GROUP 2

Question 1: (True/False)

1.2 The effect of fiscal policy is the strongest when monetary authority chooses to accommodate the government policy by fixing the interest rate.

True

1.4 Based on the Keynesian theory, interest rate is a countered-cyclical variable under supply shocks.

True

Question 2 (Self-adjustment theorem and expectation)

2.2 Suppose the economy is operating at the long-term trend, i.e. natural level. Analyze the impact of a permanent decrease in government transfers under the following scenarios.

a. What would be the short-run impact on macroeconomic variables if *the permanent cut is* ***unexpected*** Use the 4-diagram that we discussed in class.

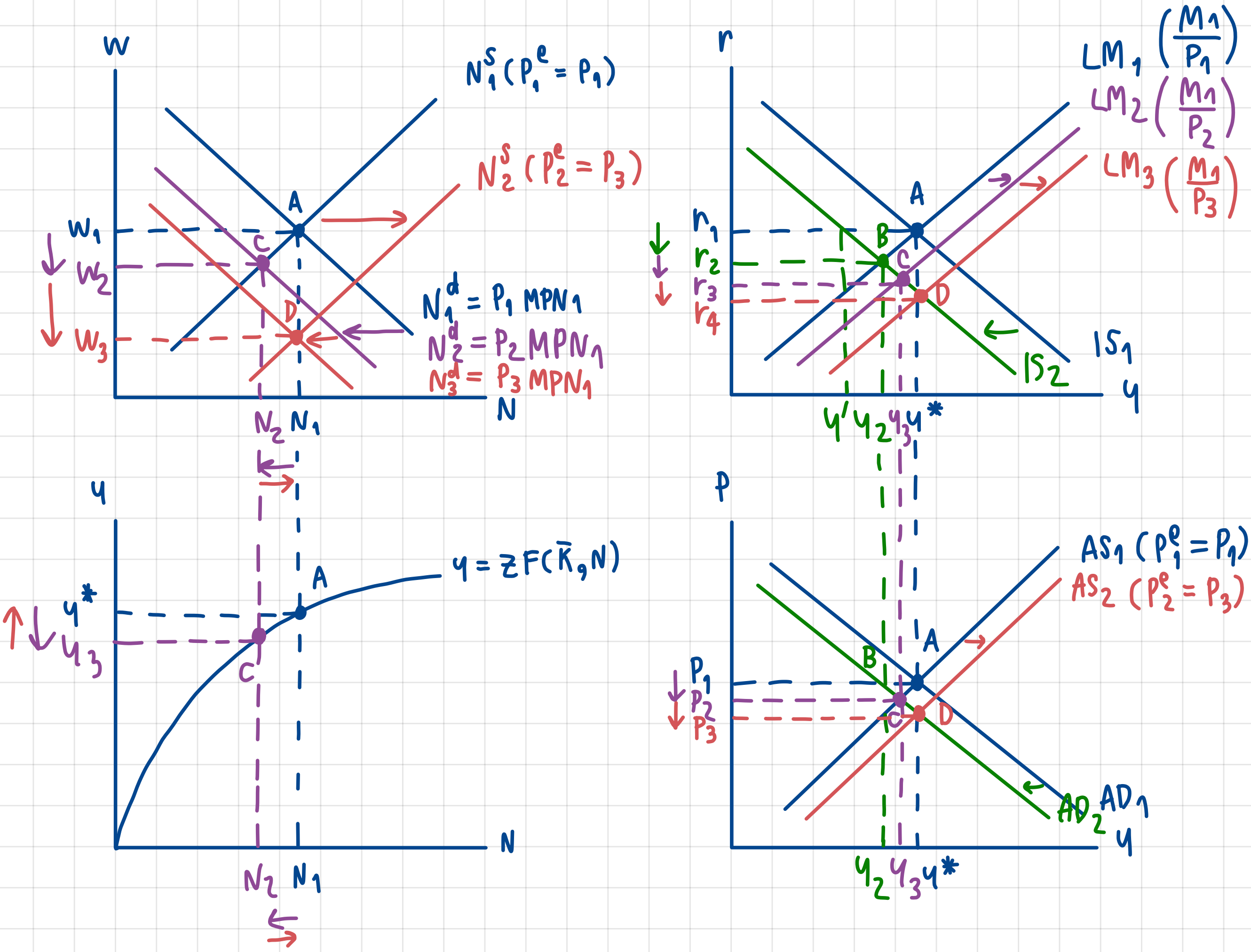
b. Describe what would happen over the medium-run. Link your analysis to the 4-diagram used in the previous sub-question.

