

# CHAPTER 18

## Solutions

### Exercise 1

1. The standard approach here is to calculate some conventional ratios. These ratios can then be used along with regression analysis to estimate the default probability.
2. To obtain the migration matrix for a particular credit rating, one could look at the past ratings data on all corporates and calculate the statistical estimates for the transition probabilities from one rating to another in a given time period.
3. There are many credit ratings and each credit comes with a migration matrix. Using past data one can also calculate the joint probabilities that two or more credits migrate to a different rating.

### Exercise 2

1. See figure 5.6 and the related example in section 3.2.1 in the text.
2. See figure 5.5 and the related example in section 3.2 in the text.
3. Yes, a swaption will be needed. The main reason being that Bond A is callable after 3 years and matures in 4 years whereas Bond B matures in 5 years. It is clear that if interest rates decrease substantially, Bond A will be called.
4. First, let's look at the required structure to convert Bond A into Bond B:

- (a) To eliminate the credit risk involved in Bond A, we need to buy a CDS with 4 year maturity. That will change the credit of the initial portfolio from AA- to AAA.
- (b) Second step involves the conversion of fixed rate in to floating rate. For this we need a (fixed payer) interest rate swap in USD with maturity 5 years.
- (c) By using a cross currency swap (floating to floating), we exchange USD floating into DEM floating. So we need a currency swap for 5 years.
- (d) Finally, we need to hedge the risk mentioned in part (c). So we should buy a (Bermudan type) swaption in USD.

### **Exercise 3**

- (a) A typical cash flow diagram will incorporate the following. If you are short the CDO, then you receive a fixed amount at the initial point *t*<sub>0</sub>. Then you make payments made of a floating risk-free rate plus a fixed spread. However, if one or more of the underlying credits default your share of the defaulted amount will be deducted from the coupon.
- (b) Since you are receiving a spread over a floating rate, the interest rate risk is minimal. There is some risk only between the coupon payments dates. This can be hedged using strips of FRA's. Or, by using swaps as the reading suggests. Otherwise the CDO is an investment vehicle and the investor is exposed to changes in the credit curve. If needed, such risks can be hedged by taking positions on a proper set of CDSs.
- (c) A decline of the overall level of interest rates means the floating rates are going down. If the investor is hedged through the FRA's this will have no effect on the overall returns. On the other hand if default rates increase the value of the CDO will decline.

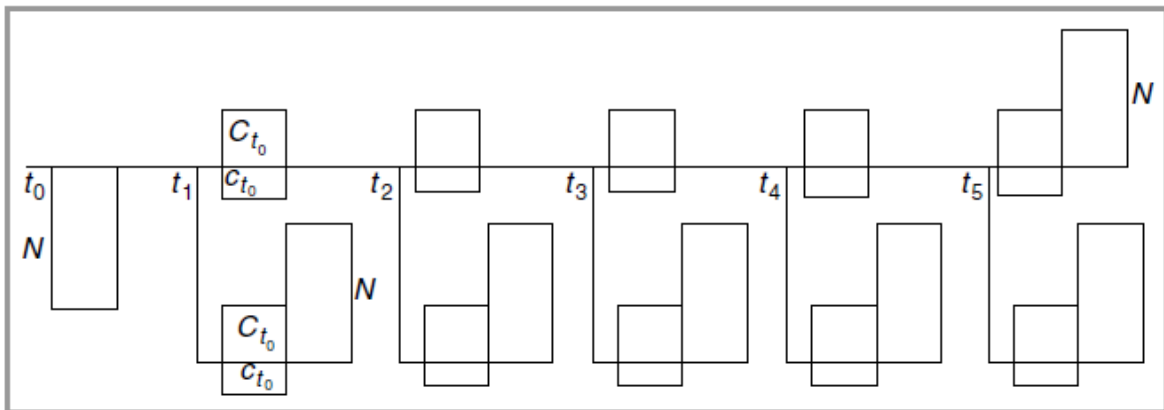
(d) As underlying credits default this will decrease the principal amount involved in the CDO during its life cycle. On the other hand if such a CDO is hedged using a swap, the swap notional will remain fixed. This means that a plain vanilla swap will end up introducing a basis risk. However, a customized swap where the swap notional decreases as CDO principal changes will be more expensive.

