HedgeRepo - Using Credit Derivatives as Repo Collateral

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Abstract

This paper discusses the HedgeRepo[1] paradigm which involves integrated derivative-based hedging, repo financing, collateral and counterparty risk management in a single repo-style instrument. In this paper, we discuss a specific example of this paradigm which is the usage of credit derivatives and specifically Credit Default Swaps, as repo collateral. We perform integrated collateral and counterparty risk management in repo financing of high yield bond bonds and also explore the qualitative and quantitative benefits of such integration.

The article is organized in two parts. In Part I, we provide some background information on repo trades and credit default swaps. We also describe the trends in the market place and the shortcomings in current practices of risk management in repo trades. In Part II, we discuss HedgeRepo and related information. We explain the benefits of HedgeRepo and provide numerical examples of repos where credit default swaps are used as additional collateral in financing a portfolio of high yield bonds. We follow by listing potential practical uses of HedgeRepo in the context of credit default swaps and high yield bond repo markets.
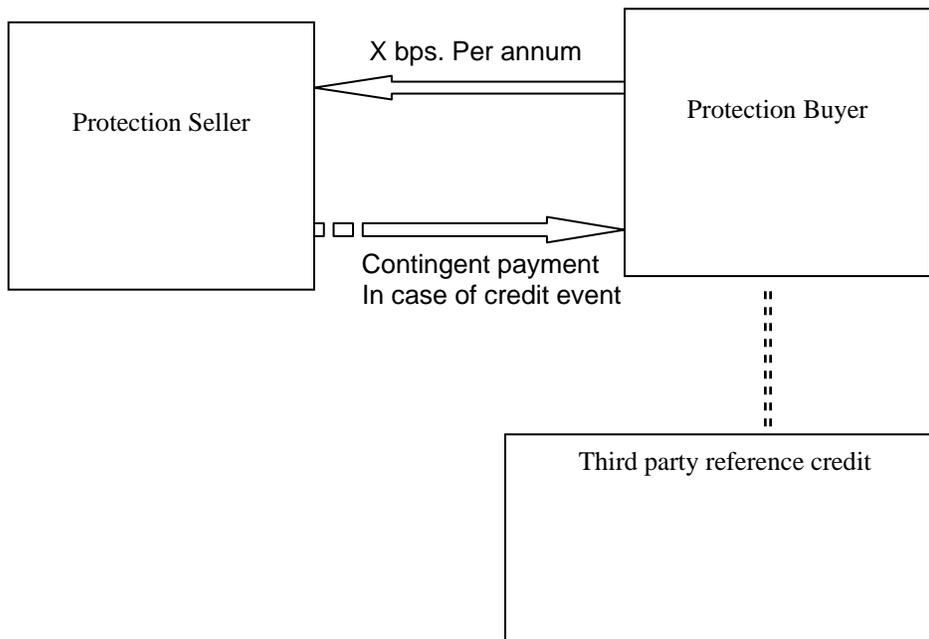
Part I - Background

Credit Default Swaps

Credit default swaps[2] (CDS) have also been called bankruptcy insurance. The structure of this derivative is quite simple. There are three parties, two of which are involved in the trade as counterparties.

The "protection buyer" pays a periodic premium (e.g. quarterly). The premium is pre-determined at X basis points of the notional value of the deal. The "protection seller" stands ready to compensate the buyer in case of a "credit event" (e.g. default) on the "reference credit". The reference credit is not part of the deal; it merely serves as a reference.

In case of a credit event, the protection seller will pay the difference between par and the recovery value of the reference credit - "cash settlement". Alternatively, the protection seller will accept a bond, from a pool of "deliverable obligations", from the buyer and pay the buyer a par amount, so called "physical settlement". Obviously, upon default, the subsequent premium payments shall cease, except for the premium accrued up to date of credit event.

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[1] Trade marked and patent pending - HedgeRepo shall mean HedgeRepo[TM]

[2] See "Implementing Credit Derivatives" by I. Nelken, McGraw Hill, ISBN 0-07-047237-8
"Structured Credit Products" by Moorad Choudhry, John Wiley & Sons, ISBN 0-470-82119-1

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┌─────────────────┐       X bps. Per annum        ┌─────────────────┐
│                 │ ◄──────────────────────────── │                 │
│ Protection      │                               │ Protection      │
│ Seller          │                               │ Buyer           │
│                 │ □ □ ──────────────────────►   │                 │
│                 │    Contingent payment         │                 │
└─────────────────┘    In case of credit event    └─────────────────┘
                                                            ┊
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                                                   ┌─────────────────┐
                                                   │ Third party     │
                                                   │ reference credit│
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For example, if the reference credit has defaulted and its bond is now worth 20 cents on the dollar, the protection seller will pay the buyer 80% of the notional amount of the deal (or pay par and receive the defaulted bond).

Credit default swaps with tenors of five years on large multi national issuers are the most liquid credit derivatives. Many other credit derivatives exist, including total return swaps, credit linked notes, collateralized debt obligations etc.

There are many reasons to transact in the credit derivatives market. The market allows the "unbundling" of credit risk from other sources of risk. The credit risk can then be sold in other markets to other participants.

For example, the protection seller can take a view on credit and earn the premium payment without exposing themselves to duration, convexity or foreign exchange risks.

Credit derivatives allow a protection buyer to hold unacceptable credits in their portfolio, as these credits are insured against default. It is also possible to take a negative view on a credit and become a protection buyer without actually shorting the credit.

Repurchase Agreements

Repos[3], or repurchase agreements, are simply short-term loans, where a security, usually a bond, is used as a collateral. They are principally used to fund bond positions in the wholesale financial markets, which in turn are used for hedging and arbitrage strategies against derivatives.

