INTRODUCTORY BANKING

Seminar 05 – Understanding interest rates

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18 March 2021

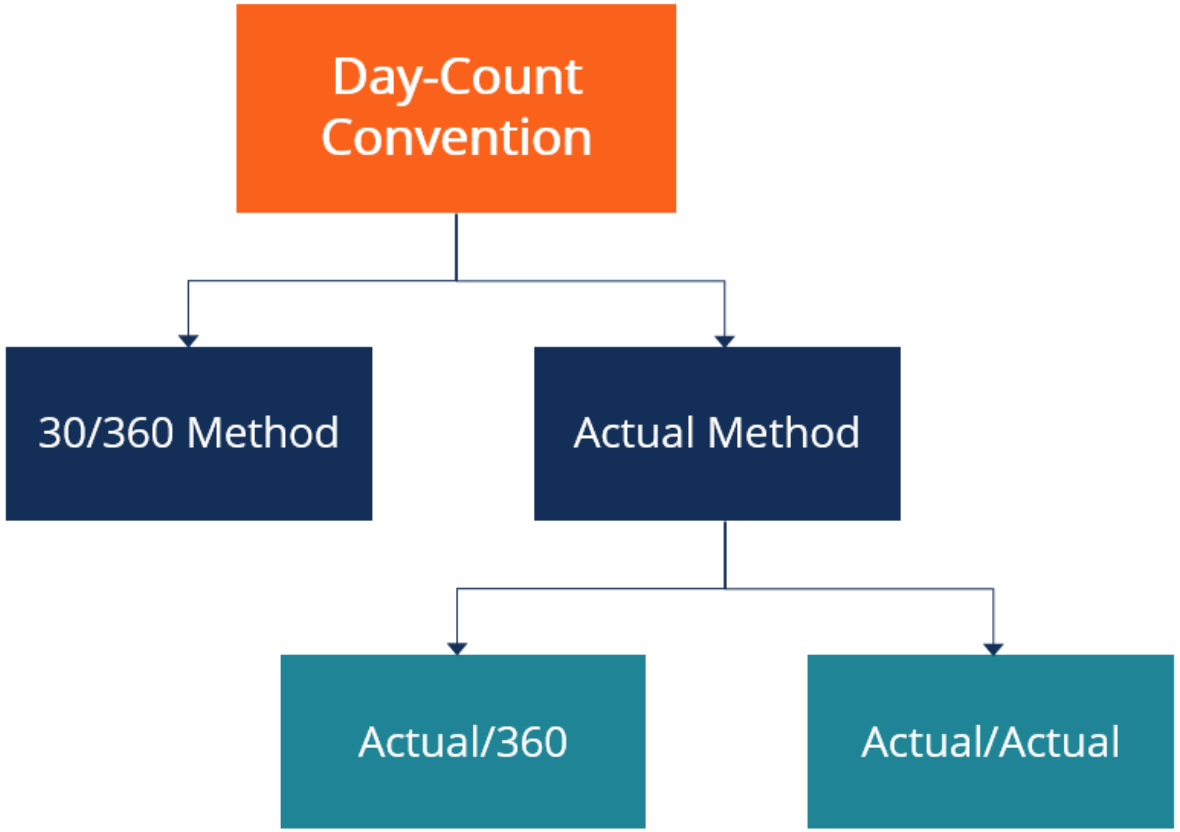
What is an interest rate?

- What might people from various fields answer?
  - An economist would say...
  - An accountant would say...
  - A trader would say...
- What types of rates are there?
  - Short vs. long term
  - ...

Types of rates

- Nominal and real interest rates
- Effective interest rate
- Fixed vs. variable rates
- Individual loan rate
- Interbank reference rates
- Discount vs. lombard rate
- Bid or offer rates
- Risk-free rate
- Prime rate
- Stressed rates
- etc.

