MONETARY THEORY AND POLICY

Kittichai Saelee

BE Thammasat University

AGENDA

- Money and real economic activities?
- Why does money affect output?
- **Modern monetary policy model**
  - Basic framework
  - **Analysis**
  - Extension

THE IS-MP-PC: ANALYSIS

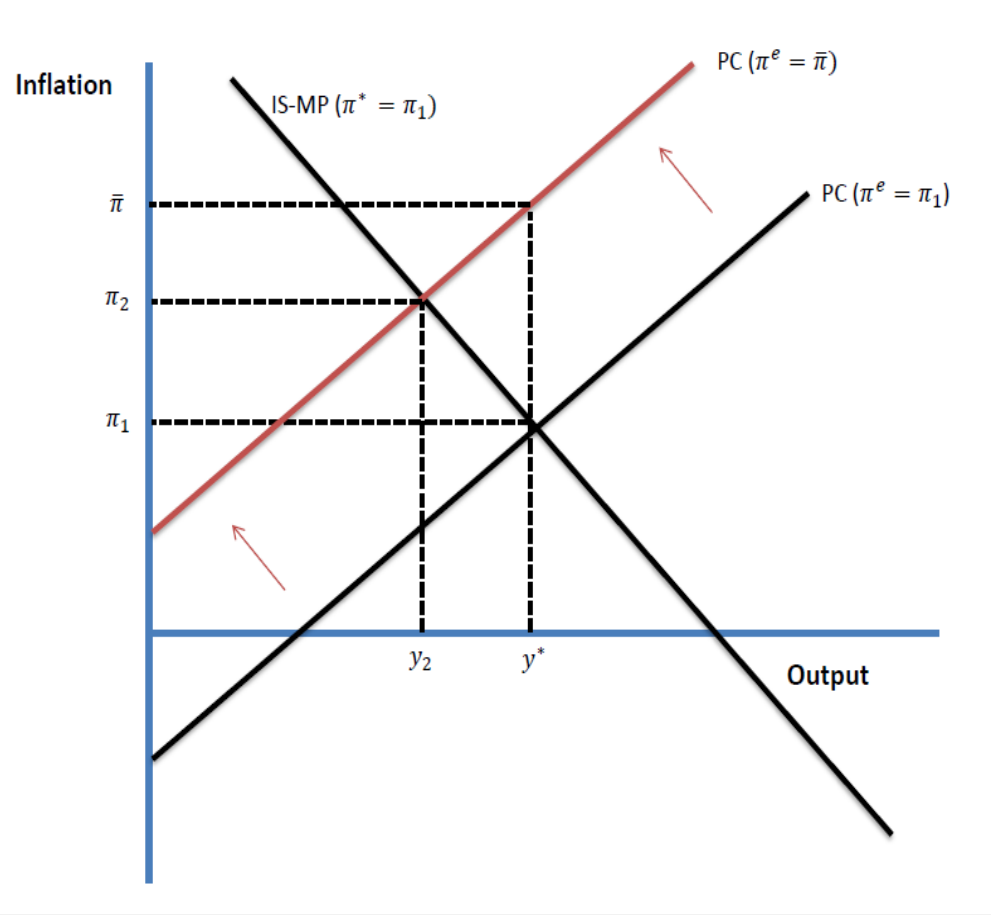
- Suppose no shock $\epsilon_t^{\pi} = \epsilon_t^{y} = 0$, we can attain that
  - Inflation expectation = targeted inflation $\pi_t^e = \pi_1 = \pi^*$
- This generates an equilibrium outcome where
  - Actual inflation = inflation expectation $\pi_t = \pi_1 = \pi^*$
  - Output = potential output $y_t = y_t^*$
- **Question:** How does the economy response under shocks?
  - Demand shocks / Supply shocks

THE IS-MP-PC: ANALYSIS

- To understand the question, we need to understand about the role of the change in inflation expectation first!
- Suppose now $\pi_t^e = \bar{\pi} > \pi_1 = \pi^*$
- What happens are the following
  - The PC curve shifts upwards
  - Output ends up being lower than its natural rate
  - Inflation rises. It ends up taking a value between $\bar{\pi}$ and π^*

THE IS-MP-PC: ANALYSIS

- The PC curve shifts upwards (why?)
- Equilibrium is now $\pi_2 \in [\pi^*, \bar{\pi}\ ]$
  - The effect of inflation expectation on inflation is partially curbed by rising real interest rate.
- Output is lowered
  - This is resulting from a higher real interest rate



THE IS-MP-PC: ANALYSIS

- The outcome here shows that inflation ends up between the public's inflation expectations and the central bank's inflation target.

- What determines this outcome? What determines how far from away target inflation will move when the public's inflation expectations change?
  - How much does it depend on the monetary policy rule?
  - How much does it depend on other aspects of the model, like the impact of real interest rates on output and the impact of output on inflation?

- However, using the equations underlying the model, we can fully answer all these questions.

THE IS-MP-PC:ANALYSIS

- Let's repeat the equations describing our two curves.
- The PC curve is

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

- And the IS-MP curve is

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

- Taking all the other elements of the model as given, we can view this as two linear equations in the two variables π_t and y_t.
- These equations can be solved to give solutions that describe how these two variables depend on all the other elements of the model.

THE IS-MP-PC:ANALYSIS

- The PC curve is

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

- And the IS-MP curve tells us that

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

- Substituting this expression for the output gap into the Phillips curve and re-arranging we get

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

- Letting

$$\theta = \frac{1}{1+\alpha\gamma\left(\beta_\pi - 1\right)}$$

- We get

$$\pi_t = \theta\pi_t^e + \left(1-\theta\right)\pi^* + \theta\left(\gamma\epsilon_t^y + \epsilon_t^\pi\right)$$

THE IS-MP-PC:ANALYSIS

- What's the meaning of our solution?

$$\pi_t = \theta \pi_t^e + (1 - \theta)\, \pi^* + \theta\, (\gamma \epsilon_t^y + \epsilon_t^\pi)$$

- If $\beta_\pi > 1$ as we've been assuming, then $0 < \theta < 1$. This means that inflation lies between the central bank's inflation target and the public's expectation of inflation.
- We can show that θ depends negatively on α, γ and β_π. This means that the central bank's inflation target plays more role in determining inflation when
  1. γ increases: This parameter determines how inflation changes when output changes.
  2. α increases: This parameter determines how output changes when real interest rates change.
  3. β_π increases: This parameter determines how the central bank responds to inflation.

