

CHAPTER 5

Repo Market Strategies in Financial Engineering

Solution to Exercise 1

You can approach clearing firms such as *Euroclear* or *Clearstream* and immediately borrow the “special” bond that you need to close the future position. These firms can lend you the bond in the exchange for cash or any general collateral that you possess. You would later return the special bond to them once you have secured it. You will receive your collateral along with any fees.

Solution to Exercise 2

a) 0% haircut implies the collateral is 30 million EUR and the cash received is also 30 million.

b) Now the Bund is more valuable than previously thought: by $101 - 100.50 = 0.50$. So, a portion of the bonds or equivalent amount of cash must be returned to the dealer by the borrower of the bond.

c) 2.7%.

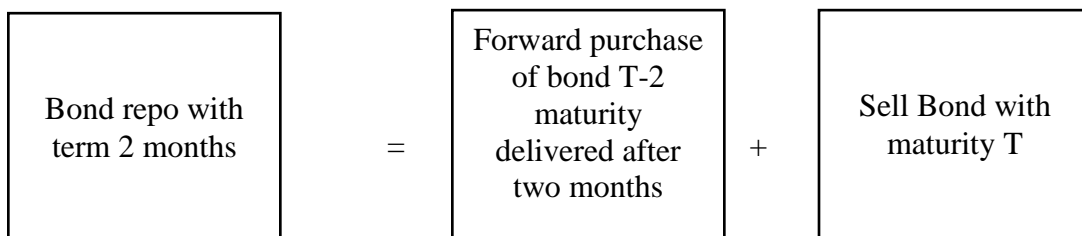
Solution to Exercise 3

a) 5% haircut implies the “lender” (of the bond) receives $0.95 \times 10,000,000$
 $= 9,500,000$ dollars

b) The dealer earns interest at 2.5% on the \$9.5 million he lends. But, the dealer can also re-lend 5% of the borrowed securities with 0% haircut and earn extra interest.

Solution to Exercise 4

a) He can set the strategy of creating synthetic repo by selling the bond and taking a long forward position to purchase the bond of maturity T-2.



b) The implied repo rate can be calculated using formula

$$F_{t_0} = B(t_0, T + 60) \left[1 + \frac{R_{t_0} * 60}{360} \right] = 43.59 * \left[1 + \frac{0.04 * 60}{360} \right] = 43.88$$

Solution to Exercise 5 (CTD and Repo Arbitrage Case Study)

Here we first review the three basic concepts that the exercises states as important background: (1) special repo versus general collateral, (2) the notion of cheapest-to-deliver bonds, and (3) failure to deliver.

5. 1a. General collateral (GC)

This is the case of a repo transaction between two parties where the borrower is willing to receive as collateral any of the securities satisfying a general set of criteria. The GC rate will be higher than the special Repo rate.

5.1b. Special Repo

The borrower asks for a particular security as collateral. Other similar securities are not accepted.

5. 1c. **Cheapest to Deliver (CTD)**

Bond futures are structured so as to result in physical settlement. The short who decides to deliver, will have to deliver a physical bond. But, usually, bonds of a certain maturity do not have large sizes to accommodate quick deliveries. Hence, the futures contracts will trade a hypothetical contract and then a physical bond that resembles the theoretical bond is delivered. For this reason Exchanges designate a set of bonds as belonging to a *deliverable basket*. Although the amount of each bond to be delivered is adjusted¹ so that they become similar to the settlement value of the theoretical bond at expiration, one of these deliverable bonds will in general be cheapest to deliver. The shorts will obviously deliver this bond called the CTD instead of more expensive ones to satisfy their liability. In this case study, the CTD is the 6.5% Bobl (see below) with maturity October 2005.

1d. **Failure to Deliver**

This occurs when a repo or futures counterparty that is short the bond, fails to deliver it will result in a failure to deliver. There are daily penalties for failure to deliver.

5. 2. Consequences

The fees for failing to deliver in repo markets are 1.33 basis points, whereas the fees for failing in Futures markets is 40bp. Hence, an agent who is short in the futures market will be penalized much more than an agent who is short in the repo market. This means that the shorts in the futures markets may be more willing to deliver the more expensive bonds instead, if they cannot find the CTD in the open market.

¹ This is done through the so-called adjustment factor.

The strategy works better if the profit from more accepting delivery of more expensive bonds is greater than the 1.33 basis points DB will be paying as penalty in the repo market.

