

Review Questions: AS/AD Model

Econ520. Prof. Lutz Hendricks

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1. Short questions AS/AD model

1.1. Regulation -> employment

(10 points) Does government regulation reduce total employment in the medium run? Through which channels? Explain using the AS/AD model as a guide.

Answer: The obvious answer is (as so often) wrong: Regulation raises firms' costs. Firms hire fewer workers. This logic works when applied to a single firm, but not in equilibrium (when workers can move between firms and prices can adjust).

In the medium run, regulation likely has little effect on employment. Employment is determined by labor supply (not obviously affected by regulation) and labor demand (real wage). Regulation presumably reduces the marginal product of labor and hence labor demand. Some employment reduction is possible this way. But then the long-run labor supply curve is probably very wage inelastic (think long-run employment trends).

1.2. Interest rate target -> AD curve

(10 points) Suppose the Fed implements an interest rate target. That is, the Fed adjusts M to hold $i = i^*$ no matter what. What would the AD curve look like (in a closed economy)? Derive your answer using the IS/LM diagram below. Explain in words what you find.

Answer: The AD curve would be vertical (independent of P). The transmission mechanism from prices to AD works only through i (in the closed economy).

Details: AD is derived by tracing out intersections of IS/LM as P varies. In our baseline model, higher P shifts LM left and raises i . That's why AD falls. When the Fed fixes i : higher P does nothing in the IS/LM diagram. The Fed increases M to hold $i = i^*$. Note: The question asks "what does AD look like?" It is not about any shifts in AD. The question is also not about policy effectiveness.

1.3. Why does AD not play a role in MR?

(10 points) In most of the models that we considered, aggregate demand plays an important role. But in the growth models, we never even wrote down a demand side. Explain why this makes sense.

Answer: One of the key insights from the short/medium run models is that supply determines medium run output. Demand just determines prices.

Why is this? Mechanically, it happens because price expectations catch up with actual prices and then the supply curve becomes vertical.

The economic mechanism is really that factor supplies do not depend on the level of aggregate demand (or prices). How many hours people want to work depends on real wages and on how much is paid to those who don't work. It does not depend on aggregate demand.

1.4. Why doesn't G increase Y in MR?

(10 points) Across all of our AS/AD models (closed and open economy) we found that increasing government spending does change not medium run output. What is the intuition for this general result?

Answer: Mechanically, the reason is that the MR-AS curve is vertical. Then it determines Y while demand only determines P .

The intuition for this result is as follows. AS is basically determined by technology (think real wage) and household preferences (how much to work for a given real wage). The price level "should" not play a role. Without any price (expectations) stickiness, raising G would simply crowd out some other form of demand (e.g., I via higher i). This does not affect real wages or the incentives to work and hence AS). In the short run, sticky prices drive a wedge between prices and price expectations. That changes perceived real wages. But the stickiness eventually resolves (P^e catches up with P).

1.5. Why is AD downward sloping?

(10 points) Explain why the aggregate demand curve is downward sloping in the price level.

Answer: Recall the AD comes from the intersection of IS and LM. Higher prices reduce M/P , shifting the LM curve left. The interest rate rises, which reduces demand. The economic intuition: People need more liquidity when prices are high. They sell bonds, which drives up interest rates and crowds out demand.

1.6. Does infrastructure spending create jobs?

(10 points) Comment on the following claim:

A \$1.1 trillion infrastructure spending package would create roughly 500,000 new jobs in the medium run.

(My interpretation of a story by CBS News, July 27, 2021.)

Answer: We discussed this in class. Medium run employment is determined entirely by AS. A spending package cannot create jobs by adding to AD. It has to shift MR-AS. Its only lever to do so is to increase labor productivity (the real wage). But that runs into the problem that medium run labor supply does not look upward sloping in the real wage.

2. Fiscal Expansion

Consider the AS/AD model, which consists of

$$\text{AS : } Y = F\left(\frac{P}{P^e} \times \frac{1}{1+m}, z\right)$$

$$\text{IS : } Y = C(Y - T) + I(Y, i) + G$$

$$\text{LM : } \frac{M}{P} = Y \times L(i)$$

We examine the idea that government spending programs (e.g., infrastructure building programs) create jobs. To be specific, consider a permanent increase in government spending ($G \uparrow$).

Use the AS/AD graph and the IS/LM graph to illustrate your answers.

