Cash flows
REAL vs. NOMINAL

Lecture for Corporate Finance

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SCHOOL OF BUSINESS ADMINISTRATION IN KARVINA

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Outline of the lecture

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- Cash flows
- Real cash flows
- Real vs. nominal interest rate
- All these examples are from Seminar 02/03

Cash flows

Cash flow is the net amount of cash and cash equivalents being transferred into and out of a business.

At the most fundamental level, a company's ability to create value for shareholders is determined by its ability to generate positive cash flows, or more specifically, maximize long-term free cash flow.

Cash flows for all periods are measured in time 0 dollars and discounted using the real discount rate i.e. a discount rate which doesn't contain the effect of any expected inflation.

If there is more than one cash flow within some time period, future and present value is calculated as a sum of its particular compounded or discounted values using next equation.

Present value of cash flows

$$PV = C_0 + \frac{C_1}{1+i} + \frac{C_2}{(1+i)^2} + \ldots + \frac{C_n}{(1+i)^n}$$

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Saving the same amount 1/2

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2. How much will you dispose of in 2022 if you deposit CZK 50,000 each year for 3 years (i.e. 2020, 2021 and 2022)? Your account bears 4% p.a.

Future value of cash flows

$$FV = C_O(1+i)^n + C_1(1+i)^{n-1} + C_2(1+i)^{n-2} + \ldots + C_{n-1}(1+i) + C_n$$

$$FV = 50{,}000 * (1.04)^{3} + 50{,}000 * (1.04)^{2} + 50{,}000 * (1.04)^{1}$$

- A case with many years will solve an annuity.

Saving the same amount 2/2

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6. Consider that you will deposit 7 thousand CZK and you intend to withdraw savings after 6 years. The first deposit will be in 2021 and the last one will be in 2026. You will withdraw the money at the beginning of 2027. What amount will you save if the interest rate is 3% p.a.

$$FV = 7{,}000 * (1.03)^{6} + 7{,}000 * (1.03)^{5} + \cdots + 7{,}000 * (1.03)^{1}$$

- A case with many years will solve an annuity.

Periods (n) can vary

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3. What will your savings be if you save $ 100,000 a year in 2020 and then in 2022 and 2023 your interest is 3% p.a., but the interest is on a **monthly basis**. You intend to withdraw your deposits at the beginning of 2024.

$$EAIR = (1 + \frac{0.03}{12})^{12} - 1$$

$$FV = 100{,}000 * (1 + EAIR)^{4} + 0^{3} + 100{,}000 * (1 + EAIR)^{2} + 100{,}000 * (1 + EAIR)^{1}$$

- Always be careful of small n! ☺ 2020-2040?

Do not forget what You have already learned

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4. Consider continuous compounding. What will be the value of CZK 20,000 that you deposit into this savings account this year and in 2021 and you collect it in 2022? The interest is 2% p.a.

$$FV_e = 20{,}000 * 2.718^{2*0.02} + 20{,}000 * 2.718^{1*0.02}$$

- The Euler number ☺

Example of nominal cash flows

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8. In 2023 you intend to travel Canada for whole year and assume that you will be able to save 2020 30,000 to cover the costs. CZK, next year 45 thousand CZK and at the end of 2022 it will be 60 thousand CZK. What will be your pre-flight savings if the account bears 5% p.a.

$$FV = 30{,}000 * (1.05)^{3} + 45{,}000 * (1.05)^{2} + 60{,}000$$

- Just combination of future values compounding, however, the last year is NOT compounded.

Typical case of cash flows (bonds)

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5. How would you pay for the bond? The nominal value is CZK 2,000; the expected yield is 9%; coupon payment 8%; and the bond is payable in 3 years.

$$PV_{bond} = \frac{160}{(1.09)^1} + \frac{160}{(1.09)^2} + \frac{160 + 2{,}000}{(1.09)^3}$$

- Fixed coupon.