THE IS-MP-PC:ANALYSIS

- The IS-MP curve tells us that output depends on how far inflation is from the central bank's target

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

- Re-arranging the solution for inflation, we get

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

- This gives

$$y_t = y_t^* - \theta\alpha\left(\beta_\pi - 1\right)\left(\pi_t^e - \pi^* + \epsilon_t^\pi + \gamma\epsilon_t^y\right) + \epsilon_t^y$$

  which can be simplified to

$$y_t = y_t^* - \theta\alpha\left(\beta_\pi - 1\right)\left(\pi_t^e - \pi^* + \epsilon_t^\pi\right) + \left(1 - \theta\alpha\gamma\left(\beta_\pi - 1\right)\right)\epsilon_t^y$$

- Output falls short of its natural rate if inflation expectations exceed the inflation target. And the amount of the shortfall depends positively on the three factors mentioned before: α, γ and β_π.

THE IS-MP-PC: ANALYSIS

- We have seen that after the public's inflation expectations rise, the result is a fall in output below its natural rate and in increase inflation, though this increase is smaller than had been expected by the public

- What happens next? Alternatively, would the result be permanent?

- To answer the question, this depends on how the public's expectation of inflation change at this point?

- Form of inflation expectation: adaptive v.s. rational expectation

THE IS-MP-PC: ANALYSIS

- Adaptive expectation = Gradually slow adjustment in the expectation
  - An example is that $\pi_t^e = \pi_{t-1}$

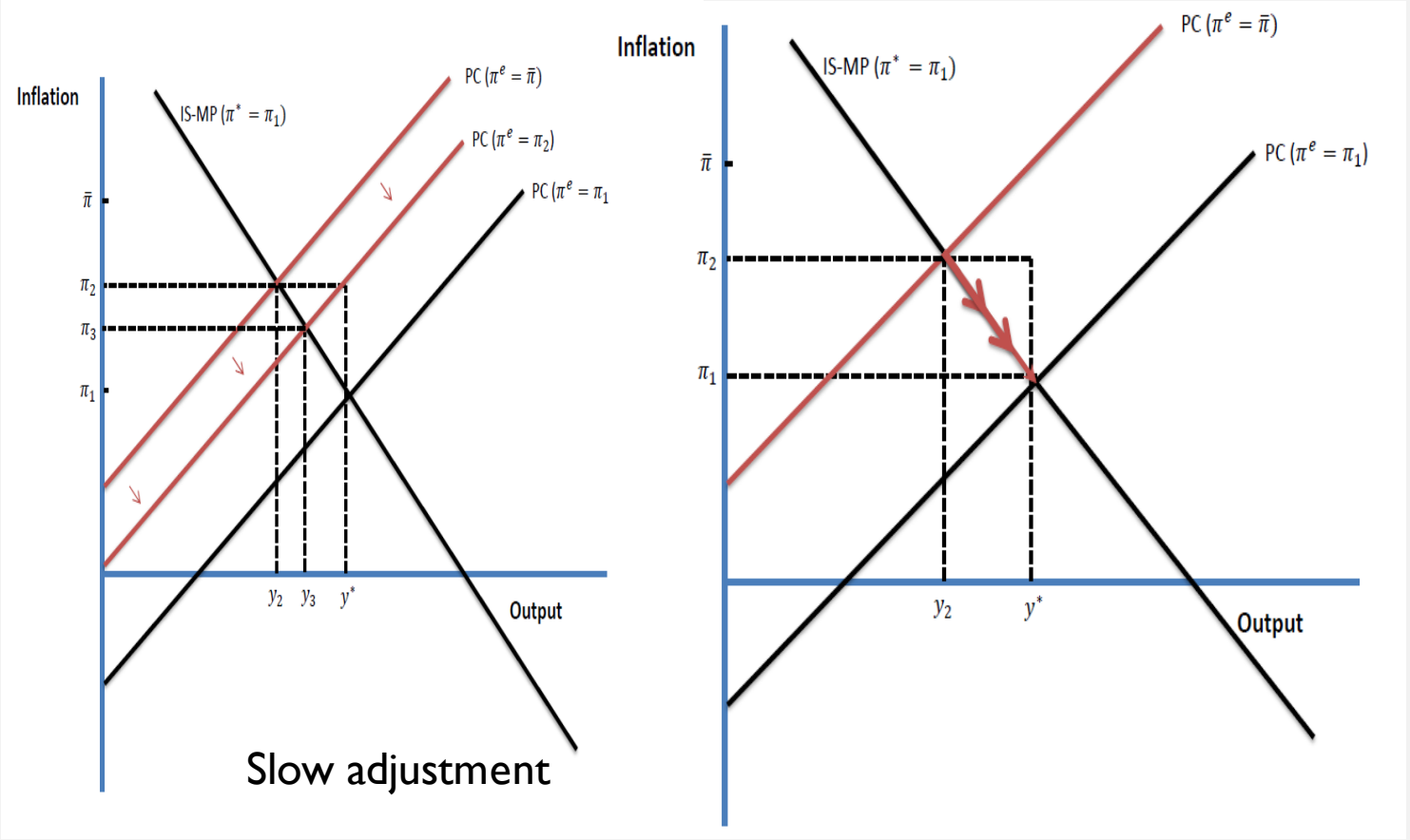
- Under this formulation of expectations, the Phillips curve becomes

$$\pi_t = \pi_{t-1} + \gamma\left(y_t - y_t^*\right) + \epsilon_t^{\pi}$$

- In other words, there should be a positive relationship between the change in inflation and the output gap. Alternatively, there should be a negative relationship between the change in inflation and the rate of unemployment.

THE IS-MP-PC: ANALYSIS

- Consider the adjustment dynamic
  - At time t=1, rising inflation expectation
  - Actual inflation rises to $\pi_2 < \bar{\pi}$
  - At time t = 2, agents now take π_2 as the new inflation expectation.
  - The Philips curve shifts down to PC($\pi^e = \pi_2$)
  - Equilibrium inflation is now reduced to π_3.
  - At time t = 3, repeating mechanism
  - Ultimately, things back to original



