Interest Rates

Bernt Arne Ødegaard

18 April 2023

1 Introduction

This lecture is about *interest rates*.

In finance we have to deal with interest rates in many different settings, which lead to a view among many that this is something very complicated.

The problem is that interest rates have many usages, and it is hard to see the simple, underlying structure.

Key points following:

- Economic interpretation of interest rates – it is the *price* for moving consumption between periods.
- Key *usage* of interest rates in corporate finance: Discounting future cash flows.
  - Need to know the rules for discounting.
- Key *problem* with interest rates: There are many of them

  Interest rates vary with
  - *horizon* of cash flows
  - *risk* of cash flows
  - and change over time.
- Key *skill* to be acquired: Use data from financial markets to find the *relevant* interest rate.

2 The role of interest rates in consumption

Exercise 1.

Suppose a consumer only lives for two periods, with projected income today of $40, and $50 next period.

1. What financial service can help this consumer moving consumption between periods?
2. What is this consumers maximum consumption today?
3. What is this consumers maximum consumption next period?

3 Translating interest rates

Exercise 2.

Corporations A and B have both issued bonds with face values of 100 and interest rates of 10%. Both bonds mature in a year. Bond A pays coupon once a year, bond B pays coupon twice a year.

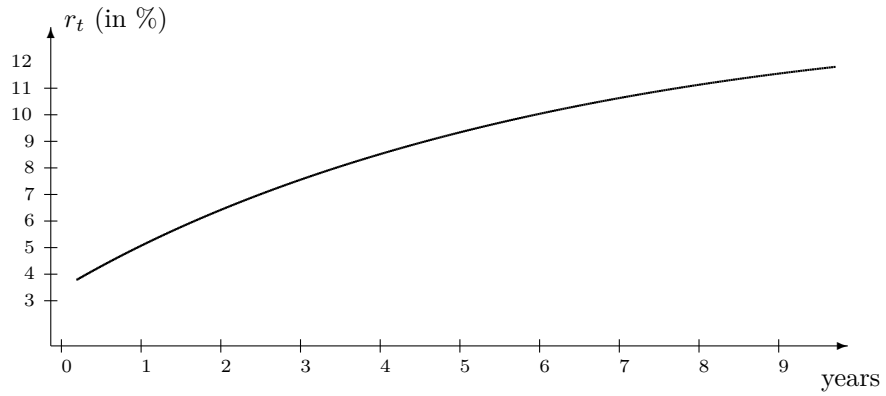
- Which of these bonds have a higher price?
- What would the rate on bond B have to be to make a buyer indifferent between bond A and bond B?

4 Term Structure of Interest Rates

The plot of spot interest rates (r_t) against maturity (t) is called the *term structure of interest rates*. The term structure can take a multitude of shapes. Typically, it is rising, but it can also be decreasing, or even "humped."

Figure 1 shows an example term structure.

Figure 1 Example Term Structure of Interest Rates



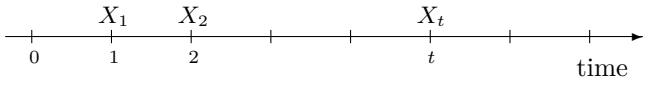
4.1 The term structure of Norwegian risk free rates

Show two views of Norwegian term structure. Figure 2: Term structures on selected dates.

Figure 3: Time series of three different interest rates: NIBOR(1m), 3 and 10 year treasury rates.

5 The term structure as prices of future payments.

We concentrate on the valuation of a sequence of *certain* future cash flows. We use the symbol X_t for the amount X to be paid at a future date t, and we want to value a set of future cash flows:



The PV of the entire stream is

$$PV = \sum_{t=1}^{T} d_t X_t.$$

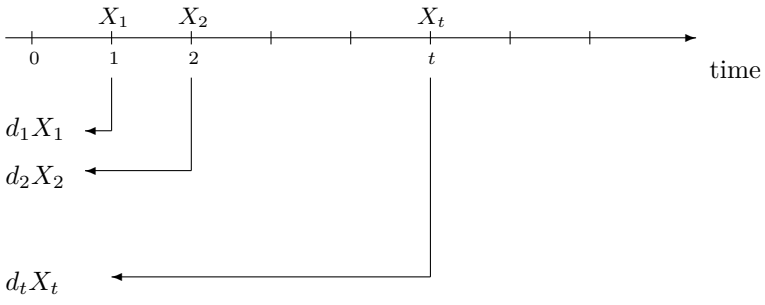
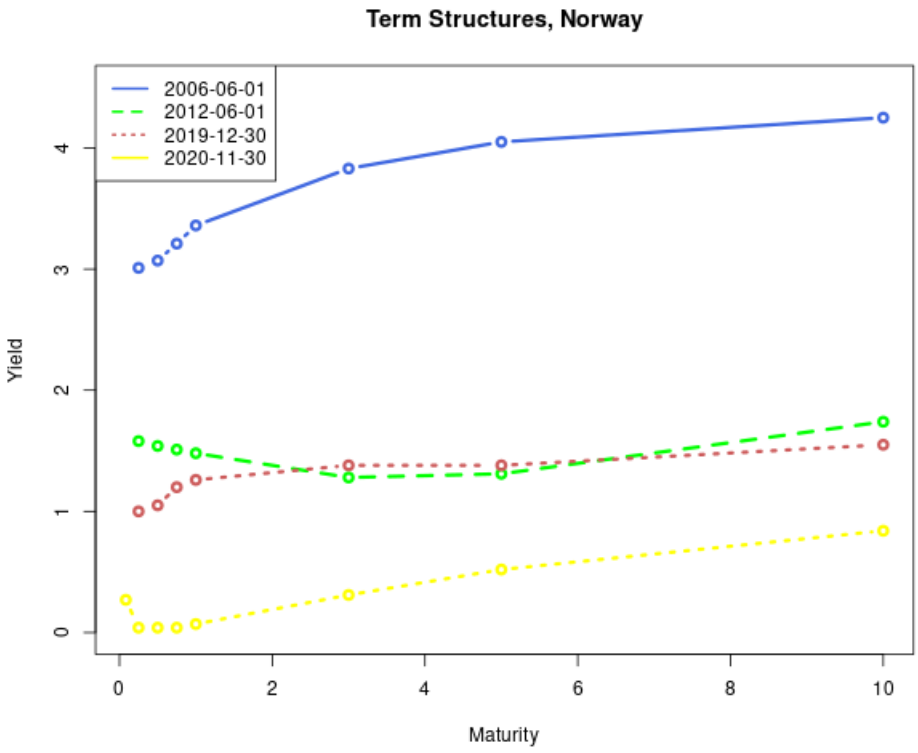


