

# Problem Set 2

ECON 304 – Intermediate Macroeconomics

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Department of Economics • Fall 2025

## ! Assignment Information

**Due Date:** October 6, 2025

**Percent of Final Grade:** 3.0 %

**Student Name:** \_\_\_\_\_

**Instructions:** Show all work clearly. Partial credit may be awarded for correct methodology even if the final answer is incorrect. Groups of no more than three are permitted.

## 💡 Submission Instructions

1. Show all mathematical work clearly
2. Include graphs where requested
3. Explain economic intuition behind your answers
4. Submit by **October 6, 2025** at the beginning of class.
5. Late submissions will be penalized 10% per day

**Office Hours:** Wednesday, 12:00-2:00 PM; Friday, 12:00-1:00 PM; or by appointment

*This problem set covers topics related to the derivation of the Phillips Curve, the accelerationist Phillips curve, and macroeconomic transmission mechanisms.*

## Problem 1: Deriving the Phillips Curve

**Points: 100**

Consider an economy with the following WS and PS relations:

$$\begin{aligned}\text{WS Relation : } w_r^{ws} &= \frac{z}{u^2} \\ \text{PS Relation : } w_r^{ps} &= \frac{1}{1+m}\end{aligned}$$

### Question 1.1

**Points: 6**

Solve for the natural rate of unemployment. Be careful with quadratics and keep in mind what makes *economic sense*.

### Question 1.2

**Points: 6**

Graphically illustrate the WS-PS model and the natural rate of unemployment that was estimated in Question 2.1.

### Question 1.3

**Points: 34**

It follows that, in equilibrium, the WS-PS model can be specified as

$$\begin{aligned}w_r^{ws}(u_n) &= w_r^{ps} \\ \frac{z}{u_n^2} &= \frac{1}{1+m}\end{aligned}$$

#### Part A (3 Points):

What is the *realized* real wage  $w_r$  in period  $t-1$  or  $w_{-1}$ ? In other words, what is the actual real wage that is observed? As part of your answer, state the real wage as an equality

#### Part B (24 Points):

With the information from your answer in **Part A**, derive the Phillips Curve. Show all of your work.

#### Part C (Points: 7)

Once derived, graph the Phillips Curve and be sure to show how inflation varies with unemployment, label the natural rate of unemployment, and explain the economic intuition behind the curve's shape. With your function and graph, determine when inflation is rising and when inflation is falling.

### Question 1.4

**Points: 9**

The Phillips curve you derived in Question 1.3 shows the relationship between inflation and unemployment for a given level of expected inflation. However, in reality, expectations can change over time, leading to what economists call the “accelerationist” Phillips curve. The next several questions will trace the full

macroeconomic transmission mechanism from fiscal policy through the goods market, labor market, and price level.

**Setup:** Consider an economy with the following structure:

- **Production Function:**  $Y = L$  (output equals employment)
- **Labor Market:**  $L = 1 - u$  (employment = 1 - unemployment rate, assuming labor force  $N = 1$ )
- **Goods Market:** Standard IS-LM model with fixed real interest rate  $r = 0.03$
- **Supply Side:** WS-PS model from previous questions
- **Price Setting:** Firms set prices according to  $P = (1 + m)w_n$  with adaptive expectations
- **Absent Central Bank:**  $\theta = 1$

The economy initially operates at the natural rate with  $\pi^e = 0.02$  and output  $Y_n = 1 - u_n$ . The government implements expansionary fiscal policy to reduce unemployment from  $u_n$  to  $0.7 \cdot u_n$ .

Using the IS relation  $Y = C + I + G$  with  $C = 0.6Y$  (assuming away taxation and autonomous consumption),  $I = 0.2 - 2r$ , and  $r = 0.03$ :

1. Calculate the required change in government spending  $\Delta G$  to achieve the unemployment target
2. Calculate the new equilibrium output level
3. Show this change using the Keynesian Cross diagram

## Question 1.5

**Points: 8**

Using the production function  $Y = L$  and labor market relation  $L = 1 - u$ :

1. Calculate the required output change to reduce unemployment from  $u_n$  to  $0.7 \cdot u_n$
2. Verify this matches the output change from the fiscal expansion in Question 1.4
3. Demonstrate these relationships graphically showing the movement from  $(L_n, Y_n)$  to  $(L_1, Y_1)$

## Question 1.6

**Points: 9**

Analyze how the unemployment change affects the WS-PS model:

1. Explain how lower unemployment affects worker wage demands in the WS relation
2. Show how this creates pressure on the PS relation through firm pricing
3. Calculate the initial inflationary pressure before expectations adjust
4. Graph the WS-PS model showing the movement from equilibrium

## Question 1.7

**Points: 12**

Using your Phillips curve equation from Question 1.3:

1. Calculate the inflation rate when unemployment falls to  $0.7 \cdot u_n$  in the first period (let  $\pi^e = \pi_{-1} = 0.02$ )
2. Explain the economic mechanism linking the specific unemployment reduction to inflation
3. Graph the Phillips curve showing the movement from  $(u_n, \pi^e)$  to  $(0.7 \cdot u_n, \pi_1)$

## Question 1.8

**Points: 16**

Assume workers adjust expectations:  $\pi_t^e = \pi_{-1}$ . Government maintains unemployment at  $0.7 \cdot u_n$  for three periods:

1. Calculate inflation rates for periods 1, 2, and 3, showing how maintaining  $u = 0.7 \cdot u_n$  requires accelerating inflation
2. Explain how changing expectations shift the Phillips curve each period while unemployment stays constant
3. Show how the WS curve shifts as expectations adjust to maintain the lower unemployment rate
4. Create a comprehensive diagram showing the complete transmission mechanism through all stages
5. Explain why attempting to permanently maintain  $u = 0.7 \cdot u_n$  demonstrates no long-run unemployment-inflation trade-off