MA Macroeconomics
6. The Zero Lower Bound and the Liquidity Trap

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Can Interest Rates Be Negative?

- Up to now, we have assumed that the central bank in our model economy sets its interest rate according to a specific policy rule.
- But what if the rule predicts the central bank should set interest rates equal to a negative value? Will they?
- Recall that the relevant interest rates in the IS curve are interest rates that private sector agents borrow at.
- Why are these private sector interest rates unlikely to ever be negative?
- A negative interest rate would mean me loaning you \$100 and getting back less than that next year. Why would I do that?
- With this in mind, we are going to adapt our model to take into account that there are times when the central bank would like to set i_t below zero but is not able to do so.

The Zero Lower Bound

- Up to now, we have mainly considered a monetary policy rule of the form

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

- The lower bound problem occurs when inflation goes below some critical value.
- We will now change the monetary policy rule to

$$i_t = \text{Maximum}\left[r^* + \pi^* + \beta_\pi \left(\pi_t - \pi^*\right), 0\right]$$

- Because the intended interest rate of the central bank declines with inflation, this means that there is a particular inflation rate, π^{ZLB}, such that if $\pi_t < \pi^{ZLB}$ then the interest rate will equal zero.
- So what determines π^{ZLB}?

Triggering the Zero Lower Bound

- We can calculate the rate of inflation that triggers the zero lower bound as the rate inflation that sees the monetary policy rule require a zero interest rate.
- Algebraically, we can write this as

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

- This can be re-arranged as

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

- Which can be solved to give

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

When Will Interest Rates be Zero?

- Zero lower bound holds if inflation is below

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

- Three factors determine this "trigger" value of inflation
  1. **The inflation target**: The higher the inflation target π^*, the higher is the level of inflation at which a central bank will be willing to set interest rates equal to zero.
  2. **The natural rate of interest**: A higher value of r^* lowers the level of inflation at which a central bank will be willing to set interest rates equal to zero. An increase in this rate makes central bank raise interest rates and so they will wait until inflation goes lower than previously to set interest rates to zero.
  3. **The responsiveness of monetary policy to inflation**: Increases in β_π raise the coefficient on π^* in this formula, increasing the first term and it makes the second term (which has a negative sign) smaller. Both effects mean a higher β_π translates into a higher value for π^{ZLB}.

The IS-MP Curve and the Zero Lower Bound

- To take account of the ZLB, we need to re-formulate the IS-MP curve.
- Remember the IS curve is

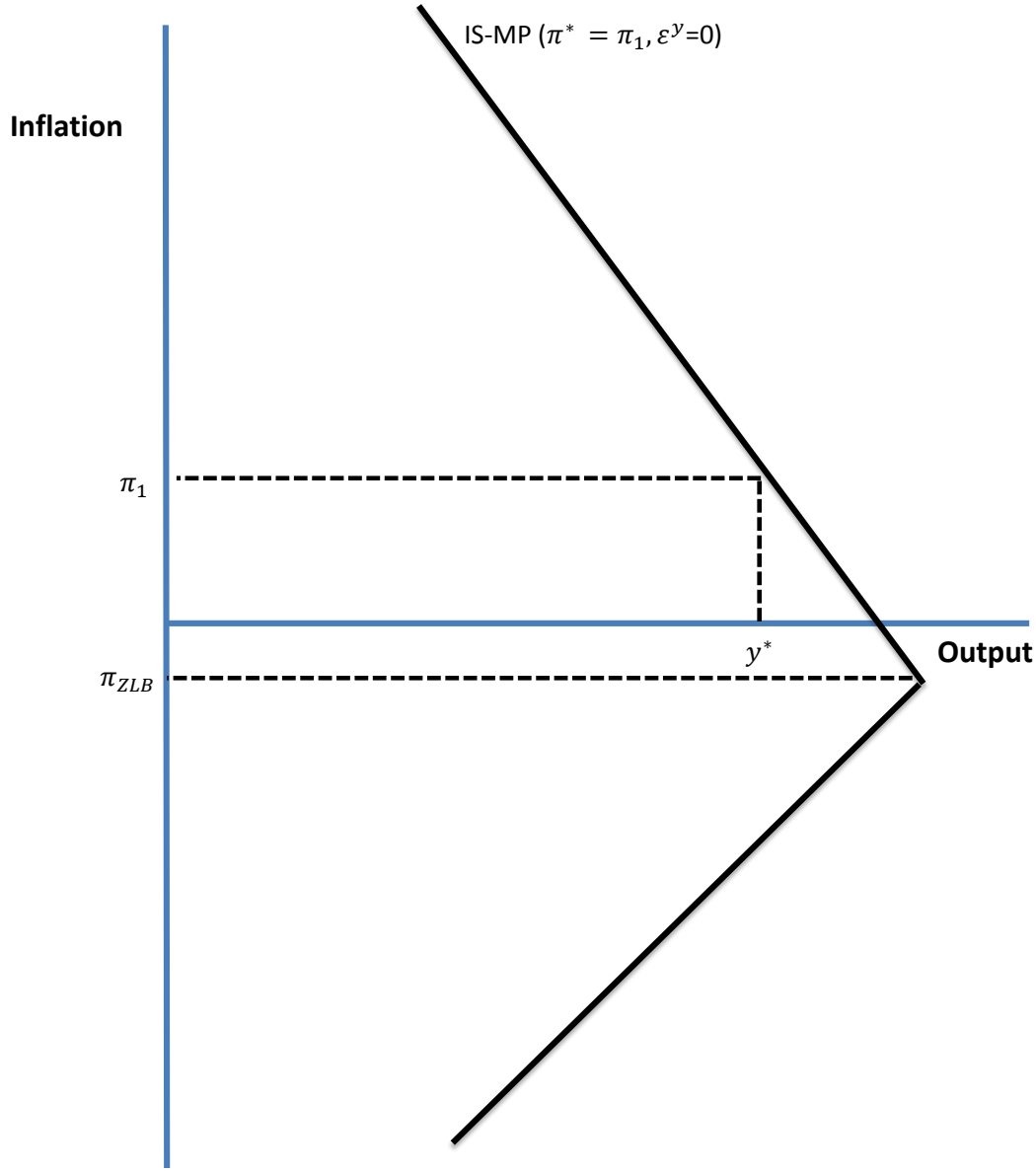
$$y_t = y_t^* - \alpha\left(i_t - \pi_t - r^*\right) + \epsilon_t^y$$