THE IS-MP-PC: ANALYSIS

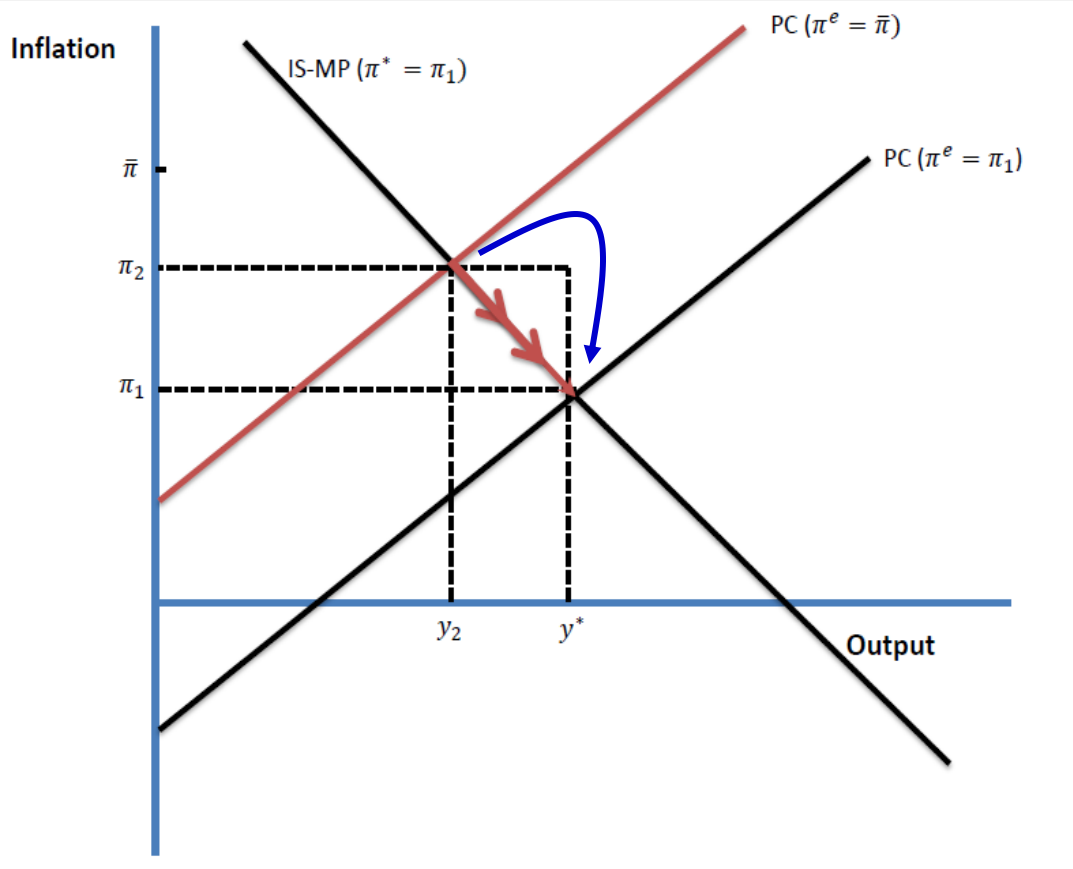
- Rational expectation = Expectation formed under current state of inflation

$$\pi_t = \theta \pi_t^e + (1-\theta)\,\pi^* + \theta\,(\gamma \epsilon_t^y + \epsilon_t^\pi)$$

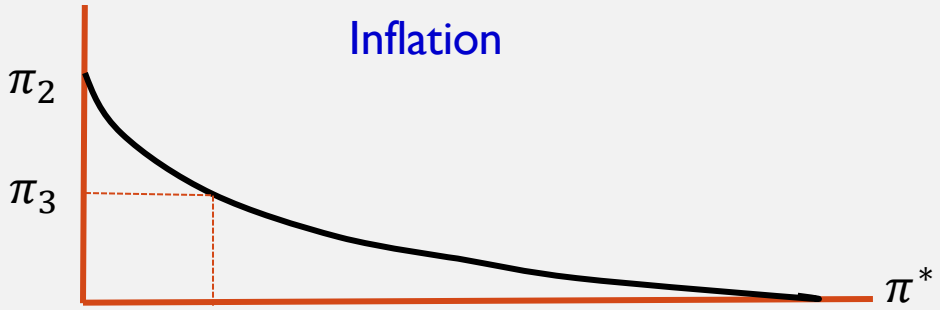
- This implies that $\pi_t^e = \pi^*$

THE IS-MP-PC:ANALYSIS

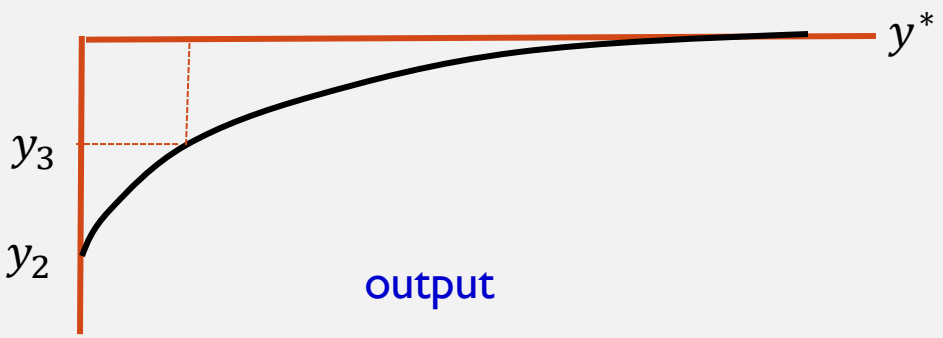
- Consider the adjustment dynamic
  - At time t=1, rising inflation expectation
  - Actual inflation rises to $\pi_2 < \bar{\pi}$
  - At time t = 2, agents now take π^*as the new inflation expectation.
  - The Philips curve shifts down to PC($\pi^e = \pi_1 = \pi^*$)
  - Equilibrium inflation is now reduced to π_1.
  - Ultimately, things back to original (in an instantaneous fashion)

