Midterm for Math4511

Quantitative Methods for Fixed-Income Securities

October 25, 2012

Problems (The numbers in brackets indicate credits):

1 Let B_T be the price of a T-maturity bond with face value $F = 100$ and coupon rate c.

1.1 (4) Show that the T-maturity forward rate $r(T)$ satisfies

$$r(T) = 2\left[\frac{(1+\frac{c}{2})d(T-\frac{1}{2})}{B_T \big/ F - \frac{c}{2}\sum_{t=1}^{2T-1} d(\frac{t}{2})} - 1\right].$$

1.2 (4) Express $r(T)$ in terms of discount factors and $y(T)$, the T-year par yield.

2 Given the YTMs of four Treasury bonds in October 25, 2012 as follows:

Bond	YTM
3.5s of 4/25/2013	1.5%
3s of 10/25/2013	2%
4.5s of 4/25/2014	2.25%
4s of 10/25/2014	2.5%

Assume semiannual compounding. Calculate the following variables.

2.1 (4) Derive the forward rates from a half to two years (You may use the result of Problem 1).

2.2 (4) The discount factors from a half to two years using the forward rates just obtained.

2.3 (4) The par yields from a half to two years.

3 Calculate the transaction prices of the following bonds

3.1 (4) The 2.85s of December 15, 2016 with clean price of 101-8.

3.2 (4) The 3.25s of January 31, 2018 with YTM of 2.75%.

4 Suppose that both 4s of 10/25/2018 and 2.5s of 10/25/2014 are par bonds.

4.1 (4) Calculate analytically the modified durations of the two bonds.

4.2 (4) Suppose that you long one unit of 4s of 10/25/2018, calculate the units of 2.5s of 10/25/2014 that you need to *short sell* in order to neutralize the duration of the hedged portfolio (Assume that yields shift in parallel).

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