ECON 1550 Spring 2026: Problem Set 1 Answer Key

1. (a)

- (A) Do not select. A flat LM curve occurs when the interest rate is exogenous.
- **(B) Select.** When income increases, money demand increases. However, equilibrium requires that money demand remains equal to the unchanged exogenous money supply. The nominal interest rate must increase to reduce the money demand by an amount that exactly offsets the increase in money demand induced by the higher income.
- (C) Do not select. A downward sloping LM would imply that the interest rate goes down as income increases, which contradicts that money demand is increasing in income and decreasing in the interest rate.
- (D) Do not select. A vertical LM curve implies that any value for the interest rate is an equilibrium value. However, with an exogenous money supply and a money demand that is decreasing in the interest rate, there is always only one equilibrium value of the interest rate.

(b) Any shape for the LM other than flat implies that the interest rate changes when output changes. However, when the interest rate is exogenous, it cannot change in response to changes in any of the variables of the model. Exogenous variables can only change if we assume they change for reasons outside the model.

- **(A) Select.**
- (B) Do not select.
- (C) Do not select.
- (D) Do not select.

(c) The IS curve gives combinations of the interest rate r and output Y that are equilibria in the goods market. When the interest rate changes, the equilibrium value of output changes (through the effect of the interest rate on investment). Because the IS is plotted with output Y on the horizontal axis and the interest rate r on the vertical axis, simultaneous changes in r and Y that maintain goods market equilibrium correspond to movements along the IS curve.

- **(A) Select.**
- (B) Do not select.
- (C) Do not select.
- (D) Do not select.

(d) When inflation expectations are unanchored, expected inflation π_t^e equals inflation in the previous period π_{t-1} The Phillips curve in this case is $\pi_t - \pi_{t-1} = \alpha(Y_t - Y^n)$. If output exceeds potential output, the output gap $(Y_t - Y^n)$ is positive. The Phillips curve then gives $\pi_t > \pi_{t-1}$, that is, inflation is increasing over time.

- (A) Do not select.
- (B) Do not select.
- **(C) Select.**
- (D) Do not select.

(e)

- (A) Do not select. In the resulting medium-run equilibrium, output equals potential just as in the initial medium-run equilibrium. Potential remains unchanged because taxes do not affect potential output.
- (B) Do not select. Taxes do not shift the LM. With an upward-sloping LM, the interest rate falls endogenously; with a flat LM, the central bank must lower the interest rate to bring output back to potential. In both cases, the medium-run real interest rate ends up below the initial medium-run equilibrium.
- **(C) Select.** Higher taxes reduce equilibrium output for any level of the interest rate, so the IS curve shifts to the left.
- (D) Do not select. Same explanation as in (B).

(f) We use that the Phillips curve is

$$\begin{aligned} \pi &= \pi^e + m + z - \alpha u \\ &= \pi^e - \alpha(u - u_n). \end{aligned}$$

- (A) Do not select. Lower expected inflation directly lowers current inflation.
- (B) Do not select. Higher unemployment reduces the bargaining power of workers relative to employers, causing the equilibrium nominal wage to go down. A lower nominal wage means the nominal marginal cost of production is lower. To keep the markup (profit rate) unchanged, firms reduce the price of goods they sell and the price level goes down. A lower price level means lower inflation (the price level in the previous period cannot change in the current period, so changes in the price level correspond directly to changes in inflation).
- (C) Do not select. A lower natural rate of unemployment is deflationary. For any given rate of unemployment, a lower natural rate of unemployment increases the unemployment gap. The amount of people unemployed relative to the stable-

inflation medium-run level is now higher. Workers' bargaining power is therefore lower, pushing the nominal wage and inflation down.

- **(D) Select.** In the Phillips curve relation $\pi = \pi^e + m + z - \alpha u$, a higher markup m increases current inflation, holding π^e, z, α and u fixed. The intuition is that to earn a higher markup at any given level of the nominal wage, firms increase the price of the goods they sell.

(g) The natural rate of unemployment is the medium-run equilibrium level of unemployment. Using the medium-run condition $\pi_t = \pi_t^e$ in the Phillips curve and solving for u gives the natural rate of unemployment $u_n = (m + z)/\alpha$.

- (A) Do not select. An increase in m raises u_n.
- (B) Do not select. An increase in z raises u_n.
- **(C) Select.** An increase in α reduces u_n.
- (D) Do not select. π_t^e does not appear in the expression for u_n, so it has no effect on the natural rate.

