Economics 442 Menzie D. Chinn
Spring 2020 Social Sciences 7418
University of Wisconsin-Madison

Problem Set 3 Answer

Due on Canvas by 5:30pm CST on Wednesday, November 11th. Be sure to put your name on your problem set. Put "boxes" around your answers to the algebraic questions.

1. Answer true/false: Recessions are:

1.1 Officially determined by the National Bureau of Economic Research, for recessions in the United States. *TRUE. Other groups can say there's a recession or not, but NBER's researchers thought up the idea of recessions and expansions, so they are usually ascribed the authority to declare recessions.*

1.2 Always characterized by at least two quarters of negative GDP growth. *FALSE. The two-quarter characterization is a rule-of-thumb, and does not even apply to NBER defined recessions.*

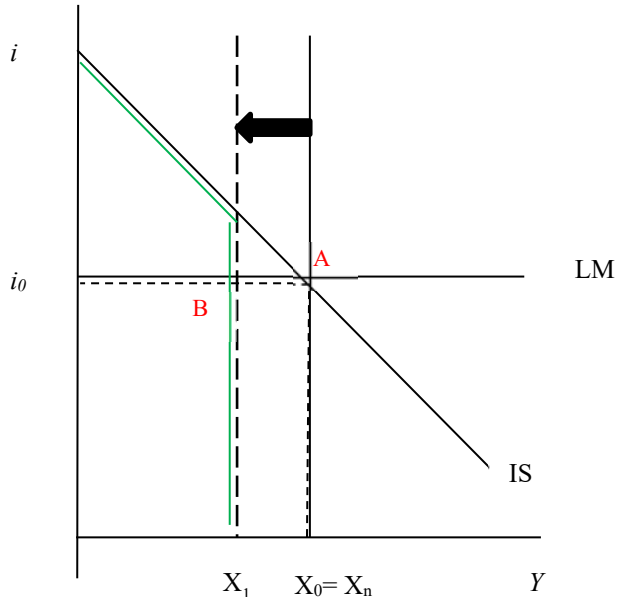
1.3 Usually follow an inversion of the 10 year-3 month Treasury spread. *TRUE. Over the last 5 decades, inversion has preceded every recession except for the 1990-91 recession.*

1.4 Are becoming less frequent over the past 100 years. *TRUE. Recessions are longer and less frequent than in the preceding century.*

2. Consider the IS-LM model in a period of Covid-19, specifically 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.

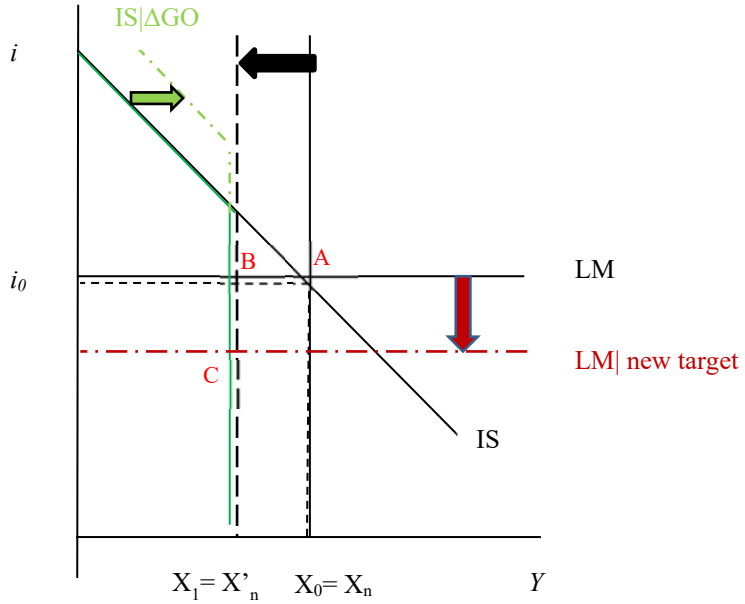
2.1 Show what happens graphically in Sector X if the pandemic hits. What is the level of output and interest rates after the shock (call it X_1)?

The pandemic constrains supply, so that the effective IS curve is then the kinked green curve. Output falls from Yn to Y1, as the equilibrium moves from point A to point B.



