The Repo Market

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1 Introduction and History of Repo

The sale of a security with agreement to repurchase, or “repo” transaction for short, exists in a legal niche between securities and loans. One party is offering financial securities, another party offers cash. Sometimes the transaction is driven by a desire to obtain cash, and other times it is driven by a desire to obtain access to a particular security. Services such as triparty or central clearing exist in some repo markets to handle the valuation of collateral, counterparty credit risk, and settlement. Some repo agreements allow for “general collateral,” which can be swapped out for different securities as the cash borrower’s trading inventory changes. This flexibility is one reason that the repo market is a dominant channel in global short-term funding markets.

1.1 The Invention of Repo

The Federal Reserve’s (“the Fed”) formation in December 1913 coincided with the outbreak of World War I just 8 months later, and led to the establishment of the first repo market in 1917. As banker to the United States Treasury, one of the Federal Reserve’s first challenges was to facilitate sales of war bonds and keep credit flowing to American businesses. Initially this took the form of marketing committees and fundraising drives, which evolved to offering preferential lending terms to banks which bought more U.S. Treasury debt. As the war progressed, European allies shipped increasing amounts of gold to the U.S. to pay for weapons and supplies, increasing the supply of gold-backed U.S. dollars as well as the reserves of the Federal Reserve. With this increase in reserves, the Fed was able to purchase Treasury securities to influence interest rates, conducting its first “Open Market Operations” and laying the groundwork for the Fed’s role supporting financial stability.

On November 28th, 1917 the surprise introduction of a $0.02 wartime stamp tax on promissory notes caused a sudden shock to U.S. short-term funding markets. A fixed tax might be bearable for longer-term bills or loans but was exorbitant bankers acceptances (then the predominant form of commercial paper) and other short-term lending, which would re-incur the tax each time the loan was rolled over. In the words of then-Fed Governor William P.G. Harding: “this tax practically prohibits this form of short term borrowings.”[

While the Fed pressed for an exemption on this tax, their member banks were clamoring for a way to exit the market for bankers acceptances and avoid the tax, threatening a market panic.

The new legislation did contain an exemption stating that banks could offer their commercial paper for cash at the Federal Reserve without incurring an additional

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1December 1, 1917 letter by W.P.G. Harding to U.S. Treasury Secretary William McAdoo and Comptroller of the Currency John Skelton Williams.
stamp tax on that transaction. The standard practice at the time would have been for the Fed to “discount” these securities, i.e., deducting the full interest upfront based on the remaining time to maturity of the commercial paper. Given that the discount window rate is designed as a penalty rate, this could have resulted in losses for banks—paying more in interest to the Fed than they earned on the commercial paper (even before the stamp tax).

Instead, the Fed decided to come up with a new solution, which they called “resale agreements.” The Fed offered to buy banks’ commercial paper with a discount only for interest during the agreement period (initially intended to be 15 days or less) and then re-sell the securities back to banks who are contractually obligated to re-purchase them after the panic subsided, or alternatively, the Fed could buy these securities with no upfront discount and charge interest in the form of a higher price when they re-sell the security. Thus, the first repo transaction was born. Repos were an immediate success, providing $34 Million out of the total $85 Million in Fed liquidity to the U.S. banking system by the end of December 1918.

1.2 Growth of Repo Markets

After WWI, the Fed continued to use repo to support the growth of commercial paper markets, even allowing nonbank dealers to participate. However, the repo market collapsed along with much of the financial system during the Great Depression. Then in 1951 the Treasury-Federal Reserve Accord was reached and the Fed was no longer required to support Treasury debt prices. This return of a free market brought higher trading activity in U.S. government bonds, bringing with it a need to finance trading inventory through a new interdealer repo market.