Figure 2 Selected term structure, Norwegian risk free rates



The figure plots interest rates for NIBOR(1 month) and treasury rates for 3 and 6 months and 1, 5 and 10 year rates. NIBOR data from Norges Bank and Oslo Børs. Treasury data from Norges Bank. Term structures for three different dates: 1 jun 2006, 1 jun 2012 and 30 dec 2019.

Figure 3 Norway, time series of term structure

Interest rate on 1 month NIBOR and 3 and 10 year Norwegian Treasuries. Treasury data from Norges Bank. NIBOR data from Norges Bank and Oslo Børs.

6 Valuing Fixed Income Securities

A fixed income security is a security that offers a predetermined sequence of future payments.

7 Where do spot rates/discount factors come from?

Suppose you want to price a risk free bond with a stream of cashflows in the future. Then you want a set of discount factors for these future cash flows. Can be found from prices of *comparable* bonds.

Exercise 3.

A two-year Treasury bond with a face value of 1000 and an annual coupon payment of 8% sells for 982.50. A one-year T bill, with a face value of 100, and no coupons, sells for 90. Compounding is discrete, annual.

Given these market prices,

1. Find the implied one and two year interest rates.

8 Determinants of interest rates

Three ideas:

- *Level* of interest rates, primarily linked to inflation.
- *Time Preferences.*

  Savings possibilities

  - Invest at a fixed rate for two years.
  - Invest at a fixed rate for one year, and then see what the interest rate is for the next year.

  Shape of the term structure driven by such considerations.

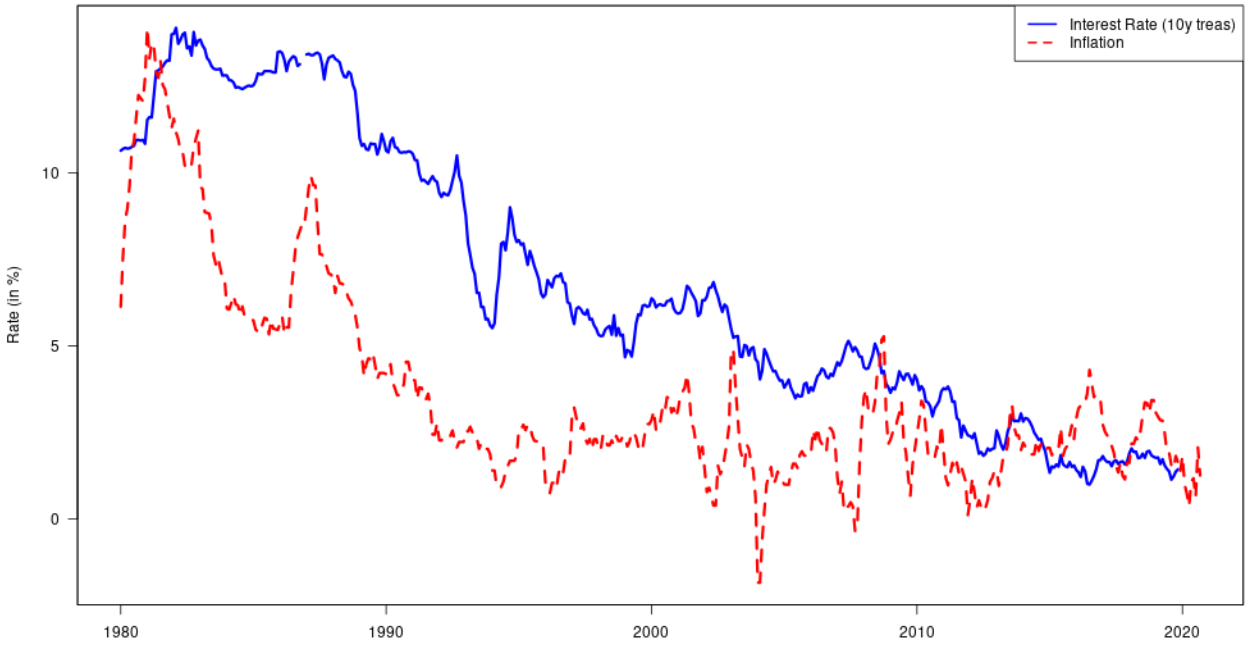
  Primarily: Expectation about macroeconomic evolution.
- *Risk.*

  Safest (in nominal terms): Treasury securities.

  Riskier: Corporate debt.

8.1 Interest and Inflation in Norway

Figure 4 Norway, long term treasury interest rate and inflation



Interest rate on 10 year Norwegian Treasuries. Inflation is annual inflation. Both measured at monthly frequencies. Treasury data from Norges Bank. Inflation from SSB.

Figure 5 US Default premium: Moody Baa vs 10y treasuries