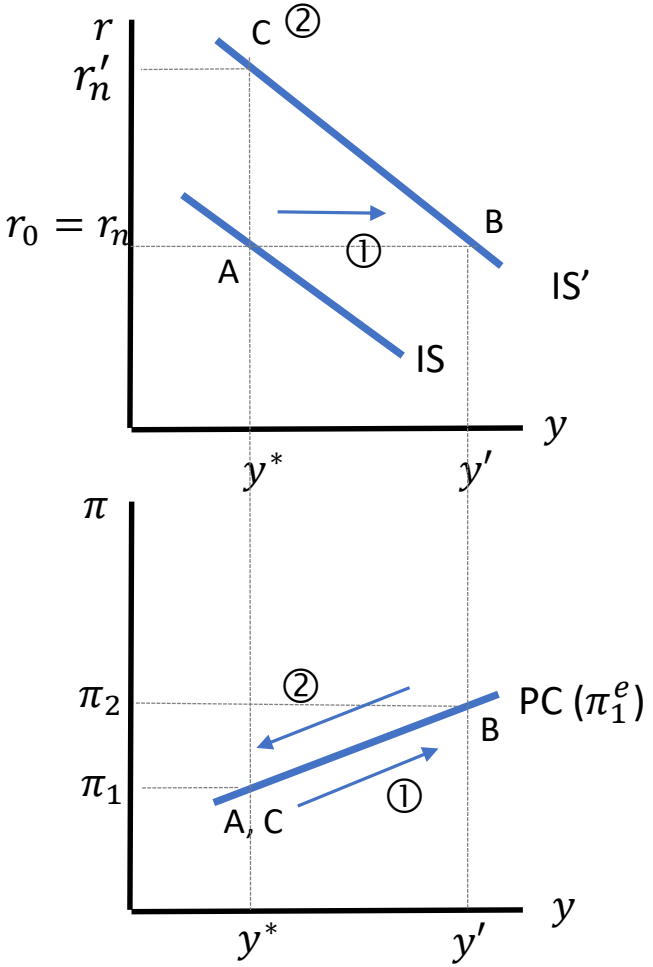
Exercise Session 11: Monetary Policy

Fiscal Policy and the ZLB

Josefine Quast, M.Sc.
University of Würzburg

TASK 1: Fiscal Policy in the IS-PC Model

a) Use the IS-PC representation discussed in class to show that a *permanent positive fiscal shock* increases the natural rate of interest. Discuss the underlying economic mechanisms concisely and use a graph to support your argument.



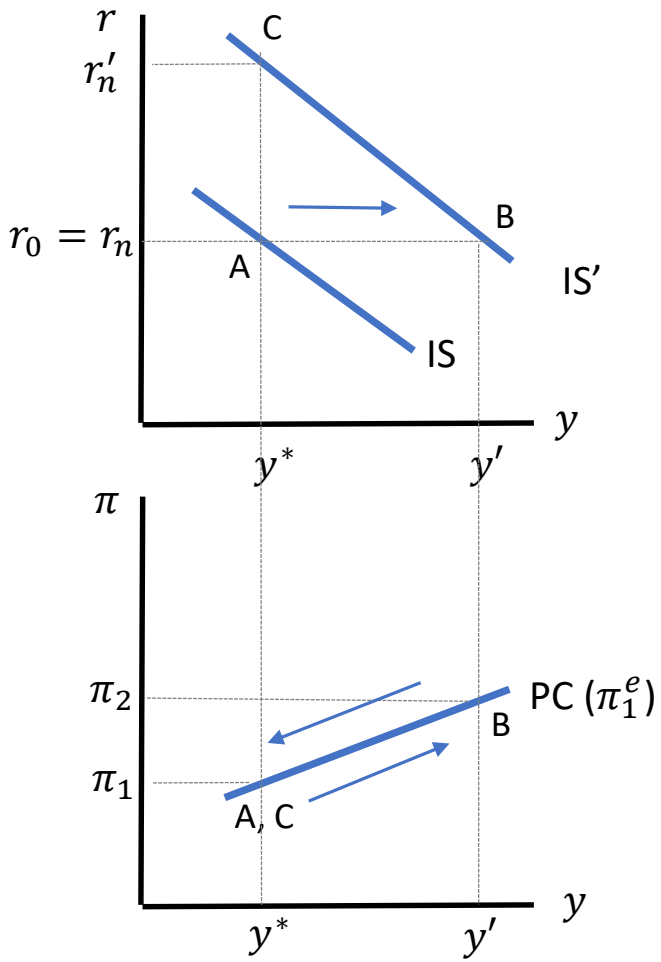
$$\pi_t = \pi_t^e + \gamma\,(y_t - y_t^*) + \varepsilon_t^{\pi} \qquad y_t = y_t^* - \alpha(r_t - r^*) + \varepsilon_t^{y}$$