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[3] "Global Repo Markets: Instruments and Applications", by Moorad Choudhry, John Wiley & Sons, ISBN 0-470-8212-72

Reverse Repo is also used to cover short positions. So, repo is important for funding and liquidity purposes, for both long and short asset positions.

In this illustration, Party A is borrowing funds from Party B. Party B transfers money to Party A. In return, as collateral, Party A deposits bond C with Party B.

During the deal, Party A will have to pay interest on the borrowed funds to Party B. In addition, Party A will keep on receiving the coupons that are paid on the Bond C.

At the termination of the deal, the funds are returned and the bond is also returned.

Obviously, during the term of the transaction, Party B is exposed to a default risk of Party A. The Repo deal exists, in part, to reduce this risk. If Party A defaults during the term of the deal, Party B will keep the bond.
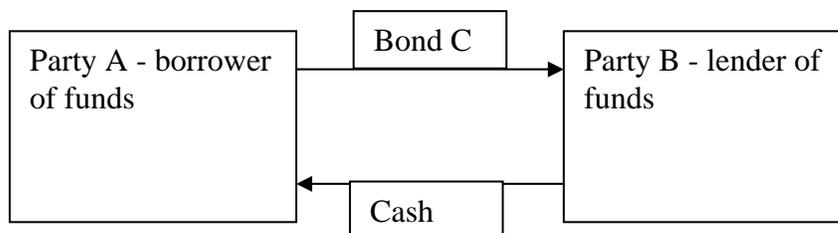
There is a fundamental risk to the lender of the funds. If Party A defaults and also Bond C defaults, the lender will suffer a substantial loss. Currently, this risk is mitigated by use of counterparty risk management measures. However, these have been originally developed for repos in government securities, which are considered bankruptcy remote. We explain the deficiencies of these procedures for risky securities later.

The HedgeRepo concept is to combine the hedging and repo deals into one package. It is most useful in tri-party Repo situations involving "risky" securities where there is an inherent need for hedging and a high margin requirement for a vanilla repo deal.

Tri-Party Repo

In a tri-party repo deal, there is a global custodian. The custodian attempts to provide the best possible protection for both borrower and lender participating in the tri-party program. The custodian ideally keeps the securities in a segregated account thereby ensuring compliance with the terms of the tri-party agreement. Once the custodian is satisfied that all stated requirements have been met, a simultaneous exchange of cash versus securities is executed between the two counterparties to the deal. Ideally, both parties receive timely confirmations and reporting of transactions and income. In the case of term repos, the custodian might also be required to mark collateral to market daily, issuing margin calls or returns when necessary. For example, the Bank of New York is a leading provider of tri-party repos. They process over $800 billion repo transactions on a daily basis worldwide[4].

Tri-party repo arrangements reduce the operational and settlement risks to both parties. An impartial, highly rated entity transfers both the cash and the securities instantaneously and is in charge of marking the deal to market.

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[4] http://www.bankofny.com/pages/cibs_tripartyrepo.htm

The advantages of the tri-party repo are:

1. Extremely low risk.
2. A secure investment vehicle that isn't subject to the volatility of equity-based markets.
3. A solution for the perpetual dilemma of where to allocate short-term cash.
4. A way to optimize large influxes of cash without a long-term commitment.
5. No cost. For the cash investor, such as a pension fund, there is no need for any special infrastructure or transactional costs.

There is a variety of tri-party repo custodians and slight differences in the level of services offered. Typically, however, the fundamental benefits of the deal include:

1. Providing an inexpensive source of funding for brokers/ dealers while enhancing yield over other money market instruments for investors.
2. An alternative to a money market investment vehicle.
3. Handling mid-office and risk management procedures, while providing pre-trade compliance.
4. Minimizing the risk of fail upon repo maturity.
5. Reducing back-office processing and operational risks (an important element of Basel II).

Trends in the Market Place

In recent years, the market has experienced tremendous growth in both derivatives and repo arrangements. The latest figures (released in June 2004 by the BIS) estimate the notional value of the OTC derivative markets at almost 200 Trillion US dollars, a growth of approximately 33% from last year[5]. The credit derivatives market has also grown quite quickly. ISDA reports that[6], Credit derivatives notional amounts now stand at $3.58 trillion. This represents a year-over-year growth of 67%. Credit derivatives, for the purposes of the Survey, consist of credit default swaps on individual names, baskets, and portfolios.

The growth in the credit derivatives market has been explosive. In 1996 the global credit derivatives market was only about $100 billion to $200 billion in size. The British Bankers Association[7] estimates the credit derivative market at $4.8 trillion in size in 2004, and 2005 growth estimates are as high as $6.5 trillion.

In the high yield market, according Bond Market Association[8], the issuance of high yield corporate debt issuance has grown by 10.7% to $49.5B from $44.8B as of May 31, 2004 compared to previous year with the outstanding US high yield debt presently at $9.2 Trillion.

The future for the credit derivatives market is enormous, given the underlying global debt (according to the Bank of International Settlements) is estimated to be $35 trillion in principal outstanding. In addition, the Basel Committee on Banking Supervision is expected to implement new rules by 2006/7. The Basel II rules will require rigorous capital adequacy standards for risk management. Credit derivatives are the most preferred products of for such risk management.

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[5] BIS 74th Annual Report, http://www.bis.org/publ/ar2004e.htm

[6] ISDA 2003 Year End Survey, http://www.isda.org

[7] 2003/2004 Credit Derivatives Report, http://www.bba.org.uk

[8] Available from http://www.bondmarkets.com

Meanwhile, the latest ISMA survey reports that the European repo markets have grown an estimated 19% year on year ending in June 2004 and are now valued at close to 4.561 Trillion Euros[9]. As for tri-party repos, ISMA reports:

"In the latest survey, 10.9% of total outstanding business was settled through triparty repo arrangements, largely sustaining the dramatic increase in share seen between December 2003 (11.2%) and June 2003 (6.2%)."

