



# Understanding Repo Markets

---

Moorad Choudhry

# Definition of a Repo

The term “Repo” is from “Sale and *Repurchase* Agreement”

Repo is a money market instrument. There are two usually two parties to a repo transaction.

One party “sells” bonds to the other while simultaneously agreeing to repurchase them or receive them back at a specified future date

One party requires either the cash or the bonds and provides collateral to the other as well as compensation for the temporary use of the desired asset

Although legal title to the collateral is transferred, the seller/lender retains both the economic benefits and the market risk of owning them

If cash is involved the party receiving the cash will pay interest on this cash at the agreed repo rate

# Repo Definition (cont.)

Repo is therefore a secured loan

Legally : a sale and repurchase of bonds

Economically : a secured loan of cash

The cash investor receives the repo rate

Advantages for the cash investor :

- secured investment
- repo rate competitive with bank deposits
- diversification away from bank risk

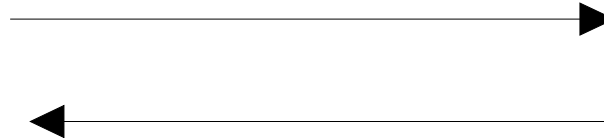
# Classic Repo

## First Leg

Bank A



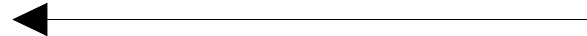
sells 100 worth of stock



Bank B



pays 100 cash for stock

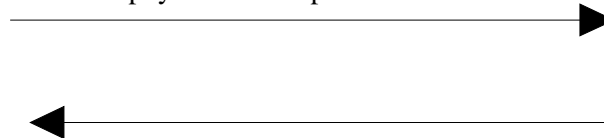


## Second leg

Bank A



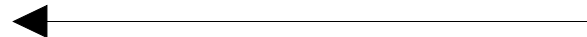
pays 100 cash plus interest



Bank B



sells 100 worth of stock



# Classic Repo Example

On 6 September 1997 Bank A agrees to sell £1m nominal of a UK gilt, the 8% Treasury 2000, which is trading at a dirty price of 104.30. Trade value date is 7 September, term 30 days, matures 7 October and agreed repo rate is 6.75%.

The first leg of the trade Bank A passes over the stock and receives £1.043m

- On 7 October Bank B returns the gilt and Bank A pays over the original monies plus repo interest of £5786.50.

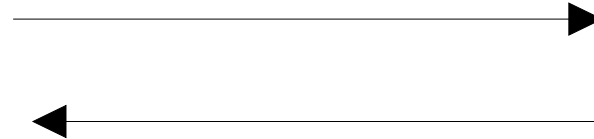
# Classic Repo Example

## First Leg

Bank A



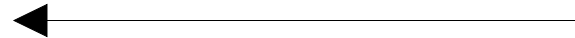
sells £1m nominal UKT 8% 2000



Bank B

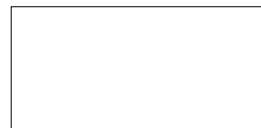


pays £1.043m

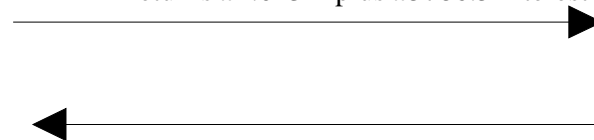


## Second leg

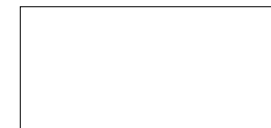
Bank A



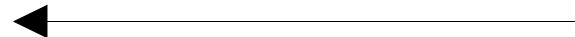
returns £1.043m plus £5786.5 interest



Bank B



returns £1m nominal UKT 8% 2000



# Classic Repo (cont.)

- In a classic repo the sale and repurchase prices are the same, although settlement values will differ because of addition of repo interest on termination
- A sale and repurchase is a “repo”, whereas a purchase and sell back is a “reverse repo”. Of course the counterparty is either one or the other, opposite to your position!
- If a coupon is paid during the term of the repo it will be handed over to the seller.
- A classic repo is subject to a legal contract signed in advance by both parties