Coupon do not have to be always fixed

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7. You are offered to purchase a bond with a nominal value of CZK 1,500 with a maturity of three years, with the yields in individual years being: CZK 250, CZK 320 and after the third year CZK 410. Will you be willing **to buy** the bond for 2000 CZK when the alternative investment cost is 8%?

$$PV_{bond} = \frac{250}{(1.08)^1} + \frac{320}{(1.08)^2} + \frac{410 + 1{,}500}{(1.08)^3}$$

- Variable coupons within bonds.
- Please, be careful of *buying* or *selling* this particular bond.

Real cash flows

Real value is defined only within conditions in which inflation exists. If there is not any inflation, then nominal interest rate will be the same as real one.

Rate of **inflation** is the rate at which the general level of prices for goods and services is rising, and subsequently, purchasing power of money is falling.

It means that for the same money kept at home it is not possible to buy the same amount of goods and services in future in case of positive inflation rate.

Prices could decrease too. In this case we speak about deflation. In connection with the inflation real value of cash flow (Cr) is defined under inflation (π), equation below. Rate of inflation is measured and reported on the webpage of the Czech Statistical Office.

Real cash flow

$$C_r = \frac{C_n}{(1+\pi)^n}$$

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Inflation – CPI

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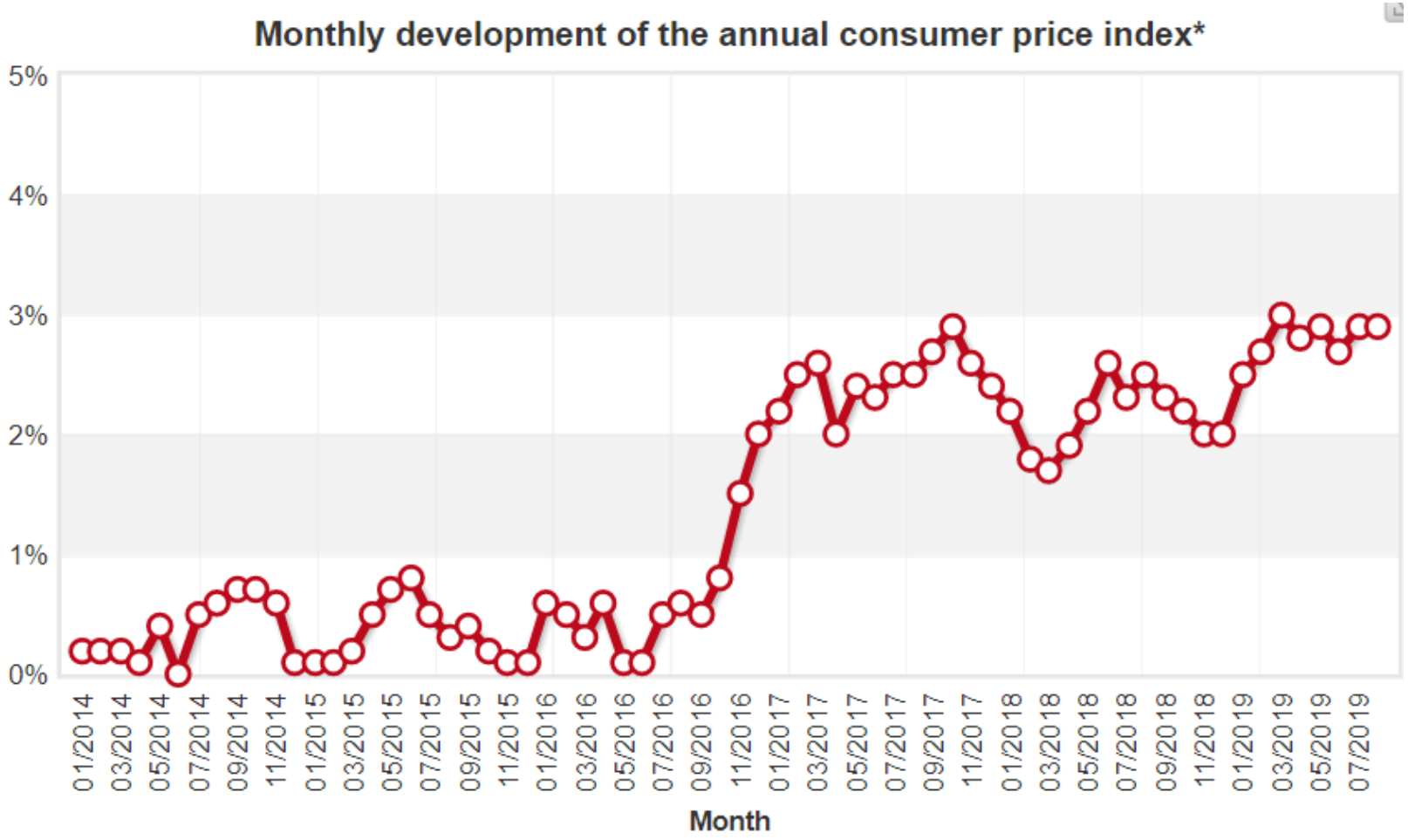
Various numbers are often given to express inflation rate using **consumer price index**, which, though different are correct. The period for which inflation rate is indicated (the reference period) and the base period, which the reference period is compared with, should be mentioned unambiguously.