Permanent fiscal policy shock $\varepsilon_t^y > 0$:

- ①: moves IS to IS′ and economy from A to B in the **short run** when $r_0 = r_n$, inflation temporary increases, too
- ②In equilibrium, r_n ↑ to increase saving incentives with constant supply (y^*) and increased demand. Hence, r_n increases to r_n', where demand meets constant supply again. Private savings ↑ and the decrease in C/I demand via intertemporal substitution offsets effects of initial increase in government spending.
- ②To stabilize output and inflation, the CB increases nom. interest rate to equal the natural interest rate. Consequently, inflation moves back to initial value due to i ↑.

TASK 1: Fiscal Policy in the IS-PC Model

a) Use the IS-PC representation discussed in class to show that a *permanent positive fiscal shock* increases the natural rate of interest. Discuss the underlying economic mechanisms concisely and use a graph to support your argument.



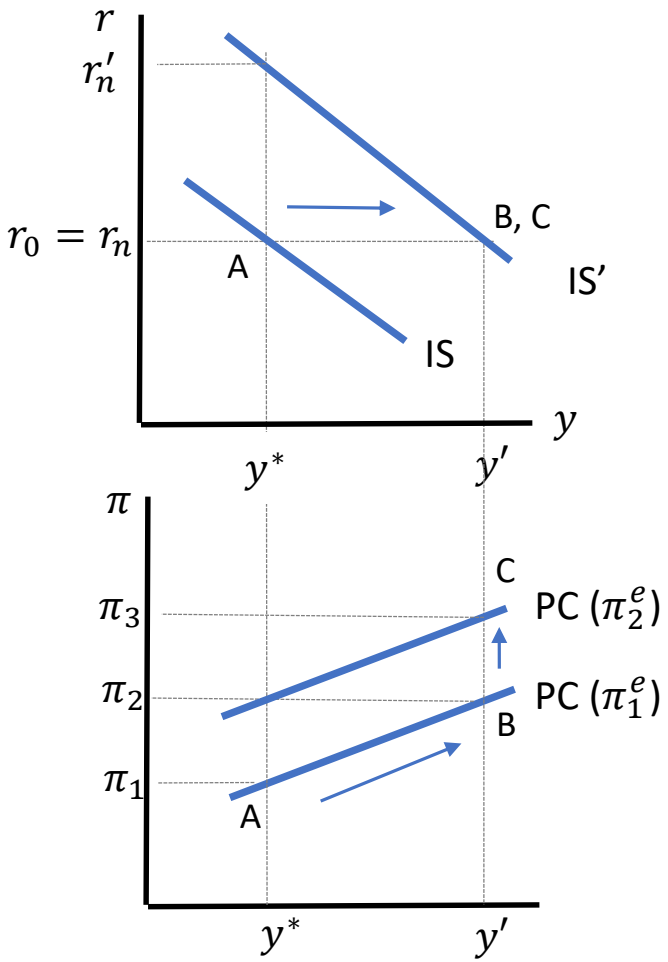
$$\pi_t = \pi_t^e + \gamma\,(y_t - y_t^*) + \varepsilon_t^{\pi} \qquad y_t = y_t^* - \alpha(r_t - r^*) + \varepsilon_t^{y}$$

Result:

- Economy returns back to same y_t^* and π_1
- However: output decomposition has changed since public demand↑ while private demand↓
- Public spending crowds out private spending via changes in the real interest rate

TASK 1: Fiscal Policy in the IS-PC Model

a) Use the IS-PC representation discussed in class to show that a *permanent positive fiscal shock* increases the natural rate of interest. Discuss the underlying economic mechanisms concisely and use a graph to support your argument.



$$\pi_t = \pi_t^e + \gamma\,(y_t - y_t^*) + \varepsilon_t^{\pi} \qquad y_t = y_t^* - \alpha(r_t - r^*) + \varepsilon_t^{y}$$