#### Exercise 4

TBC

#### Exercise 5

The following figure shows the cash flows involved in the trade.



ii. Clearly a negative basis trade is going on, leading to a riskfree gain. ING claims that while CDS rate  $c_{t_0}$  has decreased by 5bps, Attentat 2010 bond price has increased 1bp recently which is an anomaly. So, according to ING the CDS rate should eventually increase leading to gains from the current trade.

- iii. The bond is bought for 100 which pays fixed coupons  $C_{t_0}$  at each time point if it doesn't default. But it is default protected through the CDS by a payment of *midas*+27bp. The expected return is  $C_{t_0} - c_{t_0}$  at each coupon payment date. (Assuming that the insurer does not default.)
- iv. There might have been a surge of structured produce like CDOs being issued in the market which narrowed the CDS spread whereas the bond spread has actually increased.

### Exercise 6

- (a) If public debt leads to defaults in any of the items in the basket of protection sold, the investor has to pay up on that. But on the other hand the investor has hedged by buying protection on iTraxx crossover, which will guard against most of these defaults. Note that iTraxx crossover index is made up of 45 sub-investment grade (high risk of default) names. And they are most likely to default first. So it is more likely that the investor would receive payment from buying iTraxx crossover at 38bp than it would pay up for selling the CDS protection basket.
- (b) If the OECD basket's notional, say  $N$  increases by 20%, then the receipt from selling the CDS amounts to  $R_1 = N \times (1 + 20/100) \times 0.0034 = 0.0041 \times N$ . On the other hand payment by buying the iTraxx protection is  $P_1 = 0.0038 \times N$ . Hence there is a positive carry in this trade amounting  $R_1 - P_1 = 0.0003 \times N$ . A spread neutral position can be achieved by increasing  $N$  in OECD's basket even less (12% would do).
- (c) Since iTraxx is 0.65 correlated with OECD's basket, default in one basket would be highly correlated with the default in the other. iTraxx crossover protects against the high risk names, and hence a default in the OECD's basket is highly likely to occur with a

default in the names in iTraxx crossover. Hence iTraxx acts as a good hedge for the basket.

### Exercise 7

(a) A Landesbank in Germany is an independent commercial bank which is backed by the regional government and acts as the central bank for a group of regional banks. Besides this, sometimes they also offer many products and services alike modern commercial banks. For example, Landesbanks Baden-Württemberg (LBBW) is the central bank of the savings banks in Baden-Württemberg, Rhineland Palatinate and Saxony.

There are seven Landesbanks among the top 20 German banks with LBBW in the fifth place.

Backed by the regional governments the Landesbanks tend to have high ratings for both long term and short term credit. For example, according to the S & P ratings in 2008:

Landesbanks Baden-Württemberg : AA+/A-1+

Bayerische Landesbank: A/A-1.

(b) The LBBW is grandfathered and hence is guaranteed to provide the said returns on the holding. So if a trade neutral position is held by being short in DG Hyp 4.25% and long in LBBW 3.5% (under swaps), as spreads tighten, the gains from LBBW will remain the same but the payments for being short in DG Hyp will decline leading to eventual gains from holding this position.

(c) The same position can be replicated using CDS and a default-free deposit very simply. From the DG Hyp swap the investor pays coupons  $C_{t_1} = 4.25\% = c_{t_1} + s_{t_1}$  (say). On the other hand she receives Libor+6.5bp. Here 6.5 bp is the swap-rate spread  $s_{t_1}$ . So on a nominal N the payment is  $N(c_{t_1} - \text{Libor})$ .

On the other hand LBBW swap results in receiving is  $C_{t_0} c_{t_0} = 3.5\% = c_{t_0} + s_{t_0}$  (say).