# The Sell / Buy Back

- A sell / buy back is a spot sale and forward repurchase of bonds transacted simultaneously. The repo rate is not explicit but is implied in the forward price.
- Therefore the end clean price in the trade is different to the start clean price. This simply reflects repo interest and has nothing to do with the actual market price at the time.
- Coupon payments during the term of the trade are paid to the buyer, and may be passed over at the time or handed over to the seller through incorporation into the forward price (in which case a payment is not received immediately).

# The Sell / Buy Back (cont.)

- Generally sell / buy backs are not subject to a legal agreement, so in effect the seller has no legal right to any coupon and there is no provision for *variation margin*.
- The forward bond price is calculated by converting the termination money, that is, dividing the termination money by the nominal value.
- The interest accrued on the bond *during the term of the trade* is subtracted from the forward price to obtain a forward clean price
- Example 5.2 in your text book.

# The Sell / Buy Back (cont.)

- If there is a coupon payment during the trade, and it is not paid over until termination, a compensating payment is made of interest on the amount at the repo rate
- When calculating forward price where a coupon will be paid during the term, subtract coupon payment from forward price
- That is – coupon netted out with interest payment, all factored into forward price
- Sell / buy backs are not possible with open (no fixed term trades) as no forward price can be calculated

# Stock Lending

- Institutional investors such as pension funds and insurance companies may prefer to enhance income from portfolios by lending bonds, for a fee, rather than through repo
- No requirement for dealing, monitoring and settlement systems as required in repo, and no exposure to interest rate risk
- Less transparent and readily realisable value from “special” stock

# Margin

- An initial *margin* is given to the supplier of cash in the transaction. The market value of the collateral is reduced (or given a “haircut”) by the amount of margin when determining the value of cash lent out
- Two methods used to calculate the margin, assume a 2% level :
  - dirty price of bonds  $\times 0.98$
  - dirty price of bonds  $/ 1.02$
  - Bloomberg uses the second method

# Margin (cont.)

- Size of margin required in any transaction is a function of :
  - credit quality of counterparty
  - term of the repo
  - duration (price volatility) of collateral
  - existence of any legal agreement
  - quality of collateral
- A provision for *variation margin* is contained in repo agreements, to allow for the level of collateral to be say, increased if its market value has fallen significantly during the term of the trade

# Margin (Example 6.2)

- 30 day repo, at 5 9/32%, margin 2.5%.  
Principal £9.5m, clean price collateral 95-00, accrued (54 days) £88,767.12, consideration £9,588,767.12.
- Consideration is divided by 1.025, gives £9,354,894.75, rounded to £9,355,000. Repo interest is £40,607.75.
- Price of collateral drops to 92-00 after 15 days, market value now 9.2m + accrued (69 days), which is £9,313,424.65. Repo desk has lent £9.355m!
- To restore original margin of 2.5%, desk calls for adjustment calculated as follows :  
$$[(\text{original consideration} + \text{repo interest accrued}) \times (1 + \text{initial margin})] - (\text{new all-in price} \times \text{nominal amount})$$

**Margin call is  $[(9.355\text{m} + 20,303) \times 1.025] - (0.93134 \times 10\text{m})$   
= £296,261.82**

# Other Repo Types

Tri-party Repo

Hold-in-custody repo

Borrow vs Letter of Credit

Cross-currency repo

# Tri-Party Repo

- Market participants such as cash rich investors may prefer tri-party repo because it eases admin (lower admin burden than “delivery” repo, but less risky than HIC repo)
- Collateral is held in an independent third-party account; service provided by Euroclear and Clearstream Banking
- The tri-party agent is also custodian, manages exchange of collateral and cash internally
- Tri-party agreement signed by all three parties
- Tri-party repo rate is usually higher than the delivery repo rate, but lower than HIC repo