c. Based on your analyses above, complete the following table.

Variables	Short-run (relative to initial level)	Medium-run	
		Relative to after-shock level (short-run)	Relative to initial level before shock
Output (real GDP)	↓	↑	—
Consumption	↓	↑	↑
Investment	↑	↑	↑
Labor employment	↓	↑	—
Nominal wage	↓	↓	↓
Price	↓	↓	↓
Real wage	—	↑	↑
Interest rate	↓	↓	↓

d. If the permanent cut in government transfers is **anticipated**, what would be the short-run impact on macroeconomic variables? Would one observe a deviation of actual output from the trend level?

a) transfer payment ↓



— SHORT RUN —

- The initial equilibrium is at point A where $Y = Y^*$, $P = P_1$, $r = r_1$, $w = w_1$, and $N = N_1$.
- Transfer payment $\downarrow \rightarrow AE \downarrow \rightarrow Y \downarrow (Y^* \rightarrow Y')$ Effect from traditional multiplier because of fixed r and fixed P
- At r_1, IS shifts to the left ($IS_1 \rightarrow IS_2$)

  $r \downarrow (r_1 \rightarrow r_2) \rightarrow C, I \uparrow \rightarrow AE \uparrow \rightarrow Y \uparrow (Y' \rightarrow Y_2)$ Effect from IS-LM multiplier "crowding-out effect"
- However, $Y_2 > Y^*$ Overall, $Y \downarrow (Y^* \rightarrow Y_2)$
- At P_1, AD shifts to the left ($AD_1 \rightarrow AD_2$)

  $Y \downarrow (Y^* \rightarrow Y_2) \rightarrow$ excess supply of output
- To clear market, $P \downarrow (P_1 \rightarrow P_2) \rightarrow \frac{M}{P} \uparrow \left(\frac{M_1}{P_1} \rightarrow \frac{M_2}{P_2}\right) \rightarrow$ LM shifts to the right ($LM_1 \rightarrow LM_2$)

  $r \downarrow (r_2 \rightarrow r_3) \rightarrow C, I \uparrow \rightarrow AE \uparrow \rightarrow Y \uparrow (Y_2 \rightarrow Y_3)$ Effect from AD-AS multiplier (No excess demand and excess supply) "Price effect"
- However, $Y_3 < Y^*$ Overall, $Y \downarrow (Y^* \rightarrow Y_3)$
- In addition, $P \downarrow \rightarrow VMP \downarrow \rightarrow N^d$ shifts to the left ($N^d_1 \rightarrow N^d_2$)

  $W \downarrow (W_1 \rightarrow W_2) \rightarrow N \downarrow (N_1 \rightarrow N_2) \rightarrow Y \downarrow (Y^* \rightarrow Y_3)$
- The new equlibrium is at point C
- Outcomes

  $Y \downarrow \quad (Y^* \rightarrow Y_3)$

  $P \downarrow \quad (P_1 \rightarrow P_2)$

  $r \downarrow \quad (r_1 \rightarrow r_3)$

  $W \downarrow \quad (W_1 \rightarrow W_2)$

  $N \downarrow \quad (N_1 \rightarrow N_2)$

  $C \downarrow$

  $I \uparrow$

b)