The 1980s brought modernization and globalization to repo markets. Garbade (2006) discusses how the collapse of two dealers—Drysdale Government Securities and Lombard-Wall—in 1982 caused repo dealers to recognize accrued interest (i.e., “dirty price” of a bond) when offering cash in repo, and led to Congress passing a law exempting repo from the “automatic stay” process of bankruptcy courts. In Europe, the U.K.’s de-regulatory “Big Bang” created a demand for cash financing via repo as London investment banks built up large bond trading positions. Elsewhere in Europe, the need for cheaper ways to borrow securities and growth in trading of Bunds and new Eurobonds (Matif’s “Notionel” product) created a growing opportunity for repo markets. A second “Big Bang” in 1996 created an open repo market for trading gilts in the U.K.

Recent years have been marked by a return to central bank involvement in sup-

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The U.S. government bond market and the U.S. Treasuries repo market are currently the largest in the world.
porting repo functioning. In response to a sovereign debt and liquidity crisis, in 2011 the European Central Bank (ECB) created their Long-Term Refinancing Operation (LTRO), an essentially unlimited 3-year repo facility offering a 1% rate (and a large haircut). In the U.S., the Fed created a Reverse Repo Facility in 2014, offering assets they had purchased through Quantitative Easing in exchange for cash from Money Market funds and other cash lenders, in order to put a floor on short-term interest rates. In 2020, the Covid Pandemic caused central banks to intervene forcefully with new and existing tools, including a new Dollar Repo Facility between the Fed and other Central Banks.

2 Structure of a repo contract

The key terms of a repo contract are its

- **Starting Date**: Also called settlement date, on-side date, or value date, this is the date at which securities and cash are exchanged. Repo transactions are typically negotiated on the same day they will start, but not always.

- **Maturity**: The date when the exchange of securities and cash is reversed. This can be specified (e.g. 1 day, 30 days, until stated maturity of the collateral i.e. “Repo to Maturity”, etc.) or it can be “rolling”, where the contract is renewed each day but the collateral provider may change which particular CUSIP-level securities are exchanged.

- **Rate**: The rate of interest due at maturity, as a percentage of the cash initially exchanged. If the repo transaction is motivated by the counterparty seeking cash, this rate will be positive, but if the repo is driven by the counterparty seeking a specific security, this rate can be relatively small or even negative (i.e. the security is “special”). Interest is assessed under standard money market rate conventions, i.e. Effective Rate = \( \text{Rate} \times \frac{\text{Number of Days}}{360} \).

- **Description of Acceptable Collateral**: A contractual specification of what securities will be exchanged. The acceptable collateral may be any security within a broad category (e.g. government bonds, or the subset of government bonds with no more than X years to maturity), or it may be as specific as one particular security, like the latest on-the-run 10-year US Treasury bond.

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\(^3\text{This is useful for example when a dealer is making markets in various securities and financing their fluctuating inventory levels using repo.}\)
Haircut: The required over-collateralization of securities versus cash exchanged, or how much the collateral value exceeds the cash value (similar to initial margin). This protects the cash provider from losses if the collateral provider defaults. Haircuts are typically assessed at initiation of the repo and can remain static while the repo is open. However, if the value of the securities is volatile (e.g., equities), the cash provider may require the securities to be marked-to-market on a daily basis. If a drop in collateral value is material, the securities provider may be required to deliver additional securities to the cash provider, (similar to variation margin), if this was specified during the negotiation of the repo.

During a repo transaction, the economic effects of ownership are retained with the collateral provider. If a bond pays a coupon or a stock pays a dividend, that cash is returned along with the security itself when the repo matures. However, if a corporate action such as a shareholder vote occurs during the repo, the cash provider (who now possesses the collateral) gets to vote.

2.1 Example of a Classic Repo Transaction

On Wednesday, February 5, 2020, dealer wants to borrow cash overnight to finance their securities inventory. They can offer $10 million par value of 5-year US Treasuries to General Collateral (“GC”) investors. On that date, those investors would have offered a rate of 1.57%.

The clean price\(^4\) of the 5-year on-the-run US Treasury bond was 99.57813 on the repo start date, and the dirty price was 99.600795. In the U.S. General Collateral market the haircut is 0, so the initial cash exchanged would be equal to the dirty price of the bonds. Thus, with a maturity of 1 day (overnight), our dealer would sell the $10 Million par value Treasuries for $9,960,079.50.