Questions:

1. (14 points) Explain what would happen in the **medium run** to output, investment, consumption, and prices. To what extent does government spending crowd out private spending? What is the economic mechanism underlying the crowding out?

Answer:

- Equilibrium is MR-AS and AD. AD shifted out. Hence output is unchanged and prices are higher. No jobs are created. They are just shifted around.
- In the background: IS shifts out. Higher prices shift LM left. The interest rate rises. This is the mechanism that causes (full) crowding out.

2. (14 points) Explain what would happen in the **short run** to the same variables. How are workers incentivized to work more than “full employment” ($Y > Y_n$)?

Answer:

- Equilibrium is AS and AD. Hence higher output and prices. Jobs are created.
- In the background: IS shifts out. LM shifts left (less than in the MR). Interest rates rise. Partial crowding out.
- Workers are incentivized to work “too much” because $W/P^e > W/P = 1/(1+m)$. They think the real wage is high.

3. (5 points) Explain the **transition** between short run and medium run.

Answer: The standard story. In the short run, $Y > Y_n$ and $P > P^e$. Price expectations rise, shifting AS up. Prices rise. Lower M/P shifts LM left and raises i . That crowds out I and moves the economy up along AD. This continues until P^e has caught up with P and $Y = Y_n$.

3. Balanced Budget Expansion

Recall the equations for the AS/AD model:

$$\text{AS : } Y = F\left(\frac{P}{P^e} \times \frac{1}{1+m}, z\right)$$

$$\text{IS : } Y = C(Y - T) + I(Y, i) + G$$

$$\text{LM} : \frac{M}{P} = Y \times L(i)$$

Consider a balanced budget increase in taxes (G and T rise by the same amount). Assume the economy starts in the medium run equilibrium.

Explain what happens to I and i in the medium and short run, and during the transition. Explain what you draw.

Questions:

1. (5 points) What do you expect to happen to $C + G$, holding everything else equal?

Answer: The marginal propensity to consume is less than 1. Hence $C + G$ rises. The rest is exactly the same as an increase in G or a decrease in T or any other positive demand shock.

2. (15 points) Graph the old and new medium run equilibrium.

Answer: New medium run: $P = P^e$ implies $Y = Y_n$, which is unchanged (MR-AS does not shift). But AD shifts up (C falls by less than G rises). Outcomes: $P \uparrow$, $I \downarrow$, $i \uparrow$. We know that $I \downarrow$ because $C + G + I$ must be unchanged at Y_n . For I to fall, we need higher i (or look at the money market diagram to see that i must rise).

3. (15 points) Graph the short run equilibrium.

Answer: Short run: P^e is sticky, so AS has not shifted yet. Equilibrium is at the intersection of AS and AD, so that Y and P both rise. From the money market we know that i must have increased (Y and P are both up). The change in I is ambiguous.

4. (15 points) Explain the transition.

Answer: P^e rises gradually, shifting AS toward the medium run equilibrium. On the transition, P rises. That causes i to rise (IS/LM diagram), which crowds out I and causes AD to decline. This continues until P^e has caught up with P .

4. Overshooting

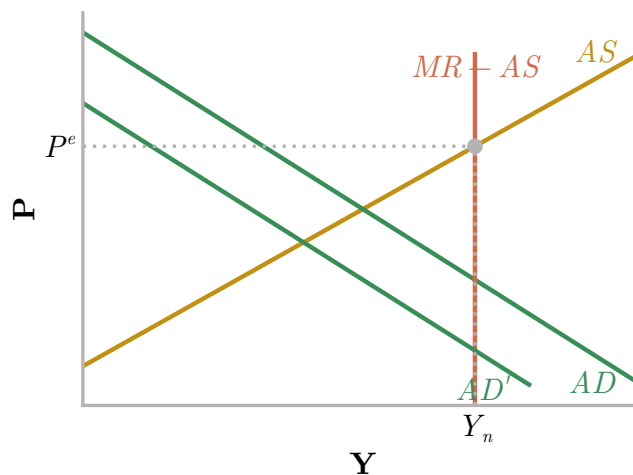
Recall the equations for the AS/AD model:

$$\text{AS} : Y = F\left(\frac{P}{P^e} \times \frac{1}{1+m}, z\right)$$

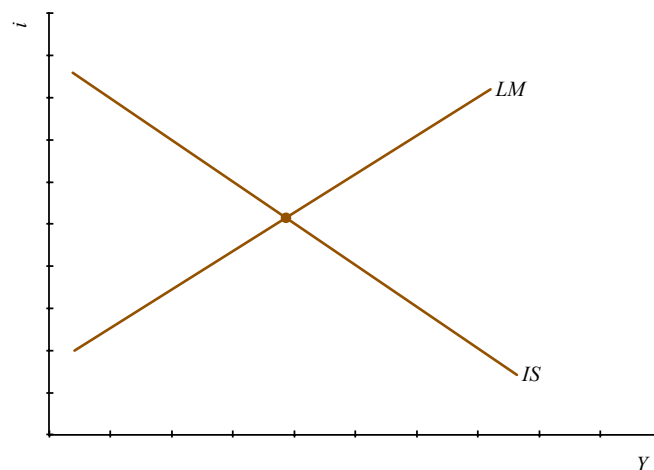
$$\text{IS} : Y = C(Y - T) + I(Y, i) + G$$

$$\text{LM} : \frac{M}{P} = Y \times L(i)$$

Consider an economy that starts in the medium-run equilibrium where $P = P^e$. The treasury reduces G , which shifts AD left. The economy now looks like this:



And the IS/LM graph underlying AD before G is reduced looks like this:



Questions:

- (15 points) Graph and explain the **short and medium run** effects of this shock. Be sure to explain how consumption, investment, and the interest rate change.

Answer: We did all of this in class. See the slides on government spending shocks. Do not forget that lower P shifts LM to the right.

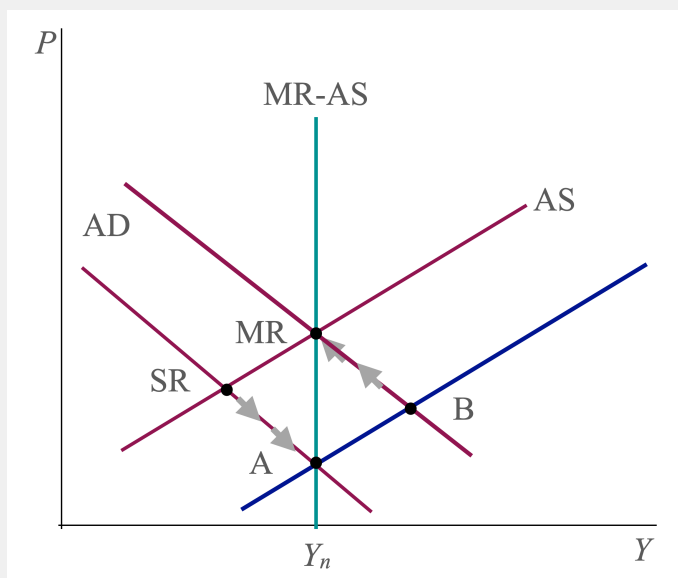
MR: Y unchanged, $P \downarrow$ from the graph. Therefore C unchanged. From IS/LM: $i \downarrow$ and therefore $I \uparrow$ (full crowding in). From money market clearing (or IS/LM): $M/P \uparrow$ (also because $P \downarrow$).

SR: $Y \downarrow$, $P \downarrow$ from the graph. Therefore $C \downarrow$. From IS/LM: $i \downarrow$ and therefore I ambiguous. $M/P \uparrow$ because prices are down.

- (18 points) Now suppose the Central Bank attempts to counteract the shock through a **monetary expansion**. However, the policy affects AD only **with a lag**. Illustrate how this can lead to an overshooting of output (Y rises above Y_n) and additional inflation. This is easiest to graph if you assume that the monetary expansion only takes effect when the economy has reached the medium run equilibrium described in the previous question.

Answer: The economy starts (after the shock) at point SR. Given the assumption that AS shifts first, the economy follows its usual SR → MR transition to point A. Now the monetary stimulus kicks in, which shifts AD right. The economy is at point B. Since we are above full employment, AS shifts left again until we reach MR.

The end result is overshooting of full employment output and a period of inflation (A → MR).