* Inflation rate as an increase in CPI compared with the corresponding month of the preceding year characterizes the percentage change comparing the price level in the reference month of a given year with the corresponding month of the preceding year.



Source: https://www.czso.cz/csu/czso/inflation_consumer_prices_ekon

Inflation – PPI

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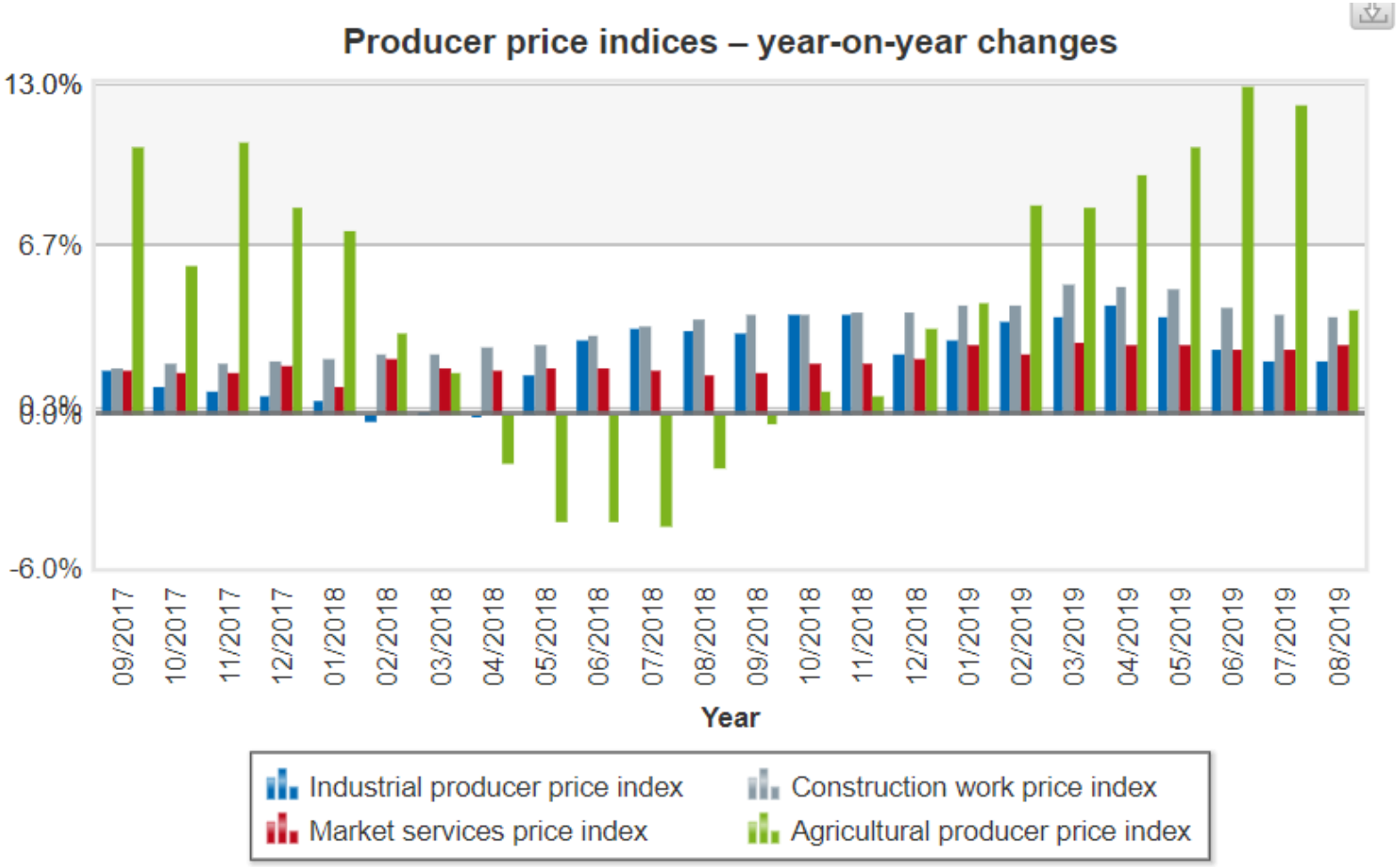
The prices of industrial producers are surveyed monthly on the basis of data provided by the selected organizations (about 1200) for the selected representatives (about 4800). The reported prices are those agreed upon between the supplier and the customer inland. They exclude VAT, excise tax, costs of transport to the customer and costs incidental to the transport, and are invoiced for the more important trade cases.

