37011 Financial Markets Instruments

Assignment Part 1

due 2 April 2024

Solutions must be submitted on Canvas as a Jupyter notebook

The file `RBAbondyields.xlsx` contains daily data (sourced from the Reserve Bank of Australia) on yields on two-, three-, five- and ten-year Australian Government Bonds, from 2 September 2013 to 6 March 2024. These series are "calculated from data representing the Reserve Bank of Australia (RBA)'s assessment of closing bond yields on Australian Government Securities." The RBA further states, "These assessments are informed by information provided to the RBA by a number of market participants, although the assessments are solely made by the RBA using its own judgment. These yields are not (and are not administered by the RBA as) financial benchmarks, and are not accorded any special status by the RBA. These yields are provided as a convenience for the public and are intended for academic research purposes. The data quality of the RBA's assessments of closing yields is not guaranteed, assessments may differ from market prices and the RBA's methodology[...]"[1] Thus, we will interpret these yields as the yields to maturity of hypothetical Australian Government Bonds with times to maturity of exactly two, three, five and ten years.

1. Using loglinear interpolation where necessary, for each day determine the term structure of zero coupon bond prices (i.e., discount factors) consistent with these yields.

2. Suppose there are the following four Australian Government Bonds trading in the market:

Bond	Maturity date	Coupon
$\mathcal{B}_1$	6 March 2025	3.25%
$\mathcal{B}_2$	6 March 2026	4.5%
$\mathcal{B}_3$	6 March 2028	0.5%
$\mathcal{B}_4$	6 March 2029	1.25%

   For each day between 7 March 2019 and 6 March 2024, calculate the prices of these bonds consistent with the discount factors you have derived.

3. Suppose a portfolio manager has a liability of \$100 million to be paid on 6 March 2027. Suppose further that the portfolio manager wishes to manage the interest rate risk of this liability by investing in a portfolio of Australian Government securities $\mathcal{B}_1$ and $\mathcal{B}_4$, in the sense that the present value of the hedge equals the present value

[1] Reserve Bank of Australia, "Capital Market Yields – Government Bonds – Daily – F2", `https://www.rba.gov.au/statistics/tables/changes-to-tables.html`, accessed 13 March 2024.

of the liability, and the net modified duration of the hedged position is zero. The portfolio manager commences the hedge on 7 March 2019.

(a) If the hedge is rebalanced monthly between 7 March 2019 and 6 March 2024, what is sum of profits/losses from rebalancing on 6 March 2024? What is the standard deviation of profits/losses?

(b) If the hedge is rebalanced daily between 7 March 2019 and 6 March 2024, what is sum of profits/losses from rebalancing on 6 March 2024? What is the standard deviation of profits/losses?

(c) Re-do the previous two cases, where the hedge is constructed using $\mathcal{B}_2$ and $\mathcal{B}_3$.

(d) Re-do the previous two cases, where the hedge is constructed using $\mathcal{B}_1$, $\mathcal{B}_2$ and $\mathcal{B}_4$, and constructed in such a way that the convexity of the hedged position is also zero.

(e) Discuss briefly the results obtained in (a)–(d).