

# Macroeconomics

## 10. The AD-AS Model with a Lower Bound for $i$

Bachelor's Degrees in Management and in Finance and Accounting

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April 27-30, 2026

# Inflation target

- All central banks in advanced countries have an optimal value for inflation that they wish to achieve. We call it the inflation target:  $\pi^T$ .
- There are two different ways of looking at this optimal value:
  - $\pi^T$  is a ceiling – the central bank suffers a loss if  $\pi > \pi^T$ :  $\min(\pi - \pi^T)$ .
  - $\pi^T$  is a target – the central bank suffers a loss if  $\pi \neq \pi^T$ :  $\min(\pi - \pi^T)^2$ .
- If  $\pi^T$  is used as a ceiling, central banks will tend to keep inflation systematically below the target.
- This may lead to “too low inflation” or even deflation.
- The costs for the economy and for society will be higher than if the target were achieved.

# Inflation target

## Exercises in Pluto

- ☒ Exercise 3 (Inflation targeting).

# Taylor rule

A broader rule than the standard MP studied in previous chapters

- Taylor proposes that the Central Bank should control the interest rate based on:
  - A benchmark value for  $\bar{r}$ ;
  - The inflation gap  $(\pi - \pi^T)$  (weighted);
  - The output gap  $(Y - Y^P)$  (weighted).

- Giving the same importance to inflation and output, the Taylor rule for  $r$  is given by:

$$r = \bar{r} + 0.5(\pi - \pi^T) + 0.5(Y - Y^P)$$

- $i$  is given by the Fisher equation with the corresponding substitution:

$$i = r + \pi \Rightarrow i = \bar{r} + \pi + 0.5(\pi - \pi^T) + 0.5(Y - Y^P)$$

- The proposed benchmark values for  $\bar{r}$  and  $\pi^T$  are both 2%, such that:

$$- r = 2 + 0.5(\pi - 2) + 0.5(Y - Y^P); i = 2 + \pi + 0.5(\pi - 2) + 0.5(Y - Y^P).$$

# Taylor rule

## Exercises in Pluto

- ⊗ Exercise 1 (The Fed's Dual Mandate (again)).
- ⊗ Exercise 2 (Unemployment and recessions).
- ⊗ Exercise 4 (The Textbook Rule (MP curve)).
- ⊗ Exercise 5 (The Taylor rule).
- ⊗ Exercise 6 (New Taylor Rule: more emphasis on the output gap).

# The MP curve

## Definition

- The MP rule reflects the relationship between the real interest rate ( $r$ ) and the inflation rate ( $\pi$ ):

$$r = \bar{r} + \lambda\pi$$

- The relationship between  $r$  and  $\pi$  is positive in order to avoid inflationary spirals, which implies the Taylor Principle:
  - If  $\downarrow \pi \Rightarrow \downarrow r$  we have  $\downarrow i$  (with  $\Delta i > \Delta \pi$ ):
- By definition, the nominal interest rate can fall only until it reaches its lower bound, that is,  $i = 0$  (zero lower bound).

# The MP curve with a lower bound for the nominal interest rate

## Rationale

- What happens when  $i = 0$  has already been reached and  $\pi$  falls even further?
  - Knowing that  $i = 0$ , we have  $r = 0 - \pi = -\pi$ .
  - From this point onwards, the Taylor Principle ( $\Delta i > \Delta \pi$ ) is no longer possible, that is, the standard MP rule is no longer used.

- Under a ZLB regime, since  $i$  cannot become negative, the monetary policy rule is then given by:

$$r = -\pi$$

- The inflation rate that corresponds to the ZLB is obtained by combining the standard MP rule with the Fisher equation when  $i = 0$ :

$$\bar{r} + \lambda\pi = -\pi \Rightarrow \pi_{ZLB} = -\frac{\bar{r}}{1+\lambda}$$

## MP and AD functions with ZLB

- The MP function can be defined as:

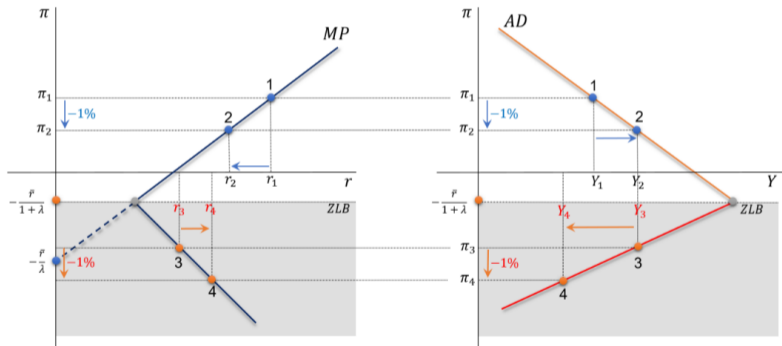
$$r = \begin{cases} \bar{r} + \lambda\pi, & \text{if } \pi \geq \pi_{ZLB} = -\frac{\bar{r}}{1+\lambda} \\ -\pi, & \text{otherwise} \end{cases}$$

