ISMA CENTRE - THE BUSINESS SCHOOL
OF THE FINANCIAL MARKETS

UNIVERSITY OF READING
ENGLAND

IFID Certificate Programme

Rates Trading and Hedging

Securities Financing

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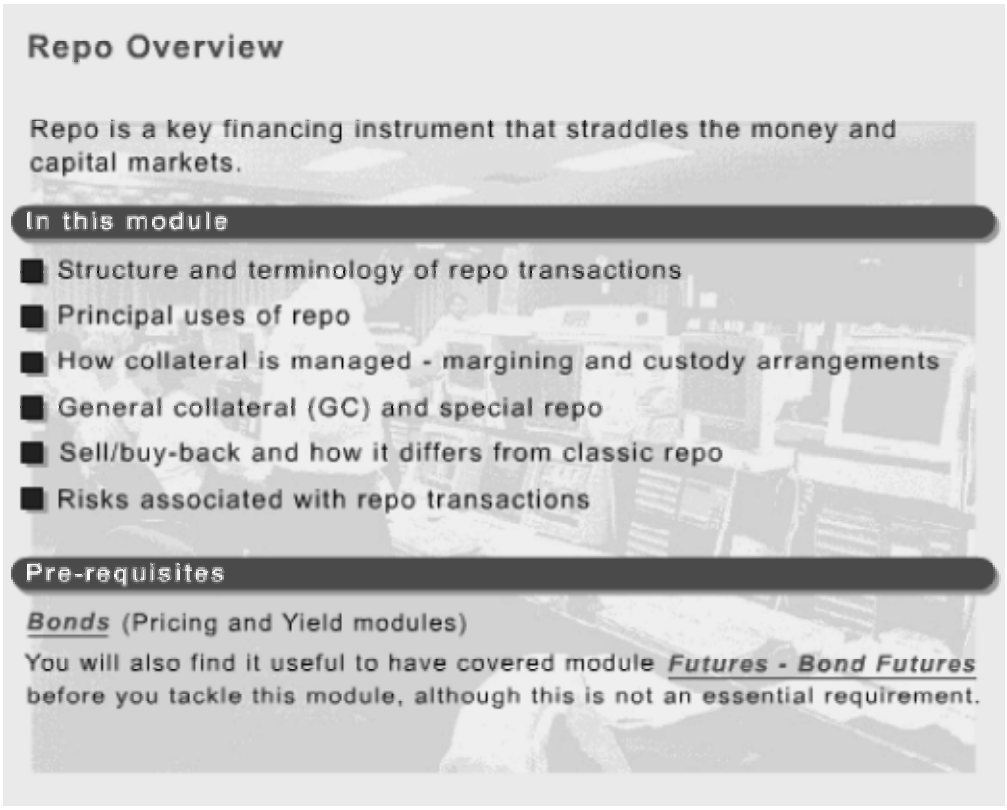
1. Overview



Learning Objectives

1. - Identify who is the buyer and who is the seller in a repo transaction
2. - Distinguish between the various methods of financing long or short positions in securities:
    - Unsecured borrowing
    - Secured borrowing
    - Margin trading
    - Securities borrowing and lending
    - Repurchase agreement (repo)
3. - Describe the main advantages of securities financing through repo
4. - Explain the difference between open repo, overnight repo and term repo
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    - Investing surplus cash in the money markets
    - Earning additional income from securities lending
6. - List the main differences between classic repo and sell/buy-backs

7. - Describe the nature of the collateral in general collateral and in special repo transactions
8. - Identify the reasons why some securities to go on special
9. - Calculate the interest due on a classic repo transaction
10. - Calculate the forward price and the end proceeds on a sell/buy-back operation
11. - Explain when a repo transaction gives rise to payments of manufactured coupons or dividends
12. - Identify the risks associated with repo transactions
13. - Critically assess the claim that a repo transaction provides each of the parties with a double indemnity against credit risk
14. - List the key elements of the PSA-ISMA and the TBMA-ISMA Global Master Repo Agreement (GMRA) and explain the advantages of trading under these terms
15. - Calculate the initial margin (or haircut) on a repo transaction using the GMRA formula
16. - Outline the procedure for margin maintenance in classic repo
17. - Distinguish between the following custodial arrangements:
    - Delivery repo
    - Hold-in-custody repo
    - Tri-party repo

2. Definition

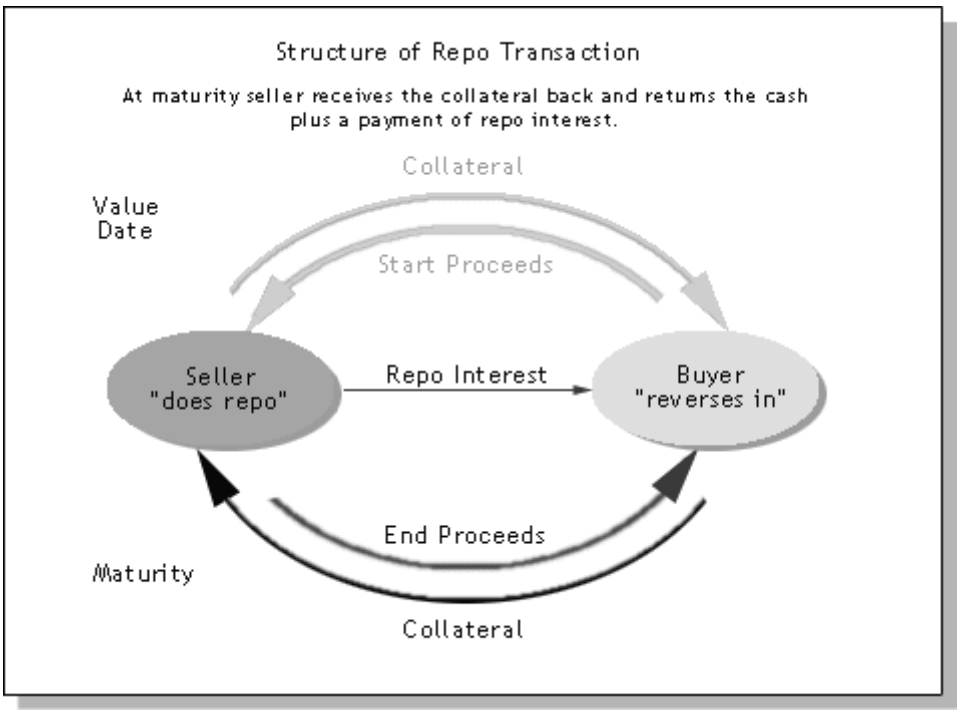
2.1. Contract Structure

A repo (**sale and repurchase agreement**) is a contract under which the **seller:**

- Commits to sell securities to the buyer for an agreed amount and value date,

  and

- Simultaneously commits to repurchase the same (or similar) securities from the buyer at a later date (the maturity date), repaying the original sum of money plus a return for the use of that money over the term of the repo



As the figure shows, there are two legs to a repo transaction:

1. On the value date, the repo seller sells securities (collateral) to the buyer for an agreed sum of money (the start proceeds)

2. At maturity, the seller:
   - Repurchases the securities for the original sum, and
   - Pays a return for the use of the cash proceeds during the term of the repo

Depending on which way you look at it, the repo is either a mechanism for borrowing/lending funds on a secured basis, or a method of borrowing/lending securities against cash.

