Fixed Income Assignment 3

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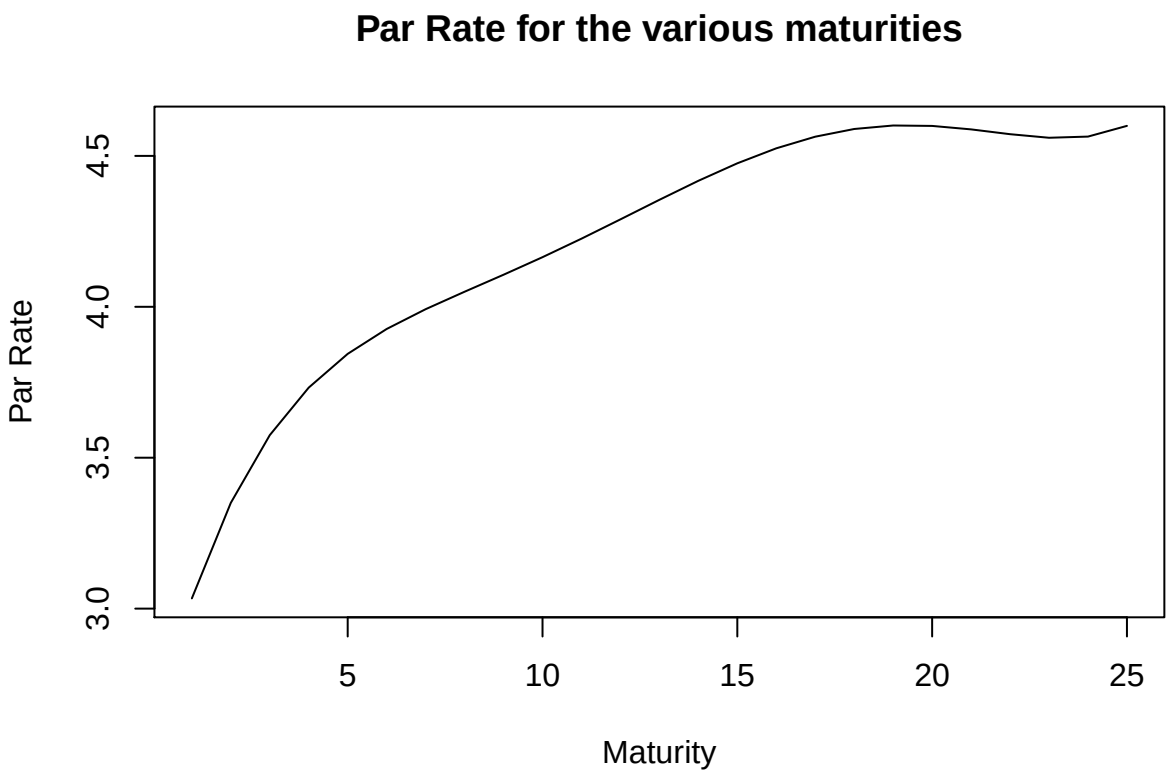
Question 1

The par rates using the bootstrapped zero coupon curves is as below from 1 to 25 years

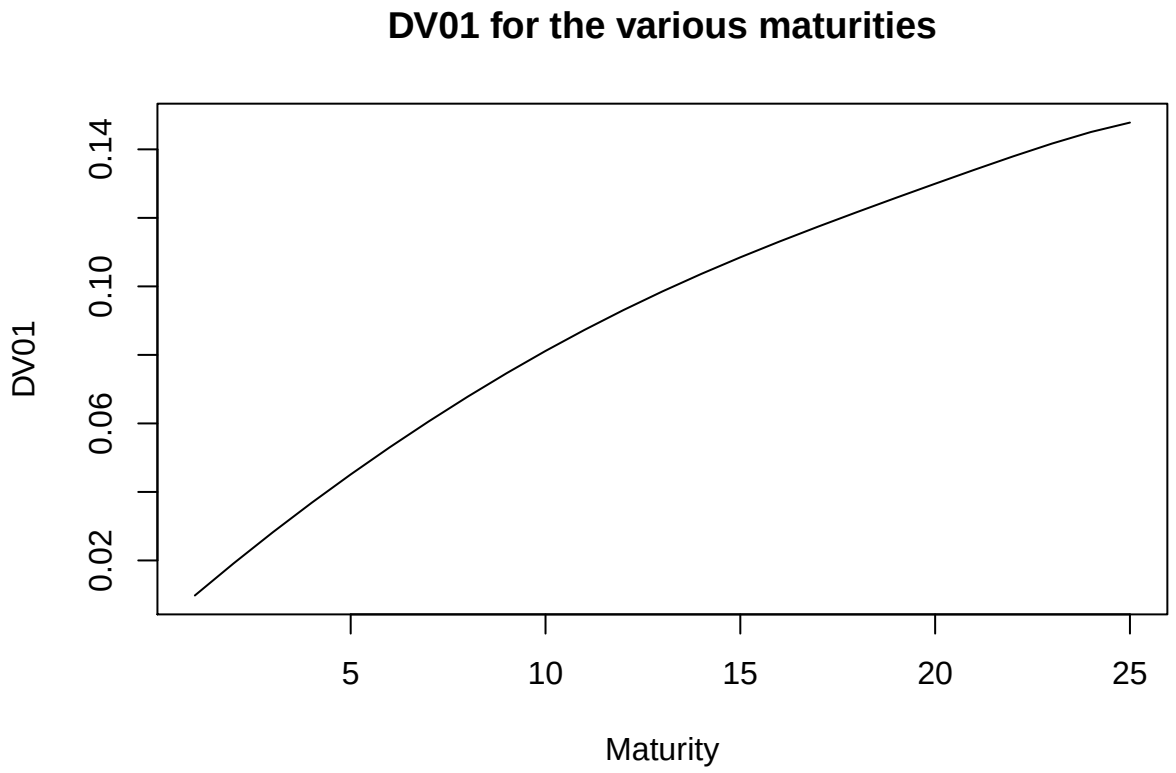
	Mat	ParRa
2	1	3.033883
4	2	3.350416
6	3	3.574708
46	23	4.560024
48	24	4.563963
50	25	4.599427



