



FIXED INCOME SECURITIES

FRE : 6411

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Yield Curve Interpolation

Cubic Spline

- Consider Constant Maturity Treasury from 12/31/2021-12/31/2022.
- Interpolate end of month (EOM) continuous yield curve using cubic spline interpolation, and 1,2,3,5,7,10,20,30 years CMT yields as discrete knots observations.
- For yield less than 1 year, assume $y_\tau = y_1$ for $\tau \leq 1$ year.
- For each month calculate M_{i+1}
 - $S_i''(x_{i+1}) = S_{i+1}''(x_{i+1}) = 2a_{2i} + 6a_{3i}x_{i+1} = 2a_{2i+1} + 6a_{3i+1}x_{i+1} = M_{i+1}$
- Plot the monthly yield curve
- Complete the following table.
- Describe a brief step by step methodology that you followed.



Cubic Spline M_i

M	1	2	3	4	5	6	7	8	9	10	11	12
1												
2												
3												
5												
7												
10												
20												
30												



Price and Return Cubic Spline

- Assume CMT are zero coupon yields, estimate the end of the month (EOM) prices and monthly rate of returns for the following treasury bonds and note. (Note to calculate the January return, first interpolate the price on 12/31/2021.)

Bond	Coupon Rate	Maturity
Bond A	4.75	02/15/2041
Bond B	1.5	2/15/2030
Bond C	3.5	01/31/2028
Bond D	1.125	1/15/2025
Bond E	3.125	8/15/2044

[illegible][illegible]

Yield Curve Interpolation

Nelson-Siegel model

- Consider Nelson-Siegel model in which :

$$y(\tau) = \beta_1 + \beta_2 \left(\frac{1 - e^{-\lambda\tau}}{\lambda\tau} \right) + \beta_3 \left(\frac{1 - e^{-\lambda\tau}}{\lambda\tau} - e^{-\lambda\tau} \right)$$

- Fix $\lambda = 2.5$, Estimate EOM continuous yield curve using Nelson-Siegel parametrization. Use EOM 1,2,3,5,7,10,20,30 years CMT yields as discrete observation to estimate monthly $\beta_1, \beta_2, \beta_3$.

	1	2	3	4	5	6	7	8	9	10	11	12
β_1												
β_2												
β_3												



Price and Return NS

- Estimate the EOM price and monthly rate of return of given 5 treasuries, assuming NS parametrization and estimate monthly $\beta_1, \beta_2, \beta_3$. (Note to calculate the January return, you need to first interpolate the price on 12/31/202.)
- Describe a brief step by step methodology that you followed.



Price and Return Table NS

Pri	1	2	3	4	5	6	7	8	9	10	11	12
A												
B												
C												
D												
E												

Ret	1	2	3	4	5	6	7	8	9	10	11	12
A												
B												
C												
D												
E												