The Repo Instrument

In this chapter we define repo and illustrate its use. We will see that the term repo is used to cover one of two different transactions: the classic repo and the sell/buy-back, and sometimes is spoken of in the same context as another instrument, the stock loan. A fourth instrument, known as the total return swap, is economically similar in some respects to a repo, so we will also look in some detail at this product. It is now commonly encountered as part of the market in credit derivatives. However, although these transactions differ in terms of their mechanics, legal documentation and accounting treatment, the economic effect of each of them is in fact very similar. The structure of any particular market and the motivations of particular counterparties will determine which transaction is entered into; there is also some crossover between markets and participants.

Market participants enter into classic repo because they wish to invest cash, for which the transaction is deemed to be cash-driven, or because they wish to borrow a certain stock, for which purpose the trade is stock-driven. A sell/buy-back, which is sometimes referred to as a buy-sell, is entered into for similar reasons but the trade itself operates under different mechanics and documentation.\(^1\) A stock loan is just that, a borrowing of stock against a fee. Long-term holders of stock will therefore enter into stock loans simply to enhance their portfolio returns. We will look at the motivations behind the total return swap in a later chapter.

In this chapter we look in detail at the main repo structures, their mechanics and the different reasons for entering into them. It’s a long chapter, but well worth studying closely.

5.1 REPO INSTRUMENTS

5.1.1 Definition

A repo agreement is a transaction in which one party sells securities to another, and at the same time and as part of the same transaction commits

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\(^1\) We shall use the term “sell/buy-back” throughout this book. A repo is still a repo whether it is cash-driven or stock-driven, and one person’s stock-driven trade may well be another’s cash-driven one.
to repurchase identical securities on a specified date at a specified price. The seller delivers securities and receives cash from the buyer. The cash is supplied at a predetermined rate of interest – the repo rate – that remains constant during the term of the trade. On maturity the original seller receives back collateral of equivalent type and quality, and returns the cash plus repo interest. One party to the repo requires either the cash or the securities and provides collateral to the other party, as well as some form of compensation for the temporary use of the desired asset. Although legal title to the securities is transferred, the seller retains both the economic benefits and the market risk of owning them. This means that the “seller” will suffer loss if the market value of the collateral drops during the term of the repo, as they still retain beneficial ownership of the collateral. The “buyer” in a repo is not affected in profit/loss account terms if the value of the collateral drops, although as we shall see later, there will be other concerns for the buyer if this happens.

We have given here the legal definition of repo. However, the purpose of the transaction as we have described above is to borrow or lend cash, which is why we have used inverted commas when referring to sellers and buyers. The “seller” of stock is really interested in borrowing cash, on which they will pay interest at a specified interest rate. The “buyer” requires security or collateral against the loan they have advanced, and/or the specific security to borrow for a period of time. The first and most important thing to state then, is that repo is a secured loan of cash, and would be categorised as a money market yield instrument.²

5.2 THE CLASSIC REPO

The classic repo is the instrument encountered in the US, UK and other markets. In a classic repo one party will enter into a contract to sell securities, simultaneously agreeing to purchase them back at a specified future date and price. The securities can be bonds or equities but also money market instruments such as T-bills. The buyer of the securities is handing over cash, which on the termination of the trade will be returned to them, and on which they will receive interest. The transaction is carried out under a standard legal agreement.

The seller in a classic repo is selling or offering stock, and therefore receiving cash, whereas the buyer is buying or bidding for stock, and consequently paying cash. So if the one-week repo interest rate is quoted by a market-making bank as “5½ - 5¼”, this means that the market maker will bid for stock, that is, lend the cash, at 5.50% and offers stock or pays interest on borrowed cash at 5.25%. In some markets the quote is reversed.

² That is, a money market product quoted as a yield instrument, similar to a bank deposit or a Certificate of Deposit. The other class of money market products are discount instruments such as a Treasury Bill or Commercial Paper.
There will be two parties to a repo trade, let us say Bank A (the seller of securities) and Bank B (the buyer of securities). On the trade date the two banks enter into an agreement whereby on a set date, the value or settlement date Bank A will sell to Bank B a nominal amount of securities in exchange for cash. The price received for the securities is the market price of the stock on the value date. The agreement also demands that on the termination date Bank B will sell identical stock back to Bank A at the previously agreed price; consequently, Bank B will have its cash returned with interest at the agreed repo rate.

In essence a repo agreement is a secured loan (or collateralised loan) in which the repo rate reflects the interest charged on the cash being lent.

On the value date, stock and cash change hands. This is known as the start date, on-side date, first leg or opening leg, while the termination date is known as the second leg, off-side leg or closing leg. When the cash is returned to Bank B, it is accompanied by the interest charged on the cash during the term of the trade. This interest is calculated at a specified rate known as the repo rate. It is important to remember that although in legal terms the stock is initially “sold” to Bank B, the economic effects of ownership are retained with Bank A. This means that if the stock falls in price it is Bank A that will suffer a capital loss. Similarly, if the stock involved is a bond and there is a coupon payment during the term of the trade, this coupon is to the benefit of Bank A, and although Bank B will have received it on the coupon date, it must be handed over on the same day or immediately after to Bank A. This reflects the fact that although legal title to the collateral passes to the repo buyer, economic costs and benefits of the collateral remain with the seller.

A classic repo transaction is subject to a legal contract signed in advance by both parties. A standard document will suffice; it is not necessary to sign a legal agreement prior to each transaction. We discuss this further in a later chapter.

Note that although we have called the two parties in this case “Bank A” and “Bank B”, it is not only banks that get involved in repo transactions, and we have used these terms for the purposes of illustration only.

The basic mechanism is illustrated in Figure 5.1.

A seller in a repo transaction is entering into a repo, whereas a buyer is entering into a reverse repo. In Figure 5.1 the repo counterparty is Bank A, while Bank B is entering into a reverse repo. That is, a reverse repo is a purchase of securities that are sold back on termination. As is evident from
Figure 5.1 every repo is a reverse repo, and the name given is dependent on from whose viewpoint one is looking at the transaction.\(^4\)

5.2.2 Examples of Classic Repo

The basic principle is illustrated with the following example. This considers a specific repo, that is, one in which the collateral supplied is specified as a particular stock, as opposed to a general collateral (GC) trade in which a basket of collateral can be supplied, of any particular issue, as long as it is of the required type and credit quality.

We consider first a classic repo in the US Treasury market between two market counterparties, in the 3.625% Treasury August 2019 stock. The terms of the trade are given in Table 5.1 and illustrated in Figure 5.2.

The repo counterparty delivers to the reverse repo counterparty $10 million nominal of the stock, and in return receives the purchase proceeds. The clean market price of the stock is $101.78125. In this example no margin has been taken so the start proceeds are equal to the market value of the stock which is $10,209,646.74. It is common for a rounded sum to be transferred on the opening leg. The repo interest is 0.25%, so the repo interest charged for the trade is

\[
\frac{10,209,646.74 \times 0.25 \times 7}{360}
\]

or $496.30. The US dollar market day-count basis is actual/360, and the repo interest is based on a seven-day repo rate of 0.25%. Repo rates are agreed at the time of the trade and are quoted, like all interest rates, on an annualised

\[^4\text{Note that the guidelines to the syllabus for the Chartered Financial Analyst examination, which is set by the Association for Investment Management and Research, defines repo and reverse repo slightly differently. This states, essentially, that a “repo” is conducted by a bank counterparty and a “reverse repo” is conducted by an investment counterparty or non-financial counterparty. Another definition states that a “repo” is any trade where the bank counterparty is offering stock (borrowing cash) and a “reverse repo” is any trade where the non-bank counterparty is borrowing cash. Such definitions are not really followed in the market.} \]
basis. The settlement price (dirty price) is used because it is the market value of the bonds on the particular trade date and therefore indicates the cash value of the gilts. By doing this the cash investor minimises credit exposure by equating the value of the cash and the collateral.

On termination the repo counterparty receives back its stock, for which it hands over the original proceeds plus the repo interest calculated above.