Question 2

DV01 can be caulated by decreasing the par rate by 1 bps and then finding the change in price.

	Maturity	DV01
2	1	0.0097777
4	2	0.0191920
6	3	0.0282140
46	23	0.1416905
48	24	0.1450692
50	25	0.1478141



Question 3

The Macauley and modified duration are:

	Maturity	Macauley Duration	Modified Duration
2	1	0.9925212	0.9776902
4	2	1.9509823	1.9188378
6	3	2.8707737	2.8203638
8	4	3.7512106	3.6824894
10	5	4.5933551	4.5067339

Question 4

The initial investment in in a 3 year zero coupon bondm is the present value of a liability of $5000000. This will be D(3) * 5000000. The value is:

```
## [1] 4494051
```

Question 5

The convexity formula can be applied and the resultant values are:

	Maturity	Convexity
2	1	1.440993
4	2	4.678763
6	3	9.554128
8	4	15.914579
10	5	23.620004

Question 6

Firstly, we can use the formula with duration and convexity to calculate change in price for a 1% hike or fall in interest rates.
Secondly, we get the price with a spot curve increase and decrease of 1%.

	Mat	up100bp	down100bp	up_priceCh	down_priceCh
2	1	-0.9704852	0.9848952	-0.9705322	0.9849427
4	2	-1.8954440	1.9422316	-1.8956719	1.9424622
6	3	-2.7725932	2.8681345	-2.7732108	2.8687603
8	4	-3.6029165	3.7620623	-3.6041956	3.7633615
10	5	-4.3886339	4.6248339	-4.3908986	4.6271422

Case

Compute Prices

Let us calculate the initial price using the 5% coupon and yield rate for the note and the 0.75% yield rate for the zero coupon TBill.

Bill	Note
99.2542	100

Compute Durations

Given the coupon and the yield value, we can calculate the macauley and the modifeid duration for both assets.

```
## Warning: package 'derivmkts' was built under R version 3.3.3
```

Bill	Note
0.996264	7.794581

Compute amounts

We can form a weighted sum of the bills and notes and match its duration to the duration of the yahoo bond. This will gives us the weight for the bils and the notes. The weights in percentage are as below:

Bill	Note
40.95022	59.04978

Value change due to decrease of 100 bps

The Value due to a change of 100bps can be calculated as (New Price - Old Price) * Original Amount.

```
## [1] -0.003364784
```

Reimmunization (decrease of 100bps)

In this case, after bumping the rates, we can re-calculate the weights using the new duration information.

```
##          Bill     Note
## [1,] 40.99211 59.00789
```

So the difference between the 2 situations is

```
##             Bill       Note
## [1,] -0.04852805 0.04852805
```

So, we need to short the bills and long the notes with a total value of $0.04852805 for a $100 face value yahoo bond.

Change due to increase of 100bps

Similar formulas to the previous case can be used. The change in value is:

```
## [1] 0.003508439
```

Reimmunization (increase of 100bps)

The new weights after re-calculating using new yields is as follows:

```
##         Bill    Note
## [1,] 40.9039 59.0961
```

So the difference between the 2 situations is

```
##            Bill        Note
## [1,] 0.05365516 -0.05365516
```

So, we need to long the bills and short the notes with a total value of $0.05365516 for a $100 face value yahoo bond.