

## BOND CURVE BUILDING WITH B-SPLINES

Your task is to build a yield curve from UK government bond data. You will notice that there are many more payment dates than bonds.

- a) What difficulties does this give rise to?
- b) By representing the discount function as a sum of seven third order basis splines estimate the term structure of interest rates. To start with use the knot points defined on the template spreadsheet. You will need to use the Basis Spline function provided and also the regression analysis tool in Excel.
  - The function for generating Basis Splines is B spline3 it takes six arguments: one for each of the five knot points and one for the evaluation date in days. The function returns the Spline value for the evaluation date. This function and the bond data are contained in the Excel workbook ICBCSE3 Template
- c) Plot the spot and forward curves (six monthly intervals)
- d) How good is your yield curve estimation? Look at the output of the regression function and in particular the confidence intervals. Plot yield curves using the upper and lower 95% confidence intervals.
- e) Examine the residuals from your regression and test for heteroscedasticity

Starting Point: ICBCSE3 Template.xls

Answers: ICBCSE3 Answer.xls

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### Notes To The Answer Spreadsheet

The answers to this exercise are contained in sheet the Excel workbook ICMBCSE3 Answer.xls. The bond data and calculations are in sheet "Data". Note that there is one bond representing cash.

In this sheet it is the product of the output of each Spline function on each date and the cashflows for that date that are regressed against bond price.

Because there are only six splines being used there are only six explanatory variables (weighting factors). It is estimates of these weights that are generated by the regression.

Notice that once the regression coefficients have been generated they can be transferred directly to a point where they are used to calculate the discount factors.

The  $R^2$  figure and confidence intervals give you a measure of how good your yield curve is. The sheet also contains a set of discount factors that were used to price the bonds initially. These can be compared with the numbers generated by the regression. They are close but as you would expect, not exactly the same.

Notice that the Spline functions must start and end at points outside of the range of dates covered by the yield curve.

If you have time you might like to try experimenting with the effect that changing the start and end points for the Spline functions has on the yield curve. You should find the output reasonably robust as long as there is an even number of bonds between knot points.

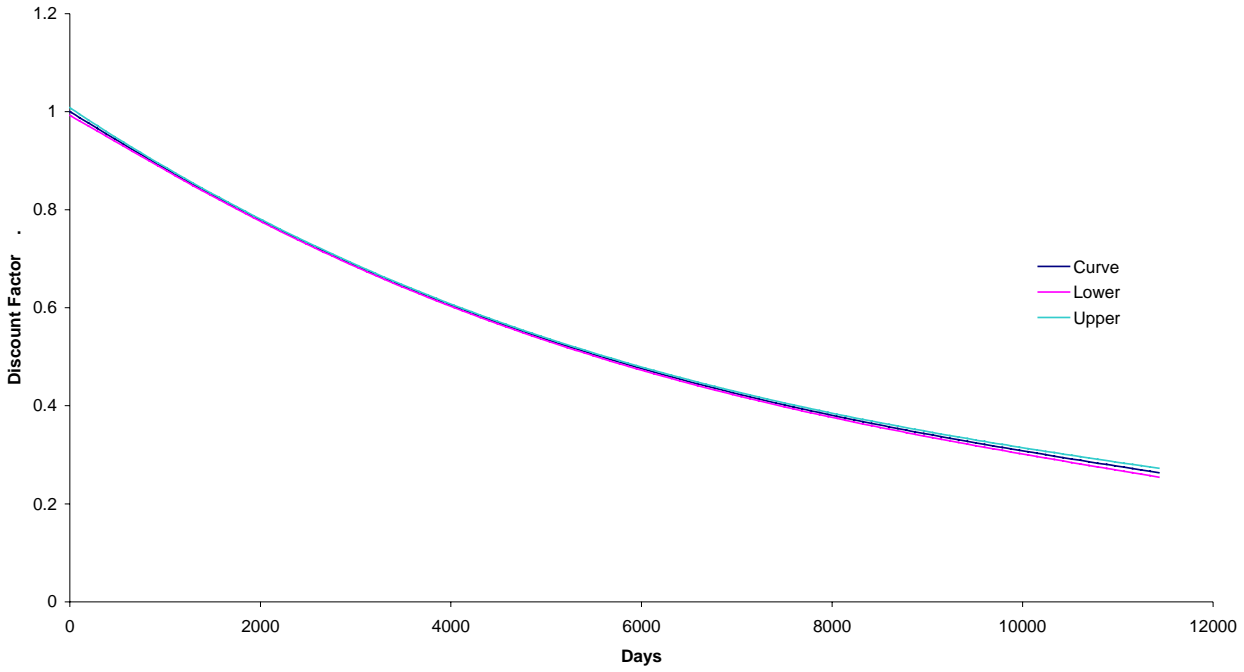
The confidence intervals are very wide at the short end of the curve because as the time period decreases a small alteration in discount factor produces an increasingly large alteration in interest rate. Note that the confidence intervals on the discount curve are fairly constant.