(h) The markup m gives the profit rate of firms.

- (A) Do not select. A positive markup occurs under imperfect (monopolistic) competition, when firms use their monopoly power to earn positive profits.
- **(B) Select.** Under perfect competition, firms earn zero profits.
- (C) Do not select. A negative markup would mean firms sell below cost, which leads to bankruptcy and exit from the market.
- (D) Do not select. The price setting equation always holds; under perfect competition it simplifies to $P = W$.

(i) The natural rate of unemployment is defined as the medium-run equilibrium level of unemployment.

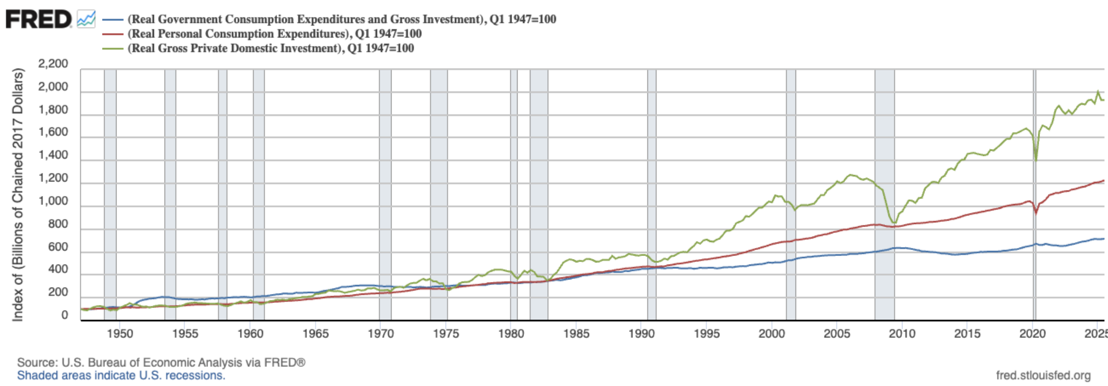
- (A) Do not select.
- (B) Do not select.
- **(C) Select.**
- (D) Do not select.

2. (a) **False.** Writing the accounting identity $Y = C + I + G$ as

$$1 = \frac{C}{Y} + \frac{I}{Y} + \frac{G}{Y}$$

shows that a 1% increase in Y, C, and I leaves C/Y and I/Y unchanged. Therefore, for the identity to hold, G/Y must also remain unchanged. However, if $G > 0$, a fixed G and a higher Y imply a lower G/Y.

(b) **True.** Volatility here refers to cyclical fluctuations; investment has visibly larger cyclical swings. The plot below shows the evolution of real consumption, investment, and government purchases for the United States between 1947-Q1 and 2025-Q2 (index, 1947=100).



Source: `https://fred.stlouisfed.org/graph/?g=1QUNW`.

(c) **True.** Higher government spending increases demand in the goods market at any given level of the interest rate. Higher demand, in equilibrium, is associated with higher output.

(d) **Uncertain.** Lower government spending reduces demand for goods. Equilibrium in the goods market then requires lower output for any given interest rate, so the IS shifts to the left. Lower output implies lower income. The decrease in income reduces the demand for money. But with an unchanged exogenous money supply, equilibrium in the money market requires money demand to also remain unchanged. The interest rate decreases so that money demand increases by an amount that exactly offsets the decrease caused by the lower income. The lower interest rate causes an increase in investment.

The overall effect on investment depends on the relative magnitude of the decline in investment caused by the initial drop in demand and the increase in investment caused by the lower interest rate. Without knowing the exact way in which investment responds to output and the interest rate, it is not possible to determine which of the two effects is stronger, making the behavior of equilibrium investment uncertain.

3. (a) The IS curve represents the combinations of interest rates and output that are consistent with equilibrium in the goods market. Using the behavioral equations for consumption and investment in the goods market equilibrium condition gives the IS relation:

$$\begin{aligned} Y &= C + I + \bar{G}, \\ &= c_0 + c_1(Y - \bar{T}) + b_0 - b_1 i + G. \end{aligned}$$

Solving for i gives the IS curve

$$i = \frac{c_0 + b_0 + \bar{G} - c_1\bar{T}}{b_1} - \left(\frac{1 - c_1}{b_1}\right) Y,$$

which is the equation of a line (when plotting i as a function of Y) with slope

$$\text{slope of IS curve} = -\frac{1 - c_1}{b_1}.$$

(b) The LM curve represents the combinations of interest rates and output that are consistent with equilibrium in the money market.

