

Midterm Exam 1 Answers

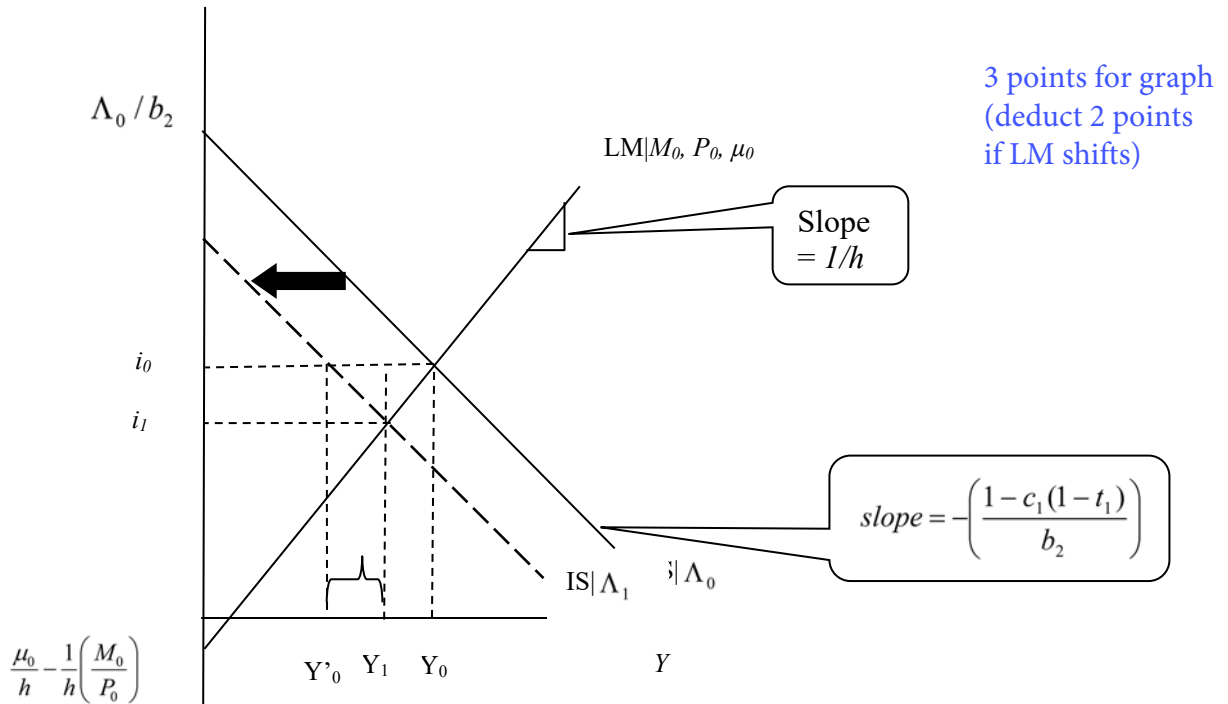
You have 75 minutes to complete this 60 minute exam. Be sure to “box in” your answers. Show your work (so that partial credit can be granted if the final answer is incorrect).

1. [20 minutes] Consider this statement:

1.1 (5 minutes) In a *standard* IS-LM model, where investment spending is given by:

$$(7') \quad I = b_0 - b_2 i$$

Use a graph to explain what happens to output and investment if the government cuts government spending and the budget surplus goes from zero to positive. (You can assume that the Fed *does not* target the interest rate, and the price level is fixed.)



Answer: The decrease in government spending shifts the IS curve in by $\bar{\alpha}\Delta GO$; aggregate demand would fall to Y'_0 , except for the decrease in interest rates – associated with the lower

money demand arising from lower income – increases investment. Hence, there is crowding in of investment of:

$$\Delta I = -b_2 \Delta i > 0$$

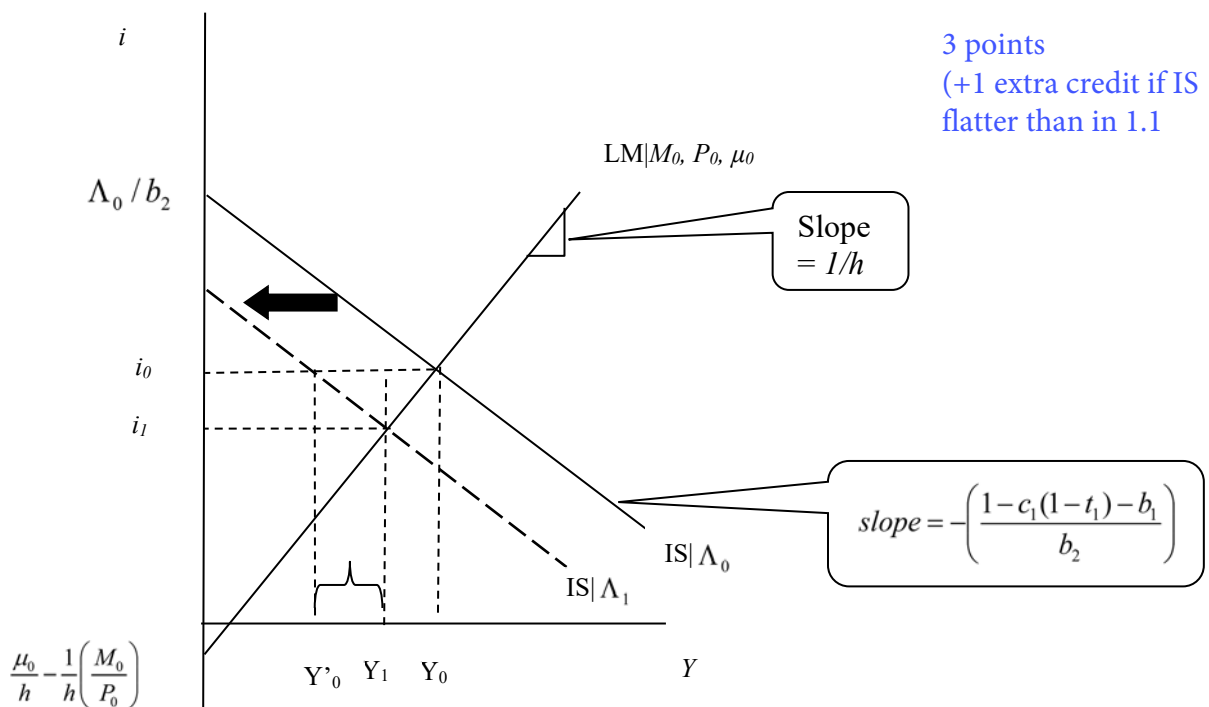
2 points

The distance $Y'_0 - Y_1$ is the amount of income crowded in.

1.2 (7 minutes) Using the same assumptions as in 1.1, suppose instead investment spending is given by:

$$(7) \quad I = b_0 + b_1 Y - b_2 i$$

What is the impact of a decrease in government spending on investment (assuming equation 7)? Use a graph and equations to help explain your answer. Be careful to state your assumptions.



Answer: We don't know whether investment increases or decreases, a priori. Note the IS curve is now flatter. The decrease in government spending shifts the IS curve in by $\bar{\alpha}\Delta G_0$; aggregate demand would fall to Y'_0 , except for the decrease in interest rates – associated with the lower money demand arising from lower income – increases investment. Hence, there is crowding out of investment of:

4 points

$$\Delta I = b_1 \Delta Y - b_2 \Delta i \quad ? \quad 0$$

The larger b_1 relative to b_2 , the more likely investment is to decline.
The distance $Y_0 - Y_1$ is the amount of income crowded in.

Extra credit: We can determine each of these components; in the textbook model:

$$Y_0 = \hat{\gamma} \left[\Lambda_0 + \frac{b_2}{h} \left(\frac{M_0}{P} \right) - \frac{b_2 \mu_0}{h} \right] \quad \text{<equilibrium income>}$$

+2 extra credit
if they get
this...