5. AS/AD: Liquidity Trap

Recall the equations for the AS/AD model:

$$AS : Y = F\left(\frac{P}{P^e} \times \frac{1}{1+m}, z\right)$$

$$IS : Y = C(Y - T) + I(Y, i) + G$$

$$LM : \frac{M}{P} = Y \times L(i)$$

Recall that the AD curve is derived as the intersection of IS and LM as the price P varies. Here, we consider the implications of a **liquidity trap**.

Questions:

1. (11 points) Using an IS/LM diagram, show that the AD curve turns vertical when the price level gets low enough for a liquidity trap. Explain the economic intuition.

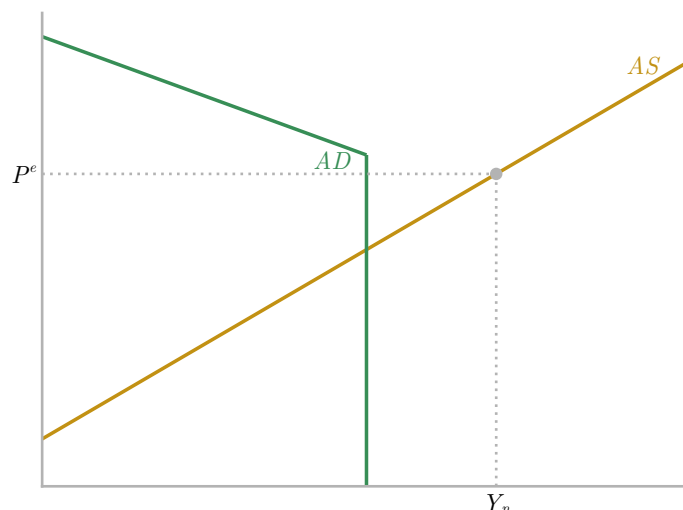
Answer: Start from a standard IS/LM diagram. When $P \downarrow$ the LM curve shifts out. Usually, the interest rate falls, moving the equilibrium along IS (as $I \uparrow$). This is the monetary transmission mechanism.

In the liquidity trap, the interest rate hits zero. The LM curve becomes flat at zero interest. Lowering P shifts LM to the right, but this can no longer reduce i . The AD curve becomes vertical ($P \downarrow \Rightarrow Y$ unchanged).

Intuition: the transmission mechanism ($i \downarrow \Rightarrow I \uparrow$) is broken.

Looking ahead to the next question: If a lower P does not raise output, then a higher M does not either. This means that raising M does not shift the AD curve (the intersection of IS/LM).

2. (7 points) Using the AS/AD graph below, show the implications of a monetary expansion when the economy is in a liquidity trap. Explain the economic intuition.



Answer: When the equilibrium is in the vertical part of AD, a monetary expansion does nothing at all. The AD curve does not shift. Higher M shifts LM to the right. Just like lower P , this does not increase output in the IS/LM diagram. Therefore, AD does not shift.

Intuition: The reason why AD usually shifts right when $M \uparrow$ is that $i \downarrow$. But, as the IS/LM diagram shows, this does not work in a liquidity trap. Households absorb the additional liquidity at a fixed interest rate.

6. Positive Supply Shock

Recall the equations for the AS/AD model:

$$AS : Y = F\left(\frac{P}{P^e} \times \frac{1}{1+m}, z\right)$$

$$IS : Y = C(Y - T) + I(Y, i) + G$$

$$LM : \frac{M}{P} = Y \times L(i)$$

Consider an economy that, starting in full employment equilibrium, experiences a positive supply shock. We model the shock as a permanent decrease of m .

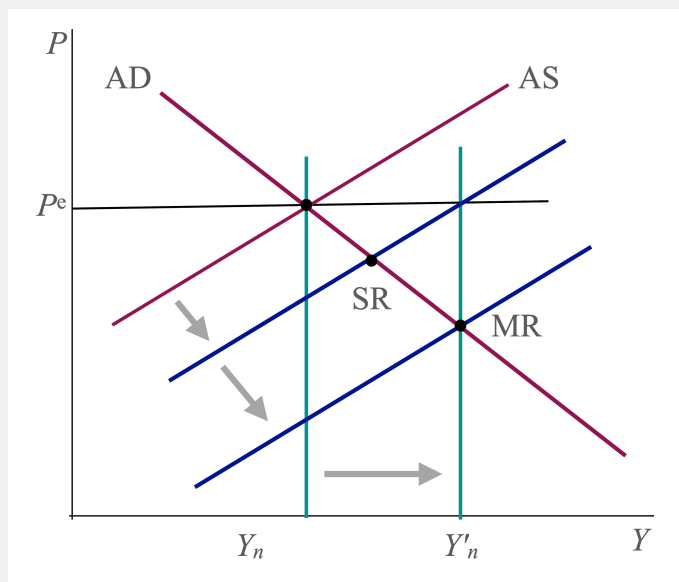
Questions:

1. (10 points) Graph the new short-run and medium run equilibria. Explain which curves shift and why. Defer other explanations to the next answer.

Answer: MR-AS shifts right. SR-AS does the same, intersecting the new MR-AS where $P = P^e$. P^e is unchanged in the SR.

MR: intersection of MR-AS and AD ($Y \uparrow, P \downarrow$).

SR: intersection of SR-AS and AD (also $Y \uparrow, P \downarrow$, but less).



2. (15 points) Derive what happens in the short run to output, prices, consumption, investment, and interest rates. Explain the sequence of events that leads from the original equilibrium to the new short run in words.

Answer: $C(Y - T) \uparrow$. From the IS/LM diagram: lower P shifts LM right. Hence lower i . Hence $I \uparrow$.

Explanation: The shock raises AS. Excess supply of goods forces firms to lower prices. Higher M/P causes households to buy bonds, which lowers i . That raises I . The process continues until AD has risen to meet the higher AS.

3. (5 points) Explain what happens during the transition from short run to medium run.

Answer: In the SR, $P < P^e$, so $P^e \downarrow$. Workers perceive a higher real wage W/P^e and work more. This acts very much like more of a supply shock. Firms can lower prices and the same process that led to the short run occurs again.

4. (10 points) If you were running the Fed, how would you respond to this shock? What real world complications would you have to worry about? Illustrate in a graph.

Answer: Without lags the answer is easy: shift AD right (by raising M) to get the economy right away to full employment. That holds prices constant. It speeds up the increase in Y and avoids a period of deflation.

The real world complication is lags. If it takes time for AD to adjust, I would opt for a smaller stimulus. I would target it so that SR-AS and the shifted AD meet at full employment once the monetary expansion has fully kicked in.

7. Adverse Supply Shock: Policy Responses

Recall the equations for the AS/AD model:

$$\text{AS} : Y = F\left(\frac{P}{P^e} \times \frac{1}{1+m}, z\right)$$

$$\text{IS} : Y = C(Y - T) + I(Y, i) + G$$

$$\text{LM} : \frac{M}{P} = Y \times L(i)$$

Suppose the economy starts in the medium run equilibrium and experiences an adverse supply shock ($m \uparrow$).

Questions:

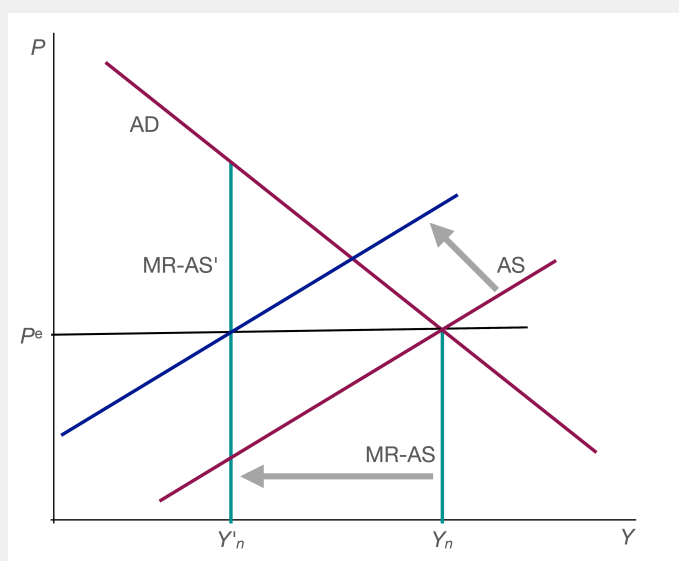
- (20 points) Graph the short-run and medium-run changes in Y and P for the case where monetary and fiscal policies do not respond to the shock. Explain your graph.

Answer: We did this in class.

MR: The vertical MR-AS curve shifts left. Y_n falls. With unchanged AD, P rises.

SR: AS shifts up, but not all the way to the MR. $Y \downarrow$, $P \uparrow$.

Transition: AS shifts toward the MR. $Y \downarrow$, $P \uparrow$.



- (16 points) Explain the outcomes if monetary or fiscal policies attempt to stabilize prices.

Answer: Inflation fighting policies. The government can either lower M or G . Both shift AD left. The SR equilibrium now has constant prices. The short-run recession is deeper. AS continues to shift left toward the MR equilibrium, but the government can keep prices constant by further contracting M or G .

This is a reasonable policy option. Eventually, lower output is unavoidable. The government just accelerates the transition to the new MR Y_n .

- (16 points) Explain the outcomes if monetary or fiscal policies attempt to stabilize output.

Answer: Recession fighting policies. The government could try to raise M or G to keep output constant. That shifts AD right and drives up prices. Now AS starts shifting up. The government can continue to fight the contraction by further raising M or G .

Eventually, expectations catch up with policies and the government will have to allow output to fall to the new MR level. It delays the recession at the expense of permanently higher inflation.

8. Government Transfers

As part of the Covid stimulus packages, the U.S. government currently pays transfers to households. Critics argue that these transfers reduce labor supply. Assuming this is true, what are the short and medium run effects of such transfers? Illustrate your answer using an AS/AD diagram.

The appropriate model for this question is the closed economy AS/AD model:

$$AS : Y = F\left(\frac{P}{P^e} \times \frac{1}{1+m}, z\right)$$

$$IS : Y = C(Y - T) + I(Y, i) + G$$

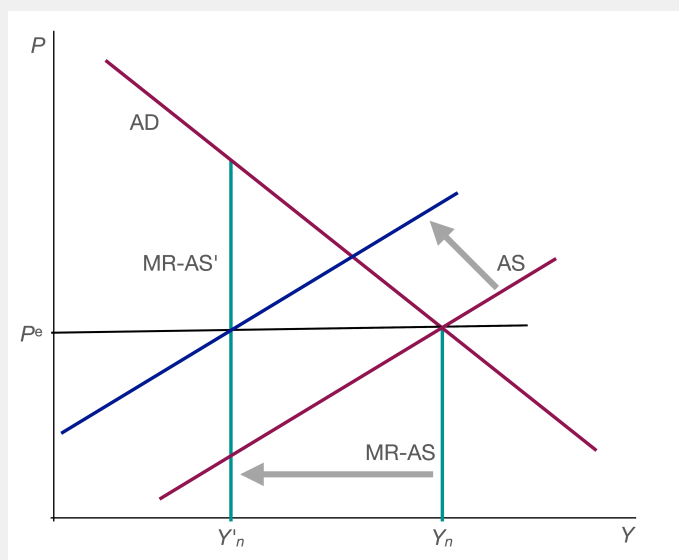
$$LM : \frac{M}{P} = Y \times L(i)$$

Questions:

- (18 points) Graph the medium-run and short-run equilibrium. Explain which curves shift.

Answer: MR-AS shifts left as labor supply declines.

One could argue that AD shifts out. It probably does, but then the transfers need to be financed somehow. So it's unclear and not of primary importance.



- (14 points) What happens to investment, consumption, and interest rates in the medium run?

Answer: The MR equilibrium has higher prices and lower output. In the background: investment declines; so does consumption. The interest rate rises. If it did not, AD would exceed AS. Note that the change in i looks ambiguous if you just look at the IS/LM graph ($M/P \downarrow$, but also $Y \downarrow$).

3. (9 points) What happens to investment, consumption, and interest rates in the short run?

Answer: The SR shift in AS is smaller than the MR shift (b/c price expectations lag behind prices). So we get a smaller contraction than in the MR and a small price increase. I and C again decline. The interest rate i rises.

4. (9 points) Explain what happens during the transition to the medium run equilibrium.

Answer: Prices are above P^e , so P^e starts to rise. That shifts AS up. Prices rise. The reduction in AD comes about because M/P declines and therefore i rises. We get stagflation.

5. (8 points) If the president asked you whether the Fed could do anything to prevent output and employment from falling in this situation, what would you answer? Distinguish between the short run and the medium run.

Answer: The Fed could push AD out. In the short run, this would prevent the output decline. But over time, price expectations will catch on and you just end up with inflation. Once medium run supply declines, demand management cannot do anything about it.

9. Pandemic: Labor Supply Shock

The Covid-19 pandemic caused a massive reduction in labor supply. Explain how this plays out in an AS/AD model. The equations are

$$\text{AS : } Y = F\left(\frac{P}{P^e} \times \frac{1}{1+m}, z\right)$$

$$\text{IS : } Y = C(Y - T) + I(Y, i) + G$$

$$\text{LM : } \frac{M}{P} = Y \times L(i)$$

Assume that the reduction in labor supply (a change in z) is transitory (z returns to normal when the pandemic is over).

Questions:

1. (15 points) Show the changes in the short run and medium run assuming that the pandemic does not affect aggregate demand (not realistic, but also not that far from the truth). Explain what happens to interest rates and investment.

Answer: Medium run: nothing has changed; by assumption, really.

Short run: AS shifts left. AD is by assumption unchanged. So we get lower output and higher prices (which is exactly what we see in the data). In the background (IS/LM diagram), LM shifts left (due to higher P) and interest rates rise. Higher i and lower Y both reduce investment.

2. (15 points) Could government policy stabilize output (in the model)? What happens to investment and interest rates in that case? What happens to inflation?

Answer: Expansionary monetary or fiscal policy could shift AD to the right and get us back to full employment right away (that would not work in reality in a pandemic). What happens to interest rates depends on whether $G \uparrow$ or $M \uparrow$.

Fiscal policy increases i , which crowds out I . But the total change in I is ambiguous (higher Y increases I). Monetary policy lowers i (think IS/LM graph) and therefore I rises unambiguously.

In both cases, we get inflation (which is one of the main risks being debated right now). While the government keeps $Y > Y_n$, P^e keeps rising (it's below P), shifting AS up.

10. European Unemployment

European unemployment rose dramatically in the 1970s and has stayed high ever since. This question studies how downward wage rigidity can cause rising unemployment.

Questions:

1. (15 points) Start with a flexible labor market where wages can rise and fall depending on labor market conditions. Explain how fluctuations in AD lead to Okun's law (a negative relationship between output and unemployment). Use an AS/AD diagram.

Answer: Normal labor market. AD fluctuates. Higher AD raises Y , which lowers u (raises labor input). Workers raise wage demands, which are passed on by firms as higher prices. In recessions the reverse occurs. Y fluctuates around a fixed Y_n (as does u).

2. (15 points) Now assume that wages are downward rigid. Explain how fluctuations in AD can lead to rising unemployment over the course of several business cycles.

Answer: Downward wage rigidity: Nothing changes in expansions. In contractions, W does not fall (z rises), so the decline in Y is larger. In the next expansion, the economy starts with higher z and therefore higher u_n .

11. Inflation Expectations

Recall the AS/AD model with inflation expectations. In the short run:

$$\text{IS : } Y = C(Y - T) + I(Y, i - \pi^e) + G$$

$$\text{LM : } \frac{M}{P} = Y \star L(i)$$

where $r = i - \pi^e$ is the real interest rate.

In the short run, prices are fixed. In the medium run, prices are endogenous and the AS curve is vertical: $Y = Y_n = F\left(\frac{1}{1+m}, z\right)$.

Consider the announcement of **faster money growth in the future** (there is no change in M today, but expected inflation is higher).

Questions:

1. (13 points) Graph the **short run** effects. Explain how Y , i , I , and $r \equiv i - \pi^e$ change. Explain the intuition.

Answer: $\pi^e \uparrow$ shifts IS up (lower r for given i). Y and i rise from the IS/LM diagram. P is fixed by assumption. Investment is up (that's the reason why IS shifts).

Inflation expectations lower the real interest rate. That stimulates investment and raises output. Higher output requires a higher i to clear the money market (as usual).

2. (12 points) Graph the **medium run** effects. Explain how Y , i , r , I , and $\frac{M}{P}$ change.

Answer: $Y = Y_n$ from AS. Then IS fixes $r = r_n$, which is where we started. So i rises by the change in $\pi = g(M)$. From LM: $\frac{M}{P} \downarrow$, so prices must rise. Money is neutral, as usual.

3. (6 points) Based on these findings, what advice would you give to a Central Bank who fights a liquidity trap?

Answer: Liquidity trap: i hits the zero lower bound. Conventional monetary policy does not work. But by convincing the public that future inflation will be higher, the CB can lower the real interest rate and stimulate the economy. Of course, the drawback is that future inflation rises.