FNCE 529Q: Fixed Income Securities

Spring 2018 Term 1

Assignment 3 due 2/26/2018

Question 1:

You are the Chief Financial Officer of a small consulting firm called Risk Management Analytics, Inc., which develops software for risk management. The firm is earning (net of expenses) $90,000 every quarter on royalties of existing software products.

On March 30, 2018, the firm will begin to build a new risk management database for the top officers of large commercial banks (who, as we all know now, badly need it). The cost is projected to be $1,000,000 every 6 months for 3 years, starting on March 30, 2018.

Your firm has a line of credit up to $6,000,000 at a bank. Interest is paid every 3 months on the outstanding loan balance. The interest rate is set at 3-month LIBOR plus 200 basis points.

A. Assuming that the 3-month LIBOR rate remains unchanged at the current rate (which you need to look up) over the next 3 years, what is the expected quarterly interest cost?

B. Collect 90-day Eurodollar futures prices. Using that information, what is your expected quarterly interest cost over the next 3 years?

C. Discuss how you can use the Eurodollar futures contracts to "lock in" your financing rate over the next 3 years.

D. Discuss the pros and cons of this hedging strategy versus no-hedging.

Question 2:

We want to price the following security. Every 6 months, from March 2018 through March 2023, the following coupons are paid:

Period n	Date	Coupon Rate (paid at end of period)
0	Mar 18	-
1	Sep 18	$L6M_0 \times L6M_0 / 0.03$
2	Mar 19	$L6M_1 \times L6M_1 / 0.03$
3	Sep 19	$L6M_2 \times L6M_2 / 0.03$
4	Mar 20	$L6M_3 \times L6M_3 / 0.03$
5	Sep 20	$L6M_4 \times L6M_4 / 0.03$
6	Mar 21	$L6M_5 \times L6M_5 / 0.03$
7	Sep 21	$L6M_6 \times L6M_6 / 0.03$
8	Mar 22	$L6M_7 \times L6M_7 / 0.03$
9	Sep 22	$L6M_8 \times L6M_8 / 0.03$
10	Mar 23	$L6M_9 \times L6M_9 / 0.03$

$L6M_n$ is the annualized 6-month LIBOR rate observed at the end of period n stated in decimal form (i.e., 1% is 0.01).

A principal of $100 is also paid in the last period.

A. Calculate the value of this security using the current 3-month Eurodollar spot rates (LIBOR) and futures prices

B. Estimate the modified duration of this security.

[P.S., this was part of a transaction that Gibson Greetings did with Bankers Trust: http://www.nytimes.com/1994/09/13/business/gibson-files-lawsuit-over-derivatives.html]

Question 3:

In the Rendleman-Bartter model (Bloomberg's "fair value model"):

$$[r_{t+\Delta t}(1) - r_t(1)]/ r_t(1) = \lambda \times \Delta t + \sigma \times \sqrt{\Delta t} \times \varepsilon_t \text{ with } \varepsilon_t \sim N[0,1],$$

which is the same as the Black-Scholes model for stock prices and implies that each period the 1-period spot rate increases by a fraction u or decreases by a fraction d. The relationship between the binomial parameters $\{u, d, q\}$ and the spot rate process parameters $\{\lambda, \sigma\}$ is:

$$u = \exp\{\sigma \times \sqrt{\Delta t}\}, d = \exp\{-\sigma \times \sqrt{\Delta t}\} = 1/u, \text{ and } q = (\exp\{\lambda \times \Delta t\} - d)/(u-d)$$

Recall q is the risk-neutral probability of a spot rate increase.

A. You observe the following Treasury zero-coupon interest rates from STRIPS:

Time to maturity in years	Spot rate
1	3.00%
2	3.50%
3	4.50%
4	4.25%
5	4.50%
6	4.75%
7	5.00%
8	5.13%
9	5.25%
10	5.25%

These spot rates are based on semi-annual compounding.

Use solver to calibrate the Rendleman-Bartter model to these spot rates.

B. Use the calibrated model to determine the price of an 8-year 6.25% coupon Treasury bond, callable at par in 3 years.

C. Suppose this 8-year 6.25% coupon Treasury bond, callable at par in 3 years, is currently trading at 0.2% above your model price. Compute the option adjusted spread (OAS) of this mispriced bond.