# Using Repo

## Funding Positions

In normal course of business, long/short of bonds is short/long of cash. Can finance this in interbank or repo market

Covering short positions

General collateral (GC) repo rate vs interbank

## Investment option

## Yield enhancement

Credit intermediation between markets (secured and unsecured, stock lending, etc)

# Collateral

## General collateral (“GC”)

Collateral that is not a specified security but of a defined homogenous credit quality, for example UK gilts or AA-rated sterling Eurobonds. A repo in GC does not specify any particular security, but the repo buyer must be informed what stock is being passed over fairly shortly after the trade is agreed

## Specific repo

Repo in a specific security, specified at time of trade. Equity repo is almost by definition always specific repo. A specific is not necessarily a “special”

- ## Special repo



# Repo Market Players

# Repo Market Players

- **Investors**

Cash-rich institutions; banks and building societies

- **Borrowers**

- Traders; financing bond positions, etc

- **Other institutions**

Flexibility and ease of trading makes this a market for almost any type of firm involved in borrowing or lending collateralised cash



# Legal, Accounting, Tax and Capital Issues

# Legal Issues

- PSA / ISMA Agreement

Introduced November 1992; updated 1995 and 2000

Market standard agreement used as legal basis for repo in non-USD markets

- Main features :

- trades structured as outright sales and purchases
- full ownership conferred of securities transferred
- obligation to return “equivalent” securities
- provision for initial and variation margin
- coupon paid over to seller at time of payment
- legal title to collateral in event of default

- Gilt Repo Agreement

# Accounting and Tax

- On-balance sheet. An accounting entry appears as secured loan and not a “sell” transaction

Bonds given as collateral remain on the balance sheet; corresponding liability is repo cash (opposite for buyer)

P&L account, repo interest treated as payment of interest on accruals basis

- Tax treatment differs according to jurisdiction

Principal issue is whether “sale” of securities triggers taxable event and/or result in transfer taxes

In UK return leg of repo treated as interest, taxed as income. Coupon payments treated as benefit to seller, taxable date is dividend date

# Capital Treatment

- BIS Capital Accord, sets minimum ratio of capital to *weighted risk assets* of 8%. Assets on balance sheet assigned weighting from 0% (“riskless”) to 100%.
- Repo transaction attracts a charge on bank’s *trading book*
- Capital allocation is :  
$$\max \{[(C_{mv} - S_{mv}) \times 8\% \times RW], 0\}$$
- By definition repo attracts lower charge than unsecured transactions. Trades conducted under legal documentation given favourable treatment; sell/buy backs attract a full charge.



# Repo Netting

# Repo Netting

Some markets have introduced central clearing with multi-lateral netting ability

Repo netting means market participants can net long and short repo positions, reducing impact on balance sheet and also freeing up credit lines. Benefit of settlement netting and more uniformity in risk management procedures

This system is already well established in US market, provided by Government Securities Clearing Corporation

Netting replaces a large number of bilateral credit exposures with a set of single exposures to a central counterparty

# Repo Netting (cont.)

Developing market, although market should eventually favour one system

*RepoClear* developed primarily by London Clearing House (LCH).

Steering committee made up of a number of banks. Initially for bund repo, followed by other European bonds including gilts. Trades capture by TRAX. Risk management by margining and a default fund. Also plan for cross-margining with swaps and futures and eventual cash bond clearing. Introduced Aug 1999 for Bund repo, other currencies to follow. *SwapClear* introduced Aug 1999

*GSCC/Euroclear* originally planned centralised netting for euro repo and cash trades in 2000...

