# Monetary Policy

## Part 2: Conventional Monetary Policy

### Exercise 6: Monetary Policy Rules, The Complete IS-MP-PC Model

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# Task 1: Monetary Policy Rules

# Task 1 (a)

Explain the general intuition behind the Taylor Rule.

# Task 1 (a)

Taylor rule: $i_t = r^* + \pi_t + \alpha(\pi_t - \pi^*) + \beta x_t$

Ingredients:

- $r^*$: natural real interest rate
- $\pi_t$: current inflation rate
- $\pi^*$: central bank's inflation target
- $x_t$: current output gap

Calibration:

- Choice of $\alpha$ and $\beta$

# Task 1 (b)

What arguments speak in favor of interest rate smoothing?

# Task 1 (b)

Interest rate smoothing: gradual adjustment of the interest rate

$$i_t = \rho i_{t-1} + (1-\rho) i_t^*$$

Taylor rule with interest rate smoothing:

$$i_t = \rho i_{t-1} + (1-\rho)[r^* + \pi_t + \alpha(\pi_t - \pi^*) + \beta x_t$$

Why interest rate smoothing:

1. Market participants are forward-looking in making investment and savings decisions, which also rely on expected level of nominal (and real) interest rate(s).
2. Measurement error in key variables induce uncertainty around e.g., output gap and inflation. Less prone to noise in data.
3. Uncertainty regarding relevant structural parameters.

# Task 1 (b)

Ad “Uncertainty regarding relevant structural parameters”:

- Structural parameters describe the relationship between macroeconomic variables.
- Examples already known include:
  1. $\gamma$ inside the PC: $\pi_t = \pi_t^e + \gamma\,(y_t - y_t^*) + \varepsilon_t^\pi$
  2. $\alpha$ inside the IS equation: $y_t = y_t^* - \alpha(\underbrace{i_t - \pi_t}_{r_t} - r^*) + \varepsilon_t^y$

Note: that’s a different $\alpha$ here!

- Central bank assumes a model of the economy, related to the IS-PC model we derived.
- For inflation stabilization, central bank relies on these structural parameters.

# Task 1 (c)

What is the challenge in estimating monetary policy rules?

# Task 1 (a)

Taylor rule:

$$i_t = r^* + \pi_t + \alpha(\pi_t - \pi^*) + \beta x_t$$

Simultaneity problem:

- Interest rate, inflation, output gap all denoted in period $t$
- Interest rate set in reaction to changes in inflation and output gap
- A change in the interest rate influences inflation and the output gap

# Task 1 (b)

How is econometrically still possible to estimate monetary policy rules?

# Task 1 (b)

Instrumental variable approach:

- Lagged economic variables
- Correlated with the endogenous variables
- Uncorrelated with the error term

Real-time data:

- Model the real-time information set of the central bank
- Data by construction not determined before the interest rate is set

# Task 2: Monetary Policy Rule in the IS-MP-PC Model

# Task 2 (a)

Derive the IS-MP curve based on the IS curve and the simplified monetary policy rule.

# Task 2 (b)

IS curve:

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

MP curve:

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

# Task 2 (b)

Show algebraically that there is a negative relationship between output and inflation. What is the intuition behind this negative relationship?

# Task 2 (b)

IS-MP curve:

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

# Task 2 (b)

Negative relationship between output and inflation:

- Taylor principle dictates that $\beta_\pi > 1$
- $\alpha > 0$, i.e. investment and consumption are affected negatively by an increase in the real interest rate
- Thus, $\alpha(\beta_\pi - 1) > 0$

Intuition:

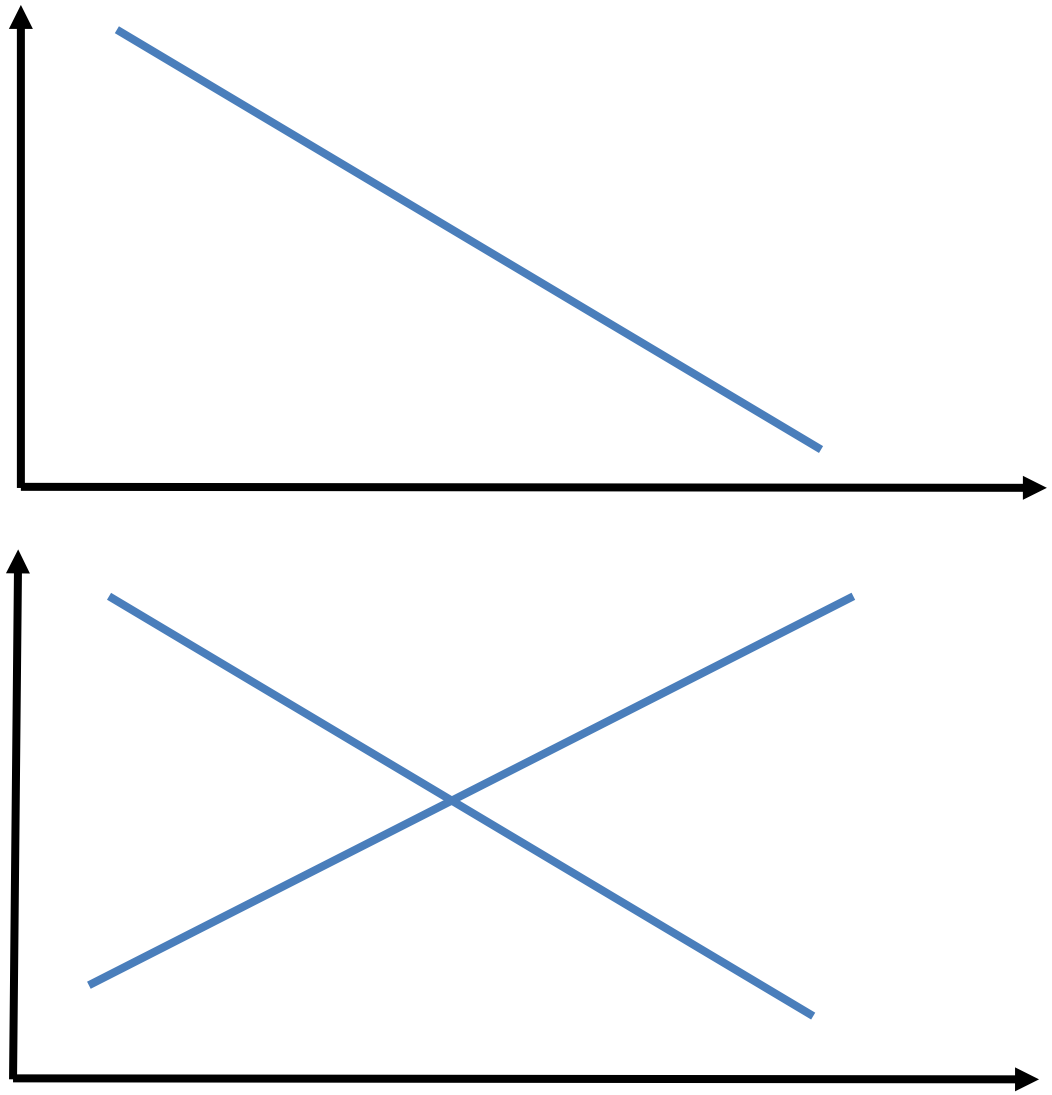
- If $\pi_t \uparrow$, the central bank will react via the Taylor rule by $i_t \uparrow$.
- The Taylor principle ensures an increase in the real interest rate
- If $r_t \uparrow$, $y_t \downarrow$ via the IS curve

# Task 3: Graphical representation and shocks

# Task 3 (a)

Draw the movements of/along the IS curve and the real interest rate following a temporary, positive demand shock assuming adaptive inflation expectations. Use the extended graphical representation of the IS-MP-PC model.

