

ECON3123

Macroeconomic Theory I

Tutorial #9: The IS-LM-PC model

Today's tutorial

- The IS-LM-PC model
 - The model setting
 - The role of expectations (again)
- Example: A fall in consumer confidence and the impact of policy responses

Where we got to last time

- We have three versions of the Phillips Curve, depending on how we treat inflation expectations and unemployment

Type	Unemployment: u_t	Unemployment gap: $u_t - u_n$
Benchmark	$\pi_t - \pi_t^e = (m + z) - \alpha u_t$	$\pi_t - \pi_t^e = -\alpha(u_t - u_n)$
Original: $\pi_t^e = \bar{\pi}$	$\pi_t - \bar{\pi} = (m + z) - \alpha u_t$	$\pi_t - \bar{\pi} = -\alpha(u_t - u_n)$
Accelerationist: $\pi_t^e = \pi_{-1}$	$\pi_t - \pi_{-1} = (m + z) - \alpha u_t$	$\pi_t - \pi_{-1} = -\alpha(u_t - u_n)$

- We noticed that controlling inflation is easier (in terms of costing less in terms of unemployment) when inflation expectations are fixed
 - When inflation is increasing, both the Original and Accelerationist approaches are backward-looking, which may not be optimal
 - Central banks have moved to inflation-targeting to try to stabilize inflation and inflation expectations
 - A high-credibility central bank finds inflation control easier than a low-credibility central bank

Another version of the Phillips Curve using the output gap

- The output gap version of the Phillips Curve:

- $\pi_t - \pi_t^e = \frac{\alpha}{AL} (Y_t - Y_n)$
- Y_n natural rate of output, when unemployment is at its natural rate (ie when $\pi_t = \pi_t^e$)
- $Y_t - Y_n$ is called the 'output gap'

Variable	Impact on inflation (via the equations)	Intuition
Y_t increases	Production function: $Y_t = A(1 - u_t)$ Wage setting: $W_t = AP_t^e (1 - \alpha u_t + z)$ Price setting: $P_t = \frac{(1+m)}{A} W_t$ Phillips curve: $\pi_t - \pi_t^e = \frac{\alpha}{AL} (Y_t - Y_n)$ The answer: higher $Y_t \Rightarrow$ lower $u_t \Rightarrow$ higher $W_t \Rightarrow$ higher $P_t \Rightarrow$ higher $\pi_t \Rightarrow$ higher $\pi_t - \pi_t^e$	<ul style="list-style-type: none"> Higher output means that more workers are hired, and so unemployment falls Lower unemployment means that there is a lower supply of workers available for every available job Therefore, employers must offer higher wages to attract workers Therefore, wages rise with lower unemployment Therefore, firms must increase prices to maintain their profitability Therefore prices and inflation rise, and inflation increases relative to expected inflation

The Output Gap version of the Phillips Curve with accelerationist expectations

- $\pi_t - \pi_t^e = \frac{\alpha}{AL} (Y_t - Y_n)$
- Let $\frac{\alpha}{AL} = 0.005$, $Y_n = 100$ and $\pi_t^e = \pi_{t-1}$
- Assume that we begin at time $t = 0$ with $\pi_0^e = 0$ and $Y_0 = 100$
- Now suppose that at $t = 1$, Y increases to 110 and stays there; what happens to inflation, inflation expectations and $\pi_t - \pi_t^e$?

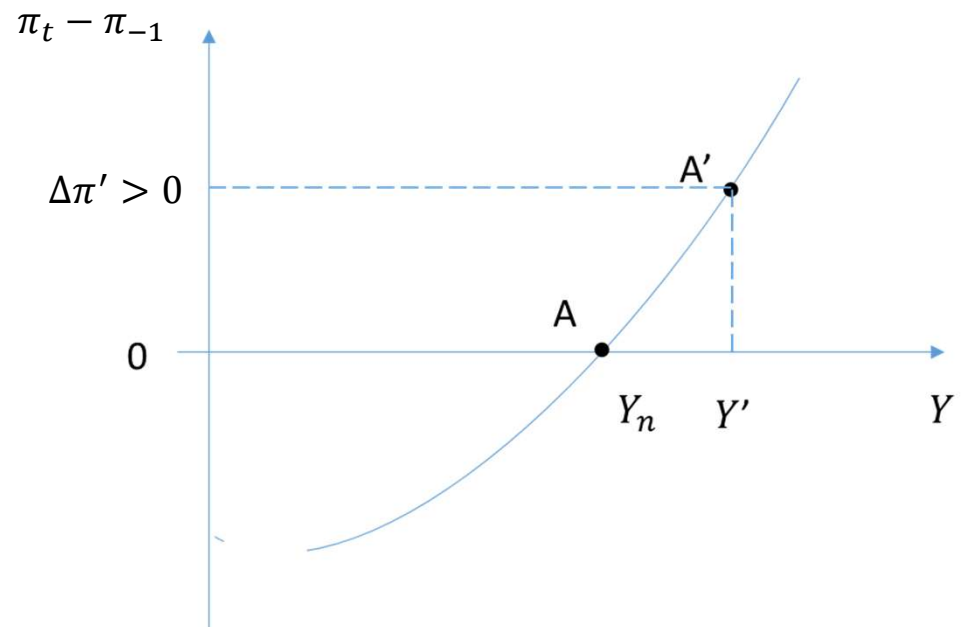
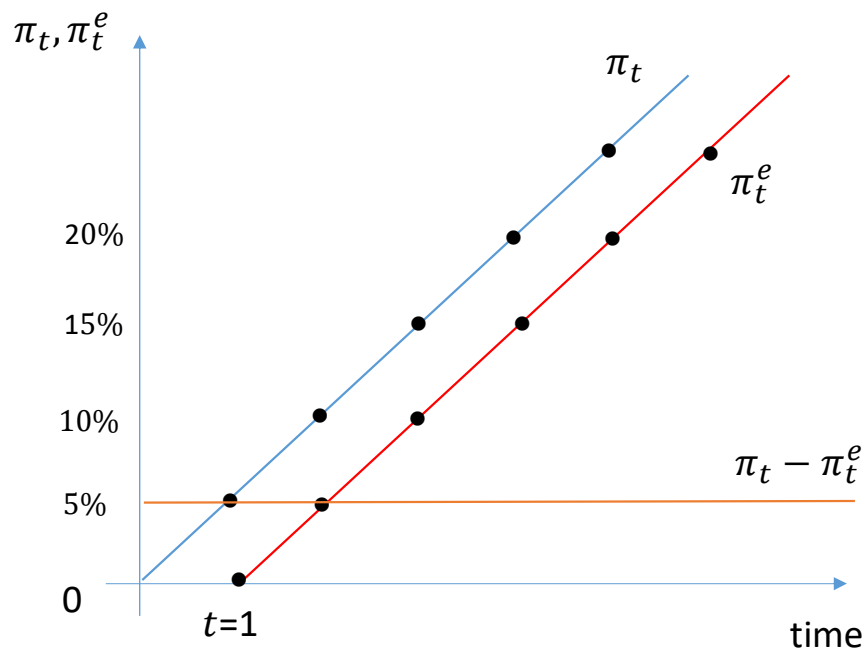
time	$\pi_t^e = \pi_{t-1}$	Y_t	Y_n	π_t	$\pi_t - \pi_t^e$
0	0%	100	100	0%	0%
1	0%	110	100	5%	5%
2	5%	110	100	10%	5%
3	10%	110	100	15%	5%
4	15%	110	100	20%	5%