- *Cleernet* set up Nov'98 for French government bonds and repo, plan other euro bonds

**RepoClear members as at 10/00 included Chase Manhattan, Deutsche Bank, RBS NatWest, Barclays Capital, CSFB and Morgan Stanley**

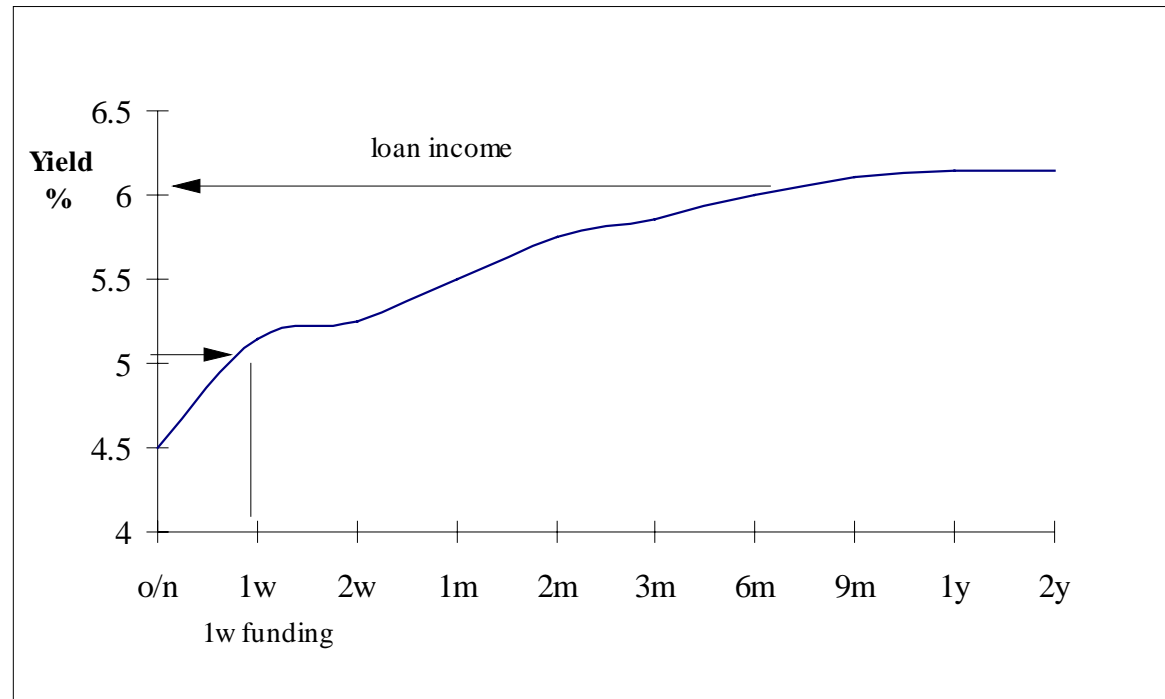
# Repo Netting (cont.)

- Mark-to-market on *RepoClear* uses Reuters prices, therefore illiquid bonds not repo-ed over it
- GSCC/Euroclear have joined LCH as a joint venture to further develop RepoClear
- Default fund £350m as at Oct 2000, plan to increase this
- See [www.repodealer.com](http://www.repodealer.com) for latest members and details on:
  - ---membership criteria
  - ---size of default fund (at least £250m)
  - ---member banks



