**Fixed Income Problem Set**

FINE 7110

Fall 2023

Please turn in (on Canvas) a Word Document with your answers for all seven problems, along with your calculations for problems 1-6. Please also turn in an Excel Spreadsheet with your calculations for problem 7. Some problems may have more information than is needed to solve them.

\*\*\*\*For problems 1, 3, 4 and 6, please carry out your final answers **four decimal places**.

1. You observe the following yields (YTMs) for Treasuries maturing at the following times:

|  |  |
| --- | --- |
| **Maturity** | **Yield** |
| 6 months | 5.48% |
| 1 year | 5.35% |
| 1.5 years | 4.95% |
| 2 years | 4.89% |
| 2.5 years | 4.65% |
| 3 years | 4.57% |
| 3.5 years | 4.50% |
| 4 years | 4.35% |

1. What is the implied six-month forward rate one year from now?
2. What is the implied six-month forward rate two years from now?
3. What is the implied one-year forward rate one year from now?
4. What is the implied one-year forward rate two years from now?
5. What is the implied one-year forward rate three years from now?

For A-E above, please express your answers as an annual (BEY) rate.

1. Find the interest payment you would have received (in dollars and cents) on July 15, 2023 if you owned a 10-year TIPS bond which was issued on Jan. 15, 2022 with a face value of $100,000 and a coupon rate of 3.60%. The annual inflation rate is announced at the end of each quarter (end of March, June, Sept. and Dec.). In 2021 the numbers were 4.4%, 4.5%, 5.6% and 6.0%. For 2022 they were 6.6%, 7.0%, 7.2%, and 6.3%. For 2023 they were 5.5%, 4.2%, and 3.7% (The December 2023 rate hadn’t come out yet). For this problem, anytime there appears to be more than one inflation rate you could use, you should use the most recently reported rate.
2. Find the YTM of a Treasury bond which you are considering purchasing. The settlement date is Oct. 20, 2023. The bond matures on Dec. 15, 2028 and has a 3.75% coupon rate (the maturity date tells you when the coupon payments are made). The quoted price for the bond is 98:14.
3. Find the BEY of a Treasury Strip that you can purchase for settlement on Oct. 20, 2023 at a quoted price of 72.20. The Strip matures on May 15, 2031.
4. Price an 8-yr. zero-coupon bond so that it has the same yield as a 4.30% coupon bond which matures at the same time and is currently priced at 97:02 (ignore accrued interest).
5. If a Treasury bill has a BEY of 5.40% and it matures in 100 days, calculate its
6. Price
7. Yield on a Discount Basis
8. Bond dealers often finance their positions through the repo market. Since repos are very short-term (usually no more than a few days) collateralized loans, the interest paid on the repo is usually less than the interest earned on the bond that is being carried (when the yield curve is upward sloping). This allows the bond dealer to earn profits on (1) the spread, (2) any appreciation of the bond while it is owned, and (3) the carry. Note though, that there is risk to holding a bond.

Here is price data for a 4 ½ % Treasury bond with a maturity date of May 15, 2030, along with the repo rates, for a week in October 2023.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Posted Treasury Quotes** | | **Overnight Repo Rates** |
| **Date** | **Bid** | **Ask** | **APR** |
| 10/9/23 | 101:18 | 101:20 | 4.30% |
| 10/10/23 | 101:19 | 101:21 | 4.34 |
| 10/11/23 | 101:21 | 101:23 | 4.36 |
| 10/12/23 | 101:24 | 101:26 | 4.40 |
| 10/13/23 | 101:23 | 101:25 | 4.43 |

Assume that on Monday October 9, an insurance company contacted you, a bond dealer, and sold you $100 million (face value) of the 4 ½ % 5/15/30 T-Bond at your quoted price. You carried the position in the repo market (one day at a time) for four days at a haircut of 0.5% before being contacted Friday morning (Oct. 13) by a pension plan that purchased the bond from you at your quoted price. For simplicity, assume that settlement occurs on the transaction dates. Calculate the following using **dollars and cents** (**NOT** percentages of face value):

1. The invoice price of the bond when you purchased it
2. The invoice price of the bond when you sold it
3. How much interest you earned for the time you held the bond
4. How much interest you paid on the Repo (you pay the entire amount when you receive the bond back – it is not paid each day – so consider compounding)
5. The net gain or loss on the round-trip transaction