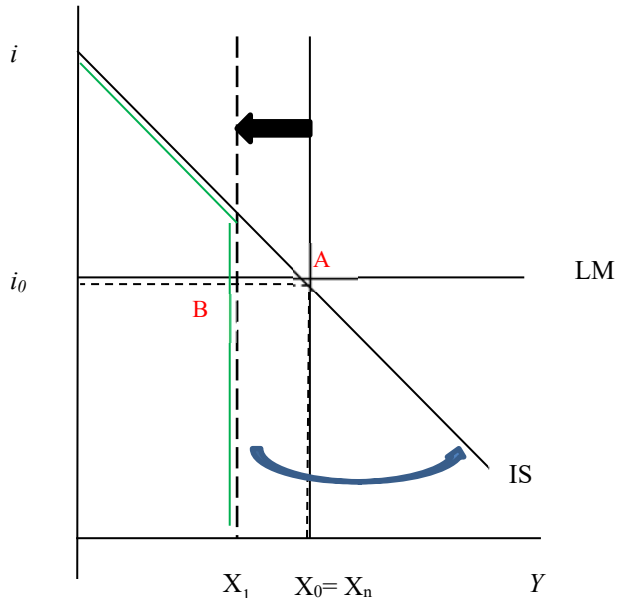
2.2 Suppose firms exit when output falls, and the new natural rate of output in the *X* sector changes to X_1. Can fiscal or monetary policy prevent the decline in the natural rate of output in *X*? If so, show how.

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 Y1. 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 Y1. No, the natural rate falls because monetary and fiscal policy can't keep output at the original level (as in the Midterm 1 question).



2.3 The Paycheck Protection Program essentially provided grants to firms that closed down, but retained (and paid) at least 90% of their pre-pandemic employees, and did *not* exit. Suppose exit of firms in Sector *X* are prevented. What will equilibrium look like *after* the pandemic?

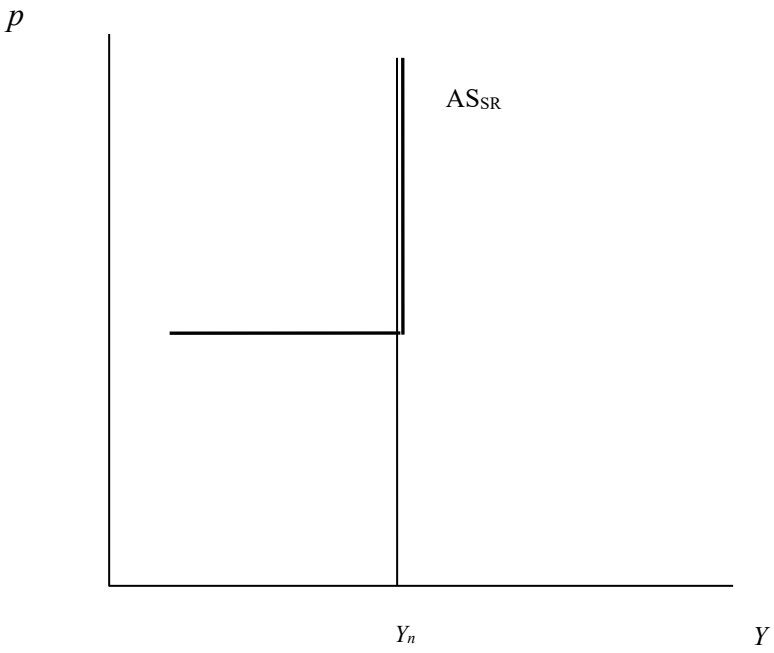
Then the IS would swing back to where it was before, equilibrium returns to point A, but because firms stayed in the market, Xn didn't decline, so $X=X_n$. We're back to medium run equilibrium. Had there been no PPP, then $X > X'_n$.



2.4 Compare the outcome from Problem 2.3 against that in 2.2.

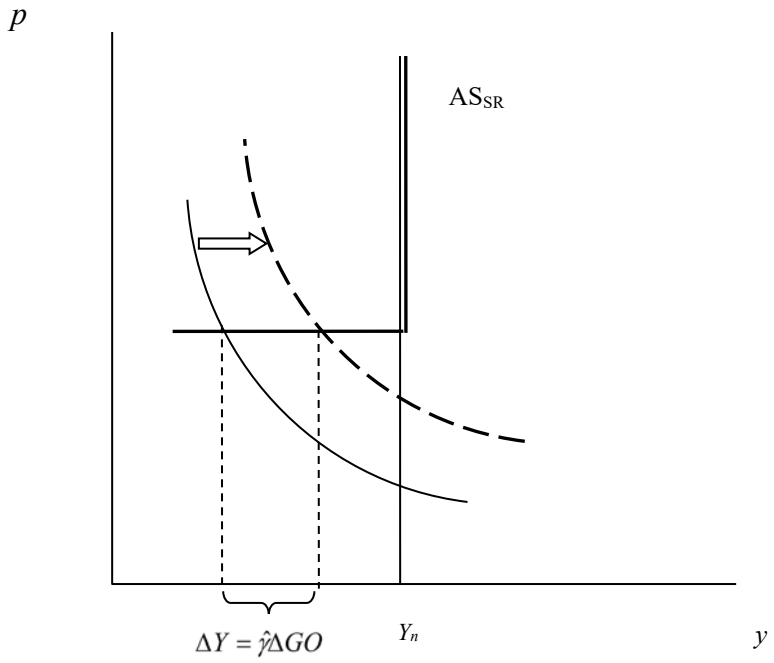
In both, we return to point A. In 2.2, we end up with X_n lower, at X'n, so $X > X'_n$, while in 2.3, $X = X_n$.