Central bank adjustment offsets effects of permanent expansion of fiscal policy;

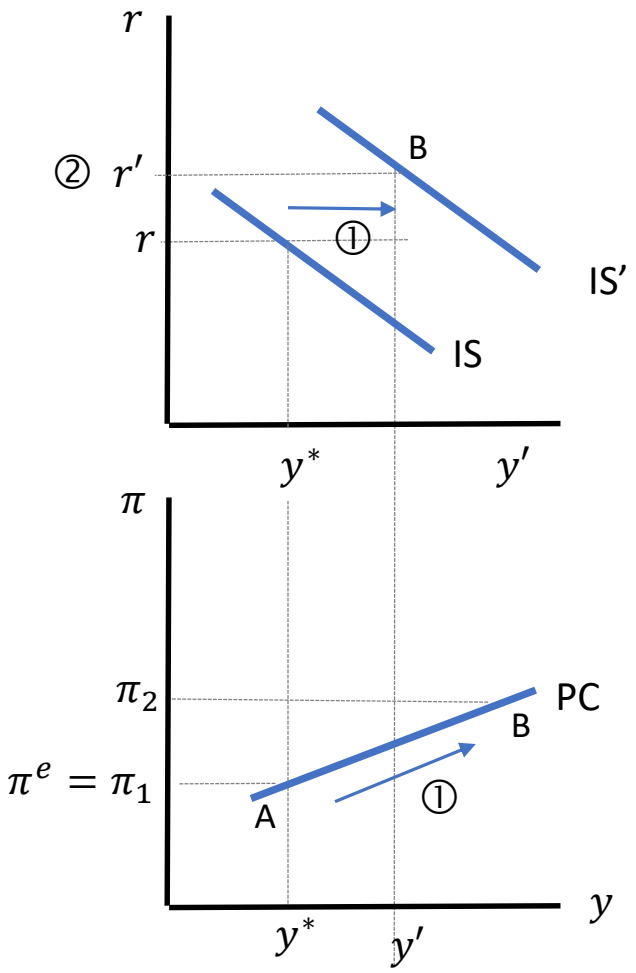
What happens without adjustment of monetary policy?:

- interest remains below r_n, i.e. monetary policy is permanently expansionary
- After a while, people realize that inflation is permanently higher ($\pi_2 > \pi_1$) → upward adjustment of π^e
- This moves the Phillips curve upwards, further increasing inflation to π_3. The economy moves to point C.
- Without stabilization by the central bank ($r \uparrow$ via i↑) or fading out of the fiscal policy shock, this will result in further increases in π^e, further pushing the PC upwards, increasing π, increasing π^e, …

→ instable inflation

TASK 1: Fiscal Policy in the IS-PC Model

b) Briefly explain, how the effects of a *temporary positive shock* differ from those of a permanent positive fiscal shock.



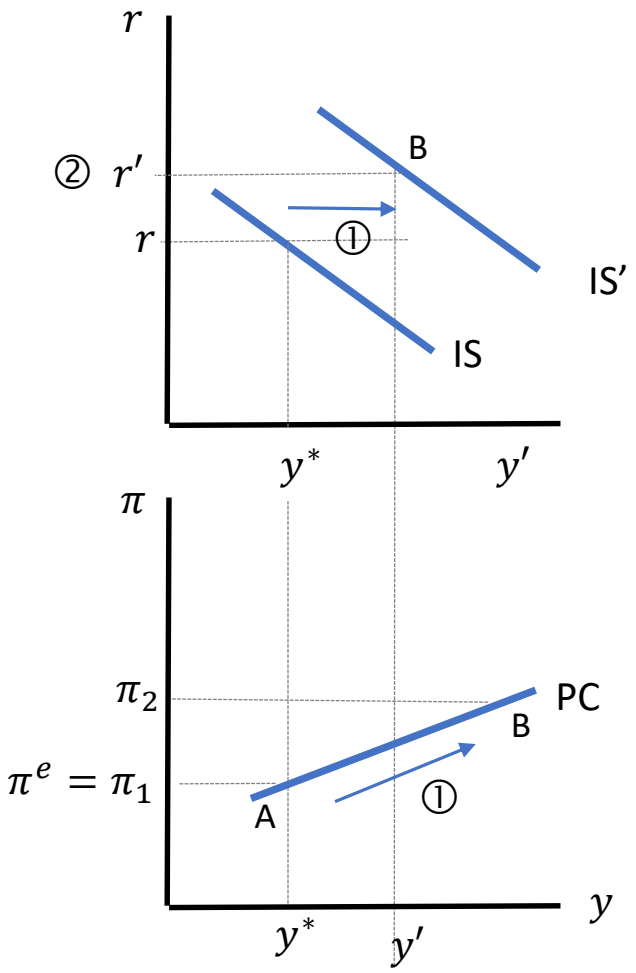
$$\pi_t = \pi_t^e + \gamma\,(y_t - y_t^*) + \varepsilon_t^{\pi} \qquad y_t = y_t^* - \alpha(r_t - r^*) + \varepsilon_t^{y}$$

