MAT1856/APM466 Assignment 1

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Fundamental Questions - 25 points

1.

   (a) Because print too much money will lead to inflation which devalues the money hold by everyone, however, issue bonds will not affect the total amount of money and can distribute the fiscal pressure more fairly.

   (b) One example is that the future inflation rate may decrease due to fiscal policies, hence, a yield curve may flatten in response to the decrease of inflation rate.

   (c) Quantitative easing is a monetary policy that central bank purchases the long-term bonds to increase the money supply, in which case the commercial banks will lower the interest rate and money will flow to the society and thus stimulate the economy. The US FED bought a large amount of long-term bonds from banks and companies, and this increase the money supply so that individuals can borrow money with lower interest rate and eventually boost the pandemic influenced economy.

2. CAN 0.5 Mar 1 2022, CAN 2.75 Jun 1 2022, CAN 1.75 Mar 1 2023, CAN 1.5 Jun 1 2023, CAN 2.25 Mar 1 2024, CAN 2.5 Jun 1 2024, CAN 1.25 Mar 1 2025, CAN 2.25 Jun 1 2025, CAN 0.25 Mar 1 2026, CAN 1.5 Jun 1 2026

   The first reason why I choose these bonds is that the maturity dates of these bonds are within '0-5years' and these dates are almost evenly distributed. Secondly, the coupon rates of these bonds are close to each other. Besides, the issue dates of these bonds are not too far away. Hence, I decided to choose these bonds.

3. By using the Principal Component Analysis, the covariance matrix of those stochastic processes is used to standardize the model by removing the excessive factors without losing too much information. By linear transformation, the eigenvectors we obtained tell us the nature of the major factors. On the other hand, the eigenvalues we obtained tell us the quantification of the major factors. Combing these together, we can figure out the which factors should be kept and which should be removed.

Empirical Questions - 75 points

4.

   (a) The 5-year yield curve is the first picture included below.

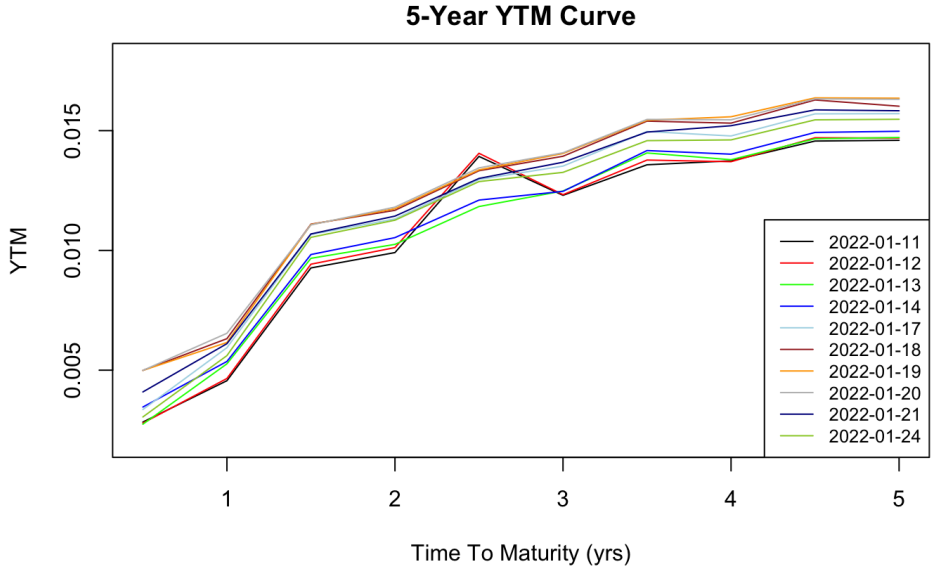
   (b) The 5-year spot curve is the second picture included below.

