

END OF CHAPTER EXERCISES

Chapter 6 : T-Bond Futures

Financial Engineering : Derivatives And Risk Management

(Keith Cuthbertson, Dirk Nitzsche)

- The duration of your long bond portfolio is 12 years. You hedge your position with a futures contract where the underlying (asset) has a duration of 3 years. You use a factor of 4 (= 12/3) to calculate the number of futures contracts in the hedge, N_f . If the volatility of 12-year rates is lower than that of 3-year rates, will the hedge be effective?
- Intuitively, if you are long a bond portfolio with duration of $D = 10$ years, how can T-bond futures be used to lower the duration of your bond portfolio? Why might you want to lower the duration of your bond portfolio?
- How does 'wild card play' help the person who holds a short position in a US T-bond futures contract?
- The average duration of your US bond portfolio of \$1m, on 15th February is 8 years. The September T-bond futures price (quote) is currently 110-16. The cheapest-to-deliver 'Note' against the futures contract has a duration of 7 years. How can you hedge against interest changes over the next 7 months?
- The current US, T-bond futures price is 101-12. Which of the following 3 bonds is cheapest to deliver ?

Bond	Price	Conversion Factor (CF)
2	142.20	1.3690
3	120.00	1.1200
4	144.16	1.4100

- On the 1st July you hold a bond portfolio of \$10m and the duration is 7 years. The December US T-bond (Note) futures price is 95-12. The cheapest to deliver bond (CTD) has a duration of 9 years and a conversion factor of unity. Any change in the bond yield, on average equals 90% of the change in the futures yield.
 - How can you hedge your bond portfolio over the **next 2 months**?
 - How can the duration of your bond portfolio be reduced to 3 years?
- It is 30th June and the current *quoted* bond price (i.e. ignoring accrued/rebate interest) for a 10% coupon bond is 112. Coupon payments on this bond are made on 4th February and 4th August each year. This bond is the CTD bond for a September US

T-bond futures contract which matures on 20th September. The conversion factor CF for this deliverable bond is 1.2.

On the 30th June the term structure is flat and the “rate of interest” is 9% (continuously compounded).

(Note: There are 182 days between 4th February and 4th August, 147 days between 4th February and 30th June, 47 days between 4th August and 20th September and 184 days between 4th August and next 4th February)

- (a.) What is the cash invoice price on 30th June of the underlying 10% coupon bond?
- (b.) What is the *no-arbitrage* T-bond futures price (on the underlying 10% coupon bond)?
- (c.) What would be the T-bond *quoted* futures price if the contract were written on the 10% bond? (Note that the quoted futures price takes account of accrued interest).
- (d.) What is the *quoted futures price* on CBOT given that the futures contract is actually written on a ‘standard’ 8% coupon bond (with over 15 years to maturity)?