- ① $\varepsilon_t > 0$ moves IS-curve to the right.
- Given a fixed real interest rate, output moves above potential output…
- … increasing inflation above expected inflation via the Phillips curve. Short run: economy moves from A to B where r went up ②
- Effect would be even larger if the central bank would not hold r_t, but i_t constant. Via the Fisher equation ($r_t = i_t - \pi_t^e$) → $r_t \downarrow$ since demand↑ yields to $\pi_t^e \uparrow$

- Size $y \uparrow$ depends on central bank reaction: If it increases r (via $i \uparrow$), the effect will be smaller. $r \uparrow \rightarrow C \downarrow, I \downarrow$ crowding-out of private by public spending
- Increase of π will be smaller, the larger the increase in r is.
- Why would the central bank increase r at all, if this reduces the effects of fiscal policy?
- → to stabilize inflation as a permanent change in fiscal policy changes r_n, so that monetary policy must react to stabilize the economy → need for policy coordination

TASK 1: Fiscal Policy in the IS-PC Model

b) Briefly explain, how the effects of a temporary positive shock differ from those of a permanent positive fiscal shock.



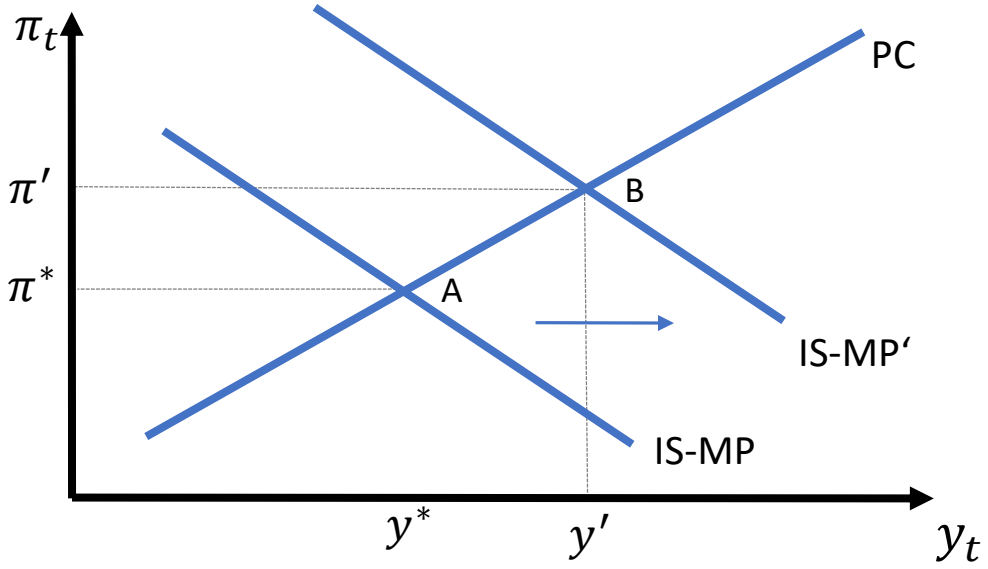
$$\pi_t = \pi_t^e + \gamma\,(y_t - y_t^*) + \varepsilon_t^{\pi} \qquad y_t = y_t^* - \alpha(r_t - r^*) + \varepsilon_t^{y}$$

Result:

- In the **short run**, fiscal policy shock increases output since r_n and π^e are constant in the **short run**
- However, these variables adjust in the **long run** so that central bank intervenes to stabilize inflation, offsetting the fiscal policy shock → this highlights role for monetary and fiscal policy coordination

TASK 1: Fiscal Policy in the IS-PC Model

c) Describe the difference between the IS-PC and the IS-MP-PC representation in this context.



$$\pi_t = \pi_t^e + \gamma\,(y_t - y_t^*) + \varepsilon_t^\pi$$

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

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

- Effects of $\varepsilon_t^y > 0$ similar to IS-PC model
- 1st difference: i_t increases automatically via monetary policy rule, so that public crowds out private spending.
- 2nd difference: central bank controls i_t rather than r_t. If the central bank holds i_t constant, r_t would decrease because (expected) inflation increases.