— LONG RUN —

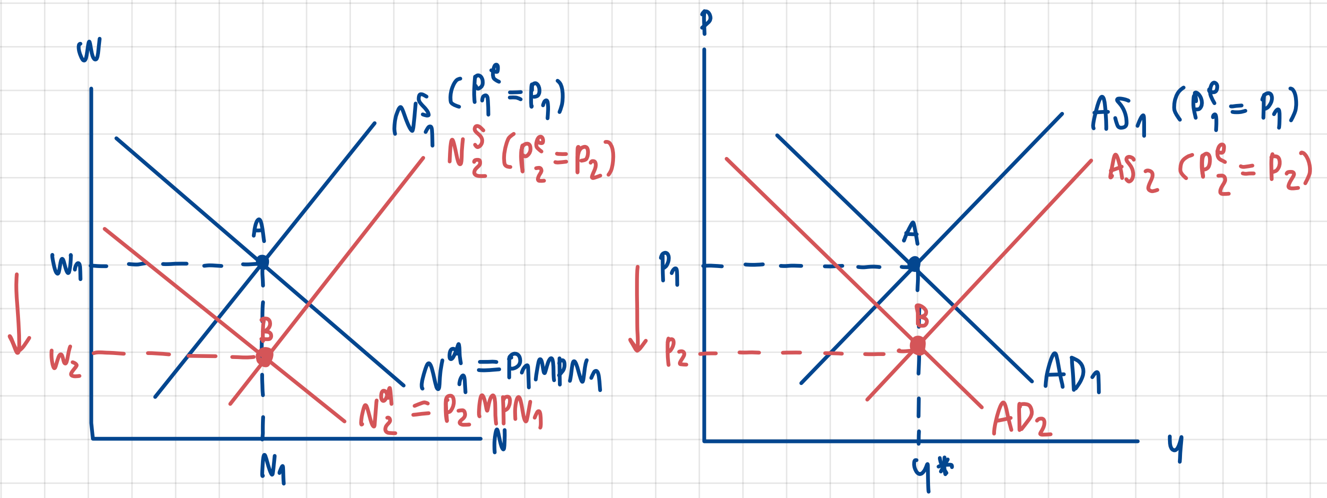
$P^e \downarrow$ $(P_1^e \rightarrow P_2^e) \rightarrow \frac{W}{P^e} \uparrow \rightarrow N^S$ shifts to the right $(N_1^S \rightarrow N_2^S) \rightarrow$ AS shifts to the right $(AS_1 \rightarrow AS_2)$

$P \downarrow$ $(P_2 \rightarrow P_3) \rightarrow \frac{M}{P} \uparrow \left(\frac{M_1}{P_2} \rightarrow \frac{M_1}{P_3}\right)$ LM shifts to the right $(LM_2 \rightarrow LM_3)$

$r \downarrow$ $(r_3 \rightarrow r_4) \rightarrow C, I \uparrow \rightarrow AE \uparrow \rightarrow Y \uparrow$ $(Y_3 \rightarrow Y^*)$ Back to potential output

In addition, $P \downarrow \rightarrow VMP \downarrow \rightarrow N^d$ shifts to the left $(N_2^d \rightarrow N_3^d)$ intersect with N_2^S at point D

$W \downarrow$ $(W_2 \rightarrow W_3) \rightarrow N \uparrow$ $(N_2 \rightarrow N_1) \rightarrow Y \uparrow$ $(Y_3 \rightarrow Y^*)$ Back to potential output



Trasfers $\downarrow$ AD shifts to the left N^d shifts to the left

People anticipated $P^e \downarrow$ suddenly N^S shift to the right AS shifts to the right

$P \downarrow$ $(P_1 \rightarrow P_2)$ $W \downarrow$ $(W_1 \rightarrow W_2)$

so, $\bar{Y}$ $\bar{N}$ $\bar{U}$ No deviation of actual output

3.1) Determine the rate of inflation in period t, t+1, t+2, t+3, t+4, t+5. How does the value of inflation in each period compare with the targeted inflation ($\bar{\pi}$)?