The position of the DB will be as follows:

1. Let $B(t_0, T)$ denote the price of the CTD at time t_0 . DB will place this amount with the repo dealer at the repo rate r_{t_0} . The second leg of repo is chosen by DB so as to settle at time $t_1 - \Delta$. Where Δ is a short period of one or two days. On this date, the exchange of cash and bond is reversed and DB receives the repo interest.
 2. Assume that DB borrows the cash placed with the repo dealer at the going Libor rate L_{t_0} .
 3. Ignore the mark-to-market in the futures position. The futures position does not involve cash at time t_0 . It is assumed to settle at t_1 . Note that according to this, the CTD bonds are supposed to be returned to the repo dealer before futures contract expires. Hence, at that point these bonds will be available in the repo market.
 4. Yet, if DB fails to deliver, these bonds will not be available to the shorts.
- Let's now see how this can result in a squeeze.

5. 2.1. What is a Squeeze?

According to these positions, DB is long the March 2001 contract. This will put upward pressure on the futures price F_{t_0} . But DB is also borrowing the underlying CTD in the repo market.

Although, originally the bonds are supposed to be returned to the repo dealer before the t_1 , DB fails to deliver in the repo market. This removes these bonds from the repo market for a few days. Then, the shorts are either forced to close their positions by offsetting them with new long

positions, which means higher futures prices, or, by delivering the more expensive bonds from the deliverable basket. Either way, DB profits.

The following excerpt is from the BIS Quarterly Review, June 2001. It deals with the squeeze discussed in this case study. (See, Anatomy of a Squeeze by Serge Jeanneau and Robert Scott in the above-mentioned BIS Review.)

“The remarkable success of German government bond contracts has created some difficulties in recent years. Most recently, a market squeeze on the bobl contract was reported during the first quarter of 2001. The bobl is the five-year German government note, which is used as the underlying asset for related futures and options traded on Eurex. A small number of European banks apparently cornered the cheapest-to-deliver (CTD) note for the contract maturing in March 2001, causing major losses to traders with short positions. In futures markets, squeezes occur when holders of short positions cannot acquire or borrow the securities required for delivery under the terms of a contract. Delivery does not normally pose a problem for traders because the majority close their positions with offsetting transactions prior to contract expiry. However, a trader who remains short at the contracts expiration is obliged to deliver the specified securities, just as one who remains long must take delivery.

Because of the difficulty in obtaining transparent prices in bond markets, most contracts on government bonds require physical delivery. This is in contrast to contracts on interbank rates and equity indices, which are settled in cash on the basis of transparent price indices. Physical delivery requires specification of the range of eligible securities and a pricing mechanism to turn the different securities into equivalent assets.

(...)

In the case of the bobl future, the deliverable securities are German government notes with maturities between 4.5 and 5.5 years. To adjust for differences in coupons and maturities, the prices of these bonds are multiplied by a conversion factor based on a valuation of coupons and principal at an annual yield of 6 dates. However, because this adjustment is imperfect, one of the securities will always turn out to be cheapest to deliver, depending on the level of market interest rates and the slope of the yield curve.

(...)

Squeezes are more likely if the supply of the CTD is small, if the choice of CTD is highly predictable and if its rotation to other deliverable securities is prevented by a lack of issues with fairly similar price sensitivities.

(...)

Market circumstances in February 2001 appear to have provided a good opportunity for a squeeze. The CTD was the 6.5% note maturing in October 2005. Open interest in the bobl future rose to over 565,000 contracts by 22 February, amounting to a notional amount of 57 billion. This was over five times the stock of CTD notes and about one and a half times the total size of the deliverable basket. By contrast, the December and September 2000 contracts had respectively only 384,000 and 281,000 futures outstanding two weeks before expiry.

The graph below illustrates the dynamics of this squeeze. We see that open interest of the March 2001 had increased significantly. At the same time, we see that the spread between the yield of the CTD and the yield of the next cheapest bond went down from 3 bp to negative 2 bp. This means that the original CTD became more expensive as the expiration of the contract approached.”