TASK 2: Fiscal Policy at the Zero Lower Bound

a) Using the solutions given above, explain why fiscal policy is more effective at the Zero Lower bound. Explicitly explain the role of β_π.

No ZLB: $\frac{\partial y_t}{\partial \varepsilon_t^y} = \frac{1}{1+\alpha\gamma(\beta_\pi - 1)}$

Binding ZLB: $\frac{\partial y_t^{ZLB}}{\partial \varepsilon_t^y} = \frac{1}{1-\alpha\gamma}$

- γ: governs inflation reaction via PC
- β_π: interest rate reaction in the MP function due to change in π_t → stemming from deviation from inflation target → how much weight is put on deviation of actual inflation from target
- α: governs output reaction due to change in r_t via the IS curve

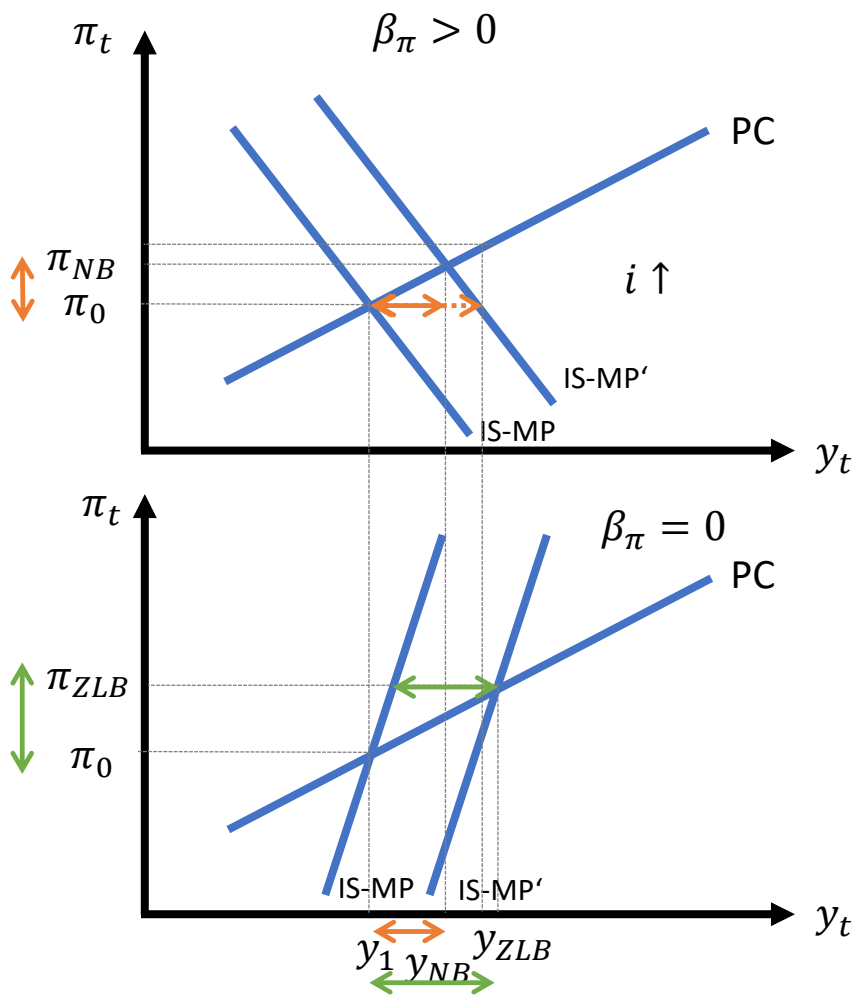
$\beta_\pi = 0$: interest rate does not respond to deviation from inflation target → CB does not counteract fiscal policy action

$\beta_\pi > 1$: central bank reacts to deviation of current inflation from target (in a stabilizing way since Taylor principle holds)

Since $\beta_\pi > 1$ when ZLB is not binding: $\frac{\partial y_t}{\partial \varepsilon_t^y} = \frac{1}{1+\alpha\gamma(\beta_\pi - 1)} < \frac{1}{1-\alpha\gamma} = \frac{\partial y_t^{ZLB}}{\partial \varepsilon_t^y}$

TASK 2: Fiscal Policy at the Zero Lower Bound

b) Use the following graph to show again that fiscal policy is more effective at the Zero Lower Bound compared to the situation when it is not binding.