Conventions



The Fisher equation

- The Fisher equation -> the nominal interest rate i equals the real interest rate i_r plus the expected rate of inflation π^e

$$i = i_r + \pi^e$$

- More precise formula:

$$i = i_r + \pi^e + (i_r \times \pi^e)$$

$$1 + i = (1 + i_r)(1 + \pi^e) = 1 + i_r + \pi^e + (i_r \times \pi^e)$$

Real versus nominal rates

Real versus nominal rates (2)

Real versus nominal rates in the US

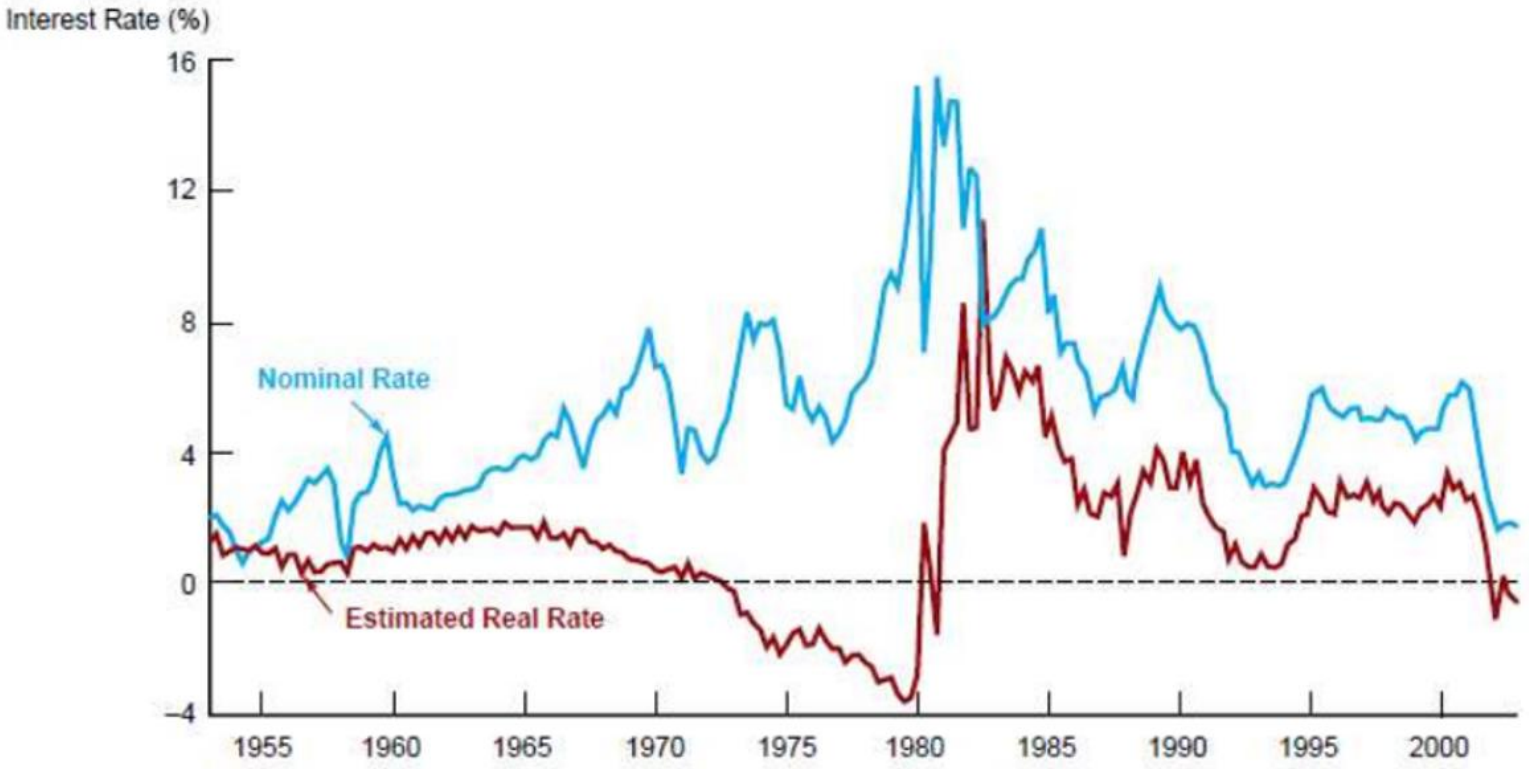


FIGURE 1 Real and Nominal Interest Rates (Three-Month Treasury Bill), 1953–2002

Sources: Nominal rates from www.federalreserve.gov/releases/H15. The real rate is constructed using the procedure outlined in Frederic S. Mishkin, "The Real Interest Rate: An Empirical Investigation," *Carnegie-Rochester Conference Series on Public Policy* 15 (1981): 151–200. This procedure involves estimating expected inflation as a function of past interest rates, inflation, and time trends and then subtracting the expected inflation measure from the nominal interest rate.

Fixed, variable and effective interest rates

- **Fixed interest rate -** a specific, fixed interest tied to a loan or a line of credit that must be repaid, along with the principal.

- **Variable interest rate -** is usually tied to the ongoing movement of base interest rates (either prime interest rate or reference rate).

- **Effective interest rate -** is the interest rate that is adjusted for compounding over a given period. The effective annual interest rate is the rate of interest that an investor can earn (or pay) in a year after taking into consideration compounding.

You may remember…

Financial Mathematics

Effective Interest Rate, Example

Considering a variety of interest frequencies, it would be difficult to compare these interest rates. Therefore a new variable has been introduced: effective interest rate, sometimes denoted as annual percentage rate or APR, corresponds to an annual nominal interest rate r_N compounded m-times a year.

