Advanced Monetary Economics

Lecture 4

Malte Rieth
Martin-Luther-Universität Halle-Wittenberg

Aim of this class

- Last week, we have learned what monetary policy does.
- Monetary policy determines the overnight rate.
- Monetary policy has the following tools available:
  1. Open market operations
  2. Standing facilities
  3. Minimum reserve requirements
- This week, we study, through which channels monetary policy influences the economy.

1 The yield curve

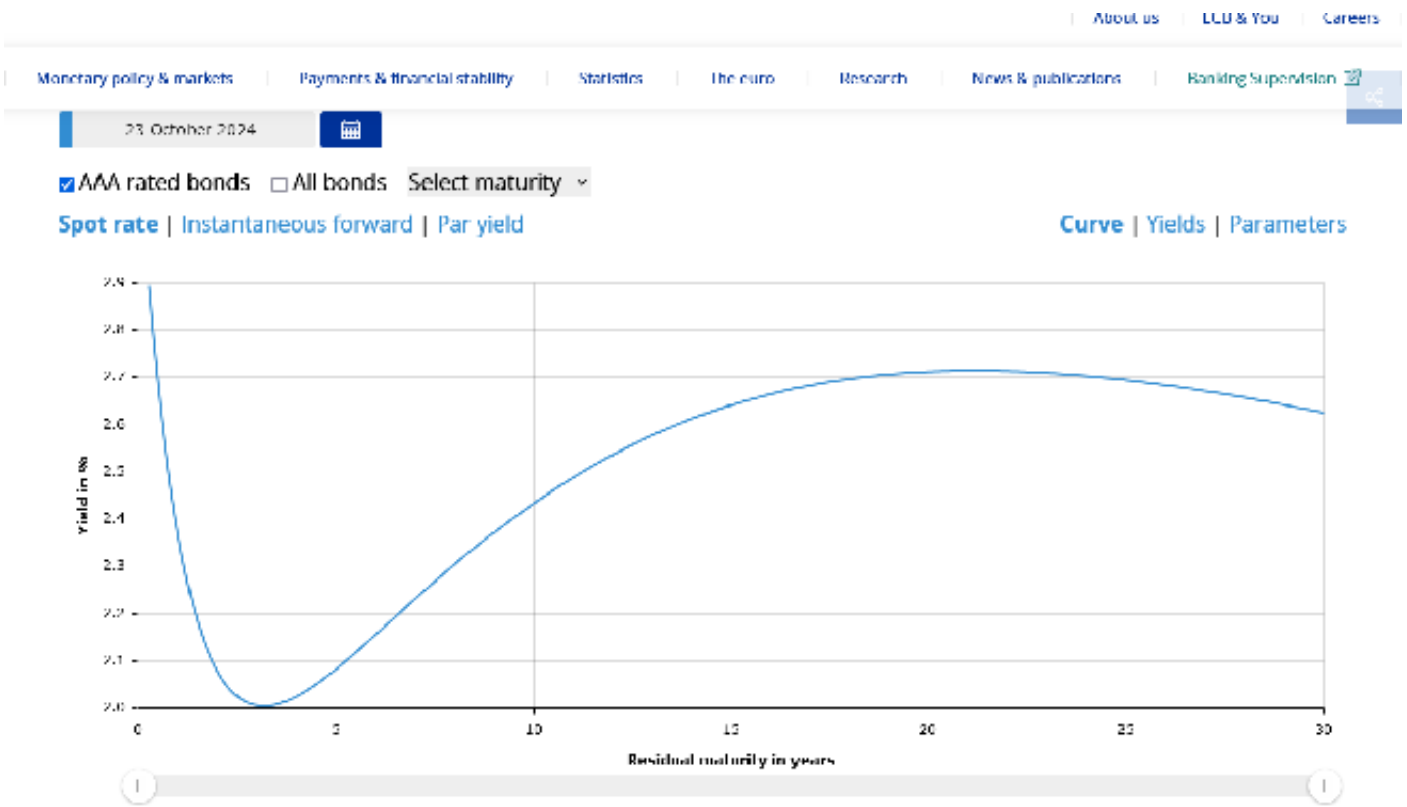
- How does a change in the short-term interest rate change the remaining interest rates?

- The yield curve connects interest rates for different time horizons.

- A yield curve represents the relationship between interest rates (in the same currency with comparable risk and liquidity) and the remaining time to maturity.