Inflation:

Inflation expectations:

$\pi_t - \pi_t^e$:

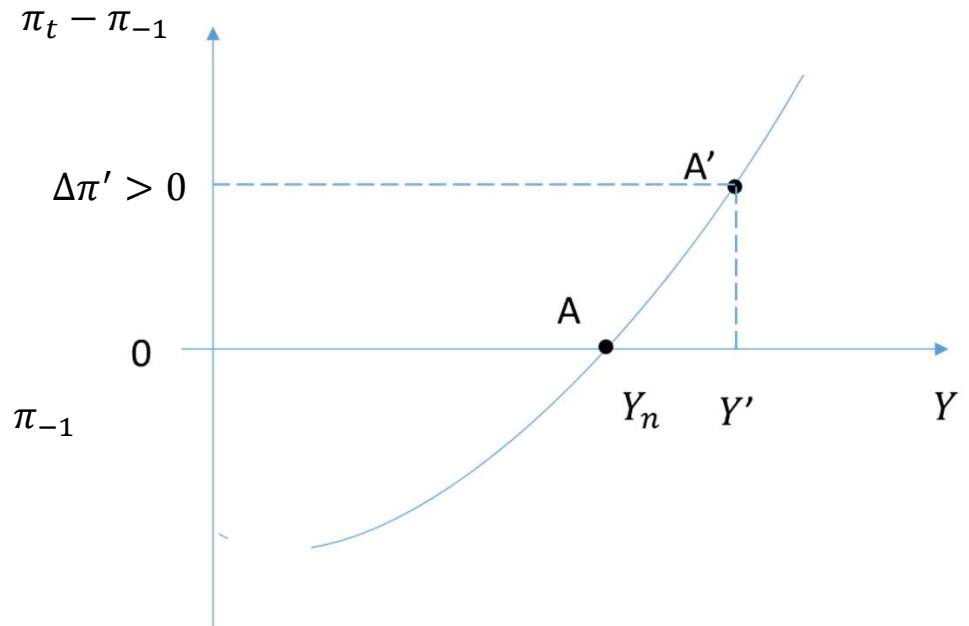
The output gap version of the Phillips Curve with accelerationist expectations



- Suppose $\pi_t^e = \pi_{-1}$ and that at $t = 0$ the economy is at point A
- When Y_t increases permanently above Y_n (at $t = 1$), the economy moves to A'
- π_t and π_t^e increase forever (unless something changes) and $\pi_t - \pi_{-1}$ increases and stays fixed at its new level