Market participants who are familiar with the Bloomberg trading system will use screen RRRA for a classic repo transaction. For this example the relevant screen entries are shown in Figure 5.3. This screen is used in conjunction with a specific stock, so in this case it would be called up by entering

\[ T \ 3.625\% \ 2019 \ < \ GOVT \ > \ RRRA \ < \ GO \ > \]

where “T” is the ticker for US Treasuries. Note that the date format for Bloomberg screens is the US style, which is mm/dd/yy. The screen inputs

<table>
<thead>
<tr>
<th>TABLE 5.1 Terms of Classic Repo Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade date</td>
</tr>
<tr>
<td>Value date</td>
</tr>
<tr>
<td>Repo term</td>
</tr>
<tr>
<td>Termination date</td>
</tr>
<tr>
<td>Collateral (stock)</td>
</tr>
<tr>
<td>Nominal amount</td>
</tr>
<tr>
<td>Price</td>
</tr>
<tr>
<td>Accrued interest (32 days)</td>
</tr>
<tr>
<td>Dirty price</td>
</tr>
<tr>
<td>Settlement proceeds (wired amount)</td>
</tr>
<tr>
<td>Repo rate</td>
</tr>
<tr>
<td>Repo interest</td>
</tr>
<tr>
<td>Termination proceeds</td>
</tr>
</tbody>
</table>

**FIGURE 5.2** Classic repo trade.
are relatively self-explanatory, with the user entering the terms of the trade that are detailed in Table 5.1. There is also a field for calculating margin, labelled “collateral” on the screen. As no margin is involved in this example, it is left at its default value of 100.00%. The bottom of the screen shows the opening leg cash proceeds or “wired amount”, the repo interest and the termination proceeds.

What if a counterparty is interested in investing $10 million against Treasury collateral? Let us assume that a corporate treasury function with surplus cash wishes to invest this amount in repo for a one-week term. It invests this cash with a bank that deals in Treasury repo. We can use Bloomberg screen RRRA to calculate the nominal amount of collateral required. Figure 5.4 shows the screen for this trade, again against the 3.625% 2009 stock as collateral. We see from Figure 5.4 that the terms of the trade are identical to that in Table 5.1, including the bond price and the repo rate; however, the opening leg wired amount is entered as $10 million, which is the cash being invested. Therefore the nominal value of the gilt collateral required will be different, as we now require a market value of this stock of $10 million. From the screen we see that this is $9,795,000. The cash amount is different from the example in Figure 5.3, so of course the repo interest charged is different, and is $486.13 for the seven-day term. The diagram at Figure 5.5 illustrates the transaction details.
5.3 THE SELL/BUY-BACK

5.3.1 Definition

In addition to classic repo there exists sell/buy-back. A sell/buy-back is defined as an outright sale of a bond on the value date, and an outright repurchase of that bond for value on a forward date. The cash flows therefore become a sale of the bond at a spot price, followed by repurchase of the bond.
Example 5.1 Classic Repo

On 15 September 2009, a corporate wishes to invest EUR 50 million against German government bonds for 7 days. The collateral is the 3½% bunds due in July 2019. The repo rate is agreed at 0.75%. The bund price is 101.93 clean, which together with 1.141 accrued interest (119 days) gives a dirty price of 103.071.

The borrower of cash will need to determine the face value of bunds required at the current market price which will equate to EUR 50 million. This is shown below.

\[
\frac{103.071}{100.000} = \frac{50,000,000}{X}
\]

The nominal value of bunds required (X) is 48,510,205.

The trade details are summarised below.

| Nominal | EUR 48,510,205 of Bund 3.50% 2019 |
| Clean start price | 101.93 |
| Accrued | 1.141 |
| Dirty start price | 103.071 |
| Settlement money | EUR 50,000,000 |
| Dirty end price | 103.071 |
| Repo interest | EUR 7,291 (50,000,000 × 0.75% × 7/360) |
| Termination money | EUR 50,007,291.67 |

Note that the sale and repurchase prices are the same.

at the forward price. The forward price calculated includes the interest on the repo, and is therefore a different price to the spot price. That is, repo interest is realised as the difference between the spot price and forward price of the collateral at the start and termination of the trade. The sell/buy-back is entered into for the same reasons as a classic repo, but was developed initially in markets where no legal agreement existed to cover repo transactions, and where the settlement and IT systems of individual counterparties were not equipped to deal with repo. Over time, sell/buy-backs have become the convention in certain markets, most notably Italy, and so the mechanism is still used.

5. The “forward price” is calculated only for the purpose of incorporating repo interest; it should not be confused with a forward interest rate, which is the interest rate for a term starting in the future and which is calculated from a spot interest rate. Nor should it be taken to be an indication of what the market price of the bond might be at the time of trade termination, the price of which could differ greatly from the sell/buy-back forward price.
In many markets therefore, sell/buy-backs are not covered by a legal agreement, although the standard legal agreement used in classic repo now includes a section that describes them.\footnote{This is the PSA/ISMA Global Master Repurchase Agreement, which is reviewed in Chapter 13.}

A sell/buy-back is a spot sale and forward repurchase of bonds transacted simultaneously, and the repo rate is not explicit, but is implied in the forward price. Any coupon payments during the term are paid to the seller; however, this is done through incorporation into the forward price, so the seller will not receive it immediately, but on termination. This is a disadvantage when compared to classic repo. However there will be compensation payable if a coupon is not handed over straight away, usually at the repo rate used in the sell/buy-back. As sell/buy-backs are not subject to a legal agreement in some cases, in effect the seller has no legal right to any coupon, and there is no provision for marking-to-market and \textit{variation margin}. This makes the sell/buy-back a higher-risk transaction when compared to classic repo, even more so in volatile markets.

A general diagram for the sell/buy-back is given in Figure 5.6.

\subsection*{5.3.2 Examples of Sell/Buy-Back}

We use the same terms of trade given in Table 5.1 in section 5.2.2 but this time the trade is a sell/buy-back.\footnote{It is unusual, if not unheard of, to observe sell/buy-backs in the US Treasury market. However, we use these terms of trade for comparison purposes with the classic repo example given in the previous section.} In a sell/buy-back we require the forward price on termination, and the difference between the spot and forward price incorporates the effects of repo interest. It is important to note that this forward price has nothing to with the actual market price of the collateral at the time of forward trade. It is simply a way of allowing for the repo interest

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{sell-bu} \caption{Sell/buy-back transaction.}
\end{figure}
that is the key factor in the trade. Thus in sell/buy-back the repo rate is not explicit (although it is the key consideration in the trade) rather, it is implicit in the forward price.

In this example, one counterparty sells $10 million nominal of the US Treasury 3.625% 2019 at the spot price of 101.78, this being the market price of the bond at the time. The consideration for this trade is the market value of the stock, which is $10,209,146 as before. Repo interest is calculated on this amount at the rate of 6.25% for one week, and from this the termination proceeds are calculated. The termination proceeds are divided by the nominal amount of stock to obtain the forward dirty price of the bond on the termination date. For various reasons, the main one being that settlement systems deal in clean prices, we require the forward clean price, which is obtained by subtracting from the forward dirty price the accrued interest on the bond on the termination date. At the start of the trade the 3.625% 2019 had 32 days’ accrued interest, therefore on termination this figure will be 32 + 7 or 39 days.

Bloomberg users access a different screen for sell/buy-backs, which is BSR. This is shown in Figure 5.7. Entering in the terms of the trade, we see from Figure 5.7 that the forward price is 101.7173. However, the fundamental nature of this transaction is evident from the bottom part of the screen: the settlement amount (“wired amount”), repo interest and termination

amount are identical for the classic repo trade described earlier. This is not surprising; the sell/buy-back is a loan of $10,209 million for one week at an interest rate of 0.25%. The mechanics of the trade do not differ on this key point.

Screen BSR on Bloomberg has a second page, which is shown at Figure 5.8. This screen summarises the cash proceeds of the trade at start and termination. Note how the repo interest is termed “funding cost”. This is because the trade is deemed to have been entered into by a bond trader who is funding his book. This will be considered later, but we can see from the screen details that during the one week of the trade the bond position has accrued interest of $6,895. This compares unfavourably with the repo funding cost of $496.

If there is a coupon payment during a sell/buy-back trade and it is not paid over to the seller until termination, a compensating amount is also payable on the coupon amount, usually at the trade’s repo rate. When calculating the forward price on a sell/buy-back where a coupon will be paid during the trade, we must subtract the coupon amount from the forward price. Note also that sell/buy-backs are not possible on an open basis, as no forward price can be calculated unless a termination date is known.
5.4 COMPARING CLASSIC REPO AND SELL/BUY-BACK

Fundamentally both classic repo and sell/buy-backs are money market instruments that are a means by which one party may lend cash to another party, secured against collateral in the form of stocks and bonds. Both transactions are a contract for one party to sell securities, with a simultaneous agreement to repurchase them at a specified future. They also involve:

- in economic terms, an exchange of assets, usually bonds but also money market paper or equities as collateral against cash;
- the supplier of cash being compensated through the payment of interest, at an explicit (repo) or implicit (sell/buy-back) rate of interest;
- short-covering of positions by market makers or speculative sellers, when they are stock-driven trades.