- So when nominal interest rates are zero, the IS-MP curve just set $i_t = 0$ in the above.
- So the IS-MP curve becomes

$$y_t = \begin{cases} y_t^* - \alpha\left(\beta_\pi - 1\right)\left(\pi_t - \pi^*\right) + \epsilon_t^y & \text{when} \quad \pi_t > \pi^{ZLB} \\ y_t^* + \alpha r^* + \alpha\pi_t + \epsilon_t^y & \text{when} \quad \pi_t \leq \pi^{ZLB} \end{cases}$$

- Above π^{ZLB}, higher values of inflation are associated with lower values of output but below π^{ZLB}, higher values of inflation are associated with *higher* values of output.
- This means the IS-MP curve shifts from being downward-sloping to being upward-sloping when inflation falls below π^{ZLB}.

The IS-MP Curve with the Zero Lower Bound



Inflation Dynamics at the Zero Bound

- When inflation falls below π^{ZLB}, output is determined by

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

- Inflation is still determined by the Phillips curve

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

- So below the lower bound, inflation is given by

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

- This can be re-arranged to give

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

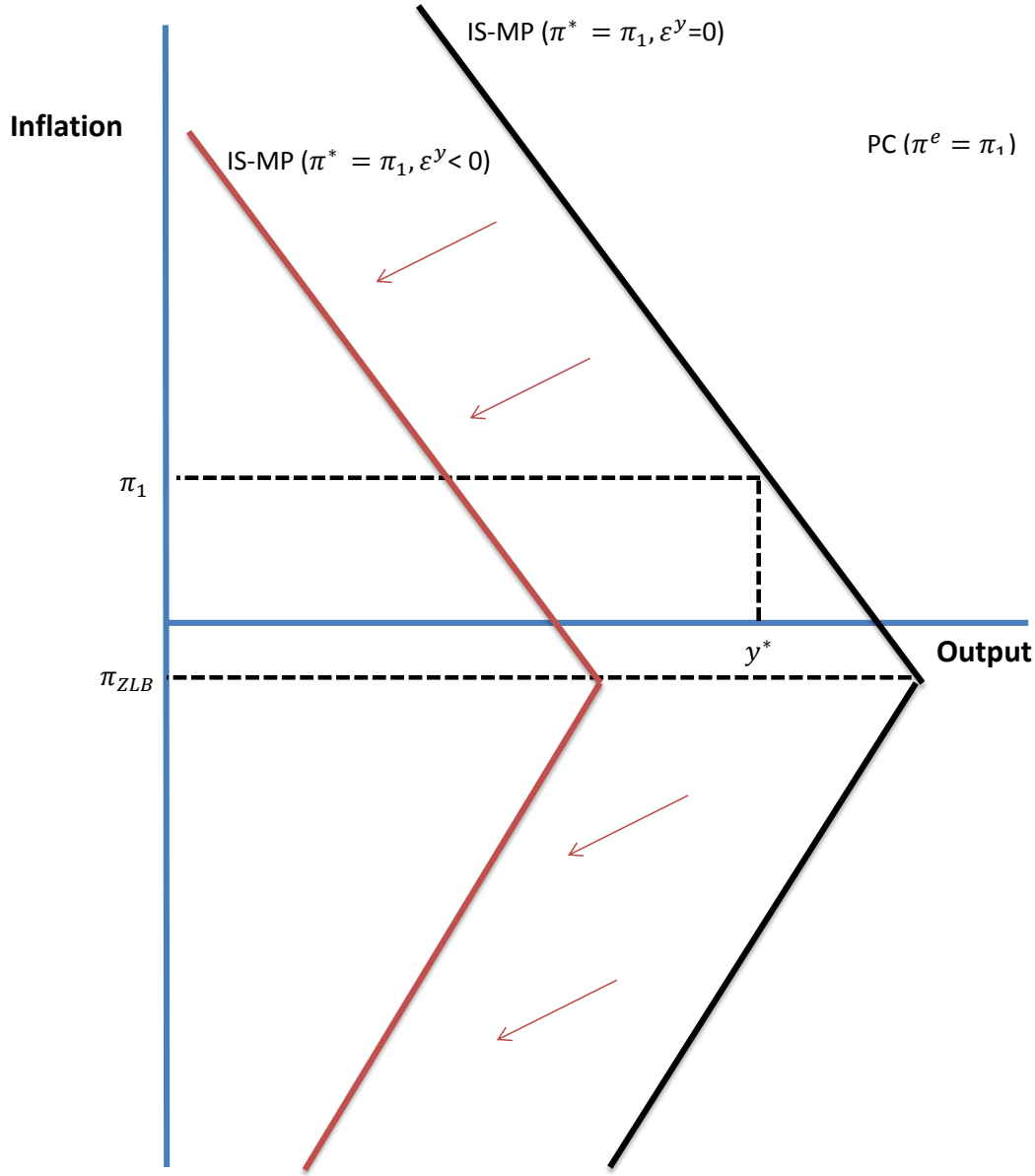
The Liquidity Trap

- Inflation dynamics at the zero lower bound are given by

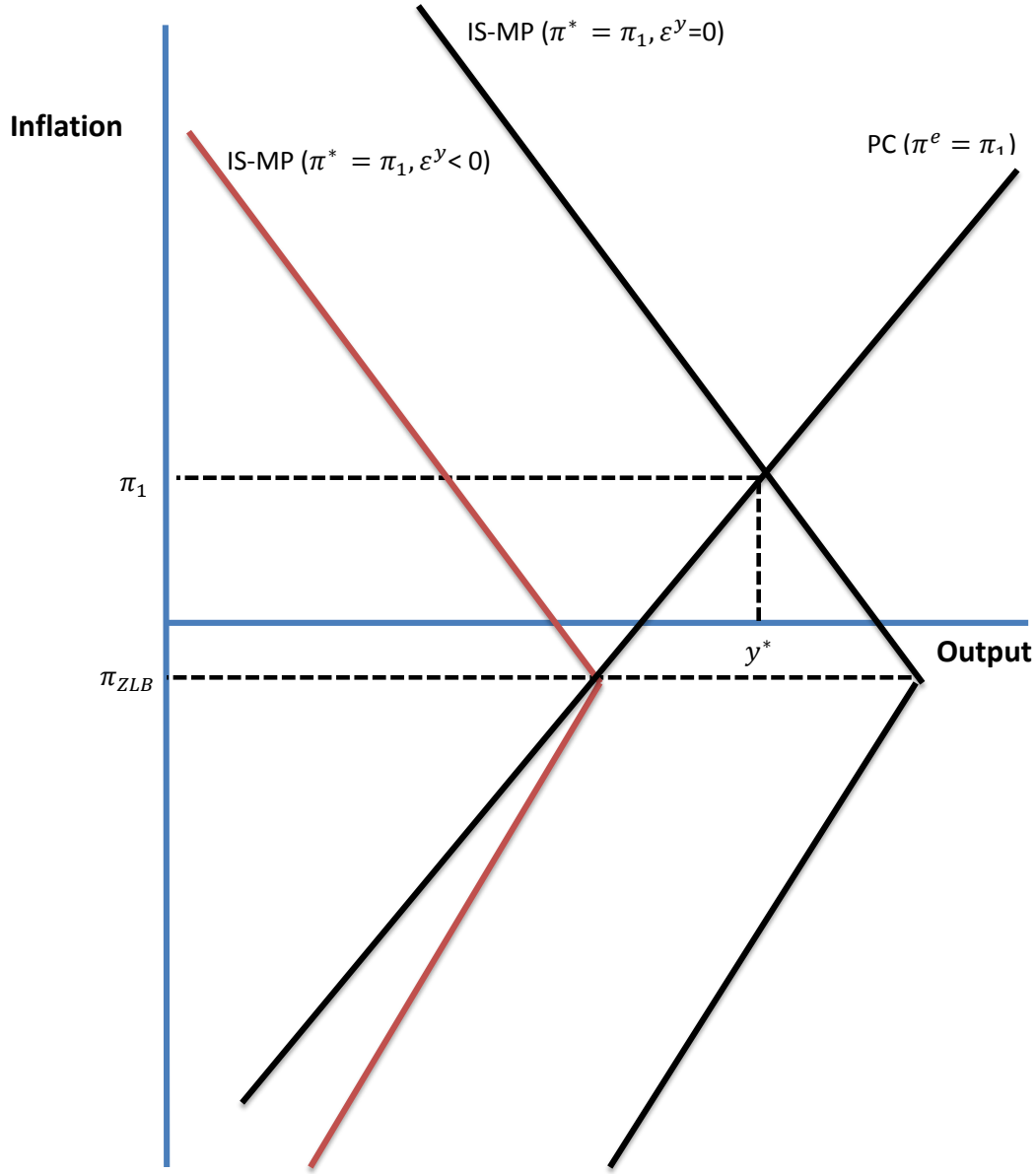
$$\pi_t = \frac{1}{1-\alpha\gamma}\pi_t^e + \frac{\alpha\gamma}{1-\alpha\gamma}r^* + \frac{\gamma}{1-\alpha\gamma}\epsilon_t^y + \frac{1}{1-\alpha\gamma}\epsilon_t^\pi$$

- The coefficient on expected inflation, $\frac{1}{1-\alpha\gamma}$ is greater than one.
- As with the Taylor principle example, changes in expected inflation translate into even bigger changes in actual inflation.
- This leads to unstable dynamics. Because these dynamics take place only when inflation has fallen below the zero lower bound, the instability here relates to falling inflation expectations, leading to further declines in inflation and further declines in inflation expectations.
- Because output depends positively on inflation when the zero-bound constraint binds, these dynamics mean falling inflation (or increasing deflation) and falling output.
- This position in which nominal interest rates are zero and the economy falls into a deflationary spiral is known as *the liquidity trap*.