The Federal Reserve Bank of NY reports that the market size in the US is 4.5 Trillion US dollars an increase of 10% from last year with approximately one-third in tri-party arrangements. Additionally, Basel II has favorable treatment for collateralized financing, which is an incentive for growth in repo markets.

Although most repo trades are done against government bonds which are risk-free or close to risk-free, a significant portion of the deals are done against corporate debt. According to ISMA, the credit quality of the collateral has been declining:

"The share of government bonds is on a general trend of decline. It was 87.4% in June 2004 compared with 88.1% in June 2003. Government bonds accounted for only 36.3% of outstanding tri-party repo contracts."

"This change largely reflected increases in the shares of non-government bond collateral in the UK, Germany and, to a lesser extent, Italy. The share of equity continued to increase, although still from a low base, to account for 1.8% in June 2004, though it fell back slightly from 2.2% of the total value of collateral outstanding in December 2003."

According to Godfried de Vidts, chairman of European Repo Council, "the size of high yield or sub-investment grade bonds in European tri-party is presently estimated to be around €40 billion or approximately 10% of total tri-party repo share. Equity repo that also includes equity linked debt such as convertible bonds is estimated around €120 billion". Additionally, usage of BBB rated or lower collateral grew[10] from 8% in 2001 to 18% in 2003 at just one tri-party provider in Europe.

Most of the repo trades are quite short, one month or less. However, very short term repos (under one week) seemed to be in decline towards 2003 year end. According to ISMA December 2003 and June 2004 surveys:

"The bulk of repo activity continues to be in terms of one month or less (68.1% compared to 63.8% in December 2003, and 66.8% in June 2003).The respective patterns established in previous December and June were also broadly repeated in December 2003 and June 2004. The overnight repo deals fell from 18.7% in June 2003 to 17.3% in June 2004. Deals with maturity between 7 days and 1 month increased from 26.1% to 28.3% in June 2004 compared to previous year. Deals with maturity ranging from 3 to 6 months increased from 7.1% to 7.3% in June 2004 compared to previous year".

Additionally, in the recent times there has been a tremendous growth in the hedge fund industry. The number of hedge funds[11] is expected to top 10,000 in 2006, with estimated assets in excess of $1.2 Trillion.

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[9] ISMA Repo Market Surveys conducted in December, 2003 and June, 2004
http://www.isma.org/surveys/repo.html

[10] ISF Magazine, March 2004 Issue "Giving Credit Where It Is Due", http://www.isfmagazine.com
[11] ISF Magazine, December 2004, "How Synthetic Broking Became the Real Deal"
http://www.isfmagazine.com

This section described several trends in the market place:

1. Increased focus on risk management. Tremendous growth in the over the counter derivative market and especially the credit derivatives market.
2. Favorable regulatory trends (Basel II) for usage of credit derivatives and collateralized transactions like repo.
3. Market for risky assets such as high yield debt is growing worldwide. Risky counterparties such as hedge funds are growing in number and the size of their assets.
4. Significant growth in the repo markets and increasing usage of non government and wider variety of repo collateral.
5. The credit quality of the repo collateral has been declining (due to increasing use of high yield debt as collateral). The potential for further growth is still considerable since the presently high yield repo collateral is only a small fraction of the total outstanding high yield debt.
6. The prevalence of very short term repo deals is declining (average term to maturity of repo deals is increasing).
7. The use of tri-party repo arrangements is on the rise, accompanied by growth in "risky" collateral in tri-party deals.

HedgeRepo is at the center of all these trends by integrating derivative based risk management with repo style deals for risky securities. It enables derivatives to be used as repo collateral along with underlying risky securities.

While doing so, it provides a number of cost benefits such as reduced repo interest rates, haircuts, margin calls and operational costs. It also reduces overall risk, regulatory capital requirements, eliminates duplicate risk management costs between hedging an asset and counterparty risk management costs during a repo financing the same asset, increases the risk adjusted return on capital (RORAC & RAROC) and also increases collateral and investing options. The benefit for repo service providers is that they could do more business with lower credit customers, expand repo collateral to multiple risky assets classes, cross-sell risk management and repo financing products.

Usage of Derivatives for Credit Support

There are numerous examples in which derivatives are used for credit support in the context of a loan.

Consider an airline which applies for a loan at the bank. Due to the fact that the financial situation of the airline is quite volatile and depends on the price of oil, the bank will charge them a high interest rate. Assuming that the airline purchases a commodity call option on the price of oil (from the same bank), the stability of its cash flows should be improved. In this case, the bank could charge them a lower rate on the loan. It is quite possible that the lower rate on the loan would be sufficient to pay for the price of the option.

Several prime brokerages allow convertible bond hedge funds to create a position of long convertible bonds and short shares on margin. The same traders can, in addition, purchase a credit derivative on the same convertible bond (in the form of *Convertible Bond Asset Swap*). If the credit derivative is purchased from the same broker, the margin requirements are much reduced. More precisely, the broker will require the same rate but on a lower balance. This is only true if the positions in the strategy reside with broker in a Prime Brokerage Custody Account or in a Total Return Swap. In the language of prime brokerage, this is called *cross margining.*

On a typical convertible bond coupled with a short equity position, the rates on a Total Return Swap might be 5%-10%. Adding a credit derivative reduces the rate to 4%-6%.

Additional Benefits:

- Removing credit risk is good for the client as well as for Prime Broker.
- The portfolio is going to be less volatile than before and that is good for all.
- Especially important to Prime Broker in developing long term relationships.

