Monetary Policy

Part 3: Monetary Policy at the Zero Lower Bound on Nominal Interest Rate

Lecture 9: IS-MP-PC Model With ZLB, Unconventional Monetary Policy

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Outline

Part 1: Basic Macroeconomic Concepts

Part 2: Conventional Monetary Policy

Part 3: Monetary Policy at the Zero Lower Bound on Nominal Interest Rate

- Lecture 8: Monetary Policy Transmission, Zero Lower Bound
- Lecture 9: IS-MP-PC Model With ZLB, Unconventional Monetary Policy
- Lecture 10: Unconventional Policy Effects, Zero Interest Equilibrium

Part 4: Monetary and Fiscal Interactions

Part 5: Financial Stability (if time permits)

Mock Exam

Learning Objective of Today‘s Lecture

1. How to model the ZLB in the IS-MP-PC model and its unstable dynamics
2. Introducing unconventional monetary policy
3. Understanding Quantitative Easing and Forward Guidance and their main transmission channels

Literature

Required reading

- Fiedler, Jannsen, Wolters, Hanisch (2016). "Transmission Channels of Unconventional Monetary Policy in the Euro Area: Where Do We Stand?" https://op.europa.eu/de/publication-detail/-/publication/fad7ac19-1daf-11e7-aeb3-01aa75ed71a1

Optional reading

- Tenreyro, Silvana (2021). Let's talk about negative interest rates, Speech 11 January 2021, https://www.bankofengland.co.uk/speech/2021/january/silvana-tenreyro-lets-talk-about-negative-interest-rates
- Claudio Borio, Magdalena Erdem, Andrew Filardo, and Boris Hofmann (2015) "The Costs of Deflation: A Historical Perspective", BIS Quarterly Review, March 2015: 31-45. https://www.bis.org/publ/qtrpdf/r_qt1503e.pdf
- Papers on the Fed's monetary policy strategy review: https://www.federalreserve.gov/monetarypolicy/review-of-monetary-policy-strategy-tools-and-communications-federal-reserve-research.htm

9.1 IS-MP-PC Model With ZLB

IS-MP-PC Model With ZLB

We have previously combined the IS and MP curve to the IS-MP curve to draw it together with the Phillips curve in the $\pi - y$ space.

Now we need to adapt the IS-MP curve to the possibility of hitting the ZLB. Rather than plugging in the standard MP curve, we need to plug in $i_t = 0$ for those situations in which the ZLB is reached.

Recall the IS equation:

$$y_t = y_t^* - \alpha(i_t - \pi_t - r^*) + \varepsilon_t^y$$

With $i_t = 0$ we get the IS-MP curve under a binding ZLB:

$$y_t = y_t^* - \alpha(0 - \pi_t - r^*) + \varepsilon_t^y$$

$$\Leftrightarrow y_t = y_t^* + \alpha r^* + \alpha\pi_t + \varepsilon_t^y$$

IS-MP-PC Model With ZLB

IS-MP curve with binding ZLB:

$$y_t = y_t^* + \alpha r^* + \alpha \pi_t + \varepsilon_t^y$$

Compare to the IS-MP curve when the ZLB is not binding:

$$y_t = y_t^* - \alpha(\beta_\pi - 1)(\pi_t - \pi^*) + \varepsilon_t^y$$

The major difference is that the IS-MP curve is downward sloping (slope: $-\alpha(\beta_\pi - 1)$) when the ZLB is not binding, while it is upward sloping (slope α) when the ZLB is binding.

- Without binding ZLB: $\pi_t \downarrow \Rightarrow i_t \downarrow \Rightarrow r_t \downarrow \Rightarrow y_t \uparrow$
- With binding ZLB: $\pi_t \downarrow \Rightarrow i_t \rightarrow \Rightarrow r_t \uparrow \Rightarrow y_t \downarrow$
- This leads to completely different dynamics. While the system of equations yields a stable solution without ZLB, with binding ZLB it is instable.

Triggering the ZLB

To draw the IS-MP curve that accounts for the ZLB in the $\pi - y$ space as before, we need to determine at which inflation rate the zero lower bound is reached. Let's denote this value of inflation with π^{ZLB}.

Recall the MP curve

$$i_t = r^* + \pi^* + \beta_\pi(\pi_t - \pi^*)$$

With ZLB:

$$r^* + \pi^* + \beta_\pi(\pi^{ZLB} - \pi^*) = 0$$

Re-writing yields:

$$\beta_\pi \pi^{ZLB} = \beta_\pi \pi^* - r^* - \pi^*$$

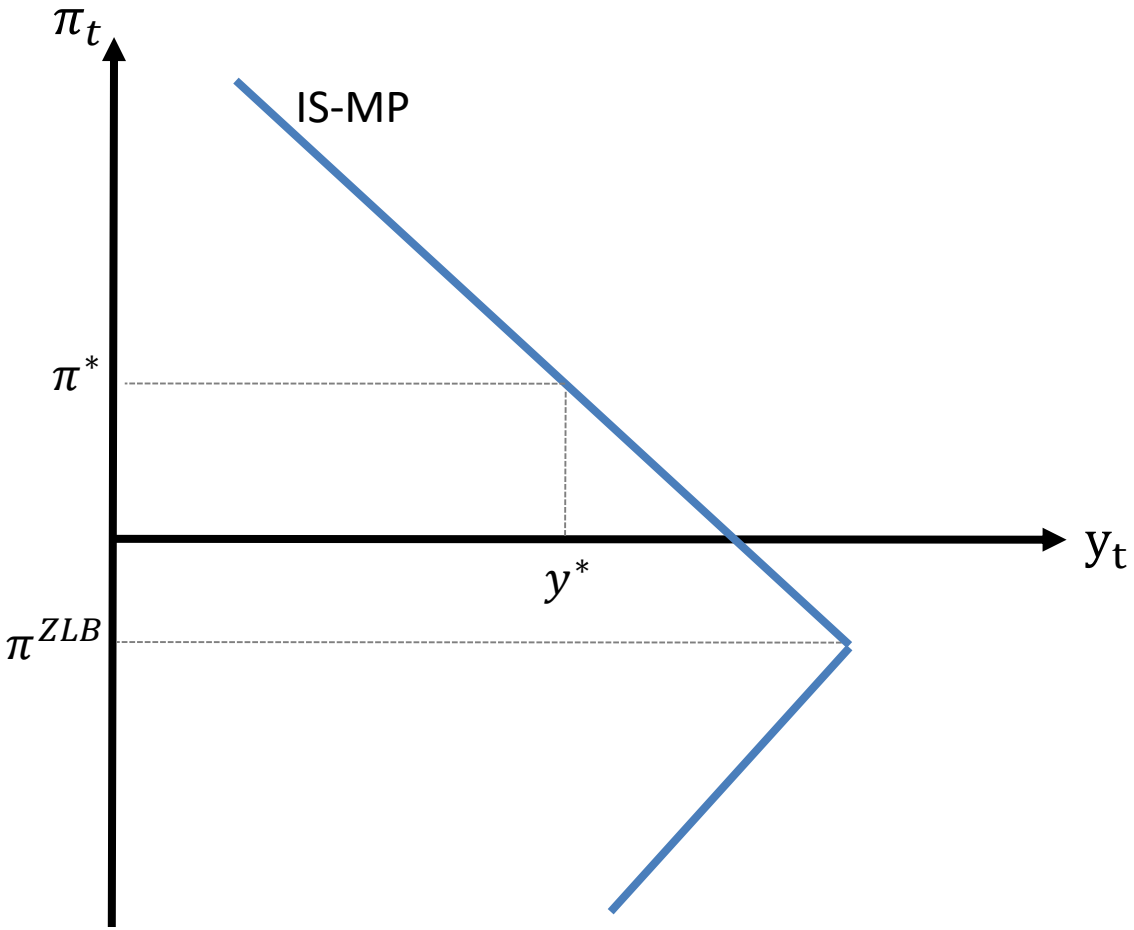
π_t^{ZLB} is then given by:

$$\pi^{ZLB} = \frac{(\beta_\pi - 1)}{\beta_\pi}\pi^* - \frac{r^*}{\beta_\pi}$$

We can then write the IS-MP curve as:

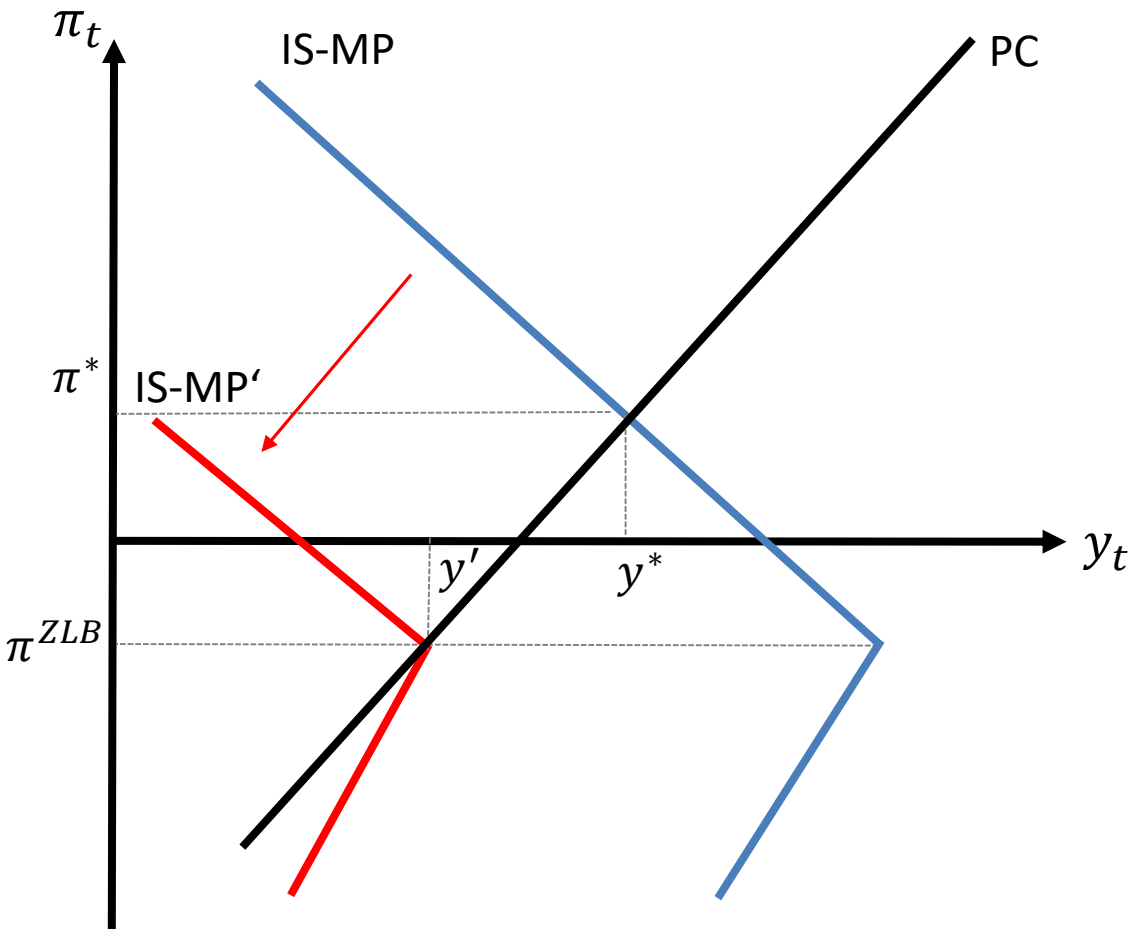
$$y_t = \begin{cases} y_t^* - \alpha(\beta_\pi - 1)(\pi_t - \pi^*) + \varepsilon_t^y & if\ \pi_t > \pi^{ZLB} \\ y_t^* + \alpha r^* + \alpha \pi_t + \varepsilon_t^y & if\ \pi_t \leq \pi^{ZLB} \end{cases}$$

IS-MP With ZLB Graphically



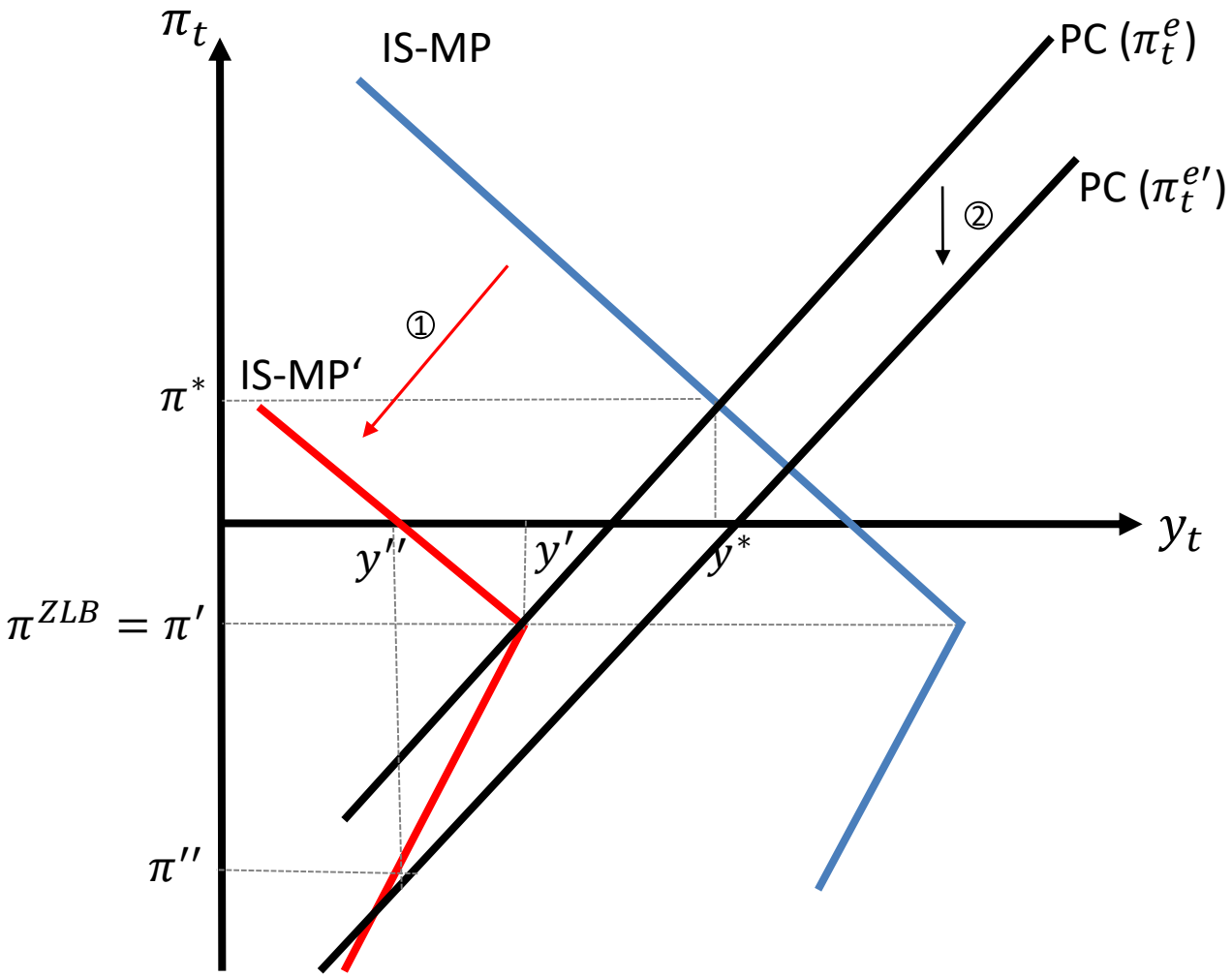
The graph implies that absent any demand shocks, the ZLB would be reached if output is above potential and inflation is very low. This is a very unlikely scenario.