- Yield curves can be flat (short-term $\approx$ long-term rates), upward sloping (short-term $<$ long-term rates) or downward sloping (short-term $>$ long-term rates, sometimes called "inverted").

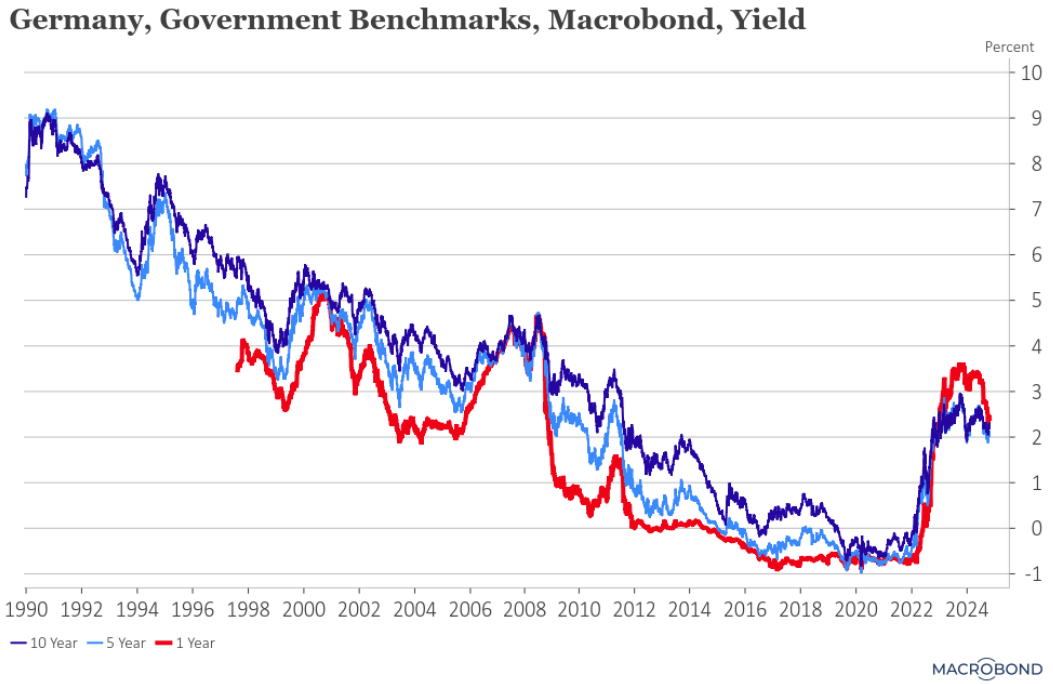
- Euro area yield curve for AAA rated government bonds on Oct. 23, 2024



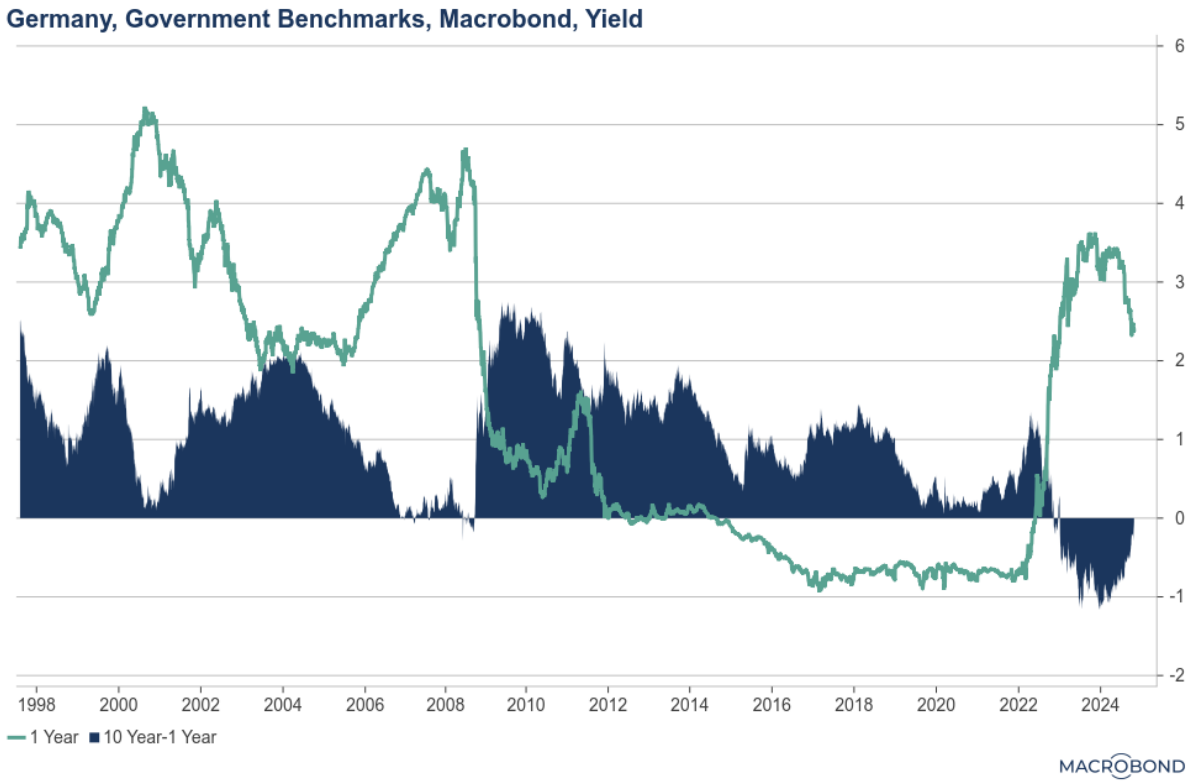
Dashed lines indicate the spot rate based on all government bonds; solid lines on AAA-rated bonds only.

