

# Econ 101b - Answer Key to Problem Set 6

*Jean-Philippe Stijns - 11/18/99*

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## Question 1

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**Under what circumstances will a government expansionary fiscal or monetary policy do nothing to raise GDP or lower unemployment? If an expansionary government policy fails to raise GDP or lower unemployment, what would the policy manage to do?**

A government expansionary fiscal or monetary policy do nothing to raise GDP or lower unemployment when expectations are fully rational. In the  $(\pi, u)$  plane, the AD shifts left but because private agents anticipate the resulting increase in the inflation rate, the Philips curve instantaneously shifts right. This results in a constant unemployment rate fixed at the natural rate of unemployment (and therefore by Okun's Law in a constant GDP) but an increase inflation rate.

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## Question 2

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**If expectations of inflation are *adaptive*, is there any way to reduce inflation without suffering unemployment higher than the natural rate? What would you advise a central bank that sought to reduce inflation without provoking high unemployment to do?**

Well, if expectations are adaptive, by definition, people need to see an actual reduction in the inflation rate before adjusting their expectations. Therefore, in order to reduce inflation, the government (or the Fed) will have to slide down along the Philips curve, giving rise to a lower inflation rate but, unfortunately, to unemployment above the "natural rate" as well. One possibility is to do this very progressively, thereby only enduring a slightly higher than usual unemployment rate. This, of course, implies that the inflation reduction process will be slower, however. Indeed, in the baseline model, the sum of unemployment rate above natural rate throughout the years has to equal some constant  $y\%$  to reduce inflation by  $x\%$ , no matter how you distribute this sacrifice over the years.

One question is what is more harmful: high but short unemployment OR somewhat lower but long unemployment. The answer probably lies in how much 'hysteresis' you get in one case or the other.

Finally, you want to tell the government to announce well in advance (and credibly) that it plans to, say, cut its expenditure. So that, private agents have time to revise their expectations before the reduction in aggregate demand actually kicks in.

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### Question 3

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#### Do you think that expectations in the U.S. are static, adaptive, or rational? Why?

Well that's a question of faith and belief :) It can be argued that since inflation has been low and stable lately, people are probably spending less energy and money forecasting the inflation rate. Arguably, expectations could then be closer to adaptive or static.

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### Question 4

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#### Suppose that the natural rate of unemployment is 5% for adults, 8% for teenagers, and that teenagers make up 10% of the labor force.

a. What is the natural rate of unemployment?

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$$.9 * 5 + .1 * 8$$

$$5.3$$

5.3%. The natural rate of unemployment is a weighted average of the natural rate of unemployment in different groups in the population, the weights being the share of the population, these groups represent.

b. What would be the natural rate of unemployment if a baby boom led to a year in which teenagers made up 20% of the labor force?

$$.8 * 5 + .2 * 8$$

$$5.6$$

5.6%. The teenagers now represent a larger fraction of the labor force. They therefore drive the unemployment rate up.

## Question 5

**Suppose you are advising a government that wants to reduce its inflation rate from 10% per year to 5% per year. It wants to know whether it should (i) try to immediately and suddenly reduce inflation to the target, or (ii) undertake a gradual reduction to the target over a number of years.**

**What are the chief arguments against option 1?**

If you believe a high rate of unemployment means considerable loss of skill on behalf of unemployed workers, then going cold turkey will actually raise the natural rate of unemployment. This is neither a good option if the Philips curve is so curved that higher reductions of the inflation come at a higher cost in terms of unemployment than moderate reductions. There is of course the political argument that extremely high rates of unemployment can lead to civil unrest and losses of confidence in the economy/ capitalist (and democratic) system.

### What are the chief arguments against option 2?

If you believe that long spells of unemployment mean considerable loss of skill on behalf of unemployed workers, then reducing the inflation rate smoothly will actually raise the natural rate of unemployment. This is neither a good option if the Philips curve is so curved that higher reductions of the inflation come at a proportionally lower cost in terms of unemployment than moderate reductions. Finally and importantly, if you believe expectations to be fully rational, reductions in inflation actually come at no cost in terms of unemployment; so why, tolerate inflation any longer?

## Question 6

Suppose the Philips Curve in an economy is:

$$\pi[t] = \pi^e[t] + 0.18 - 3 * u[t]$$

where  $u[t]$  is the unemployment rate (and  $6\% = .06$ ),  $\pi[t]$  is the inflation rate, and  $\pi^e[t]$  is the rate of expected inflation.

a. What is the natural rate of unemployment?

In general,  $\pi[t] = \pi^e[t] + \gamma(u^n[t] - u[t])$ , thus  $\gamma = 3$  and  $u^n[t] = .06 = 6\%$

Suppose that in year  $t-1$ , the unemployment rate is equal to its natural rate and the inflation rate is zero. Suppose that beginning in period  $t$  the authorities bring the unemployment rate down to 5% and keep it there. If expected inflation is equal to last year's inflation ( $\pi^e[t] = \pi[t-1]$ ), what is the inflation rate in periods  $t, t+1, t+2, t+3$ ?

$$\pi[t] = \pi^e[t] + 3(u^n[t] - u[t]) = \pi[t-1] + 3(u^n[t] - u[t]) =$$

$$0 + 3 * (0.06 - 0.05)$$

$$0.03$$

$$\pi[t + 1] = \pi^e[t + 1] + 3(u^n[t + 1] - u[t + 1]) = \pi[t] + 3(u^n[t + 1] - u[t + 1]) =$$

$$0.03 + 3 * (0.06 - 0.05)$$

$$0.06$$

$$\pi[t + 2] = \pi^e[t + 2] + 3(u^n[t + 2] - u[t + 2]) = \pi[t + 1] + 3(u^n[t + 2] - u[t + 2]) =$$

$$0.06 + 3 * (0.06 - 0.05)$$

$$0.09$$

$$\pi[t + 3] = \pi^e[t + 3] + 3(u^n[t + 3] - u[t + 3]) = \pi[t + 2] + 3(u^n[t + 3] - u[t + 3]) =$$

$$0.09 + 3 * (0.06 - 0.05)$$

$$0.12$$

Maintaining the unemployment rate 1% below its natural rate requires an inflation rate accelerating by 3% per year.

