Fixed Income Assignment 5

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Question 1

The optimised value of the parameters are:

Alphax	Sigmax	Sigmay	Betax	Betay
0.0514694	0.0181515	0.0023141	0.4935019	0.0103351

RMSE in %

0.0910861

Question 2

The mean and variance of the computed X and Y :

Table 2: Mean from model

X	Y
0.0881515	-0.032467

Table 3: Variance from model

X	Y
0.0002776	0.0001838

The theoritical mean and variance of X and Y using the formula are:

Table 4: Theoritical mean

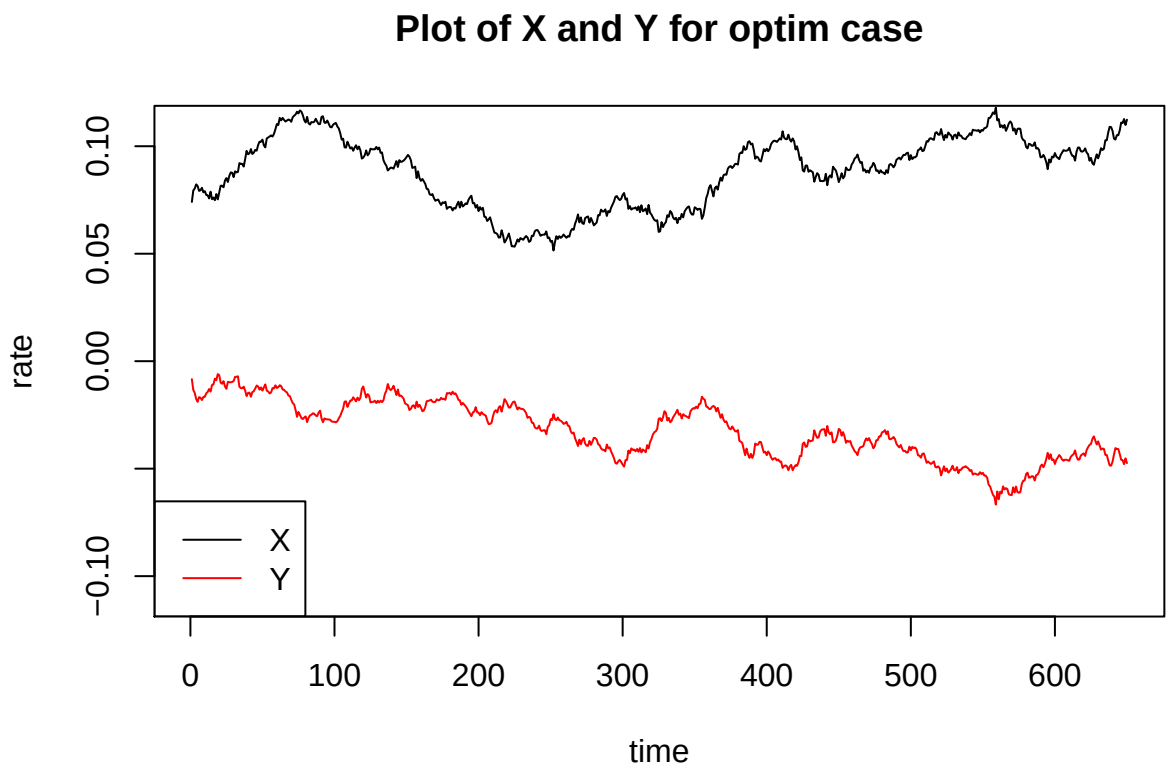
X	Y
0.1042943	0

Table 5: Theoritical variance

X	Y
0.0003338	0.0002591

As it can be seen, the mean and variance of the model are similar to the theoritical mean and variance.