The IS-LM-PC model

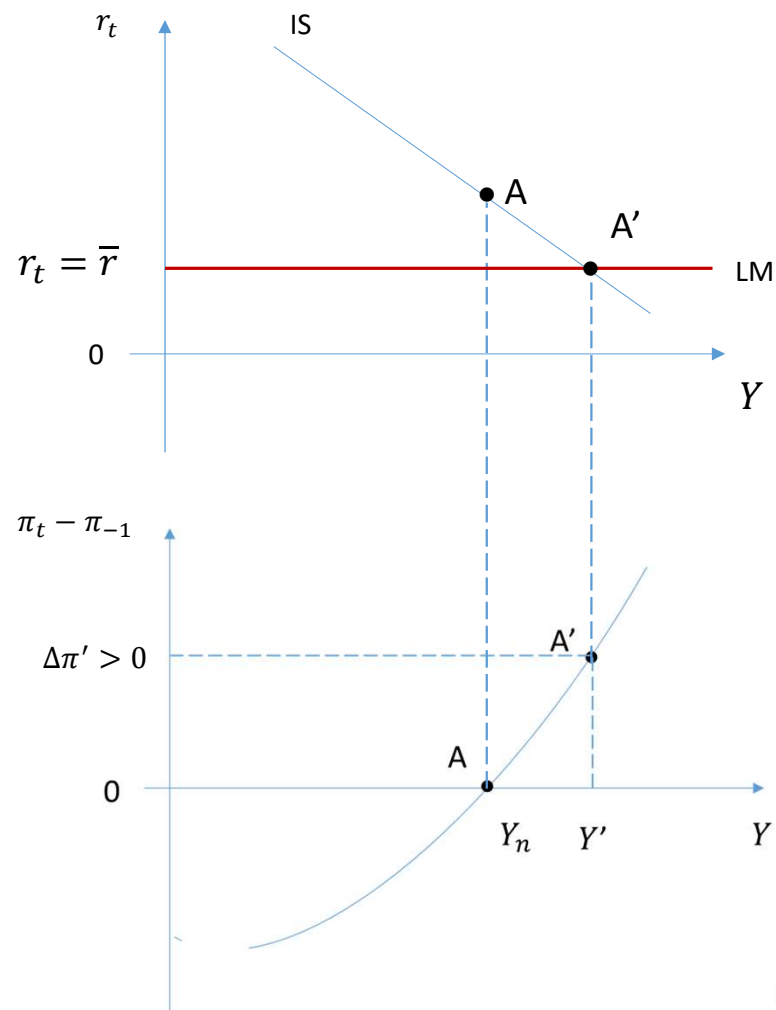
- IS: $Y_t = C(Y_t - T) + I(r_t + x, Y_t) + G$
- LM: $r_t = \bar{r}$
- PC: $\pi_t - \pi_t^e = \frac{\alpha}{AL} (Y_t - Y_n)$
- Assume $\pi_t^e = \pi_{-1}$
- We define:
 - The medium term: $Y_t = Y_n, u_t = u_n, \pi_t = \pi_t^e = \pi_{-1}$
 - $Y_t = Y_n, \pi - \pi_t^e = 0$
 - The short term:
 - Y_t may deviate from Y_n
 - u_t may deviate from u_n
 - π_t may deviate from π_t^e



- Point A is the medium term equilibrium
- At point A', inflation is increasing forever (unless something changes)

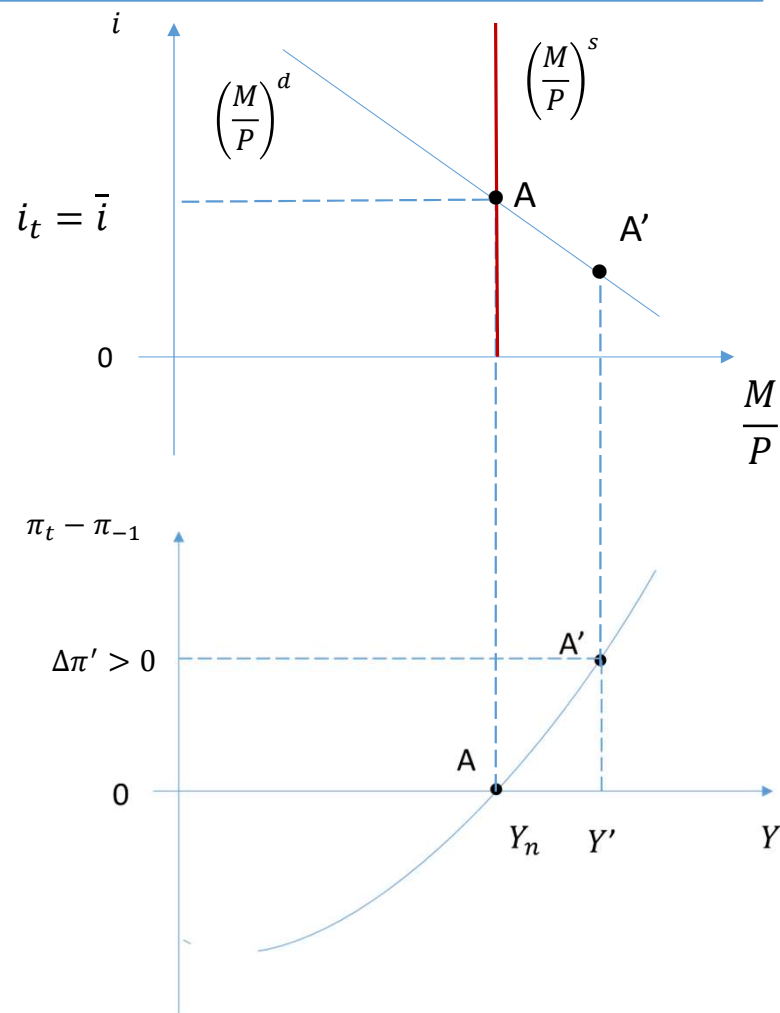
The IS-LM-PC model

- IS: $Y_t = C(Y_t - T) + I(r_t + x, Y_t) + G$
- LM: $r_t = \bar{r}$
- PC: $\pi_t - \pi_t^e = \frac{\alpha}{AL} (Y_t - Y_n)$
- How the model works:
- The central bank sets \bar{r} (so determines the LM curve)
- G, T and x are assumed given, and so the IS curve determines Y_t
- Then, given Y_t and π_t^e , the PC curve determines π_t
- So a key role for π_t^e !



Remember the money supply?

