

Homework I

March 12, 2015

Yield Curve Object & Bonds Object

In this task you will need to program a yield curve object and a bond object. Both object are going to interact with each other, and therefore we will describe them together. In addition, for simplicity, we are going to assume continuous compounding. For the question we will use the following yield curve.

Year	r
1	2%
2	2.3%
3	3%

You should design a yield curve object that has at least the following methods:

1. public double getInterestRate(double time); returns the per-year interest rate for a given duration in continues compounding.
2. public double getForwardRate(double t_1 , double t_2); return the forward rate between two dates. In continues compounding this translates to $\frac{r_0^{t_2} t_2 - r_0^{t_1} t_1}{t_2 - t_1}$
3. public double getDiscountFactor(double t); Should return the discount factor for a given duration. i.e., $e^{r_0^T T}$.

Your object should be able to create an object from a list of bonds (some Zero coupon some not). That is you should have at least a constructor that takes "List

jBond

i bonds" as one of its arguments.

You need to design a bond object/objects. Your object/objects should be able to represents at least a coupon bearing and non-coupon bearing bonds. A bond should be able to provide at least the following methods.

1. public double getPrice(); The price of the bound.
2. public double getCoupon(); The bond's coupon if any.
3. public double getMaturity(); The bond maturity in years.
4. public double getFaceValue(); The bond's face value.
5. public Map<Double,Double> getCashFlow(); This method can be used to get a map with the key being time and the value being the cash flow distributed at that period.

You should also implement the following methods in a place of your choice.

1. public double getPrice(YieldCurve ycm Bond bond); Calculate the bond's fair price given a yield curve object.
2. public double getYTM(Bond bond, double price); returns the yield-to-maturity of the bond for a particular price.
3. public double getPrice(Bond bond, double ytm); returns the bond's fair price given the yield to maturity.

In a package called edu.nyu.cims.compfin14.hw2 you should have a class called Test and the main should do the following.

1. Instantiate the yield curve that is described in question 3, and print the object (implement toString).

2. Assume a half year zero coupon bond with face value of 100\$ traded at 95\$ maturing in half a year. Another one with face value of 1000\$ traded at 895\$ maturing in a year. You should create two bonds objects and use them to instantiate a yield curve objects. print the yield curve. What is `getInterestRate(0.75)` returns? print it.
3. Use your yield curve to price a 5% coupon bond with 500\$ face value, which pays semi-annually and duration of three years. Print the price and YTM to the screen. You can use the yield curve from the beginning or the second question in your answer.