The repo is a vehicle for funding long positions or covering short positions in securities, in much the same way as the FX swap in foreign exchange is a vehicle for funding FX positions (see FX Swaps - A Funding Tool).

2.2. Legal Status

The collateral in a repo is not pledged but sold to the buyer, so that legal ownership of the collateral passes from the seller to the buyer. This should allow the repo buyer to liquidate the collateral immediately and without hindrance, if the seller defaults on the contract.

If the collateral was only pledged, as in a secured loan, the buyer would not be allowed to liquidate it immediately upon a default by the seller, but would have to wait until insolvency proceedings were completed, and this could take a long time. Moreover, the buyer may have to defend his rights to the collateral in court against claims by other creditors.

In comparison with pledged collateral, collateral sold through a repo is therefore exposed to much less legal risk.

Transferring legal title to the collateral also allows the buyer to use repo to cover a short position in securities, as we shall see in an example in section *Applications*.

Transferring legal title to collateral does not imply that repo is a sale and repurchase of identical securities, as the repo buyer will not necessarily be able to return securities with the same identification numbers. This is why repo is defined as a sale and repurchase of "the same or similar securities" and in some contracts the buyer has the right to return substitute securities within certain broad parameters (see section *Managing Collateral*).

2.3. Risk and Return on Collateral

Although legal title to collateral in a repo is transferred to the buyer, the commitment of the seller to repurchase the collateral at the original value means that the risk and return on the collateral remain with the seller:

- If the value of the collateral rises during the term of a repo - the seller repurchases the collateral at its original (lower) value, so he makes a profit
- If the value of the collateral falls during the term of the repo - as a result of a fall in its price or because the issuer defaults - the seller repurchases it at its original (higher) value, so he makes a loss

Therefore, the seller retains all the economic risk on the collateral, even though the buyer becomes the legal owner during the term of the repo.

Since the seller retains all the risks on the collateral, he is also entitled to keep the return. In the case of repoed bonds, this includes the coupon interest which accrues over the term of a repo. In fact, the seller recovers this accrued interest automatically because he repurchase the collateral at the same value as he sold it at the start of the repo; he does not have to pay extra for the additional coupon interest that has accrued over the term of the repo.

If a coupon is paid on a bond collateral during the term of a repo, it will actually be paid to the repo buyer, who is the legal owner of the securities during the term of the repo. However, under the terms of the repo contract, the repo buyer is required to make an equivalent cash payment to the seller. This payment is called a **manufactured dividend** in the UK.

2.4. Types of Repo

The value date for a repo transaction in a particular currency will typically be the same as the conventional value date in the interbank deposits market in the same currency. Forward value dates are also available.

In terms of maturities, there are **3** main types:

- **Open repo** or **demand repo** - which is rolled over at the same rate until one of the counterparties decides to terminate the transaction
- **Short dated repo**- which is for a term of less than one month (most commonly, on an overnight basis)
- **Term repo** - which is negotiated for a fixed term longer than one month

The most common securities used in repo are domestic government bonds. However, other types of assets are increasingly being used, including supranational and sovereign Eurobonds, equities, corporate bonds, high-yield debt, emerging market debt, asset-backed securities and money market instruments.

Repo is in fact a generic term that includes two different types of transactions:

- **Classic repo**, also known as US-style repo (and in France *pension livree*)
- **Sell/buy-backs**, or buy/sell-backs (or just buy/sells)

We shall focus the discussion initially on the classic repo; later on we'll explain the difference between the two.

3. Applications

3.1. Securities Borrowing

Repo has two major uses:

- **Securities lending and borrowing**: the repo buyer can request a specific bond or equity and, instead of providing other bonds as collateral - as would be the case in traditional securities lending - he provides cash as collateral.

- **Secured lending and borrowing**: cash is lent or borrowed against collateral. The repo is used much like a fixed deposit or loan, except that with repo the funds are secured with the assets sold as collateral.

Example - Securities Borrowing (Classic Repo)

Situation
A bond trader anticipates a fall in German bond prices and wishes to short-sell EUR 10 million of the 4½% Deutschland Republik of 4 July 2011 for one week. This bond is currently bid at a clean price of 95.84 for settlement 13 August 2002, to yield 5.043%.

To cover the short-sale, the dealer needs to reverse in the bond for a week. A repo market maker quotes 2.708 - 2.703 for this term.

The bond trader therefore enters into a reverse repo transaction on the following terms:

Repo buyer:	Bond trader
Repo seller:	Repo dealer
Collateral:	4½% Deutschland Republik of 4 July 2011
Amount:	EUR 10,000,000
Clean price:	95.84%
Accrued interest:	0.4931507% (annual, actual/actual)
Dirty price:	96.3331507
Market value:	EUR 9,633,315.07
Value date:	13 August 2002
Maturity:	20 August 2002
Term:	7 days
Rate:	2.703%
Start proceeds:	EUR 9,633,000.00
End proceeds:	EUR 9,633,000.00
Repo interest:	EUR 5,062.94

On the value date:

- The repo dealer delivers EUR 10 million nominal of the agreed collateral
- The bond trader delivers EUR 9,633,000 in cash

At the maturity of the repo:

- The bond trader returns EUR 10 million nominal of the 4½s of 2009
- The repo dealer repays EUR 9,633,000, plus repo interest of EUR 5,062.94

Notice how the value of the collateral is rounded to the nearest EUR 1,000 when calculating the start and end proceeds (this is done as a convenience, but it is not compulsory).

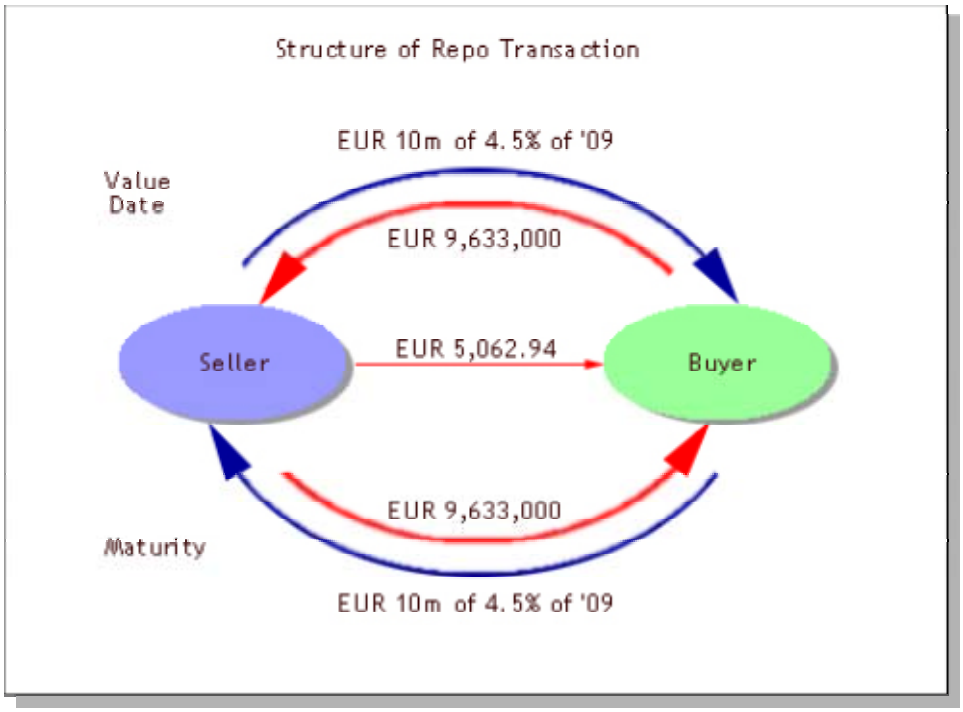
The repo interest is calculated as follows:

Repo interest = 9,633,000.00 x 0.02703 x 7 / 360
= **EUR 5,062.94**

Repo interest amount = Start proceeds x Repo rate x Term / Basis

Where Basis = 360 or 365, depending on local money market day-count conventions.