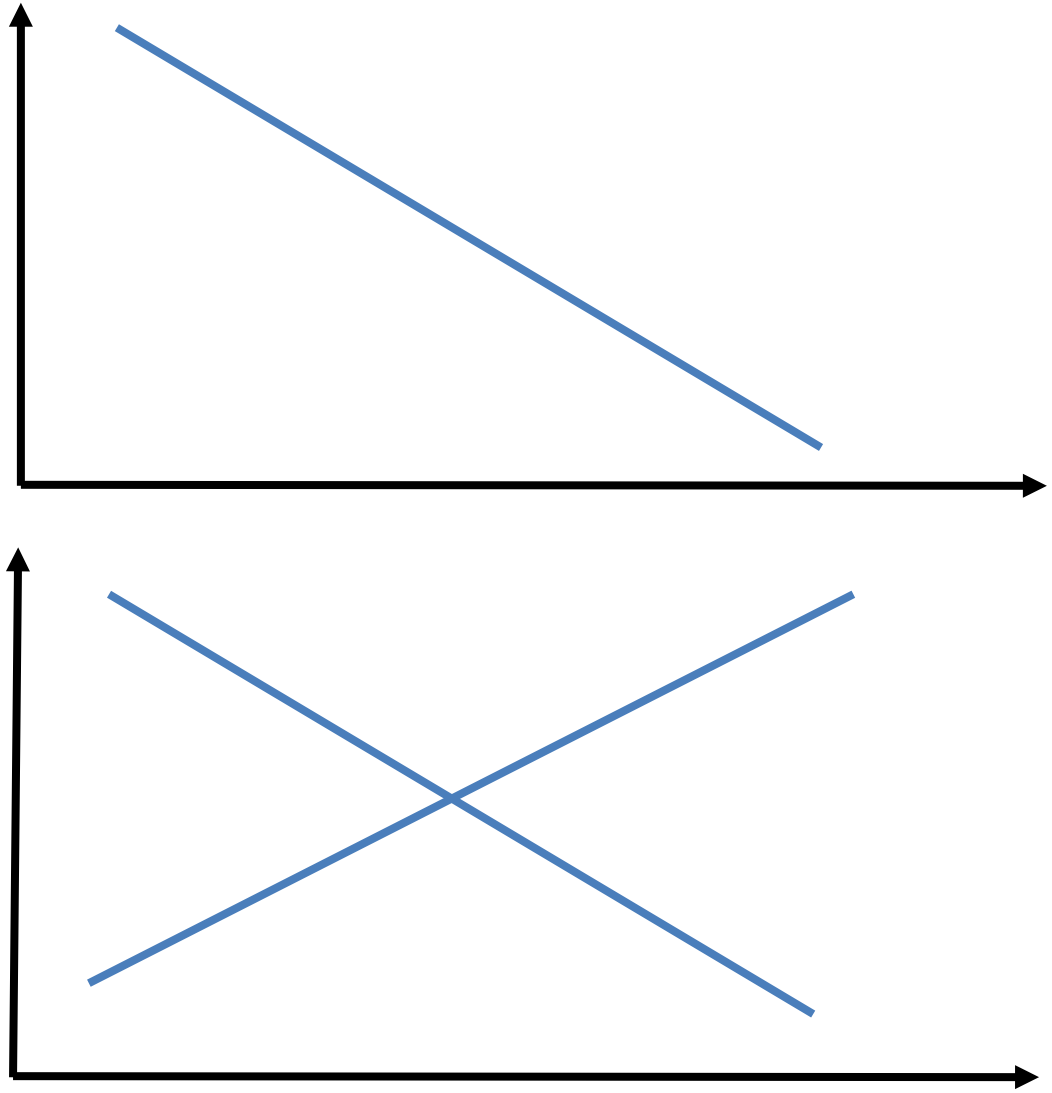
# Task 3 (a)



# Task 3 (b)

Redo exercise 3 (a) but assume anchored inflation expectations.