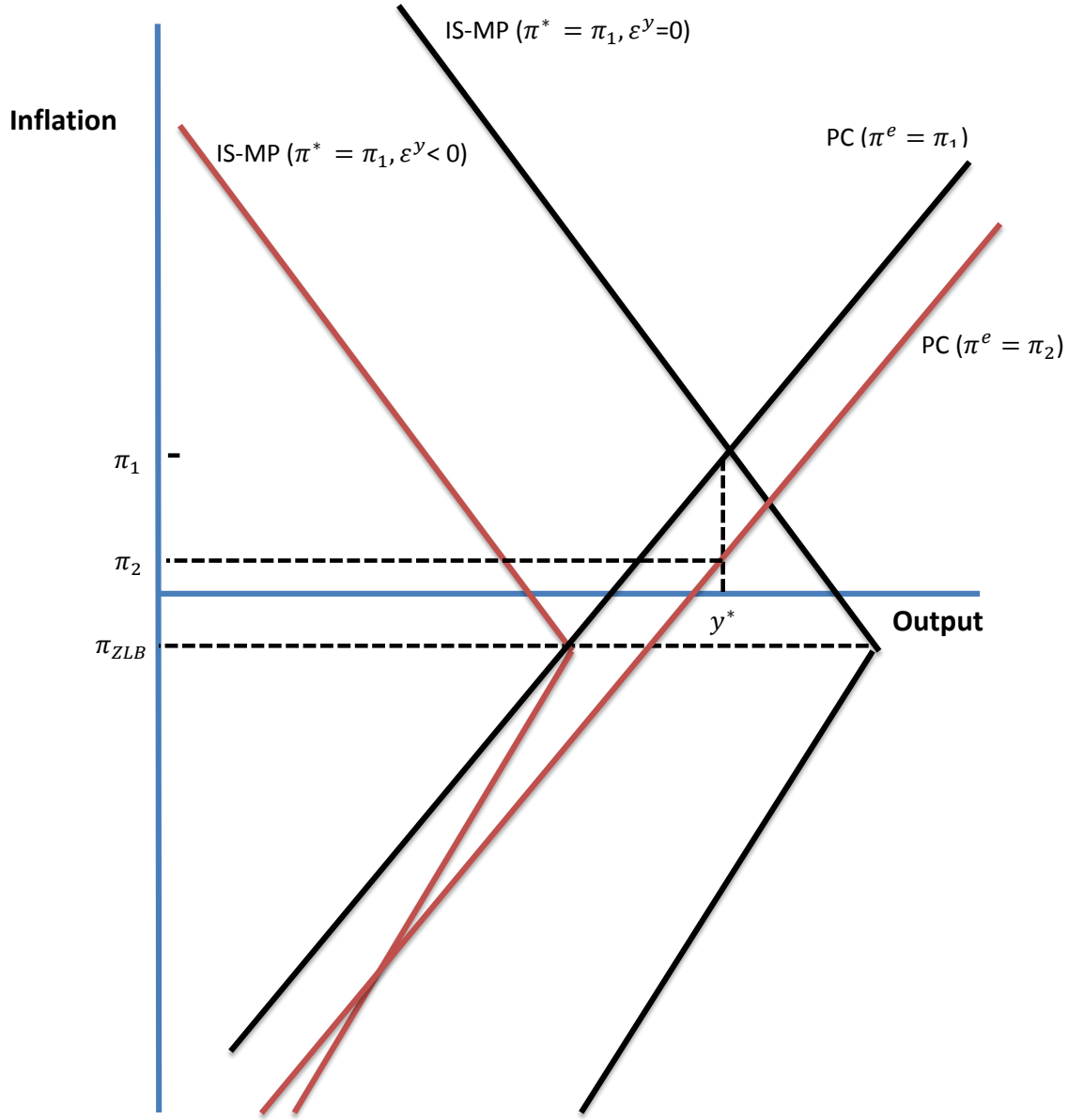
A Negative Aggregate Demand Shock



Equilibrium At the Lower Bound



Falling Expected Inflation Worsens Slump



The Liquidity Trap with a Taylor Rule

- For the monetary policy rule that we have considered, the zero lower bound is hit when inflation falls below some particular value.
- But what if policy followed the Taylor-type rule?

$$i_t = \text{Maximum}\left[r^* + \pi^* + \beta_\pi\left(\pi_t - \pi^*\right) + \beta_y\left(y_t - y_t^*\right), 0\right]$$

- Zero lower bound is hit when

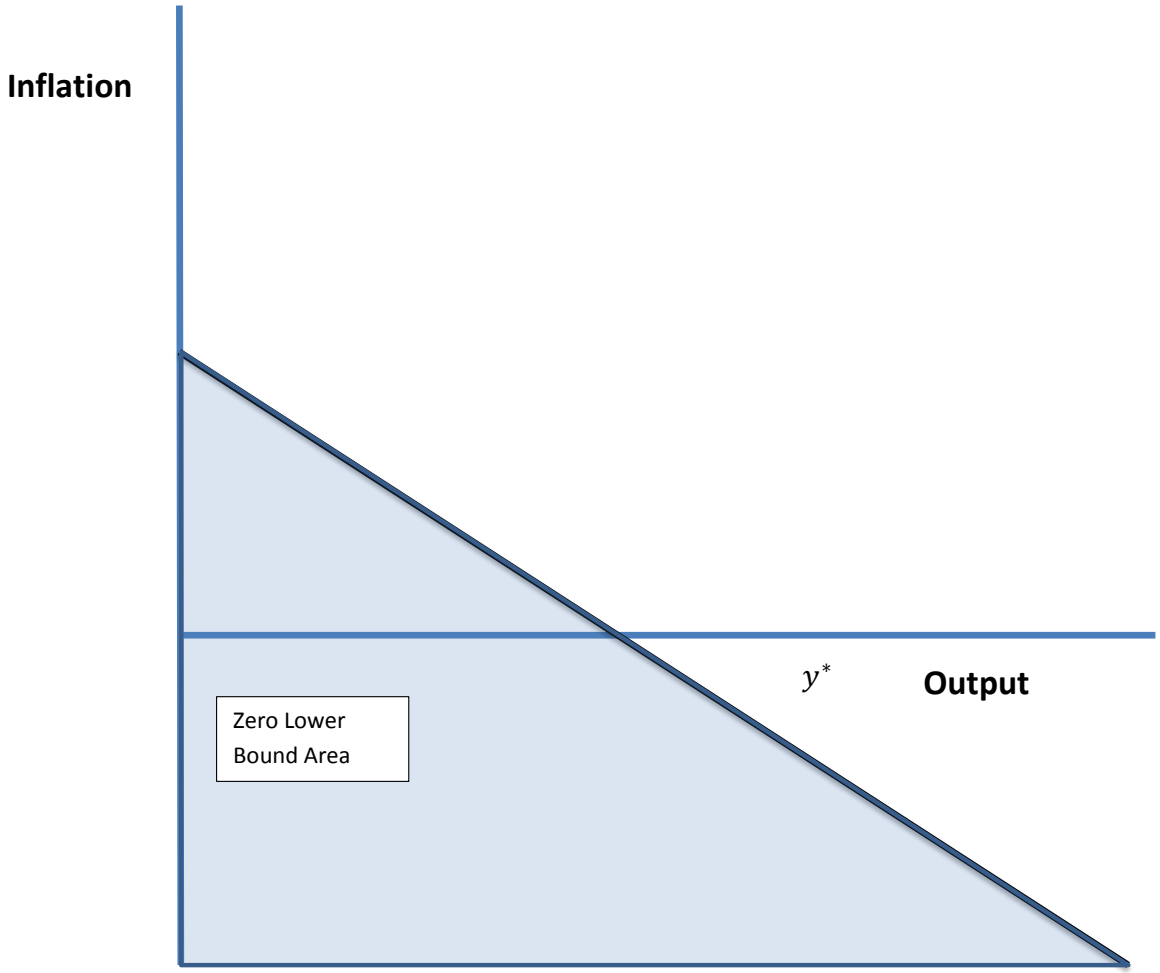
$$r^* + \pi^* + \beta_\pi\left(\pi_t - \pi^*\right) + \beta_y\left(y_t - y_t^*\right) = 0$$