$$\pi_t = (1-\theta)\bar{\pi} + \theta\pi_{t-1} - 0.7(u_t - u_t^n) + v_t$$

$$\pi_t = (1-\cancelto{0}{\theta})\bar{\pi} + \cancelto{0}{\theta}\pi_{t-1} - 0.7(u_t - u_t^n) + \cancelto{0}{v_t}$$

$$\pi_t = \bar{\pi} - 0.7(u_t - u_t^n)$$

$$\pi_t = 0.02 - 0.7(0.03 - 0.05)$$

$$\pi_t = 0.034 = 3.4\%$$

To find $\pi_{t+1}, \pi_{t+2}, \pi_{t+3}, \pi_{t+4}, \pi_{t+5}$, the prediction is based on past inflation (π_t)

$$\pi_{t+1} = (1-\theta)\bar{\pi} + \theta\pi_t - 0.7(u_t - u_t^n) + v_t \Rightarrow \pi_{t+1} = \bar{\pi} - 0.7(u_t - u_t^n)$$

$$\pi_{t+2} = (1-\theta)\bar{\pi} + \theta\pi_{t+1} - 0.7(u_t - u_t^n) + v_t$$

$$\pi_{t+3} = (1-\theta)\bar{\pi} + \theta\pi_{t+2} - 0.7(u_t - u_t^n) + v_t$$

$$\pi_{t+4} = (1-\theta)\bar{\pi} + \theta\pi_{t+3} - 0.7(u_t - u_t^n) + v_t$$

$$\pi_{t+5} = (1-\theta)\bar{\pi} + \theta\pi_{t+4} - 0.7(u_t - u_t^n) + v_t$$

If holding $\theta = 0$ forever, $\pi_t = \pi_{t+1} = \pi_{t+2} = \pi_{t+3} = \pi_{t+4} = \pi_{t+5}$

Hence, $\pi_t > \bar{\pi}$ $\quad 3.4\% > 2\%$

$\pi_{t+1}, \pi_{t+2}, \pi_{t+3}, \pi_{t+4}, \pi_{t+5} > \bar{\pi}$

3.2) Do you believe the answer given in 3.1? Why or why not? (Hint: Think about how people are more likely to form the expectations of inflation.)

Given $\theta = 0$, $\pi_t^e = 0$, $\pi_t = 3.4\%$ in every year

It means that $\pi_t^e < \pi_t$

However, people are more likely to form π_t^e by π_t.

They will not be wrong forever.

Thus, θ cannot be fixed at zero but it can be vary between 0 to 1.

Now suppose in year t+6, θ increases from 0 to 1. Suppose that the government still determines to keep unemployment rate at 3%

$\theta = 1 \quad u_t = 3$

3.3) Why might theta (θ) increase this way?

As inflation becomes more persistent and stays above the expectations, people will come to expect the higher inflation rate and see the current inflation rate as a good predictor for next year's inflation.

3.4) What might be the rate of inflation in period t+6, t+7, t+8, and t+9?

$$\pi_t = (1-\theta)\bar{\pi} + \theta \pi_{t-1} - 0.7(u_t - u_t^n) + v_t$$

$$\pi_{t+6} = (1-\overset{1}{\cancel{\theta}})\bar{\pi} + \overset{1}{\cancel{\theta}}\pi_{t+5} - 0.7(u_{t+6} - u_t^n) + \overset{0}{\cancel{v_t}}$$

$$\pi_{t+6} = \pi_{t+5} - 0.7(0.03 - 0.05)$$

; From question 3.1 $\pi_{t+5} = 0.034$

$$\pi_{t+6} = 0.034 + 0.014$$

$$\pi_{t+6} = 0.048 = 4.8\%$$

$$\pi_{t+7} = (1-\overset{1}{\cancel{\theta}})\bar{\pi} + \overset{1}{\cancel{\theta}}\pi_{t+6} - 0.7(u_{t+6} - u_t^n) + \overset{0}{\cancel{v_t}}$$