3. Suppose the AD-AS diagram looks like the following:



3.1 Suppose output is currently below Y_n (at Y_0) and interest rates are above 0. Using IS-LM and AD-AS diagrams, show what is the size of the multiplier for government spending, assuming the final level of income is below Y_n? You can let $\hat{\gamma}$ be the multiplier from the IS-LM handout, in your answer.

The AD shifts outward, as shown in the figure below, and since the AS curve is perfectly flat, the output increase is exactly the multiplier times the change in government spending.

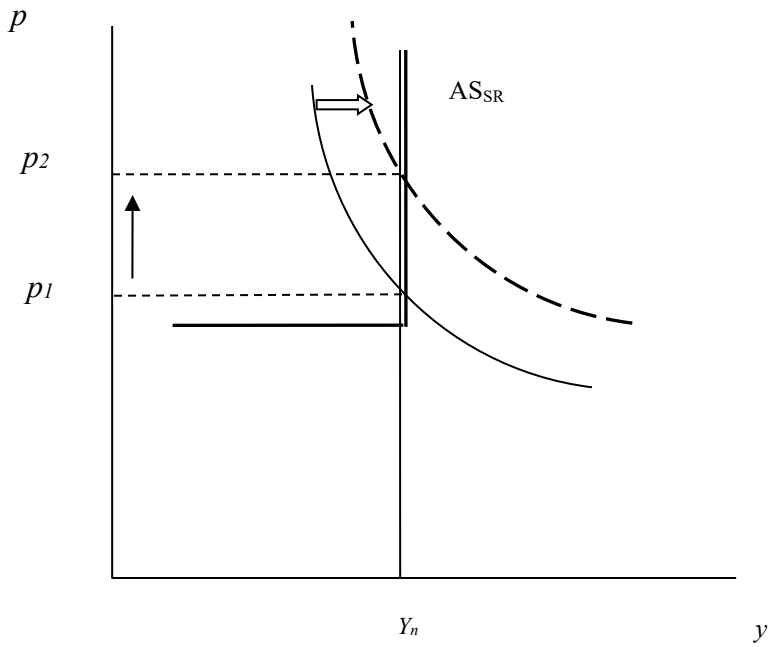


Where:

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

3.2 Suppose output is at Y_n. What is the size of the government spending multiplier for an increase in government spending?

As shown in the figure below, when output is already at yn, then an increase in aggregate demand merely increases the price level (and alters the composition of output) with no impact on output.

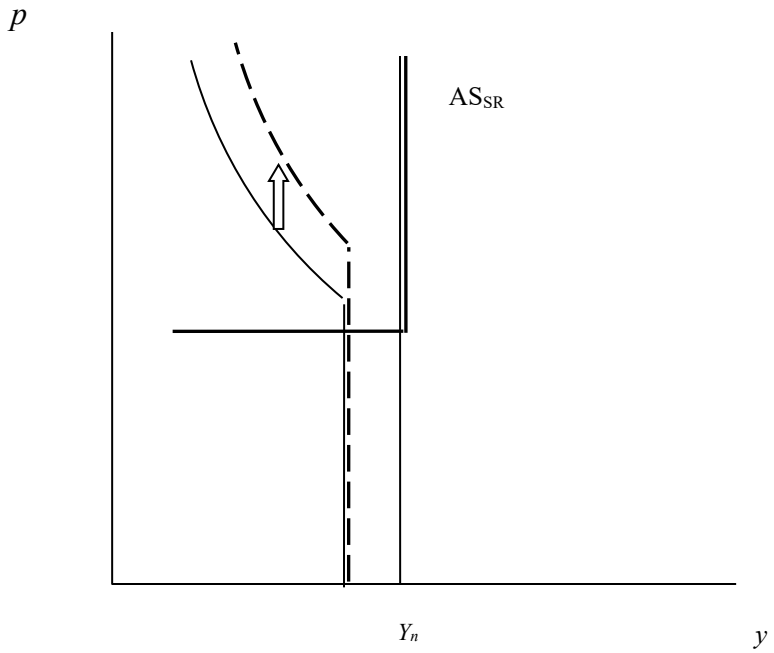


3.3 Using the same assumptions as in 3.2, state the size of the increase in income arising from a $1 billion increase in the money supply.