$$r_{ef} = \left(1 + \frac{r_N}{m}\right)^m - 1$$

You are looking at different banks to find the best investment choice for deposit. You have CZK 1,000,000 and (for sake of simplicity) a one year horizon. What bank would you recommend to him:

Bank	Rate (p.a.)	Compounding	APR (Effective interest rate)
Unicreditbank	2,35%	1	2,350%
CSOB	2,33%	4	2,350%
Moneta Money Bank	2,35%	2	2,364%
Bank Creditas	2,34%	12	2,365%

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Some facts about individual loan rates

- The amount of interest paid depends on the terms of the loan, worked out between the lender and the borrower.
- Interest represents the price paid for taking out a loan – the principal still has be paid off.
- Interest on loans is usually pegged to current banking interest rates.
- The interest rate on a credit card, auto loan or another form of interest can also depend largely on your credit score.
- In certain cases, like with credit cards, the interest rate can rise if the payment is late, or is not provided.

Interbank rates

- Primarily these rates are the interest charged on short-term loans made between financial institutions.
- These are the lowest rates that can be found at any particular time and are reserved for the big banking institutions.
- The interbank rate is available only to the largest and most creditworthy financial institutions.
- However, all interest rates for borrowing or saving money are based on that rate, although they will include premiums (profit for the bank).

The most important reference rates

The world of IBORs

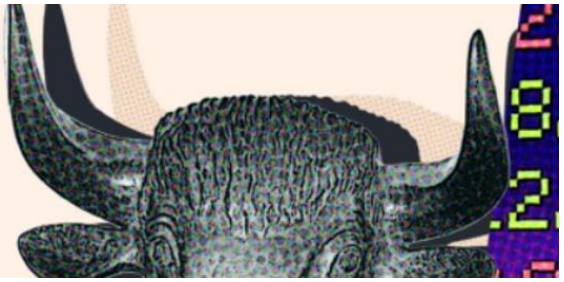
The most important IBORs and Alternative Reference Rates (ARR) worldwide

Source: LBBW Research

The LIBOR scandal

Become an FT subscriber to read:

"Libor trader Tom Hayes released after five-and-a-half years in prison"