$$\pi_{t+7} = \pi_{t+6} - 0.7(0.03 - 0.05)$$

$$\pi_{t+7} = 0.048 + 0.014$$

$$\pi_{t+7} = 0.062 = 6.2\%$$

$$\pi_{t+8} = (1-\overset{1}{\cancel{\theta}})\bar{\pi} + \overset{1}{\cancel{\theta}}\pi_{t+7} - 0.7(u_{t+6} - u_t^n) + \overset{0}{\cancel{v_t}}$$

$$\pi_{t+8} = \pi_{t+7} - 0.7(0.03 - 0.05)$$

$$\pi_{t+8} = 0.062 + 0.014$$

$$\pi_{t+8} = 0.076 = 7.6\%$$

$$\pi_{t+9} = (1-\overset{1}{\cancel{\theta}})\bar{\pi} + \overset{1}{\cancel{\theta}}\pi_{t+8} - 0.7(u_{t+6} - u_t^n) + \overset{0}{\cancel{v_t}}$$

$$\pi_{t+9} = \pi_{t+8} - 0.7(0.03 - 0.05)$$

$$\pi_{t+9} = 0.076 + 0.014$$

$$\pi_{t+9} = 0.09 = 9\%$$

3.5) From (3.4), what can we conclude about inflation when $\theta = 1$ and unemployment rate is kept at 3%?

$\theta = 1$ $u_t = 3\%$ $u_n = 5\%$

$u_t < u_n$; Unemployment is kept below the natural rate of unemployment.

This means inflation is increasing by 1.4% each year.

(period $t+6$, $t+7$, $t+8$, $t+9$)

3.6) What happen to inflation in period t+10 if the government instead keeps the unemployment rate at 5%. Would this allow central bank to be successful in achieving the targeted inflation in period t+10?

$\theta = 1$ unemployment is kept at the natural rate of unemployment

$\pi_{t+10} = \pi_{t+9} - 0.7(0.05 - 0.05)$

$\pi_{t+10} = 0.09 = 9\%$

Inflation is constant each year.

Central bank would fail in achieving the targeted inflation ($\bar{\pi} = 2\%$) in period $t+10$

3.7) To bring down the inflation to the targeted level, what does government need to do in period t+11? What will happen to the unemployment rate?

π_{t+11} must equal to $\bar{\pi} = 0.02 = 2\%$

$\pi_{t+11} = \pi_{t+10} - 0.7(u_{t+11} - 0.05)$

$0.02 = 0.09 - 0.7(u_{t+11} - 0.05)$

$0.02 = 0.09 - 0.7u_{t+11} + 0.035$

$u_{t+11} = 0.15 = 1.5\%$

Thus, government needs to set unemployment rate to be 1.5%

3.8) Given the result in (3.7) and its full commitment to keep unemployment rate at 5%, what happen to inflation in period t+12, t+13, t+14, t+15?

$$\pi_{t+12} = \pi_{t+11} - 0.7\,(u_{t+12} - 0.05)$$

$$\pi_{t+12} = 0.02 - 0.7\,(0.05 - 0.05)$$

$$\pi_{t+12} = 0.02 = 2\%$$

$$\pi_{t+13} = 0.02 - 0.7\,(0.05 - 0.05)$$

$$\pi_{t+13} = 0.02 = 2\%$$

$$\pi_{t+14} = 0.02 - 0.7\,(0.05 - 0.05)$$

$$\pi_{t+14} = 0.02 = 2\%$$

$$\pi_{t+15} = 0.02 - 0.7\,(0.05 - 0.05)$$

$$\pi_{t+15} = 0.02 = 2\%$$

In period t+12, t+13, t+14, t+15, inflation rate remains the same

Now suppose in year t+16, the value of theta reduces from 1 t0 0.

3.9) Why might theta (θ) reduce this way? What can we imply about the value of theta (θ) and the past macroeconomic outcomes?

