

CFRM 501 - Investment Science

Assignment 7

Due: December 14, 2020 - 11:59 pm

Late submissions will receive an automatic grade of zero.

Question 1: There are five bonds traded in the market with maturities $T = 1, 2, 3, 5, 10$. The bonds each have a face value of $F = 1$ and pay semi-annual coupons of size 2%. At time 0 the bond prices are:

Maturity (years)	1	2	3	5	10
Bond Price	1.0298	1.0194	1.0004	0.9570	0.8861

Table 1: Coupon bearing bond prices.

Estimate a yield curve for all times of the form $m/2$ for $m \in \{1, \dots, 20\}$ (use the bootstrapping method illustrated in lecture). For each bond also compute the yield-to-maturity, the Macaulay duration, and the duration.

Question 2: Download the historical US treasury yield curves posted on the course website. The maturities of these yields are 1, 2, 3, 5, 7, 10, 20, and 30 years.

Let $X_{i,n} = y_n(T_i) - y_{n-1}(T_i)$. Estimate a 3-factor model for \mathbf{X} where the factors are the first three principal components of \mathbf{X} . Plot the three factor loadings β_1 , β_2 , and β_3 . **Note:** when computing orthonormal eigenvectors, there is always a degree of freedom because if v is a normalized eigenvector then so is $-v$. Choose all of the eigenvectors such that the element corresponding to the 30 year yield is positive.

Continued Reading: Chapters 6, 7, and 9 of Asset Management by Andrew Ang must be completed before the final exam (December 14, 2020).