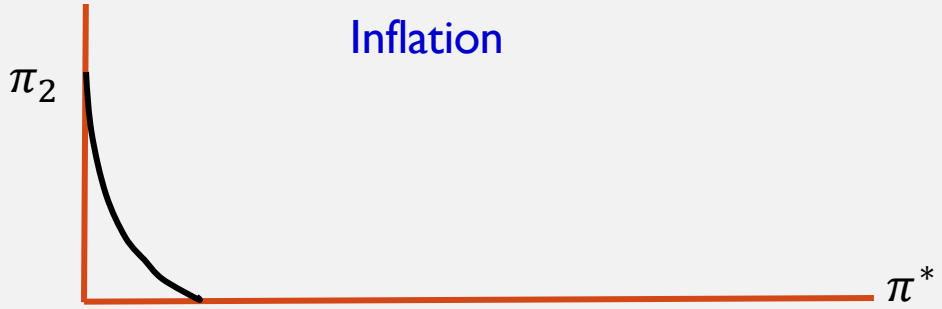


THE IS-MP-PC:ANALYSIS

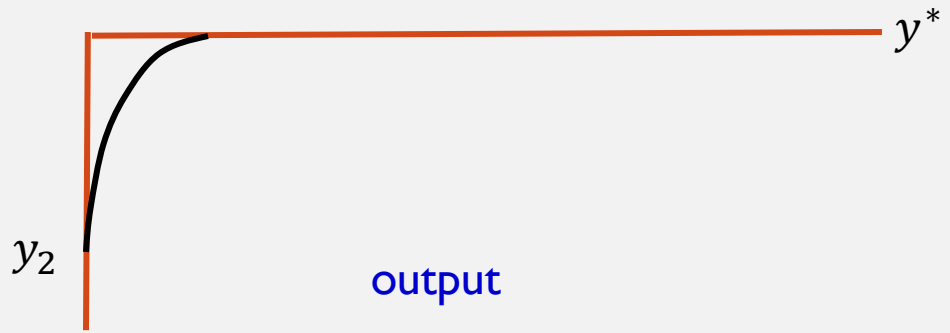


T=1 T=2 Adaptive expectation



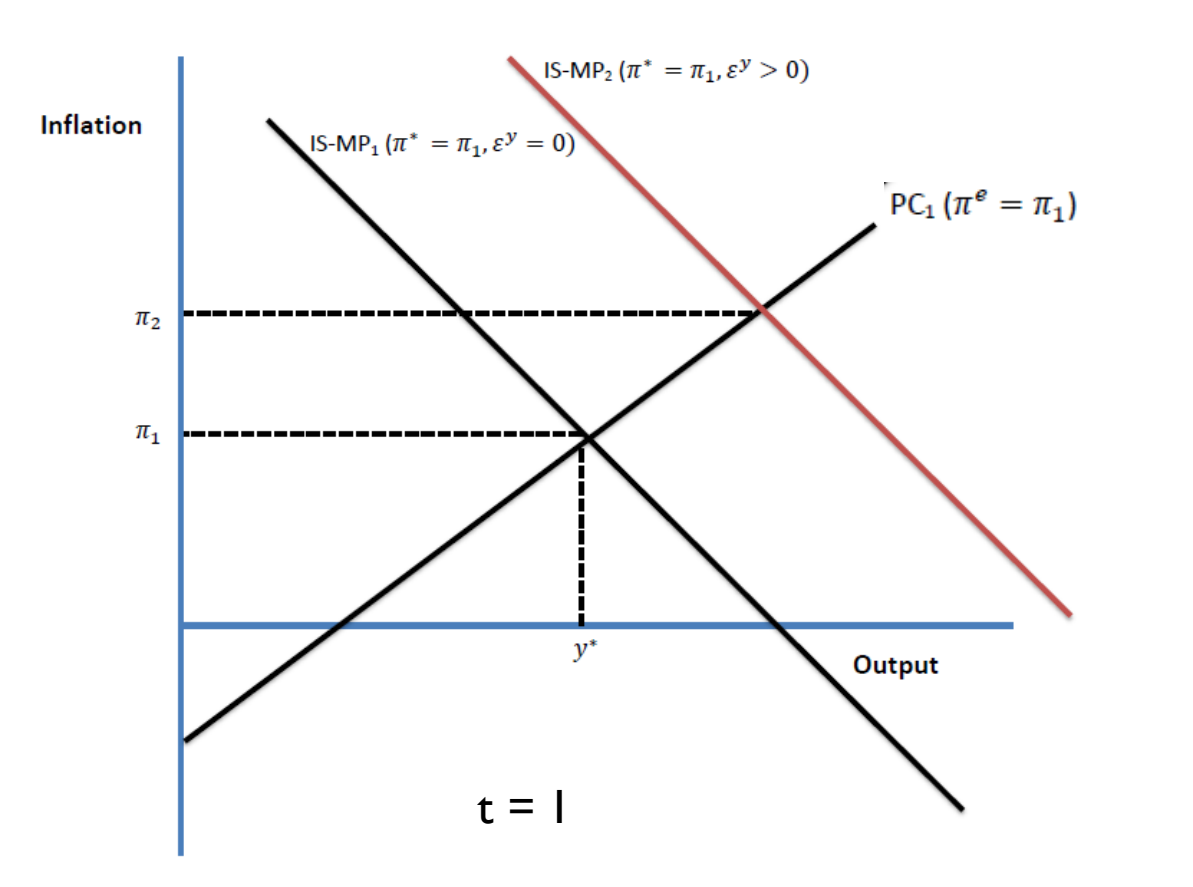


T=1 T=2 Rational expectation



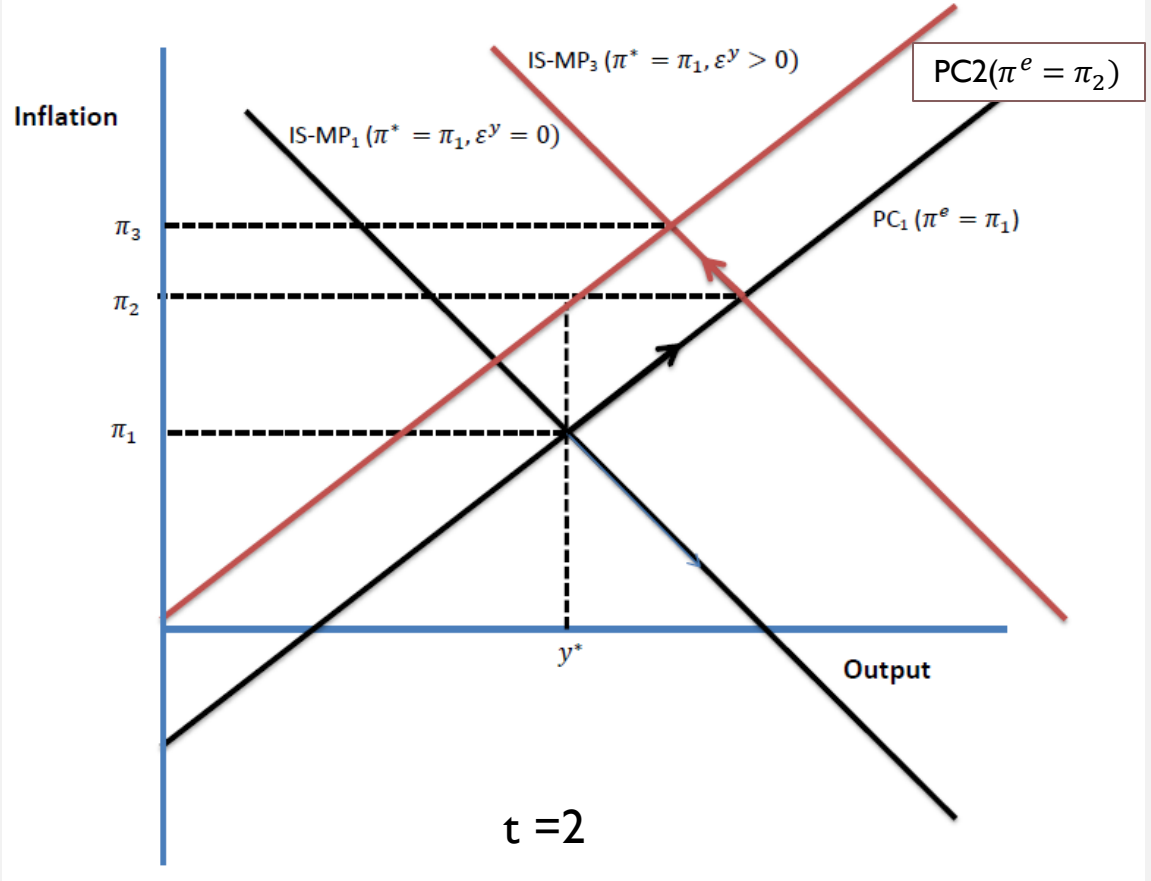
THE IS-MP-PC:ANALYSIS

- Consider a positive demand shock
  - **Example:** Optimistic sentiments / Positive government spending shock etc.
- Given the same expected inflation, IS-MP curve shifts up.
- At time t = 1, equilibrium inflation and output can be illustrated in the figure. $(\pi_t = \pi_2)$