Shortcomings with Current Risk Management Practices in Repo trades

Traditional methods for counterparty and collateral risk management work well with default free collateral such as government bonds. These methods do not work so well with volatile securities such as risky corporate bonds or equities. Currently, repo providers eliminate certain types of collateral by using collateral eligibility criteria. They attempt to reduce collateral risks by imposing concentration limits and maintain collateral diversification by using different types of collateral. Another common technique is to require over collateralization by the use of haircuts and margins. These techniques are useful, but only to a limited extent and not without some undesirable side effects especially during a market decline.

For junk bond deals by risky borrowers such as hedge funds, higher haircuts are a must since, without them, it is too risky for the lender. On the other hand, they are expensive for the cash borrower because they impose an additional financing cost. Additionally, haircuts do not protect the borrower's investment either. For the lender, haircuts alone do not provide adequate security. The lender still has to rely on daily mark-to-market procedures and margin calls to manage counterparty risk and ensure the adequacy of collateral. During a market meltdown, there could be sufficient collateral decline intra day or between mark-to-market events to dramatically increase the counterparty risk exposure. Margin maintenance is the primary source of counterparty risk and back office costs for the lender. Haircuts or traditional mark to market or margin calls would not have helped if Xerox, Enron or Parmalat bonds were used as collateral by a low rated counterparty. Hence in the present systems, repo lenders limit themselves to doing business with higher rated instruments.

A counterpoint could be made that imposing high initial margin requirements could reduce the scope for frequent margin calls. However, high initial margin requirements are still expensive for the borrower. In addition, even with high initial margins, frequent revaluation and monitoring of counterparties would be necessary. The revaluation of collateralized positions requires counterparties with rapidly declining positions to come up with additional collateral at short notice, which may, in turn, force them to liquidate other positions. Therefore, margin calls, when made, would be more frequent and likely to generate liquidity pressures for providers of collateral. This is inefficient and wasteful of time and resources. It is always better to have the lowest-possible haircut levels (which allows for lower funding cost for the borrower cash borrower) and less-frequent margin calls.

Restricting collateral types becomes a problem in times of market correction or illiquidity. As the accepted collateral is restricted, it becomes harder to borrow, which in turn, reduces market liquidity. On the other hand, market liquidity is assisted the easier it is for market entities to obtain funding for their asset pools.

Other traditional counterparty risk management methods such as collateral diversification also have some problems. For example, a collateral provider in the repo, while trying to address counterparty risk for one type of collateral, is now forced to tie up another type of collateral which may or may not meet his objectives. Collateral concentration limits, as the name obviously suggests, limit the size of any particular collateral, and consequently imposes an additional constraint for the collateral provider though it benefits the collateral receiver. Eligibility criteria are another restriction for the collateral provider that limits the types of collateral that could be financed using repo.

Currently, derivatives market and repo markets are separately well developed. However, there is no process or methods for using derivatives in the context of a repo deals. Derivative instruments like Credit Default Swaps or Total Return Swaps provide better protection for risky repo collateral such as Worldcom or Parmalat bonds. Currently, however, there is no easy or established way to use them in a repo context.

Part II - HedgeRepo

HedgeRepo extends the existing repo models to provide integrated hedging, collateral and counterparty risk management in a single repo style instrument. It provides derivative based custom hedging of the short and/or long positions in volatile collateral, while simultaneously using the same hedges to also manage collateral and counterparty risk with in the context of repo deal.

The motivation behind HedgeRepo is cost efficient integration of repo and risk management of risky securities. If the same security or portfolio is hedged using derivatives and also used as repo collateral, then why pay twice for risk management –i.e. pay once for hedging outside the repo deal, and pay again for counterparty risk management inside the repo deal in the form of a haircut? In the current repo systems, there is duplication of risk management costs and also increased complexity because there is no way to hedge and finance/borrow risky securities in a single package. HedgeRepo avoids this double cost of separate risk management in hedging and financing/investing in volatile collateral by providing a single integrated instrument, with the additional benefit of convenience and simplicity. Explicitly speaking, HedgeRepo enables a hedge, put on for risk management purposes, to be used as repo collateral as well.

Though the HedgeRepo could be used in any repo style deals (including securities lending, bi-lateral, tri-party repo etc.), it is most useful in a tri-party term repo situations involving volatile securities or portfolios. HedgeRepo is more beneficial to longer term repos than for overnight repo deals due to the fact that it is best to match the terms of the repo deal with the hedge. Since tri-party repo custodians already handle many collateral management tasks, and also have the necessary repo infrastructure, it is most efficient for them to provide a value added risk management service for the same repo collateral.

Consider the following two scenarios:

1. The borrower does not have a hedge but will be motivated to put on the hedge through better terms of the repo deal. The lender will offer better terms as the collateral which consists of a bond and a hedge is less risky than one that consists of the bond by itself.
2. The borrower already has a pre-existing hedge (e.g. a credit default swap) on the collateral bond. In this case, the bond and the hedge will be combined to form the collateral.

HedgeRepo also makes it possible to also hedge the credit risk of the borrower or even a joint hedge to improve the credit risk of the borrower and the collateral.

Case Study

Suppose a dealer wants to borrow funds. They are willing to place one or more of the bonds in their portfolio as collateral. An institutional investor is ready to lend them money but is concerned about the credit quality of the dealer as well as the poor credit quality of the bonds offered as collateral.

This could be handled by:

1. Refusing the deal
2. Charging a high interest rate on the loan
3. Imposing a high margin and haircut requirement on the deal

We now consider these three cases:

1. Approving or refusing the deal must be done on a case by case basis. Typically, in these situations there are relationship considerations that will favor deal approval. In that case, the decision that is taken by the institution might not be the optimal one.
2. Charging a high interest rate. The rate must be calculated as a function of the amounts involved, the tenor of the deal, the credit quality of the counterparty and that of the collateral.
3. Similarly, a sufficiently high margin requirement could be set on the deal. This will, again have to be done on a case by case basis. Setting a high margin requirement is likely to result in many margin calls and causes higher administrative expenses. Also, requiring higher haircut raises the cost of capital locked up just to satisfy the margin requirements. Margin calls are uncomfortable for the dealer as well as the client and may have detrimental relationship consequences.

