**Fixed Income Asset Pricing**

**Bus 35130 Spring 2024**

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**Homework 3**

Due at the beginning of Class 4

**Note 1:** For each section below, there are questions that require a "pencil and paper" (PP) answer, and questions that require actual computations using data and computer programs (CP). You are supposed to do both.

**Note 2:** As with Homework #1 there are "guides" for doing the homework in Excel, Matlab and Python. In each code provides partial solutions to the questions. To make the code run you are required to complete some formulas or to produce some of the results yourself. You are not required to use any of the guides, but use of one of them is recommended.

**Part I. Duration Hedging and Factor Neutrality**

Consider the Leverage Inverse Floater discussed in HW 2. The data set *FBYields_2024_v2.xlsx* contains monthly data on continuously compounded zero coupon yields (1 months - 5 years) from June 1952 to December 2023.

1. (PP) Describe the Principal Component methodology, and what "Level," "Slope," and "Curvature" mean? Are these assumptions or results of the analysis? Why the names?

2. (CP) Use this zero-coupon bond term structure to compute the value of the LIF on March 31, 2009 as well as on April 30, 2009. Compare the change in value of LIF with the one predicted by the duration computation performed in HW 2 (for the latter computation, you have to compute the average change in the term structure over the two dates (why?)). Discuss your results, also in view of the actual change of the term structure of interest rates over the two dates. (*Tip: It is OK for this exercise to keep the maturity of LIF to 5 years on both dates. Tip 2: It helps to actually plot the term structures on the dates on the same graph.)*

3. (CP) Use the time series of the data to compute the Principal Component betas for level and slope. Plot the beta coefficients as well as the level and slope factors (*Tip. See the Guide files for matlab or excel*).

4. (CP) Compute the factor durations against level and slope. (*Tip: This is a small modification from the solution to HW 2*)

5. (CP) Compare the variation in LIF (in point (A)) with the one predicted from the factor duration in point (B). Discuss. (*To compute the actual change in Factor 1 (level) and 2 (slope), you just have to multiply the betas in point (B) by the actual change in the yields over the two days.*)

**II: Predicting Zero-Coupon Bond Returns**

Recommended readings:

- Book. Chapter 7.3
- Cochrane and Piazzesi (2005) "Bond Risk Premia" American Economic Review. `http://www.stanford.edu/~piazzesi/cp.pdf`

1. (PP) Explain the logic behind Fama-Bliss regressions. According to the Expectation Hypothesis, what should be the regression coefficients of the regression?

2. (CP) Use the data *FByields_2024_v2.xlsx* and run Fama-Bliss and Cochrane-Piazzesi annual predictive regressions of zero coupon bonds with time to maturity $T = 2, 3, 4, 5$. Please, only use *annual* data for this exercise, so as to avoid econometric problems (overlapping samples).

    - (CP) Plot the expected excess return for the 5-year bond over time using both Fama-Bliss and Cochrane-Piazzesi methodologies. As of the last day in the sample (December 2023), what is the 1-year forecast of the 5-year bond excess return? Compare the difference in prediction about the 2022-2023 excess bond returns between Fama and Bliss and Cochrane and Piazzesi.
    - (PP) What do your results imply about time varying risk premia? Interpret in light of your knowledge of macro-economic events (inflation, growth, etc).

- (PP) How well can you predict future bond returns? Do your results differ from those illustrated in the teaching notes? Discuss.