On Thursday, February 6th, the repo matures and our dealer repurchases those same Treasuries by wiring the cash investor $9,960,079.50 \times (1 + 0.0157 \times \frac{1}{360})\), or $9,960,513.87 and receiving their 5 year Treasuries. Total interest paid was $434.37, and the security was repurchased to close the repo at the same price it had been sold for to open the repo.

2.2 Repo vs Reverse Repo

In a repo transaction, one side is receiving cash in exchange for their securities (selling securities under agreement to repurchase), while their counterparty is doing the op-

\(^4\)The clean price of a bond ignores accrued interest, the dirty price includes accrued interest. Both are quoted as a percentage of the bond's par value, which is typically $1000.
posite (buying securities under agreement to resell). The former is sometimes called
“cash-in” on the repo, while the latter would be “cash-out.” In standard industry
terms, the “cash-in” leg is called a repo, while the “cash-out” leg is called a reverse
repo.

Somewhat idiosyncratically, central banks such as the Federal Reserve Bank of
New York (“Fed”) may adopt the opposite nomenclature of typical market partic-
pants. When the Fed is “cash-out” (purchasing securities with agreement to resell,
and therefore transmitting cash to a dealer) they call this a repo. The Fed’s Reverse
Repurchase Agreement facility calls their operations reverse repo even though they
are “cash-in”, selling Fed securities holdings under agreement to repurchase.\footnote{This
facility is discussed more in section \ref{sec:reverse-repo}}

\subsection{Rehypothecation}

In a process called rehypothecation lending, a client of a dealer offers securities in
exchange for cash financing (sometimes through a repo, or other times simply through
a prime brokerage margin account), and the dealer re-pledges those same securities for
its own cash financing. This re-pledging can then be repeated by the next cash lender,
and so on. While some amount of rehypothecation may help lower borrowing costs
for the initial cash borrowers, the practice could be potentially problematic if one
participant somewhere in the “chain of rehypothecation” defaulted.\footnote{Especially
if the collateral had also been rehypothecated off to a foreign country!} Indeed, Singh
and Aitken\citeyear{SinghAitken2009} show that after Lehman Brothers’ bankruptcy in 2008,
the extent of rehypothecation declined substantially, as investment firms feared losing access to
their collateral if their prime broker went bankrupt.

\subsection{Default vs Fail-to-Deliver}

If a cash borrower in a repo fails to return the cash with interest at the repo maturity
date, this is considered a default, and the cash lender may hope to recoup their losses
by liquidating the collateral. However, if a cash lender (collateral borrower) in a repo
fails to return the collateral at the repo maturity date, this is not considered a default
but rather a fail-to-deliver (or “fail”). In a fail-to-deliver, the cash lender may pay a
fee and the cash borrower must wait to unwind the repo. Alternatively, at the start
of a repo transaction, a fail may occur when the cash borrower does not deliver the
obligated securities (and therefore doesn’t get cash but must still pay the full amount
of specified interest on the repo).

While an uncommon occurrence, fail-to-delivers are usually triggered by some
type of special collateral. For example, Fleming and Garbade\citeyear{FlemingGarbade2004} and Fleming
and Garbade (2005) discuss how heavy short interest in the on-the-run 10 year U.S.
Treasury Note led to a surge in "strategic" fails: investors had expected the note to be
re-opened through a new Treasury auction in September 2003 (increasing the supply
of that security for short sellers and reducing its specialness), but when the Treasury
announced it wouldn’t re-open the note these investors simply failed to deliver on
repos involving that note rather than try to locate these scarce securities. To remedy
this situation, Garbade, Keane, Logan, Kirby, and Wolgemuth (2010) discuss how a
"fails charge" was introduced to penalize fail-to-delivers and discourage the practice
of strategic fails.