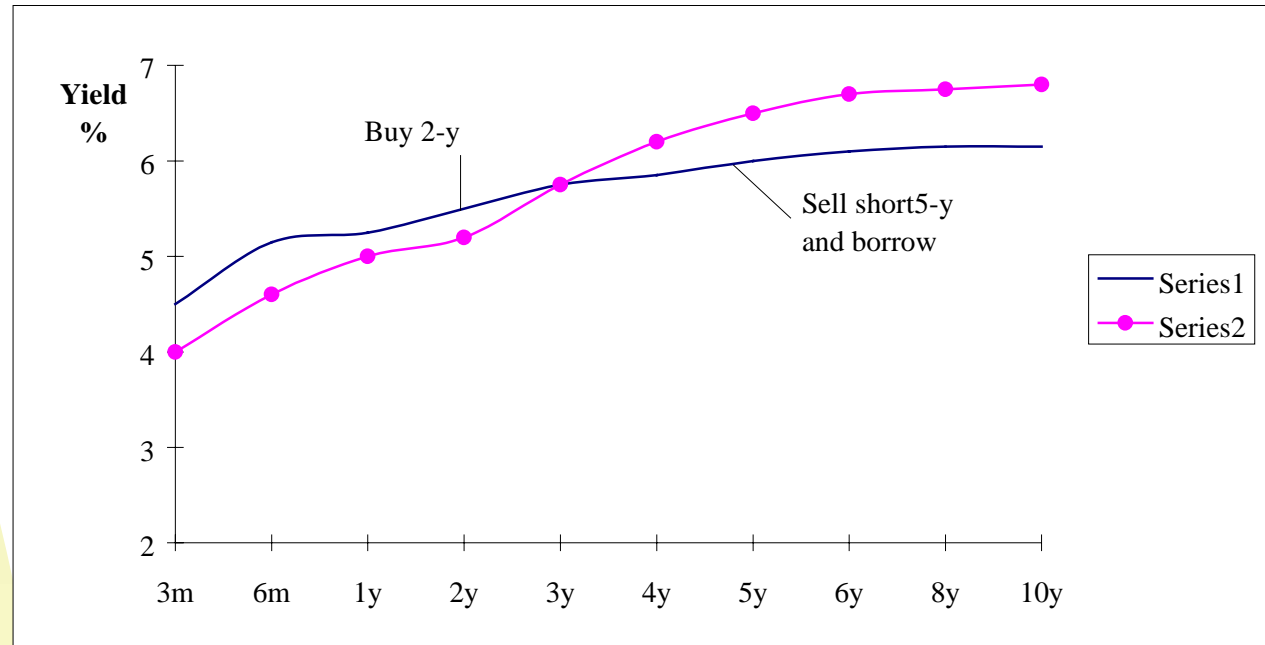
# Trading and Hedging Strategies

# Positive Yield Curve Environment



- Creating a “tail”, funding short
- Interest rate gap exposure
- Issues in inverted (negative) yield curve environment ?

# Yield Curve Arbitrage



- Expect yield curve steepening; spread trade 2-yr vs 5-yr
- “series 1” is shape of curve at start of trade, “series 2” shape of curve at point profit taken and trade unwound

# Credit Intermediation

- Government bond repo will usually trade lower than other money market instruments; this allows trading of spreads between markets of different credits.
- Examples
  - Repo dealer lends GC currently trading at Libor-25 and invests cash in CDs trading at Libor-12.5
  - Securities house borrows specific collateral in stock lending market, on-lends stock in repo; cash then lent in interbank at higher rate, eg., to buy CDs
  - Trading repo at GC, uses cash to reverse in emerging market collateral at spread of say, 400 bps higher

# Matched Book Trading

- Principals with large volumes of repos and reverse repos are said to be running “matched books” - essentially market-making in repo
- Term “matched book” is a misnomer - books are deliberately mismatched; traders take positions according to their view of :
  - short term interest rates
  - anticipated supply and demand in underlying stock
- The examples of position gap and interest rate tails are matched book trades

# Specials Trading

- A repo market allows demand for borrowing / lending stocks to be cleared by the price mechanism
- Reasons for stocks going “special” :
  - government bond auctions
  - outright short selling
  - hedging; bond underwriting
  - derivatives trading, such as basis trading
  - small size issues leading to low liquidity
  - buy-back or cancellation of debt
- Link between dearness in cash market and special status flows both ways

# Specials Analysis

Relationship between cash prices and repo rates on specials :

- there is a positive correlation between changes in a stock trading expensive to the yield curve and changes in the degree to which it trades special.
- Theory predicts this : traders maintain short positions for paper with high funding costs only if the anticipated fall in the price of the bond is large enough to give a profit  
(also implies longer duration stocks should be less expensive for a given specials premium, as prices are more sensitive to yield changes, so any rise in yield gives trader running a short position a higher profit to offset cost of repo)