In certain respects however, there are significant differences between the two instruments. A classic repo trade is carried out under formal legal documentation, which sets out the formal position of each counterparty in the event of default. Sell/buy-backs have traditionally not been covered by this
type of documentation, although this is no longer the case as standard docu-
mentation now exists to cater for them. There is no provision for marking-
to-market and variation margining in sell/buy-backs, issues we shall look at
shortly.

A summary of the main features of both types of trade is given in
Table 5.2.

5.5 STOCK LENDING

5.5.1 Definition

Stock lending or securities lending is defined as a temporary transfer of secu-
rities in exchange for collateral. It is not a repo in the normal sense; there is no
sale or repurchase of the securities. The temporary use of the desired asset
(the stock that is being borrowed) is reflected in a fixed fee payable by the
party temporarily taking the desired asset. In stock loan, the lender does not
monitor interest rates during the term of the trade, but instead realises value
by receiving this fixed fee during the term of the loan. This makes

<table>
<thead>
<tr>
<th>TABLE 5.2 Summary of Highlights of Classic Repo and Sell/Buy-Back</th>
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</thead>
<tbody>
<tr>
<td><strong>Classic Repo</strong></td>
</tr>
<tr>
<td>“Sale” and repurchase</td>
</tr>
<tr>
<td>Bid at repo rate: bid for stock, lend the cash</td>
</tr>
<tr>
<td>(Offer at repo rate: offer the stock, take the cash)</td>
</tr>
<tr>
<td>Sale and repurchase prices identical</td>
</tr>
<tr>
<td>Return to cash lender is repo interest on cash</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Bond coupon received during trade is returned to seller</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Standard legal agreement (BMA/ISMA GMRA)</td>
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<tr>
<td></td>
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<tr>
<td>Initial margin may be taken</td>
</tr>
<tr>
<td>Variation margin may be called</td>
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<tr>
<td></td>
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<tr>
<td>Specific repo dealing systems required</td>
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</tbody>
</table>
administration of stock lending transactions less onerous compared to repo. The formal definition of a stock loan is a contract between two parties in which one party lends securities to another for a fixed or open term. The party that borrows must supply collateral to the stock lender, which can be other high-quality securities, cash or a letter of credit. This protects against credit risk. Fabozzi (2001) states that in the US the most common type of collateral is cash; however, in the UK market it is quite common for other securities to be given as collateral, typically gilts. In addition the lender charges a fixed fee, usually quoted as a basis point charge on the market value of the stock being lent, payable by the borrower on termination. The origins and history of the stock-lending market are different from that of the repo market. The range of counterparties is also different, although of course a large number of counterparties are involved in both markets. Most stock loans are on an “open” basis, meaning that they are confirmed (or terminated) each morning, although term loans also occur.

Institutional investors such as pension funds and insurance companies often prefer to enhance the income from their fixed interest portfolios by lending their bonds, for a fee, rather than entering into repo transactions. This obviates the need to set up complex settlement and administration systems, as well as the need to monitor what is, in effect, an interest rate position. Initial margin is given to institutional lenders of stock, usually in the form of a greater value of collateral stock than the market value of the stock being lent.

5.5.2 Basic concepts

Stock lending transactions are the transfer of a security or basket of securities from a lending counterparty, for a temporary period, in return for a fee payable by the borrowing counterparty. During the term of the loan the stock is lent out in exchange for collateral, which may be in the form of other securities or cash. If other securities are handed over as collateral, they must be high-quality assets such as Treasuries, gilts or other highly rated paper. Lenders are institutional investors such as pension funds, life assurance companies, local authority treasury offices and other fund managers, and loans of their portfolio holdings are often facilitated via the use of a broking agent, known as a prime broker or a clearing agent custodian such as Euroclear or Clearstream. In addition, banks and securities houses that require stock to cover short positions sometimes have access to their own source of stock lenders—for example, clients of their custody services.

Stock lending is not a sale and repurchase in the conventional sense but is used by banks and securities houses to cover short positions in securities put on as part of market-making or proprietary trading activity. In some markets (for example, the Japanese equity market) regulations require a counterparty to have arranged stock lending before putting on the short trade.
Other reasons why banks may wish to enter into stock loan (or stock borrowing, from their viewpoint) transactions include:

- where they have effected a purchase, and then sold this security on, and their original purchase has not settled, putting them at risk of failing on their sale;
- as part of *disintermediation* between the stock loan market and the repo and unsecured money market.

An institution that wishes to borrow stock must pay a fee for the term of the loan. This is usually a basis point charge on the market value of the loan, and is payable in arrears on a monthly basis. In the Eurobond market the fee is calculated at the start of the loan, and unless there is a significant change in the market value of the stock, it will be paid at the end of the loan period. In the UK gilt market the basis point fee is calculated on a daily basis on the market value of the stock that has been lent, and so the total charge payable is not known until the loan maturity. This arrangement requires that the stock be *marked-to-market* at the end of each business day. The fee itself is agreed between the stock borrower and the stock lender at the time of each loan, but this may be a general fee payable for all loans. There may be a different fee payable for specific stocks, so in this case the fee is agreed on a trade-by-trade basis, depending on the stock being lent out. Any fee is usually for the term of the loan, although it is possible in most markets to adjust the rate through negotiation at any time during the loan. The fee charged by the stock lender is a function of supply and demand for the stock in the market. A specific security that is in high demand in the market will be lent out at a higher fee than one that is in lower demand. For this reason it is important for the bank’s Treasury desk\(^8\) to be aware of which stocks are in demand, and more importantly to have a reasonable idea of which stocks will be in demand in the near future. Some banks will be in possession of better *market intelligence* than others. If excessive demand is anticipated, a prospective short seller may borrow stock in advance of entering into the short sale.

The term of a stock loan can be fixed, in which case it is known as a *term loan*, or it can be open. A term loan is economically similar to a classic repo transactions. An open loan is just that: there is no fixed maturity term, and the borrower will confirm on the telephone at the start of each day whether it wishes to continue with the loan or will be returning the security.

As in a classic repo transaction, coupon or dividend payments that become payable on a security or bond during the term of the loan will be to the benefit of the stock lender. In the standard stock loan legal agreement, known as the OSLA agreement,\(^9\) there is no change of beneficial ownership when a security is lent out. The usual arrangement when a coupon is payable is that...

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8. Or whichever desk is responsible for covering short positions by borrowing or reverse-repoing stock.
9. After the trade association overseeing the stock loan market.
the payment is automatically returned to the stock lender via its settlement system. Such a coupon payment is known as a manufactured dividend.

Clients of prime brokers and custodians will inform their agent if they wish their asset holdings to be used for stock-lending purposes. At this point a stock-lending agreement is set up between the holder of the securities and the prime broker or custodian. Borrowers of stock are also required to set up an agreement with brokers and custodians. The return to the broker or custodian is the difference between the fee paid by the stock borrower and that paid to the stock lender. Banks that have their own internal lending lines can access this stock at a lower borrowing rate. If they wish to pursue this source they will set up a stock-lending agreement with institutional investors directly.

5.5.3 Example of Stock Loan

We illustrate a stock loan where the transaction is “stock-driven”. Let us assume that a securities house has a requirement to borrow a UK gilt, the 4.50% 2019, for a one-week period. We presume the requirement is to cover a short position in the stock, although there are other reasons why the securities house may wish to borrow the stock. The bond that it is offering as collateral is another gilt, the 4.25% 2011. The stock lender, who we may assume is an institutional investor such as a pension fund, but may as likely be another securities house or a bank, requires a margin of 5% as well as a fee of 20 basis points. The transaction is summarised in Table 5.3.

Note that in reality, in the gilt market the stock loan fee (here 20 bps) is calculated on the daily mark-to-market stock price, automatically within the gilt settlement mechanism known as CREST–CGO, so the final charge is not known until termination. Within the Eurobond market, for example in Clearstream, the fee on the initial loan value is taken, and adjustments are made only in the case of large movements in stock price.

There is no specialist screen for stock loan transactions on Bloomberg, but it is sometimes useful to use the RRRA screen for calculations and analysis; for example Figure 5.9 shows this screen being used to calculate the nominal amount of collateral required for the loan of £10 million nominal of the 4.25% 2011 gilt shown in Table 5.3. The margin-adjusted market value of the collateral is £11,242,546, and if this is entered into the “wired amount” field on the screen, with the current price of the stock, we see that it shows a required nominal of £10,703,551 of the 4.25% 2011 gilt.