Solving of i in the money market equilibrium condition gives the LM curve:

$$i = \frac{m_0 - \bar{M}^s}{m_2} + \left(\frac{m_1}{m_2}\right) Y,$$

which is the equation of a line (when plotting i as a function of Y) with slope

$$\text{slope of LM curve} = \frac{m_1}{m_2}.$$

(c) To make the algebra easier, write the IS from part (a) and the LM from part (b) as

$$\begin{aligned} \text{IS: } i &= p - fY, \\ \text{LM: } i &= q + gY, \end{aligned}$$

where we have created the new auxiliary variables

$$\begin{aligned} p &= \frac{c_0 + b_0 + \bar{G} - c_1\bar{T}}{b_1}, & q &= \frac{m_0 - \bar{M}^s}{m_2}, \\ f &= \frac{1 - c_1}{b_1}, & g &= \frac{m_1}{m_2}. \end{aligned}$$

The IS and the LM are a system of two equations in the two unknowns Y and i. Solving the system gives

$$Y^* = \frac{p - q}{f + g},$$

and

$$i^* = \frac{gp + qf}{f + g},$$

or, in terms of the original variables

$$Y^* = \frac{m_2(c_0 + b_0 + \bar{G} - c_1\bar{T}) + b_1(\bar{M}^s - m_0)}{m_1 b_1 + m_2(1 - c_1)},$$

and

$$i^* = \frac{m_1(c_0 + b_0 + \bar{G} - c_1\bar{T}) + (1 - c_1)(m_0 - \bar{M}^s)}{m_1 b_1 + m_2(1 - c_1)}.$$

(d) Y^* goes up and i^* goes down. An increase in the money supply means a larger $\bar{M}^s$. For money markets to be in equilibrium, money demand must also increase. For people to have a higher money demand for a given level of income, the interest rate must go down so that bonds become less attractive, and people decide to sell bonds and hold more money. The LM curve shifts down.

The fall in the interest rate makes investment increase, pushing up the equilibrium level of output. The economy moves along the IS curve toward the new equilibrium with higher Y^* and lower i^*.

(e) The new level of output Y^{W} can be found by replacing m_0 by $m_0 + \Delta m_0$ in the expression for Y^* from part (c):

$$Y^{\mathrm{W}} = Y^* - \frac{\Delta m_0}{m_2(f + g)},$$

with f and g defined as before.

(f) The increase in money demand caused by the war scare makes the interest rate rise for any given level of output. The LM shifts up. The IS curve is unchanged, as are the slopes of both curves.

As people move away from bonds and toward money, the interest rate increases. A higher interest rate leads to lower investment and lower output. The fall in investment makes equilibrium output fall due to the war scare.

(g) Replace $\bar{G}$ by $\bar{G} + g_1(Y - Y^*)$ in the IS from part (a) to get

$$i = \frac{c_0 + b_0 + \bar{G} + g_1(Y - Y^*) - c_1\bar{T}}{b_1} - \left(\frac{1 - c_1}{b_1}\right) Y,$$

Using the same notation as in (c), we can rewrite this new IS as

$$i = p - \frac{g_1 Y^*}{b_1} - \left(f - \frac{g_1}{b_1}\right) Y.$$

The new intercept is

$$\text{new intercept of IS} = p - \frac{g_1 Y^*}{b_1},$$

and the new slope is

$$\text{new slope of IS} = -\left(f - \frac{g_1}{b_1}\right) = -\frac{1 - c_1 - g_1}{b_1}.$$

Compared to the IS from part (a), the new intercept is

- higher when $g_1 < 0$,
- the same when $g_1 = 0$,
- lower when $g_1 > 0$.

The new slope goes from negative to zero for values of g_1 increasing from negative to $(1 - c_1)$. When g_1 is higher than $(1 - c_1)$, the new slope is positive. Putting together the simultaneous changes in the intercept and slope, the effect of the fiscal rule is to rotate the IS around the equilibrium (Y^*, i^*) from (c).

(h) The war scare shifts the LM only, while the fiscal rule changes the IS only. In the figure below, the LM curve is shown in green and labeled LM^{W} (the W is for "war scare"). This is the LM curve after the war scare; it is unaffected by the fiscal rule since government spending does not enter the money market equilibrium.