θ reduces from 1 to 0

As inflation becomes more persistent, people will come to expect inflation rate to be the same because they see the current inflation rate as a good predictor for next year's inflation. ($\pi_{t+11} = \pi_{t+12} = \dots = \pi_{t+15}$)

$$\pi_{t+16} = (1 - \overset{0}{\cancel{\theta}})\,\bar{\pi} + \overset{0}{\cancel{\theta}}\,\pi_{t+15} - 0.7\,(u_{t+12} - u_t^n) + \overset{0}{\cancel{\nu}}_t$$

$$\pi_{t+16} = \bar{\pi} - 0.7\,(0.05 - 0.05)$$

$$\pi_{t+16} = \bar{\pi} = 0.02 = 2\%$$

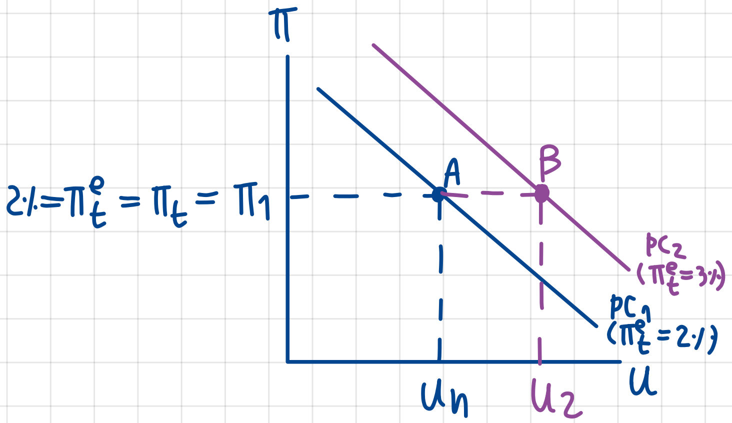
Now suppose that, in year t+17, Oil price suddenly increases, causing the random supply shocks to be equal to 1%. Assume the supply shock occurs temporarily, and takes the value of 1% only in period t+17. In the period afterwards, the shocks disappear, with the value of ϑ_t set to remain zero.

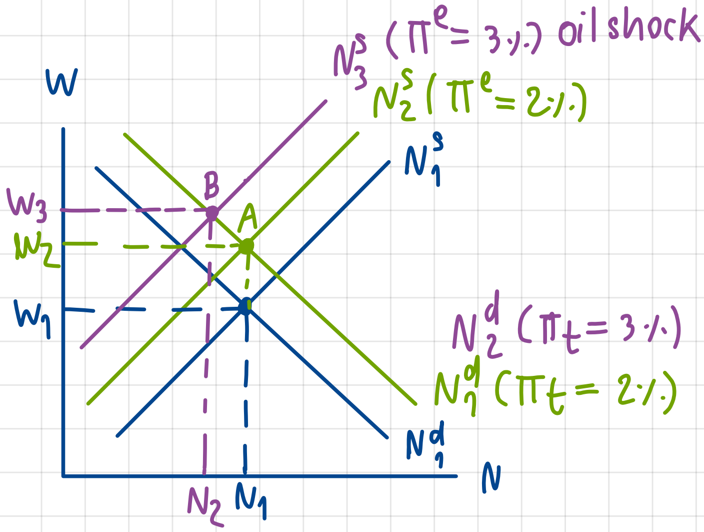
3.10) With the supply shock and the policy to keep unemployment rate at its natural level, what is the inflation in period t+17? Supplement your analysis using the diagram that we discussed in class.

$$\pi_{t+17} = (1-\cancel{\theta}^{0})\bar{\pi} + \cancel{\theta}^{0}\pi_{t+16} - 0.7(u_t - u_t^n) + \cancel{1\%_t}^{0.01}$$

$$= \bar{\pi} - 0.07(0.05 - 0.05) + 0.01$$

$$= 0.02 + 0.01 = 0.03 = 3\%$$





In period t+16, people expect that $\pi^e = 2\%$

The equilibrium is at point A. $N_2^d = N_2^s$

In period t+17, there is a temporary oil shock

N^s shifts left ($N_2^s \rightarrow N_3^s$)