- This can be re-written as

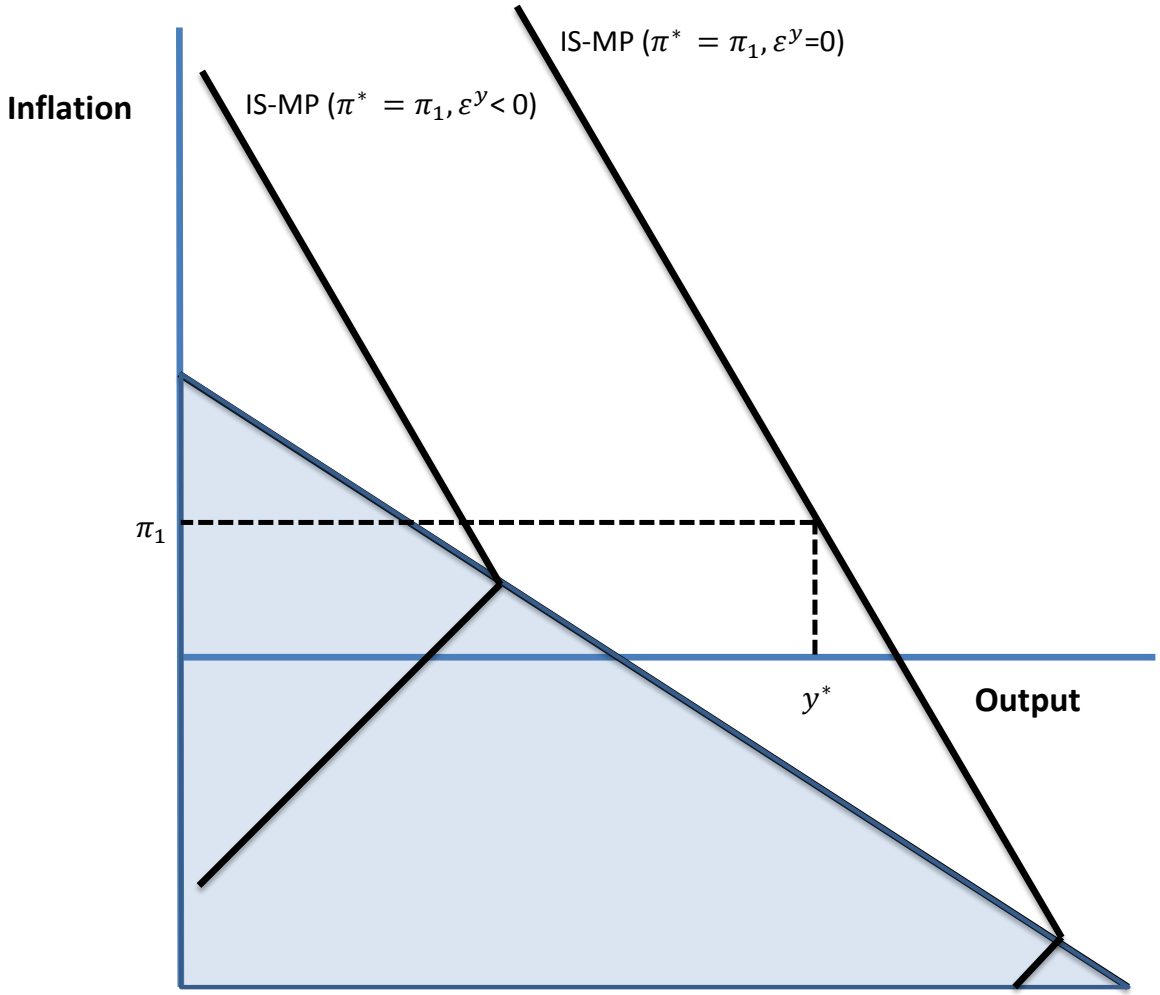
$$\beta_\pi\left(\pi_t - \pi^*\right) + \beta_y\left(y_t - y_t^*\right) = -r^* - \pi^*$$

- There are a series of different combinations of inflation gaps and output gaps that can lead to monetary policy hitting the zero lower bound.
- Can represent all the combinations of output and inflation that produce zero interest rates under the Taylor rule as the area under a downward-sloping line in Inflation-Output space.

Zero Bound is Binding in Blue Triangle Area



Zero Bound Can Be Hit With Positive Inflation



The Liquidity Trap: Reversing Conventional Wisdom

- Some predictions our model made (and which are now part of the conventional wisdom among monetary policy makers) do not hold when the economy is in a liquidity trap.
- Previously our model predicted that deviations of the public's inflation expectations from this target will be temporary and the economy will tend to converge back towards its natural level of output.
- But once interest rates have hit the zero bound, this is no longer the case. Instead, the adaptive expectations model predicts the economy can spiral into an ever-declining slump.
- Similarly, our earlier model predicted that a strong belief from the public that the central bank would keep inflation at target was helpful in stabilising the economy. However, once you reach the zero bound, convincing the public to raise its inflation expectations (perhaps by announcing a higher target for inflation) is helpful.

