Derivatives Use

The 'HedgeRepo' concept: Using credit derivatives as repo collateral

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Received: 7th January, 2005

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Practical applications

HedgeRepo is most practical in markets where there are mature repo and derivative markets. It has applicability in a variety of repo financing deals such as equity repos, credit repos and commodity repos that involve risky collateral and risky counterparties.

Liquid derivatives, such as exchange traded equity options/futures, and OTC instruments, such as equity index swaps, could be used as additional collateral in equity repo deals. Similarly, credit default swaps — the most liquid instruments in the credit derivatives market — could be used as additional collateral in credit repo deals.

Lower rated and risky borrowers, such as hedge funds with high repo costs, would be immediate beneficiaries of HedgeRepo. Hedge funds could use any existing derivative positions as additional collateral in their repo financing of risky securities such as equities, high yield corporate or emerging market bonds. Other beneficiaries would be market participants with positions in both derivative and repo markets. Examples are: traders and arbitrageurs involved in relative value trades between cash and derivatives markets; asset managers in the high yield debt markets; and derivative/cash market dealers who hedge their positions and also use the repo market.

Additionally, repo service providers could use HedgeRepo to enhance their product portfolio and expand repo business to riskier asset classes and riskier counterparties without necessarily increasing risk for lenders.

Extensions to existing repo and derivative legal agreements would be required to implement HedgeRepo. Further, the extensions would have to be standardised or endorsed by industry organisations in order to commoditise HedgeRepo for acceptance by a wider variety of market participants.

Abstract

This paper discusses the concept of the HedgeRepo (trademarked and patent pending — HedgeRepo shall mean HedgeRepo™) paradigm, which integrates derivative-based hedging, repo financing, collateral and counterparty risk management in a single repo-style instrument. This paper discusses a particular example of this paradigm, which is the use of credit derivatives — specifically credit default swaps (CDSs) — as repo collateral. Integrated collateral and counterparty risk management are performed in repo financing of high yield bonds, and the qualitative and quantitative benefits of such integration are also explored. The paper is organised in two parts. The first part provides some background information on repo trades and CDSs. It also describes the trends in the marketplace and the shortcomings in current risk management practice in repo trades. The second part discusses HedgeRepo and related information. The benefits of HedgeRepo are explained and numerical examples of repos are provided where CDSs are used as additional collateral in financing a portfolio of high yield bonds. These illustrate the advantages of applying the HedgeRepo concept. The potential practical uses of HedgeRepo in the context of CDSs and high yield bond repo markets are listed.

BACKGROUND

Credit default swaps

The primary credit derivative instrument is the credit default swap. Credit default swaps¹ (CDSs) 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 (eg quarterly) (see Figure 1). The premium is pre-determined at X basis points (6ps) of the notional value of the deal. The ‘protection seller’ stands ready to compensate the buyer in case of a ‘credit event’ (eg default) on the ‘reference credit’. The reference credit is not part of the deal; it merely serves as a reference.

In the 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, called ‘physical settlement’. Obviously, upon default, the subsequent premium payments shall cease,

Figure 1: Credit default swap

Figure 2: A vanilla repo deal

except for the premium accrued up to the date of the credit event.

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 per cent 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 corporate names are the most

liquid credit derivatives. Many other credit derivatives exist, including total return swaps, credit linked notes and collateralised debt obligations.

There are a number of reasons why market participants transact business 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 sellers can take a view on credit and earn the premium payment without exposing themselves to duration, convexity or foreign exchange risks.

Credit derivatives allow protection buyers to hold unacceptable credits in their portfolios, 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

Repurchase agreements or repos are simply short-term loans, where a security, usually a bond, is used as 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. Reverse repo is used to cover short positions. So, repo is important for funding and liquidity purposes, for both long and short asset positions.

In Figure 2, 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 Bond C also defaults, the lender will suffer a substantial loss. Currently, this risk is mitigated using counterparty risk-management measures. These, however, were originally developed for repos in government securities, which are considered bankruptcy remote. The deficiencies of these procedures for risky securities are explained later.

The HedgeRepo³ 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 programme. 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. It processes over \$800bn 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.