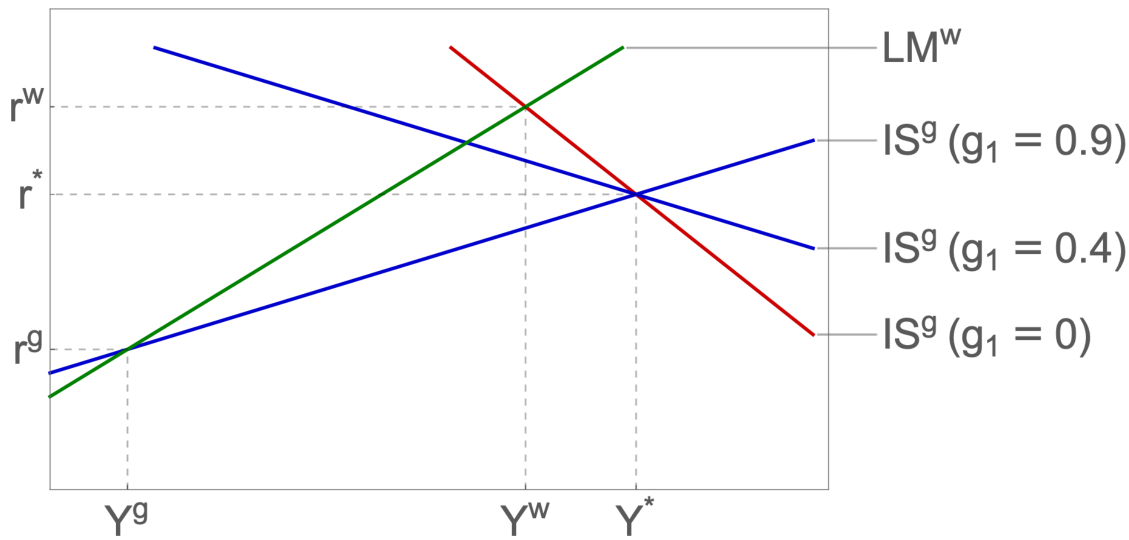
The red line, labeled $IS^g(g_1 = 0)$, is the IS curve before the war scare and also after the war scare. This red IS line is also the IS that would result from the government following the rule $G = \bar{G} + g_1(Y - Y^*)$ with $g_1 = 0$, which is equivalent to the policy $G = \bar{G}$ used in parts (a) through (f).

The two blue lines are two examples of IS curves that result for two different values of $g_1 > 0$. As g_1 increases from zero (the case of the red line) to positive values, it rotates counter-clockwise around (Y^*, i^*). For any positive values of g_1, equilibrium output is even further below the original equilibrium Y^* than it was under the war scare alone. The higher the g_1, the lower the levels of equilibrium output and the interest rate. For the case labeled $IS^g(g_1 = 0.9)$, we have equilibrium values (Y^g, i^g).

We conclude that when $g_1 > 0$, the fiscal policy pursued does not help stabilize the economy. On the contrary, it reduces output even below Y^{W}. The intuition is that with a positive g_1, when output goes down, government spending also goes down. The reduction in government spending reduces demand, which in turn reduces output. The policy amplifies the decline in Y.

A much better policy is to have a negative g_1 so that government spending increases as output decreases. The same analysis as before but with signs for g_1 reversed shows that fiscal policy makes the decline in output due to the war scare be smaller in magnitude than when G stays constant at $\bar{G}$.

A policy of this type (a negative g_1) is called an automatic stabilizer.



4. (a) The consumption function $C(\cdot)$ is increasing in disposable income $Y_D \equiv Y - \bar{T}$. Intuition: When households have higher disposable income, they consume more. This is a fundamental behavioral assumption: as people earn more (after taxes), they spend more on goods and services.

(b) The investment function $I(\cdot)$ is decreasing in the real interest rate R_t. Intuition: The real interest rate represents the cost of borrowing for firms. When the real interest rate rises, it becomes more expensive for firms to finance investment projects, so they invest less. Equivalently, a higher real interest rate raises the required return on investment projects, making fewer projects profitable.

(c) The money demand function $\mathcal{L}(i, Y)$ is decreasing in the nominal interest rate i and increasing in income Y. Intuition: When i goes up, people prefer to hold less money and more bonds, so money demand falls. The variable Y in this context plays the role of aggregate income. Higher income makes people want to buy more goods, which requires more transactions. To be able to conduct more transactions, people must hold more money.