Also notice what is happening to the forward rate at the long end of the curve. Is this realistic?

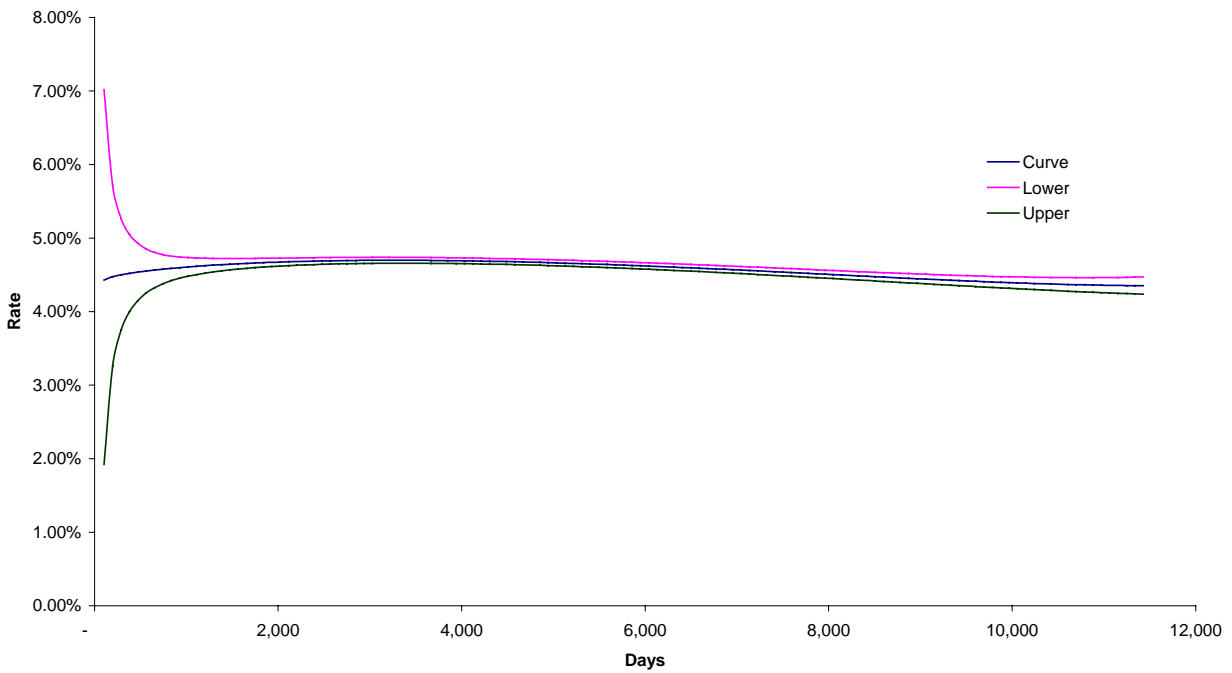
Graphs are as follows:



### Discount Curve



### Yield Curve



### Forward Curve