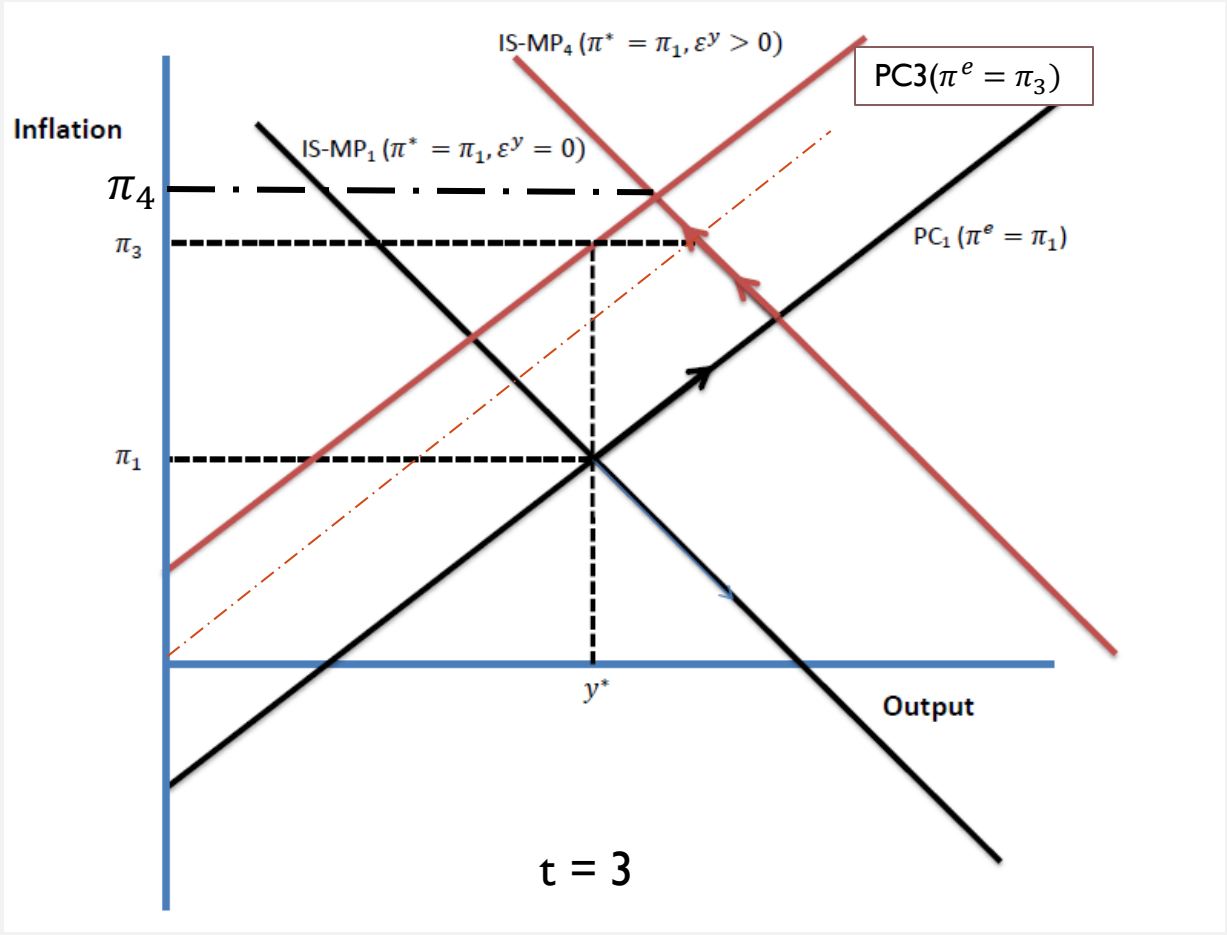
THE IS-MP-PC:ANALYSIS

- Suppose that demand shocks temporarily persist for a couple of periods!
  - IS-MP curve remains at the one shifted out.
- As inflation rises above inflation expectation, at time t = 2, PC curve will shift up, becoming PC2($\pi^e = \pi_2$)
- At time t = 2, equilibrium inflation rises to ($\pi_t = \pi_3$), and output starts to fall.



THE IS-MP-PC: ANALYSIS

- Continued with persistent of demand shocks!
- As inflation rises above inflation expectation, at time t = 3, PC curve will shift up, becoming PC3($\pi^e = \pi_3$)
- At time t = 3, equilibrium inflation rises further ($\pi_t = \pi_4$) and output keeps falling further



THE IS-MP-PC: ANALYSIS

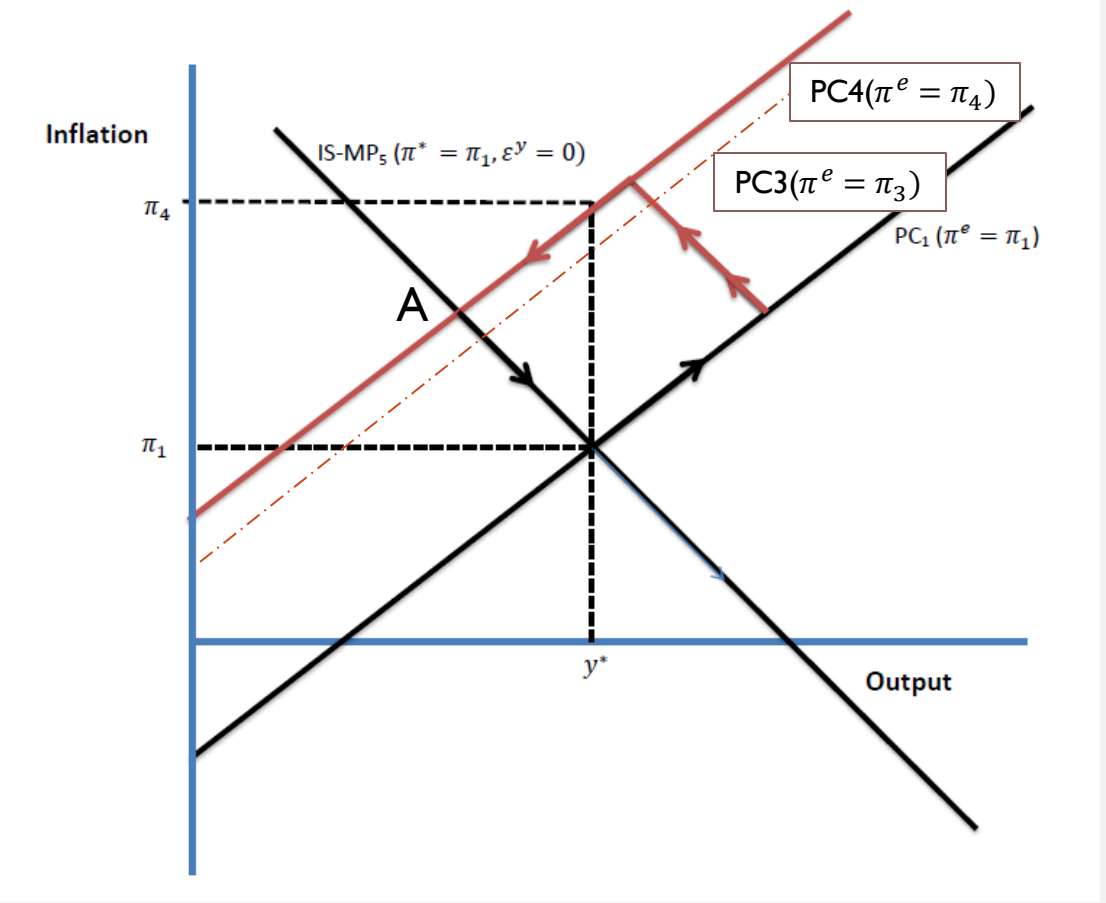
- If demand shock is **permanent**, inflation will keep rising to sustain itself at **a new high level** while output will gradually fall back to the original potential level.