5.6 COMPARING CLASSIC REPO AND STOCK LENDING

A stock loan transaction in which the collateral is in the form of cash is similar in some ways to a classic repo trade. Here we compare the two transactions. Consider the following situation: ABC is an entity, perhaps a bank or fund manager, that owns government bond G. Bank XYZ is a bank that
requires bond G in order to deliver into a short sale that it has transacted in G. To temporarily acquire bond G to cover the short sale Bank XYZ may enter into either a stock loan or a classic repo. Table 5.4 looks at the similarities between the two, and the differences.

### 5.7 REPO VARIATIONS

In the earlier section we described the standard classic repo trade, which has a fixed term to maturity and a fixed repo rate. Generally, classic repo trades will range in maturity from overnight to one year, but it is possible to transact longer maturities than this if required. The overwhelming majority of repo trades are between overnight and three months in maturity, although longer-term trades are not uncommon. A fixed-maturity repo is sometimes called a term repo. One could call this the “plain vanilla” repo. It is usually possible to terminate a vanilla repo before its stated maturity date if this is required by one or both of the counterparties.  

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10. The term delivery repo is sometimes used to refer to a vanilla classic repo transaction where the supplier of cash takes delivery of the collateral, whether in physical form or as a book-entry transfer to his account in the clearing system (or his agent’s account).
A repo that does not have a specified fixed maturity date is known as an open repo. In an open repo the borrower of cash will confirm each morning that the repo is required for a further overnight term. The interest rate is also fixed at this point. If the borrower no longer requires the cash, or requires the return of his collateral, the trade will be terminated at one day’s notice.

In the remainder of this section we present an overview of the most common variations on the vanilla repo transaction that are traded in the markets.

### 5.7.1 Tri-Party Repo

The tri-party repo mechanism is a relatively recent development and is designed to make the repo arrangement accessible to a wider range of market counterparties. Essentially it introduces a third-party agent in between the two repo counterparties, who can fulfil a number of roles from security custodian to cash account manager. The tri-party mechanism allows bond and equity dealers full control over their inventory, and incurs minimal settlement cost to the cash investor, but gives the investor independent confirmation that their cash is fully collater-alised. Under a tri-party agreement, the securities dealer delivers collateral to an independent third-party custodian, such as Euroclear.
TABLE 5.4 Comparison of Stock Loan Transaction with Repo

| Similarities                                                                                                                                                                                                 |  |
| ---                                                                                                                                                                                                         |  |
| ABC transfers bond G to XYZ.                                                                                                                                                                              |  |
| XYZ passes cash to the market value of G to ABC.                                                                                                                                                          |  |
| At the termination of the transaction, XYZ returns bond G to ABC.                                                                                                                                          |  |
| At termination, ABC returns the cash it received at the start of the transaction to XYZ.                                                                                                                   |  |

<table>
<thead>
<tr>
<th>Classic Repo Transaction</th>
<th>Stock Loan Transaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC is the stock seller. It may be viewed as the borrower of funds, but not in the context of this trade.</td>
<td>ABC is the stock lender.</td>
</tr>
<tr>
<td>XYZ is the stock buyer.</td>
<td>XYZ is the stock borrower.</td>
</tr>
<tr>
<td>ABC places cash received from XYZ on deposit, or otherwise invests it.</td>
<td>ABC receives cash from XYZ, which is collateral for the loan, and which is placed on deposit. The interest earned is payable to XYZ.</td>
</tr>
<tr>
<td>On termination, ABC returns the cash received at the start, together with interest charged at the repo rate.</td>
<td>On termination, ABC returns the cash to XYZ, together with the interest earned on it. XYZ pays over the fee charged by ABC for making the loan.</td>
</tr>
<tr>
<td>The net gain to ABC is based on the difference between the repo rate paid to XYZ and the rate earned on the cash placed on deposit.</td>
<td>The gain to ABC is considered as the stock loan fee.</td>
</tr>
<tr>
<td>If there is a coupon payment on bond G, this is paid by XYZ to ABC.</td>
<td>If there is a coupon payment on bond G to ABC.</td>
</tr>
<tr>
<td>On termination, ABC “buys back” bond G from XYZ at the repurchase price agreed at the trade start. As this is classic repo, the repurchase price is identical to the sale price, but the cash flow includes repo interest.</td>
<td>On termination, XYZ returns bond G to ABC, who returns the cash collateral it received at the start.</td>
</tr>
</tbody>
</table>

or Clearstream, who will place it into a segregated tri-party account. The securities dealer maintains control over which precise securities are in this

---

11. Clearstream was previously known as Cedel Bank. Other tri-party providers include Deutsche Bank and Bank of New York Mellon.
account (multiple substitutions are permitted) but the custodian undertakes to confirm each day to the investor that their cash remains fully collateralised by securities of suitable quality. A tri-party agreement needs to be in place with all three parties before trading can commence. This arrangement reduces the administrative burden for the cash-investor, but is not, in theory, as secure as a conventional delivery-versus-payment structure. Consequently the yield on the investor’s cash (assuming collateral of identical credit quality) should be slightly higher. The structure is shown in Figure 5.10.

The first tri-party repo deal took place in 1993 between the European Bank for Reconstruction and Development (EBRD) and Swiss Bank Corporation.12

A tri-party arrangement is, in theory, more attractive to smaller market participants as it removes the expense of setting up in-house administration facilities that would be required for conventional repo. This is mainly because the delivery and collection of collateral is handled by the tri-party agent. Additional benefits to cash-rich investors include:

- no requirement to install repo settlement and monitoring systems;
- no requirement to take delivery of collateral, or to maintain an account at the clearing agency;
- independent monitoring of market movements and margin requirements;
- in the event of default, a third-party agent that can implement default measures.

Set against the benefits is of course the cost of tri-party repo, essentially the fee payable to the third-party agent. This fee will include a charge for setting up accounts and arrangements at the tri-party agent, and a custodian charge for holding securities in the clearing system.

As well as being attractive to smaller banks and cash-rich investors, the larger banks will also use tri-party repo, in order to be able to offer it as a service to their smaller-size clients. The usual arrangement is that both dealer and cash investor will pay a fee to the tri-party agent based on the range of services that are required, and this will be detailed in the legal agreement in place between the market counterparty and the agent. This agreement will also specify, among other detail, the specific types of security that are acceptable.

![Figure 5.10 Tri-party repo structure.](image)

12. Stated in Corrigan et al. (1999), page 27.
as collateral to the cash lender; the repo rate that is earned by the lender will reflect the nature of collateral that is supplied. In every other respect, however, the tri-party mechanism offers the same flexibility of conventional repo, and may be transacted from maturities ranging from overnight to one year.

The tri-party agent is an agent to both parties in the repo transaction. It provides a collateral management service overseeing the exchange of securities and cash, and managing collateral during the life of the repo. It also carries out daily marking-to-market, and substitution of collateral as required. The responsibilities of the agent can include:

- the preparation of documentation;
- the setting up of the repo account;
- monitoring of cash against purchased securities, both at inception and at maturity;
- initial and ongoing testing of concentration limits;
- the safekeeping of securities handed over as collateral;
- managing the substitution of securities, where this is required;
- monitoring the market value of the securities against the cash lent out in the repo;
- issuing margin calls to the borrower of cash.

The tri-party agent will issue close-of-business reports to both parties. The contents of the report can include some or all of the following:

- tri-party repo cash and securities valuation;
- corporate actions;
- pre-advice of expected income;
- exchange rates;
- collateral substitution.

The extent of the duties performed by the tri-party agent is dependent of the sophistication of an individual party’s operation. Smaller market participants who do not wish to invest in extensive infrastructure may outsource all repo-related functions to the tri-party agent.

Tri-party repo was originally conceived as a mechanism through which repo would become accessible to smaller banks and non-bank counterparties. It is primarily targeted at cash-rich investors. However users of the instrument range across the spectrum of market participants, and include, on the investing side, cash-rich financial institutions such as banks, fund managers including life companies and pension funds, and savings institutions such as UK building societies. On the borrowing side users include bond and equity market makers, and banks with inventories of high-quality assets such as government bonds and highly rated corporate bonds.13

---

13. Fabozzi (2001) also refers to four-party repos. The difference between tri-party and four-party repo is given as follows: “in a four-party repo there is a sub-custodian that is the custodian for the lender.” This might occur because of legal considerations; for instance, local regulations stating that the custodian in a repo transaction must be a financial institution or must be based in a particular location.
Tri-party Repo: Further Discussion

The process of cash and collateral flow in a tri-party repo trade is illustrated in Figure 5.11.