- Find the latest data on euro area yield curves here: `https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/euro_area_yield_curves/html/index.en.html`

- Evolution of German government bond yields for different maturities



- Evolution of 10y-1y spread and 1y yield in Germany



- 3 facts on yield curves

  1. Interest rates on bonds of different maturities move together over time.

  2. When short-term interest rates are low, yield curves are more likely to have an upward slope – and vice versa.

  3. Yield curves almost always slope upward.

- 3 theories to explain the facts

  1. Expectations theory

  2. Segmented markets theory (not part of this class)

  3. Liquidity premium theory

2 Expectations theory

- Basic intuition: long-term rates are an average of the expected short-term rates over the duration of the long-term bond.

- Yields on bonds with different maturities may differ because of changing short-term rates in the future.

- Assumption: bonds with different maturities are perfect substitutes. All that matters is the expected return.

- Example with two periods: investors are indifferent between

  1. one bond with two period maturity

  2. two one-period bonds

Investment strategy 1

- Notation: $i_{n,t}$ – agreed interest rate for n periods at period t:
- bond with two-period maturity pays $i_{2,0}$
- Investment of 1 euro yields after two periods:

$$(1 + i_{2,0})(1 + i_{2,0}) = 1 + 2i_{2,0} + (i_{2,0})^2$$

- $(i_{2,0})^2$ is very small if $i_{2,0}$ is small.
- Subtract the investment of 1 euro, the profits are: $2i_{2,0}$.

Investment strategy 2

- We now consider two bonds:
  1. one-period bond from period 0 to 1, paying interest rate $i_{1,0}$.
  2. one-period bond from period 1 to 2, paying *expected* interest rate $i^e_{1,1}$.

- Expected interest rate of 1 euro after two periods is:

$$(1 + i_{1,0})(1 + i^e_{1,1}) = 1 + i_{1,0} + i^e_{1,1} + i_{1,0} i^e_{1,1}$$

- Neglecting the last term and subtracting the investment, profit is: $i_{1,0} + i^e_{1,1}$.

Comparing both strategies

- Investors are indifferent between both ways to invest by assumption.
- It has to hold:

$$\begin{aligned} 2i_{2,0} &= i_{1,0} + i^e_{1,1} \\ i_{2,0} &= \frac{i_{1,0} + i^e_{1,1}}{2} \end{aligned}$$

- Expected interest rates determine the interest rate for the two-period bond.
- Two-period interest rate is equal to the average interest rate over two periods.