- However, demand shock is temporary; stay for a while and gone!

- Suppose that in t = 4 the IS-MP curve is back to the original one, what would happen?

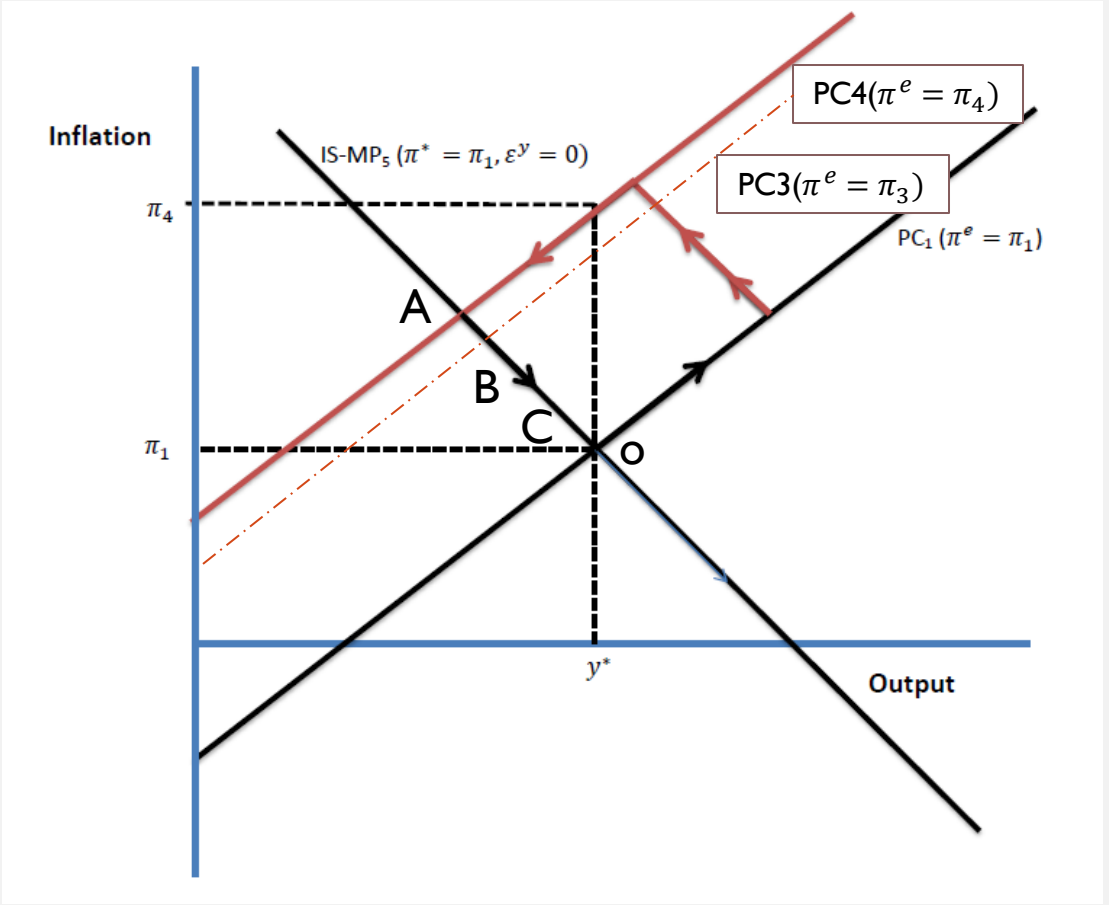
THE IS-MP-PC: ANALYSIS

- In period t = 4, PC continues to shift further to PC4($\pi^e = \pi_4$)
- However, as demand now drops to the original, equilibrium inflation will then fall.
  - This is captured by point "A"
- Experience a recession



THE IS-MP-PC:ANALYSIS

- In all the subsequent periods, downward revision of inflation expectation will play role
  - Inflation will be gradually falling back to the targeted level, as well as potential output
  - Country has experienced a temporary recession