Where

$$\hat{\gamma} \equiv \frac{1}{1 - c_1(1 - t_1) - b_1 + \frac{b_2}{h}}$$

So:

$$\Delta Y = \hat{\gamma} \left[\Delta \Lambda + \frac{b_2}{h} \Delta \left(\frac{M}{P} \right) - \frac{b_2}{h} \Delta \mu \right] \quad \text{and assuming no activist monetary policy}$$

$$\Delta Y = \hat{\gamma} \Delta GO$$

To find out the change in the interest rate, substitute into the total differential of the LM curve

$$\Delta i = \Delta \left(\frac{\mu_0}{h} \right) - \left(\frac{1}{h} \right) \Delta \left(\frac{M}{P} \right) + \left(\frac{1}{h} \right) \Delta Y$$

$$\Delta i = \left(\frac{1}{h} \right) \Delta Y$$

$$\Delta i = \left(\frac{1}{h} \right) \hat{\gamma} \Delta GO$$

Substituting into the investment equation:

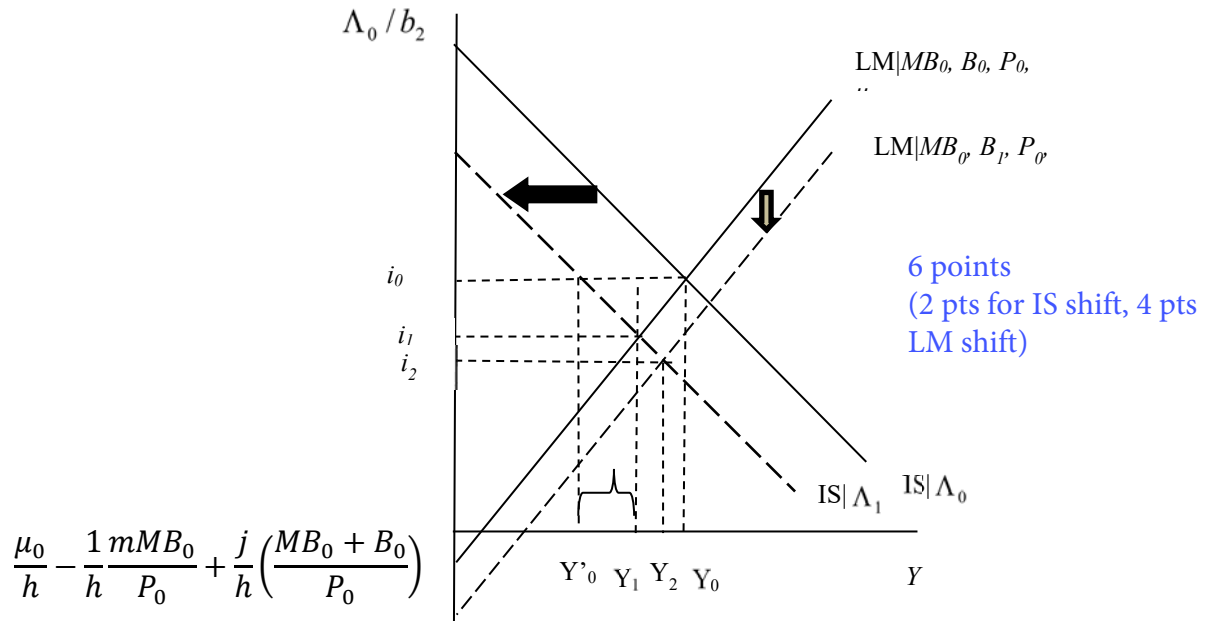
$$\Delta I = b_1 \hat{\gamma} \Delta GO - b_2 \left(\frac{1}{h} \right) \hat{\gamma} \Delta GO$$

So if $b_2/h > b_1$, then investment will increase as output and government spending declines.

1.3 (8 minutes) Consider problem 1.1 again, but assume:

$$\frac{M^d}{P} = \mu_0 + Y + j \left(\frac{B}{P} + \frac{MB}{P} \right) - hi$$

Where MB is money base, and the price level is held fixed. Use a graph to help explain your answer. Be careful to state your assumptions.



