FIXED INCOME SECURITIES

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HW Lecture 1

- $P^{t_0}(y) = \sum_{i=1}^{N} C_i \left[\frac{1}{1+y}\right]^{-\frac{T_i - t_0}{365}}$
  - $C_x = \frac{1}{2P^{t_0}(y)} \frac{\partial^2 P^{t_0}(y)}{\partial y^2}$
  - $D = -\frac{(1+y)}{P^{t_0}(y)} \frac{\partial P^{t_0}(y)}{\partial y}$
  - Express C_x and D in summation form in terms of C_i and T_i as above expression of $P^{t_0}(y)$.

HW Lecture 1

- Enclosed is ALL outstanding US Treasury Security (Bills, Notes and Bonds) on 11/2/2021
  - For each of the securities compute its bond statistic (YTM, Duration, Modified Duration & Convexity)
- Construct 5 different equally value weighted portfolios of above securities each valued at $100,000,000 and :
  - Portfolio A are ALL US Treasury Security with Minimum of 15 Years to Maturity
  - Portfolio B are ALL US Treasury Security with Minimum of 10 and Maximum of 15 Years to Maturity
  - Portfolio C are ALL US Treasury Security with Minimum of 7 and Maximum of 10 Years to Maturity
  - Portfolio D are ALL US Treasury Security with Minimum of 2 and Maximum of 7 Years to Maturity
- For Each of the above Portfolios compute the Portfolio Bond Statistics (YTM, Duration, Convexity).
- Compare the computed Portfolio Duration and Convexity with the Duration and Convexity obtained as value weighted sum of the portfolio component.
- Assume you Hedge Fund Fix Income Manager. (Butterfly Trade)
  - You believe that the YTM of the portfolio C is high compare with the YTM of portfolio A and D. As such you would like to purchase 1 unit of portfolio C ($N_c = 1$) and short appropriate number of portfolios A and D, such that :
  - The overall portfolio will be Duration Neutral $D_p = 0$.
  - The overall portfolio will be Convexity Neutral $C_{xp} = 0$.

HW Lecture 1

- $\frac{N_A P_A}{N_A P_A + N_C P_C + N_D P_D} D_A + \frac{N_C P_C}{N_A P_A + N_C P_C + N_D P_D} D_C + \frac{N_D P_D}{N_A P_A + N_C P_C + N_D P_D} D_D = D_p = 0$
- $\frac{N_A P_A}{N_A P_A + N_C P_C + N_D P_D} C_{xA} + \frac{N_C P_C}{N_A P_A + N_C P_C + N_D P_D} C_{xC} + \frac{N_D P_D}{N_A P_A + N_C P_C + N_D P_D} C_{xD} = C_{xp} = 0$
- $P_A = P_C = P_D = \$100{,}000{,}000 \; and \; N_C = 1$
- Solve for $N_A \; and N_D$
- Find the value of the final portfolio.

- The par value of US Treasury Notes and Bonds are $1,000 and US Treasury Bills are $10,000.