- What is happening to the money supply in this model?
- Re-call:
 - $\left(\frac{M}{P}\right)^s = \left(\frac{M}{P}\right)^d = YL(Y, i)$
- If inflation is positive, then P is increasing
- Therefore, to maintain equilibrium in the money market, M must be increasing at the same rate
- And if inflation is increasing, then M must be increasing at an increasing rate
- So a 1:1 correspondence between the growth of the money supply and inflation
- “Inflation is always and everywhere a monetary phenomenon”, Milton Friedman, “Inflation, Causes and Consequences”, 1963



The role of macro-economic policy in this model

- In the short term, fiscal and monetary policy can make Y_t different from Y_n
 - Allows short term gains from an economic boom
 - With an accelerationist Phillips Curve, though, we know that an economic boom causes inflation to increase forever
- Eventually, fiscal and monetary policy will have to be used to bring Y_t back to Y_n and so bring inflation under control
- Monetary Policy is usually the preferred option:
 - Quicker to decide and implement
 - Can be implemented in smaller amounts to take account of economic conditions as they change

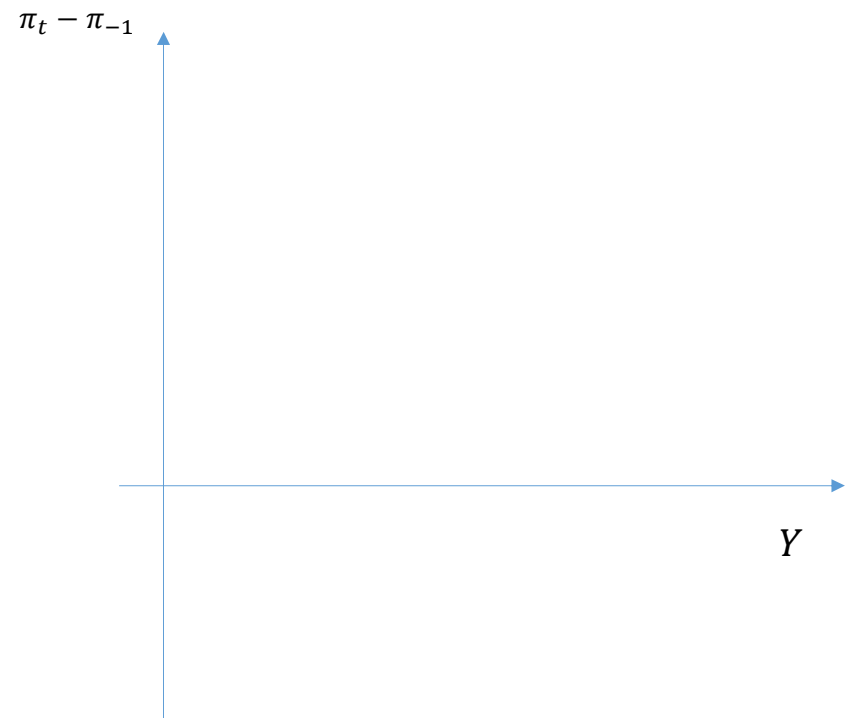
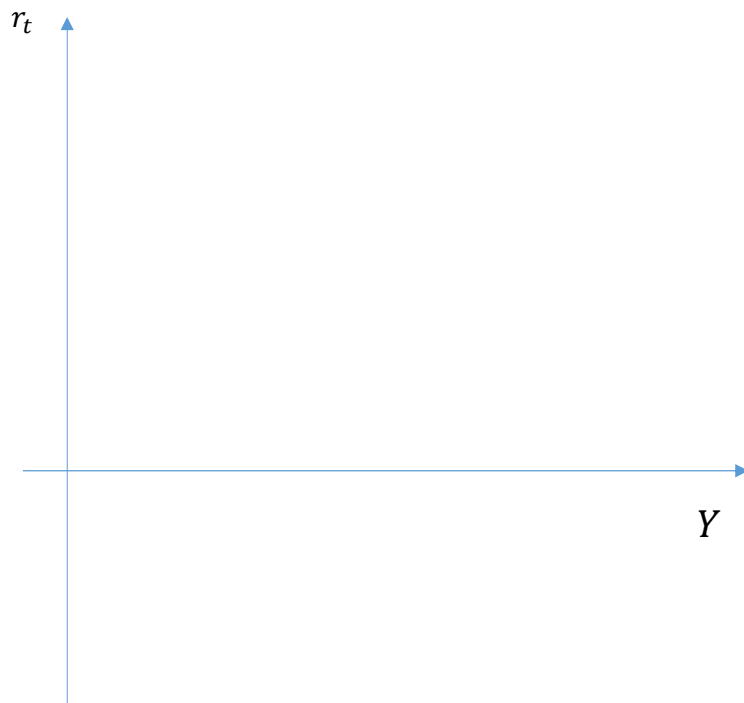
Example: A loss of consumer confidence

- Assume the IS-LM-PC model with $\pi_t^e = \pi_{-1}$
 - IS: $Y_t = C(Y_t - T) + I(r_t + x, Y_t) + G$
 - LM: $r_t = \bar{r}$
 - PC: $\pi_t - \pi_t^e = \frac{\alpha}{AL} (Y_t - Y_n)$
- Suppose that the economy starts at medium term equilibrium, and that there is a sudden and severe drop in consumer confidence
 - 1) Show the initial equilibrium on a diagram, and show where the economy moves to in the short term as a result of the fall in consumer confidence
 - 2) Determine what happens to the following in the short term:

$$C, G, T, u, W, P, \frac{W}{P}, \pi_t, i, r, I$$

Example: A loss of consumer confidence

1) Show the initial equilibrium on a diagram, and show where the economy moves to in the short term as a result of the fall in consumer confidence



Example: A loss of consumer confidence

We have $\Delta Y < 0$ and $\Delta c_0 < 0$

Wage setting: $W = AP^e(1 - \alpha u + z)$

Price setting: $P = \frac{W}{A}(1 + m)$

2) Determine what happens to the following in the short term:

variable	effect	variable	effect
C		W/P	
G		i	
T		r_t	
u		I	
W		π_t	
P			

Example: A loss of consumer confidence

- 3) Following the initial fall in consumer confidence, what happens to inflation and inflation expectations if nothing changes from now on?
- 4) What happens to real interest rates in this situation? Therefore, what happens to aggregate demand and to Y_t in the periods after the initial fall in consumer confidence?