3 Repo Pricing

Because a repo is economically similar to a collateralized loan, the interest rate on a
repo contract should be capped by the interest rate on (unsecured) interbank lending,
i.e. Libor. Choudhry (2010) shows that the GC overnight rate tracks closely with
the Libor overnight rate.

3.1 Implied Repo Rates

A theoretical repo rate can be calculated using the relationship between bond futures
and the price of underlying bonds. For a bond with spot price $P$ and a futures
contract on that bond priced $F$, a risk-free rate $r$ and a forward yield $R$, and time to
contract maturity $T$, the forward-spot parity relationship is

$$ F = P \left( \frac{r}{R} \right)^T $$

Solving for the risk-free rate $r$ gives

$$ r = R \left( \frac{F}{P} \right)^{(1/T)} $$

This rate is the implied repo rate from market prices. The implied repo rate can be
calculated for different futures contracts and their underlying bonds to understand
which assets or maturities should carry a higher rate as repo collateral.

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7A more detailed account of calculating implied repo rates in U.S. Treasuries and European bond
3.2 Specialness

Duffie (1996) shows that the general collateral (GC) rate should be the upper bound for repo rates, but that individual repo rates can be significantly lower when the collateral is "special" for some reason. For example, on-the-run 10 year U.S. Treasury bonds typically trade "on special", with a lower repo rate shortly after issuance due to their importance in the interest rate derivatives market. In general, if the price of a general collateral bond is $P$ and the price of a bond on special is $P'$, the no-arbitrage relation between the general collateral rate $R$ and the special repo rate $r$ must be given by

$$P' = P \frac{1 + r}{1 + R}$$

Specialness of a bond can therefore be measured by the difference in overnight repo rates $s = r - R$ for the special versus general collateral security. Jordan and Jordan (1997) empirically test this model and find strong support for it in the U.S. Treasury market. One useful implication of this model is that although Duffie (1996) argues the most liquid securities should be the most special, this specialness can be filtered out when constructing yield curve simply by multiplying each bond’s market price by its relative specialness $\frac{(1+r)}{(1+R)}$.

3.3 SOFR

Following the 2008 financial crisis, investigations revealed that some banks were routinely and systematically colluding to manipulate the Libor interest rate. In order to avoid future manipulation, a replacement rate was designed for U.S. markets based on repo market transacted interest rates. The Secured Overnight Funding Rate (SOFR) uses tri-party and GCF Repo overnight interest rates to construct a daily aggregate rate. Forward contracts on 1-month and longer tenors pay out based on the realized overnight SOFR over the contract period and are used to determine the longer-term SOFR rates. These features should make SOFR a floating rate benchmark which is less susceptible to manipulation. On November 30, 2020, the Federal Reserve announced Libor would be fully phased out in favor of SOFR by June 2023.

3.4 Market Segmentation

Repo rates may also be lower due to market segmentation and relationships. As Anbil, Anderson, and Senyuz (2021) show, triparty repo market rates are persistently lower than GCF Repo rates, and this spread rises during periods of market stress. Han and Nikolaou (2016) show that within the triparty repo market, relationships
between cash investors and dealers matter, and stronger relationships lead to more stable trading volumes at lower repo rates.

4 Variations on Repo Contracts and Substitutes for Repo

4.1 Variations on Repo Contracts

While Section 2 describes the standard features that define a repo contract, many variations exist within the repo market. Just as repurchase agreements were first invented due to an unusual financing need, repo has continued to evolve to suit the needs of different market participants.

In a sell/buyback repo, the security is sold at an initial spot price, with an agreement to repurchase the security at a higher forward price. While no separate interest is collected, the difference in spot and forward prices for the bond is calculated to incorporate interest on the repo. This structure has been common in Italy (until 2017) and Spain, but because this type of repo is so simple it is also used in countries where no legal framework dealing with repo transactions exists.

In a tri-party repo, securities providers and cash providers interact through a clearing bank (e.g. Bank of NY Mellon in the U.S.). This third party handles custody of the collateral, values the securities and applies specified haircuts, and settles the repo on their books. These administrative services are attractive to many cash-rich investors who want an easy way to access the repo markets, and this market segmentation is part of why tri-party repo rates are often cheaper than other forms of repo.