The industrial **producer price index** is calculated from the reported prices using constant weights. The index measures the average trend in prices of all industrial products produced and sold in the domestic, Czech market.



Source: https://www.czso.cz/csu/czso/producer_prices_ekon

Real values

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1. Calculate the real interest rate on deposits under the following conditions:

a) the interest rate shall be 2,5%, the inflation rate shall be 1,7%.

b) the interest rate is 2.3%, the inflation rate is 2.9%.

Real interest rate

$$r = \frac{(1+i)}{(1+\pi)} - 1$$

$$a)\ r = \frac{1.025}{1.017} - 1$$

$$b)\ r = \frac{1.023}{1.029} - 1$$

- Be careful whether or not the inflation is higher than nominal interest rate.

Using a real FV

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3. What is the real value of a deposit of CZK 42,000 over 3 years at an interest rate of 4.5% and an inflation rate of 1.3%?

Real interest rate

$$r = \frac{(1+i)}{(1+\pi)} - 1$$

$$FV = 42{,}000 * \left(\frac{1.045}{1.013}\right)^3$$

Effective annual interest rate

$$EAIR = \left[1 + \frac{i}{m}\right]^m - 1$$

FV with multiple compounding

$$FV = C_0\left(1 + \frac{i}{m}\right)^{nm}$$

- It is always necessary to thing about the inflation in the real world, be careful, when it would be monthly/daily, then first EAIR ☺

The basic questions remains PV/FV?

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5. In 15 years, you want to dispose of CZK 1 million. The nominal interest rate is 5.8% p.a. and the inflation rate is 3.4%.

a) How much do you have to deposit?

b) What will be the fair value of CZK 1 million after 15 years if you have them at home?

$$a)\ PV = \frac{1mil}{(\frac{1.058}{1.034})^{15}} \qquad FV = 1mil * (\frac{1+0}{1.034})^{15}$$

- Use the right formulae even if the money are left below a pillow ☺

Discount rates

In economics and finance, the term "discount rate" could mean one of two things, depending on context.