The transaction is summarised in the figure below.



Outcome - 20 August 2002
After 7 days the price of this Bund fell to 95.20. At that point the bond trader closes the short position by purchasing the bonds from the market and delivers those bonds back to the repo counterparty.

For settlement on 20 August the bonds carry accrued interest of 0.5794521%, so closing the short position will cost the bond trader:

Settlement amount = 10,000,000 x (0.9520 + 0.005794521)
= EUR 9,577,945.21

The table below summarises the all cash flows to the bond trader (underlying short sale and repo).

Date	Transaction	Cash flows
13 August	Short sale of 4½% of 2009	+9,633,315.07
	Delivery of cash on repo	- 9,633,000.00
20 August	Receipt of cash + interest on repo	+9,633,000.00
	Repo interest	+5,062.92
	Close of short position in 4½s of 2009	- 9,577,945.21
Net profit		**+ 60,432.78**

It will be useful when we discuss sell/buy-backs, later on, if you have a look at the return and the breakeven price on this trade, net of repo costs.

Net return and breakeven on the trade

In this campaign the bond trader made a net return of:

Net return = 60,432.78 / 9,633,315.07
= 0.0063 or **0.63%**

We can analyse this return in terms of two components[1]:

Net return = Capital gain on bond + Net carry
= Capital gain on bond + (Repo rate - Accrued interest on bond)
= (95.84 / 95.20 - 1) x 100 + (2.703 - 4.50) x 7 / 360
= 0.63%

It is also useful to calculate the breakeven price on this trade - the price to which the bond being shorted needs to fall, in order for the trader to cover his net cost of carrying the position.

FP + Forward accrued = SP + Spot accrued + Funding cost

Where:
FP = Forward clean price
SP = Spot clean price

FP = SP + Funding cost + (Spot accrued - Forward accrued)
= 95.84 + [0.02703 x 96.3331507 x 7/360] + (0.4931507 - 0.5794521)
= **95.804**

Therefore if, by the maturity of the repo the bonds are trading lower than 95.804, then the trader will have made a profit.

Short sales are typical of market-makers, who commit to buy or sell on demand and may not hold a particular security requested by a client. The market-maker will have to sell to the client and then go into the market to buy that security in order to make delivery. If the security is not easily available, or if the dealer thinks it is too expensive at the time, he will borrow the security through a reverse repo until it becomes available at a lower price.

[1] This is only an approximate calculation because the year basis on the repo differs from that on the bond and also because the funds repoed in are slightly less than the bond's dirty price. But it is useful in highlighting the two factors behind the deal's net performance.

3.2. Secured Borrowing

Example - Secured Borrowing (Classic Repo)

Situation
A fund manager holds EUR 10 million of the 4½% Deutschland Republik of 4 July 2011 and is prepared to repo these out for one week. This bond is currently trading at a clean price of 95.84 for settlement 13 August 2002, to yield 5.043%.

A repo market maker quotes 2.708 - 2.703 for this term and the rate for 1 week EUR fixed deposits at the time is 3.00 - 3.06. The fund manager enters into the following repo transaction:

Repo seller:	Fund manager
Repo buyer:	Repo dealer
Collateral:	4½% Deutschland Republik of 4 July 2011
Amount:	EUR 10,381,000
Clean price:	95.84%
Accrued interest:	0.4931507% (annual, actual/actual)
Dirty price:	96.3331507
Market value:	EUR 10,000,344.37
Value date:	13 August 2002
Maturity:	20 August 2002
Term:	7 days
Rate:	2.708%
Start proceeds:	EUR 10,000,344.37
End proceeds:	EUR 10,000,344.37
Repo interest:	EUR 5,265.74

On the value date:

- The repo dealer pays EUR 10,000,344.37 and receives EUR 10,381,000 nominal of the collateral bonds
- The fund manager receives EUR 10,000,344.37 which he places in the money markets at 3.00%

At the maturity of the repo:

- The repo dealer delivers back the collateral bonds
- The fund manager delivers EUR 10,000,344.37 back to the repo dealer

Notice how in this example the fund manager wished to adjust the funds borrowed as close as possible to EUR 10 million. If one of the counterparties wishes to borrow or lend a round amount of cash, then the collateral would have to be for an odd amount.

Effectively, the fund manager has earned the difference between:

- The rate he paid on the repo transaction (2.708%), and
- The rate at which he placed the start proceeds from the repo on deposit (3.00%)

This is a total of nearly 3 basis points on the start proceeds for 7 days, or **EUR 567.80**.

3.3. Main Market Participants

The examples on the previous pages highlight some of the main participants in the repo market:

- **Fund managers**, who wish to earn additional income by lending the securities they hold; the repo interest they pay on the cash proceeds may be very low, compared with rates available in other money market instruments, if the securities being lent are on special (see section *GC & Specials*)

- **Investors** who have surplus cash to place in the money markets. Because repo is secured, it is a particularly attractive to credit risk averse institutions investors with surplus cash to invest:

    - It carries lower credit risk than unsecured lending

    - It incurs lower capital charges than unsecured lending under regulations on Capital Adequacy. However, this is only true for repo transactions that are properly documented and where the counterparties are able to call variation margins (see section *Sell/buy-backs*)

- **Securities traders**, who need to fund long or short positions in securities. As we showed in the example earlier, repo is the natural mechanism for borrowing the required securities.

  The proprietary trading desks of investment banks and hedge funds use repo to fund long positions in securities, in preference to fixed deposits. This is because they lack the balance sheet strength necessary to borrow at or below LIBOR. These institutions are often highly-leveraged and therefore relatively risky, unsecured borrowing - e.g. by taking loans from commercial banks or issuing commercial paper - would cost them more than LIBOR. Repo is usually cheaper because:

    - It is a secured form of borrowing and therefore less risky

    - It is transacted without the intermediation of commercial banks, so it avoids the bid-offer spreads that commercial banks charge their clients. Repo is an example of the process of disintermediation of commercial banks.

- **Repo market makers**, who earn a bid-offer spread between the rate they buy repo (in our case 2.708%) and the rate at which they sell repo (2.703%) on a matched-book basis, although in very mature markets the spread may all but vanish

Central Banks

Another important repo player in most countries is the central bank. Central banks use repo as a tool of domestic money market intervention, in order to control short-term interest rates (see module Yield Curve Dynamics – Official Rates).