The advantages of tri-party repo are:

- extremely low risk
- a secure investment vehicle that is not subject to the volatility of equity-based markets
- a solution to the perpetual dilemma of where to allocate short-term cash
- a way to optimise large influxes of cash without a long-term commitment
- no cost: for the cash investor, such as a pension fund, there is no need for any special infrastructure or transactional costs.

There are 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:

- providing an inexpensive source of funding for brokers/dealers while enhancing yield over other money market instruments for investors
- an alternative to a money market investment vehicles
- handling mid-office and risk-management procedures, while providing pre-trade compliance

- minimising the risk of failure upon repo maturity
- reducing back-office processing and operational risks (an important element of Basel II).

Trends in the marketplace

In recent years, the market has experienced tremendous growth in both derivatives and repo arrangements. The latest figures (released in June 2004 by the Bank for International Settlements (BIS)) estimate the notional value of the over-the-counter (OTC) derivative markets at almost US\$200 trillion, a growth of approximately 33 per cent from 2003.⁵ The credit derivatives market has also grown quite quickly. The International Swaps and Derivatives Association (ISDA) reports that credit derivative notional amounts now stand at \$3.58 trillion.⁶ This represents a year-on-year growth of 67 per cent. Credit derivatives, for the purposes of the survey, consist of CDSs 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 \$100bn to \$200bn in size. The British Bankers Association⁷ 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 to the Bond Market Association,⁸ the issuance of high yield corporate debt grew by 10.7 per cent to \$49.5bn from \$44.8bn as at 31st May, 2004, compared with the previous year.

The future for the credit derivatives market is enormous, given that the underlying global debt (according to the BIS) 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 for such risk management.

Meanwhile, the latest ISMA survey reports that the European repo markets have grown an estimated 19 per cent year-on-year ending June 2004 and are now valued at close to €4.561 trillion.⁹ As for tri-party repos, ISMA reports:

‘In the latest survey, 10.9 per cent of total outstanding business was settled through tri-party repo arrangements, largely sustaining the dramatic increase in share seen between December 2003 (11.2 per cent) and June 2003 (6.2 per cent).’

The Federal Reserve Bank of NY reports that the market size in the US is \$4.5 trillion, an increase of 10 per cent from last year with approximately one-third in tri-party arrangements. Additionally, Basel II has favourable treatment for collateralised 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 per cent in June 2004 compared with 88.1 per cent in June 2003. Government bonds accounted for only 36.3 per cent 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 per cent in June 2004, though it fell back slightly from 2.2 per cent of the total value of collateral outstanding in December 2003.’

According to Godfried de Vidts, chairman of the European Repo Council, ‘the size of high yield or sub-investment grade bonds in European tri-party is presently estimated to be around €40bn or approximately 10 per cent of total tri-party repo share. Equity repo that also includes equity linked debt such as convertible bonds is estimated around €120bn.’ Additionally, use of BBB rated or lower collateral grew¹⁰ from 8 per cent in 2001 to 18 per cent in 2003 at just one tri-party provider in Europe.

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

‘The bulk of repo activity continues to be in terms of one month or less (68.1

per cent compared with 63.8% in December 2003, and 66.8 per cent in June 2003). The respective patterns established in [the] previous December and June were also broadly repeated in December 2003 and June 2004.

The overnight repo deals fell from 18.7 per cent in June 2003 to 17.3 per cent in June 2004. Deals with maturity between 7 days and 1 month increased from 26.1 per cent to 28.3 per cent in June 2004 compared to previous year. Deals with maturity ranging from 3 to 6 months increased from 7.1 per cent to 7.3 per cent in June 2004 compared to [the] previous year’.

Additionally, in recent times there has been a tremendous growth in the hedge fund industry. The number of hedge funds¹¹ is expected to top 10,000 in 2006, with estimated assets in excess of \$1.2 trillion.

This section has described several trends in the marketplace:

- (1) There is an increased focus on risk management: tremendous growth in the OTC derivative market and especially the credit derivatives market.
- (2) Favourable regulatory trends under Basel II should exist for use of credit derivatives and collateralised transactions like repo.
- (3) The 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 use of non-government

and a wider variety of repo collateral.

- (5) The credit quality of the repo collateral has been declining (owing to increasing use of high yield debt as collateral). The potential for further growth is still considerable, since at present, the 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 increasing, accompanied by growth in ‘risky’ collateral in tri-party deals.

