

Review Questions: IS/LM

Econ520. Prof. Lutz Hendricks

1. Consumption / saving

1.1. Permanent vs transitory consumption tax

(10 points) Suppose the treasury tries to stimulate aggregate demand by **cutting consumption taxes** (i.e., sales taxes). How does the effectiveness of the tax cut depend on households' expectations about how **persistent** the tax cut will be?

Hint: Think income and substitution effects. But the answer is different from the income tax cut that we discussed in class.

Answer: Key idea: income versus substitution effects.

A **temporary** consumption tax cut lowers prices today relative to tomorrow. Households respond by substituting intertemporally. Consumption rises. The tax cut also increases households' real incomes. Side note: If you are familiar with Ricardian equivalence, you may doubt this statement. But we won't go there. The income effect is weak for a transitory tax cut (small increase in lifetime income).

For a **permanent** tax cut, it's the other way around. There are no substitution effects. The relative price of consumption today vs tomorrow is unchanged. But the income effects get larger.

So the overall answer is ambiguous.

2. Monetary Policy

2.1. What does Fed control? What does it need to control?

(10 points) What is the main policy tool of **traditional monetary policy**? What does the Fed need to control in order to affect aggregate demand? How does the difference between the two interest rates make monetary policy difficult?

Answer: The Fed controls the federal funds rate, which is a nominal, overnight interest rate that only banks care about. Investment and consumption depend on real, longer-term interest rates, such as corporate bond and mortgage rates.

Difficulties:

- Varying the FFR may not affect the nominal bond rates. For example, banks may soak up any liquidity that the Fed injects.
- Lags: It takes a long time for a change in the FFR to affect long-term interest rates.
- The Fed controls nominal rates, but investment and consumption depend on real rates. Lose monetary policy, for example, may change inflation expectations. That affects real rates in a way the Fed does not control.

2.2. Monetary transmission

(10 points) In the IS/LM model, how does the transmission from a monetary expansion to an increase in aggregate demand work? Explain in words.

Answer: If the money supply expands, agents hold more liquidity than they find optimal. They try to sell money and buy bonds. This drives up the price of bonds and lowers the interest rate. Investment demand rises.

2.3. Liquidity trap

(10 points) What is a **liquidity trap**? In words, why does it render conventional monetary policy ineffective? How could the Fed still stimulate aggregate demand in a liquidity trap? You need not graph the IS/LM curves to answer this question.

Answer: Liquidity trap: demand for money becomes highly interest elastic. Typically that happens when interest rates get very close to zero, so that the opportunity cost of holding money is also close to zero. I gave full credit for answers along the lines: a liquidity trap occurs when the interest rate hits zero.

Monetary policy becomes ineffective because the Fed has trouble changing the interest rate. The normal transmission mechanism ($i \downarrow \Rightarrow I \uparrow$) is then broken.

To be effective, the Fed needs to change either the real interest rate (inflation expectations) or expectations about future output or interest rates. Note: The Fed does not control fiscal policy (the treasury and congress do); changing G is not a valid answer.

3. IS/LM Equilibrium

3.1. What happens above the IS curve?

(10 points) The IS curve divides the (i, Y) plane into two halves. In the region above the IS curve, do we have excess supply of or excess demand for goods? **Explain** your answer.

Answer: Above the IS curve there is excess supply of goods. To see this, take a point on IS and move straight up. Higher i reduces demand, while supply stays the same.

3.2. Fiscal multiplier

(10 points) In the IS/LM model, if government spending rises by \$1, equilibrium output rises by more than \$1. What is the economic story underlying this “fiscal multiplier?” How does the size of the multiplier depend on the marginal propensity to consume?

Answer: Higher G increases Y (which equals aggregate demand). That increases consumption (by the MPC times the change in G). That in turn increases Y , which increases C , and so on. By this logic, a higher MPC raises the multiplier.

3.3. Money demand shift

(10 points) In the IS/LM model, money market clearing requires $\frac{M}{P} = Y \times L(i)$. Holding $\frac{M}{P}$ and Y fixed, how does higher money demand (an upward shift of $L(i)$) affect i ? Explain the process that restores money market clearing.

Answer: The money demand curve shifts up, so the interest rate has to rise.

Intuition: Households need more liquidity. They try to sell bonds. That drives down bond prices and raises interest rates. The process continues until liquidity is so costly that households are happy with the liquidity they have (which is fixed).

