate	1.12%	1.38%
BRO-DLR		
Outstanding	\$198.45 billion	\$214.60 billion
Rate	1.13%	1.14%
HF		
Outstanding	\$97.99 billion	\$121.52 billion
Rate	1.04%	1.24%
MMF-MUT		
Outstanding	\$255.07 billion	\$ 0.00 billion
Rate	1.29%	N/A
OTH		
Outstanding	\$61.51 billion	\$74.87 billion
Rate	1.24%	1.12%

Note: Outstanding volumes are for the five pilot participants that provide counterparty identifying information. They are averaged across the sample dates of June 15, 22, and 30, 2022. The totals are the volumes given in \$ billions. Rate is the weighted average rate of the outstanding transactions contained in the outstanding figure. The blue shading (right column) represents reverse repo activity from the dealer's perspective; and the green shading (left column) represents repo activity. All estimates in this figure are aggregated across repo market segments.

Sources: 2022 OFR NCCBR Pilot Collection, OFR Cleared Repo Collection, Federal Reserve Tri-Party Repo Collection, Authors' analysis.

and dealers (BRO-DLR); hedge funds (HF); money market and mutual funds (MMF-MUT); and other institutions (OTH), which include pension funds, insurance, government-sponsored entities (GSEs), foreign governments, sovereign wealth funds, real estate investment trusts (REITs), and non-financial corporations.

Figure 10 shows dealers’ repo activity differs markedly based on the type of institution they are trading with. For example, repo funding is critical to financing repo brokers and dealers and hedge funds activity as they are the largest reverse repo counterparties to dealers. In contrast, money market and mutual funds, repo brokers and dealers, commercial banks, and hedge funds are all large cash lenders. While the cash lent by dealers can flexibly be used across repo counterparties, the cash lenders that dealers provide collateral to are often constrained by the securities they are willing to take. This implies that dealers can raise their margins by efficiently matching collateral from high-rate borrowers to low-rate lenders. However, these indirect sector lending relationships that are formed through dealers may create funding interdependencies that could cause financial stability concerns.

While dealers know their counterparties on each side of the repo market, less is known about the indirect relationships implicitly linked through dealers’ intermediation.¹³ To understand these connections further, **Figure 11** presents the volume of offsetting repo and reverse repo activity between dealer counterparties, with the rows representing counterparties that dealers receive collateral from and the columns representing the counterparties dealers deliver collateral to. For example, \$19.87 billion of reverse repo collateral done with brokers and dealers is rehypothecated and delivered into repos with hedge funds.

When looking at which collateral is being rehypothecated to whom, a few strong relationships emerge in **Figure 11**. Collateral received from repo brokers and dealers is often rehypothecated to other repo brokers and dealers. This relationship underscores the importance of repo brokers and dealers among themselves to sort collateral and deliver it to those who need it or are willing to lend cash against it.

Figure 11. Rehypothecated Collateral Flows by Counterparty Types (\$ billions)

		Collateral Delivered (Repo)					Balance
		BNK	BRO-DLR	HF	MMF-MUT	OTH	
Collateral Received (Reverse Repo)	BNK	3.26	4.91	3.06	5.52	1.21	9.64
	BRO-DLR	12.65	64.09	19.87	29.73	8.34	79.92
	HF	14.57	18.10	31.12	24.47	6.77	26.49
	MMF-MUT	-	-	-	-	-	-
	OTH	7.88	8.74	10.81	10.18	8.62	28.64
	Balance	60.65	102.61	33.13	185.17	36.57	

Note: Outstanding volumes are for the five pilot participants that provide counterparty identifying information. They are averaged across the sample dates of June 15, 22, and 30, 2022. The totals are the volumes given in \$ billions.

Sources: 2022 OFR NCCBR Pilot Collection, OFR Cleared Repo Collection, Federal Reserve Tri-Party Repo Collection, Authors’ analysis.

Also, dealers often rehypothecate collateral sourced from hedge funds to other hedge funds (26% of total volume), money market and mutual funds (20%), and repo brokers and dealers (15%). It is somewhat surprising that hedge funds demand collateral from other hedge funds because the sector is relatively sophisticated in its specific collateral demand and will often borrow against securities that they are long. This may be indicative of sizable contrarian views. Additionally, relatively little hedge fund collateral remains on dealer balance sheets, suggesting

that dealers stay clear of these positions. In part, this finding may explain how dealers manage their collateral risk, as mentioned earlier in this brief.

The cost of counterparty transformation is apparent in the realized spread that repo dealers obtain based on whether they are lending (reverse repo) or borrowing (repo) cash (see **Figure 12**). Overall, the spreads imply that lending cash to riskier counterparties and using their collateral to borrow from safer counterparties is what generates greater potential margins for dealers. Dealers receive larger spreads when performing reverse repos with less creditworthy counterparties (e.g., hedge funds) than more creditworthy borrowers (e.g., repo brokers and dealers).