**Deal agreed date**
- Bank
- Investor counterparty
- Agree transaction
- Advise agent
- Tri-party agent
- Bank a/c
- Investor a/c

**Deal start date**
- Bank
- Investor counterparty
- Tri-party agent
- Bank a/c
- Investor a/c
- Collateral
- Cash

Cash is transferred to the Bank’s account and securities to the Investor’s account after the tri-party agent confirms the collateral quality and adequacy.

**Termination date**
- Bank
- Investor counterparty
- Confirm deal end date
- Tri-party agent
- Bank a/c
- Investor a/c
- Collateral
- Capital and interest

The tri-party agent effects a simultaneous transfer of cash (original capital plus repo interest) versus securities.

**FIGURE 5.11** Tri-party repo flow.
Table 5.5 shows the acceptable collateral types as advised by the institutional
trust arm of a US investment bank. Table 5.6 shows typical yields available on the
different collateral types as at September 2009, and the amount of margin
required. Not surprisingly, bonds such as Treasuries and gilts are marked at
100% of their market value, with the highest margin required for collateral such
as listed equities that are outside of a recognised index.

<table>
<thead>
<tr>
<th>TABLE 5.5 Tri-Party Acceptable Collateral: US Investment bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government bonds</td>
</tr>
<tr>
<td>Government guaranteed/local authority bonds</td>
</tr>
<tr>
<td>Supranational bonds</td>
</tr>
<tr>
<td>Eurobonds</td>
</tr>
<tr>
<td>Corporate bonds</td>
</tr>
<tr>
<td>ABS/MBS</td>
</tr>
<tr>
<td>Convertible bonds</td>
</tr>
</tbody>
</table>

5.7.2 Hold-in-Custody Repo

This is part of the general collateral (GC) market and is more common in the
United States than elsewhere. Consider the case of a cash-rich institution
investing in GC as an alternative to deposits or commercial paper. The better
the quality of collateral, the lower the yield the institution can expect, while
the mechanics of settlement may also affect the repo rate. The most secure
procedure is to take physical possession of the collateral. However, if the
dealer needs one or more substitutions during the term of the trade, the settle-
ment costs involved may make the trade unworkable for one or both parties.
Therefore, the dealer may offer to hold the securities in his own custody
against the investor’s cash. This is known as a hold-in-custody (HIC) repo.
The advantage of this trade is that since securities do not physically move,
no settlement charges are incurred. However, this carries some risk for the
investor because they only have the dealer’s word that their cash is indeed
fully collateralised in the event of default. Thus this type of trade is sometime
referred to as a “Trust Me” repo; it is also referred to as a due-bill repo or a letter repo.

In the US market there have been cases of securities houses that went into
bankruptcy and defaulted on loans that were found to have pledged the same
collateral for multiple HIC repo trades. Investors dealing in HIC repo must
ensure:

- they only invest with dealers of good credit quality, since an HIC repo
  may be perceived as an unsecured transaction;
- they receive a higher yield on their cash in order to compensate them for
  the higher credit risk involved.
A **safekeeping repo** is identical to an HIC repo whereby the collateral from the repo seller is not delivered to the cash lender but held in “safe keeping” by the seller. This has advantages in that there is no administration and cost associated with the movement of stock. The risk is that the cash lender must entrust the safekeeping of collateral to the counterparty and has no means of confirming that the security is indeed segregated, and only being used for one transaction.

**TABLE 5.6 Tri-Party Yields, September 2009**

<table>
<thead>
<tr>
<th>Collateral Type</th>
<th>Valuation for Mark-to-Market Purposes</th>
<th>Indicative Yield Spread to Libor (Basis Points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OECD Sovereign bonds (e.g., UK gilts, US Treasuries, Bunds, 0–20 year maturity)</td>
<td>100%</td>
<td>−5 to −10</td>
</tr>
<tr>
<td>Bank CDs, LOCs (A1/P1 rated), Supranational securities</td>
<td>47%</td>
<td>+10 to +30</td>
</tr>
<tr>
<td>OECD Sovereign bonds (e.g., UK gilts, US Treasuries, Bunds, &gt;20-year maturity), and other OECD government debt rated AA– or better</td>
<td>96%</td>
<td>−5 to −10</td>
</tr>
<tr>
<td>G7 OECD domiciled corporate bonds rated AA– or better</td>
<td>90%</td>
<td>+10 to +50</td>
</tr>
<tr>
<td>G10 prime index equities (e.g., FTSE100, S&amp;P500, Nikkei225, CAC40, DAX30, IBEX35, MIB30)</td>
<td>80%</td>
<td>+20 to +100</td>
</tr>
<tr>
<td>Other prime index equities (e.g., OMX, BEL, HEX, TSE, QBX, KFX, NZSE, also FTSE and S&amp;P convertibles rated AA– or better)</td>
<td>80%</td>
<td>+50 to +100</td>
</tr>
<tr>
<td>Equities in Singapore SST30, Hong Kong HSI33</td>
<td>80%</td>
<td>+50 to +100</td>
</tr>
<tr>
<td>Equities in Johannesburg ASI40, Lisbon BVL30</td>
<td>70%</td>
<td>+100</td>
</tr>
<tr>
<td>G7 OECD domiciled corporate bonds and convertibles rated between AA– and BBB–</td>
<td>70%</td>
<td>+100 upwards</td>
</tr>
<tr>
<td>All other collateral, provided it is exchange-traded and with individual SEDOL numbers of less than $5 million value, and no more than $25 million total category value</td>
<td>65%</td>
<td>+100 upwards</td>
</tr>
</tbody>
</table>

*Source: Bloomberg, Morgan Stanley.*
Due to the counterparty risk inherent in an HIC repo, it is rare to see it transacted either in the US market or elsewhere. Certain securities are not suitable for delivery—for example, the class of mortgage securities known as whole loans in the US—and these are often funded using HIC repo (termed whole-loan repo).

5.7.3 Borrow/Loan vs Cash

This is similar in almost all respects to a classic repo/reverse repo. A legal agreement between the two parties is necessary, and trades generally settle delivery-versus-payment. The key difference is that under a repo agreement legal title over the collateral changes hands. Under a securities lending agreement this is not necessarily the case. The UK standard securities lending agreement does involve transfer of title, but it is possible to construct a securities lending agreement where legal title does not move. This can be an advantage for customers who may have accounting or tax problems in doing a repo trade. Such institutions will opt to transact a loan versus cash. The UK standard lending agreement also covers items such as dividends and voting rights and is therefore the preferred transaction structure in the equity repo market.

5.7.4 Bonds Borrowed/Collateral Pledged

In the case of a bonds borrowed/collateral pledged trade the institution lending the bonds does not want or need to receive cash against them, as it is already cash-rich and would only have to re-invest any further cash generated. As such this transaction only occurs with special collateral. The dealer borrows the special bonds and pledges securities of similar quality and value (general collateral). The dealer builds in a fee payable to the lending institution as an incentive to do the trade.

5.7.5 Borrow Versus Letter of Credit

This instrument is used when an institution lending securities does not require cash, but takes a third-party bank letter of credit as collateral. However, since banks typically charge 25–50 basis points for this facility, transactions of this kind are relatively rare.

5.7.6 Cross-Currency Repo

All of the examples of repo trades discussed so far have used cash and securities denominated in the same currency, for example gilts trading versus sterling cash, and so on. In fact, there is no requirement to limit oneself to single-
currency transactions. It is possible to trade, say, gilts versus US dollar cash (or any other currency), or pledge Spanish government bonds against borrowing Japanese government bonds. A cross-currency repo is essentially a plain vanilla transaction, but where collateral that is handed over is denominated in a different currency to that of the cash lent against it. Other features of cross-currency repo include:

- possible significant daylight credit exposure on the transaction if securities cannot settle versus payment;
- a requirement for the transaction to be covered by appropriate legal documentation;
- fluctuating foreign exchange rates, which mean that it is likely that the transaction will need to be marked-to-market frequently in order to ensure that cash or securities remain fully collateralised.

**Example 5.3 Cross-Currency Repo**

On 4 January 2000 a hedge fund manager funds a long position in US Treasury securities against sterling, for value the following day. It is offered a bid of 4.90% in the one-week, and the market maker also requires a 2% margin. The one-week Libor rate is 4.95% and the exchange rate at the time of trade is £1/$1.63. The terms of the trade are given below.