Answer: The decrease in government spending shifts the IS curve in by $\bar{\alpha}\Delta G_0$; aggregate demand would fall to Y'_0 , except for the decrease in interest rates – associated with the lower money demand arising from lower income – increases investment. Assuming the budget balance goes from zero to $Z = \Delta(B/P)$, then the LM curve shifts down (gray arrow). The interest rate falls to i_2 . Hence, there is crowding in of investment of:

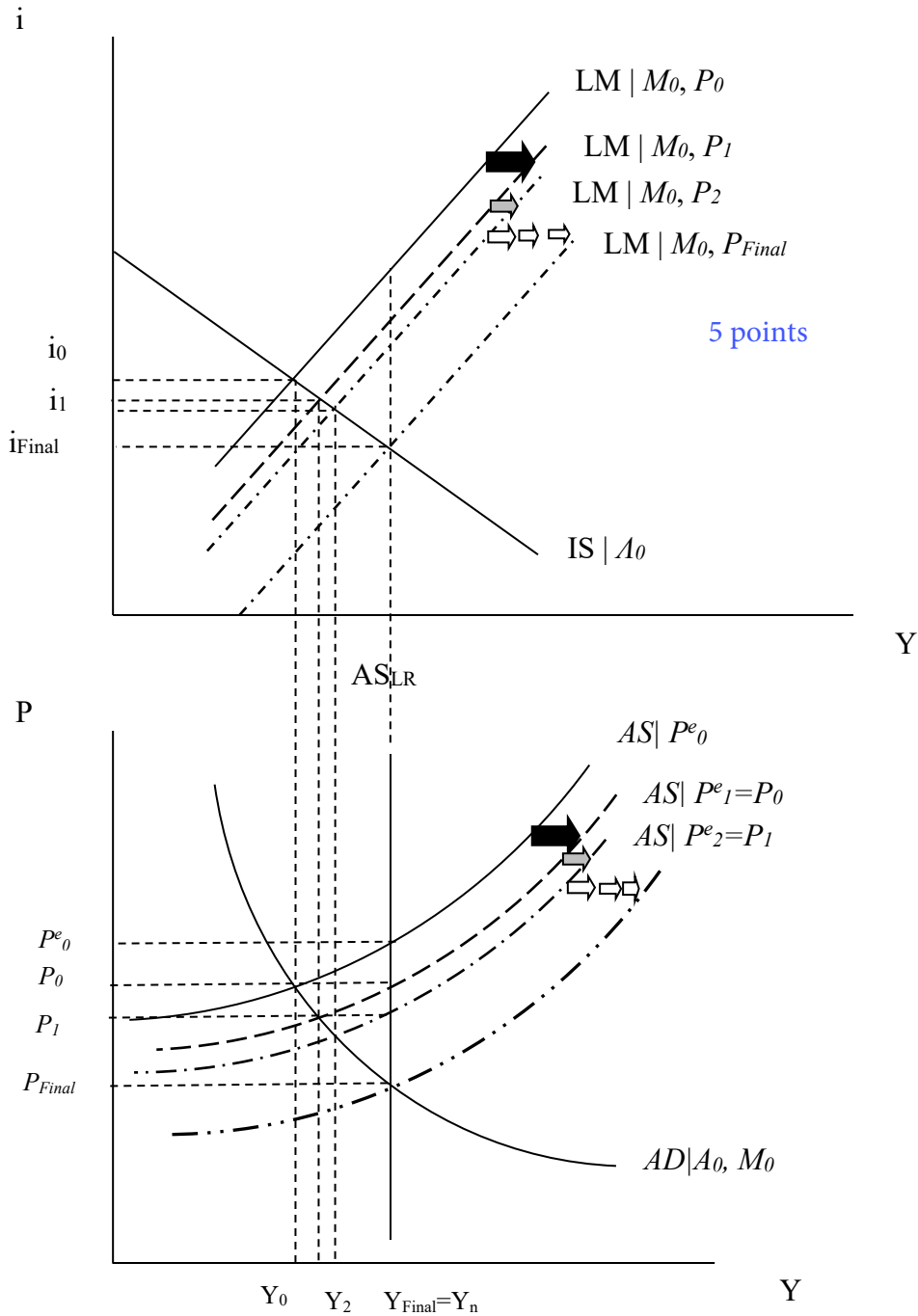
2 points

$$\Delta I = -b_2 \Delta i > 0$$

The distance $Y'_0 - Y_2$ is the amount of income crowded in.

2. [15 minutes] Use the AD-AS model, assuming the economy *begins and stays out of a liquidity trap*, and output is below natural output, Y_n .

2.1 (7 minutes) Show what happens in period 1, and over time, assuming no activist government policy or central bank policy, using IS-LM *and* AD-AS graphs. You can assume adaptive price expectations.