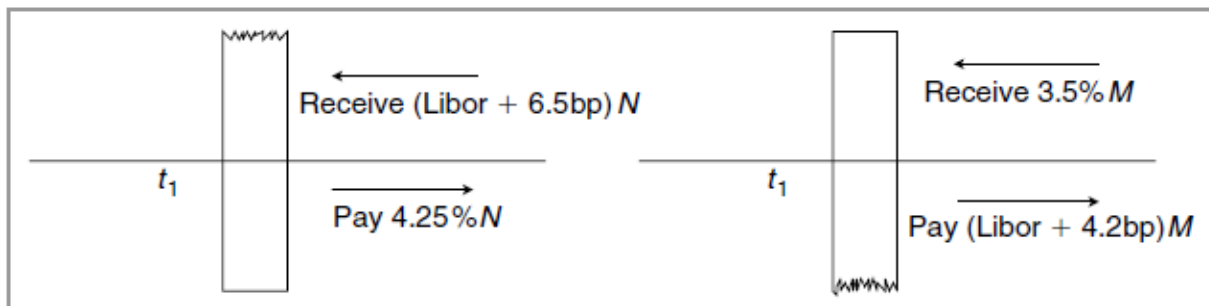
The payment is  $\text{Libor} + 4.2\text{bp}$ . Here 4.2 bp is the swap-rate spread  $s_{t_0}$ . So on a nominal  $M$  the receipt is  $M(c_{t_0} - \text{Libor})$ .

Hence total gain is  $G = M(c_{t_0} - \text{Libor}) - N(c_{t_1} - \text{Libor}) = M c_{t_0} - N c_{t_1} + (N - M)\text{Libor}$ .

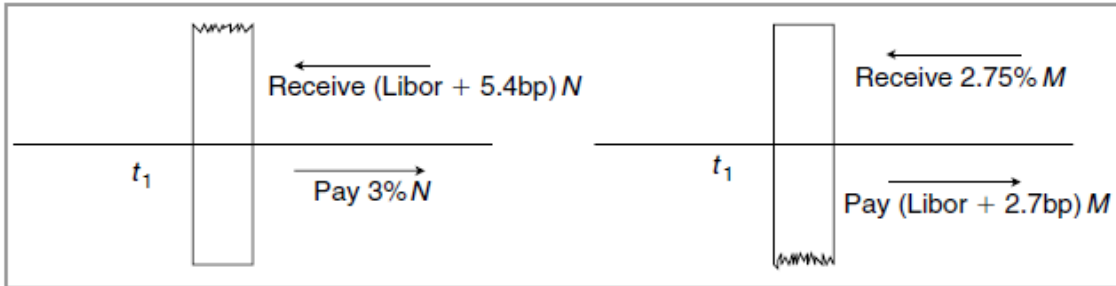
This position can be replicated by selling protection on LBBW 3.5% (which is secure by state guarantee) at a CDS rate  $c_{t_0}$  for a notional amount  $M$  and buying protection on DG Hyp 4.25% at CDS rate  $c_{t_1}$  on a notional amount  $N$ . An amount  $M - N$  is deposited in a default-free account enjoying  $\text{Libor}$ . Sell protection on LBBW 3.5%, and get into an IRS receiving  $\text{Libor} + \text{spread}$ , which is the swap rate,  $s_{t_0}$ . Also ([http://www.germanbanks.org/html/10\\_news/news\\_00.asp](http://www.germanbanks.org/html/10_news/news_00.asp))

### Exercise 8

- (a) The LBBW is grandfathered and hence is guaranteed to provide the said returns on the holding. So if a trade neutral position is held by being short in DG Hyp 4.25% and long in LBBW 3.5% (under swaps), as spreads tighten, the gains from LBBW will remain the same but the payments for being short in DG Hyp will decline leading to eventual gains from holding this position.



In the second case Land Berlin 2.75% is risk protected and hence the same logic as the previous case holds.



(b) Note that the trade has an yearly positive carry. Besides the 5-year iTraxx spread 38bp is considered to be high now, considering the forward rates. Hence they are expected to drop in the future. Thus this trade results in an advantage for the investor if implied forward rates are.