IS-MP With ZLB Graphically With Negative Demand Shock



A much more likely scenario is, that negative demand shocks shift the IS-MP curve to the left/downwards, so that the ZLB becomes binding when output is below potential output

Deflationary Spiral in the IS-MP-PC Model



If inflation expectations fall, this shifts down the Phillips curve, lowering inflation and output further. A deflationary spiral has started.

Policymakers will try to prevent this situation. We will study how unconventional monetary policy and fiscal policy can be used to shift the IS-MP curve back and/or to increase inflation expectations to prevent the Phillips curve from shifting down.

Algebraic Solution for Inflation at the ZLB

IS-MP at the ZLB:

$$y_t = y_t^* + \alpha r^* + \alpha \pi_t + \varepsilon_t^y$$

Inflation is determined by the Phillips curve as before:

$$\pi_t = \pi_t^e + \gamma \left(y_t - y^*\right) + \varepsilon_t^\pi$$

Plugging the IS-MP equation into the Phillips curve yields the solution for inflation when the ZLB is binding:

$$\pi_t = \pi_t^e + \gamma \left(\alpha r^* + \alpha \pi_t + \varepsilon_t^y\right) + \varepsilon_t^\pi$$

Re-arranging yields:

$$\pi_t = \frac{1}{1-\alpha\gamma}\pi_t^e + \frac{\alpha\gamma}{1-\alpha\gamma} r^* + \frac{\gamma}{1-\alpha\gamma}\varepsilon_t^y + \frac{1}{1-\alpha\gamma}\varepsilon_t^\pi$$

Algebraic Solution for Inflation at the ZLB

$$\pi_t = \frac{1}{1-\alpha\gamma}\pi_t^e + \frac{\alpha\gamma}{1-\alpha\gamma}r^* + \frac{\gamma}{1-\alpha\gamma}\varepsilon_t^y + \frac{1}{1-\alpha\gamma}\varepsilon_t^\pi$$

The coefficient on expected inflation, $\frac{1}{1-\alpha\gamma}$ is greater than one. This has strong implications:

- A decrease in inflation expectations leads to a more than one-to-one decrease in inflation
- Unstable inflation dynamics are the results
- In the case of adaptive expectations this can be directly seen from $\pi_t = \underbrace{\frac{1}{1-\alpha\gamma}}_{>1}\pi_{t-1}$
- In the case of other expectation formations like rational expectations, an exogenous change in inflation expectations is self-fulfilling as it has a large impact on actual inflation. The impact is more than one-to-one which would lead to a further decline in inflation expectations, leading to a further decline in inflation, …

Algebraic Solution for Output at the ZLB

Solution for output can be found by substituting the solution for inflation at the ZLB in the IS-MP curve at the ZLB:

$$y_t = y_t^* + \alpha r^* + \alpha\left(\frac{1}{1-\alpha\gamma}\pi_t^e + \frac{\alpha\gamma}{1-\alpha\gamma}r^* + \frac{\gamma}{1-\alpha\gamma}\varepsilon_t^y + \frac{1}{1-\alpha\gamma}\varepsilon_t^\pi\right) + \varepsilon_t^y$$

$$y_t = y_t^* + \alpha r^* + \frac{\alpha}{1-\alpha\gamma}\pi_t^e + \frac{\alpha^2\gamma}{1-\alpha\gamma}r^* + \frac{1}{1-\alpha\gamma}\varepsilon_t^y + \frac{\alpha}{1-\alpha\gamma}\varepsilon_t^\pi$$

Output decreases if expected inflation decreases. We have seen for the solution of inflation that inflation dynamics are instable, so that falling inflation expectations would lead to a deflationary spiral. The solution for output shows that this leads to falling output, too.

Output can be increased by:

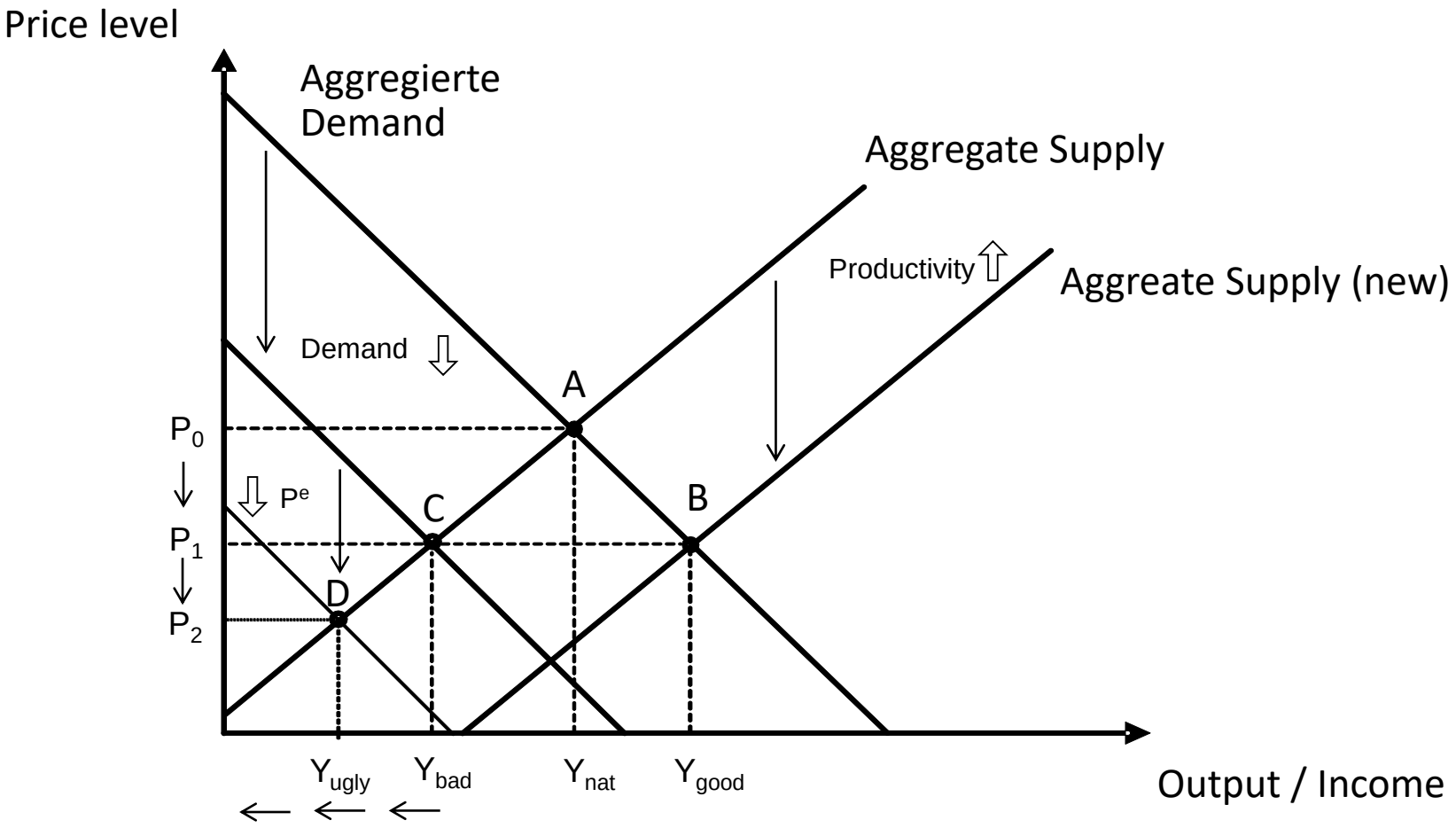
- Increasing Inflation expectations π_t^e
- Increasing demand ε_t^y, for example by increasing government spending
- Increasing inflation ε_t^π