The concept of HedgeRepo is at the centre of all these trends. Integrating derivative-based risk management with repo-style deals for risky securities 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 of the same asset, increases the risk adjusted return on capital (RAROC), (or return on risk adjusted capital [RORAC]) 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 and cross-sell risk management and repo financing products.

Using 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 that applies for a loan at the bank. Owing to the fact that the financial situation of the airline is quite volatile and depends on the price of oil, the bank will charge it 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 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 the 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 per cent. Adding a credit derivative reduces the rate to 4–6 per cent.

Additional benefits include that:

- Removing credit risk is good for the client as well as for the prime broker.
- The portfolio is going to be less volatile than before, and that is good for all.
- It is especially important to prime brokers in developing long-term relationships.

Shortcomings of 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 using collateral eligibility criteria. They attempt to reduce collateral risks by imposing concentration limits and maintain collateral diversification using different types of collateral. Another common technique is to require over-collateralisation through 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. Conversely, 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 intraday or between mark-to-market events to increase the counterparty risk exposure dramatically. 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 had been 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 argument could be made that imposing high initial margin requirements could reduce the scope for frequent margin calls. High initial margin requirements, however, 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 collateralised 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 costs for the 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. Conversely, market liquidity is assisted as it becomes easier 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 impose an additional constraint for the collateral provider, though it benefits the collateral receiver. Eligibility criteria are another restriction for the collateral provider which limit the types of collateral that could be financed using repo.

Currently, derivatives market and repo markets are separately well developed. There is no process or method, however, for using derivatives in the context of a repo deal. Derivative instruments such as CDSs 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.

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 position in volatile collateral, while simultaneously using the same hedges to manage collateral and counterparty risk within the context of a 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, why pay twice for risk-management, ie 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, HedgeRepo enables a hedge, put on for risk-management purposes, also to be used as repo collateral.

Though the HedgeRepo could be used in any repo-style deals (including securities lending, bilateral, tri-party repo etc), it is most useful in tri-party term repo situations involving volatile securities or portfolios. HedgeRepo is more beneficial to longer-term repos than for overnight repo deals, owing 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 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 (eg a CDS) 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 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. The dealer is willing to place one or more of the bonds in his/her portfolio as collateral. An institutional investor is ready to lend the 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.

These three cases are now considered.

Scenario 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 favour deal approval. In that case, the decision that is taken by the institution might not be the optimal one.

Scenario 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.

Scenario 3

Similarly, a sufficiently high margin requirement could be set on the deal. Again, this will have to be done on a case by case basis. Setting a high margin requirement is likely to result in many margin calls and cause 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 consequences for the relationship.

HedgeRepo opens the possibility of another solution. Use 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 would.

Term mismatch

One difficulty in applying credit derivatives to repo trades is that of term mismatch. Most CDSs have a term of five years, whereas 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 the 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, who would continue to hold 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 set-up costs incurred for the hedge to be used as repo collateral.

Comparison

A simple repo can be compared with a hedged repo.

A repo with a particular corporate bond issued by the XYZ Corporation as

Table 1: Compare HedgeRepo with classic repo in these different cases

	<i>Type of repo</i>	<i>Description</i>
Case 1	Vanilla basket repo, no hedge	Bond portfolio 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

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 (which actually protects the asset against default risk) compared with the cost 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 the haircut amount and frequency of margin calls. A haircut is an additional expense, because it means that less of the position or portfolio is being funded. Margin calls are an administrative and operational burden for the lender and inconvenient for the borrower, so having fewer calls during the term of a repo would be welcome from the relationship perspective.