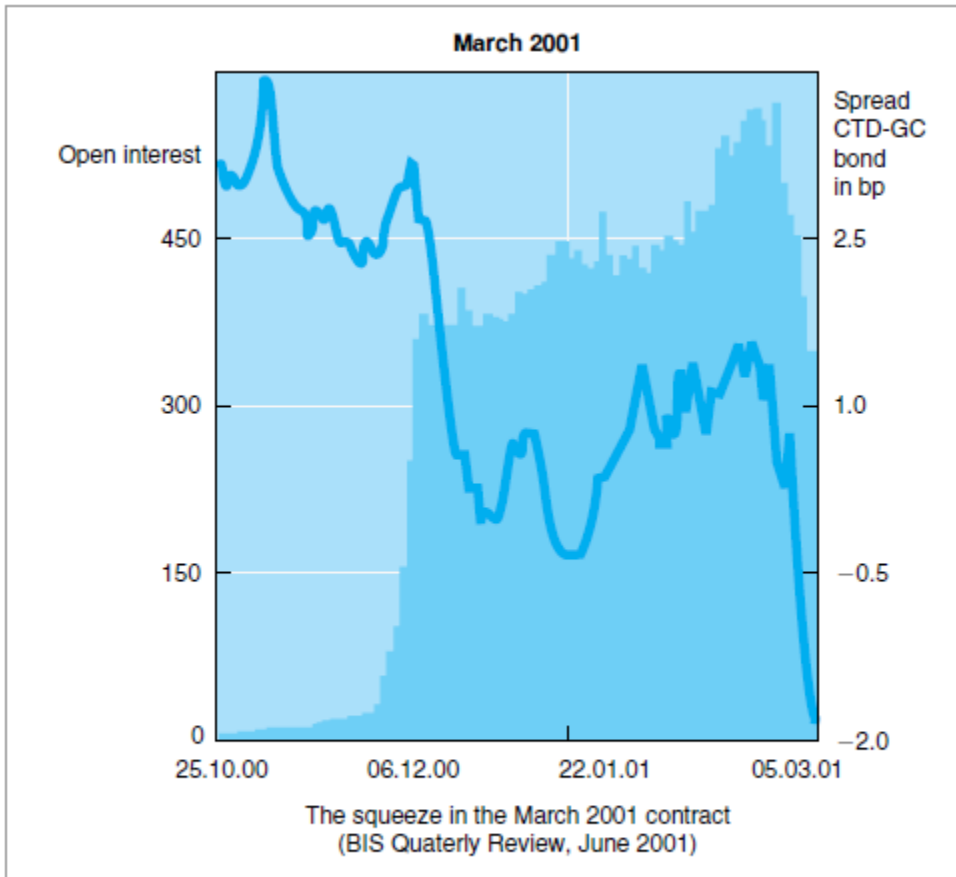


Figure 5:

5. 3. Hedging the short position

Can shorts use other ways to hedge their risks? Consider first a Total Return Swap. A Total Return Swap (TRS) is an exchange of interest and capital gains(losses) generated by a fixed income security against Libor plus a spread.

According to this in a TRS swap the receiver gains exposure to the underlying bond without any capital and without physically owning the asset. Clearly, the shorts could hedge their short positions in the CTD bond by entering a TRS. The TRS has to be set up with that particular bond

as the underlying. Of course, the spreads to Libor may already incorporate the price movements due to the squeeze and the hedge may not, at the end, be very useful. This especially is the case here, since the counterparty to the TRS deal will have to hedge his or her position and this means getting the CTD in the open market. This party will find out that this particular bond is expensive.

On the other hand, the use of FRA's will not help the shorts. It is unlikely that the FRA will move significantly due to this squeeze. Squeezes involve CTD's that are in relative small sizes when originally issued. A shortage in a small issue will not affect the overall level of bond prices.

5. 3.1. Zero repo rates

When a security is heavily demanded by market participants, the repo dealers will lend it at an "expensive price". The way this occurs is by adjusting the repo rate. Hence, the CTD in this question will be in heavy demand. To receive this bond in the repo market, shorts will have to surrender their cash at a rate lower than the normal repo rate. At the extreme, the repo rate will approach zero. On the other hand, the repo dealer is securing funds at a cost of 0% while lending them with a return of r_t .

5. 4. Other Readings

There are some other readings on this particular event that the readers may find useful. One is "The Banker, October 2001, Traders Squeeze Bobl ". Another is BID quarterly Reviews, for example, June 2002 issue. An academic paper that helps to understand the mechanics of squeezes and the related dynamics is by John Merrick, Narayan Naik and Pradeep Yadav, et. al.

“Strategic Trading Behavior and Price distortion in a Manipulated Market: anatomy of a Squeeze.”