

Derivatives Lab

Session 5

September 24, 2012

1. Suppose you want to immunize a liability at time D with two bonds of Macaulay durations D_1 and D_2 , respectively. Show that the fraction ω_1 and ω_2 of the two bonds in the initial portfolio need to satisfy

$$\begin{aligned}\omega_1 + \omega_2 &= 1, \\ \omega_1 D_1 + \omega_2 D_2 &= D.\end{aligned}$$

2. Construct a “financial perpetual motion machine” as follows.
 - (a) Sell a zero coupon bond with a maturity date of 2 periods at interest rate r .
 - (b) From the proceeds of this transaction, buy zero coupon bonds at the identical interest rate r with a maturities of 1 and 3 periods in a combination which immunizes the liability at maturity time of the initial zero coupon bond.
 - (c) After one period, liquidate (convert to cash) all bonds at their current market value.
 - (d) Show that if the interest rate remained constant, you neither gain nor lose money through these transactions.
 - (e) Now assume a random change in interest rate during the first period. Repeat many times and display gains and losses. Describe what you see.
3. Visit the web site of the European Central Bank (ECB) and look for their yield curve data. What data is contained in the files?
(This is to be submitted as a written answer!)
4. The ECB publishes spot rate data in a downloadable CSV file. Find online documentation on how to read CSV files, read in the ECB spot rates, and plot the yield curve.