Example with numbers and general formula

- One-period bonds: $i_{1,0} = 5\%, i^e_{1,1} = 6\%, i^e_{1,2} = 7\%, i^e_{1,3} = 8\%, i^e_{1,4} = 9\%.$
- Interest-rate for a two period bond is then: $i_{2,0} = \frac{5\%+6\%}{2} = 5.5\%.$
- Interest-rate for a five period bond is then: $i_{5,0} = \frac{5\%+6\%+7\%+8\%+9\%}{5} = 7\%.$
- The yield curve is increasing.
- General formula

$$i_{n,t} = \frac{i_{1,0} + i^e_{1,1} + i^e_{1,2} + \ldots + i^e_{1,n-1}}{n}$$

Facts vs. expectations theory

1. Interest rates on bonds of different maturities move together over time. ✓

   Expectations theory implies that interest rates on bonds with different maturities influence each other (change in $i^e_{1,1}$, for example, affects $i_{2,0}$ and $i_{5,0}$ in same direction).

2. When short-term interest rates are low, yield curves are more likely to have an upward slope – and vice versa. ✓

   This is what the expectations theory implies. When current short-term rates are low, people expect them to rise to a normal level in the future, and vice versa.

3. Yield curves almost always slope upward.

   Expectations theory cannot explain this fact.

3 Liquidity premium theory

- Assumption: bonds with different maturities are substitutes (as before), but not perfect substitutes.

- Instead: preference for shorter maturities, for example, because of interest rate risk.

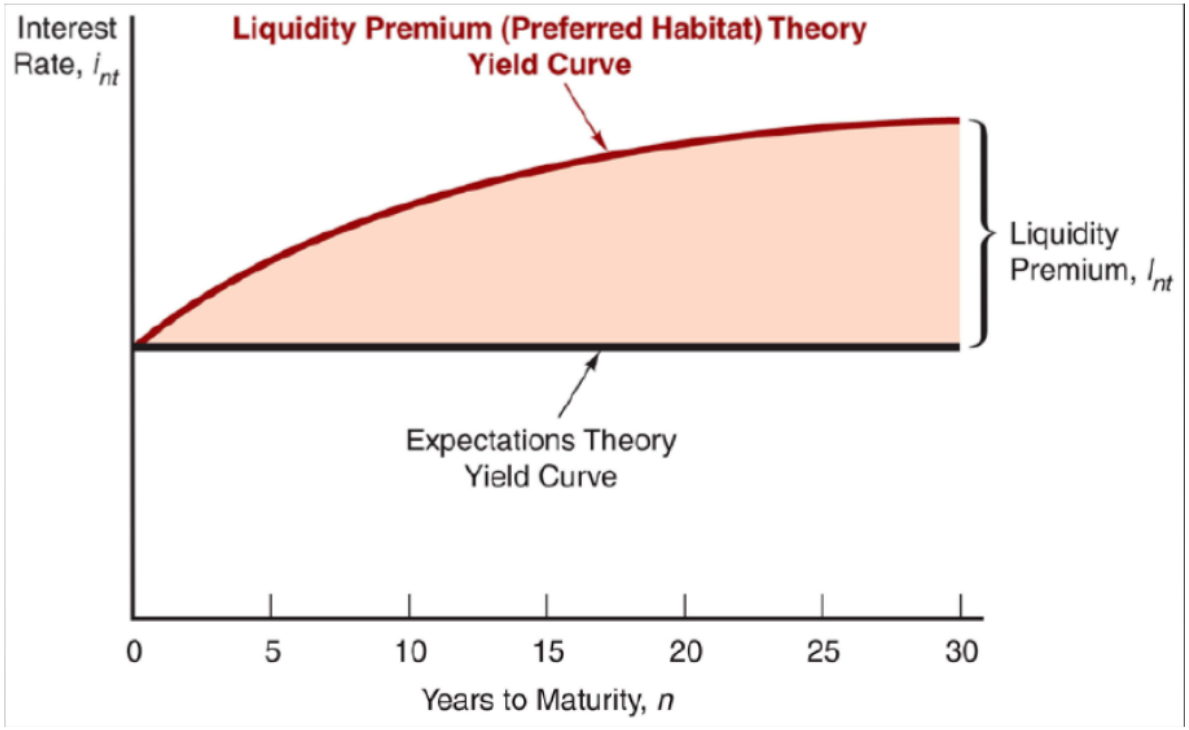
- Liquidity premium theory captures this preference by adding an additional term to the equation of the expectation theory: $l_{n,t}$, which is called liquidity or term premium.

- This additional term is increasing in the maturity n as longer-term bonds bear greater interest rate risk.

