Problem Set #1

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Due: November 28, 2025

Problem 1 (Phillips Curve).
Consider the Phillips Curve from class:

$$\pi_t = \beta \mathbb{E}[\pi_t] - \kappa(u_t - \bar{u}) + \nu_t, \quad \kappa > 0,$$

where π_t is inflation, $\mathbb{E}[\pi_t]$ expected inflation, u_t unemployment, $\bar{u}$ the natural rate, and ν_t a shock. The subscript t indicates the time period.

(a) Explain in words what the equation says about the relationship between inflation and unemployment. Explain the economic intuition.

(b) What happens to the slope of the Phillips Curve as κ increases? What does that imply economically?

(c) Graph π_t against u_t for a fixed $\mathbb{E}[\pi_t]$ and $\nu_t = 0$. Label the intercept and slope.

(d) How does a positive supply shock ($\nu_t > 0$) shift the curve? Indicate the direction on your graph.

Problem 2 (Expectations).
Suppose expectations are formed adaptively:

$$\mathbb{E}[\pi_t] = \pi_{t-1}$$

(a) Explain in words what this equation means about how people form expectations.

(b) Substitute these adaptive expectations into the Phillips Curve and rewrite it such that $\pi_t - \pi_{t-1}$ is on the left-hand side. For the rest of problem 2, assume that $\beta = 1$.

(c) Interpret your result as a relationship between the change in inflation and the unemployment gap $(u_t - \bar{u})$.

(d) If unemployment is held below $\bar{u}$ for several periods, what does the model predict for inflation over time?

(e) Now suppose instead that expectations are anchored at a constant target $\bar{\pi}$, so $\mathbb{E}[\pi] = \bar{\pi}$. How do your answers change?

(f) Why might the Federal Reserve focus on maintaining anchored inflation expectations?

Problem 3 (Okun's Law).

Okun's Law links the unemployment gap to the output gap:

$$u_t - \bar{u} = -\frac{1}{2}\left(\frac{Y_t - Y^p}{Y^p}\right)$$

where Y_t is actual output and Y^p is potential output.

(a) Interpret Okun's Law in words. Why is the sign negative?

(b) If the output gap is $+2\%$, compute $u_t - \bar{u}$.

(c) If $\bar{u} = 4\%$, what is the implied unemployment rate u_t in part (b)?

(d) Why might the coefficient on the output gap (1/2 above) differ over time?

Problem 4 (From Phillips Curve and Okun's Law to SRAS).

In this problem, we will build the SRAS curve from the Phillips Curve and Okun's Law.

(a) Substitute Okun's Law into the Phillips Curve to derive an expression for inflation in terms of the output gap.

(b) What makes SRAS steeper or flatter?

(c) Graph the SRAS curve in (Y_t, π_t) space for a fixed $\mathbb{E}[\pi_t]$. Label Y^p on the horizontal axis.

(d) Suppose expected inflation is fixed at $\mathbb{E}[\pi_t] = 2\%$, $\beta = 1$, and $\kappa = 0.2$. If a negative demand shock creates an output gap of -3%, what inflation rate does the SRAS predict when $\nu_t = 0$?

(e) Now suppose a positive supply shock of 1% hits the economy. Recompute inflation.

(f) Can the Federal Reserve accomplish its dual mandate here?

Problem 5 (Bringing it All Together Graphically).

Recall the market for money, the loanable funds market, the Phillips Curve, and the AD-AS model. Suppose a positive government spending shock hits the economy.

(a) Draw what happens immediately in the AD-AS market. Then graphically analyze what happens in the market for money and reconcile that movement with the loanable funds market. Lastly, show what happens graphically with the Phillips Curve.

(b) Explain in words the economic logic behind each movement in (a).

(c) Now suppose the Federal Reserve acts to satisfy its dual mandate. What happens next in each market? Draw it.

Problem 6 (*Hard*: Bringing it All Together Mathematically).

In this problem, we will solve quantitatively for each piece of the economy.

(a) First, suppose that TFP = 1.5, the capital stock is 100, and labor hours is 1000. Solve for Y^p given a labor share of output of 3/4 and a constant-returns-to-scale production function.

(b) Now, suppose that $MPC = 0.8$, $TR = 20$, $T = 10$, $I = 15$, and $G = 5$. Solve for A in long-run equilibrium.

(c) Suppose that $\beta = 1$ and $\kappa = 0.2$, and that we are still in long-run equilibrium. What is the long-run inflation rate if $\mathbb{E}[\pi_t] = 2\%$?

(d) Suppose that initially $P = 1$ and that $L(r) = 0.4 - 20\frac{r}{Y}$. If $M_s = 300$, what is r?

(e) Suppose that $\bar{u} = 4\%$. What is u_t in long-run equilibrium?

(f) Suppose that a negative demand shock decreases autonomous consumption spending by 10%. Compute Y_t and the output gap holding all else constant.

(g) Go to Okun's Law. What is the new unemployment rate?

(h) Go to the Phillips Curve and calculate the new inflation rate. Verify that this inflation rate matches what you would get from the SRAS.

(i) Now go to the money market. Assume the Fed does not move the money supply for now. Recall that $\pi_t = 100(\frac{P_t}{P_{t-1}} - 1)$. What is the new interest rate?

(j) We assumed that investment was not a function of the interest rate. If investment was a function of the interest rate, why would solving this problem become much harder?