(d) Substituting the functional forms into the goods market equilibrium:

$$Y_t = 1 + \frac{1}{2}(Y_t - \bar{T}) + 2 - R_t + \bar{G} = 1 + \frac{1}{2}(Y_t - \bar{T}) + 2 - (i_t - \pi^e) + \bar{G}.$$

Solving for i_t:

$$i_t = 3 - \frac{1}{2}\bar{T} + \bar{G} + \pi^e - \frac{1}{2}Y_t.$$

(e) From the money market equilibrium:

$$\frac{\bar{M}^s}{P_t} = 2 + Y_t - 0.2i_t.$$

Solving for i_t:

$$i_t = 5\left(2 + Y_t - \frac{\bar{M}^s}{P_t}\right) = 10 - 5\frac{\bar{M}^s}{P_t} + 5Y_t.$$

(f) Equating the i_t implied by the IS from part (d) to the i_t implied by the LM from part (e) gives

$$3 - \frac{1}{2}\bar{T} + \bar{G} + \pi^e - \frac{1}{2}Y_t = 10 - 5\frac{\bar{M}^s}{P_t} + 5Y_t.$$

Solving for Y_t:

$$Y_t = -\frac{14}{11} - \frac{1}{11}\bar{T} + \frac{2}{11}\bar{G} + \frac{2}{11}\pi^e + \frac{10}{11}\frac{\bar{M}^s}{P_t}.$$

(g) With $P_t^e = P_t$, the aggregate supply relation becomes:

$$P_t = (1+m)P_t F\left(1 - \frac{Y^n}{L}, z\right).$$

This simplifies to:

$$1 = (1+m)\left(1 - \alpha\left(1 - \frac{Y^n}{L}\right) + z\right).$$

Solving for Y^n:

$$Y^n = \left(1 - \frac{1}{\alpha}\left(1 - \frac{1}{1+m} + z\right)\right) L = \left(1 - \frac{m + z(1+m)}{\alpha(1+m)}\right) L.$$

(h) Y^n does not depend on $\bar{M}^s, \bar{T}, \bar{G}$ because in the medium run, the labor market determines output through the wage and price setting process. Monetary and fiscal policy can only affect output in the short run when prices are sticky; in the medium run, output is determined by real factors (technology, labor force, markup, labor market conditions).

(i) Using the AD relation at time $t = 0$ and with $Y_0 = Y^n$:

$$Y^n = -\frac{14}{11} - \frac{1}{11}\bar{T} + \frac{2}{11}\bar{G} + \frac{2}{11}\pi^e + \frac{10}{11}\frac{\bar{M}^s}{P_0}.$$

Solving for P_0:

$$P_0 = \frac{10\bar{M}^s}{11Y^n + \bar{T} - 2\bar{G} - 2\pi^e + 14}.$$

Substituting $Y^n = \left(1 - \frac{m+z(1+m)}{\alpha(1+m)}\right) L$ from (g):

$$P_0 = \frac{10\bar{M}^s}{11\left(1 - \frac{m+z(1+m)}{\alpha(1+m)} L\right) + \bar{T} - 2\bar{G} - 2\pi^e + 14}.$$

(j) Using the AD relation with $T_1 = \bar{T} + \Delta T$ and $P_1 = P_0$:

$$Y_1 = -\frac{14}{11} - \frac{1}{11}(\bar{T} + \Delta T) + \frac{2}{11}\bar{G} + \frac{2}{11}\pi^e + \frac{10}{11}\frac{\bar{M}^s}{P_0} = Y^n - \frac{1}{11}\Delta T,$$

where the second equality follows by using the expression for Y^n from (i). For i_1, use the LM relation:

$$i_1 = 10 + 5Y_1 - 5\frac{\bar{M}^s}{P_0} = 10 + 5Y^n - \frac{5}{11}\Delta T - 5\frac{\bar{M}^s}{P_0}.$$

(k) In the new medium run with $Y = Y^n$ and taxes at $\bar{T} + \Delta T$:

$$Y^n = \frac{10}{11}\frac{\bar{M}^s}{P_{\text{MR}}} - \frac{1}{11}(\bar{T} + \Delta T) + \frac{2}{11}\bar{G} + \frac{2}{11}\pi^e - \frac{14}{11}.$$

Solving for P_{MR}:

$$P_{\text{MR}} = \frac{10\bar{M}^s}{11Y^n + (\bar{T} + \Delta T) - 2\bar{G} - 2\pi^e + 14}.$$

Since $\bar{T} + \Delta T > \bar{T}$, the denominator is larger, so $P_{\text{MR}} < P_0$. The permanent tax increase leads to a lower price level in the medium run.