HedgeRepo opens the possibility of another solution. Usage of derivatives will allow transactions with lower rated counterparties providing poor quality collaterals. It is likely that the liquid credit derivative markets might be able to find a more efficient way of hedging the counterparty risks (arising out of the credit risk of the collateral) than the single dealer involved in the transaction.

Term Mismatch

One difficulty in applying credit derivatives to repo trades is that of term mismatch. Most credit default swaps (CDS) have a term of five years, where repo trades (even term repos) are much shorter.

Consider a HedgeRepo trade with corporate bond collateral. A five year CDS (most popular and liquid maturity in Credit Default Swap market) could be used to hedge the default risk, even if the term of the repo is three months. If the borrower already has a CDS hedge on the bond, it is simply transferred as part of the collateral. Otherwise, the borrower might consider purchasing a CDS on the bond.

The question is what to do with the CDS at the maturity of the repo. There are several possibilities:
1. The CDS could be sold out and the remaining value recouped as cash.
2. The CDS could be returned to the borrower which would keep holding on to it. This is especially likely if the borrower already had the CDS hedge before the deal was started.

Essentially, where a hedge is already in place, it is highly advantageous for the borrower to use HedgeRepo, since there would be no additional setup costs incurred for the hedge to be used as repo collateral.

Comparison

We can compare a simple repo with a hedged repo.

A repo with a particular corporate bond issued by the XYZ Corporation as collateral might be accomplished with a high interest rate.

A repo with a corporate bond and a credit derivative hedge will be accomplished with a lower interest rate.

It is likely that the cost of the credit derivative will be lower than the difference between the two interest rates (and the resulting savings could possibly even finance the portfolio insurance costs). It might be cheaper in some cases to purchase the hedge (that actually protects the asset against default risk) compared to costs of locking up considerable capital as haircut. Derivatives offer more precise, efficient and flexible control of risks than haircut.

Also, using derivatives as collateral would add value by reducing haircut amount and frequency of margin call. A haircut is an additional expense because it means that less of the position or portfolio is being funded. Margin calls are administrative and operational burden for the lender and inconvenient for the borrower, so fewer ones would be welcome from the relationship perspective.

In addition, there are other points to consider:

The collateral becomes less volatile due to the inclusion of credit derivative. Hence there is less dependency on margin calls to manage counterparty risk due to collateral volatility. Hedged collateral reduces this risk, not just until next mark to market event, but for the entire repo term in a more continuous manner than the traditional daily (or at certain discrete intervals) of managing risk using mark-to-market and margin call procedures. It is more efficient and operationally simpler one shot deal. Management of repo collateral risk by derivatives reduces the dependency on counterparty risk management via traditional methods, and eliminates the requirement for good counterparty credit ratings. This is a fundamental shift in HedgeRepo compared to Classic repo.

As such, it makes HedgeRepo attractive to those market participants who trade or hold lower-quality assets and it presents a wider group of (risky) counterparties to tri-party repo agents or repo lenders. It increases the range of alternatives for lenders of cash (i.e., greater range of what type of collateral to take and what range of counterparties – via tri-party or direct – they can trade with). The widening of the market for potential borrowers and lenders in repo is a key advantage of HedgeRepo. For repo service providers, benefits are increased business volumes due to flexibility and expansion in collateral variety to risky assets and/or risky repo counterparties without necessarily increasing credit risk for the lender and also without raising costs for the borrower.

Repo providers could also cross-sell derivative risk management and repo financing services between repo and risk management customers. E.g. Tri-party provider could sell CDS to a low credit rated hedge fund who needs to hedge and also repo finance a junk bond

A Numerical Example

In this section, we explore specific examples of usage of Credit Default Swaps to support repo trades and illustrate the benefits of HedgeRepo in a quantitative way. The examples compute the relative advantage of HedgeRepo in terms of the increase in RORAC (return on risk adjusted capital) compared to the Classic (or Vanilla) Repo.

We can compare Vanilla Repo with HedgeRepo in the three cases shown in Table 1. Case 1 is the typical Classic Repo. Case 2 involves a bond or a portfolio and a separate Credit Default Swap that is not included as repo collateral. Case 3 is illustrative of HedgeRepo.

Single Bond Repo

As a simple example, we first compare the costs between financing GM bond using Classic Repo vs. HedgeRepo from the perspective of the cash borrower in the three cases shown in Table 1. Later, we perform similar comparison for the high yield portfolio that is shown in Table 2[12] .

An investor holds the General Motors (GM) 8.375% bond that matures on July 2033. The three month repo rate for this bond is 2.35%. The premium on the CDS is 169.08 bps. Assume $10 million cash loan is obtained using the GM bond as repo collateral.

From the GM bond section of the spreadsheet in Table 4, it can be observed that, in HedgeRepo, the borrower is able to insure the $10MM notional bond for credit default risk. The haircut in HedgeRepo is only 5% and repo rate is 1.8%. A number of benefits are achieved by the borrower when HedgeRepo is compared to case 1 (Classic Repo with no hedge):

- The borrower is now able to insure $10MM junk bond portfolio for credit default risk.
- Though the insurance costs an additional $42,270, it reduces the total profit by only $6,020 (or 4.11%) from $146,475 to $140,455. This is because of the reduction in repo interest expense and haircut cost of capital when CDS is included as additional collateral in HedgeRepo.
- Repo interest expense decreases by $13.75K (23.4%) from $58.75K to $45K.
- Cost of funds for haircut decreases by $22.5K (75%) from $30K to $7.5K.
- Total CAD[13] charge decreases by $768K (68.57%) from $1.12MM to $352K.
- The RORAC[14] increases by 362.92% from 13.08% to $60.54%.