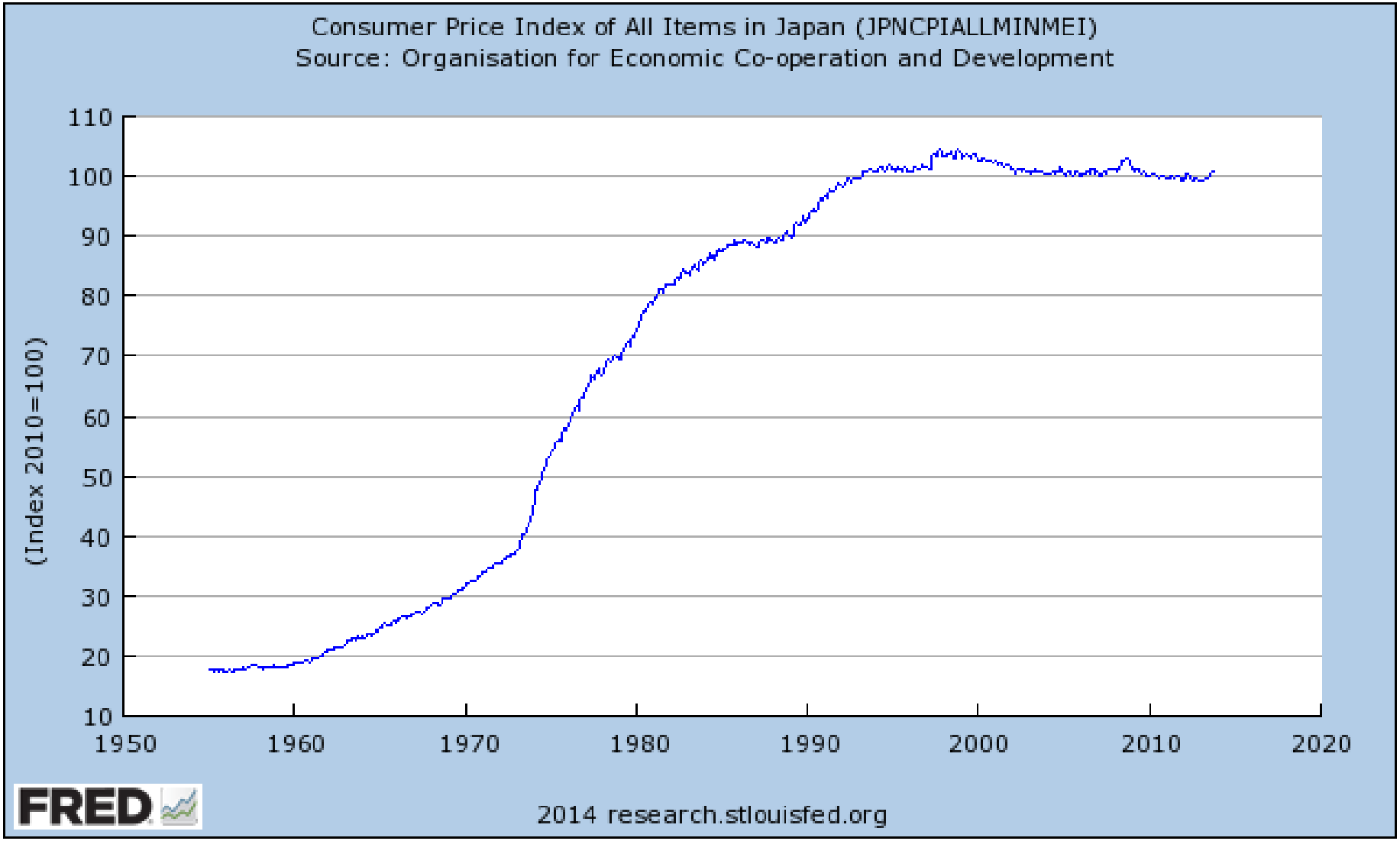
Increasing Inflation Expectations

- Our model tells us that output can be boosted when the economy is in a liquidity trap by raising inflation expectations.
- Prior to becoming Chairman, Ben Bernanke advocated that the Bank of Japan should attempt to raise inflation expectations by committing to having a period of inflation above some target level.
- In a 2003 speech titled "Some Thoughts on Monetary Policy in Japan" Bernanke said:

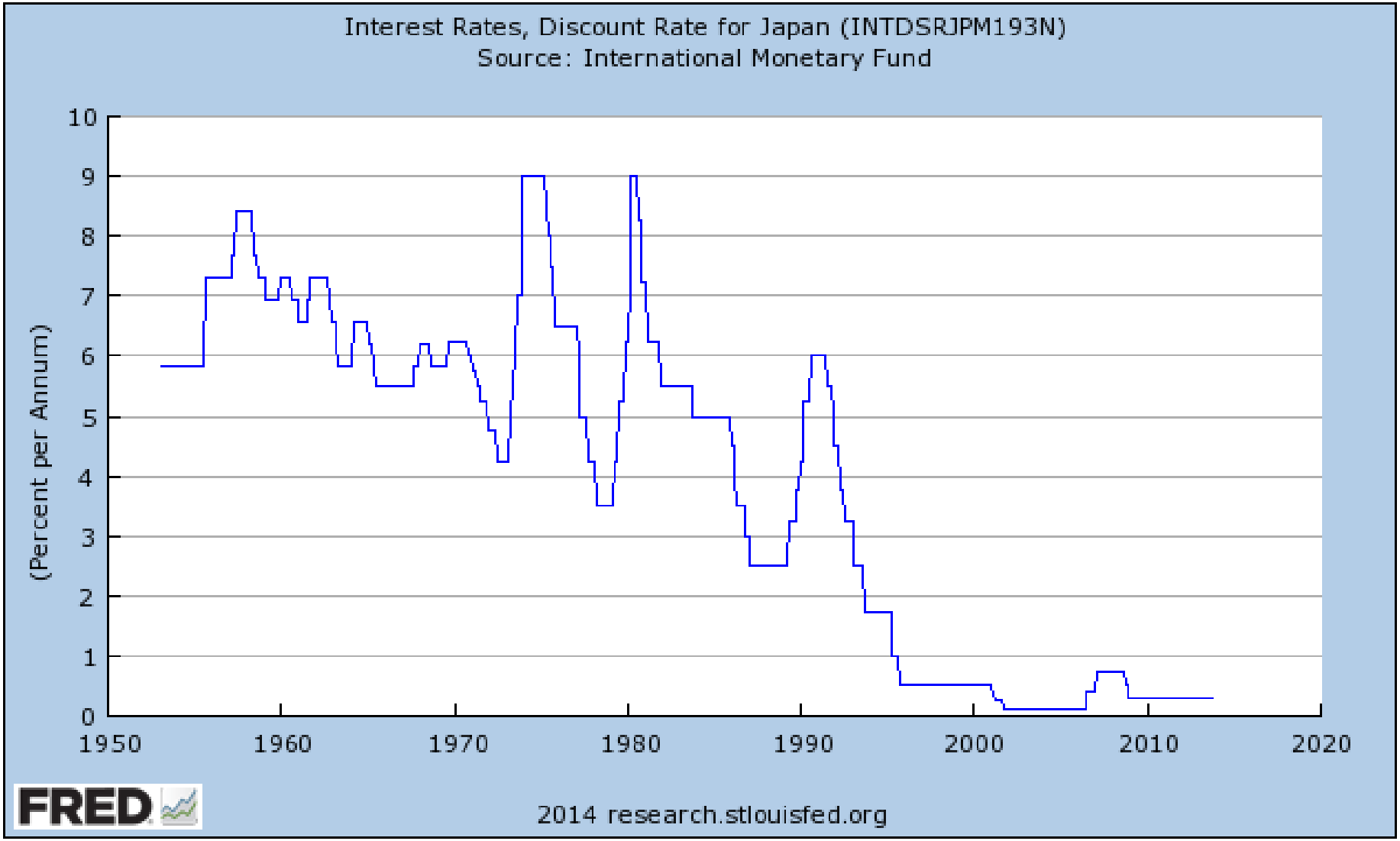
> *What I have in mind is that the Bank of Japan would announce its intention to restore the price level (as measured by some standard index of prices, such as the consumer price index excluding fresh food) to the value it would have reached if, instead of the deflation of the past five years, a moderate inflation of, say, 1 percent per year had occurred.*