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade date</td>
<td>4 January 2000</td>
</tr>
<tr>
<td>Settlement date</td>
<td>5 January 2000</td>
</tr>
<tr>
<td>Stock (collateral)</td>
<td>US Treasury 6.125% 2001</td>
</tr>
<tr>
<td>Nominal amount</td>
<td>$100 million</td>
</tr>
<tr>
<td>Repo rate</td>
<td>4.90% (sterling)</td>
</tr>
<tr>
<td>Term</td>
<td>7 days</td>
</tr>
<tr>
<td>Maturity date</td>
<td>12 January 2001</td>
</tr>
<tr>
<td>Clean price</td>
<td>99–19</td>
</tr>
<tr>
<td>Accrued interest</td>
<td>5 days (0.0841346)</td>
</tr>
<tr>
<td>Dirty price</td>
<td>99.6778846</td>
</tr>
<tr>
<td>Gross settlement amount</td>
<td>$99,677,884.62</td>
</tr>
<tr>
<td>Net settlement amount (after 2% haircut)</td>
<td>$97,723,416.29</td>
</tr>
<tr>
<td>Net wired settlement amount in sterling</td>
<td>£59,953,016.13</td>
</tr>
<tr>
<td>Repo interest</td>
<td>£56,339.41</td>
</tr>
<tr>
<td>Sterling termination money</td>
<td>£60,009,355.54</td>
</tr>
</tbody>
</table>

The repo market has allowed the hedge fund to borrow in sterling at a rate below the cost of unsecured borrowing in the money market (4.95%). The repo market maker is “overcollateralised” by the difference between the value of the bonds (in £) and the loan proceeds (2%). A rise in USD yields or a fall in the USD exchange rate value will adversely affect the value of the bonds, causing the market maker to be undercollateralised.
It is also necessary to take into account the fluctuations in the relevant exchange rate when marking securities used as collateral, which are obviously handed over against cash that is denominated in a different currency.

5.7.7 Dollar Rolls

Dollar rolls are repo-type trades specific to the US mortgage-backed bond market. A dollar roll is so-called because the buyer “rolls in” the security and then may well return, or “roll out”, a different security, but one from the same issuer and with the same coupon rate. The procedure developed due to the special characteristics of mortgage-backed securities, as a means by which market makers could borrow stock to deliver into short positions. In essence dollar rolls are very similar to classic repo, as they are secured loans that involve the sale and simultaneous forward repurchase of a security. The main difference is that the party buying in the securities is not required to return the exact identical securities on termination, but only “substantially identical securities”. To be deemed identical, the returned security must have the same coupon rate, issuer and type of mortgage collateral. This is required because (amongst other reasons) with a mortgage pass-through issue, for a given coupon and programme there are a number of pass-through securities representing different underlying pools of mortgage loans. Therefore the dealer bank may not return a security with the identical underlying pool of mortgages. The dealer bank thus has some flexibility with regard to the collateral, and in return does not receive any margin. That is, the cash proceeds are those of the market value of the securities transferred. This in turn results in some cases in the repo rate being lower than the GC repo rate. The other significant difference is that coupon payments made during the term of the trade are retained by the buying party, thus making dollar rolls more akin to a true sale.

The mechanics of the forward market have an influence on dollar roll activity. The difference between the spot or cash price of an MBS issue and its forward price is known as the drop, and in a positive-sloping yield curve environment, the drop is always positive (in other words, the cash price of an MBS tranche is always higher than the forward price in this situation). Fund managers may exploit this difference by selling their holding of an MBS issue and buying it back forward, and making use of the sale proceeds in the intervening period. It is this feature of the mortgage bonds market that led to the development of dollar rolls, and from our description of it we can already observe its similarities to repo, although it is conceptually closer to a sell/buy-back. The cash proceeds in a dollar roll can be used by the seller

14. My thanks and appreciation to Mr Frank Fabozzi for his assistance with this section.
15. For a good introduction to mortgage-backed bonds see Hu (2001). The MBS chapters in Mr Fabozzi’s Handbook also provide an excellent description and review of the main analytical techniques.
during the term of the trade, as in a repo trade. However, the key difference between dollar rolls and repo, sell/buy-back and securities lending is of course that in a dollar roll, the seller forfeits the coupon interest and the principal repayment on the security during the term of the trade.

The term of a dollar roll can vary from one week to six months, although most trades are around one month in duration. In market terminology, selling the bond and buying it back forward is known as “selling the roll”, while buying the bond and selling it forward is “buying the roll”. The Bond Market Association (BMA) publishes a calendar of dollar roll settlement dates at the start of each year. The accounting authorities have stated that for a dollar roll to be deemed a “financing” trade rather than an actual sale of assets, the bonds must have been owned by the seller for a period of 35 days prior to their sale. Savings and loans institutions (thrifts) must take delivery of dollar rolls within 12 months, although other financial institutions need not take delivery.

Unlike in a classic repo, the funding rate on a dollar roll is a function of a number of special factors, assuming that the dealing bank is buying securities and lending cash. These include:

- the security sale and repurchase price;
- the size of any expected coupon payment;
- the level of expected principal repayments during the term of the trade;
- the level of prepayments during the term of the trade;
- the features of the similar security that is returned on maturity of the trade;
- the level of under- or over-delivery of securities allowed.

Since the repurchase price in a dollar roll must take into account any coupon payment, the repurchase price is frequently lower than the opening leg purchase price (bear in mind that mortgage-backed securities usually pay a monthly coupon). This contrasts with a classic repo, where, depending on one’s interpretation, the repurchase price is either greater than the sale price (the difference representing repo interest) or the same as the sale price, with repo interest an additional amount on the final cash flow. The amount of principal payments and prepayments also affects the financing rate, because all principal payments during the term of the trade are retained by the buyer. The buyer realises a gain if the security was originally purchased below par, as principal is paid off at par; if the security was purchased at a price above par, the buyer will realise a loss when principal is paid off. The total level of principal payments cannot be determined with certainty at the start of the trade, and this represents a risk to the buyer. Another material factor is what features the returned security possesses. This represents a risk for the seller.

There are additional esoteric factors that make dollar rolls differ from repo. The seller of securities may “under-deliver” the amount of securities by up to 0.1% of the agreed nominal value, and will do so if the price of the
The size of the drop can be a key motivation for entering into a dollar roll. As Hu states:

“Given the size of the drop, the implied financing rate is mathematically determined by the coupon rate of the mortgage pass-through [a type of MBS] and the monthly prepayment during the roll period.”

(Hu 2001, page 141).

Sometimes dealing banks will sell the roll because there is an arbitrage opportunity and short-term financing can be obtained at a favourable rate. Under certain circumstances, given the coupon of an MBS issue, its prepayment rate, current price and the market reinvestment rate, the current drop value will imply a certain funding rate. As the drop rises, the funding rate will decline, and vice versa. The point at which the value of the drop implies a funding rate that is equal to the market short-term repo rate is known as the break-even drop. At the break-even drop value, the mortgage bond holder will observe no difference from entering into a dollar roll or from continuing to hold the bond.

5.7.8 Repo-to-Maturity

A repo-to-maturity is a classic repo where the termination date on the repo matches the maturity date of the bond in the repo. We can discuss this trade by considering the Bloomberg screen used to analyse repo-to-maturity, which is REM. The screen used to analyse a reverse repo-to-maturity is RRM.

---

16. The facility to under- or over-deliver securities is known as the tolerance and has fallen from a 1% level when dollar rolls were first introduced.
Example 5.4 Dollar Roll and Calculation of Financing Rate

A fund manager holds $1 million nominal of the GNMA 7.5% 30-year bond. It enters into a one-month dollar roll with a repo dealer bank in which it sells the bond holding at a price of 100–05 and buys it back at a forward price of par. This gives a drop of 5/32nds, and although the trade assumes that $1 million nominal of the bonds will be bought back, there may be an under-delivery if part of the bond principal has repaid during the term of the trade.

The bonds are sold at 100–05, therefore the cash consideration is $1,001,562.50. On the buy-back date the fund manager will receive back the same or identical bonds for a price of par, or consideration of $1,000,000. Hence the value of the drop is $1,562 and is the difference between the sale and repurchase prices.

In return for this feature the fund manager must forgo the coupon interest that is receivable during the roll period, which is 7.50% on $1 million nominal for a period of 30/360 of a year. This is calculated as

\[
\left(7.50\% \times 1,000,000\right) \times \left(\frac{30}{360}\right)
\]

or $6,250.

In a dollar roll the dealing back is also entitled to scheduled and unscheduled prepayments of the bond’s principal balance. In our example the repayment of principal would result in a loss of 5 ticks per cent of par value, as the dealer has purchased the bonds by this much above par. This is a negative feature for the dealing bank but a positive feature for the fund manager. In common with all mortgage-backed securities analysis, in order to assess what level of prepayment can be expected, interested parties must assume a level of prepayment.\(^1\)

For the purposes of illustration we assume that this particular bond has a scheduled payment of principal of $5,000 per month and an assumed prepayment of $15,000 per month. As the dealing bank will lose 5/32nds per $100 nominal repaid, from these levels we can calculate that it will lose

\[
0.15625 \times \left(\frac{5,000}{100}\right)
\]

or $7.81 as a result of the scheduled principal repayment and

\[
0.15625 \times \left(\frac{15,000}{100}\right)
\]

or $23.44 as a result of prepayments.