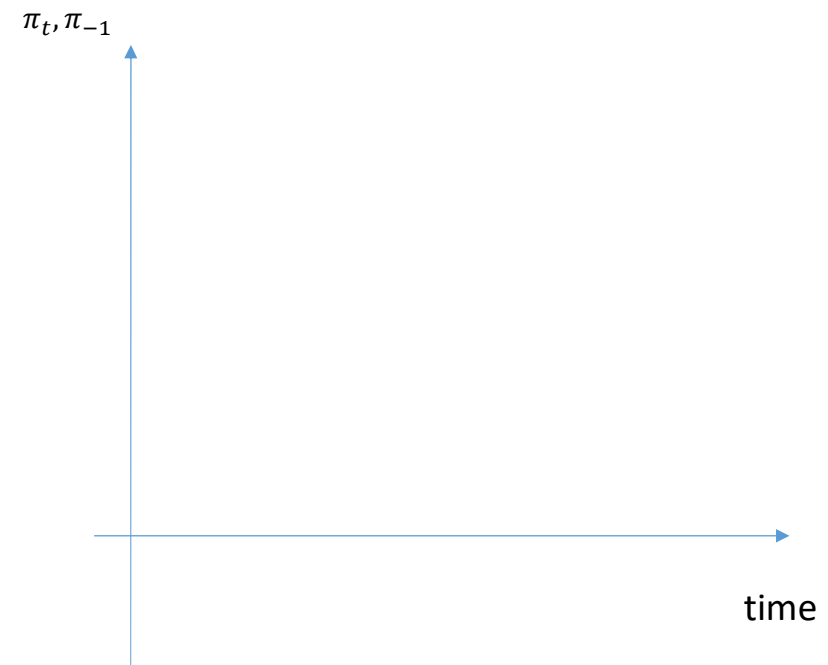
Example: A loss of consumer confidence

3) Following the initial fall in consumer confidence, what happens to inflation and inflation expectations if nothing changes from now on?

- Suppose that the fall in consumer confidence occurs at $t = 1$

Changes in variables in the period

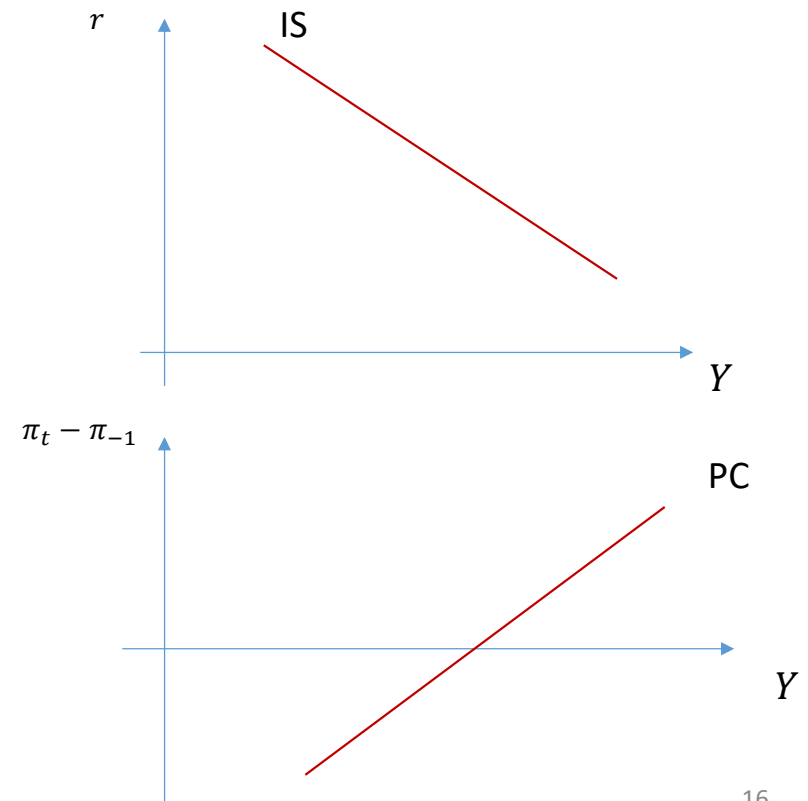
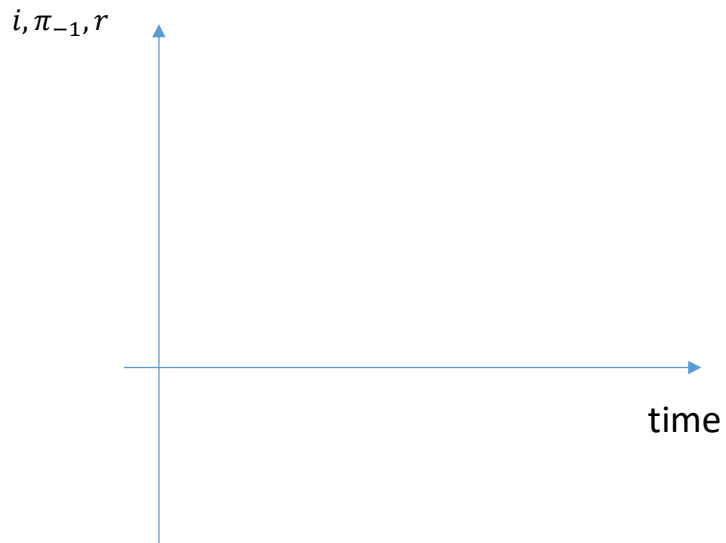
time	$\pi_t^e = \pi_{-1}$	Y_t	Y_n	π_t	$\pi_t - \pi_t^e$
0	—	—	—	—	—
1	—	↓	—	↓	↓
2	↓	—	—	↓	—
3	↓	—	—	↓	—
4	↓	—	—	↓	—