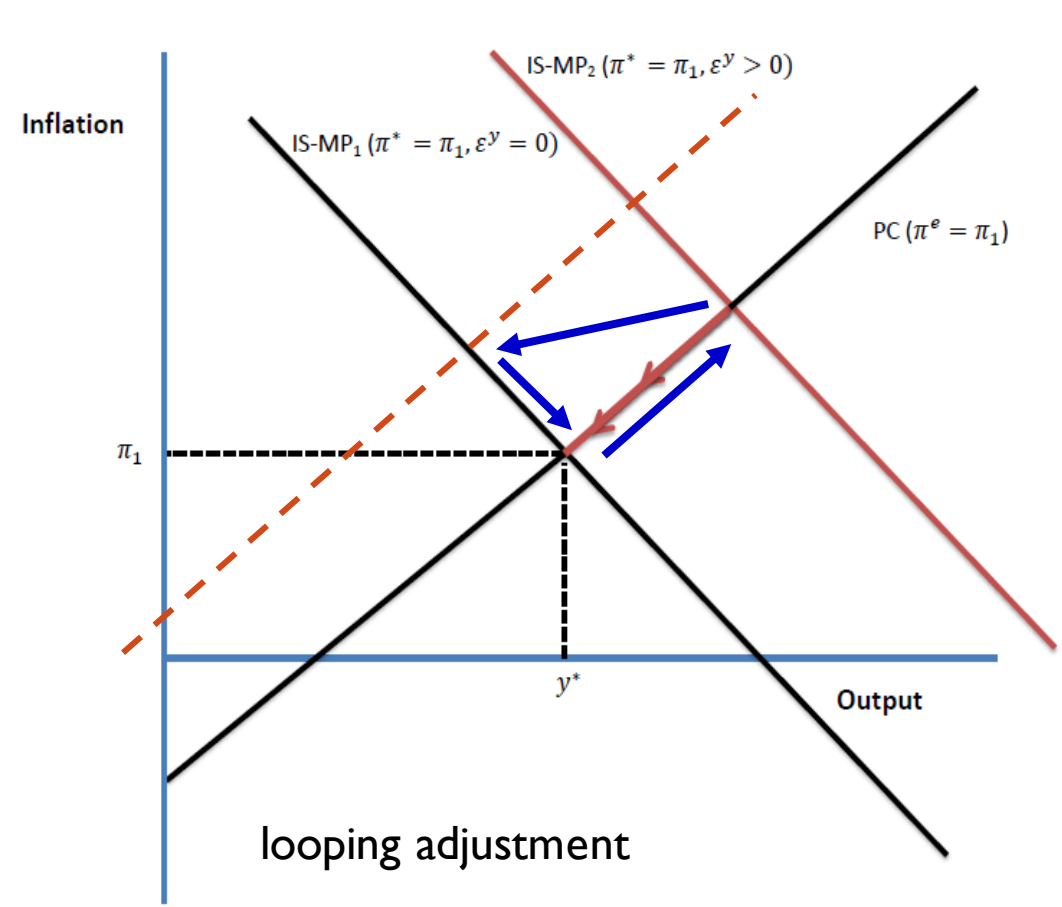


THE IS-MP-PC: ANALYSIS

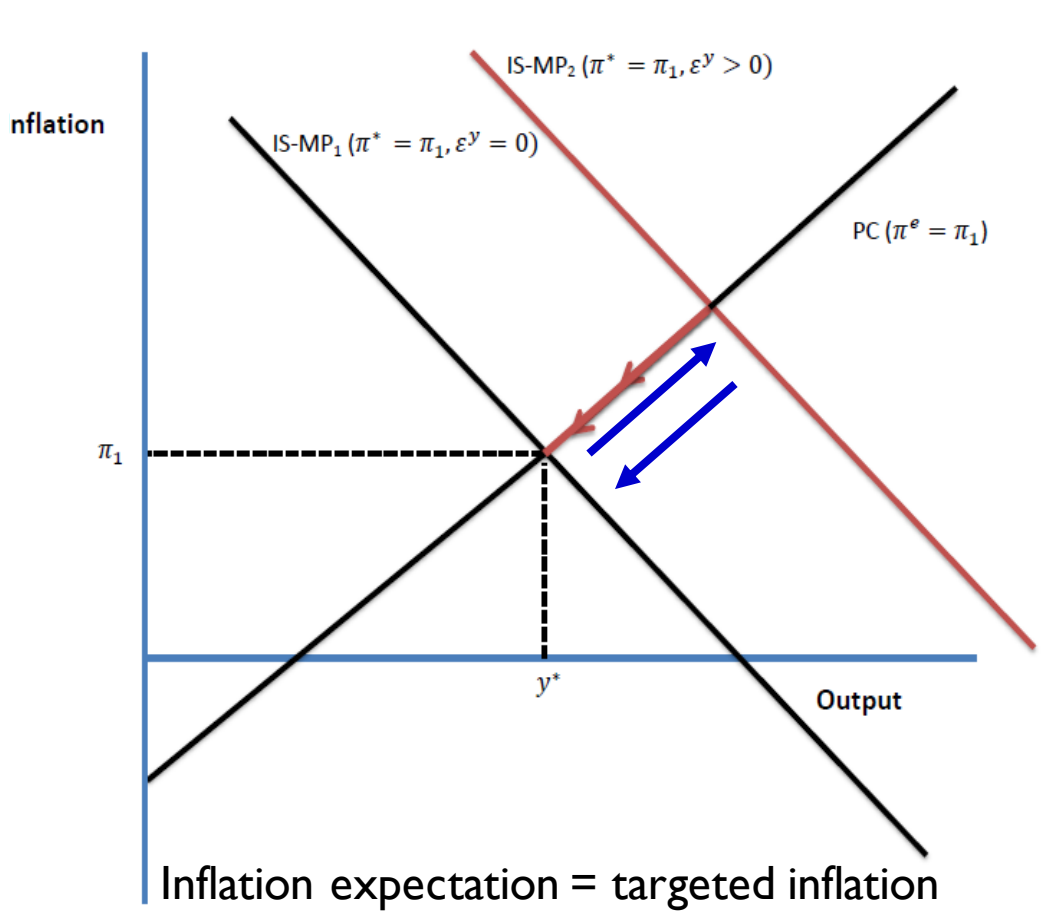
- Notice that the dynamic response of macroeconomy depends on how inflation expectation changes / evolves!
  - Having inflation tracked the past historical inflation tends to lead a gradually slow adjustment
  - Take some time before everything is back to normal (looping adjustment)

- Interesting, if inflation expectation remains fixed at the targeted level, none of this **looping adjustment** would have happened.