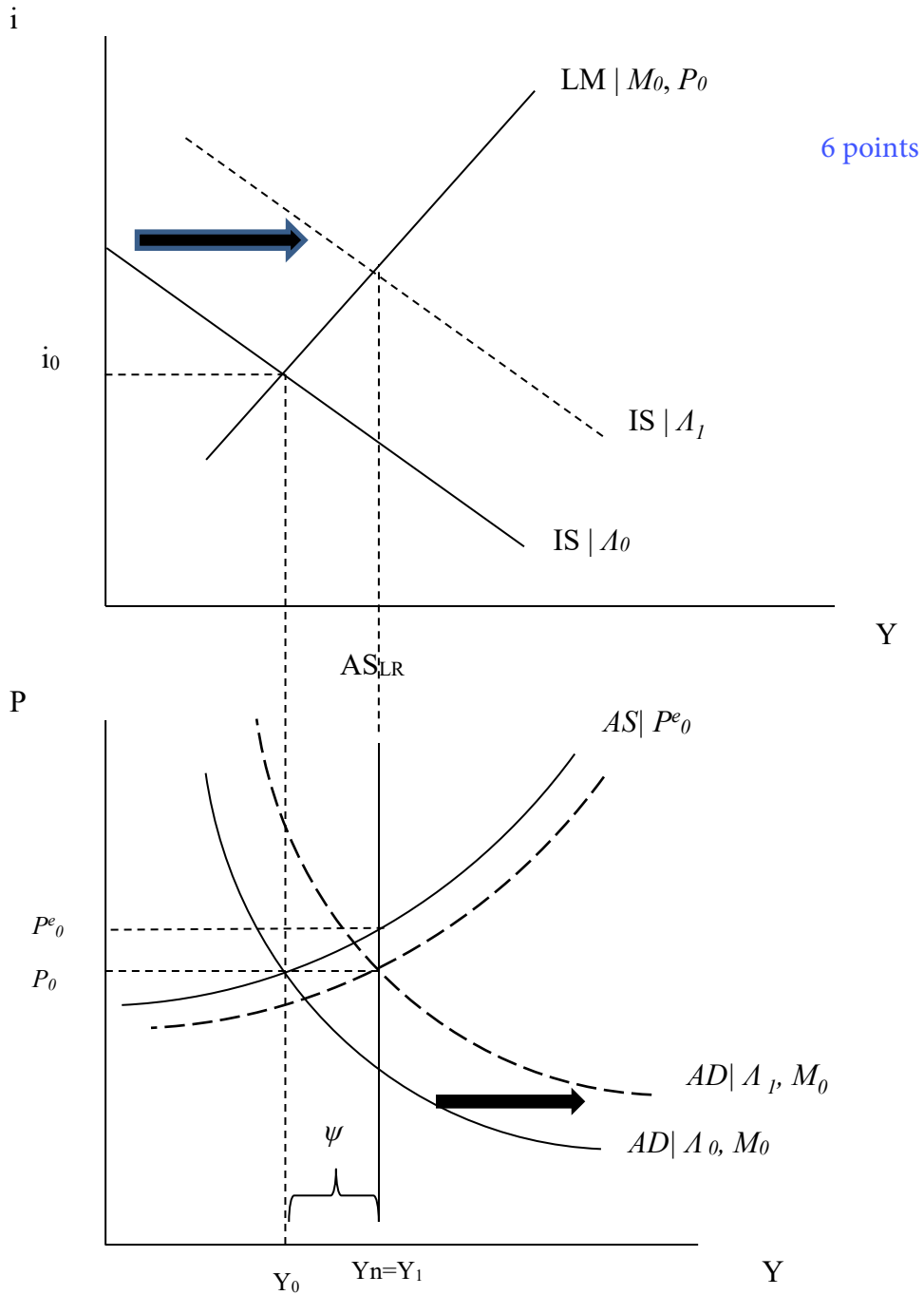


Answer: Originally output is at Y_0 , price level P_0 , given P^{e_0} . No activist monetary or fiscal policy implies no shifts of the IS curve, and no shifts of the LM due to a change in M . Over time, with a negative output gap, the price level is less than the expected price level. The expected price level falls to P_0 in period 1, so the AS curve shifts down (black arrow below). As the price level falls to P_1 , the real money supply rises so the LM curve shifts out (black arrow). Output rises to Y_1 as investment is crowded in. In period 2, the expected price level falls to P_1 ,

so the AS shifts down again (gray arrow), so the LM shifts out (gray arrow), and output rises to Y_2 . Over time, this process repeats until the AS shifts down all the way so the expected price level equals the actual (white arrows). As that happens, the LM curve repeatedly shifts out (white arrows).