Cash received through tri-party repo often flows into other repo markets. Sometimes repo dealers borrow cash in tri-party just so they can lend it out in other repo markets and collect a spread. Other times, a dealer may finance their customer’s securities inventory by doing a bilateral repo with that customer, and then re-pledging (“rehypothecating”) those same securities in the tri-party repo market in order to source the cash their customer needs.

Within government securities dealers, the GCF (“General Collateral Financing”) Repo market operated by the Depository Trust & Clearing Corporation (DTCC) in the U.S. offers tri-party repo as a way to enhance liquidity in the U.S. Government securities market. Trading within this market is anonymous and counterparty credit risk is guaranteed by the parent of DTCC (the Fixed Income Clearing Corporation). Settlement is handled on a daily basis after netting repo transactions across all parties, and cash borrowers can substitute collateral within a broad class of “general collateral” government securities as their securities holdings change throughout the
day.

Other types of repo include Dollar rolls, used commonly in U.S. as part of the process to create mortgage-backed securities. Whole Loan repo, which use higher-yielding collateral such as mortgage pass-through securities or credit card loans, and Repo-to-Maturity, which simply matches the maturity of the repo to the maturity of the underlying collateral, reducing rollover risk for the cash borrower.

4.2 Substitues for Repo

Similar to repo agreements, securities lending offers an exchange of cash and securities. Typically, securities lending is collateral-driven, such as when an investor is trying to locate a stock they would like to sell short. Cash collateral above the amount of the security’s value is exchanged, and that cash may be invested by the securities lender to earn additional interest income. Additionally, a securities lending fee is charged to the securities borrower similar to a repo rate, with the rate depending on how “special” the security is. However, the fact that there is no actual sale of the securities and the fee is fixed make it easier to monitor and administer these transactions, and may explain many asset managers’ preference for lending securities rather than selling them under agreement to repurchase.

As a derivative instrument, total return swaps can offer similar economic exposure as a repo without the need to pay out cash or trade the asset. To complete the swap, the asset holder or “Beneficiary” of the swap agrees to pay the total return (interest and appreciation) of the underlying asset to their counterparty (the “Guarantor”). In return the Guarantor pays the Beneficiary a market interest rate such as Libor or SOFR, plus a spread.

The economic effect of the total return swap is as if the Guarantor now owned the asset, while paying a financing cost to the Beneficiary. If the term of the total return swap is less than the maturity of the underlying asset, the Guarantor earns an interest spread (carry) from the short-term vs long-term interest rate spread. They could have achieved this result by purchasing the asset and pledging it as collateral in a repo, but now there is no need to purchase the asset or hold it on the Guarantor’s balance sheet.

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8 If there is a drop in the asset’s value during the swap, that would result in a payment from the Guarantor to the Beneficiary.
9 This can be useful for banks facing size-based capital requirements such as the Supplementary Leverage Ratio, since the same notional position is now “off-balance sheet” and carries a smaller penalty.
5 Markets for trading repo

5.1 U.S. repo markets

There are three main markets for trading repo in the U.S.: triparty, GCF repo, and bilateral.

The tri-party repo market is the most studied U.S. repo markets, due to its importance as a cash source for repo markets, as well as the availability of data. Following the collapse of Bear Stearns in March 2008, the Fed began collecting daily transaction-level data on triparty repo, identifying the counterparties, maturities, pricing, amounts traded, and collateral. From this, studies such as Copeland, Martin, and Walker (2014) are able to show that while broad tri-party repo market activity was stable during the financial crisis, there was a sharp decline in tri-party cash financing of Lehman Brothers in the days before its September 2008 collapse. The current size of the triparty repo market in September 2021 is $3.2 Trillion, having surged from just $2.3 Trillion in April 2021 and a low of $1.5 Trillion in 2016.\textsuperscript{10}

Paddrik, Ramírez, and McCormick (2021) studies intraday transaction data in the triparty market and finds a regular clearing cycle, with most activity occurring between 8-9AM. Those cash lenders who do wish to transact late in the day almost always end up with the Fed as their counterparty through its ON RRP program. This suggests that for some triparty cash lenders, the Fed’s repo market participation functions somewhat like a deposit account.