We will discuss how unconventional monetary policy and fiscal policy try to make use of these channels to get away from the ZLB.

Historical Deflation Episodes

Source: Borio et al. (2015)

Deflation: the good, the bad, the ugly

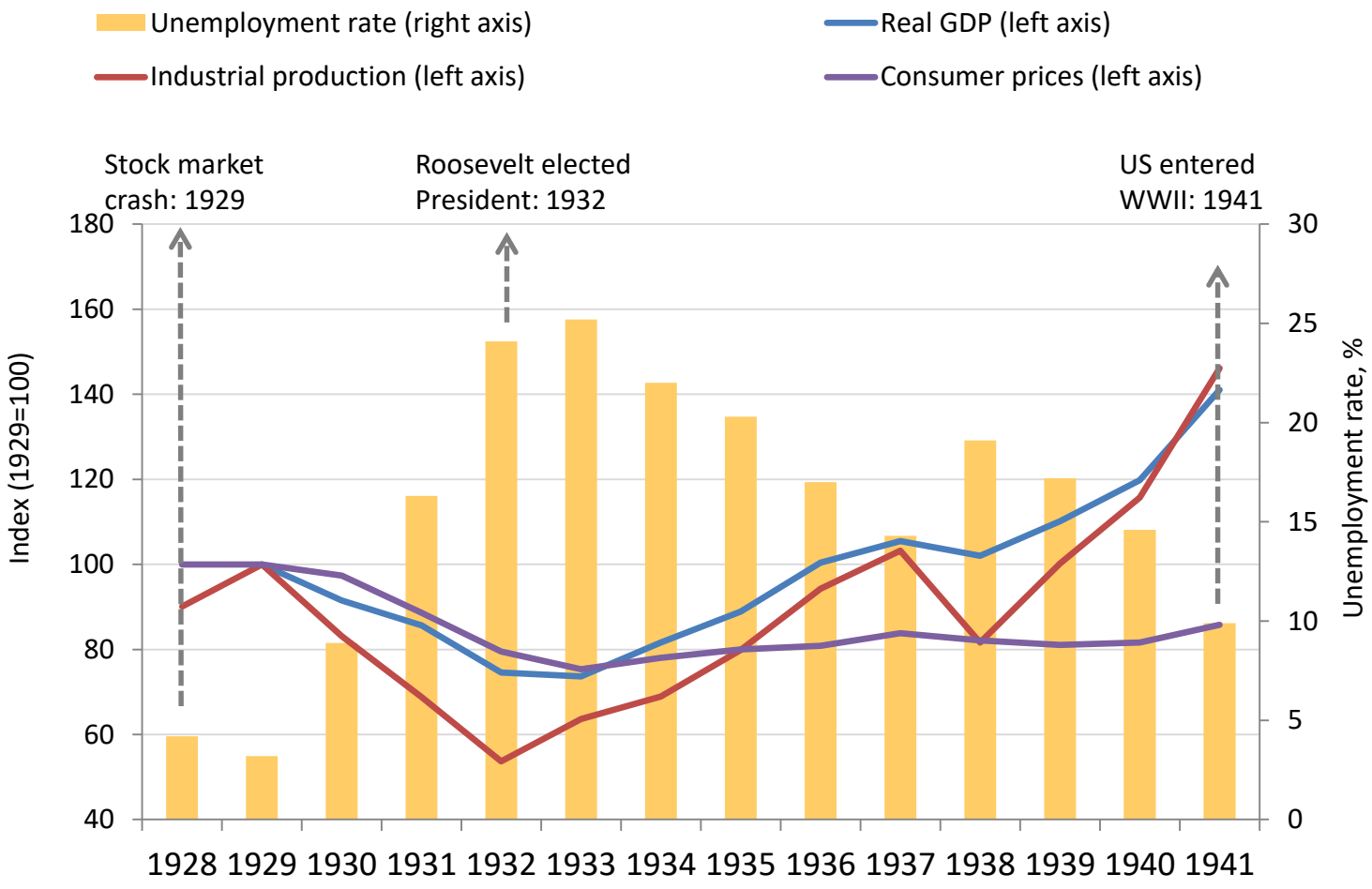


- Good: Productivity/Technology shocks increase output, decrease prices.
- Bad: Demand shocks reduce output and prices
- Ugly: Self-enforcing deflationary spiral. For example: Irving Fisher's (1867-1947) debt-deflation spiral.