In the USA:

- When the central bank **does repo** this means they buy-and-sell securities in the repo market; this adds liquidity to the money markets

- When the central bank does **matched funding**, this means that they sell-and-buy securities in the repo market; this drains liquidity from the money markets

Compared to outright sale and purchases of securities, which central banks have traditionally used as a means of managing money market liquidity, repo is not constrained by the supply of securities with the required maturities. For example, if a central bank wants to soak up liquidity from the money market only for a short period through outright sales, it would have to issue short-term paper. Repo allows the central bank to soak up short-term liquidity by selling collateral of any maturity.

4. Managing Collateral

4.1. Initial Margin/Haircut

The collateral in a repo is intended to protect the buyer against default by the seller. The buyer therefore has to ensure that he has enough collateral.

Typically, the collateral is valued at its current market price at the start of the repo. This may subsequently prove to be inadequate cover because:

- The market in the asset used as collateral may be illiquid, in which case, the valuation may be inaccurate
- The market in the asset used as collateral may be illiquid, in which case, if the buyer has to sell collateral, he may find prices fall very fast as he begins to sell. Even liquid markets may become illiquid in a crisis
- The price of the asset used as collateral may be volatile

To build in some protection against valuation problems, the buyer may insist on buying the collateral at a discount to its current market value - i.e. the repo will be over collateralised. The degree of over collateralisation is called an **initial margin** or **haircut**.

In theory, the seller could seek similar protection by insisting that his collateral should be sold at a premium to its current market value - i.e. that the repo should be under collateralised. In practice, protection against valuation problems is typically given to the buyer.

Typical haircuts are 2% for European government bonds, at least 5% for equity and as much as 50% for emerging market debt. However, haircuts are unusual between repo professionals and on very short-term repo.

4.2. Calculating the Initial Margin

For bond collateral, the haircut is applied to the dirty price of the bond in one of two different ways:

Method 1:

$$\text{Start proceeds} = \text{Nominal value} \times \frac{\text{Dirty price}}{100} \times \left(\frac{100 - \text{Percentage haircut}}{100} \right)$$

Method 2:

$$\text{Start proceeds} = \text{Nominal value} \times \frac{\text{Dirty price}}{(100 + \text{Percentage haircut})}$$

Method 1 applies the margin discount directly to the market value of the collateral, using an approach similar to the way we discount bills, whereas method 2 discounts the market value of the collateral using a discount factor. The **PSA/ISMA Global Master Repurchase Agreement**, the standard documentation for international repo, uses Method 2 (see section *Risks*).

Example

Consider the following collateral:

Collateral: 6% Bundesrepublik 4 Jan 2007
Nominal value: EUR 25,000,000
Dirty price: 104.286667
Percentage haircut: 2%

The two alternative ways of calculating the start proceeds are:

Method 1:

Start proceeds = $25{,}000{,}000 \times \frac{104.286667}{100} \times \left(\frac{100 - 2}{100} \right)$

= **EUR 25,550,233.42**

Method 2:

Start proceeds = $25{,}000{,}000 \times \frac{104.286667}{(100 + 2)}$

= **EUR 25,560,457.60**

As we have seen, in classic repo the start proceeds are conventionally rounded for convenience.

4.3. Variation Margin

Initial margins may prove inadequate if the price of the collateral falls more than expected. Moreover, they favour the repo buyer and ignore the risk to the seller if the price of the collateral rises.

To maintain the intended balance between the collateral and cash in a repo, use is made of **variation margins**. Variation margins are extra transfers of collateral or extra payments of cash, made during the term of a repo, to eliminate divergences between the agreed initial values of the collateral and the cash. For example:

- If the value of the collateral falls during the term of a repo, the buyer can demand that the seller provides either extra collateral, or refunds the excess cash
- If the value of the collateral rises, the seller can demand that the buyer either returns the excess collateral or pays extra cash

Note that variation margins may be made by either buyer or seller, whereas initial margins are usually only made by the seller.

Variation margining may be used in conjunction with initial margins or on their own. Unlike initial margins, regulators require that variation margins should be used by all types of market participant, including professionals. Variation margins require that the collateral should be marked to market - i.e. revalued - at least daily for professional players.

Variation margins require considerable operational resources. In order to reduce the burden on the back office, it is standard practice to reduce the size and frequency of variation margin calls by netting the calls due on individual repos transacted under the same documentation with the same counterparty. It is also common to set a minimum margin maintenance limit, on net margin calls, below which a margin call will not be made.

4.4. Custody of Collateral

A major issue in repo is, who has custody of the collateral? There are three basic alternatives:

- **Delivery repo** - the buyer takes custody of the collateral from the seller. This is safest for the buyer, given that the collateral is under his direct control. However, because collateral has to be transferred across settlement systems, it is also the most expensive alternative.
- **Hold-in-custody** (HIC) repo - the seller retains custody of the collateral on behalf of the buyer. This exposes the buyer to the greatest credit risk, as there could be difficulties in recovering the collateral from the seller, in the event that the seller defaults. In addition, an unscrupulous seller could use the same piece of collateral several times in parallel HIC repos. However, because collateral does not have to be transferred against settlement systems, HIC repo is the cheapest option and should reward the buyer with a higher repo rate than delivery repo.

- **Tri-party repo** - collateral is transferred into the custody of the buyer across accounts held with an independent third-party custodian. This means that the buyer controls the collateral, as in delivery repo. However, because the transfer of collateral is handled internally by the custodian, tri-party repo should avoid the cost of using a settlement system. The seller pays a fee to the custodian, but this should be less than the cost of the settlement system, so tri-party repo should be cheaper than delivery repo.

The tri-party agent typically also provide back office services such as marking collateral to market, making variation margin calls, handling manufactured dividends, etc. Tri-party repo is the normal method of settlement in the US market. The main tri-party agents in Europe are Euroclear, Clearstream and Bank of New York.

4.5. Rights of Substitution

Sellers may be reluctant to use certain securities as collateral in longer-term repo, in case they need the securities for another purpose before the maturity of the repo. This concern will tend to reduce the terms for which sellers will repo out certain assets or result in those assets being withheld from the repo market entirely.

A solution is for the repo seller to seek **rights of substitution** of collateral from the buyer. This allows the seller to recall collateral during a repo and substitute alternative collateral of equivalent value and quality. Rights of substitution may be limited to certain dates within the contract period, or the seller may only be allowed to substitute a limited number of times during the course of a contract.

Substitution rights are valuable to the seller, but they may be inconvenient for the buyer, for example if the collateral has been used to settle a short sale. If the seller exercises his rights of substitution, the buyer will incur operational expenses in returning the original collateral and taking in new collateral. Accordingly, a buyer will expect to receive a higher repo rate on his cash in exchange for granting rights of substitution.

5. GC & Specials

5.1. General collateral

Activity in the repo market is segmented into:

- **General collateral** (or **GC**) repo
- **Specials**

GC repo

GC repo is a transaction in which the buyer is willing to accept as collateral any of several securities satisfying certain predetermined criteria - e.g. any domestic government bond with at least 5 years to maturity.