- The AD function is obtained by substituting the MP function into the IS function:

$$Y = \begin{cases} m \times \bar{A} - m \times \phi \times (\bar{r} + \lambda\pi), & \text{if } \pi \geq \pi_{ZLB} = -\frac{\bar{r}}{1+\lambda} \\ m \times \bar{A} + m \times \phi \times \pi, & \text{otherwise} \end{cases}$$

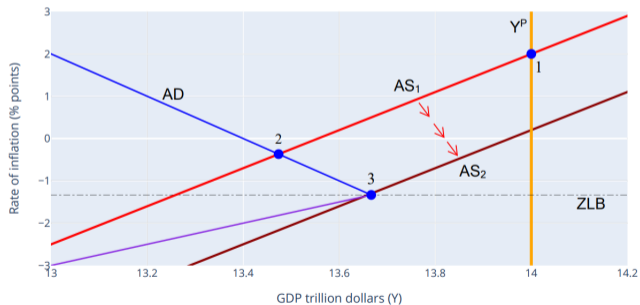
# MP and AD functions with ZLB

## Graphical representation



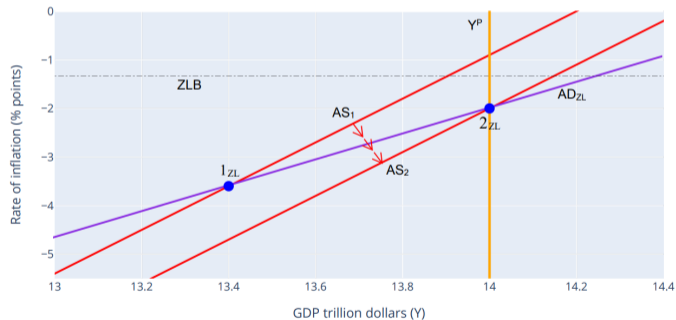
## Secular stagnation with ZLB

- If AD suffers a shock large enough for the economy to move from point 1 to point 2, it will then reach point 3, from which demand is insufficient to equal supply at a higher level of GDP.
- GDP stagnates permanently at a level below what the economy can produce.



## Deflation trap with ZLB

- If AS suffers a large shock such that the economy reaches point  $1^{ZL}$ , the long-run equilibrium will be at point  $2^{ZL}$  (considered a bad equilibrium).

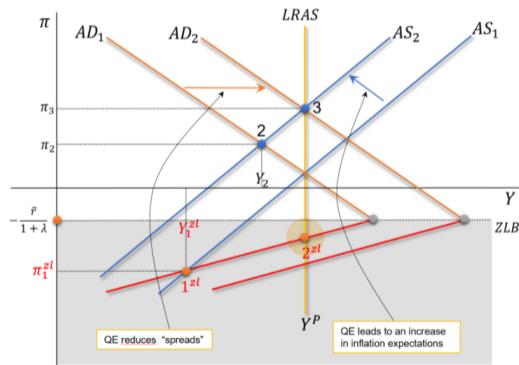


# Unconventional monetary policy: Quantitative Easing

- When the nominal interest rate is already very low but is still not enough to stimulate the economy, unconventional monetary policy can complement the stimulus already coming from conventional policy.
- One way to do this is through Quantitative Easing, which:
  - Reduces financial risk and spreads ( $\downarrow \bar{f}$ );
  - Creates expectations in the economy of higher inflation ( $\uparrow \pi^e$ );
  - Provides forward guidance (convincing private economic agents that the Fed will do whatever is necessary to lift the economy out of the ZLB).

# Escaping the ZLB through Quantitative Easing

- Through QE, it is possible to escape the ZLB.



# Escaping the ZLB through Quantitative Easing

## Exercises in Pluto

- ☒ Exercise 7 (The Volcker Disinflation, 1980-1986).
- ☒ Exercise 8 (Inflation and the Scariest Opinion of 2022).
- ☒ Exercise 9 (Abenomics and Japanese deflation).
- ☒ Exercise 10 (The Zero Lower Bound).
- ☒ Exercise 11 (A negative demand shock).
- ☒ Exercise 12 (Stuck in deflation).
- ☒ Exercise 13 (Secular stagnation).

# References

- Mishkin, F. S. (2014), *Macroeconomics: Policy and Practice*, 2nd Edition, Pearson, Addison-Wesley, New York.