THE IS-MP-PC: ANALYSIS



looping adjustment

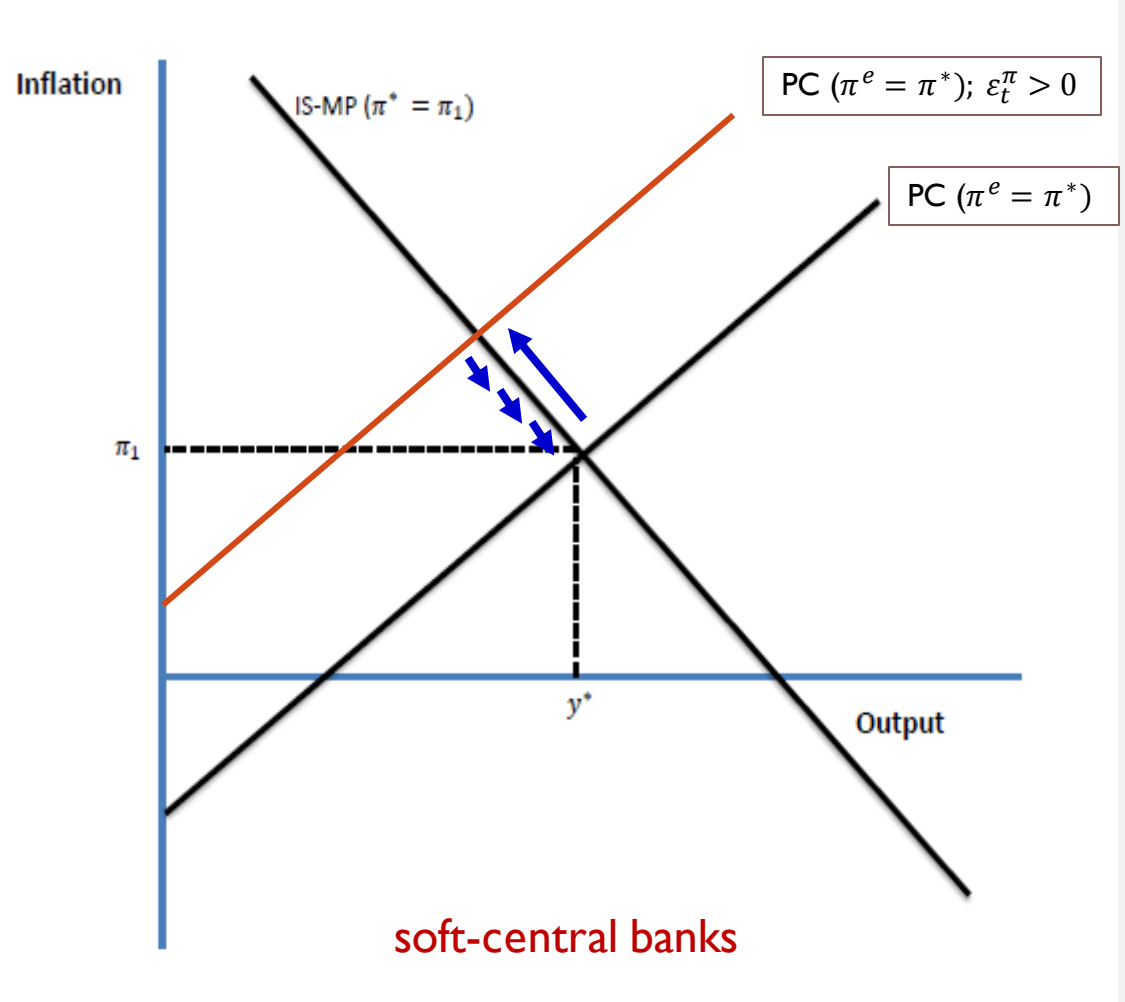


Inflation expectation = targeted inflation

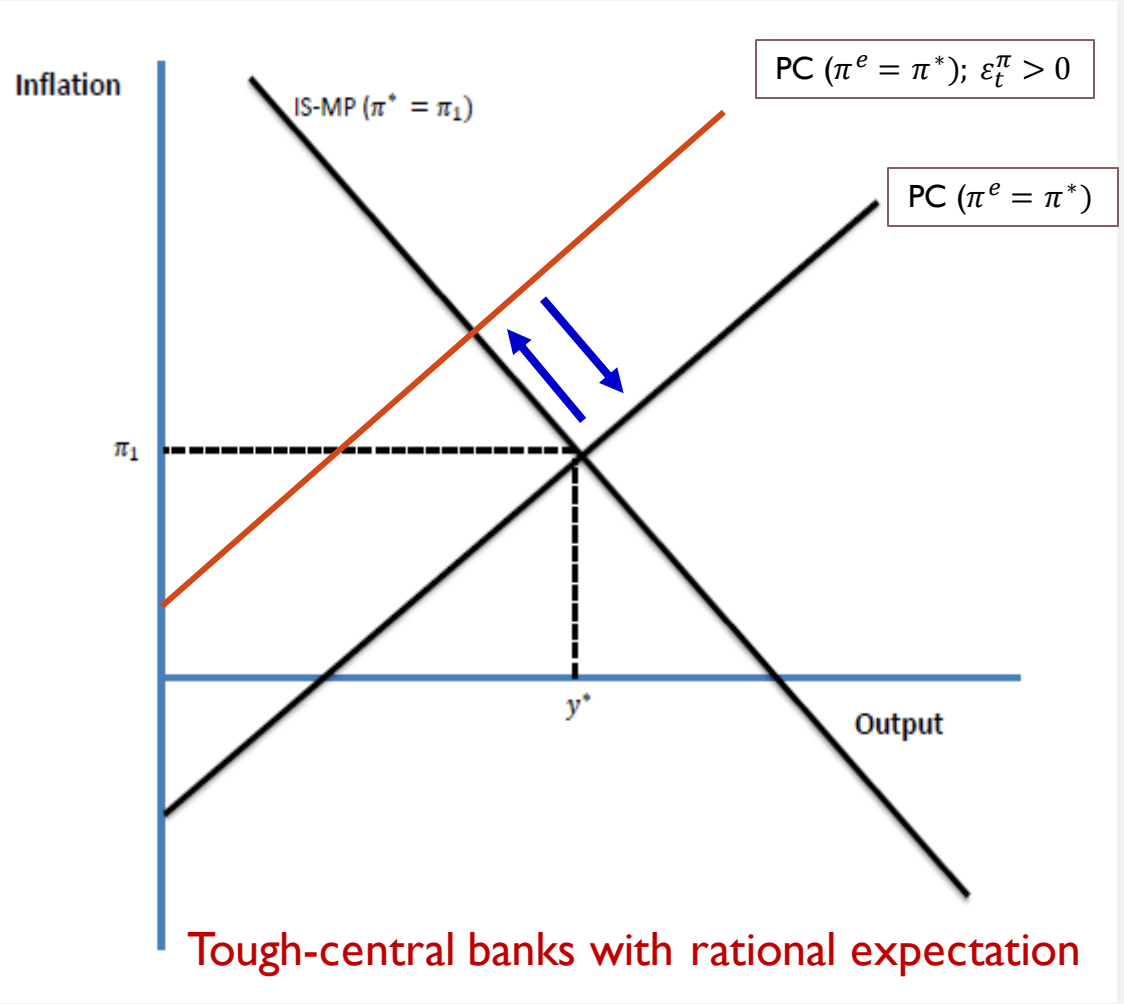
THE IS-MP-PC: ANALYSIS

- Policy implications
  - Our model predicts that "soft-central banks" hurt themselves in the long-run.
  - If you have been tough, it pays you off in the long-run.
  - Public maintain the stable inflation expectation, central bank build the reputation, and allow for a better anchoring of inflation expectation.
  - Economy will be less volatile.
  - This is crucially benefit if central banks frequently face with negative supply shock.

THE IS-MP-PC: ANALYSIS



soft-central banks



Tough-central banks with rational expectation

THE IS-MP-PC: ANALYSIS

- A better outcome is obtained if the central bank can commit to a low inflation, and this commitment be believed by the public. This suggests the following ways of achieving the best outcome:
  - **Political Independence:** Central banks that plan for the long-term and don't worry about economic performance during election years are is more likely to stick to a commitment to low inflation.
  - **Conservative Central Bankers:** If the central banker is known to really dislike Inflation |and the public believes this, the economy gets closer to the ideal low inflation outcome even without commitment. The government may choose to appoint a central banker who is more Inflation -averse than they are.
  - **Consequences for Bad Inflation Outcomes:** If bad things happen to central bankers when Inflation is high, then the public are more likely to believe they will commit to a low Inflation rate.