Advanced Macroeconomics
3. The Taylor Principle

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What is the Taylor Principle?

- We have assumed $\beta_\pi > 1$.
- This which means the central bank reacts to a change in inflation by implementing a bigger change in interest rates.
- This means that real interest rates go up when inflation rises and go down when inflation falls. This is why the IS-MP curve slopes downwards: Along this curve, Higher inflation means lower output.
- Because Taylor's original proposed rule had the feature that $\beta_\pi > 1$, the idea that monetary policy rules should have this feature has become known as *the Taylor Principle*.
- We now discuss why policy rules should satisfy the Taylor principle.

Three Cases: 1. Taylor Principle Case ($\beta_\pi > 1$)

- Inflation in the IS-MP-PC model is given by

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

where

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

- Under adaptive expectations, $\pi_t^e = \pi_{t-1}$ and the model can be re-written as

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

- Three different cases depending on different values of β_π.

1. $\beta_\pi > 1$
    - ★ $\beta_\pi > 1 \Rightarrow \alpha\gamma\left(\beta_\pi - 1\right) > 0$
    - ★ $\beta_\pi > 1 \Rightarrow 1 + \alpha\gamma\left(\beta_\pi - 1\right) > 1$
    - ★ $\beta_\pi > 1 \Rightarrow 0 < \theta < 1$

Three Cases: 2. β_π falls below one

- Recall from our last set of notes that inflation in the IS-MP-PC model is given by

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

where

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

- Under adaptive expectations, $\pi_t^e = \pi_{t-1}$ and the model can be re-written as

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

- Three different cases depending on different values of β_π.

2. $\left(1 - \frac{1}{\alpha\gamma}\right) < \beta_\pi < 1$:
   - ★ $\beta_\pi < 1 \Rightarrow \alpha\gamma\left(\beta_\pi - 1\right) < 0 \Rightarrow 1 + \alpha\gamma\left(\beta_\pi - 1\right) < 1$
   - ★ $\beta_\pi > \left(1 - \frac{1}{\alpha\gamma}\right) \Rightarrow 1 + \alpha\gamma\left(\beta_\pi - 1\right) > 0.$
   - ★ $\theta > 1$

Three Cases: 3. Where β_π is well below one

- Recall from our last set of notes that inflation in the IS-MP-PC model is given by

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

where

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

- Under adaptive expectations, $\pi_t^e = \pi_{t-1}$ and the model can be re-written as

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

- Three different cases depending on different values of β_π.

  3. $\beta_\pi < \left(1 - \frac{1}{\alpha\gamma}\right)$:
     - ★ $\beta_\pi < \left(1 - \frac{1}{\alpha\gamma}\right) \Rightarrow 1 + \alpha\gamma\left(\beta_\pi - 1\right) < 0.$
     - ★ $\beta_\pi < \left(1 - \frac{1}{\alpha\gamma}\right) \Rightarrow \theta < 0$

The Taylor Principle and Macroeconomic Stability

- These considerations explain why the Taylor principle is so important.
- If $\beta_\pi > 1$ then inflation dynamics

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

  are described by an AR(1) model with $0 < \theta < 1$. Inflation and output will be stable around long-run average values.
- If $\left(1 - \frac{1}{\alpha\gamma}\right) < \beta_\pi < 1$, then $\theta > 1$ and inflation ends up exploding off to either plus or minus infinity. Output either collapses or explodes.
- Why does β_π matter so much for macroeconomic stability? Obeying the Taylor principle means that shocks that boost inflation raise real interest rates and thus reduce output, which contains the increase in inflation.
- In contrast, when the β_π falls below 1, shocks that raise inflation result in lower real interest rates and higher output which further fuels the initial increase in inflation.