Instead of using restricted regulatory data on repo transactions to study triparty repo, Krishnamurthy, Nagel, and Orlov (2014) use quarterly form N-CSR filings by Money Market Mutual Funds (a major class of triparty repo cash lender) to document the repo activity of the 20 largest money market fund families during the 2007-2010 period surrounding the Global Financial Crisis. They find that their sample of repo transactions was fairly stable during this period, but the contraction in repo against private-sector collateral was significant enough to drive key dealer banks to emergency lending programs from the Federal Reserve. Similarly, Hu, Pan, and Wang (2021) are able to infer repo activity using the SEC’s Form N-MFP filings. These filings provide detailed information on repo counterparties, collateral, and pricing at a monthly frequency, and the authors use it to show the important role of key fund families, particularly Fidelity, to the financial stability of the triparty repo market.

In the GCF repo market, Copeland, Davis, and Martin (2015) use regulatory data to examine and infer the strategies used by dealers. They find that dealers use GCF repo and triparty repo as substitutes, and find that the market mainly serves as a source of cash and a resource for dealers to manage their bond inventory (e.g.

\textsuperscript{10}This surge is due largely to the Fed’s expansion of its ON RRP facility, which operates through the triparty repo market.
by simultaneously pledging U.S. Treasuries to the market in repo and receiving U.S. Agency Mortgage-Backed Securities in reverse repo). A key benefit of this study was to dispel concerns of “collateral upgrade” trades, where dealers had been suspected of holding excessively risky securities, but using repo markets to swap them for safer securities. Additionally, Boyarchenko, Eisenbach, Shachar, et al. (2015) find that the supplementary leverage ratio (SLR) has reduced the size of the GCF repo market.\footnote{GCF Repo volumes are down from approximately $1$ Trillion to $450$ Billion since 2012.}

The **bilateral repo market** conducts repo operations without the infrastructure of a third-party custodian or netting service. It is also the most opaque repo market, with volumes often inferred through Primary Dealer Statistics published from the Federal Reserve Bank of New York rather than examining direct regulatory data. Copeland, Davis, LeSueur, Martin, et al. (2014) use such data to estimate the size of the bilateral repo market as roughly equal to triparty repo, with U.S. Treasuries comprising approximately 67% of bilateral repo collateral. In a special data collection pilot program, Baklanova, Caglio, Cipriani, Copeland, et al. (2016) were able to examine 3 one-day snapshots of 9 large bank holding companies’ bilateral repo and securities lending activities over the course of 3 months. The authors found that the great majority of bilateral repo involved U.S. Treasuries as collateral, and approximately 1/3 of bilateral repo was for overnight maturities. Interestingly, the authors did find that among equity collateral there was a high degree of variation in repo rates, suggesting collateral “specialness” drove many of these transactions.

### 5.2 European Repo Markets

Although the European repo markets became well-established in the 1980s, the 2008 financial crisis highlighted the importance of collateral in interbank lending and spurred short-term cash investors away from unsecured lending and into repo. In contrast to the relatively opaque repo markets of the U.S., the ECB’s Money Market Statistical Reporting (MMSR) Regulation dataset provides detailed public data on daily repo market activity in the Eurozone. These data show nearly 90% of repo is overnight in maturity, and more than 75% of repo is collateralized by government bonds. The main centers of repo activity in the Eurozone are Germany, Italy, France, and Spain. Mancini, Ranaldo, and Wrampelmeyer (2016) note that while the size of the European repo market is comparable to U.S. repo markets, most European repo transactions are cleared through a Central Counterparty (“CCP”). That market feature appears to explain why European interbank repo did not experience the types of disruptions (e.g. higher haircuts, rates, or shorter maturities) that had been documented in U.S. repo markets, and instead CCP-based repo became investors’ destination during “risk-off” periods of liquidity hoarding.
Corradin and Maddaloni (2020) have shown that in contrast to prior periods of funding stress, European Central Bank purchases of high quality collateral have created ample funding liquidity but drove up the specialness of remaining collateral. Schaffner, Ranaldo, and Tsatsaronis (2019) find that obtaining specific securities rather than cash has begun to drive repo activity. The authors are able to discern this through the rise in “specific collateral” repos compared with the stagnation and decline in “general collateral” Euro repo activity. This has had the unintended effect of segmenting European repo markets by country, consistent to a “home bias” of repo traders for bonds issued by their domestic sovereign.