On the one hand, it is the interest rate at which an agent discounts future events in preferences in a multi-period model, which can be contrasted with the phrase discount factor.

On the other, it means the rate at which commercial banks can borrow from the central bank.

In the United States, the U.S. Federal Reserve controls the discount rate, which is the interest rate for the Federal Reserve charges commercial banks on loans they receive. The Federal Reserve's discount rate is broken into three discount window programs: primary credit, secondary credit, and season credit, each with its own interest rate.

Primary credit programs are reserved for commercial banks in high standings with the Reserve as these loans are typically only given for a very short time (typically overnight).

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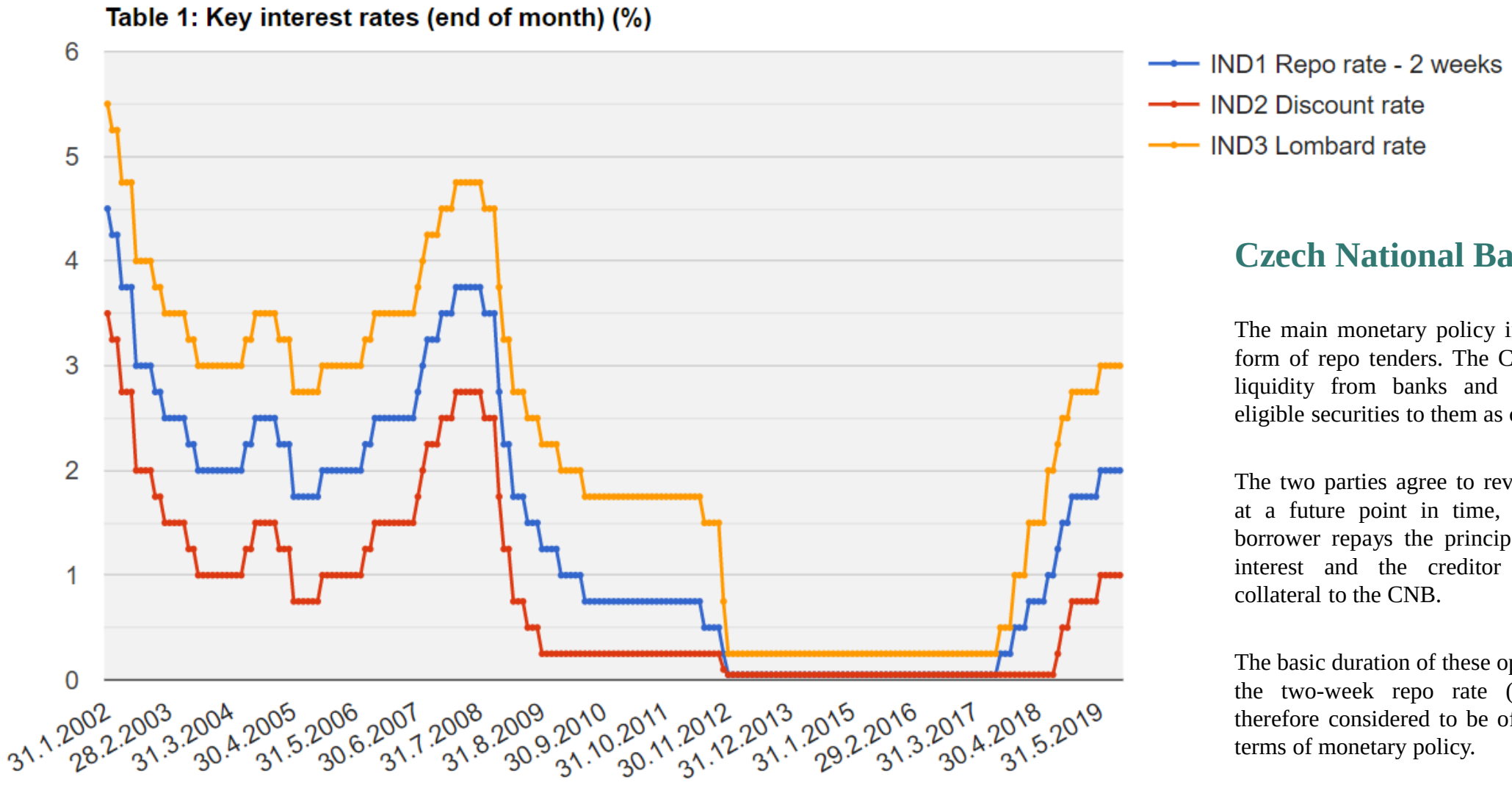
Czech National Bank interest rates