Given that the buyer does not insist on a specific security, the essential purpose of a GC repo is the borrowing and lending of cash. The collateral is important only as protection against default, and within the specified parameters any securities will do. In this sense, GC repo is a secured form of borrowing and lending, and is very much a money market instrument.

GC repo rates tend to trade close to other money market rates.

5.2. Specials

If the buyer in a repo transaction requires a specific security as collateral - e.g. the 6% Treasury 2006, in order to settle a short sale - then he needs to do a **special repo**. The essential purpose of repo in this context is the borrowing and lending of specific securities, not the borrowing and lending of cash.

Buyers of special repo often find themselves competing against each other for the same securities. In those situations, competition will force the buyers to offer cheap cash in exchange and the repo rate on the collateral falls below the GC rate; the security in question will be said to have **gone on special**. The repo rate on specials can touch 0% and may even be negative in exceptional circumstances.

Securities go on special for a number of reasons. In particular:

A government bond that becomes the cheapest-to-deliver (CTD) against a bond futures contract is prone to go on special (see Bond Futures - Cheapest to Deliver for an explanation of this term). Such bonds are strong contenders for delivery against maturing futures contracts, so the market is reluctant to lend them out on repo.

Benchmark bond issues (e.g. 2-, 3-, 5- and 10-year maturities) are also prone to go on special because they are usually in demand by traders who tend to concentrate their activity in swaps, caps and other fixed income derivatives on those maturities.

Winners and Losers

A trader who carries a short position in a specific security is especially vulnerable to the risk that the security might go on special. This event may significantly increase the cost of carrying a short position and wipe out any potential profits expected from the trade.

On the other hand, repo market makers trade specials by reversing in bonds while they are still GC and later repoing them out when they go on special. The dealer:

- Lends cash and earns a higher GC rate on the reverse repo
- Borrows cash and pays a lower rate on specials that he repoes out.

This kind of matched-book repo trading can be an extremely profitable, low-risk activity, given the wide spreads that can emerge between GC and special repo.

6. Sell/buy-backs

6.1. Explanation

As we mentioned in section *Definition*, the term repo is used to describe two types of transaction:

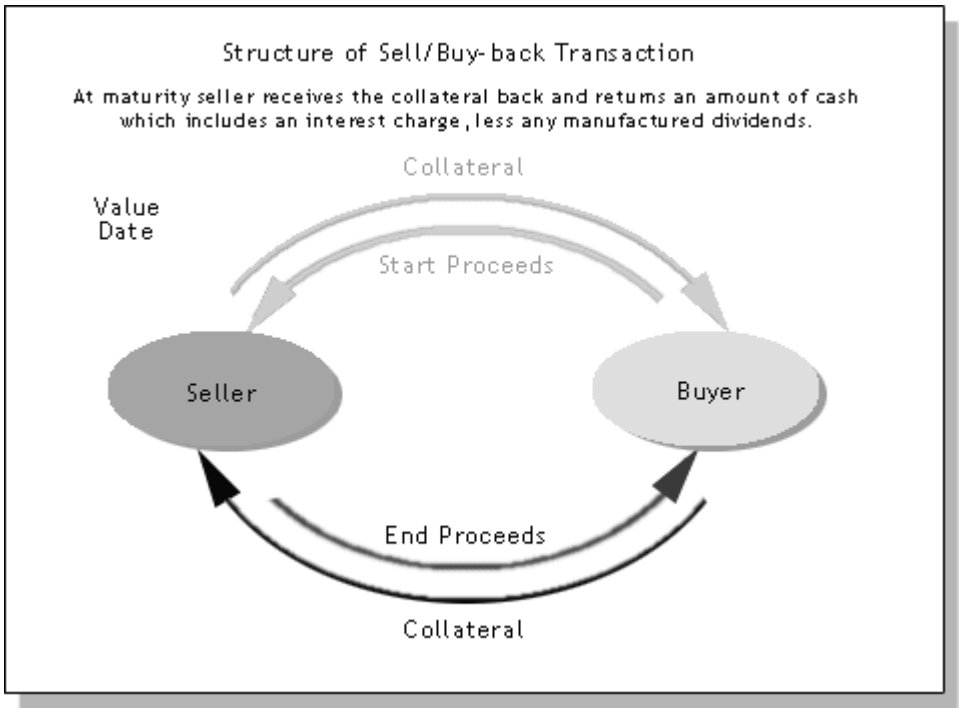
- **Classic repo**, also known as US-style repo (and in France *pension livree*)
- **Sell/buy-backs** (or buy/sell-backs or just buy/sells)

There is no significant economic difference between the two types of repo, only minor structural differences: classic repos and sell/buy-backs for the same maturity, amount and collateral should yield approximately the same return.

The really significant difference is in their legal status and in the way in which each types of repo is managed. Sell/buy-backs are not as secure or as flexible as classic repo. Classic repos predominate in the US, the UK, France and Switzerland; sell/buy-backs predominate in Germany, Italy, Spain and most emerging markets.

The main structural difference with a sell/buy-back is that the net cost of the repo is implicit in the difference between the start and the end proceeds, whereas in classic repo the proceeds are the same and the cost of repo is explicitly stated as a repo interest amount.

The figure below summarises the structure of a sell/buy-back.



On the value date:

- The seller delivers an agreed amount of collateral
- The buyer delivers the start proceeds

At maturity of the repo:

- The buyer delivers back the collateral
- The seller delivers the end proceeds which include:
    - An interest charge for the use of the funds
    - Any manufactured dividends that may have been payable on the collateral during the term of the contract

6.2. Classic Repo Compared

Sell/buy-back and Classic Repo Compared

Classic Repo	Sell/buy-back
A single contract	Two separate contracts
Documented: a written legal agreement evidences the rights and obligations of the counterparties	Traditionally undocumented
The start proceeds equal the end proceeds, and the return on the use of the cash is paid at maturity but separately from the end proceeds, in the form of repo interest	The start proceeds are different from the end proceeds, and the return on the use of the cash is paid at maturity as part of the end proceeds
The start proceeds can be rounded for convenience	The start proceeds should never be rounded
Is quoted in terms of the repo rate	Has traditionally been quoted in terms of a **forward price**, which is a measure based on the end-proceeds (however, sell/buy-backs are increasingly being quoted as repo rates)
Allows initial margins/haircuts and variation margins. Margins make classic repo a safer instrument by helping to ensure the adequacy of collateral	No initial margins/haircuts or variation margins are applied
Allows rights of substitution: this encourages the counterparties to undertake longer-term transactions	No rights of substitution
If a return is paid on collateral during the term of the repo - e.g. a coupon on bonds - the buyer is obliged to pay the manufactured dividend to the seller on the same day he receives the coupon from the issuer	If a return is paid on collateral during the term of the repo, the buyer is only obliged to pay the manufactured dividend to the seller at maturity. However, the buyer will have to add reinvestment interest to compensate the seller for the delay

Since November 1995, it has been possible to document sell/buy-backs under the PSA/ISMA Global Master Repurchase Agreement. Consequently, it is now possible to distinguish three major types of repo:

- **Classic repo** - always documented
- **Traditional sell/buy-back** - undocumented
- **Documented sell/buy-back** - always documented

Documented sell/buy-backs are more like classic repos in that they are single contracts and allow margins and rights of substitution. However, instead of variation margins, sell/buy-backs use a method called **early close-out**, in which the sell/buy-back is terminated and a new transaction arranged for the remaining term to maturity at the original rates, but with the amount of cash or collateral changed.