- The Bank of Japan did not take Bernanke's advice. In 2013, however, under pressure from the new Japanese government, the Bank of Japan changed their inflation target from 1% per year to 2% per year.

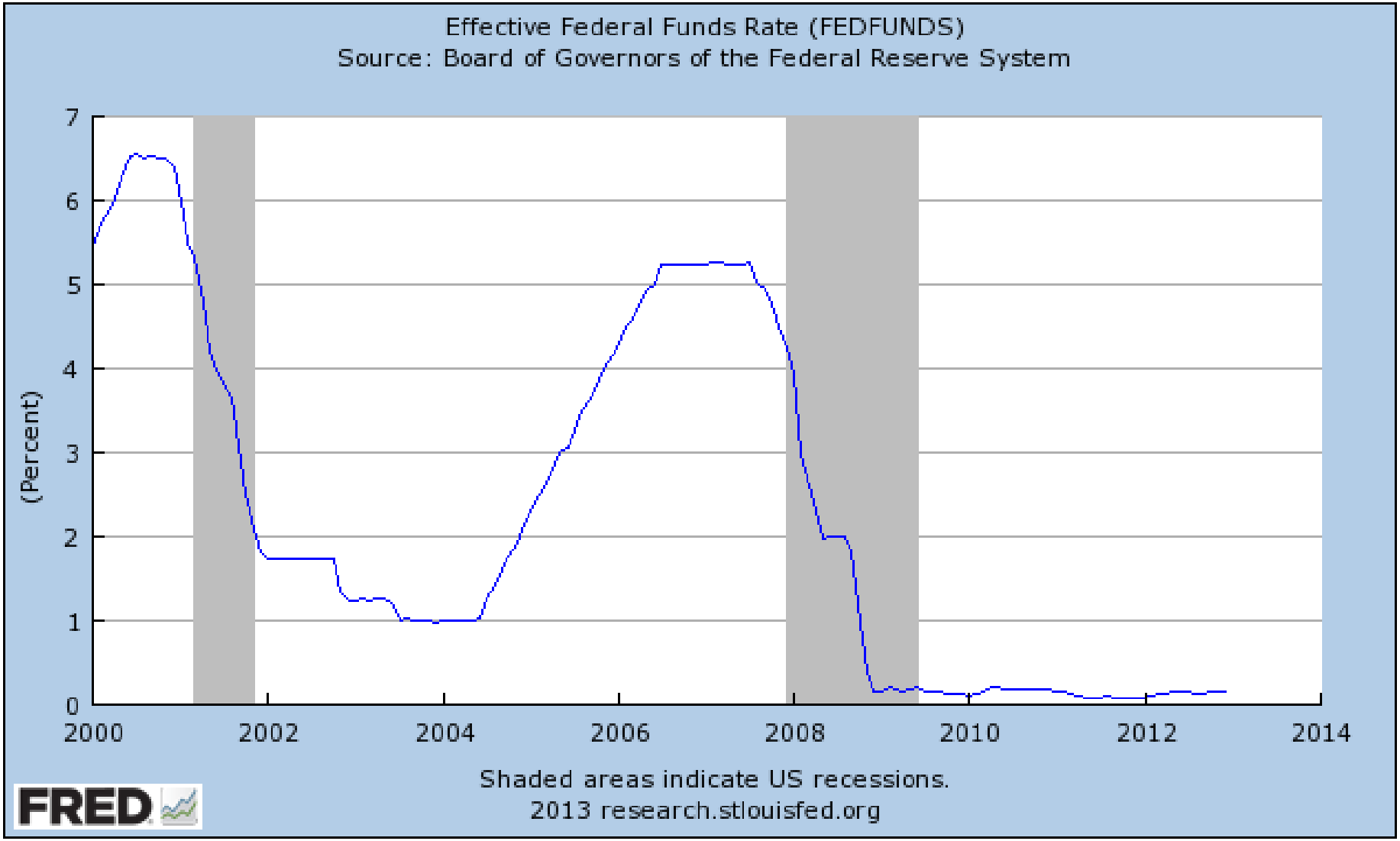
Japanese Consumer Price Level



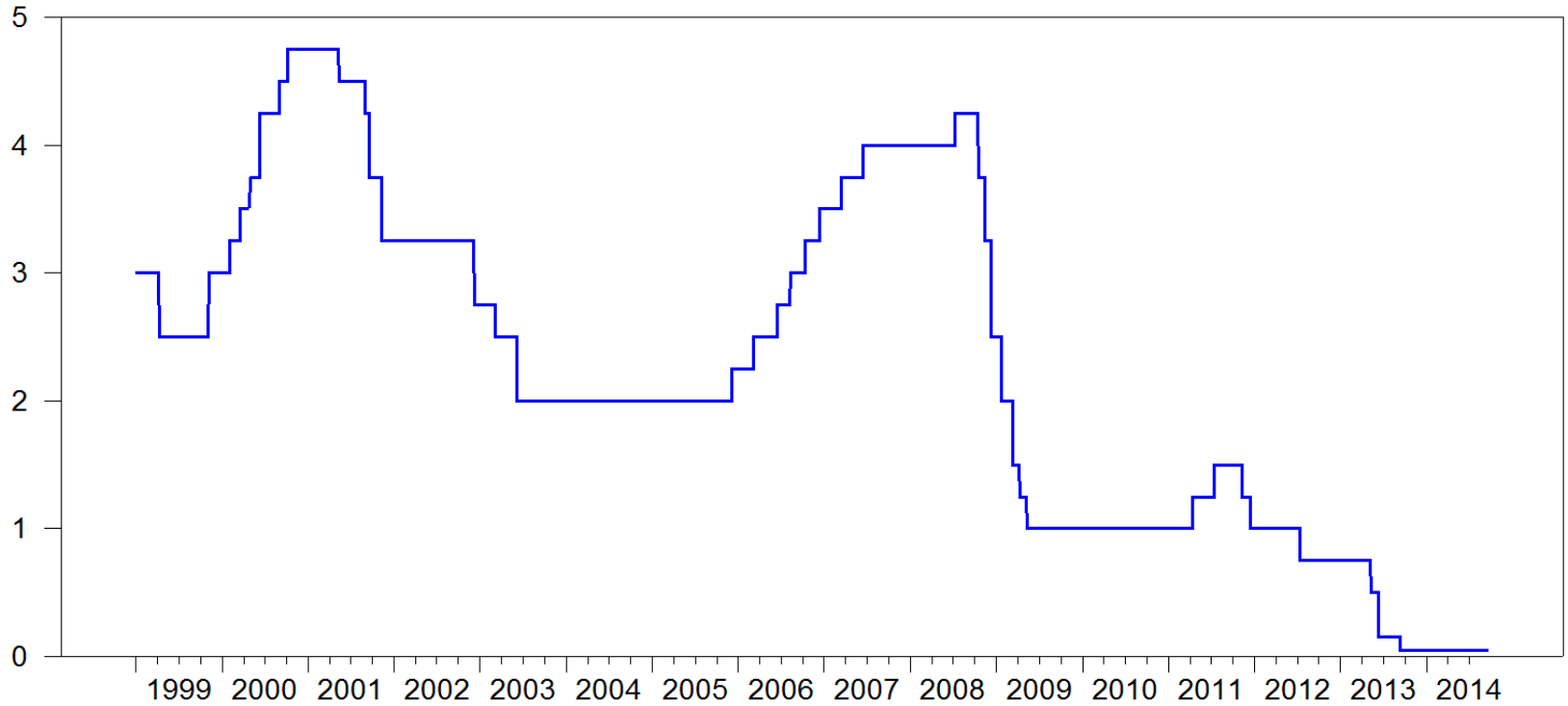
Short-Term Interest Rates in Japan



Federal Funds Rate



The ECB's Policy Rate



Chairman Bernanke versus Academic Bernanke

- In recent years, the US economy has been in a position that resembles Japan during its long liquidity trap period: The economy has been weak the Fed has kept its policy rate close to zero.
- Ben Bernanke, as Chairman of the Fed, was not keen to implement the ideas he recommended as an academic. At his April 2012 press conference, he said:

> *I guess the question is, does it make sense to actively seek a higher inflation rate in order to achieve a slightly increased reduction-a slightly increased pace of reduction in the unemployment rate? The view of the Committee is that that would be very reckless. We have-we, the Federal Reserve, have spent 30 years building up credibility for low and stable inflation, which has proved extremely valuable in that we've been be able to take strong accommodative actions in the last four or five years to support the economy without leading to an unanchoring of inflation expectations or a destabilization of inflation. To risk that asset for what I think would be quite tentative and perhaps doubtful gains on the real side would be, I think, an unwise thing to do.*

Committing to Be Irresponsible

- Bernanke's former colleague Paul Krugman was critical of his reluctance to boost inflation expectations.
- Since his research on Japan in the late 1990s, Paul Krugman has discussed the tension that central bankers feel when in a liquidity trap. When up against the zero bound, they might like to raise inflation expectations but then they are concerned that this could make inflation go higher than they would like.
- The public's awareness that the central bank will clamp down on inflation if the economy picks up then prevents there being a sufficient increase in inflation rates to get the economy out of the liquidity trap.
- Krugman thus stresses the need for central banks facing a liquidity trap to "'commit to being irresponsible" as a way out of these slumps—commit to a temporary period of inflation being higher than you would normally like.