We can now calculate the overall funding cost for the one-month period, as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupon interest foregone</td>
<td>6,250.00</td>
</tr>
<tr>
<td>Drop</td>
<td>1,562.00</td>
</tr>
<tr>
<td>Principal repayment</td>
<td>31.25</td>
</tr>
<tr>
<td>Total offset</td>
<td>1,593.25</td>
</tr>
<tr>
<td>Total funding cost</td>
<td>4,656.75</td>
</tr>
</tbody>
</table>

\(^1\) See either of the previously mentioned references for an introduction to the prepayment “speeds” used in the analysis of MBS issues. These are known as “PSA100”, “PSA200”, and so on, after the Public Securities Association (since renamed The Bond Market Association, and now part of SIFMA) that initially introduced them, and refer to an assumed level of prepayment of the underlying mortgages that are used as asset backing in an MBS transaction.
Therefore, the funding cost for the one-month term of the trade is

\[
4,656.75/1,001,52.50
\]

or 0.46495%.

The simple annualised financing rate is therefore 5.579%.

If during the term of the trade no repayments or prepayments had actually taken place, the offset against the foregone coupon would be lower, and consequently the funding cost for the fund manager would have risen.

Screen REM is used to analyse the effect of borrowing funds in repo to purchase a bond, where the bond is the collateral security. This is conventional and we considered this earlier. In essence, the screen will compare the financing costs on the borrowed funds to the coupons received on the bond up to and including maturity. The key determining factor is the repo rate used to finance the borrowing. From Figure 5.12 we see that the screen calculates the breakeven rate, which is the rate at which the financing cost equals the bond return. The screen also works out cash flows at start and termination, and the borrowed amount is labelled as the “repo principal”. This is the bond total consideration. Under “outflows” we see the repo interest at the selected repo rate, labelled as “Int. Exp”. Gross profit is the total inflow minus total outflow, which in our example is zero because the repo rate entered is the break-even rate. The user will enter the actual repo rate payable to calculate the total profit.

A reverse repo-to-maturity is a reverse repo with matching repo termination and bond expiry dates. This shown at Figure 5.13.

Repo-to-maturity is a low-risk trade as the financing profit on the bond position is known with certainty to the bond’s maturity. For financial institutions that operate on an accruals basis rather mark-to-market basis, the trade can guarantee a profit and not suffer any losses in the interim while they hold the bond.

### 5.7.9 Whole Loan Repo

_Whole loans_ are a fixed income instrument in the domestic US market; the term is typically used to refer to mortgage securitisation products such as pass-throughs but also covers other underlying assets such as retail asset receivables—for example, credit card loans. Whole loan repo is a repo using a whole loan as the collateral. The market developed in the US because of the demand for higher yields in a falling interest rate environment. The whole loan repo rate trades above the Treasury GC repo rate because of the lower quality of the collateral. In addition, the collateral itself suffers from prepayment risk – the risk that all or part of the outstanding amount is paid off ahead
FIGURE 5.12  Bloomberg screen REM; used for repo-to-maturity analysis, for UK Treasury 5.75% 2009 on 15 September 2009. ©Bloomberg L.P. Reproduced with permission.

FIGURE 5.13  Bloomberg screen RRM, used for reverse repo-to-maturity analysis, for UK Treasury 5.75% 2009 on 15 September 2009. ©Bloomberg L.P. Used with permission.
of the stated maturity date. This will have the effect of cancelling a repo trade that has been entered into using the whole loan as collateral. For these reasons, in general the whole loan repo trades at an average of 25–30 basis points above the Treasury repo rate.

5.8 REPO MECHANICS

5.8.1 Repo Collateral

The collateral in a repo trade is the security passed to the lender of cash by the borrower of cash. It is not always secondary to the transaction; in stock-driven transactions the requirement for specific collateral is the motivation behind the trade. However, in a classic repo or sell/buy-back, the collateral is always the security handed over against cash.\(^\text{18}\) In a stock loan transaction, the collateral against stock lent can be other securities or cash. Collateral is used in repo to provide security against default by the cash borrower. Therefore, it is protection against counterparty risk or credit risk; the risk that the cash borrowing counterparty defaults on the loan. A secured or collateralised loan is theoretically a lower credit risk exposure for a cash lender compared to an unsecured loan.

The most commonly encountered collateral is government bonds, and the repo market in government bonds is the largest in the world. Other forms of collateral include Eurobonds, other forms of corporate and supranational debt, asset-backed bonds, mortgage-backed bonds, money market securities such as T-bills, and equities.

In any market where there is a defined class of collateral of identical credit quality, this is known as general collateral or “GC”. So, for example, in the UK gilt market a GC repo is one where any gilt will be acceptable as repo collateral. Another form of GC might be “AA-rated sterling Eurobonds”. In the US market the term stock collateral is sometimes used to refer to GC securities. In equity repo it is more problematic to define GC and by definition almost all trades are specifics; however, it is becoming more common for counterparties to specify any equity being acceptable if it is in an established index; for example, a FTSE100 or a CAC40 stock, and this is the nearest equity market equivalent of general collateral. If a specific security is required in a reverse repo or as the other side of a sell/buy-back, this is known as a specific or specific collateral. A specific stock that is in high demand in the market, such that the repo rate against it is significantly different from the GC rate, is known as a special. We will look at specials again in Chapter 8.\(^\text{19}\) In the US market another term for special is hot.

\(^{18}\) So that even in a stock-driven reverse repo the collateral is the security handed over against the borrowing of cash by the repo seller.

\(^{19}\) Note that it is not technically correct to refer to a specific as a special unless its repo rate is materially different to the GC rate. A repo in a specific stock that trades at or near the GC rate is just that, a specific repo, and not a special.
Where a coupon payment is received on collateral during the term of a repo, it is to the benefit of the repo seller. Under the standard repo legal agreement, legal title to collateral is transferred to the buyer during the term of the repo, but it is accepted that the economic benefits remain with the seller. For this reason, coupon is returned to the seller. In classic repo (and in stock lending) the coupon is returned to the seller on the dividend date, or in some cases on the following date. In a sell/buy-back the effect of the coupon is incorporated into the repurchase price. This includes interest on the coupon amount that is payable by the buyer during the period from the coupon date to the buy-back date.

5.8.2 Repo Return

The return on a repo is the interest paid on the cash that is lent out as part of the transaction. It is therefore received by the supplier of cash, the repo buyer. This return is the repo rate, the money market rate for the relevant maturity term which is a function of the central bank base rate as well as supply and demand in the money market and repo market. As we noted earlier, this repo rate is explicit in classic repo and implicit in sell/buy-back. In a stock loan transaction, return is quoted as a fixed fee in basis points. This fee is also a function of supply and demand in the stock loan market. There will be some interaction between the stock loan and repo markets. Where cash is received as collateral in a stock loan, the stock lender must pay interest on this cash during the term of the loan, and the stock loan fee will reflect this interest liability.

Where a specific stock is in high demand, the repo rate payable on cash lent against must reflect this demand in a way that benefits the owner of this stock (the repo seller). Therefore the specific repo rate will be lower than the GC rate, and becomes known as a special rate. The benefit to the owner of a special stock is that they pay a lower rate of interest on cash that they have borrowed, compared to if they had borrowed the cash in a GC trade or in the unsecured market.

5.8.3 Repo Risks

We look at risks in dealing in repo later on in this book, but here we provide a basic overview. The primary risk in a money market transaction is credit risk, the risk that the borrower of cash will default during the term of the loan. Repo reduces this risk to the supplier of cash as it is secured. However, the risk is not eliminated, and even where AAA-rated collateral is supplied, there is still a legal process to be entered into that is time-consuming and administratively costly. There is also a risk in the nature of the collateral itself, which is sometimes known as issuer risk – the risk that the issuer of bonds defaults or is declared bankrupt. The supplier of cash will wish to ensure that the market value of collateral is at least equal to the value of cash lent; there is a
greater risk that this will not be the case for long-term trades or where the collateral is highly price-volatile. To counter this repo buyers often specify margin to guarantee a minimum value for collateral; they will also prefer that bonds supplied as collateral are of low modified duration and so have lower market risk.