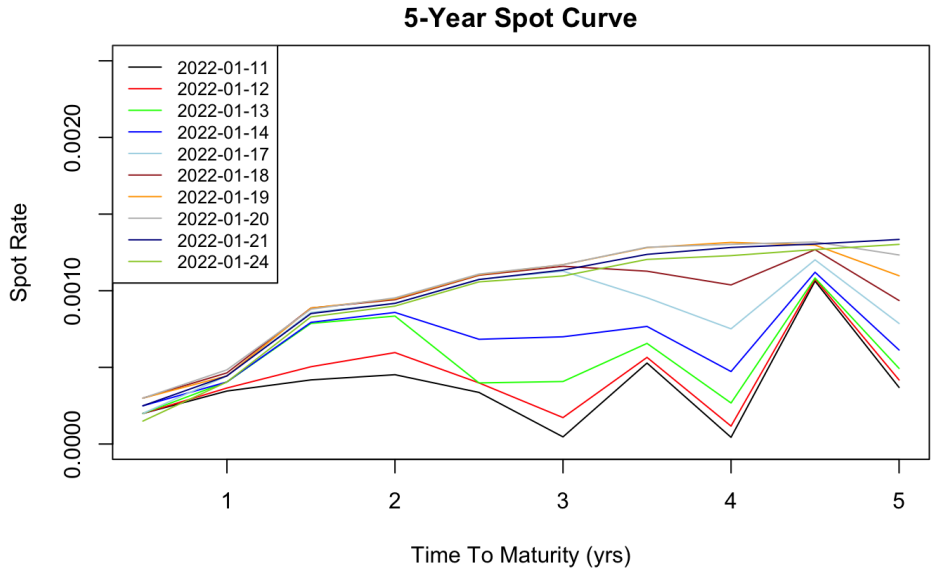
   Explanation of an algorithm - First I found the dirty price of the selected bonds. Then I generated a series of the up-coming coupon time. Next, I calculated the spot rate and present value of coupon. Combining these together I got the spot curve.

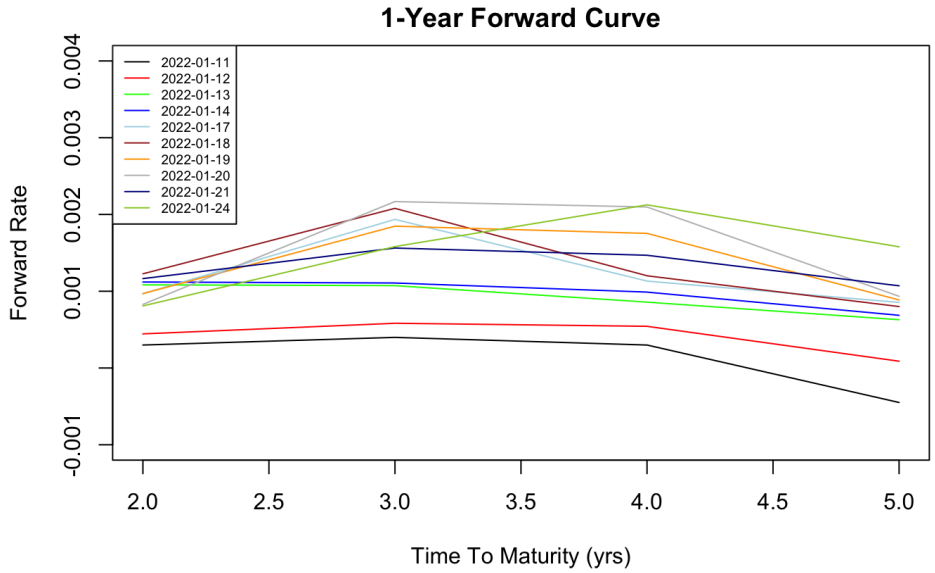
(c) The forward curve is the third picture included below. Explanation of an algorithm - First I calculated the spot rate in one year and n year respectively. Then based on these two spots rate I used the forward rate formula to get the forward rate.

5. The covariance matrix for daily log-returns of yield is the fourth picture included below.

6. The size of the first eigenvalue tell us the effect of this bond is the largest and the associated eigenvector tell us the direction of the effect is positive so it can best describe the market.







	x1	x2	x3	x4	x5
x1	0.07509640	0.05579907	0.04496376	0.04331379	0.06463550
x2	0.05579907	0.04570368	0.03681123	0.03544769	0.05311175
x3	0.04496376	0.03681123	0.03226394	0.03024292	0.04053781
x4	0.04331379	0.03544769	0.03024292	0.02861648	0.03978962
x5	0.06463550	0.05311175	0.04053781	0.03978962	0.06409665

References and GitHub Link to Code

GitHub Link - https://github.com/BobbigGao/APM466

https://www.investopedia.com/terms/s/spot$_r ate_y ield_c urve.asp$

https://www.investopedia.com/terms/f/forwardrate.asp