The Great Depression: Prime Example for a Deflationary Spiral

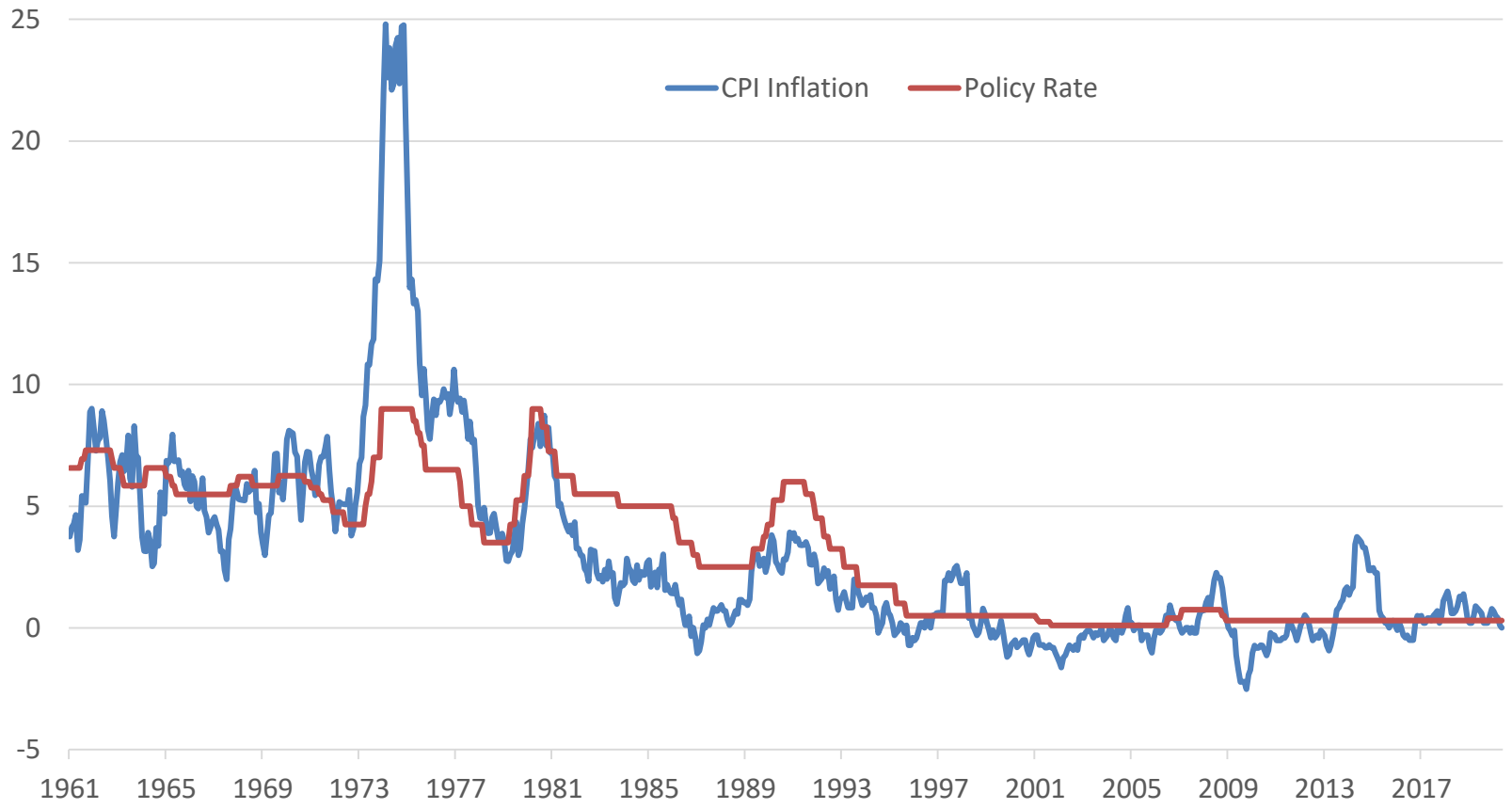
- The Great Depression started with a normal recession in 1929.
- Rather than expanding monetary policy, it was even tightened due to the gold standard. From 1930-1933 money supply fell by 30 % in the US and the Fed did not counteract these developments.
- Fiscal policy was contractionary. It was thought that an increase in public spending would fully crowds out private spending, i.e. that fiscal policy is a zero-sum game
- The belief that deflation was a necessary and inevitable adjustment from the preceding boom also provided an excuse to refrain from any significant policy response. The idea of a cold-turkey-type recession that would let non-productive firms and banks go bankrupt and in this way free up resources for a fast recovery and higher growth in the future was dominating.
- A series of financial crises and banking panics occurred between 1930 and 1933.
- In the mid-1930s a severe drought occurred.
- Great Depression spread from the US to other countries.
- The economy began to recover, once the convertibility of gold was suspended and Roosevelt enacted the “New Deal”, but it took until the beginning of World War II to end the Great Depression.
- Keynes ideas were heavily influenced by the Great Depression. Nowadays, the mainstream view is, however, that the monetarist explanation of not sufficiently expanding money supply is the main explanation for the Great Depression.

The Great Depression



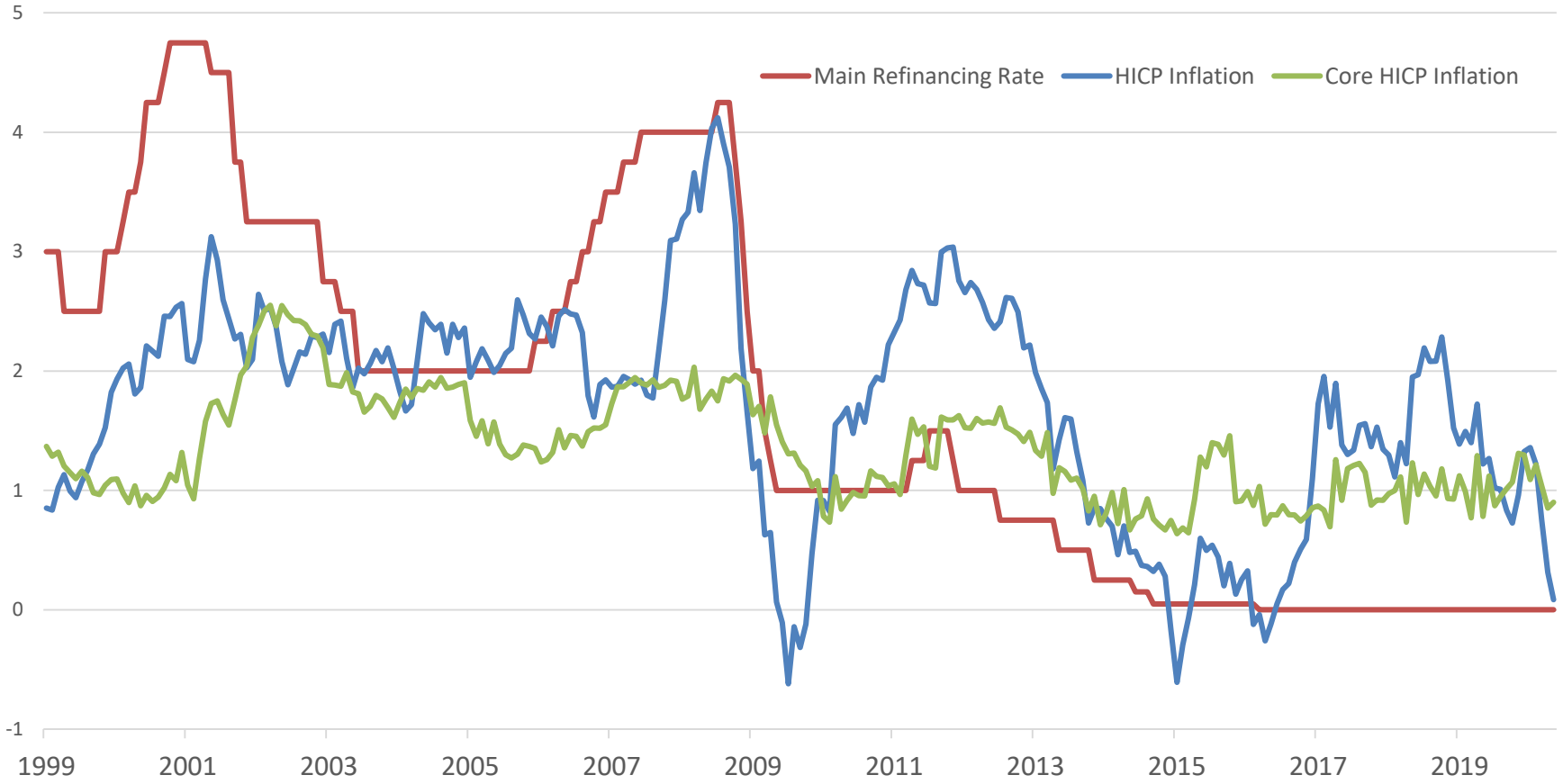
Source: http://www.core-econ.org

Policy Rate and Inflation in Japan: No Deflationary Spiral



- The policy rate has been close to zero at least since 2001.
- Inflation was on average 0.16 % since 2001.
- Low inflation rather than a deflationary spiral.
- Implies that there are some policy options remaining to stabilize the economy at the ZLB, though the Bank of Japan has not succeeded in bringing inflation back to its target of 2%.