- Mathematical representation of liquidity premium theory:

$$i_{n,t} = \frac{i_{1,0} + i^e_{1,1} + i^e_{1,2} + \ldots + i^e_{1,n-1}}{n} + l_{n,t}$$

- Graphical representation of liquidity premium theory:



Facts vs. liquidity premium theory

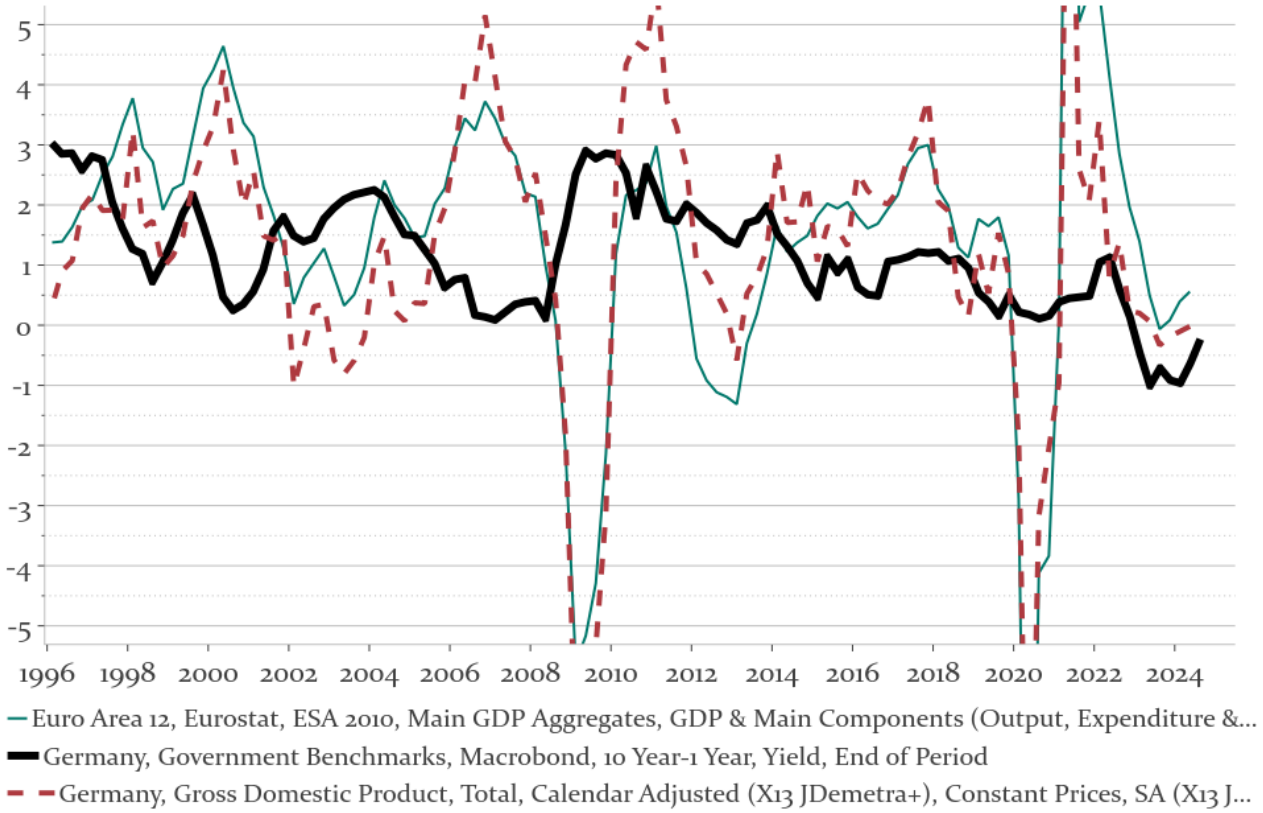
1. Interest rates on bonds of different maturities move together over time. ✓

2. When short-term interest rates are low, yield curves are more likely to have an upward slope – and vice versa. ✓

3. Yield curves almost always slope upward. ✓

   Expectations theory explains this fact well. Investors prefer bonds with shorter maturities which are more liquid. So longer-term interest rates need to contain a liquidity premium.

- Term spread (10y-1y) and annual real GDP growth in the euro area and Germany (in %)



4 Monetary policy and the yield curve

- On the market for reserves the central bank influences the overnight interest rate.

- Other important interest rates in the economy are mortgage rates and credit rates. These are mid- and long-term interest rates

- The yield curve relates the short-term to the long-term rates.