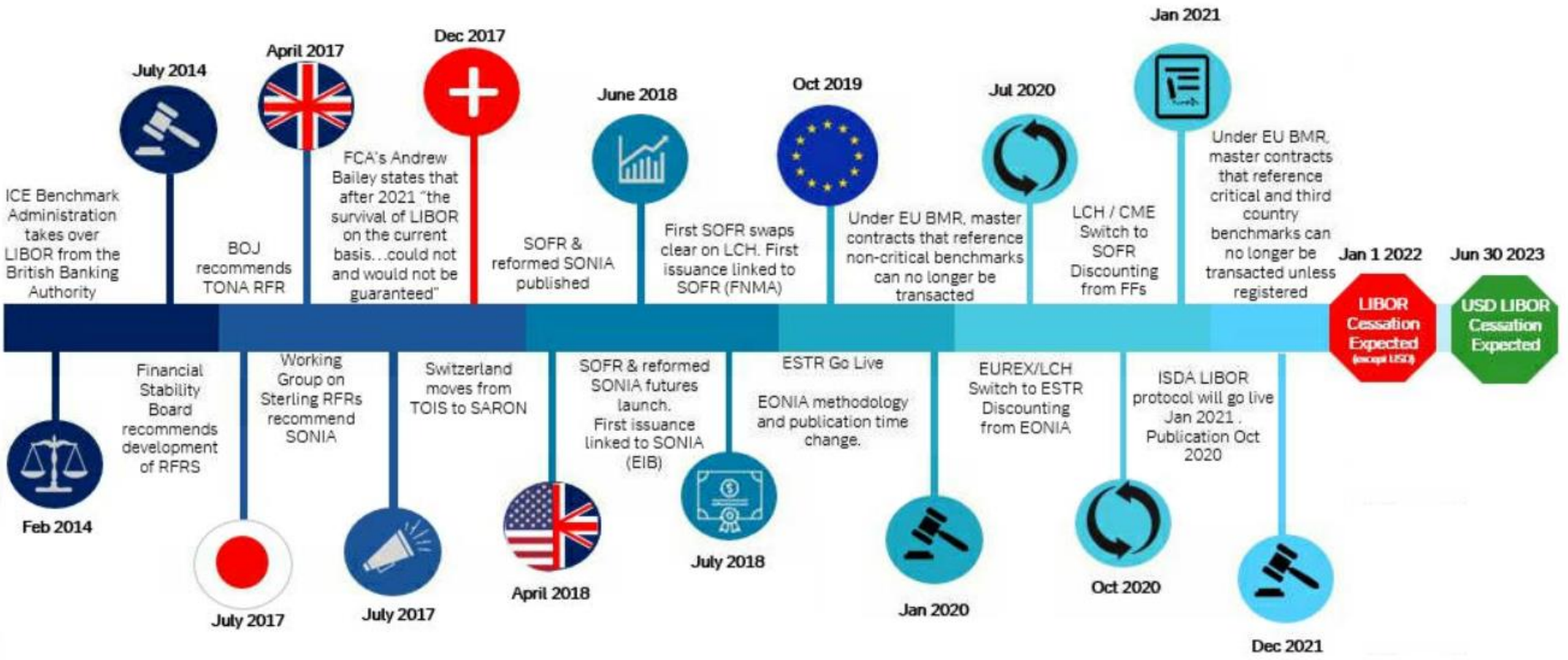
Become an FT subscriber to read:

"Libor to cease for most currencies by end of 2021"

The **LIBOR Scandal** was a highly-publicized **scheme** in which bankers at several major financial institutions colluded with each other to **manipulate the London Interbank Offered Rate (LIBOR).** The scandal sowed distrust in the financial industry and led to a wave of fines, lawsuits, and regulatory actions.

The LIBOR scandal - reaction

Timeline of RFR/IBOR reforms



Bid and offer rates

- **Bid rate -** the "bid" rate at which banks are willing to borrow eurocurrency deposits. The most common currency deposited as eurocurrency is the USD.

- **Offer rate -** the "offer" rate at which banks are willing to lend one another in the international interbank market for short-term loans.