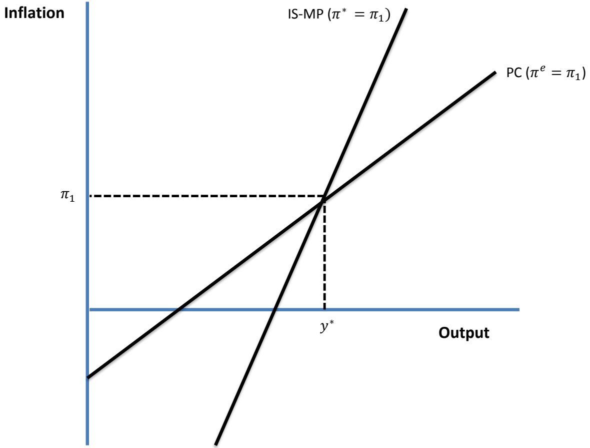
Graphical Representation

- We can use graphs to illustrate the properties of the IS-MP-PC model when the Taylor principle is not obeyed.
- The IS-MP curve is given by

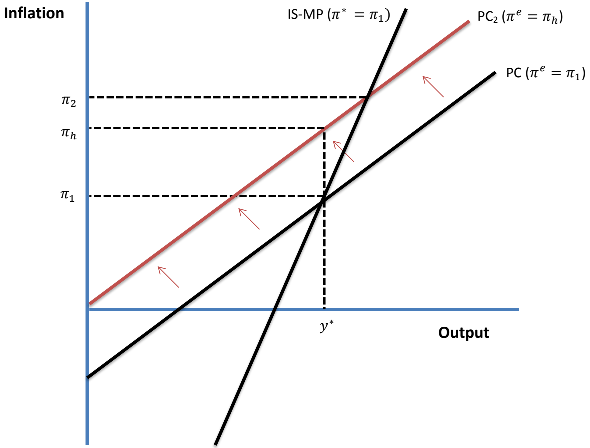
$$y_t = y_t^* - \alpha \left(\beta_\pi - 1\right)\left(\pi_t - \pi^*\right) + \epsilon_t^y$$

  The slope of the curve depends on whether or not $\beta_\pi > 1$.
- When $\beta_\pi > 1$ the slope $-\alpha\left(\beta_\pi - 1\right) < 0$. The IS-MP curve slopes down.
- When $\beta_\pi < 1$ the slope $-\alpha\left(\beta_\pi - 1\right) > 0$. The IS-MP curve slopes up.
- But when is the upward-sloping IS-MP curve steeper than the Phillips curve and when is it not?
- I won't show it here but the condition for IS-MP curve to slope up and be steeper than the Phillips curve is $\left(1 - \frac{1}{\alpha\gamma}\right) < \beta_\pi < 1$. In other words, this graph corresponds to the second case considered above. This is the case we will show in graphs here.

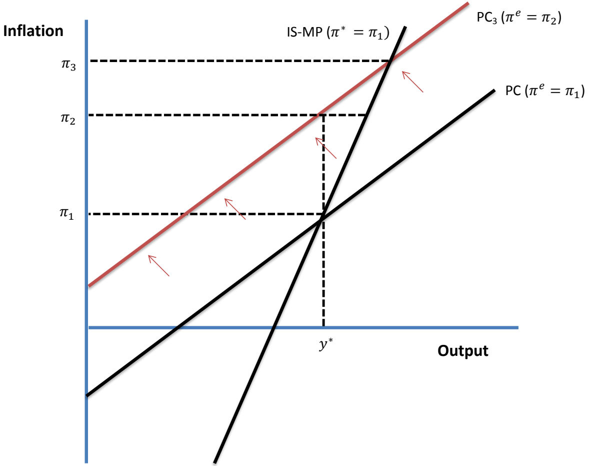
The IS-MP-PC Model when $\left(1 - \frac{1}{\alpha\gamma}\right) < \beta_\pi < 1$