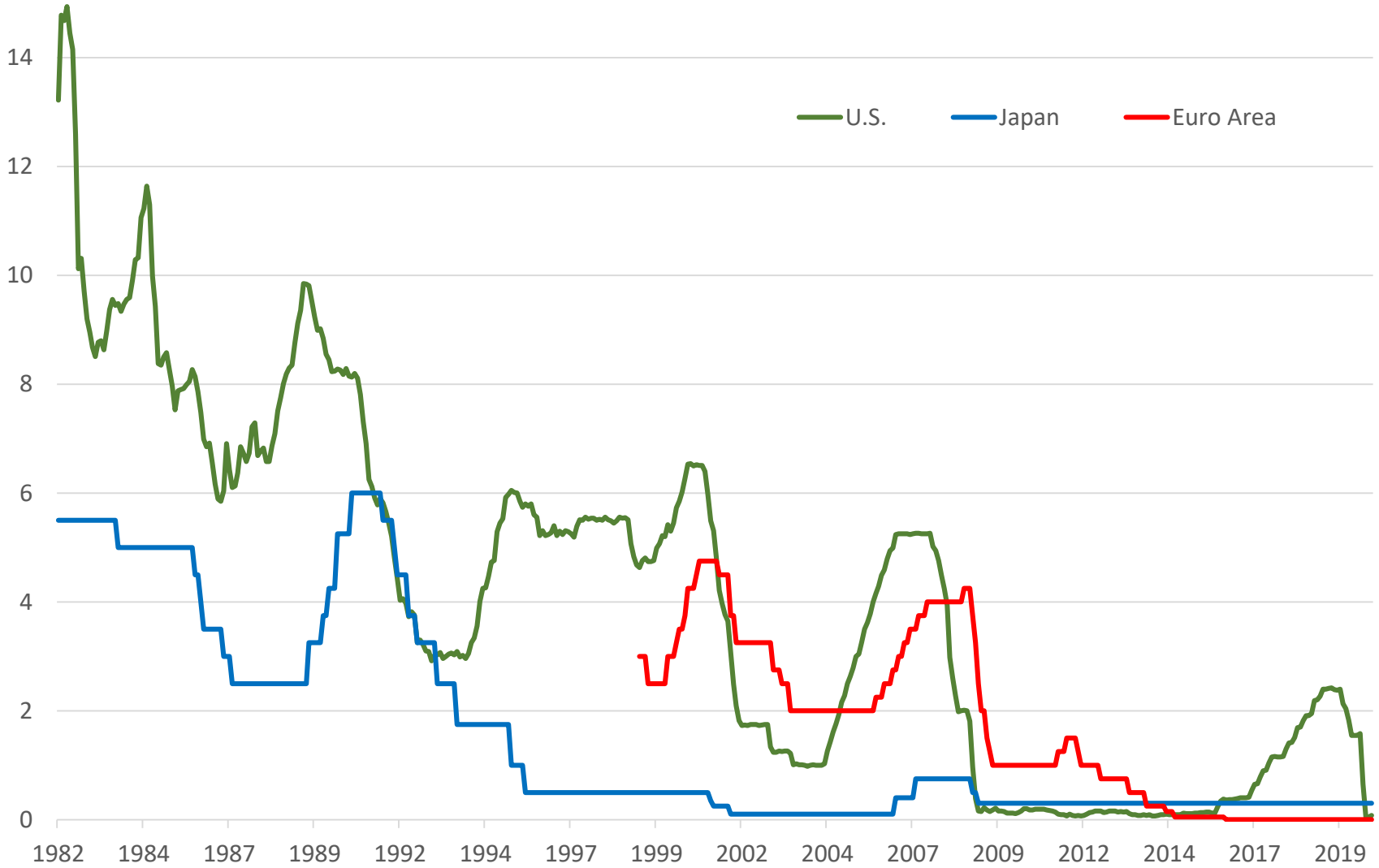
Policy Rate and Inflation in the Euro Area: No Deflationary Spiral



- The policy rate has been close to zero since 2015
- Inflation has been below 2%, but not too much due to energy prices. Core inflation stable around 1 %.
- Low inflation rather than a deflationary spiral.
- Implies that there are some policy options remaining to stabilize the economy at the ZLB, though the ECB has not succeeded in bringing inflation back to its target of 2%.

9.2 Unconventional Monetary Policy

Policy Rates of Major Central Banks



Source: Fred St. Louis, Bundesbank, Bank of Japan, own computations

Unconventional Monetary Policy

Four broad categories

- Balance sheet policies mainly known as Quantitative Easing
- Communication strategies known as Forward Guidance
- Liquidity operations
- Negative Interest rates

We will focus here on quantitative easing and forward guidance.

Liquidity operations are mainly used to deal with acute problems in the interbanking market during a financial crisis rather than replacing conventional monetary policy in order to influence output and inflation.

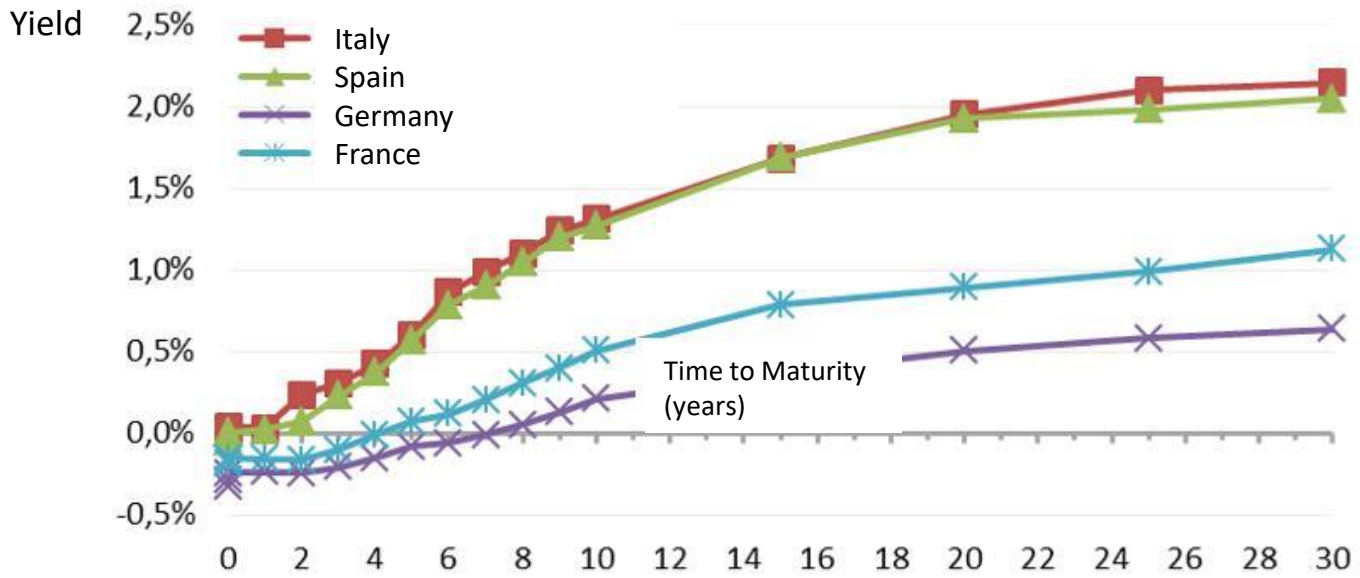
The usage of negative interest rates is rather limited as the effective lower bound is not far below zero (see Tenreyro's speech on negative interest rates in optional readings).