The U.K. Repo market, also called the “Gilt Repo” market has been an open market since 1996, encouraging non-dealer participation. This openness encouraged market growth, and gilt repo grew steadily from £43 Billion to over £400 Billion by 2007. The market shrank by as much as 40% following the 2008 financial crisis and the Eurozone sovereign debt crisis and gilt repo rates, but was back above £400 Billion by 2018. However, during the 2008 crisis period itself, cash investor demand for gilt repo soared due to a flight to safety, driving rates on one-month repo more than 150 basis points below interbank (Libor) rates. Due to the open market structure design, both gilt repo and gilt stock lending operate essentially as one market. A trader that wants to short a security can source that security either through a gilt repo or a gilt stock loan, and some investors do both. Although participation is open, repos are conducted bilaterally and settled through the CREST settlement system—triparty repo is not significant part of the market.

6 Fragility in Repo Markets and Systemic Risk

Since at least the 2008 financial crisis, academics and policymakers have recognized that repo markets may be fragile, or vulnerable to sudden stress. Gorton and Metrick (2012) described the 2008 Financial Crisis as a panic equivalent to a bank run. Essentially, they argue repo markets created a downward “liquidity spiral”: concerns about the liquidity of bond markets led repo cash investors to raise haircuts, which forced asset sales by repo cash borrowers, leading to lower prices and still higher haircuts, and thus further reduction in repo financing and yet more asset sales, and so on.

Copeland, Martin, and Walker (2014) and Krishnamurthy, Nagel, and Orlov (2014) offer a somewhat contrasting view. Using regulatory data on triparty repo and money market mutual fund filings, respectively, these authors show that this part of the repo market was rather stable during the crisis, and the “run” on repo in September 2008 was confined to just Lehman Brothers.

Gorton, Metrick, and Ross (2020) then responded to this theme, showing that market survey evidence suggested bilateral repo was much larger than the triparty
repo market in 2008, and thus studies showing the stability of triparty repo were missing the bigger picture. Investigating Flow of Funds data on net repo funding sources and “nonreporting cash pools”, they argue that net repo financing to US banks and dealers may have fallen by more than half during the crisis. 

Ennis (2011) and Martin, Skeie, and Thadden (2014) offer theoretical models to show that runs are possible in repo markets. Moreover, these papers demonstrate how technical details of different repo markets can influence their susceptibility to runs, and individual banks may be subject to repo runs if they are perceived to be weak: unprofitable, small, or excessively reliant on short-term funding.

More recent papers have shown that even outside of a financial crisis, repo markets are critical to the smooth functioning of other markets. Macchiavelli and Zhou (2021) shows that when dealers are unable to access their normal levels of repo funding (in this case due to a shock to money market mutual funds in 2016), market liquidity falls in the form of wider bid-ask spreads and realized transaction costs in corporate bonds. At the individual dealer level, those dealers with weaker relationships with money funds in triparty repo also have lower corporate bond market share and conduct more riskless-principal trades to avoid taking positions into inventory. Huh and Infante (2021) and Infante and Vardoulakis (2021) offer a theoretical model of the interlinkages between repo markets and bond market liquidity.

