Nanyang Technological University
School of Social Sciences

HE2002 Macroeconomics II AY23-24 SEMESTER 2

Solution to Tutorial 7

1. **Chapter 8, Q5. Mutations of the Phillips curve**

   Suppose that the Phillips curve is given by

$$\pi_t = \pi_t^e + 0.1 - 2u_t$$

   and expected inflation is given by

$$\pi_t^e = (1-\theta)\bar{\pi} + \theta\pi_{t-1}$$

   and suppose that θ is initially equal to 0, and that $\bar{\pi}$ is given and does not change. It could be zero or any positive value.
   Suppose that the rate of unemployment is initially equal to the natural rate. In year t, the authorities decide to bring the unemployment rate down to 3% and hold it there forever.

   (a) Set the actual inflation rate equal to the expected inflation rate to obtain the natural rate of unemployment $u_n = 0.1/2 = 0.05$.In this case $\pi_t^e = (1)(\bar{\pi}) + (0)\pi_{t-1} = \bar{\pi}$ in all periods since $\theta = 0$.

   Initial unemployment is 0.05 or 5%. In period t, unemployment is reduced to 3%. If we then use Phillips curve, inflation in period t is: $\bar{\pi} + 0.1 - (2 * 0.03) = \bar{\pi} + 0.04$. Given the model we have, this will also be the value of inflation in period $t+1$, $t+2$, $t+3$, $t+4$, $t+5$. This value of inflation is a higher value than the anchored rate of inflation $\bar{\pi}$.

   (b) This does not make much sense. Every period actual inflation exceeds expected anchored inflation by 4%. Remember that $\bar{\pi} = \pi^e$ in this model.

   (c) This will put more weight on previous year's inflation in forming the expectation of inflation. In the periods from $t+1$ to $t+5$, a reasonable person might think last period's inflation (4 percentage points higher than $\bar{\pi}$) is a better predictor of actual inflation than the fixed value $\bar{\pi}$.

   (d) Solving $\pi_t = \pi_t^e + 0.1 - 2u_t$ and using $\pi_t^e = \pi_{t-1}$, the values will be
   $t+6 : u_{t+6} = 0.03, \pi_{t+6} = \bar{\pi} + 0.04 + 0.1 - (2 * 0.03) = \bar{\pi} + 0.04 + 0.04 = \bar{\pi} + 0.08$
   $t+7 : u_{t+7} = 0.03, \pi_{t+7} = \bar{\pi} + 0.08 + 0.1 - (2 * 0.03) = \bar{\pi} + 0.08 + 0.04 = \bar{\pi} + 0.12$
   $t+8 : u_{t+8} = 0.03, \pi_{t+8} = \bar{\pi} + 0.12 + 0.1 - (2 * 0.03) = \bar{\pi} + 0.12 + 0.04 = \bar{\pi} + 0.16$

   (e) You can see that keeping unemployment below the natural rate leads to an ever accelerating rate of inflation when $\theta = 1$. Hence the other name for the natural rate is the *NAIRU*, the non-accelerating inflation rate of unemployment. In this case inflation rises by 4 percentage points each year. This does not seem to be a feasible long run policy choice.

(f) If the unemployment rate is at the natural rate of unemployment (5%) and we assume that $\theta = 1$ then we solve $\pi_t - \pi_{t-1} = 0.1 - (2 * 0.05) = 0$. In this situation, in every period actual inflation equals the previous period's rate of inflation. Inflation does not change.

2. **Chapter 8, Q6. The macroeconomic effects of the indexation of wages**

Suppose that the Phillips curve is given by

$$\pi_t - \pi_t^e = 0.1 - 2u_t \tag{1}$$

where

$$\pi_t^e = \pi_{t-1} \tag{2}$$

Suppose that inflation in year $t-1$ is zero. (There is a typo in the textbook.) In year t, the central bank decides to keep the unemployment rate at 4% forever.

(a) This will move the model of expected inflation so that
$\pi_t = \pi_{t-1} - 2(u_t - 0.05) = \pi_{t-1} + 2\% = 2\%$
$\pi_t = 2\%; \pi_{t+1} = 4\%; \pi_{t+2} = 6\%; \pi_{t+3} = 8\%$.
Now suppose that half the workers have indexed labor contracts.

(b) With wage indexation of labor contracts, the equation becomes $\pi_t = 0.5\pi_t + 0.5\pi_{t-1} - 2(u_t - 0.05)$ i.e., half of contracts is now set on the basis of actual inflation while the rest still respond to the expected inflation. It can be rewritten as $\pi_t = \pi_{t-1} - 4(u_t - 0.05) = \pi_{t-1} + 4\%$.

(c) $\pi_t = 4\%; \pi_{t+1} = 8\%; \pi_{t+2} = 12\%; \pi_{t+3} = 16\%$

(d) As indexation increases, inflation becomes more sensitive to the difference between the unemployment rate and the natural rate.