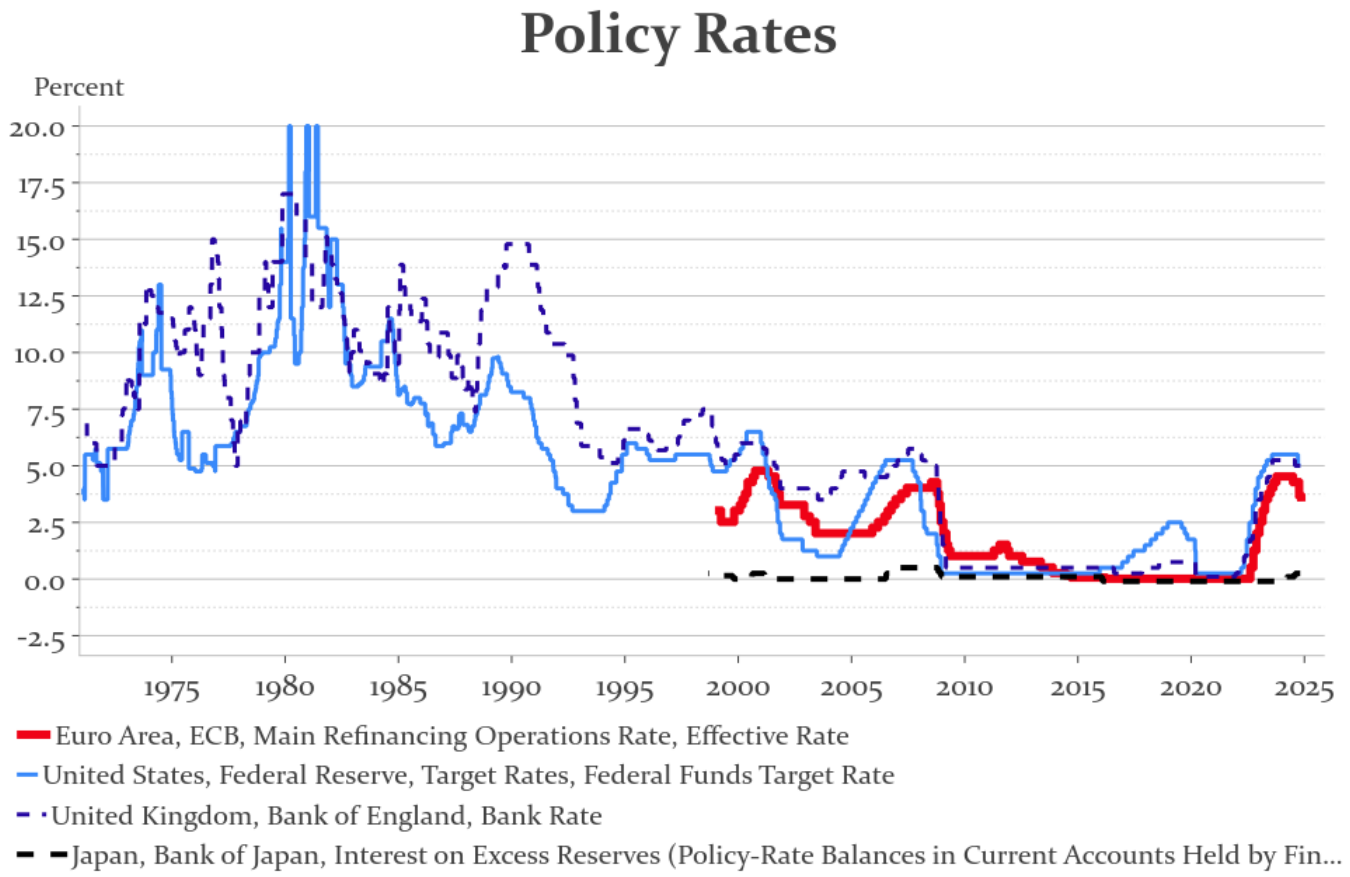
- Monetary policy can influence the long-term interest rates in three ways:

  1. Changing the short-term interest rate.

  2. Changing expectations about future interest rates.

  3. Influencing long-term interest rates.

- Challenge if short-term interest rates are at zero



- ECB PRESS RELEASE, Monetary policy decisions, 29 October 2020: At today's meeting the Governing Council of the ECB took the following monetary policy decisions:

1. The interest rate on the main refinancing operations and the interest rates on the marginal lending facility and the deposit facility will remain unchanged at 0.00%, 0.25% and -0.50% respectively.