These findings about runs, liquidity spirals, and knock-on effects in other markets inspired the “macroprudential regulation” approach espoused by Hanson, Kashyap, and Stein (2011). In this view repo is important to the health of the overall financial system, and regulation should treat repo markets accordingly. In this spirit, much of the recent literature has examined how regulatory policy has affected the function and fragility of repo markets.

7 Regulation and Central Bank Interactions with Repo Markets

7.1 Bank Capital Requirements and Window Dressing

As daily data on transaction volumes began to be collected in different repo markets, a clear seasonality pattern became evident around quarter- and year-ends. Because European banks report to regulators on a quarter-end “snapshot” basis, they are able to improve their reported leverage ratio by reducing their assets and thus their need for repo financing. After the new quarter starts, these banks can swell their balance sheets again and return to the repo market for financing. Although Munyan (2017) was the first to show this “window dressing” effect was driven by European banks, it has now been well documented across both U.S. and European repo markets.
by Kotidis and Van Horen (2018), Schaffner, Ranaldo, and Tsatsaronis (2019) and others.

7.2 Basel III Implementation Effects on Repo

In addition to higher risk-based capital requirements for banks, the 2010 Basel III capital accords brought additional measures designed to combat bank leverage and liquidity risk exposure, as these were perceived to be key drivers of the 2008 financial crisis. Both the leverage ratio and the liquidity coverage ratio (LCR) reduced the attractiveness of repo to bank-affiliated dealers. As studied by Allahrakha, Cetina, and Munyan (2018), Kotidis and Van Horen (2018), Macchiavelli and Pettit (2021), and Ranaldo, Schaffner, and Vasios (2021), these policies had unintended consequences for repo market volume, bank dealer participation in repo markets, and liquidity in other markets such as corporate bonds.

7.3 Recent Central Bank Innovations in Repo

As central banks have purchased large quantities of assets to suppress interest rates (“quantitative easing” or QE), this has pushed rates below zero in some countries. Seeking to avoid negative rates while continuing QE, the Fed decided in 2014 to offer some of its now vast securities holdings as “Reverse Repo” to absorb excess short-term cash and put a floor under interest rates. Anbil and Senyuz (2018) show this RRP facility has acted as a shock absorber to changes in repo market demand.

In mid-September 2021, the repo market experienced an unexpected shock as overnight rates suddenly spiked. In response to this disruption, the Fed has re-evaluated its “balance-sheet normalization” strategy and moved instead to a focus on “ample reserves”, as described in Copeland, Duffie, and Yang (2021). More recently, in June 2021 the interest rate of the Reverse Repurchase Facility (RRP) was raised from 0 to 5 basis points, and the size of this program surged from $20 Billion in March 2021 to almost $1.5 Trillion by the end of September. Just as it invented the repo in 1917, the Fed continues to innovate in order to support repo markets’ role in the broader financial system.

8 Conclusion

Although there are certainly other ways to finance a position or obtain a security, the repo market persists. Born out of a short-term funding crisis, the repo market’s structure has evolved to become a key component of liquidity for government securities and other markets. As the U.S. Treasury Borrowing Advisory Committee noted in
July 2013, repo is the “silently beating heart” of financial markets. The academic literature attests to that fact, with many papers showing both the externalities of proper repo market functioning, as well as the threat to financial stability from a repo market failure.

The new repo facilities and programs, along with ever-changing regulation, offer new ways to study repo markets from a macroprudential perspective. Yet much of the market is still only partially observed, non-bank dealer participation in repo has risen due to enhanced bank regulation, and nontraditional financial institutions such as cryptocurrencies offer an increasing array of products that compete with traditional money markets. Therefore many opportunities remain to complete our picture of the modern repo market.


Copeland, Adam, Darrell Duffie, and Yilin Yang, 2021, Reserves were not so ample after all, Discussion paper National Bureau of Economic Research.


Schaffner, Patrick, Angelo Ranaldo, and Kostas Tsatsaronis, 2019, Euro repo market functioning: collateral is king, *BIS Quarterly Review, December*.