Example: A loss of consumer confidence

4) What happens to real interest rates in this situation? Therefore, what happens to aggregate demand and to Y_t in the periods after the initial fall in consumer confidence?

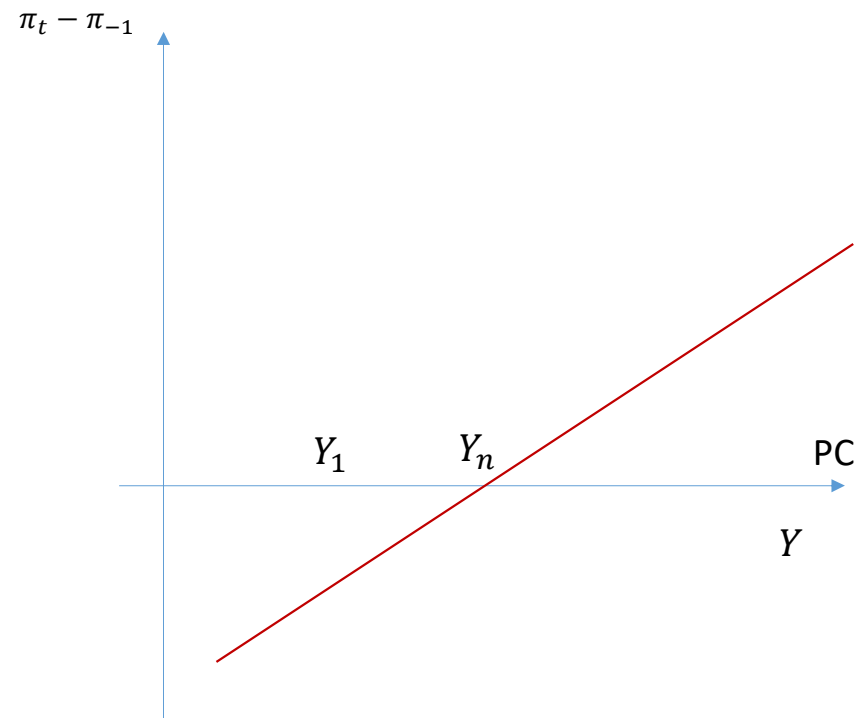
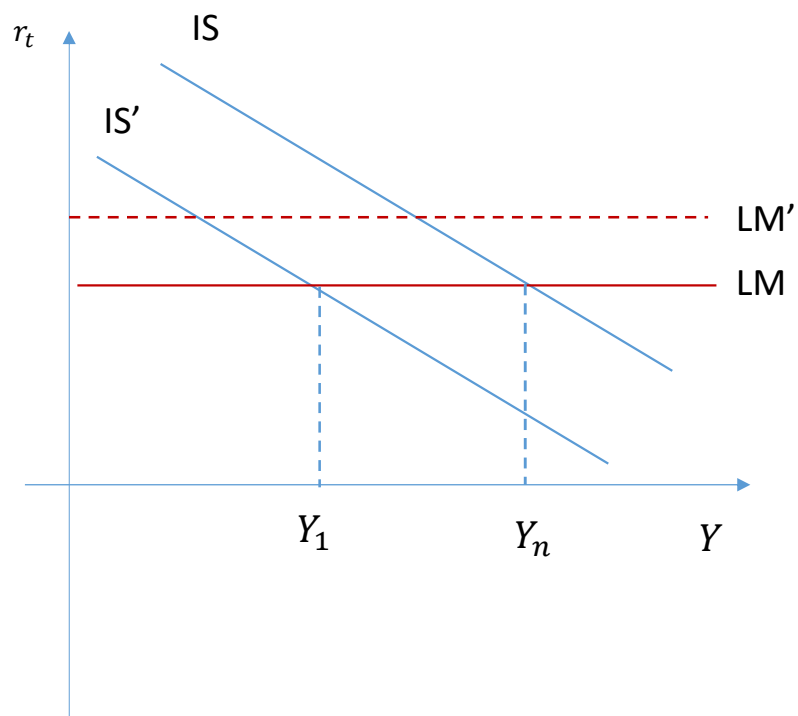
- $r = i - \pi^e = i - \pi_{-1}$



Example: A loss of consumer confidence

5) What can the central bank do to return the economy to Y_n ?