6.3. Example

Situation:
A bond trader anticipates a fall in German bond prices and wishes to short-sell EUR 10 million of the 4½% Deutschland Republik of 4 July 2009 for one week. This bond is currently bid at a clean price of 95.84 for settlement 13 August 1999, to yield 5.043%.

To cover the short-sale, the dealer needs to repo in the bond for a week, so he enters into a buy/sell-back on the following terms:

Repo buyer:	Bond trader
Repo seller:	Repo dealer
Collateral:	4½% Deutschland Republik of 4 July 2011
Amount:	EUR 10,000,000
Clean price:	95.84%
Accrued interest:	0.4931507% (annual, actual/actual)
Dirty price:	96.3331507
Market value:	EUR 9,633,315.07
Value date:	13 August 2002
Maturity:	20 August 2002
Term:	7 days
Start proceeds:	EUR 9,633,315.07
End proceeds:	EUR 9,638,378.18

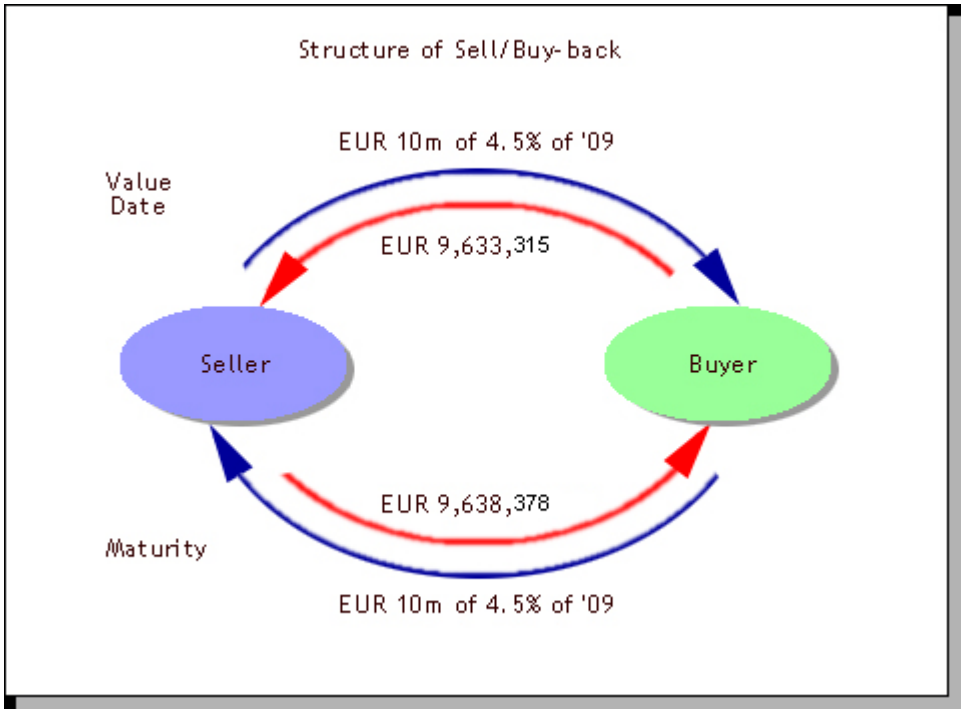
On the value date:

- The repo dealer delivers EUR 10 million nominal of the agreed collateral
- The bond trader delivers EUR 9,633,315.07 in cash

At the maturity of the repo:

- The bond trader returns EUR 10 million nominal of the 4½s of 2009
- The repo dealer repays EUR 9,638,378.18

The figure below summarises the flows involved in this transaction.



Analysis
This is the same situation as in the example in section *Applications*, except that now the dealer covers the short position with a buy/sell-back instead of a classic repo. Notice how the start and end proceeds are not rounded, as it is sometimes done with classic repo. The cost of this buy/sell-back is implied in the difference between the start and the end proceeds:

$$\text{Implied repo interest} = \left(\frac{9{,}638{,}378.18 - 9{,}633{,}315.07}{9{,}633{,}315.07} \right) \times \frac{360}{7}$$

$$= 0.02703 \text{ or } \mathbf{2.703\%}$$

This is the same rate that was quoted for the classic repo in the example in section *Applications*!

6.4. Pricing Sell/buy-backs

The return on a sell/buy-back is paid as part of its end proceeds and is therefore classified as capital. As it is paid as not interest, the return should not strictly be quoted as an interest rate. Instead, a sell/buy-back is traditionally quoted as a clean price that measures the repurchase price of the collateral - in other words, a forward bond price.

Forward price of a sell/buy-back

$$= \frac{(\text{End proceeds} - \text{Accrued interest at maturity}) \times 100}{\text{Nominal value}}$$

This representation of a forward bond price is not very intuitive, but in fact is identical to the forward bond pricing formula presented in section *Applications* and in Bond Futures - Pricing, as the following example will demonstrate.

Example

Let's work out what would be the quoted forward price on the sell/buy-back in the previous example

For settlement 20 August 2002 (the maturity date of the sell/buy-back) the accrued interest on EUR 10 million of the collateral bonds will be:

$$\text{Accrued interest} = 10{,}000{,}000 \times 0.5794521 / 100$$
$$= \text{EUR } 57{,}945.21$$

Therefore:

$$\text{Forward price of sell/buy-back} = \frac{(9{,}638{,}378.18 - 57{,}945.21) \times 100}{10{,}000{,}000}$$

$$= \mathbf{95.804}$$

This is nothing other than the breakeven forward price calculated in the classic repo example in section *Applications*, using the standard forward bond pricing formula! Thus, a sell/buy-back price of 95.804 for this bond is, in the current market, equivalent to a classic repo rate of 2.703%. Now we can see why the sell/buyback is quoted as a forward price:

The forward price in a sell/buy-back gives a trader an indication of the level a bond price needs to fall (or rise) to in order to cover the cost of carrying a position in it.