Figure 12. Rehypothecated Collateral Spreads by Counterparty Types (percent)

	BNK	BRO-DLR	HF	MMF-MUT	OTH
Collateral Delivered (Repo)	0.49	0.28	0.05	0.26	-0.02
Collateral Received (Reverse Repo)	0.12	0.04	0.47	-	0.38

Note: Spreads represent the matched collateral rehypothecated within and across repo market segments for the five pilot participants that provide counterparty identifying information. They are averaged across the sample dates of June 15, 22, and 30, 2022. The spreads are presented as the annualized percentage return, where 0.01% represents a 1 basis point spread.

Sources: 2022 OFR NCCBR Pilot Collection, OFR Cleared Repo Collection, Federal Reserve Tri-Party Repo Collection, Authors' analysis.

The reverse is also true. Dealers receive larger spreads by borrowing cash from more creditworthy counterparties (e.g., banks and money market and mutual funds) than through repos with less creditworthy counterparties (e.g., hedge funds).

Conclusion

Much like traditional banks that provide lending to businesses and individuals, repo dealers provide secured lending for cash and securities across financial institutions. However, as securities are not as liquid as cash, the ease of dealers in matching opposing counterparties is essential to the allocation of funding across the U.S. financial system. This brief examines how dealers manage cash and securities collateral across the repo market and the compensation they receive to intermediate risk.

The OFR's NCCBR pilot collection that was combined with the two current permanent collections of repo data provides a unique and more complete view of the repo market. This study uses over \$2 trillion of outstanding daily repo positions to furnish an interconnected view of the flow of cash and collateral across the U.S. financial system. The analysis reveals that dealers are efficient at rehypothecating collateral and generally earn a positive net interest margin on their intermediation of the repo market. While dealers earn a positive net interest margin by reusing collateral, they take on risk across the collateral, maturity, and counterparties of their repos. The compensation is higher when the collateral is less liquid and when dealers borrow from counterparties that are more creditworthy than those they lend to. Dealers also lend at different maturities than they borrow, although their compensation for this risk transformation is unclear.

Each of these risk transformations performed within and across market segments helps explain the net interest margin earned by dealers and serves to unify the funding demand and supply of the repo market. As such, dealers have a critical role in the stability of funding markets. This early work highlights the importance of a permanent OFR data collection for further study and monitoring of the NCCBR market.