In addition, there are other points to consider. The collateral becomes less volatile owing to the inclusion of the 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 the 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 a more efficient and operationally simpler one shot deal. Management of repo collateral risk by derivatives reduces the dependence on counterparty risk management via traditional methods and eliminates the requirement for good counterparty credit ratings. This is a fundamental shift in HedgeRepo compared with 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 (ie more types of collateral

Table 2: Portfolio of high yield bonds — market prices, repo rate, credit default swap (CDS) prices and haircut rates

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 3: Relative increase in RORAC in HedgeRepo (case 3) versus cases 1 and 2

Type of repo	Collateral	Repo interest expenses (\$)	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 change (\$)	Bond CAD change (\$)	Total CAD change (\$)	RORAC	% increase of RORAC in HedgeRepo
Case 1	GM 8.375% 7/33	58,750	15,000	73,750	N/A	73,750	235,225	161,475	-17,270	-10.70%	32,000	960,000	992,000	16.28%	342.95%
Case 2	GM 8.375% 7/33	58,750	15,000	73,750	42,270	116,020	235,225	119,205	25,000	20.97%	32,000	192,000	224,000	53.22%	35.49%
Case 3	GM Bond + CDS	45,000	3,750	48,750	42,270	91,020	235,225	144,205			8,000	192,000	200,000	72.10%	
Case 1	F 7% 10/13	28,750	15,000	43,750	N/A	43,750	194,613	150,863	-30,765	-20.39%	32,000	960,000	992,000	15.21%	294.85%
Case 2	F 7% 10/13	28,750	15,000	43,750	42,015	85,765	194,613	108,848	11,250	10.34%	32,000	192,000	224,000	48.59%	23.58%
Case 3	Ford Bond + CDS	28,750	3,750	32,500	42,015	74,515	194,613	120,098			8,000	192,000	200,000	60.05%	
Case 1	ACCR 2004-3 2M7	55,000	15,000	70,000	N/A	70,000	166,646	96,646	67,500	-69.84%	32,000	960,000	992,000	9.74%	49.58%
Case 2	ACCR 2004-3 2M7	55,000	15,000	70,000	54,875	153,750	166,646	12,896	16,250	128.01%	32,000	192,000	224,000	5.76%	153.13%
Case 3	ACCR Bond + CDS	50,000	3,750	53,750	54,875	137,500	166,646	29,146			8,000	192,000	200,000	14.57%	
Case 1	RUSS 12.75% 2028	35,000	18,750	53,750	N/A	53,750	257,760	204,010	39,675	-19.55%	40,000	1,000,000	1,040,000	19.62%	302.27%
Case 2	RUSS 12.75% 2028	35,000	18,750	53,750	122,500	108,625	257,760	149,135	15,000	10.06%	40,000	200,000	240,000	62.14%	26.99%
Case 3	RUSS Bond + CDS	35,000	3,750	38,750	122,500	93,625	257,760	164,135			8,000	200,000	208,000	78.91%	
Case 1	BRZ C 8% 4/14	27,000	18,750	46,250	N/A	46,250	247,688	201,438	107,500	-53.37%	40,000	1,000,000	1,040,000	19.37%	133.17%
Case 2	BRZ C 8% 4/14	27,000	18,750	46,250	345,410	168,750	247,688	78,938	15,000	19.00%	40,000	200,000	240,000	32.89%	37.31%
Case 3	BRZ Bond + CDS	27,500	3,750	31,250	345,410	153,750	247,688	93,938			8,000	200,000	208,000	45.16%	
Basket Repo Totals															
Case 1	5 Bond portfolio	205,000	82,500	287,500		287,500	1,101,931	814,431	262,910	-32.28%	176,000	4,880,000	5,056,000	16.11%	236.99%
Case 2	5 Bond portfolio	205,000	82,500	287,500		632,910	1,101,931	469,021	82,500	17.59%	176,000	976,000	1,152,000	40.71%	33.33%
Case 3	5 Bond portfolio + 5 single name CDSs	186,000	18,750	205,000		550,410	1,101,931	551,521			40,000	976,000	1,016,000	54.28%	

GM, General Motors; F, Ford; ACCR, Accredited Mortgage Loan Trust; RUSS, Russian; BRZ, Brazilian; P&L, profit & loss; CDS, credit default swaps; RORAC, return on risk adjusted capital.

Table 4: Terms of the repo and HedgeRepo deals

<i>Term</i>	<i>Value</i>
Cash loan for each bond	\$10m
Total market value of portfolio	\$61m
Total cash loan from basket repo	\$50m
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 ¹⁵
Baseline haircut in HedgeRepo	5%
Non repo funding rate for borrower	3%
CDS notional for each bond	\$10m
Type of hedge for each bond	5 Year CDS
Hedge term	3 months
Haircut CAD rate	1.6%
Bond CAD rate	8%
Bond + CDS CAD rate	1.60%

CAD, Capital Adequacy Directive; CDS, credit default swap.

to take and greater variety of counterparties — via tri-party or direct — to 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 come from increased business volumes due to flexibility and expansion in collateral variety to risky assets and/or risky repo counterparties without necessarily increasing the credit risk for the lender and 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. For example, a

tri-party provider could sell CDSs to a low credit rated hedge fund which needs to hedge and also repo finance a junk bond.