Czech National Bank rates

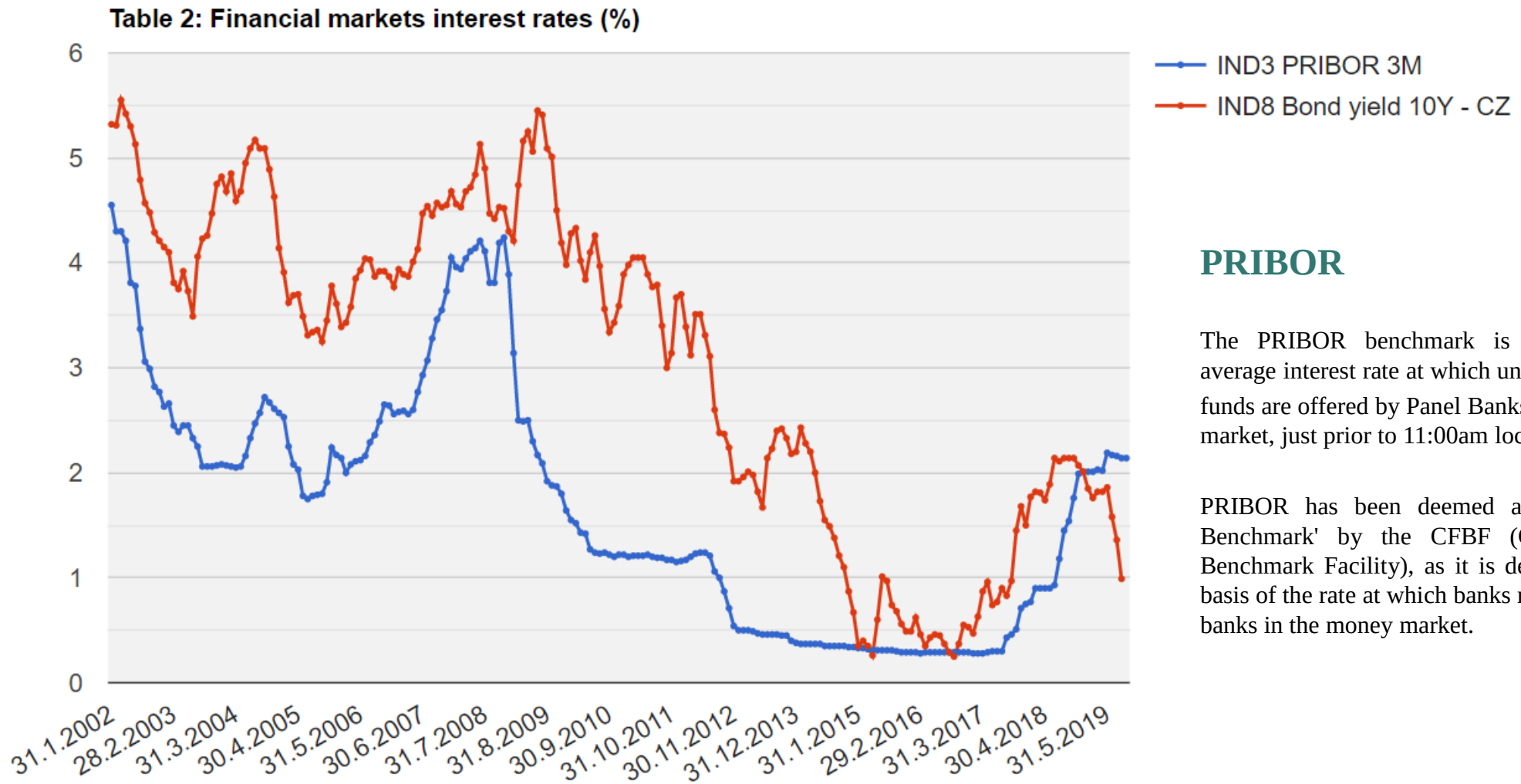
The main monetary policy instrument takes the form of repo tenders. The CNB accepts surplus liquidity from banks and in return transfers eligible securities to them as collateral.