Background on IS-MP slopes: repetition:

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

- If ZLB not binding/non-accommodative MP:

$\beta_\pi > 1 \rightarrow -\alpha(\beta_\pi - 1) < 0, \rightarrow$ negative slope of IS-MP curve

- At ZLB (lower panel): positive slope of IS-MP curve

- Upper panel: MP reacts to fiscal shock (via i↑) so that effect of fiscal expansion on output & inflation is partly offset again during normal times
- Lower panel: effects on inflation and output are larger since CB does not react to fiscal shock via changing i
  - Shock is accelerated: $r = i - \pi$ → if π increases more due to missing CB reaction & i remains constant, r decreases (extra stimulus)

TASK 2: Fiscal Policy at the Zero Lower Bound

c) Discuss the implications for monetary and fiscal policy at the Zero Lower Bound. Put this into perspective of the ongoing COVID-19 crisis.

The effect of fiscal policy (demand shocks in general) is larger at the ZLB compared to the standard case.

→ Fiscal policy is more powerful at the ZLB, i.e. the stabilization effects on output are larger.

→ Negative demand shocks have larger adverse effects at the ZLB. The reason is that monetary policy cannot accommodate these by lowering the interest rate.

- → COVID-19 crisis: since e.g. ECB was still stuck at the ZLB after the European debt crisis, lowering the interest rate wasn't available as a policy measure → a series of crisis where the interest rate doesn't leave the ZLB in between, yields larger negative effects of the next adverse shock
- → Monetary policy cannot pick up the slack as under normal conditions → greater role for fiscal policy (however, countries have different capabilities of undertaking large fiscal stimulus due to differing debt levels)

TASK 2: Fiscal Policy at the Zero Lower Bound

d) Discuss the impact of central bank policy on inflation at the Zero Lower Bound. Use the algebraic expressions discussed in class to underpin your argument.

Without ZLB:

$$\frac{\partial \pi_t}{\partial \varepsilon_t^y} = \theta\gamma = \frac{\gamma}{1 + \alpha\gamma(\beta_\pi - 1)}$$

With ZLB:

$$\frac{\partial \pi_t^{ZLB}}{\partial \varepsilon_t^y} = \frac{\gamma}{1 - \alpha\gamma}$$

Again, as $\beta_\pi > 1$, it follows that:

$$\frac{\partial \pi_t^{ZLB}}{\partial \varepsilon_t^y} = \frac{\gamma}{1 - \alpha\gamma} > \frac{\gamma}{1 + \alpha\gamma(\beta_\pi - 1)} = \frac{\partial \pi_t}{\partial \varepsilon_t^y}$$

Intuition: if CB reacts to inflationary effects of fiscal policy stronger during normal times (via raising i), the reaction of inflation to a fiscal policy shock is smaller compared to the ZLB

When i=0 at ZLB, i.e. accommodative monetary policy → inflation reaction larger

TASK 2: Fiscal Policy at the Zero Lower Bound

e) Discuss why the effectiveness of fiscal policy increases in terms of the output reaction with the degree of flatness in the Phillips Curve. What is the implication for inflation stabilization?

$$\pi_t = \pi_t^e + \gamma\,(y_t - y_t^*) + \varepsilon_t^\pi$$

- γ governs the slope in the PC curve, i.e. how responsive π_t is to deviations of current output from its equilibrium value ('potential')
- the larger γ, the more responsive is π_t → smaller stimulus is needed to stabilize inflation, whereas a smaller stimulus doesn't increase output as much
- the smaller γ, i.e. the flatter the PC curve, the less responsive is π_t → larger stimulus is needed to stabilize inflation; that larger stimulus yields a larger increase in output
- still open debate in empirical discussion on how flat the PC curve is