Compared to case 2 (Classic repo where the CDS is used but not integrated with repo), HedgeRepo is also quite beneficial.

- Profits are higher by $36,250 (or 34.79%) from $104,205 to $140,455.
- Repo interest expense decreases by $13.75K (23.4%) from $58.75K to $45K.
- Cost of funds for haircut decreases by $22.5K (75%) from $30K to $7.5K.
- Total CAD charge decreases by $120K (34.09%) from $352K to $232K.
- RORAC improves by 104.79% from 29.6% to 60.54%.

Similar arguments could be made for a *reverse repo* deal in which the client has a short position in a bond and a short position in a CDS. However, in case of a *reverse repo* of a bond trading on special, the repo rate in HedgeRepo may not improve, though haircut savings and improvement in RORAC could still be achieved.

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[12] All examples use market rates that were obtained by the authors on August 26, 2004. CDS quotes are obtained from Bloomberg and Repo rates provided by Garban-ICAP.

[13] The Capital Adequacy Directive ("CAD") is an agreement on regulatory capital standards for financial intermediaries doing business in the European Union ("E.U."). CAD contains a "building block" approach requiring banks and securities houses to put up capital to cover the market risk with respect to their trading book: position risk, counterparty/settlement risk, interest risk and foreign exchange risk. The next version of CAD will be known as CAD III, and will be largely based on Basel II.

[14] RORAC is Return on Risk-Adjusted Capital. In the examples provided, it is computed as Adjusted Net Income versus Regulatory Capital Charge as per Basel I. By considering return on risk-adjusted capital, rather than conventional accounting-based profit-and-loss calculations, it is possible to evaluate relative performances for minimizing risk and maximizing return. RORAC provides a way of quantifying and comparing returns from more and less risky business ventures. Unlike VAR and other market risk measures, RORAC allows incorporating market risk, credit risk and operational risk in a single comprehensive risk measurement methodology.

Basket Repo

Next, we perform similar analysis on the portfolio shown in Table 2. The portfolio is a mix of variety of high yield bonds from corporate sector, emerging markets and home loan mortgage areas. The issuers are Brazil, Russia, Ford, GM, ACCR (MBS bond) with varying repo rates. The total market value of the high yield bond portfolio is $61MM and the nominal value is $55MM. $50 million of cash loan by repo of a high yield bond portfolio by BBB rated cash borrower. The lender of cash is AA rated. The repo term is for 3 months. The portfolio is hedged with Credit Default Swaps on the individual bonds. Each CDS is based on a notional of $10MM. These and other details of the repo deal are shown in Table 3.

Compared to the Classic Repo with no hedge, the HedgeRepo produces the following benefits.

- The borrower is now able to insure $61MM junk bond portfolio for credit default risk.
- Though the insurance costs an additional $345,410, it only reduces the total profit by only $199,160 (or 27% less) because of the repo interest savings and reduction in haircut cost of capital in HedgeRepo.
- The borrower is also able to increase the RORAC by 256.52%.

Compared to Classic Repo with already hedged collateral, the HedgeRepo produces the following benefits.

- The borrower's profits increase by $146,250 or 37.84% on P&L.
- The borrower's RORAC improves by 117.54%.

Also note that properly structured derivatives, by managing risk, further reduce regulatory capital requirements for repo participants. In this particular case, on the entire $50 million repo cash loan, the regulatory CAD charge is reduced by $680K for the cash borrower. We should, however, not forget that there are other qualitative benefits that a HedgeRepo deal in the bond and CDS combination offers. These and others have been described in a previous section.

To be conservative, the authors have hedged the portfolio with five Credit Default Swaps each tied to a single particular bond. A more economical hedge could be accomplished by using a "first to default CDS" which would protect the portfolio against the first to default bond of the collateral. Such a CDS will be a lot cheaper than buying five separate CDS as the authors have done. However, it will not protect the lender against simultaneous defaults of more than one bond. Using a first to default CDS, would provide some protection to the lender, leaving them exposed to catastrophic risk.

However, the point to be noted here is that the derivative markets could provide many different solutions and are quite flexible, even in a repo context.

Applications of HedgeRepo

Market participants who are either in case 1 or case 2 categories (Table 1) could switch to HedgeRepo (case 3) and benefit as shown above. Following is the possible list of beneficiaries for each category.

- **Benefit by switching from Classic Repo to HedgeRepo:** Market participants in this category include those who have a position in the cash market, and who need to use the repo market, but do not currently have a position in the derivative market. They might be motivated to initiate a derivative position for better terms offered via the HedgeRepo as illustrated in the above example. Following are such beneficiaries.

1. Arbitrageurs can now trade between repo and derivative markets in new and different ways. Repo trading would be based on cost differences in repo counterparty risk management via traditional methods vs. derivative methods. If the CDS is cheap, but the repo rate & haircuts are relatively quite high, then including the CDS as repo collateral will not only save money but may even generate a risk free profit. For example, using Classic Repo, a repo dealer doing business with a low rated counterparty, could accept junk bond as collateral at a high haircut, and lend cash at a high repo rate. The dealer could then turn around and use HedgeRepo to raise cash at a lower repo rate by using the (junk bond + long CDS) as collateral.
2. There might be some situations, where reducing financing costs is a priority for the repo counterparty. So, even though risk management is not a priority, one could include CDS as collateral just to qualify for better repo rate and lower haircut. Instead of paying for a high haircut cost of capital, why not pay for the derivative based hedge, especially if it does not cost that much more?
3. Useful for lower rated credit parties with lower rated assets who could not otherwise access repo financing. They could now qualify by using a hedge as additional repo collateral.