# Specials Analysis (cont.)

Explanation of cause and effect :

- when stock *perceived* as expensive, eg., after auction announcement; creates a greater demand for short positions, and hence greater demand for the paper in repo (to cover shorts)
- at other times stock might go tight in the market; tends to be bid higher in the *cash* market as traders closed out existing shorts (now too dear to run); at same time traders and investors try to buy the stock outright since it is now cheap to finance by repo-ing out

# Specials Analysis (cont.)

- The link between dearness in the cash market and specialness in the repo market flows both ways, either preceding change in the other
- In both cases stock remains expensive until existing holders take profits by selling their stock or making it available for repo / lending
- Central bank may intervene (if a government bond)

# Specials Analysis (cont.)

RBS Trust May 1999

Investec Bank Sep 2000

- Repo of gilt strips: these stocks are “special” on an almost permanent basis
- For example in stock loan market, 8% 2021 lent out on an open basis (no fixed term) at approx. 10bps. The 2021 principal strip lent out at 50-100bps!
- It is also rare to find repo in coupon strips - reflecting low demand for this type of paper at present



# The Implied Repo Rate and Basis Trading

# Basis Trading

- The simultaneous trading of cash bonds and the related bond futures contract, for which an open repo market is essential. Also known as *cash and carry* trading.
- The definition of the long gilt contract on LIFFE calls for delivery of a gilt of notional 7% coupon and between 8.75 - 13 years maturity
- The *conversion factor* for each bond is intended to compensate for coupon and timing differences of deliverable bonds

The conversion factor gives the price of a bond such that its YTM on delivery day equals notional coupon

# Bloomberg Screen - page DLV

Futures price: 114.55

|                   | Price    | Source | Yield | C.Factor  | Gross Basis | Implied Repo % | Actual Repo % | Net Basis |
|-------------------|----------|--------|-------|-----------|-------------|----------------|---------------|-----------|
|                   |          |        |       |           |             |                | 7.26          |           |
| UKT9 10/13/08     | 130.7188 | BGN    | 5.035 | 1.1407155 | 0.05        | 6.64           | 7.26          | 0.131     |
| UKT7 1/4 12/07/07 | 116.3750 | BGN    | 4.988 | 1.0165266 | -0.068      | 6.51           | 7.26          | 0.144     |
| UKT8 09/25/09     | 125.4375 | BGN    | 4.950 | 1.0750106 | 2.295       | -4.86          | 7.26          | 2.474     |
| UKT9 07/12/11     | 136.1563 | BGN    | 5.095 | 1.1655465 | 2.643       | -5.34          | 7.26          | 2.831     |
| UKT6 1/4 11/25/10 | 110.7500 | BGN    | 5.049 | 0.9400748 | 3.064       | -11.38         | 7.26          | 3.362     |
| UKT5 3/4 12/07/09 | 106.6250 | BGN    | 4.966 | 0.9051249 | 2.943       | -11.61         | 7.26          | 3.273     |

# Cheapest-to-Deliver Bond

- As bonds trade at different levels, those in the delivery basket will not be equivalent at time of delivery; the bond that maximises the expression below will be the “cheapest to deliver” :
- $\text{Gross basis} = P_{\text{bond}} - (P_{\text{fut}} \times \text{CF})$
- Two measures of determining CTD, net basis and implied repo rate

# Gross and Net Basis

- Basis trading arises from the difference between the current clean price of a bond and the clean price at which the bond is bought through the purchase of a futures contract; the difference between these two prices is the gross basis.
- Gross basis is essentially the difference between the running yield on the bond and the current repo (money market) rate.
- Net basis is gross basis adjusted for net carry; the actual coupon income and re-investment minus borrowing cost, which is at the security's actual repo (money market) rate. Bond with lowest net basis is CTD.
- A positive net basis represents the *loss* to a long cash / short futures position, and the expected profit for the short cash / long futures position.