Goals

- Flattening the yield curve, i.e. decreasing interest rates relevant for consumption and investment decisions. While the policy rate might be already at zero, there can be positive rates for bonds with longer maturities.
- Decreasing the real interest rate via increasing inflation expectations to decrease real financing cost.

Yield Curve and Unconventional Monetary Policy

Example: Yields on sovereign bonds in the euro area March 2015



The graph shows the yield curve when the policy rate in the euro area reached zero and the ECB started Quantitative Easing (the Expanded Asset Purchase Program).

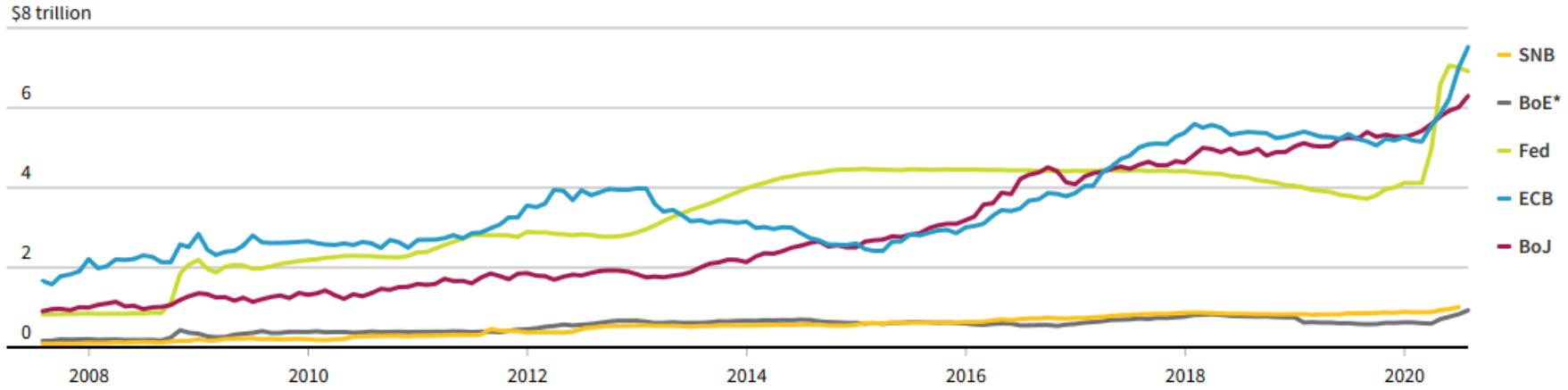
While the policy rate was zero and short-term sovereign bonds even showed a negative yield, long-term rates were still positive.

Quantitative Easing

Definition: Large scale purchases of securities on the secondary market in order to increase bank reserves, lower longer term interest rates, and inflate a wide range of asset prices.

It leads to a large expansion of central banks' balance sheets and has been frequently employed since 2008.

Central Bank Balance Sheets since mid-2007



Source: Thomson Reuters

Credit easing is also sometimes included in the definition of QE. In this case the composition of the central bank's balance sheet changes without increasing its size. The aim of credit easing is the improvement of the functioning of a particular segment of the credit market.

Transmission of Quantitative Easing

Bernanke: „The problem with QE is it works in practice, but it doesn't work in theory."

- Wallace neutrality: Assets are priced based on future expected returns and risks independent of ownership of the assets.
- If the central bank buys assets, thereby increasing demand and asset prices, private investors would sell these assets as they are overvalued in their view. The effect of QE would be zero.
- Therefore, QE can only have an effect if different assets are not perfect substitutes (recall the Segmented Markets Theory from previous lecture). Example: Pensions funds and Life Insurance companies are obliged to hold long maturity bonds, because they have long-run payment obligations.
- Two main channels: The porfolio rebalancing channel and the signalling channel.
- On top, there can be a reduction in risk premia if assets like corporate bonds or mortgage backed securities are bought (the latter might extract credit risk from bank balance sheets).