The increase in the money supply by $1 billion (in real terms) cannot be accomplished. An increase in $1 billion results in a proportionate increase in the price level such that the real money supply is unchanged (as is output). The AD shifts out, as in the figure provided in the answer to 3.2, and the price level is the only variable changed. Notice that if $1 billion were to represent an x% change in the nominal money supply, the price level would rise by x%.

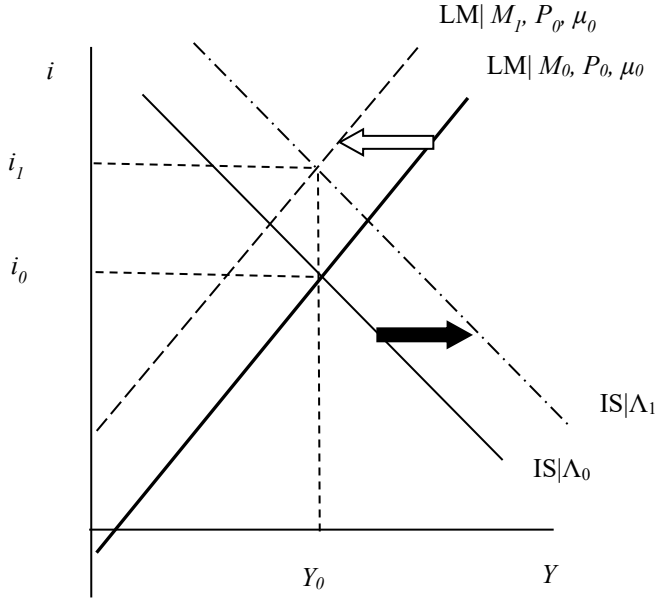
3.4 Suppose output is currently below Y_n, but interest rates are already at zero. What is the size of the increase in income for a $1 billion real increase in money supply?

This answer is similar to the answer to a question on the midterm. If interest rates are at the zero lower bound, then an increase in the real money supply has no impact on aggregate demand, and hence output.



3.5 Re-answer 3.1, using the same assumptions, but assume the central bank will not let output rise. Show what does the IS-LM diagram look like.

When the government increases government spending, the IS curve shifts out (black arrow). The LM is shifted in (white arrow) so as to keep the income level at Y_0, with interest rates rising from i_0 to i_1. The composition of GDP changes with government spending rising as a proportion, and investment falling.



4. Suppose the pure expectations hypothesis of the term structure applies.

4.1 Can credit easing (buying long term Treasury securities) affect the long term interest rate relative to the short term interest rate?

If the pure expectations hypothesis of the term structure (EHTS) holds, then:

$$i_{nt} = \frac{(i_{1t} + i^e_{1t+1} + \ldots + i^e_{1t+n-1})}{n}$$

So only the expected future interest rates matter. Remember, EHTS holds if bonds of different maturities are treated as perfect substitutes. Then purchases of long term Treasury securities have no effect on prices (and hence yields) of long term vs. short term bonds.