# Reverse cash-and-carry; real world trading

- Generally a cash-and-carry strategy will produce a negative result; bid-offer spreads will also erode any theoretical advantage.
- Does this mean the reverse cash-and-carry will produce a profit? In theory yes, trader earns repo rate on short sale proceeds, indicated when implied repo rate is lower than actual repo rate.
- However the short future initiates the delivery process, and chooses time of delivery and which bond.
- Finally, *basis risk* - the risk that price changes in one instrument are not matched exactly by changes in the other - can also produce negative results

# The Implied Repo Rate

- IRR: annualised % difference between the dirty price of the CTD bond and the dirty price of the future
- Represents the profit (or loss) that could be locked in by buying the CTD bond and selling it forward (or by selling it short and buying it forward)
- If a profit, this should be offset by the cost of financing the CTD bond.
- If a loss, it should be offset by the return earned on the cash proceeds of the short sale.

# Calculating the Implied Repo Rate

$$\text{IRR} = \frac{\text{Dirty futures price} - \text{Dirty cash price}}{\text{Dirty cash price}} \times \frac{365}{\text{Days to expiry}} \times 100$$

Dirty futures price = cash inflow

Dirty cash price = cash outflow

The rate implied by a cash-and-carry strategy is called the repo rate because it is equivalent to a repo agreement with the futures market.

# Summary: Cash and Carry Strategy

- Buy the cash bond and sell it forward at the futures price (i.e. sell the futures) in the hope of making a profit
- A profit will be realised only if the capital gain earned by selling the bond forward at a higher price exceeds the cost of financing the bond, i.e. the actual repo rate.
- This will be the case when the implied repo rate is higher than the actual repo rate

# Summary: Reverse Cash and Carry Strategy

- Buy the futures and simultaneously sell the underlying CTD bond
- Earn the actual repo rate on the proceeds from the sale of the cash bond
- Profit realised when the cash inflow from selling the bond and investing the proceeds is greater than the outflow from buying the bond forward (on settlement of the futures contract)
- Potential profit from such a trade is indicated when the implied repo rate is *lower* than the actual repo rate



# Introduction to Repo Structures

# Example repo structures

- Callable repo
- Whole Loan Repo
- Total Return Swap

# Callable Repo

- If lender of cash on a term fixed rate repo negotiates the right to terminate early, or take back a portion of the cash.
- Lender has an interest rate option
- Benefits if repo rates rise
- Can terminate repo, take back cash and reinvest at higher rates
- 'Callable' repo will therefore offer lower fixed rates than conventional repo

# Whole Loan Repo

- Common in USD market
- PSA Agreement used
- Daily mark to market
- Asset-backed loans as collateral in a repo, credit quality affords higher spread
- HIC most popular method, although triparty is growing

# Total Return Swap

- Also known as Total Rate of Return Swap, economically identical to a repo; main difference is transaction typically governed by ISDA swap agreement
- This may alter way in which trade is reflected on balance sheet
- Transaction works as follows :
  - i) Institution sells security at market price
  - ii) Institution executes a swap transaction for a fixed term, exchanging the total return on the security for an agreed rate on the relevant cash amount
  - iii) On maturity of the swap, Institution repurchases security at the market price
- In theory, each leg can be executed separately with different parties; in reality trade is bundled together and so economically identical to a repo