2 points

2.2 (8 minutes) Suppose the fiscal authorities decide to shift out the AD curve by amount ψ in order to accelerate the recovery. Show what happens to output and the price level. You can assume adaptive price expectations.



Answer: The AD curve shifts out by ψ , and IS curve shifts out as well. The two graphs should be drawn consistently. The AS curve shifts down so that the new expected price level equals the price level in period 0. Hence, as it turns out, output rises to Y_1 , just equaling Y_n .

2 points

3. [10 minutes] Consider the following data from US Treasury <http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield> (accessed 10/5/2020):

Date	1 Mo	3 Mo	6 Mo	1 Yr	2 Yr	3 Yr	5 Yr	7 Yr	10 Yr	20 Yr	30 Yr
10/15/20	0.10	0.11	0.12	0.12	0.14	0.18	0.32	0.52	0.74	1.29	1.52

Suppose the expectations hypothesis of the term structure holds (and the term premiums at 5, 10 years = 0).

Calculate the expected 5 year interest rate, five years from 10/15/2020. Show your work!

$$i_{nt} = (i_{1t} + i^{e}_{1t+1} + i^{e}_{1t+2} + \dots + i^{e}_{1t+n-1})/n + tp_{nt} \quad \text{3 points if this is written}$$
$$i_{10t} = (i_{1t} + i^{e}_{1t+1} + i^{e}_{1t+2} + \dots + i^{e}_{1t+9})/10 + tp_{10t}$$

Note that:

$$i_{5t} = (i_{1t} + i^{e}_{1t+1} + i^{e}_{1t+2} + \dots + i^{e}_{1t+4})/5 + tp_{5t}$$
$$i^{e}_{5t+5} = (i^{e}_{1t+5} + i^{e}_{1t+6} + \dots + i^{e}_{1t+9})/5 + tp^{e}_{5t+5}$$

We assume $tp_{10t} = tp_{5t} = tp^{e}_{5t+5} = 0$

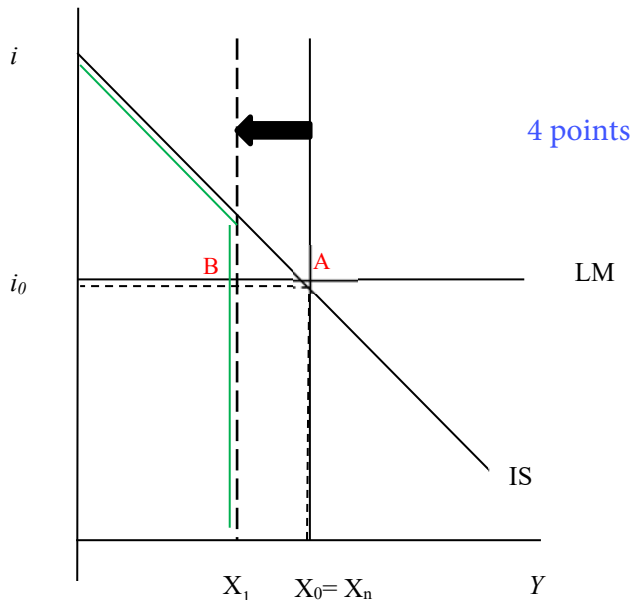
$$i_{10t} = (i_{5t} + i^{e}_{5t+5})/2 \quad \text{Cumulative 7 points to here}$$
$$0.74\% = (0.32\% + i^{e}_{5t+5})/2$$
$$1.48\% - 0.32\% = i^{e}_{5t+5}$$
$$1.16\% = i^{e}_{5t+5}$$

4. [15 minutes] IS-LM in a period of Covid-19. Consider the two-good model described by Blanchard, X is the affected sector, Z is the unaffected sector, and they both start out at full employment.

4.1 (5 minutes) Show what happens graphically if the pandemic hits. What is the level of output and interest rates after the shock?