Endnotes

- 1 Samuel J. Hempel, Senior Economist, Federal Reserve Board (sam.hempel@frb.gov); R. Jay Kahn, Senior Economist, Federal Reserve Board (jay.kahn@frb.gov); Robert Mann, Research Economist, Office of Financial Research (robert.mann@ofr.treasury.gov); and Mark E. Paddrik, Associate Director, Office of Financial Research (mark.paddrik@ofr.treasury.gov). The authors thank David Bowman, Corey Garriott, Marco Machiavelli, Matthew McCormick, Sriram Rajan, Stacey Schreft, Stathis Tompaidis, and Alex Zhao for their comments and suggestions. The OFR Non-Centrally Cleared Bilateral Pilot was the result of effort by many different parties. The authors also thank the pilot participants for agreeing to share their data with the OFR, as well as Melissa Avstreich, Danylo Rakowsky, Kevin Kostka, Adam Cook, Laura Craig, David Van Kannon, Valerie Wells, and the entire OFR staff who have been involved in the collection process.
- 2 For this brief, rehypothecation only considers collateral used in a repo transaction that was obtained from a reverse repo transaction and not in other potential destinations or sources (e.g., securities lending).
- 3 For more detail on repo runs during the 2007-09 financial crisis, see Adam Copeland et al., “Repo Runs: Evidence from the Tri-Party Repo Market,” *The Journal of Finance* 69.6 (2014): 2343-2380; Antoine Martin et al., “Repo Runs,” *The Review of Financial Studies* 27.4 (2014): 957-989; and Gary Gorton and Andrew Metrick, “Securitized Banking and the Run on Repo,” *Journal of Financial Economics* 104.3 (2012): 425-451.
- 4 For more details on the general structure of the repo market, see Viktoria Baklanova et al., “Reference Guide to U.S. Repo and Securities Lending Markets,” Working Paper No. 15-17 (Office of Financial Research, September 9, 2015), <https://www.financialresearch.gov/working-papers/2015/09/09/reference-guide-to-u-s-repo-and-securities-lending-markets/>; and R. Jay Kahn and Luke M. Olson, “Who Participates in Cleared Repo?,” Brief No. 21-01 (Office of Financial Research, July 8, 2021), <https://www.financialresearch.gov/briefs/2021/07/08/who-participates-in-cleared-repo/>. For discussion and some evidence on how this market segmentation impacts dealer intermediation, see Sriya Anbil et al., “Are Repo Markets Fragile? Evidence from September 2019,” Finance and Economics Discussion Series (FEDS) (Board of Governors of the Federal Reserve System, April 2021), <https://www.federalreserve.gov/econres/feds/are-repo-markets-fragile-evidence-from-september-2019.htm>.
- 5 The dates were chosen to show repo activity on “normal” days (June 22) and “abnormal” days, such as a quarter end (June 30) and a Treasury settlement day (June 15). These different dates provide a comprehensive view of the activity in this segment across a variety of market environments. The nine dealers include primary dealers and nonprimary dealers, bank affiliated and non-bank affiliated dealers, and purely domestic dealers and dealers that are affiliates of foreign institutions.
- 6 For more detail on this market size estimate, see a related blog post from the OFR: Samuel J. Hempel et al., “Non-Centrally Cleared Bilateral Repo,” The OFR Blog, Office of Financial Research, August 24, 2022, <https://www.financialresearch.gov/the-ofr-blog/2022/08/24/non-centrally-cleared-bilateral-repo/>. These estimates are also consistent with the evidence presented in an earlier analysis; see Sebastian Infante et al., “Insights from Revised Form FR2004 into Primary Dealer Securities Financing and MBS Activity,” FEDS Notes (Board of Governors of the Federal Reserve System, August 5, 2022), <https://www.federalreserve.gov/econres/notes/feds-notes/insights-from-revised-form-fr2004-into-primary-dealer-securities-financing-and-mbs-activity-20220805.html>.
- 7 In the collateral offsetting exercise, securities are matched across transactions based on their nine-digit securities identifier (CUSIP) and the dealer’s name.
- 8 Within the context of this paper, offsetting means matching collateral on lending and borrowing at the same time for the same dealer. For example, if a piece of collateral is lent for \$60 in NCCBR and borrowed against for \$20 in DVP and \$50 in NCCBR, then the within-NCCBR offset is \$50 and the NCCBR to DVP offset is \$10. In later analyses, we will also offset in a similar manner when focusing on each aspect of trading, such as maturity and counterparty types.
- 9 For more detail on the nature of the NCCBR segment and some basic insights from the Pilot Data, see Samuel J. Hempel et al., “Why Is So Much Repo Not Centrally Cleared?,” Brief No. 23-01 (Office of Financial Research, May 12, 2023), <https://www.financialresearch.gov/briefs/2023/05/12/why-is-so-much-repo-not-centrally-cleared/>.
- 10 GCF is dropped in figures, such as Figure 5, as conventions in the GCF market make it difficult to match a rate with a specific piece of collateral. Since GCF comprises a small amount of the overall activity of these dealers, this exclusion is not quantitatively important.
- 11 For more details on the distribution of tenor within each market segment (overnight versus term) see Figure 11 of Samuel J. Hempel et al., “Why Is So Much Repo Not Centrally Cleared?,” Brief No. 23-01 (Office of Financial Research, May 12, 2023), <https://www.financialresearch.gov/briefs/2023/05/12/why-is-so-much-repo-not-centrally-cleared/>.
- 12 Recent research has highlighted dealer’s use of maturity transformation in repo markets, see Marco Macchiavelli and Luke Pettit, “Liquidity Regulation and Financial Intermediaries,” *Journal of Financial and Quantitative Analysis* 56(6) (2021): 2237-2271; and David Bowman et al., “Balance-Sheet Netting in U.S. Treasury Markets and Central Clearing,” Finance and Economics Discussion Series (FEDS) No. 2024-057 (Board of Governors of the Federal Reserve System, 2024), <https://www.federalreserve.gov/econres/feds/files/2024057pap.pdf>.
- 13 For information on counterparty types within the different market segments, see R. Jay Kahn and Luke M. Olson, “Who Participates in Cleared Repo?,” Brief No. 21-01 (Office of Financial Research, July 8, 2021), <https://www.financialresearch.gov/briefs/2021/07/08/who-participates-in-cleared-repo/>; Viktoria Baklanova et al., “Reference Guide to U.S. Repo and Securities Lending Markets,” Staff Reports 740 (Federal Reserve Bank of New York, 2015); and Mark Paddrik et al., “The Dynamics of the U.S. Overnight Triparty Repo Market,” Brief No. 21-02 (Office of Financial Research, July 22, 2021), <https://www.financialresearch.gov/briefs/2021/07/22/dynamics-overnight-triparty-repo-market/>. As far as the authors are aware, this is the first study to attempt to match counterparties across the different market segments.