Numerical example

This section explores specific examples of the use of CDSs to support repo trades and illustrates the benefits of HedgeRepo in a quantitative way. The examples compute the relative advantage of HedgeRepo in terms of the increase in RORAC compared with the classic (or vanilla) repo.

Vanilla repo can be compared 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 which is not included as repo collateral. Case 3 is illustrative of applying HedgeRepo.

Single bond repo

As a simple example, first compare the costs of financing a General Motors (GM) bond using classic repo with those of a HedgeRepo from the perspective of the cash borrower in the three cases shown in Table 1. Later, a similar comparison is performed for the high yield portfolio shown in Table 2.¹²

An investor holds the GM 8.375 per cent bond which matures in July 2033. The three month repo rate for this bond is 2.35 per cent. The premium on the CDS is 169.08 bps. A \$10m cash loan is obtained using the GM bond as repo collateral.

The GM bond section of the spreadsheet in Table 3 shows that, in HedgeRepo, the haircut is only 5 per cent and the repo rate is 1.8 per cent. A number of benefits are achieved by the borrower in HedgeRepo when compared with case 1 (classic repo with no hedge).

- The borrower is now able to insure the \$10m junk bond position for credit default risk.
- Though the insurance costs an additional \$42,270, it reduces the total profit by only \$17,270 (10.7 per cent) from \$161,475 to \$144,205. 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

\$13,750 (23.4 per cent) from \$58,750 to \$45,000.

- The cost of funds for haircut decreases by \$11,250 (75 per cent) from \$15,000 to \$3,750.
- Total Capital Adequacy Directive (CAD)¹³ charge decreases by \$792,000 (79.84 per cent) from \$992,000 to \$200,000.
- The RORAC¹⁴ increases by 342.95 per cent from 16.28 per cent to 72.10 per cent.

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

- Profits increase by \$25,000 (20.7 per cent) from \$119,205 to \$144,205.
- Repo interest expense decreases by \$13,750 (23.4 per cent) from \$58,750 to \$45,000.
- The cost of funds for haircut decreases by \$11,250 (75 per cent) from \$15,000 to \$3,750.
- The total CAD charge decreases by \$24,000 (10.71 per cent) from \$224,000 to \$200,000.
- The RORAC improves by 35.49 per cent from 53.22 per cent to 72.10 per cent.

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. In the case of a reverse repo of a bond trading on special, however, the repo rate in HedgeRepo may not improve, though haircut savings and improvement in RORAC could still be achieved.

Basket repo

Next, a similar analysis is performed on the portfolio shown in Table 2. The portfolio is a mix of a variety of high yield bonds from corporate sector, emerging markets and home loan mortgage areas. The issuers are Brazil, Russia, Ford, GM, Accredited Mortgage Loan Trust (MBS bond) with varying repo rates. The total market value of the high yield bond portfolio is \$61m and the nominal value is \$55m. The trade involves repo of a high yield bond portfolio by a BBB rated borrower for a cash loan of \$50m. The lender of cash is AA rated. The repo term is for three months. The portfolio is hedged with CDSs on the individual bonds. Each CDS is based on a notional \$10m. These and other details of the repo deal are shown in Table 4.

Compared with the classic repo with no hedge, HedgeRepo produces the following benefits.

- The borrower is now able to insure the \$61m junk bond portfolio for credit default risk.
- Though the insurance costs an additional \$345,410, it only reduces the total profit by \$262,910 (or 32.28 per cent 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 236.99 per cent.

Compared with classic repo with already hedged collateral, HedgeRepo produces the following benefits.

- The borrower's profits increase by

\$82,500 or 17.59 per cent on profit and loss (P&L).

- The borrower's RORAC improves by 33.33 per cent.