The two parties agree to reverse the transaction at a future point in time, when the CNB as borrower repays the principal of the loan plus interest and the creditor bank returns the collateral to the CNB.

The basic duration of these operations is 14 days; the two-week repo rate (2W repo rate) is therefore considered to be of key importance in terms of monetary policy.

Source:
https://www.cnb.cz/cnb/STAT.ARADY_PKG.PARAMETRY_SESTAVY?p_sestuid=377&p_strid=AAAG&p_lang=EN

Better to discount 10Y bond yields



PRIBOR

The PRIBOR benchmark is defined as the average interest rate at which unsecured CZK funds are offered by Panel Banks in the interbank market, just prior to 11:00am local time.

PRIBOR has been deemed an 'Interest Rate Benchmark' by the CFBF (Czech Financial Benchmark Facility), as it is determined on the basis of the rate at which banks may lend to other banks in the money market.

Source:
https://www.cnb.cz/cnb/STAT.ARADY_PKG.PARAMETRY_SESTAVY?p_sestuid=22643&p_strid=AAAG&p_lang=EN

Real case within a Czech bank

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6. We want to dispose of a real amount of CZK 550,000 over 25 years. The nominal interest rate is 2.3% p.a. and the inflation rate is 3.1%. How much do you have to deposit today?

$$PV = \frac{550{,}000}{\left(\frac{1.023}{1.031}\right)^{25}}$$

- Rather use the money for a business or an investment.

Inflation over a long-term period

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7. How much will be a purchasing power of CZK 1 million in 30 years be expected if inflation is expected to be 5% per year?

$$FV = 1mil * (\frac{1+0}{1.05})^{30}$$

- Further, there is even not any insurance for such a deposit at home.

Differentiate between types of interest rates

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8. Calculate the nominal interest rate if the inflation rate is 2.8% and the real interest rate is 0.8%.

Nominal interest rate

$$i = (1+r)(1+\pi) - 1$$

$$i = (1.008) * (1.028) - 1$$

- If You know the real interest rate You cannot calculate a real one again ☺

From the business world

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9. Calculate the real interest rate if you get CZK 1,115 at the end of the year for CZK 1,000 received for the sale of goods and the price of the goods has risen to CZK 1,095.

$$a)\ i = 11.5\%\ ;\ \pi = 9.5\%$$

$$b)\ r = \frac{1.115}{1.095} - 1$$

- Try to use Your logic to solve this example

Literature

1) Seminar 02/03 Examples
2) ROSS, S. A., R. W. WESTERFIELD, J. JAFFE & B. D. JORDAN, 2019. Valuation and Capital Budgeting. In: Corporate Finance, PART II, pp. 85-298. ISBN 978-1-260-09187-8.
3) BERK, J. & P. DeMARZO, 2017. The Time Value of Money. In: Corporate Finance, Chap. 4, pp. 130-174. ISBN 978-1-292-16016-0.

- Have You already bought Your own calculator ?? ☺

Thank you for your attention!