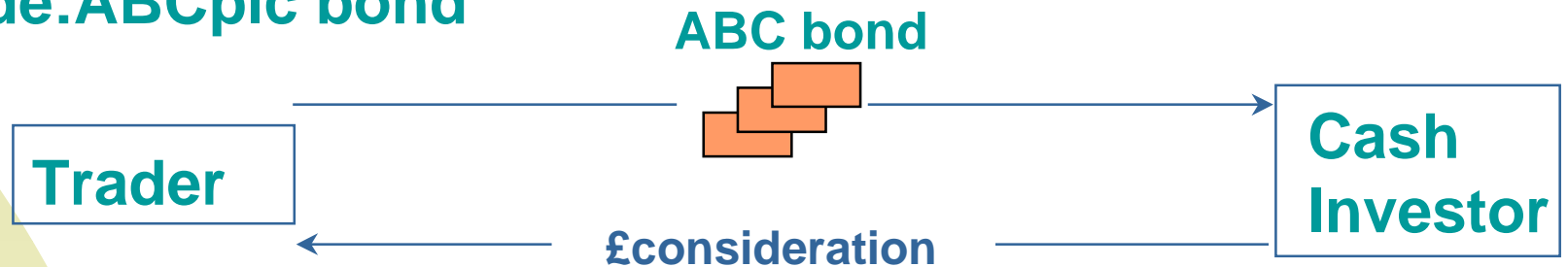
# Total return swap (cont.)

- The bond trader will receive the “total return” on the bonds, which means that
  - if bond rises in value, trader pays the difference in value to the counterparty
  - if the bonds fall in value, the trader will receive the difference from the counterparty
- As part of the swap, trader pays Libor +/- swap on the cash proceeds
- The cash investor counterparty has full title and can sell securities in the open market at termination
- Dealer has no legal obligation to repurchase the bonds
- The trade will take bonds off dealer's balance sheet, which may be desired if a year-end is approaching, for (say) credit rating analysis

# Sale + Total Return Swap

Start of trade: ABC plc bond

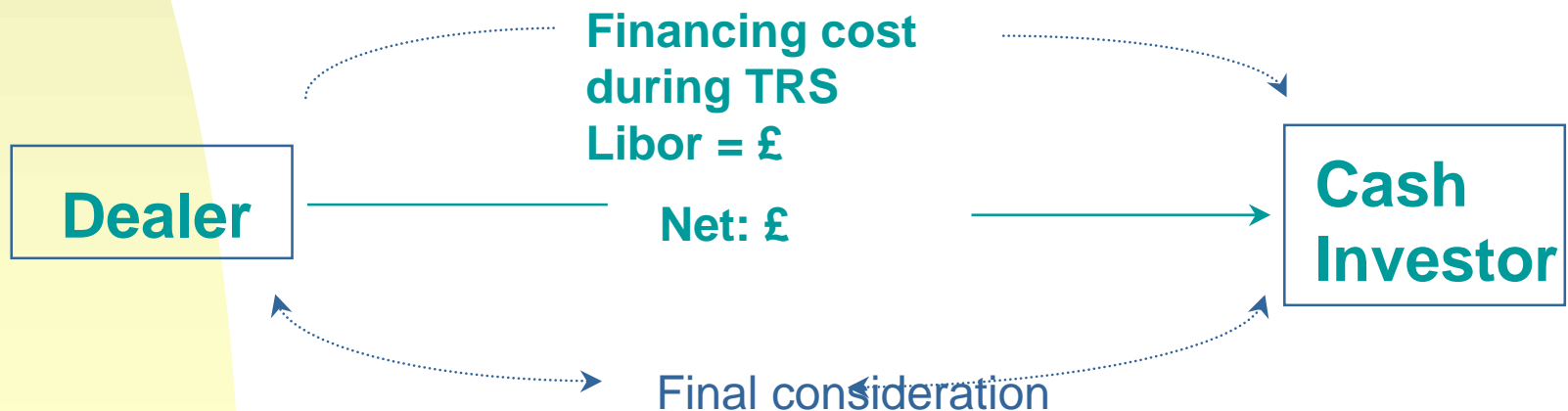
Sale of  
bonds...



Termination: rise in price

Settlement  
(unwind) of  
OTC swap  
agreement

Bonds bought  
back



Bond price appreciation, so trader pays difference

# Total Return Swap (cont.)

- The TRS trade is common in equity repo, as a fixed term trade
- It is often used as a form of hedge, as well as for financing the underlying position
- Hedge transaction: pay Libor on funds received; on termination of the trade receive difference in market value if price has dropped
- This is “selling the swap”, opposite is buying the swap