Market risk is the risk that the value of a financial instrument falls due to the fluctuations in market price levels. For a bond this is the risk that its price falls due to changes in market interest rates. This is a risk for the repo buyer, the lender of cash, and is addressed through incorporating margins. The repo seller is of course also exposed to this market risk, as they are still the owner of the stock and will mark the loss on their balance sheet throughout the term of the repo trade.

5.8.4 Legal Treatment

Classic repo is carried out under a legal agreement that defines the transaction as a full transfer of the title to the stock. The standard legal agreement is the BMA/ISMA GMRA, which we review in Chapter 13. It is now possible to trade sell/buy-backs under this agreement as well. This agreement was based on the standard BMA legal agreement used in the US domestic market, and was compiled because certain financial institutions were not allowed to legally borrow or lend securities. By transacting repo under the BMA agreement, these institutions were defined as legally buying and selling securities rather than borrowing or lending them.

5.9 MARGIN

To reduce the level of risk exposure in a repo transaction it is common for the lender of cash to ask for a margin, which is where the market value of collateral is higher than the cash value of cash lent out in the repo. This is a form of protection should the cash-borrowing counterparty default on the loan. Another term for margin is overcollateralisation or haircut. There are two types of margin: an initial margin taken at the start of the trade, and variation margin which is called if required during the term of the trade.

5.9.1 Initial Margin

The cash proceeds in a repo are typically no more than the market value of the collateral. This minimises credit exposure by equating the value of the cash to that of the collateral. The market value of the collateral is calculated at its

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20. The risk that its price falls due to a downgrade in its credit quality is of course credit risk.
21. The Bond Market Association (BMA) was previously known as the Public Securities Association (PSA), so the GMRA is, in some quarters, still referred to as the PSA/ISMA agreement.
dirty price, not clean price – that is, including accrued interest. This is referred to as *accrual pricing*. To calculate the accrued interest on the (bond) collateral we require the day-count basis for the particular bond.

The start proceeds of a repo can be less than the market value of the collateral by an agreed amount or percentage. This is known as the *initial margin* or *haircut*. The initial margin protects the buyer against:

- a sudden fall in the market value of the collateral;
- illiquidity of collateral;
- other sources of volatility of value (for example, approaching maturity);
- counterparty risk.

The margin level of repo varies from 0–2% for collateral such as UK gilts to 5% for cross-currency and equity repo, to 10–35% for emerging market debt repo.

In both classic repo and sell/buy-back, any initial margin is given to the supplier of cash in the transaction. This remains true in the case of specific repo. For initial margin the market value of the bond collateral is reduced (or given a "haircut") by the percentage of the initial margin and the nominal value determined from this reduced amount. In a stock loan transaction the lender of stock will ask for margin.

There are two methods for calculating the margin; for a 2% margin this could be one of the following:

- (dirty price of the bonds) × 0.98
- (dirty price of the bonds)/1.02

The two methods do not give the same value! The RRRA repo page on Bloomberg uses the second method for its calculations and this method is turning into something of a convention.

For a 2% margin level the BMA/ISMA GMRA defines a “margin ratio” as:

\[
\frac{\text{collateral value}}{\text{cash}} = 102\%.
\]

The size of margin required in any particular transaction is a function of the following:

- the credit quality of the counterparty supplying the collateral; for example, a central bank counterparty, interbank counterparty and corporate will all suggest different margin levels;
- the term of the repo; an overnight repo is inherently lower risk than a one-year risk;
- the duration (price volatility) of the collateral—for example, a T-bill compared to the long bond;
- the existence or absence of a legal agreement; repo traded under a standard agreement is considered lower risk.
Certain market practitioners, particularly those that work on bond research desks, believe that the level of margin is a function of the volatility of the collateral stock. This may be either, say, one-year historical volatility or the implied volatility given by option prices. Given a volatility level of, say, 10%, suggesting a maximum expected price movement of $-10\%$ to $+10\%$, the margin level may be set at, say, 5% to cover expected movement in the market value of the collateral. This approach to setting initial margin is regarded as onerous by most repo traders, given the differing volatility levels of stocks within GC bands. The counterparty credit risk and terms of trade remain the most influential elements in setting margin, followed by quality of collateral.

In the final analysis margin is required to guard against market risk – the risk that the value of collateral will drop during the course of the repo. Therefore, the margin call must reflect the risks prevalent in the market at the time; extremely volatile market conditions may call for large increases in initial margin.

### 5.9.2 Variation Margin

The market value of the collateral is maintained through the use of variation margin. So if the market value of the collateral falls, the buyer calls for extra cash or collateral. If the market value of the collateral rises, the seller calls for extra cash or collateral. In order to reduce the administrative burden, margin calls can be limited to changes in the market value of the collateral in excess of an agreed amount or percentage, which is called a margin maintenance limit.

The standard market documentation that exists for the three structures covered so far includes clauses that allow parties to a transaction to call for variation margin during the term of a repo. This can be in the form of extra collateral (if the value of the collateral has dropped in relation to the asset exchanged) or a return of collateral, if the value has risen. If the cash-borrowing counterparty is unable to supply more collateral where required, they will have to return a portion of the cash loan. Both parties have an interest in making and meeting margin calls, although there is no obligation. The level at which variation margin is triggered is often agreed beforehand in the legal agreement put in place between individual counterparties. Although primarily viewed as an instrument used by the supplier of cash against a fall in the value of the collateral, variation margin can of course also be called by the repo seller if the value of the collateral has risen in value.

An illustration of variation margin being applied during the term of a trade is given in Example 5.5.
Example 5.5 Variation Margin

Figure 5.14 shows a 60-day repo in the 3.625% 2019, a US Treasury, where a margin of 2% is taken. The repo rate is 0.25%. The start of the trade is 16 September 2009. The clean price of the Treasury is 101.6875

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal amount</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Principal</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Accrued interest (32 days)</td>
<td>$3,152.17</td>
</tr>
<tr>
<td><strong>Total consideration</strong></td>
<td><strong>$1,020,027.17</strong></td>
</tr>
</tbody>
</table>

The consideration is divided by 1.02, the amount of margin, to give $1,000,026.67. Assume that this is rounded up to the nearest dollar.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan amount</td>
<td>$1,000,026.00</td>
</tr>
<tr>
<td>Repo interest at 0.25%</td>
<td>$423.62</td>
</tr>
<tr>
<td><strong>Termination proceeds</strong></td>
<td><strong>$1,000,450.62</strong></td>
</tr>
</tbody>
</table>

Assume that one month later there has been a catastrophic fall in the bond market and the 3.625% 2019 Treasury is trading down at 98.00. Following this drop, the market value of the collateral is now:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal</td>
<td>$996,183</td>
</tr>
<tr>
<td>Accrued interest (62 days)</td>
<td>$6107.34</td>
</tr>
<tr>
<td><strong>Market value</strong></td>
<td><strong>$986,107.34</strong></td>
</tr>
</tbody>
</table>

However, the repo desk has lent $1,000,026 against this security, which exceeds its market value. Under a variation margin arrangement it can call margin from the counterparty in the form of general collateral securities or cash.

The formula used to calculate the amount required to restore the original margin of 2% is given by:

\[
\text{Margin adjustment} = \frac{(\text{original consideration} + \text{repo interest charged to date} \times (1 + \text{initial margin})) - (\text{new all in price} \times \text{nominal amount})}{\text{nominal amount}}
\]

This therefore becomes:

\[
((1,000,026 + 204.82) \times (1 + 0.02)) - (0.98315 \times 1,000,000) = 37,085.44.
\]

The margin requirement can be taken as additional stock or cash. In practice, margin calls are made on what is known as a portfolio basis, based on the net position resulting from all repos and reverse repos in place between the two counterparties, so that a margin delivery may be made in a general collateral stock rather than more of the original repo stock. The diagrams below show the relevant cash flows at the various dates.
16 September

<table>
<thead>
<tr>
<th>Repo seller</th>
<th>$1million US Treasury 3.625% 2019</th>
<th>Bank repo desk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$1,600,026 loan proceeds</td>
<td></td>
</tr>
</tbody>
</table>

A variation margin call is made one month later after the price of the stock has fallen to 98.00

16 October

<table>
<thead>
<tr>
<th>Repo seller</th>
<th>$37,085 nominal 3.625% 2019</th>
<th>Bank repo desk</th>
</tr>
</thead>
</table>

16 November

<table>
<thead>
<tr>
<th>Repo seller</th>
<th>$1 million US Treasury 3.625% 2019</th>
<th>Bank repo desk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$1,000,450.62 termination proceeds</td>
<td></td>
</tr>
</tbody>
</table>

FIGURE 5.14 Variation margin cash flows.

SELECTED BIBLIOGRAPHY AND REFERENCES