- Policy response:



Example: A loss of consumer confidence

6) Describe the medium term adjustment process

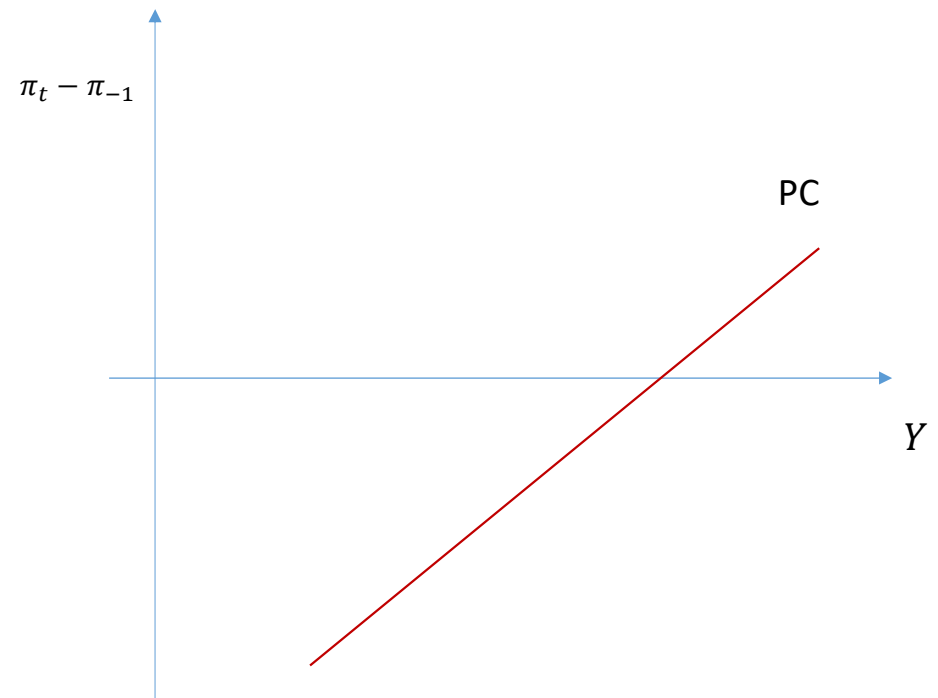
1) First period: central bank cuts nominal interest rates:

2)

3)

4)

5) Second period:



Example: A loss of consumer confidence

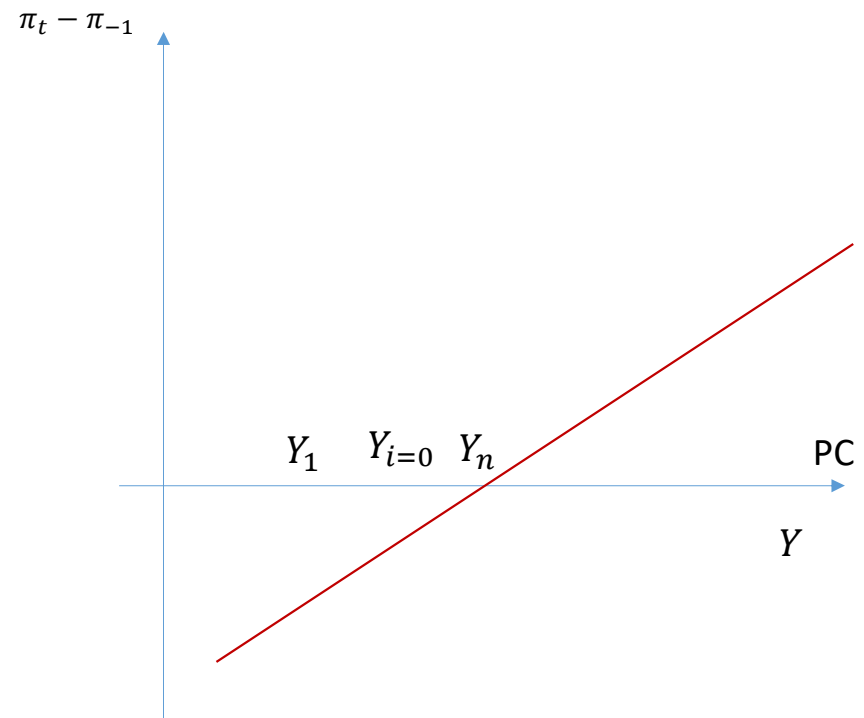
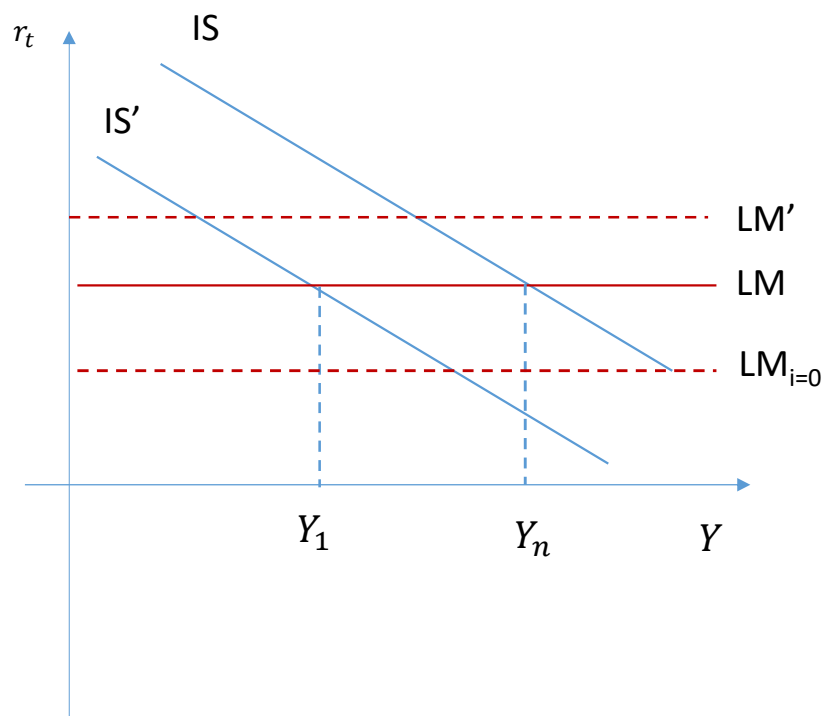
7) In the medium term what has happened to the following compared to the initial equilibrium (ie compared to point A)?

variable	effect	variable	effect
Y		P	
C		W/P	
G		i	
T		r_t	
u		I	
W		π_t	

- What happens to W and P every period?