Also note that properly structured derivatives, by managing risk, further reduce regulatory capital requirements for repo participants. In the above two particular cases, on the entire \$50m repo cash loan, the regulatory CAD charge is reduced by \$4.04m (79.91 per cent) and \$136,000 (11.81 per cent), respectively, for the cash borrower. It should not be forgotten, however, that there are other qualitative benefits offered by a HedgeRepo deal that uses a combination of bond and CDS as collateral. These and others have been described in a previous section.

To be conservative, the authors have hedged the portfolio with five CDSs, each tied to a single particular bond. A more economical hedge could be accomplished 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 CDSs as the authors have done. It will not protect the lender against simultaneous defaults of more than one bond, 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 in either case 1 or case 2 category (Table 1) could switch

to HedgeRepo (case 3) and benefit as shown above. The possible list of beneficiaries for each category follows.

— *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. The following are such beneficiaries:

- (1) Arbitrageurs, who 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 versus derivative methods. If the CDS is cheap, but the repo rate and haircuts are relatively quite high, then including the CDS as repo collateral will not only reduce costs 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 a 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 much more?

- (3) 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. The following are such beneficiaries:

- (1) Cash-CDS basis traders who use the repo market could further benefit from HedgeRepo, eg 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 (eg high yield corporate bond) and also use the repo market for financing or borrowing cash instruments. The dealers could use

the derivative positions as repo collateral. Likewise, cash market dealers (eg 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 (eg 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.

Choice of hedging instruments

Within the ‘credit markets’, several hedging instruments¹ can be considered.

- (1) A CDS — as described above, this instrument protects against default risk. Five-year CDSs 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 a CDS protects only against credit risk, while a TRS mitigates exposure 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 (eg banking book).
- (5) Options on CDS — 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 have grown in popularity recently.
- (6) Straight vanilla options on a bond, equity or other asset — these are the most straightforward derivative instruments to use for repo collateral purposes.

CONCLUSION

HedgeRepo is an extension of the traditional repo instrument. It enables multiple types of derivative instruments to be used as repo collateral, while still retaining all the safety features of traditional repo. The scope of the HedgeRepo is significant, considering the growth rates in

derivative and repo markets and the recent trends in repo, high yield bond and credit derivative markets. These trends include the use 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 and credit derivative markets are growing rapidly across various regions of the world (Europe and Asia). Risky counterparties, such as hedge funds, are increasingly using repo. The market penetration of repo in risky securities (eg high yield bonds or equities), however, is quite low compared with the repo market in 'safe' securities (eg government securities or highly rated corporate bonds) because of the inefficiencies of the classic repo in handling non traditional collateral. HedgeRepo would make growth in repo markets for risky securities possible by attracting new participants and new types of collateral. It reduces costs in repo for borrowers and increases the repo and derivative business volumes for repo providers and increases the 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 the derivative markets.

This paper has discussed the applicability of credit derivatives, specifically CDS in repo deals. The scope of HedgeRepo, however, is not limited to CDS. Exchange traded derivatives such as futures and options on equities, bonds and indices, and 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 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 a 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 risky 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 include hedge funds, bond, equity and derivative, dealers, traders and arbitrageurs, asset managers etc.

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 - 11 Eden, J. (2004) 'How Synthetic Broking Became the Real Deal', *ISF Magazine*, December, <http://www.isfinagazine.com>.
 - 12 All examples, except for the ACCR bond, use market rates obtained by the authors on 26th August, 2004. For the ACCR bond, the market data were as of 6th October, 2004. CDS prices were obtained from Bloomberg, and repo rates were provided by ICAP.
 - 13 The Capital Adequacy Directive (CAD) is an agreement on regulatory capital standards for financial intermediaries doing business in the European Union (EU). The CAD takes 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 vs regulatory capital charge as per Basel I. By considering RORAC, rather than conventional accounting-based profit-and-loss calculations, it is possible to evaluate relative performances for minimising risk and maximising 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 market risk, credit risk and operational risk to be incorporated in a single comprehensive risk measurement methodology.
 - 15 The authors have used an approximate repo rate for general collateral hedged with credit derivatives in HedgeRepo. The repo rate, however, could also be calculated in a more precise way, using a quantitative approach. For bonds that are on special, the repo rate has not been changed in HedgeRepo.