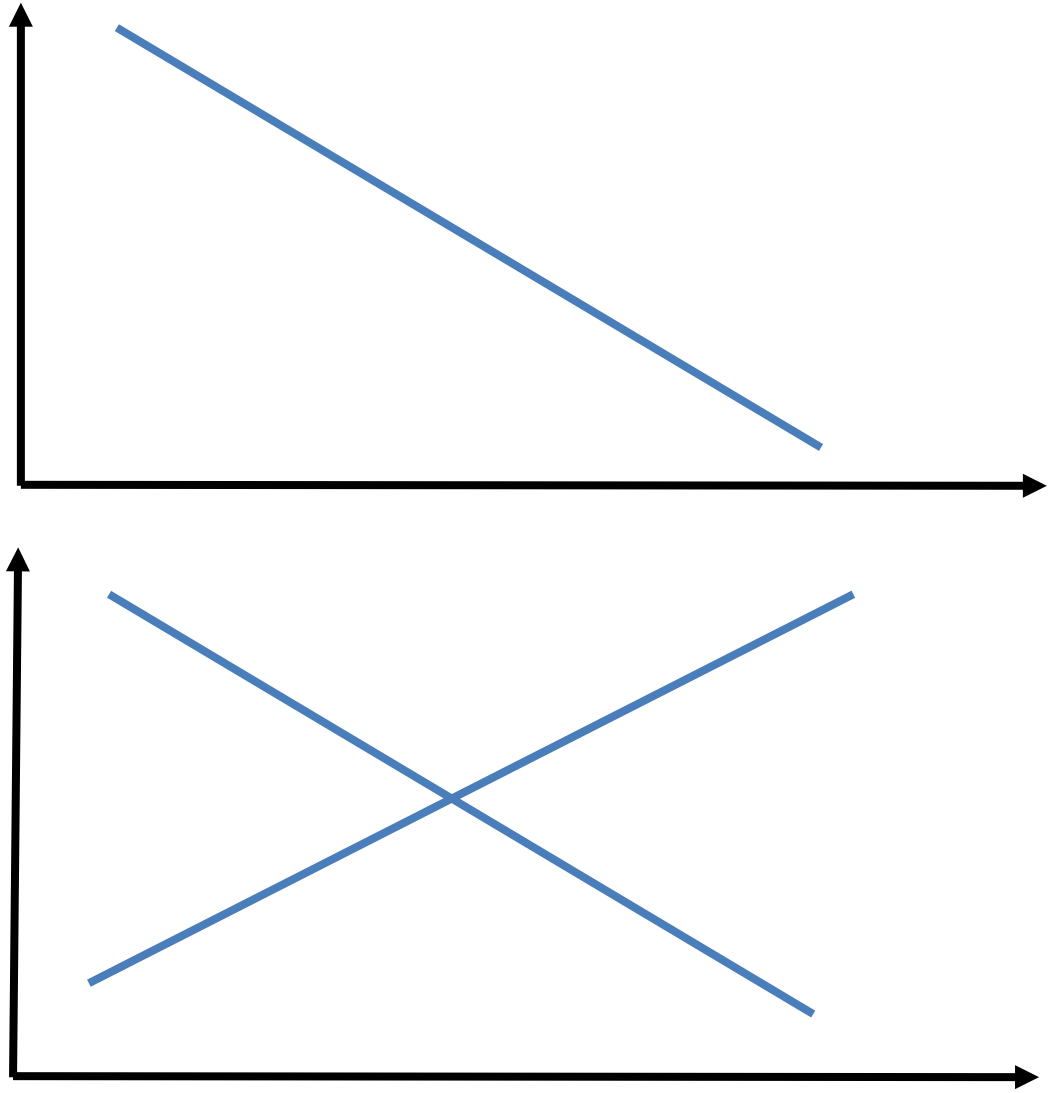
# Task 3 (b)



# Task 3 (c)

Draw the movements of/along the IS curve and the real interest rate following a temporary, negative supply shock assuming adaptive inflation expectations. Use the extended graphical representation of the IS-MP-PC model.

# Task 3 (c)



# Task 3 (d)

Redo exercise 3 (c) but assume anchored inflation expectations.

# Task 3 (d)