- **Benefit by switching from already hedged collateral to HedgeRepo:** Market participants who have positions in both the cash and derivative instruments would benefit from HedgeRepo. Following are such beneficiaries.

  1. Cash-CDS Basis traders who use the repo market could further benefit from HedgeRepo. E.g. Negative basis traders purchase the bond and the CDS. The bond is financed via the HedgeRepo using bond+CDS as collateral, and the trade is beneficial as illustrated in the above numerical example. Likewise, positive basis traders short the bond and sell the CDS. The short bond is reversed in via HedgeRepo using (cash+short position in CDS) as packaged collateral.
  2. CDS dealers who hedge their derivative positions via the underlying cash markets (e.g. high yield corporate bond) and also use the repo market for financing or borrowing cash instrument. The dealers could use the derivative positions as repo collateral. Like wise, cash market dealers (e.g. bond/equity dealers) who finance/borrow their cash positions in the repo market, and also hedge their cash positions via the derivative markets, can use the derivative positions as repo collateral.
  3. Hedgers (e.g. asset managers of bond/equity portfolios) who use derivatives to hedge the risks and also finance/borrow the assets using the repo market. Integrated derivative risk management reduces financing costs for this group of participants.

	Type of Repo	Description
Case 1	Vanilla Basket Repo, No Hedge	Bond porfolio that is financed but not hedged
Case 2	Vanilla Basket Repo + Hedge (hedge separate from repo)	Bond portfolio that is hedged and then separately financed using vanilla repo
Case 3	Basket Repo with integrated hedge via HedgeRepo	Bond portfolio that is hedged and financed using HedgeRepo

Table 1 Compare HedgeRepo with Classic Repo in these different cases

Bond	Rating	Cash Borrowed	Dirty Price	Repo Rate in Vanilla Repo	Repo Rate in HedgeRepo	Haircut in Vanilla Repo	Haircut in HedgeRepo	CDS Price	Market value of bond collateral with haircut
GM 8.375% 7/33	BBB	$10MM	106.8128	2.35%	1.80%	20%	5%	1.69%	$12,000,000
FORD 7% 10/13	BBB	$10MM	107.9064	1.15%	1.15%	20%	5%	1.68%	$12,000,000
ACCR 2004-3 2M7	BBB	$10MM	99.0125	2.20%	2.00%	20%	5%	3.35%	$12,000,000
RUSSIA 12.75% 2028	BB+	$10MM	154.5772	1.40%	1.40%	25%	5%	2.20%	$12,500,000
BRAZIL C 8% 4/14	B+	$10MM	100.9333	1.10%	1.10%	25%	5%	4.90%	$12,500,000
Total Cash Loan		**$50MM**	**Total Portfolio Market Value**						**$61MM**

Table 2 Portfolio of high yield bonds - market prices, repo rate, CDS prices & haircut rates

Cash loan for each bond	$10MM
Total market value of portfolio	$61MM
Total cash loan from basket repo	$50MM
Repo term	3 months
Credit rating of borrower	BBB
Credit rating of lender	AA
Repo rate for BBB Borrower	Repo Rate for AA Borrower+25bps
Baseline repo rate in HedgeRepo	LIBOR+10bps
Baseline haircut in HedgeRepo	5%
Non repo funding rate for borrower	6%
CDS notional for each bond	$10MM
Type of hedge for each bond	5 Year CDS
Hedge Term	3 months
Haircut CAD Rate	8%
Bond CAD Rate	8%
Bond + CDS CAD Rate	1.60%

Table 3 Terms of the Repo & HedgeRepo deals.

Type of Repo	Bond	Repo Interest Expense	Cost of Funds for Haircut	Total Repo Cost	Total Hedge Expense	Total Repo & Hedge Costs	Income from bond coupons	P&L	Increase in P&L in HedgeRepo	% Increase in P&L in HedgeRepo	Haircut CAD Charge	Bond CAD Charge	Total CAD Charge	RORAC	%Increase of RORAC in HedgeRepo
Case 1	GM 8.375% 7/33	$58,750	$30,000.00	$88,750		$88,750	$235,225	$146,475	-$6,020	-4.11%	$160,000	$960,000	$1,120,000	13.08%	362.92%
Case 2	GM 8.375% 7/33	$58,750	$30,000.00	$88,750	$42,270	$131,020	$235,225	$104,205	$36,250	34.79%	$160,000	$192,000	$352,000	29.60%	104.50%
Case 3	Benchmark Repo	$45,000	$7,500.00	$52,500	$42,270	$94,770	$235,225	$140,455			$40,000	$192,000	$232,000	60.54%	
Case 1	F 7% 10/13	$28,750	$30,000.00	$58,750		$58,750	$194,613	$135,863	-$19,515	-14.36%	$160,000	$960,000	$1,120,000	12.13%	313.42%
Case 2	F 7% 10/13	$28,750	$30,000.00	$58,750	$42,015	$100,765	$194,613	$93,848	$22,500	23.97%	$160,000	$192,000	$352,000	26.66%	88.10%
Case 3	Benchmark Repo	$28,750	$7,500.00	$36,250	$42,015	$78,265	$194,613	$116,348			$40,000	$192,000	$232,000	50.15%	
Case 1	ACCR 2004-3 2M7	$55,000	$30,000.00	$85,000		$85,000	$166,646	$81,646	-$56,250	-68.90%	$160,000	$960,000	$1,120,000	7.29%	50.16%
Case 2	ACCR 2004-3 2M7	$55,000	$30,000.00	$85,000	$83,750	$168,750	$166,646	-$2,104	$27,500	1306.60%	$160,000	$192,000	$352,000	-0.60%	1931.01%
Case 3	Benchmark Repo	$50,000	$7,500.00	$57,500	$83,750	$141,250	$166,646	$25,396			$40,000	$192,000	$232,000	10.95%	
Case 1	RUSS 12.75% 2028	$35,000	$37,500.00	$72,500		$72,500	$257,760	$185,260	-$24,875	-13.43%	$200,000	$1,000,000	$1,200,000	15.44%	332.86%
Case 2	RUSS 12.75% 2028	$35,000	$37,500.00	$72,500	$54,875	$127,375	$257,760	$130,385	$30,000	23.01%	$200,000	$200,000	$400,000	32.60%	105.01%
Case 3	Benchmark Repo	$35,000	$7,500.00	$42,500	$54,875	$97,375	$257,760	$160,385			$40,000	$200,000	$240,000	66.83%	
Case 1	BRZ C 8% 4/14	$27,500	$37,500.00	$65,000		$65,000	$247,688	$182,688	-$92,500	-50.63%	$200,000	$1,000,000	$1,200,000	15.22%	146.84%
Case 2	BRZ C 8% 4/14	$27,500	$37,500.00	$65,000	$122,500	$187,500	$247,688	$60,188	$30,000	49.84%	$200,000	$200,000	$400,000	15.05%	149.74%
Case 3	Benchmark Repo	$27,500	$7,500.00	$35,000	$122,500	$157,500	$247,688	$90,188			$40,000	$200,000	$240,000	37.58%	
Portfolio Totals															
Case 1	Basket Repo No Hedge	$205,000	$165,000	$370,000		$370,000	$1,101,931	$731,931	-$199,160	-27.21%	$880,000	$4,880,000	$5,760,000	12.71%	256.52%
Case 2	Basket Repo + Hedge	$205,000	$165,000	$370,000	$345,410	$715,410	$1,101,931	$386,521	$146,250	37.84%	$880,000	$976,000	$1,856,000	20.83%	117.54%
Case 3	Basket HedgeRepo	$186,250	$37,500	$223,750	$345,410	$569,160	$1,101,931	$532,771			$200,000	$976,000	$1,176,000	45.30%	