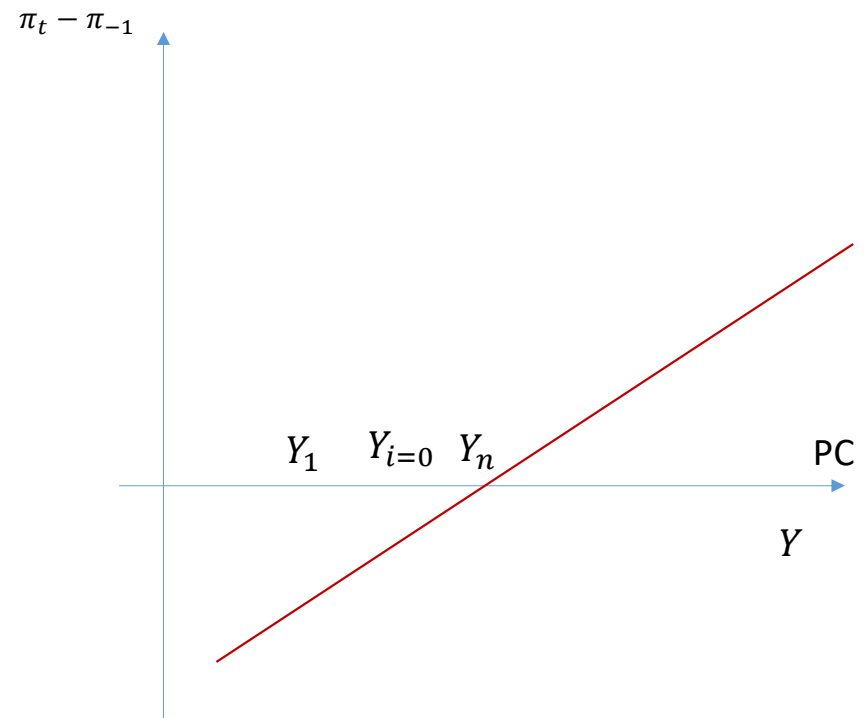
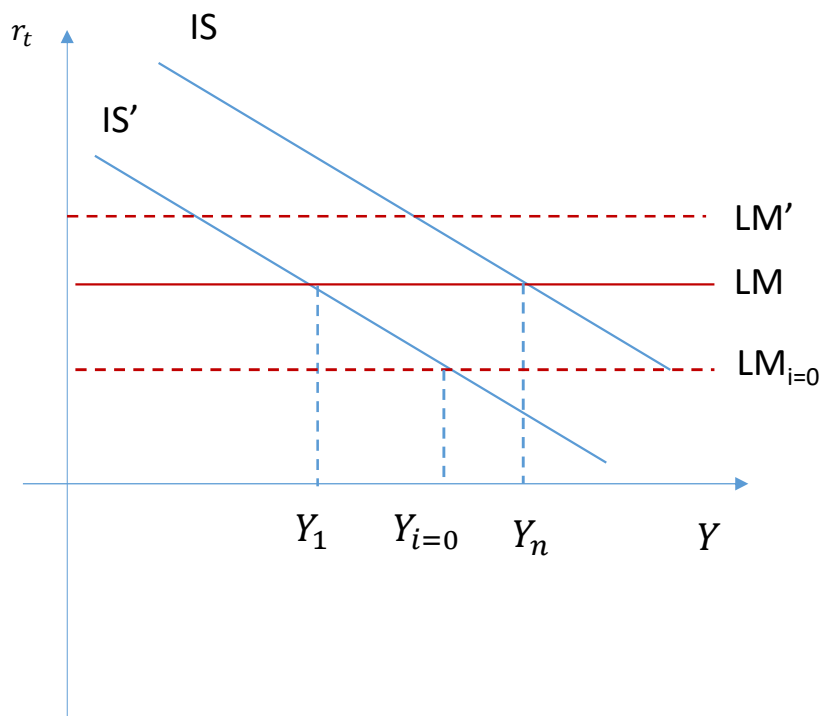
Example: A loss of consumer confidence

8) What would happen if nominal interest rates, i , reached zero before the adjustment process was complete?
That is, before the economy had returned to Y_n ?



Example: A loss of consumer confidence

9) Once nominal interest rates had reached zero, what else could the government do to return the economy to Y_n ?



Example: A loss of consumer confidence

10) Why doesn't the government just increase G at the beginning to avoid the problems of zero nominal interest rates?

- For the reasons mentioned previously:
 - Fiscal policy takes longer to agree and implement and is more difficult to reverse
 - Fiscal policy tends to take place in large discrete amounts, compared to monetary policy which can be implemented in smaller amounts
 - Monetary policy can be more responsive to changing economic conditions
 - Can take advantage of positive feedback loops

Example: A loss of consumer confidence

11) In the medium term what has happened to the following compared to the initial equilibrium (ie compared to point A) in this case (ie zero lower bound and increased government spending)?

variable	effect	variable	effect
Y		P	
C		W/P	
G		i	
T		r_t	
u		I	
W		π_t	