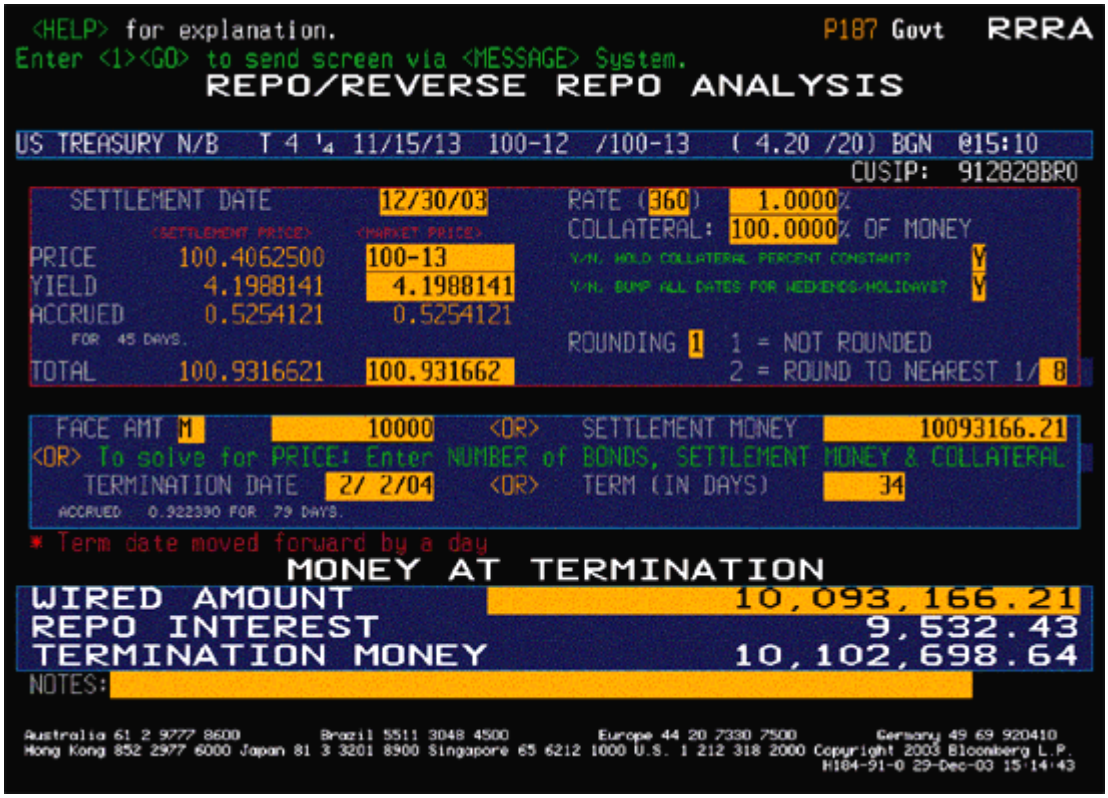
The drawback is that this pricing convention does not allow direct comparisons with classic repos, so market practice has changed in recent years towards quoting sell/buy-backs as repo rates.

Analytic systems
Examples of Bloomberg and Reuters repo analysis functions

Below are sample screens from two widely-used providers of market information and analytics.

These examples are for illustration purposes only and do not form part of the IFID Certificate syllabus.

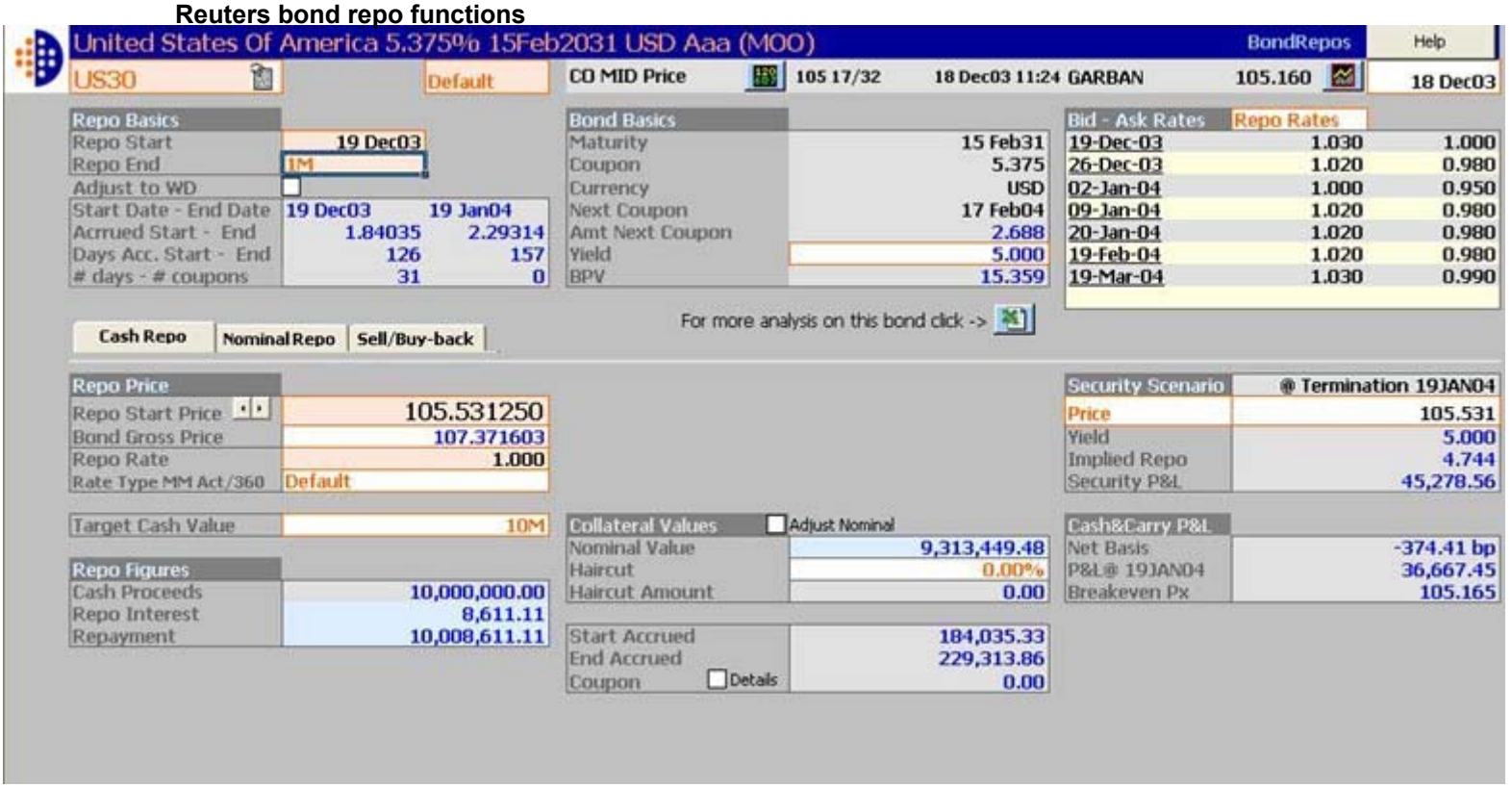
Bloomberg bond repo functions



Notes

- The *Classic Repo* function shows the cost of funding USD 10 million worth of a bond on classic term repo, given the assumed repo rate
- The *Sell/Buy-back* repo analysis function shows what would be the cost of funding exactly the same position on the same bond on a sell/buy-back basis

Reuters bond repo functions



Notes

- The *Cash Repo* tab shows the cost of funding USD 10 million worth of a bond on classic term repo, given the market rates shown at the right of the screen:
    - In this example there was no haircut imposed on the cash collateral, which is not normal market practice
    - The panel on the middle-right of the screen allows you to calculate the cash & carry arbitrage on this position, expressed as an **implied repo rate** and a **net basis**, assuming a price of this bond at the termination of the repo contract (for an explanation of these terms, see module Bond Futures – Implied Repo Rate and Bond Futures – Net Basis)
- The *Sell/Buy-back* tab on this screen shows what would be the cost of funding USD 10 nominal of the same bond on a sell/buy-back basis:

7. Risks

7.1. Counterparty risk

Repos offer a **double indemnity** against credit risk:

- Repo collateral provides protection against loss due to a default by a repo counterparty; if a repo counterparty fails, the non-defaulting buyer would sell the collateral and the non-defaulting seller would use the cash to buy new collateral

- The repo counterparty provides protection against loss due to a default by the issuer of the collateral securities; if the issuer of the collateral fails, the seller has an obligation to repurchase the defaulted collateral at the original price, or provide new collateral

As long as there is limited correlation between the credit risk on the repo counterparty and the credit risk on the issuer of the collateral, making a simultaneous default unlikely, each repo counterparty has two more or less independent sources of comfort which significantly reduces the credit risk exposure through a repo.