Transmission of Quantitative Easing

Portfolio rebalancing channel

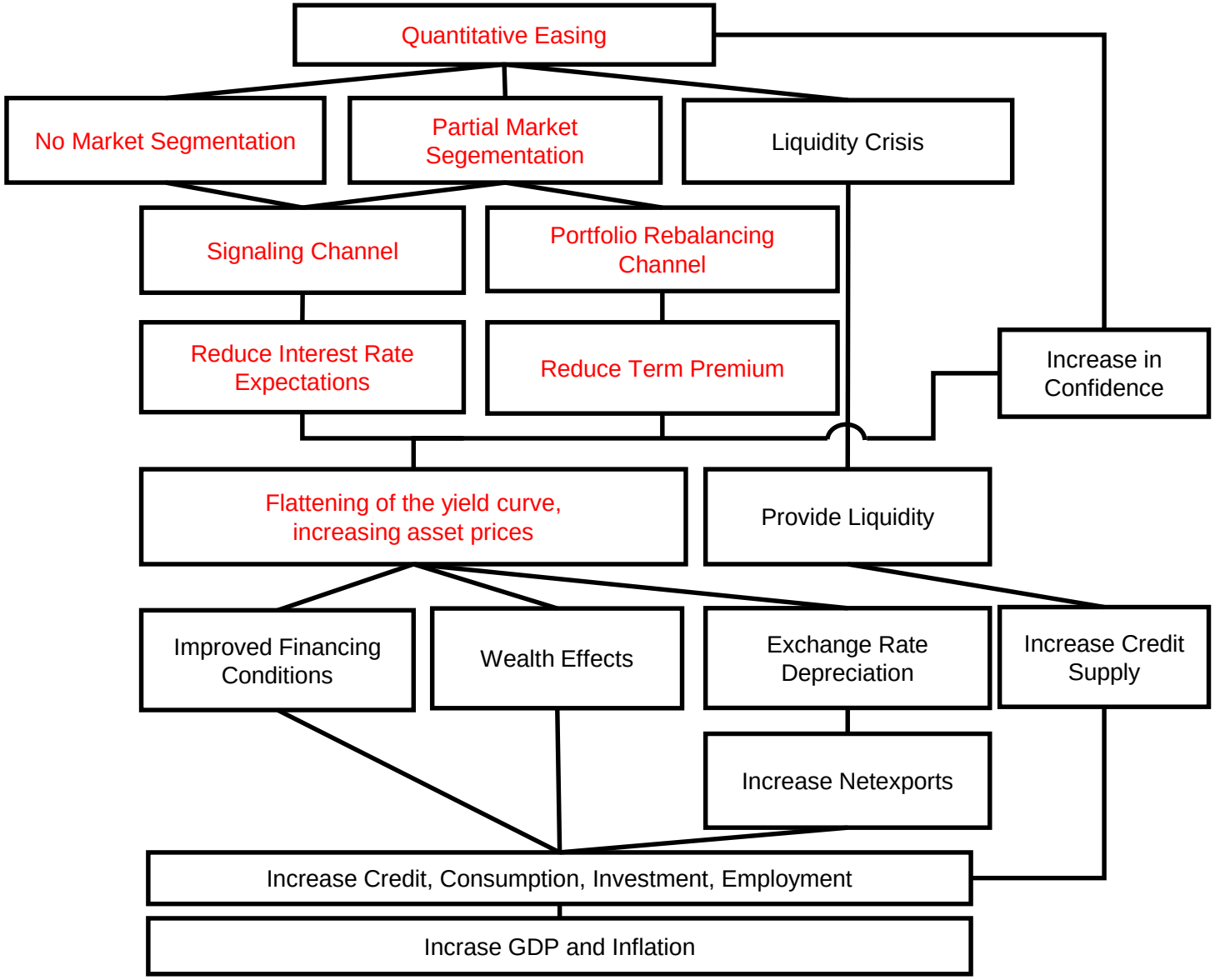
- If there is some market segmentation, the prices of those assets that are bought by the central bank will increase and their yields will decrease
- Some investors will rebalance their portfolio to other assets. In turn, prices of these assets will increase as well and yields will decrease, although they were not directly targeted by QE.
- These effects can then jointly affect output and inflation via the interest rate channel, the asset price channel, the risk channel, the credit channel and exchange rate channel (see transmission channels of conventional monetary policy in the previous lecture)
- It mainly affects the term premium component of long-term interest rates

Transmission of Quantitative Easing

Signaling channel

- Via loading its balance sheet with a large amount of high-duration securities, the central bank runs the risk of incurring huge losses if interest rates rise early, because the value of the central bank's portfolio would decrease in this case.
- Hence, QE can increase credibility of forward guidance announcements of keeping interest rates low for an extended period and thereby decrease expectations about future short-term interest rates.
- We will see that forward guidance entails a time inconsistency problem

Overview on Transmission Channels of QE



Gern, K-J, N Jannsen, S Kooths, M Wolters (2015), Quantitative Easing in the Euro Area: Transmission Channels and Risks, Intereconomics, 50(4): 206-212.

Forward Guidance

Definition: Central bank communication about future monetary policy in order to guide market expectations.

Two types:

- Delphic forward guidance (refers to the oracle of ancient Greece's Delphi): the central bank tells the public about its expectations of its own policy course conditional on its expectations about future developments. Implies that if circumstances change, the policy can change.
- Odyssean forward guidance (refers to the Odyssey when Ulysses ties himself to the mast of his boat to escape the Sirens): Commitment to a preset course for interest rates even if it turns out to be not optimal in the future.
- Delphic is softer than Odyssean, though in practice Odyssean forward guidance might face credibility issues to time inconsistency of unconditional announcements.
- Delphic forward guidance dominates in central bank practice.

Transmission of Forward Guidance

Transmission

- Decrease long rates via the expectation channel.
- Reduce term premia via reducing uncertainty about future interest rates.
- Effects depend on credibility of announcements

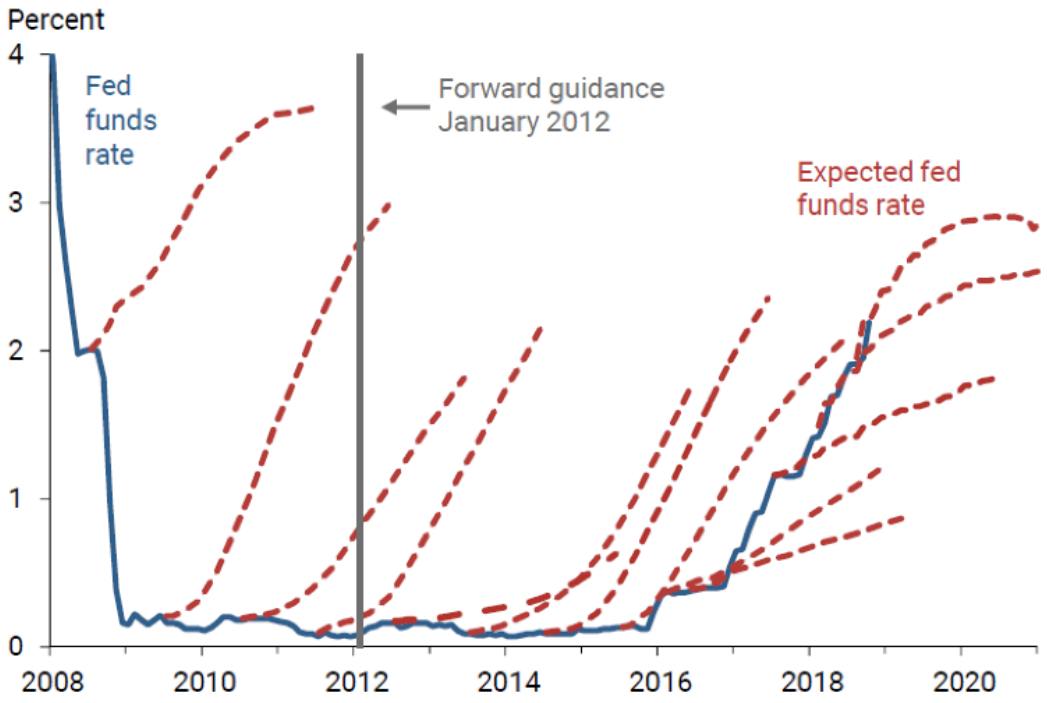
QE and forward guidance can be combined.

- Example: the ECB Announced in 2015 that the bonds purchased would be held to maturity. In 2016, it announced that they would be reinvested: the central bank's balance sheet would start shrinking only long after the end of net purchases.

Forward Guidance Example

January 25, 2012, FOMC statement

„Economic conditions … are likely to warrant exceptionally low levels for the federal funds rate at least through late 2014."



Source: Rudebusch (2018)

Summary

- ZLB switches the slope of the IS-MP curve from negative to positive.
  - Negative slope without ZLB: An increase in inflation is followed by an increase in the interest rate leading to a decrease in output.
  - Positive slope with ZLB: After an increase in inflation, the nominal interest rate remains constant at zero, so that the real interest rate decreases. In turn, output increases
- Quantitative easing and forward guidance policies aim at flattening the yield curve.
- QE: the portfolio rebalancing channel affects the term premium, the signaling channel affects expectations of future short term interest rates
- FG: expectations of future short term interest rates are targeted, but there are time-inconsistency problems