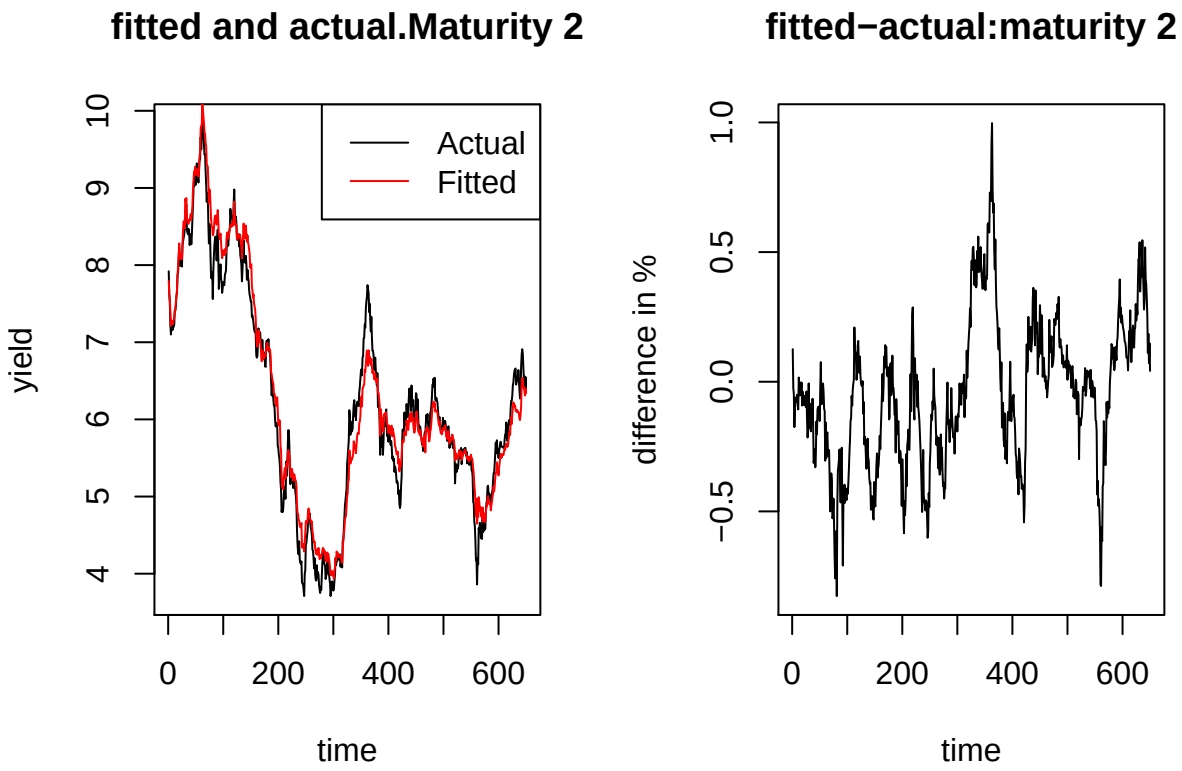
The plot of X and Y are as below:



Question 3

Maturity 2

The graph of the actual vs fitted and the deviations are:

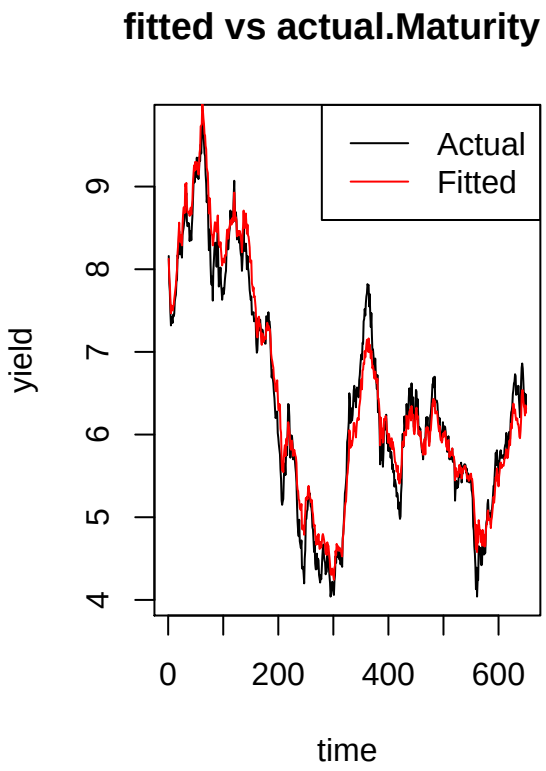


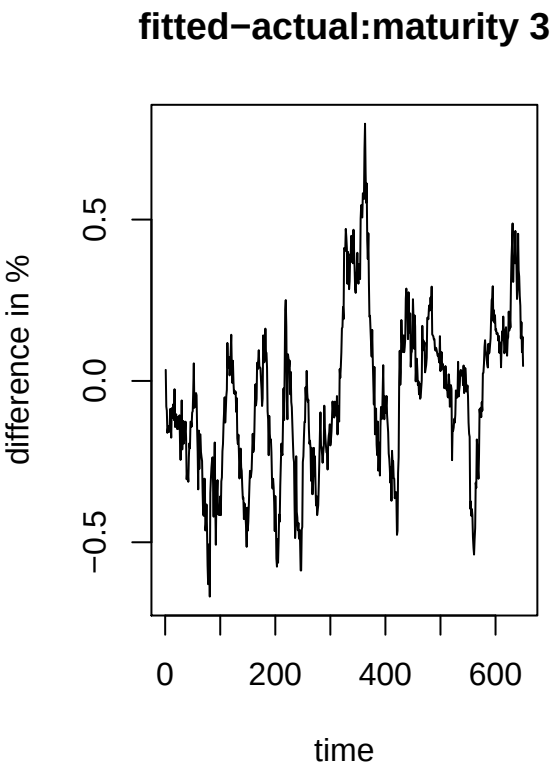
If we fit the deviation in a AR model,

1	2	3	4	5	6	7	8
0.7634726	0.1205837	0.1448811	0.0137408	-0.0259612	-0.0679121	0.1045382	-0.1029074

Maturity 3

The graph of the actual vs fitted and the deviations are:



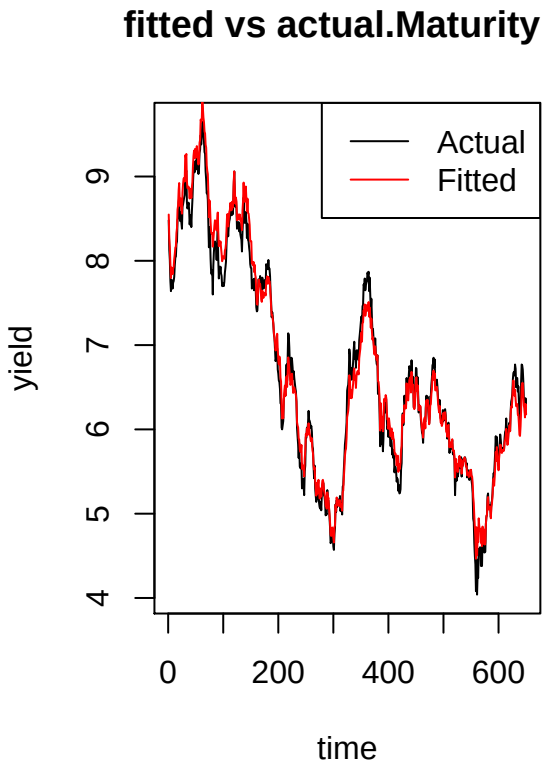


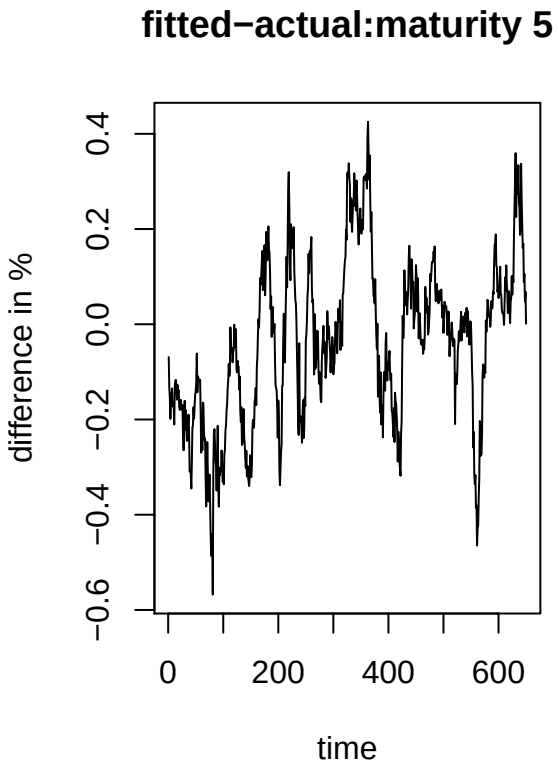
If we fit the deviation in a AR model,

1	2	3	4	5	6	7	8
0.8066158	0.1028318	0.1382273	-0.0056417	-0.0308524	-0.0107367	0.0425507	-0.0921408

Maturity 5

The graph of the actual vs fitted and the deviations are:



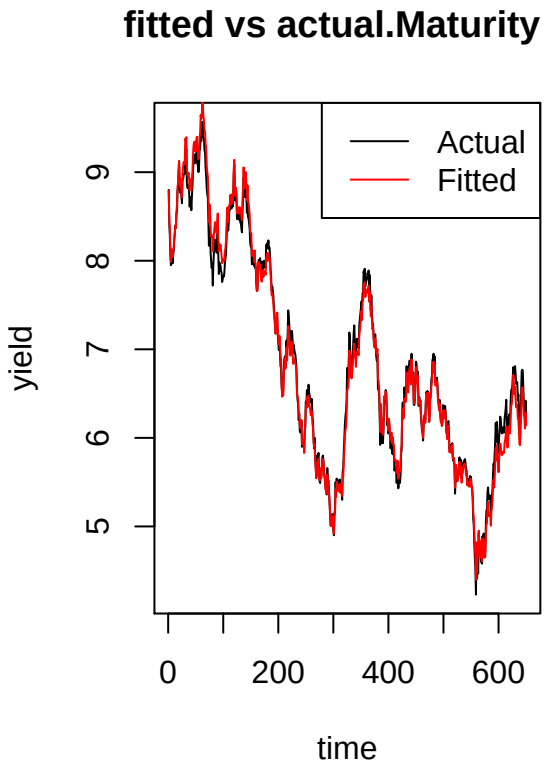


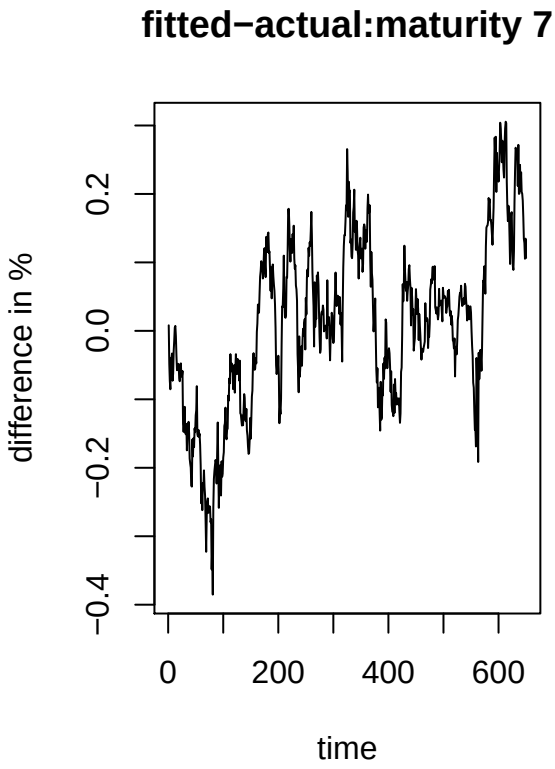
If we fit the deviation in a AR model,

1	2	3	4	5	6	7	8
0.8233009	0.1073699	0.1183638	-0.030353	-0.0242685	0.0002043	0.0542609	-0.0974103

Maturity 7

The graph of the actual vs fitted and the deviations are:





If we fit the deviation in a AR model,

1	2	3	4	5	6
0.8458077	0.1603703	-0.0549746	0.0356669	-0.0497254	0.0331088

This shows a high value for the 1st lag coefficient. The value is lower for low maturity bonds compared to higher maturity's. This might be because the variance of low maturity deviations is higher compared to the higher maturity deviations. This would mean the forecasting power of the higher maturity deviations is better.

Question 4

Hedge a 3year par bond for last week

We can assume that they are zero coupon bonds.

Differentiation method
For this method, we will differentiate the portfolio of the 3 year bond, 2 year and 10 year hedging bond based on X and Y (Vasicek Model rates). By setting it to 0, we can calculate weight on the 2 year and 10 year hedging bond.

2 Year	10 Year
-1.038729	-0.1232103

Duration and Convexity

For this method, we calculate the duration and convexity of the portfolio for 3 year bond, 2 year hedging and 10 year hedging bond. We expect both to be 0. Using that we can get the weight on the 2 year and 10 year hedges.

2 Year	10 Year
-1.236358	-0.0569485

Hedge a 5year par bond

Differentiation method

2 Year	10 Year
-0.807371	-0.4205472

Duration and Convexity

2 Year	10 Year
-1.307116	-0.2530192

Hedge a 7year par bond

Differentiation method

2 Year	10 Year
-0.4639182	-0.6954103

Duration and Convexity

2 Year	10 Year
-0.9746542	-0.5242278

As we can see, the ratio of weight towards the 10 year hedging bond increases with increase in maturity using the differentiation method, but doesn't follow a trend with the convexity method.

Differentiation method
1) It takes into consideration that there are individual components (X and Y), while coming up with the duration hedging.
2) It doesnt take convexity into consideration

Duration and Convexity method
1)This method takes the changes incorporated by X and Y together.

2) As it takes convexity, it might be better at handling the curvature of the duration of the bonds.