As a practical matter, the creditworthiness of a repo counterparty is of greater importance than the creditworthiness of the repo collateral.

If the issuer of collateral fails, the buyer has merely to demand fresh collateral from the seller, whereas if the repo counterparty fails, the non-defaulting counterparty may be exposed to a variety of potential problems:

- **Inconvenience** - a default, even on a secured instrument like repo, will require the non-defaulting counterparty to monitor bankruptcy proceedings, to ensure that there are no legal challenges to the buyer's right to collateral, and it may have to pursue a claim if there is a shortfall in collateral

- **Legal risk** - even though the repo should transfer ownership of the collateral to the buyer, the buyer's rights to it may be challenged in court by the administrator of a defaulting counterparty, or by other creditors

- **Operational risk** - the collateral may turn out to be inadequate due to operational inefficiencies - e.g. inability to sell illiquid collateral, failure to call variation margins, inefficiency in collecting the collateral from a custodian, or a delay in identifying an event of default

Because of the potential problems, the primary credit risk in a repo is typically on the repo counterparty, rather than on the collateral. The collateral provided through a repo should be regarded only as secondary protection against default by the counterparty.

Repo transactions are inherently safer than unsecured instruments, but they should not be used to do business with institutions who would otherwise be unacceptable counterparties for unsecured business. The appropriate way of taking extra risk to enhance returns on repos is to take riskier collateral from acceptable counterparties.

7.2. Legal & Documentary Risk

Repo depends on the ability of the buyer to sell collateral in order to recover his cash in the event of a default by the seller. This depends on legal title to the collateral being successfully transferred to the buyer. However, transfer of legal title is not possible in all jurisdictions. Even in jurisdictions where this is possible, the transfer may be subject to conditions. Anyone using repo should take care to ensure that the contracts are legally enforceable in the event of a dispute.

This problem is compounded by the number of jurisdictions potentially involved, which could be different for the repo seller, the buyer, the issuer of the collateral, the depository holding the collateral and the jurisdiction of the governing law chosen by the counterparties to the contract.

A vital safeguard against legal difficulties is obviously to document the agreed rights and obligations of the counterparties. The main obstacle to documentation in the past has been cost, but this has been greatly reduced by the publication of standard repo documentation in the US by the Public Securities Association (PSA) and its adaptation in November 1992 under English law for the international repo market by the International Securities Market Association (ISMA) in the form of the PSA/ISMA Global Master Repurchase Agreement (GMRA). The PSA/ISMA Agreement is now the international market standard.

7.3. Operational Risk

Repos - especially classic repos - are operationally intensive:

- The sale and repurchase, variation margins, rights of substitution and payments of manufactured dividends all involve transfers of securities and/or cash
- Collateral has to be marked to market frequently in order to check whether it is necessary to make variation margin calls, or whether the margin received is correct. In order to mark to market, good price sources are required. Once made, margin calls have to be monitored until they arrive
- Collateral has to be managed to avoid undue concentrations of particular securities in holdings of collateral
- Documentation, tax and accounting implications have to be understood and monitored

All this activity requires an efficient back office operation in terms of people and systems.

8. Exercises

8.1. Question 1

Question 1

Settlement date: 11 October 2000

Situation:
A bond dealer purchases GBP 50 million nominal of the 5¾% UK Treasury maturing 7 December 2009, at a clean price of 103.98. On the settlement date, there will be 126 days of accrued interest.

The dealer finances his purchase by repoing out the gilts to another investment bank on the following terms:

Repo type:	Classic repo
Repo buyer:	Investment bank
Repo seller:	Bond dealer
Collateral:	5¾% Treasury 7 December 2009
Type:	Semi-annual, Actual/Actual
Nominal amount:	GBP 50,000,000
Clean price:	103.98
Dirty price:	105.960 (rounded to 3 decimal places, by convention)
Value date of repo:	11 October 2000
Maturity of repo:	18 October 2000
Term of repo:	7 days
Repo rate:	6.22% (Actual/365)
Haircut:	2%

The haircut in this transaction is applied using the PSA/ISMA Global Master Repurchase Agreement formula (see section *Managing Collateral*):

$$\textbf{Start proceeds} = \textbf{Nominal value} \times \frac{\textbf{Dirty price of collateral}}{\textbf{(100 + Percentage haircut)}}$$

What are the cash flows through this repo (all figures to the nearest pound)?

a) Start proceeds GBP: ____

b) Payable by:

- ☐ Repo Seller
- ☐ Repo Buyer

c) End proceeds GBP: ____
Repo interest GBP: ____
Total GBP: ____

d) Payable by:

- ☐ Repo Buyer
- ☐ Repo Seller

e) Which of the following statements is/are true about this transaction?

- ☐ The Repo buyer suffers credit risk if the bond price falls
- ☐ The Repo seller suffers credit risk if the bond price rises
- ☐ The Repo buyer suffers credit risk if the bond price rises
- ☐ The Repo seller suffers credit risk if the bond price falls

8.2. Question 2

Question 2

Settlement date: 7 April 2000

Situation
You are a market maker in Italian government bonds (BTP). For settlement 7 April 2000 you sell a customer EUR 25 million nominal of the 5% BTP maturing 15 February 2003 at a clean price of 100.59.

As you do not have the BTP in your inventory, and you think it is a little overpriced at the moment, you decide to cover the short position by reversing in the bond for 10 days from a mutual fund. The terms of the transaction are:

Repo type:	Buy/sell-back
Buyer:	Market maker (you)
Seller:	Mutual fund
Collateral:	5% BTP 15 February 2003
Type:	Semi-annual, Actual/Actual
Nominal amount:	EUR 25,000,000
Value date:	7 April 2000
Maturity:	17 April 2000
Term:	10 days
Clean price at value date:	100.59
Accrued interest at value date:	0.714285714%
Accrued interest at maturity:	0.851648352%
Repo rate:	3.834% (Actual/360)

What are the cash flows through this buy/sell-back (all figures rounded to the nearest EUR)?

a) Start proceeds EUR: ☐

b) Payable by:

- ☐ Repo Seller
- ☐ Repo Buyer

c) End proceeds EUR: ☐

d) Payable by:

- ☐ Repo Buyer
- ☐ Repo Seller

e) If the buy/sell-back was quoted as a forward price, what would this be (rounded to 2 decimal places)?

Forward price:

f) What is the breakeven on your short position - i.e. the price at which you should buy back the bond after 10 days in order to cover the net cost of carrying the position? (Your answer to 2 decimal places.)

Breakeven price: