

NOTES ON THE MIDTERM

Preface: This is not an answer sheet! Rather, each of the GSIs has written up some notes on the answers to the questions that they graded; we hope you will find them helpful. Each of them did this in a slightly different way, and none of them tried to provide perfect answers to their questions. For example, although good answers generally include diagrams and these notes often allude to diagrams that could or should go in answers, the notes do not include any actual diagrams. In addition, the GSIs' sometimes often go into more detail than is reasonable to expect on an exam.

PART I: Multiple choice

There are two versions: a (with an "α" at the top of p. 1) and b (with no "α").

Answers to version a: B A A B D A C C B C A D C D

Answers to version b: A C D C C A D C B D B A B A

Some notes on specific questions that many people got wrong:

- A major reason that we assume $G = \bar{G}$ in most of our models is that:
 - Many people chose "D" for this answer, which stated that "This is an undergraduate course..." The correct answer was "C," that modeling G this way allows us to consider exogenous shocks to G and not to concern ourselves with how G changes endogenously in business cycles. In fact, most graduate level courses model G this way. (The broader message here is one that was mentioned a few times early in the semester: you shouldn't think of the goal of modeling as trying to build ever more complicated and more realistic models.)
- A problem with "natural experiments" is that:
 - Many people chose "C," which stated that random measurement error in the dependent variable will cause bias in the result. Actually, measurement error in the dependent variable is not a problem. It is measurement error in the independent variable that causes attenuation bias (bias toward zero). more importantly, the correct answer "D," captures something that is specific to natural experiments—natural experiments are not genuinely random (that is, not truly randomly assigned), so there may still be omitted variable bias. In a natural experiment, we take a real life event that we think gets us very close to random assignment, but in the real world there is always a concern that non-random factors may be playing a role.
- The following best describes the behavior of real output in the US in the Depression:
 - Many people chose "B," that output fell rapidly from 1929 until 1933 and then changed little until the US entered WWII. This is incorrect since there was clearly rapid growth in output after output hit its trough. Many people were thrown off by the 1937 recession. It is true that there was a decline in output in 1937, but that does not justify the statement made in "B," and it does not invalidate the statement in "A" (the correct answer) that output began growing rapidly after April 1933.

PART II: Short answer

15:

This question asks you to figure out what happens to net exports when we move up the aggregate demand curve. As we move up the AD curve, inflation is rising and output is falling. As inflation rises, the central bank adjusts monetary policy according to its interest rate rule: $r = r(Y, \pi)$, which is increasing in both arguments. When π rises, the central bank sets a higher level of the target interest rate at every level of output: the MP curve shifts up on the IS-MP diagram. When the MP curve shifts up, it intersects the IS curve (which has not been affected) at a new, higher level of the real interest rate (r) and a lower level of output. When r increases, net capital outflows fall, since capital outflows are a decreasing function of the (domestic) real interest rate. Finally, we know that $CF(r) = NX(\epsilon)$, so when capital outflows fall, net exports also fall. Therefore, as we move up along the AD curve, net exports are falling.

(Note: Since the question does not ask about the exchange rate, and since it is not necessary to figure out what happens to the exchange rate to figure out what happens to net exports, it was not necessary to discuss the exchange rate to answer the question well.)

16:

The statement raises a large number of issues. Since the problem was in the “short answer” section, we did not expect you to address all of them.

We can go much further in analyzing this question than simply stating that correlation is not causation. In fact, it's possible to say a lot in response to the statement using the models from class and the historical evidence.

First, note that in the standard IS-LM model, a negative spending (IS) shock will cause both output and the real interest rate to fall. If expected inflation (π^e) is constant, the nominal interest rate will also fall. This provides evidence that the mechanism suggested by the problem statement can indeed generate the observed pattern of interest rates. Note that while expansionary monetary policy (moving LM out) also causes declines in the real interest rate, it causes output to increase --which is not consistent with the fact that the economy was severely contracting between 1929 and 1933.

Next, relax the assumption that expected inflation was constant. In the IS-LM model, falls in π^e shift the LM curve up, but r rises less than π^e falls, so nominal interest rates ($i = r + \pi^e$) will fall on net. So, a fall in π^e can cause output to fall, real interest rates to rise, and nominal interest rates to fall, meaning that a second mechanism apart from IS shocks can cause the observed behavior of interest rates and output. Further note that if a monetary shock (pushing LM in/up) is what *causes* π^e to fall (and not some external force), monetary shocks can cause i to fall as output falls, even with rising r . In fact, we know that during the Depression, there was significant expected *deflation* ($\pi^e < 0$).

Finally, evidence: In “The Missing Transmission Mechanism in the Monetary Explanation of the Great Depression,” Romer and Romer argue exactly along the lines above. In the article, they note that for Friedman and Schwartz's monetary explanation of the Depression to hold, expectations of deflation must have been *caused* by monetary contraction. Using evidence from *Business Week*, Romer and Romer document that monetary policy developments were a key source of the expected deflation after mid-1930. Further, thinking back to lecture, we saw that between 1928 and 1930, high-powered money fell, and nominal interest rates rose in 1928 and early 1929. After that, both nominal and real interest rates fell through early 1930. There is thus some evidence that IS shocks played a role in the early part of the downturn. However (as Romer and Romer argue), there is not much evidence of further IS shocks between mid-1930 and 1933, while there is lots of evidence of monetary shocks (for instance, bank failures) during that period.

Given all of this, it's best to label the statement as false or uncertain, and then go from there along the lines above in explaining why.

PART III: Problem (17a and 17b)

17a:

There are two parts to this question: First, reducing g from a positive number to zero leads to a flat MP curve in the IS-MP diagram. The positive slope of the MP curve in the model we usually assume is exactly due to the response of monetary policy to the output gap in the monetary policy rule. If the central bank does not respond to deviations of output from trend (or from full employment output) as in this question, the real interest rate only responds to deviations of inflation from the target. Hence, in the IS-MP diagram the real interest rate is the same for every level of output in the short run, or we can say that the MP curve is a horizontal line. Changes in inflation still shift the MP curve up or down as in the conventional model. The size of these shifts is also identical between both models because h in the policy rule is the same for both models.

Second, an increase in government spending shifts the IS curve to the right. Now, you need to compare the effect on output (in the short run!) in the standard model and the model with $g = 0$. Starting at the same equilibrium you can directly see that horizontal MP curve leads to larger change in output compared to the upward sloping MP curve (it is a similar logic as we found that fiscal policy is more powerful at the ZLB). The intuition can be summarized as follows: Starting at full employment output, an increase in government spending brings output above full employment level. In the standard model the central bank responds by increasing the nominal rate i based on its policy rule ($g > 0$). Since inflation is constant in the short run the real interest rate is higher. This crowds out investment and net exports, hence output is reduced partly but is still higher than initially (as MP is not a vertical line). With $g = 0$ this effect disappears. The central bank does not change the real interest rate in the short run, so output increases by the full amount of the rightward shift of the IS curve.

17b:

In this question you are not asked to think about the long run effects of the fiscal expansion. We asked you to think how the change in the policy rule affects the AD-IA diagram. You can answer by exclusion: Does the change affect the IA curve? NO, the adjustment of inflation to the output gap is derived from the price-setting behavior of firms and households and independent of monetary policy. Does it affect the AD curve? YES. But how? It is advisable to derive the AD curve from the IS-MP diagram as we did in class. The MP curve shifts to changes in inflation in the same magnitude in both models (h in the policy rule is unchanged). We can shift the MP curve up and/or down under both policies and remember that the vertical distance at the initial output must be the same when we shift either MP curve (upward-sloping, which corresponds to $g > 0$, or flat, which corresponds to $g = 0$). Then trace out the AD curves for both models. You will find the AD curve under the new policy rule is flatter than under the old policy. However, it is still downward-sloping. Intuitively, the AD curve tells us what output is given inflation (lecture notes). Output is more sensitive to inflation with $g = 0$ now since the central bank does not “work against” output movements directly. We can see this better with $r = i - \pi$. Given π , with $g = 0$, the nominal interest rate does not respond to the output gap, hence the real interest rate does not respond to the output gap. With the feedback from the output gap to the real interest rate to output gap (via investment and net exports) no longer present, the output gap responds more (in absolute terms) to a given change in the inflation rate. Therefore, the AD curve is flatter when $g = 0$.

PART IV: Essay (18)

There are many ways of writing a good essay. What good essays have in common is that they have a logical structure where arguments are linked and claims are substantiated with evidence. Excellent answers flesh out arguments by working through the mechanisms in our model, and cite readings / lecture notes to evaluate whether they are likely to hold empirically.

Here's a sketch of an excellent answer, with occasional commentary. (Note that not all aspects were required to get full marks!):

1. Start by using IS-MP to illustrate the initial situation: the IS and MP curves cross along the flat part of the MP curve (because the problem states that the central bank has reduced the policy interest rate to zero) at a point where Y is less than \bar{Y} (because the problem states that output is less than potential). Then argue that conventional monetary policy, i.e. lowering the Federal Funds Rate or increasing the money supply, is not effective at the Zero Lower Bound (ZLB). It also makes sense to introduce the question from a historical perspective, mentioning the Great Depression, Great Recession and Japan in the last 25 years as episodes where the ZLB was binding.
2. Discuss, using IS-MP, what could be done at a general level to raise output in the short run. This includes either a shift right of the IS curve, or a shift down of the flat part of the MP curve.
3. Then, discuss *specific* actions, relating them to the diagram, and saying why/how they would shift the curves. (Note that 'shifting IS right' and 'raising expected inflation' are not good answers here, because they are not specific actions, just categories of actions.) Superb answers do not only mention specific actions, but also demonstrate a knowledge of when and how these actions have been used in the past.

Here are some of the most common actions mentioned. (This list is not exhaustive—but since the problem only asked for three actions, there was no extra credit for listing more than three in an answer.)

- a. **Fiscal Policy:** Increasing government expenditure or reducing taxes. This shifts out the IS curve, which is particularly effective at the ZLB, because interest rates do not rise to counteract some of the effect on Y . This was part of the policy mix in all three episodes, the New Deal during the Great Depression, the Stimulus Package in the Great Recession and under Shinzo Abe in Japan.
- b. **Quantitative Easing:** Quantitative Easing means the purchase of assets such as long-term government bonds or mortgage backed securities by the central bank to a) increase their price and b) reduce their yields/interest rates. Higher prices mean more wealth which increases consumption at every interest rate. Lower long-term interest rates mean more investment at any given short-term interest rate. Both of those shift the IS curve to the right. Moreover, QE might signal the central bank's commitment to higher inflation, thus increasing expected inflation and shifting the flat part of the MP curve down. (Note that QE does NOT work simply through increasing the money supply/shifting the upward-sloping part of the MP curve). QE was used in the Great Recession by many countries, including the US and Japan.
- c. **Currency devaluation:** Currency devaluation works by increasing net exports/capital outflows *at any given real interest rate*, thus shifting out the IS curve. (Note that this corresponds to a shift in the $CF(r)$ function rather than a movement along it.) Excellent answers noticed that the central bank cannot devalue its currency simply by printing money, as the usual channel through lower interest rates does not work at the ZLB. When exchange rates are floating, it can use a combination of interventions in the foreign exchange market and signaling that returns on domestic assets are likely to be low for a long time. When exchange rates are fixed (or during the Gold Standard), it can peg the currency at a lower rate. It can also move from fixed to floating exchange rates and vice versa. Examples from history include Roosevelt taking the US off the Gold Standard in 1933 or the actions by the Japanese central bank after Shinzo Abe was elected.

- d. **Forward guidance:** Forward guidance means that the central bank attempts to manage economic agents' expectations to increase expected inflation now and thus lower the flat part of the MP curve. Specifically, it can promise to keep interest rates low until unemployment (output) has fallen (risen) to a specified level. It can also directly issue positively worded statements about inflation and output rising. Good answers mentioned that its effectiveness depends on the central bank's credibility. Examples include the fireside chats of Roosevelt and the video on inflation we watched in lecture, and FED policy under Bernanke after the Great Recession.
 - e. **Adjust inflation target / price level targeting:** One way of raising expected inflation is by increasing the inflation target, or by moving to price level / average inflation targeting. Price level or average inflation targeting is effective because it implies the FED will want inflation to be *above* average for a time after a period of low inflation. Examples include Japan's shift from a target inflation rate of 1 to 2% under Shinzo Abe. Good answers mentioned that the effectiveness of this policy depends on the central bank's credibility.
 - f. **Reduce financial frictions:** 'Financial frictions' refers to anything that leads to the non-optimal functioning of financial markets. For instance, output may be low after a financial crisis because banks have toxic assets on their balance sheets and want to lend even less than they normally would at zero interest rates. One way to increase lending and therefore investment is to take those toxic assets of banks' balance sheets, thereby increasing liquidity. This would shift out the IS curve by increasing investment at any given real interest rate. Examples include the bail-out packages for banks that were passed in many countries during the Great Recession.
 - g. **Negative nominal interest rates:** Recent experience by central banks in Europe and Japan suggests that the ZLB may not actually be strictly binding. Nominal interest rates can be lowered *slightly* below zero, thus shifting the flat part of the MP curve down. Excellent answers described that the scope of this policy is likely limited, since consumers could always switch to cash if interest rates became too negative.
 - h. **Regime shift:** A regime shift is a fundamental change in the conduct of monetary and/or fiscal policy. It can include a variety of the measures mentioned above. Examples include the US leaving the Gold Standard in 1933 or the move to 'Abenomics' in Japan after the Great Recession. Excellent answers fleshed out some of those specific examples, and argued that regime shifts were particularly likely to change inflation expectations because it was more likely that economic agents noticed something was changing, and because they signal strong commitment on behalf of policy makers to increase output and inflation.
4. Finally, evidence. The best essays used references to the readings and/or the lecture slides to critically evaluate whether a given policy action is likely to be effective. Simply mentioning that a certain tool has been used in the past does not constitute good evidence. Frequent references included Gagnon et al. on QE, Romer and Hausman-Wieland on regime shifts and expected inflation, and Nakamura & Steinsson on fiscal policy. Another way to substantiate your arguments is by referring to specific episodes in history. For instance, you could argue that forward guidance is difficult to implement in practice, as evinced by Japanese inflation being far below the new 2% target even years after it was announced.