- Hence, central banks tried the second option (changing expectations about future interest rates, forward guidance) and the third option (influencing long-term interest rates, quantitative easing).

- These measures are called unconventional monetary policy. They aim at influencing the medium to longer end of the yield curve, not through the current short-term rate.

- ECB PRESS RELEASE again and continued:

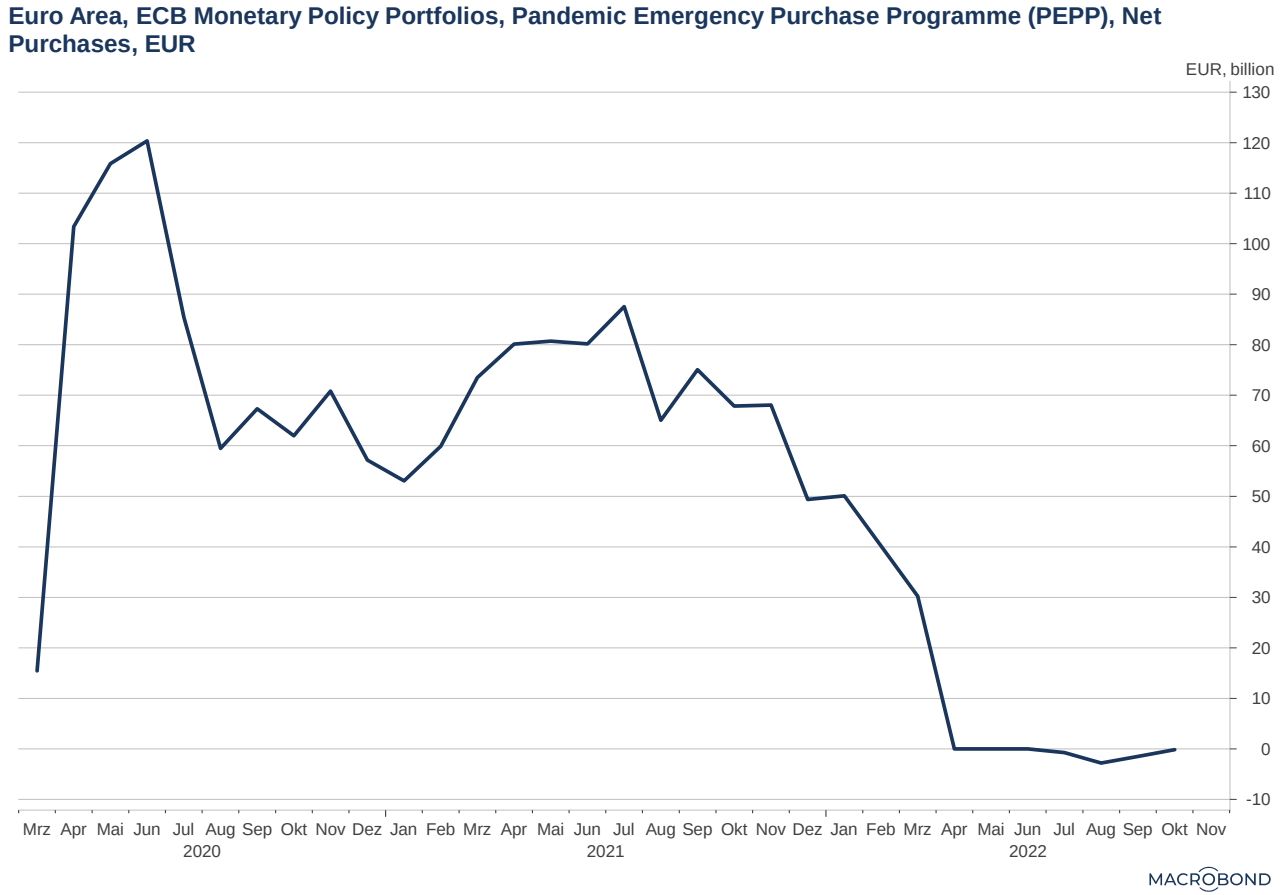
1. "[...] The Governing Council expects the key ECB interest *rates to remain at their present or lower levels until* it has seen the inflation outlook robustly converge to a level sufficiently close to, but below, 2% within its projection horizon, and such convergence has been consistently reflected in underlying inflation dynamics."