4.2. How can forward guidance affect the long term interest rate. Show using algebra.

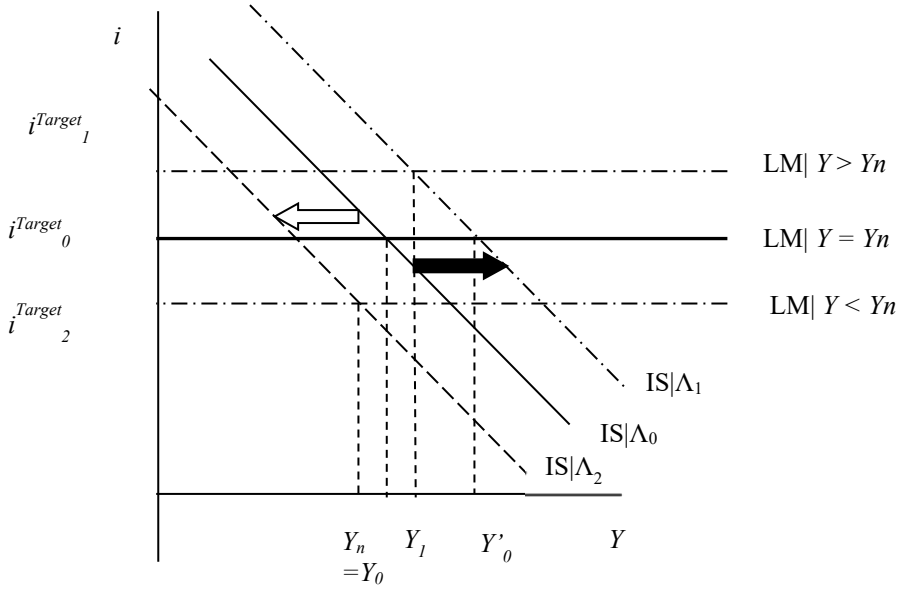
Forward guidance (stating a path for future short rates) can affect expected future short rates. Given the expression shown above in the answer to 4.1:

$$\delta i_{nt} = \frac{(\delta i_{1t} + \delta i^e_{1t+1} + \ldots + \delta i^e_{1t+n-1})}{n}$$

Where the δ denotes the change relative to pre-forward guidance.

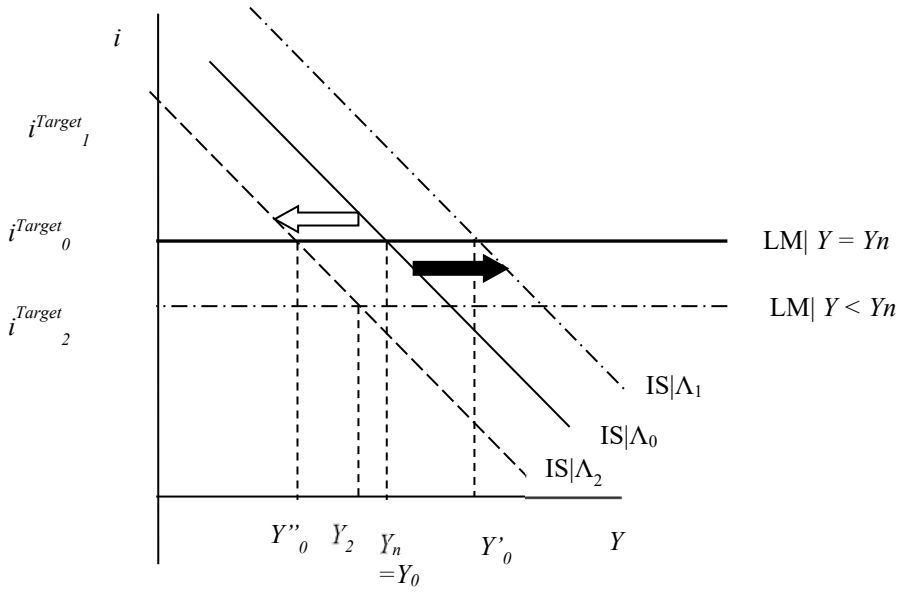
5. The new monetary policy framework indicates that the Fed will pursue a maximum employment target, rather than a full employment target. (By Okun's Law, when $Y > Y_n$, $u < u_n$, and vice versa).

5.1 Show how the LM curve is moved when output rises above Y_n, and when it falls below Y_n, using the old framework (assuming the Taylor rule is used).



When IS shifts out as Λ_0 rises to Λ_1 (black arrow) without a Taylor rule, the LM would stay targeted at $i^{Target}{}_0$. When the Taylor rule applies, the Fed raises the target interest rate to $i^{Target}{}_1$ as output would tend to rise above Y_n. So instead of output rising to Y'_0, it rises only to Y_1. The reverse occurs for Y < Yn, as IS shifts in (white arrow).

5.2 Show how the LM curve is moved when output rises above Y_n, and when it falls below Y_n, using the new framework.



Under the new framework, when IS shifts out as Λ_0 rises to Λ_1 (black arrow) the LM would stay targeted at $i^{Target}{}_0$ *, output rises to* Y'_0. But when output falls as IS shift in (white arrow), the Fed lowers the target interest rate to $i^{Target}{}_2$ as output would tend to fall below Y_n. So instead of output falling only to Y_2.

5.3 What does the new monetary policy framework imply for fiscal multipliers? Will they be generally larger or smaller, or just different, from those seen in the old framework.

Fiscal multipliers as IS shifts out are larger under new framework than under old, because the Fed doesn't raise interest rates as IS shifts out.