Answer: The pandemic constrains supply, so that the effective IS curve is then the kinked green curve. Output falls from Y_n to Y_1 , as the equilibrium moves from point A to point B.

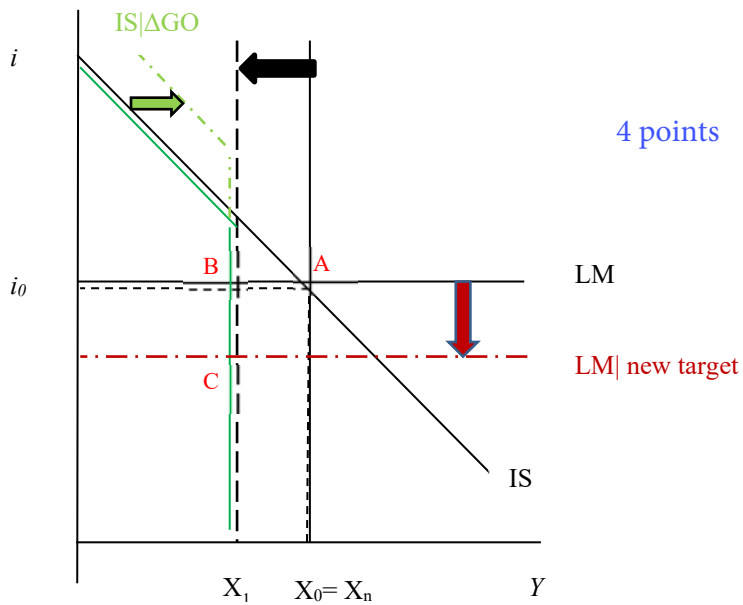
1 point



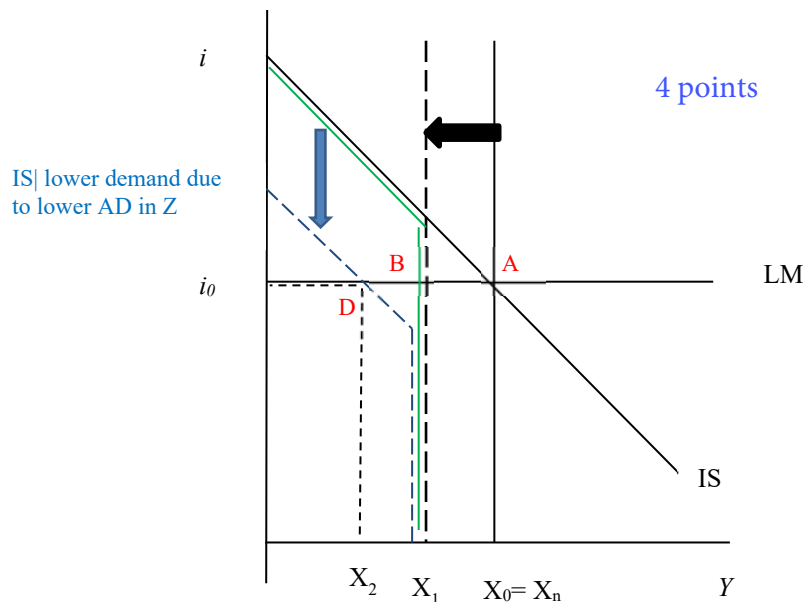
4.2 (5 minutes) Using your answer to 4.1, show whether monetary or fiscal policy can counteract the effects of the shock on the X sector.

Answer: If expansionary fiscal policy is undertaken, the kinked effective IS curve shifts out (green arrow; to green dashed line). In this case equilibrium remains at point B, output remains at Y_1 . If expansionary monetary policy is undertaken, the LM curve shifts down to the dark red LM curve (red arrow). Equilibrium moves to point C, but output remains at Y_1 .

1 point



4.3 (5 minutes) Can the decrease in Z sector aggregate demand cause a decrease in output in the X sector if it's been hit by the pandemic as in your answer to 4.1? If it can, show and explain how.



Answer: If the reduction in aggregate demand in X due to decreased demand Z is large enough (as shown by the blue arrow), then the equilibrium point moves from point B to point D. Output falls further to X_2 . If the IS inward shift is small enough so LM still intersects on the vertical portion of the (new) IS curve, then there is no additional impact on the X sector.

1 point