Table 4 Shows relative increase in RORAC in HedgeRepo (case 3) vs. cases 1 & 2

Choice of Hedging Instruments

Within the "credit markets", several hedging instruments[15] can be considered.

1) A Credit Default Swap (CDS) – as described above, this instrument protects against default risk. Five year CDS are the most liquid credit derivatives.
2) A Total Return Swap (TRS) – this derivative instrument provides the counterparty with the total return of the instrument. It is well known that the cash flows of a TRS closely mimic the cash flows of a Repo trade. The main difference is that the CDS protects only against credit risk while the TRS mitigates exposures to both market and credit risks.
3) A First to Default Swap (FtD CDS) – this derivative instrument would provide protection against the first bond to default in a portfolio of risky bonds. It would be useful in a basket HedgeRepo of risky bonds.
4) A Constant Maturity CDS (CMCDS) – this is a relatively new instrument in the credit markets and offers investors access to floating credit spreads. With CMCDS, the premium changes as the spread moves. It would be useful for Classic Repo participants who switch to HedgeRepo by purchasing a hedge. They could purchase a CMCDS instead of a standard CDS and reduce their exposure to CDS price volatility. This would be especially useful, if they hold the underlying bond in a 'non-mark-to-market' book (e.g. banking book).
5) Options on Credit Default Swaps – these derivative instruments function in a manner similar to interest rate or currency options. In a European-style option, the holder has the right to buy or sell protection (CDS) on a specified reference entity for a predetermined period, typically five years. These instruments are growing in popularity recently.
6) Straight vanilla options on a bond, equity or other asset – the most straightforward derivative instruments to use for repo collateral purposes.

Conclusion

HedgeRepo is a repo style instrument that enables derivative instruments to be used as repo collateral. The scope of the HedgeRepo is significant considering the growth rates in derivative and repo markets and the recent trends in repo and high yield bond markets. These trends include usage of risky securities as repo collateral coupled with an increasing focus on risk management to drive the returns on investments and trading. Additionally, the high yield bond market is growing rapidly across various regions of the world (Europe and Asia). The market penetration of repo in risky securities (e.g. high yield bonds or equities) is quite low compared to repo market in "safe" securities (e.g. government securities or highly rated corporate bonds). Additionally, risky counterparties such as hedge funds are increasingly using repo. HedgeRepo would make it possible for growth in repo markets for risky securities by attracting new participants and new types of collateral. It reduces costs in repo for borrowers and increases the repo & derivative business volumes for repo providers, increases variety of counterparties and collateral flexibility without increasing risk for repo lenders

Additionally, integrated derivative based hedging of repo collateral transfers the collateral and counterparty risks from participants in the repo markets to derivative markets.

In this article, we discussed the applicability of credit derivatives, specifically, credit default swaps in repo deals, however, the scope of HedgeRepo is not limited only to CDS. Exchange traded derivatives such as futures and options on equities, bonds and indices; OTC derivatives such as interest rate swaps, equity index swaps, swaptions, caps/floor etc. could be used in combination with various underlying risky assets such as bonds, equities or portfolios of such assets in

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[15] "Implementing Credit Derivatives" by I. Nelken, McGraw Hill, ISBN 0-07-047237
 "Structured Credit Products" by Moorad Choudhry, John Wiley & Sons, ISBN 0-470-82119-1

HedgeRepo. For example, long positions in equity put options or short position in stock index futures or equity index swaps could be used to secure equity collateral in an equity repo.

HedgeRepo is most useful for risky participants such as hedge funds, using open or term repo financing of risky securities which inherently need to be hedged as well. Typical users would be market participants with a position in both the cash and derivative markets and who use the repo market for funding or borrowing the cash position. Examples of such participants are - bond, equity and derivative dealers, traders & arbitrageurs, asset managers etc.

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