- The ECB thus aims at affecting expectations about future short-term rates through its communication.

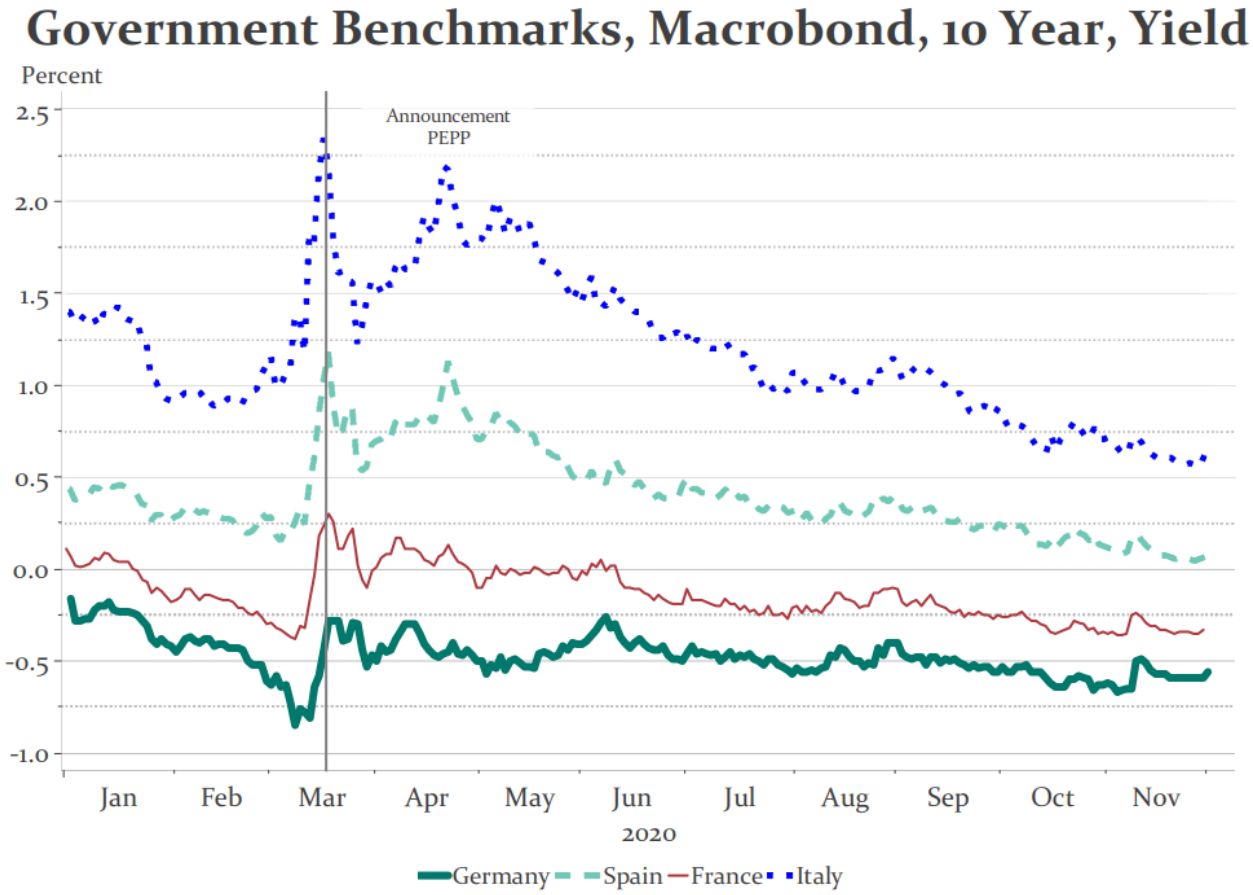
- ECB PRESS RELEASE continued:

2 "The Governing Council will continue its purchases under the *pandemic emergency purchase programme (PEPP)* with a total envelope of €1,350 billion. These purchases contribute to easing the overall monetary policy stance, thereby helping to offset the downward impact of the pandemic on the projected path of inflation. [...]"

- Monthly ECB purchases within PEPP



- 18 March 2020: ECB announces PEPP with initially €750 billion



Summary

- How does monetary policy influence the economy?
- Monetary policy sets short-term interest rates, gives forward guidance and buys assets.
- All tools affect the yield curve.
- These interest rates influence the economy.