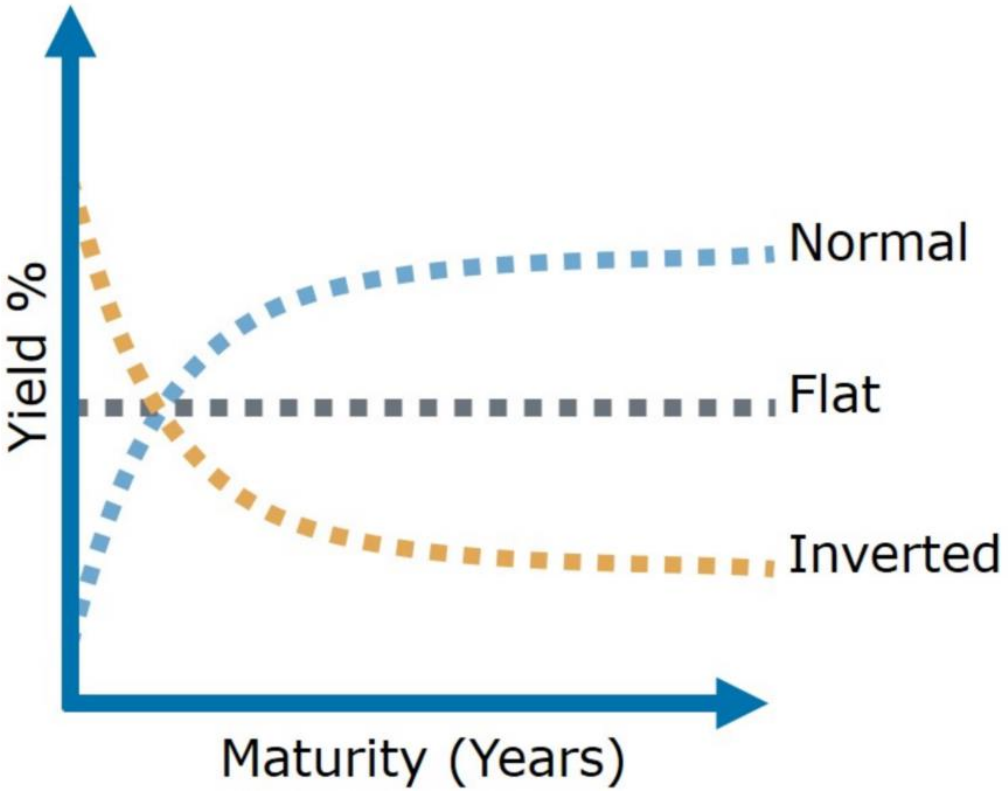
Repo, discount and lombard rates

- **Repo rate -** rate at which the central bank of a country lends money to commercial banks in the event of any shortfall of funds. Repo rate is used by monetary authorities to control inflation.

- **Discount rate -** the rate of interest that the central bank offers for short-term deposits of excess liquidity.

- **Lombard rate -** The rate of interest at which the central bank lends short-term funds to banks in case they have shortage of liquidity.

Yield curve shapes and their meaning



Bond valuation

- Coupon bond (coupon rate is 10%)

$$P = \frac{\$100}{(1+i)} + \frac{\$100}{(1+i)^2} + \frac{\$100}{(1+i)^3} + \ldots + \frac{\$100}{(1+i)^{10}} + \frac{\$1000}{(1+i)^{10}}$$

$$P = \frac{C}{(1+i)} + \frac{C}{(1+i)^2} + \frac{C}{(1+i)^3} + \ldots + \frac{C}{(1+i)^n} + \frac{F}{(1+i)^n}$$

Consol: Fixed coupon payments of $\$C$ forever

$$P = \frac{C}{i} \qquad i = \frac{C}{P}$$

- Discount bond (P = 900 USD, F = 1000 USD)

$$\$900 = \frac{\$1000}{(1+i)} \Rightarrow$$

$$i = \frac{\$1000 - \$900}{\$900} = 0.111 = 11.1\%$$

$$i = \frac{F - P}{P}$$

Bond valuation (2)

- Three interesting facts about bond valuation

  I. When bond is at par, yield equals coupon rate
  II. Price and yield are negatively correlated
  III. Yield is greater than coupon rate when bond price is below par value (and vice versa)

Thank you for your attention!