**Suppose that in year t-1, the unemployment rate is equal to its natural rate and the inflation rate is zero. Suppose that beginning in period t the authorities bring the unemployment rate down to 5% and keep it there. If expected inflation is static ( $\pi^e[t]=0$ ), what is the inflation rate in periods t,t+1,t+2,t+3?**

$$\pi[t] = \pi^e[t] + 3(u^n[t] - u[t]) = 0 + 3(u^n[t] - u[t]) =$$

$$0 + 3 * (0.06 - 0.05)$$

$$0.03$$

$$\pi[t + 1] = \pi^e[t + 1] + 3(u^n[t + 1] - u[t + 1]) = \pi[t] + 3(u^n[t + 1] - u[t + 1]) =$$

$$0 + 3 * (0.06 - 0.05)$$

$$0.03$$

$$\pi[t + 2] = \pi^e[t + 2] + 3(u^n[t + 2] - u[t + 2]) = \pi[t + 1] + 3(u^n[t + 2] - u[t + 2]) =$$

$$0 + 3 * (0.06 - 0.05)$$

$$0.03$$

$$\pi[t + 3] = \pi^e[t + 3] + 3(u^n[t + 3] - u[t + 3]) = \pi[t + 2] + 3(u^n[t + 3] - u[t + 3]) =$$

$$0 + 3 * (0.06 - 0.05)$$

$$0.03$$

Maintaining the unemployment rate 1% below its natural rate requires a 3% inflation rate every year.

## Question 7

**Suppose that the economy is described by:**

$$\pi[t] = \pi[t-1] - (u[t] - 0.06) \text{ (Philips Curve with adaptive expectations)}$$

$$u[t] = u[t-1] + 0.12 - 0.4 * M[t] \text{ (Aggregate Demand)}$$

Where  $\pi[t]$  is the inflation rate,  $u$  is the unemployment rate, and  $M$  is an index of changes in government policy that affect aggregate demand.

Suppose that at the beginning  $u[t] = u[t-1] = 0.06$ ,

$\pi[t] = \pi[t-1] = 0.07$ ,  $M[t] = 0.30$ . And suppose that the government suddenly follows a policy in year  $t-1$  of reducing  $M[t]$  to 0, and keeping it at zero.

▽ Note:  $M[t] = 0.10$  in the original problem but we want to start from a stable solution. This does not affect the answer though.

### a. What happens to unemployment and inflation in year t+1?

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$$u[t+1]=u[t]+.012-0.4*M[t+1]$$

$$0.06 + 0.012 - (0.4 * 0)$$

$$0.072$$

The unemployment rate increases by 1.2%.

$$\pi[t+1]=\pi[t]-(u[t+1]-0.06)$$

$$0.07 - (0.072 - 0.06)$$

$$0.058$$

Inflation shrinks by 1.2%

### b. What happens to unemployment and inflation in year t+2?

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$$u[t+2]=u[t+1]+.012-0.4*M[t+1]$$

$$0.072 + 0.012 - (0.4 * 0)$$

$$0.084$$

The unemployment rate further rises by 1.2%.

$$\pi[t+2]=\pi[t+1]-(u[t+2]-0.06)$$

$$0.058 - (0.084 - 0.06)$$

$$0.034$$

Inflation shrinks again by 1.2%

### c. What happens to unemployment and inflation in the long run?

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The inflation rate will kiss 0 and if monetary policy is left unchanged, we could even see accelerating deflation. The unemployment rate is going to go through the roof. Indeed, aggregate demand suggests that there is hysteresis in this economy. Thus tightening monetary policy more than is needed to keep inflation under control will cause the unemployment rate to increase constantly. The only way to stop deflation here would be to increase  $M$  above its original level, *i.e.* 0.3, in which case, the unemployment rate decreases, and deflation decelerates.

### d. How would the answer be different if the economy had rational rather than adaptive expectations?

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Well, when  $M[t+1]$  is set to zero. The unemployment rate starts to increase.

$$u[t+1] = u[t] + 0.012 - 0.4 * M[t+1] =$$

$$0.06 + 0.012 - (0.4 * 0)$$

$$0.072$$

With rational expectations, here is the new (vertical) Philips curve:

$$\pi[t+1] = \pi[t+1] - (u[t+1] - 0.06) \Leftrightarrow u[t+1] = 0.06$$

Since we don't get the same answer for  $u[t+1]$ , it's hard to conclude... In principle, with rational expectations, inflation gets to its target instantaneously. However, here, with  $M=0$ , aggregate demand is too weak to maintain the unemployment rate at its natural rate. Producers are accumulating inventories. That can't last forever, so they lay off workers and that, due to hysteresis, increases the natural rate of unemployment. Obviously, if nothing's done about the economy, it's going to implode or turn into a dictatorship...