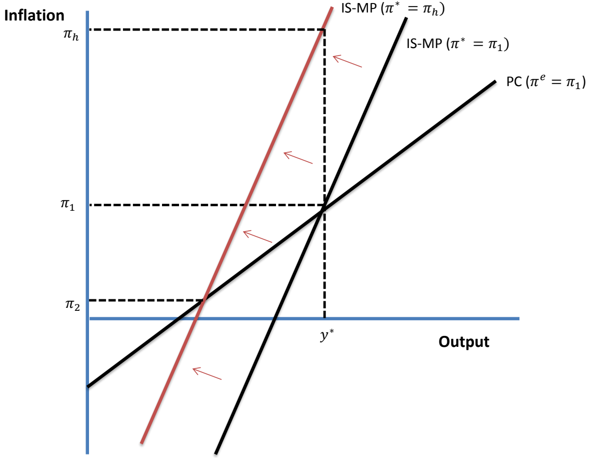
An Increase in π_t^e when $\left(1 - \frac{1}{\alpha\gamma}\right) < \beta_\pi < 1$



Explosive Dynamics when $\left(1 - \frac{1}{\alpha\gamma}\right) < \beta_\pi < 1$



An Increase in π^* when $\left(1 - \frac{1}{\alpha\gamma}\right) < \beta_\pi < 1$



An Increase in π^* when $\beta_\pi < 1$

- This last result is consistent with our basic equation for inflation:

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

  because we are considering the case where $\theta > 1$ so the coefficient on π^* is negative.
- Still, it seems odd. Shouldn't a higher inflation target lead to higher inflation?
- The explanation is that this doesn't happen with our monetary policy rule:

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

- A higher inflation target lowers i_t because it reduces the "inflation gap" $\pi_t - \pi^*$ but it increases i_t because of the first term $r^* + \pi^*$ which is required to maintain the natural real rate in the long term, a reduction in inflation must be matched by a reduction in nominal interest rates.
- When $\beta_\pi < 1$ this second effect is bigger than the first effect. A higher inflation target leads to higher interest rates and lower inflation.

Does This All Depend On Adaptive Expectations?

- Do these results depend crucially on the assumption of adaptive expectations?
- No
- Without assuming adaptive expectations, we still have

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

- So, when $\beta < 1$ and thus $\theta > 1$, the coefficient in the inflation equation on the central bank's inflation target, π^*, is negative.
- If you introduced a more sophisticated model of expectations formation, the public would realise that the central bank's inflation target doesn't have its intended influence on inflation and so there would no reason to expect this value of inflation to come about.
- And if people know that changes in expected inflation are translated more than one-for-one into changes in actual inflation then this could produce self-fulfilling inflationary spirals, even if the public had a more sophisticated method of forming expectations than the adaptive one employed here.

Evidence on Monetary Policy Rules and Stability

- The website links to a paper titled "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory" by Richard Clarida, Jordi Gali and Mark Gertler.
- These economists reported that estimated policy rules for the Federal Reserve appeared to show a change after Paul Volcker was appointed Chairman in 1979.
- Post-1979 monetary policy appeared consistent with a rule in which the coefficient on inflation that was greater than one while the pre-1979 policy seemed consistent with a rule in which this coefficient was less than one.
- The paper also introduce a small model that shows how failure to obey the Taylor principle can lead to the economy generating cycles based on self-fulfilling fluctuations.
- They argue that failure to obey the Taylor principle could have been responsible for the poor macroeconomic performance, featuring the stagflation combination of high inflation and recession, during the 1970s in the US.

Things to Understand From This Topic

1. Definition of the Taylor principle.
2. How variations in β_π affect θ: The three different cases.
3. Difference equations and conditions for stability.
4. Rationale for why obeying the Taylor principle stabilises the economy.
5. How the three cases are represented on graphs.
6. How to graph the explosive dynamics when Taylor principle is not satisfied.
7. Impact of a change in the inflation target when Taylor principle is not satisfied.
8. Evidence on monetary policy rules and macroeconomic stability.