$W\uparrow$ ($W_2 \rightarrow W_3$) $N\downarrow$ ($N_1 \rightarrow N_2$)

$u\uparrow$ ($u_n \rightarrow u_2$)

3.11) What happen to the inflation in period t+18 and t+19?

$$\pi_{t+18} = (1-\cancelto{0}{\theta})\bar{\pi} + \cancelto{0}{\theta}\,\pi_{t+17} - 0.7\,(u_{t+12} - u_t^n) + \cancelto{0}{v_t}$$

$$\pi_{t+18} = \bar{\pi} - 0.7\,(0.05 - 0.05) + 0$$

$$\pi_{t+18} = 0.02 = 2\%$$

$$\pi_{t+18} = (1-\cancelto{0}{\theta})\bar{\pi} + \cancelto{0}{\theta}\,\pi_{t+17} - 0.7\,(u_{t+12} - u_t^n) + \cancelto{0}{v_t}$$

$$\pi_{t+18} = \bar{\pi} - 0.7\,(0.05 - 0.05) + 0$$

$$\pi_{t+18} = 0.02 = 2\%$$

Inflation rate in both periods remains the same

3.12) Redo (3.10) and (3.11) with the alternative assumption that the value of theta (θ) sets equal to 1. What would happen to the inflation in period t+17 and t+18? Would the inflation in period t+18 be equal to the targeted level?

$\theta = 1$ $\quad t+17$

$$\pi_{t+17} = (1-\cancelto{1}{\theta})\bar{\pi} + \cancelto{1}{\theta}\,\pi_{t+16} - 0.7\,(u_{t+12} - u_{t+12}^n) + \cancelto{0.01}{v_t}$$

$$\pi_{t+17} = \bar{\pi}_{t+16} - 0.7\,(0.05 - 0.05) + 0.01$$

$$\pi_{t+17} = 0.02 + 0.01 = 0.03 = 3\%$$

$$\pi_{t+18} = (1-\cancelto{1}{\theta})\bar{\pi} + \cancelto{1}{\theta}\,\pi_{t+17} - 0.7\,(u_{t+12} - u_{t+12}^n) + \cancelto{0}{v_t}$$

$$\pi_{t+18} = \bar{\pi}_{t+17} - 0.7\,(0.05 - 0.05)$$

$$\pi_{t+18} = 0.03 = 3\%$$

$\pi_{t+17}, \pi_{t+18} > \bar{\pi}$ because $\theta = 1$ implies that supply shock from period t+17 still affect inflation in period t+18

3.13) Following from the analysis in (3.12), what would be the required policy plan in year t+19 if the government wants to keep the inflation equal to *the targeted level* ($\bar{\pi}$)?

$$\pi_{t+19} = (1-\cancelto{1}{\theta})\bar{\pi} + \cancelto{1}{\theta}\,\pi_{t+18} - 0.7\,(u_{t+19} - u_t^n) + \cancelto{0}{v_t}$$

$$0.02 = 0.3 - 0.7\,(u_{t+19} - 0.05)$$

$$u_{t+19} = 0.064 = 6.4\%$$

to keep inflation at $\bar{\pi}$, government must trade off level of higher unemployment rate in period t+19 by 1.4% compared with U_n.

3.14) Based on the analysis given so far, do you think what could possibly determine the volatility of rate of inflation and the rate of unemployment under the presence of supply shocks? How does the credible commitment on inflation target play role in the determination of macroeconomic stability outcomes?

- From analysis 3.1 − 3.4,
  there is no volatility as $\pi_t = \pi_t^e$ and $u_t = u_t^n$
- If $v_t > 0$, $\pi_t > \pi_t^e$
  To keep $\pi_t = \pi_t^e$, government has to adjust unemployment rate.
  According to the case of supply shock, goverment has to increase unemployment rate.
- Targeted Inflation play important role in macroeconomic stability
  if π_t deviates much from $\bar{\pi}$, it means that macroeconomics is less stable.