- But central bankers are a conservative crowd and even temporary "irresponsibility" does not come easy to them.
- The Fed may be willing at some point to consider more flexible approaches such as price level targeting. The ECB's requirement to place price stability above all other goals means they are very unlikely to adopt such policies.

Other Ways to Get Out of a Liquidity Trap

- **Fiscal Policy**:
  - Increasing ϵ_t^y helps to shift the IS-MP curve back upwards.
  - However, liquidity traps such as the Japanese situation since the mid-1990s have occurred at times of very persistent weak private aggregate demand that can be hard to counteract with fiscal policy.
- **Monetary Policy**:
  - **Forward Guidance**: While the short-term interest rates that are controlled by central banks may be zero, that doesn't mean the longer-term rates that many people borrow at will equal zero. By signalling that they intend to keep short-term rates low for a long period of time they can lower longer-term rates.
  - **Quantitative Easing**: Purchasing large quantities of longer-term bonds. Reduces supply available to private sector and may push down interest rates on these bonds.
  - **Exchange Rate Targeting**: For example, the ECB could announce that it is willing to swap a euro for \$1. Currency depreciation makes imports more expensive and raises inflation. Termed the "foolproof way to escape from a liquidity trap" by monetary policy expert Lars Svensson.

Things to Understand From This Topic

1. Why there is a zero bound on interest rates.
2. The factors that influence when the central bank sets zero rates.
3. How the IS-MP curve changes when incorporating the zero lower bound.
4. How changes in inflation expectations affect the economy above and below the zero lower bound.
5. What is meant by the liquidity trap, i.e. why the economy doesn't automatically recover when the zero bound binds.
6. How the IS-MP-PC graphs work when we incorporate the zero bound.
7. Bernanke's advice to the Bank of Japan and change of mind as Fed Chairman.
8. Why the US and Euro Area economies could be considered to be in a liquidity trap.
9. The debate about "committing to be irresponsible."
10. Other policies to get out of the liquidity trap.