4. Expectations as a Policy Tool

Consider a slight variation of the standard IS/LM model:

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

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

The new feature is the underlined expectations term in the IS curve $\underline{i^e}$. The idea is that investment projects last a long time. Therefore, investors care about future interest rates, i^e . In particular, low future interest rates stimulate investment today because capital costs are low.

Suppose that the Fed announces today that it plans to keep interest rates low in the future.

Questions:

1. (15 points) In an IS/LM diagram, show how this announcement would affect today's output and interest rate. Explain your answer.

Answer: In short, this is a standard positive demand shock that shifts IS to the right. Output and interest rates rise, as do investment and consumption.

A complete answer explains that IS shifts right because $I \uparrow$. It illustrates the new equilibrium in the graph, which shows that Y and i both rise.

2. (20 points) Explain in words why these changes come about. In particular:
 - Explain what happens to investment and consumption.
 - Explain what role the money market plays in dampening the effects of the shock on output.
 - Explain the sequence of events that lead to the new equilibrium.

Answer: The answer is essentially the same as that for any other positive demand shock. Consumption rises because $Y \uparrow$. Investment rises due to the shock and because $Y \uparrow$, but it is dampened by higher i .

Sequence of events (as for any demand shock):

- Higher I raises Y .
- C rises, creating the usual multiplier effect.
- The economy moves horizontally to the right (new IS curve; same i).
- Money demand rises. People try to sell bonds, driving up i . That crowds out I .
- We move north-west along the IS curve to the new equilibrium. That movement reduces money demand and continues until the money market clears again. It also reduces I as interest rates rise. That's how the money market dampens the shock.

Notes:

- The answer should stay “within the model.” For example, it may be reasonable to surmise that consumption also depends on future interest rates, but that’s not in the model. Here, consumption simply rises because current income rises.
- The future increase in i does not mean that M rises today.

5. Interest Rate Rule

Recall the equations of the IS/LM model:

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

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

Empirically, Fed policy is well approximated by a “Taylor rule” where the interest rate is a function of the output gap ($Y - Y_n$) and inflation. Here we consider the case where only the output gap matters (because prices are fixed) and the Fed sets

$$i = i_0 + d(Y - Y_n)$$

with $d > 0$ and Y_n is the Fed’s full employment target.

Consider shocks to the demand for goods (e.g., $G \uparrow$) or to the demand for money (e.g., $L \uparrow$ for given i). For each case:

- Does the Taylor rule stabilize output compared with the baseline model where the Fed simply holds $\frac{M}{P}$ constant?
- How does the Fed change M in response to the shock?

How do your answers depend on the value of d and the slope of LM? Illustrate your answers in graphs and explain the intuition.

Questions:

1. (21 points) Fiscal shock

Answer: Let’s work with the model. We now have 3 equations: IS, LM, Taylor. So we need 3 endogenous variables: i, Y, M . If we place i and Y on the axes of the graph (as usual), IS and Taylor determine those variables. LM determines M . We are basically replacing the LM curve with the upward sloping Taylor rule curve (slope d).

The fiscal shock moves the IS curve out. The equilibrium moves north-east along the Taylor rule curve. The LM curve no longer matters for equilibrium because M is now endogenous.

Does the Taylor Rule stabilize output? The answer depends on whether the Taylor Rule is steeper or flatter than the LM curve. This is determined by the value of d .

Start with the case where the Taylor rule curve has the same slope as LM. Then we get constant money and the same outcomes as in the baseline model.

If the Taylor rule is steeper than LM (the Fed places more emphasis on output stability), we get the same result as if the LM curve were steeper. To get that, the Fed has to contract M when $G \uparrow$. The opposite happens when d is small.

Intuition: Start with the extreme case where d is very large. Then the Taylor rule curve is essentially vertical and output never deviates much from Y_n . The Fed achieves this outcome

by raising i a lot (contracting M a lot) when Y starts to rise above Y_n . Any shock to output is immediately neutralized through monetary policy.

2. (10 points) Money demand shock

Answer: Output and the interest rate are again determined by IS and Taylor. The LM curve only determines M . Any shocks to LM are immediately neutralized by the Fed. If money demand rises, the Fed simply supplies more money to keep the interest rate and output fixed.

6. IS/LM: Liquidity Trap

Consider a simple IS/LM closed economy model where

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

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

Questions:

1. (10 points) Draw the IS/LM diagram for an economy in a liquidity trap. Explain what you draw.

Answer: See the slides. The key is that the LM curve has a flat portion at zero interest rates because at that point liquidity is free.

2. (10 points) Show that monetary policy is ineffective and explain the economic intuition.

Answer: Shift the LM curve and nothing happens. When liquidity is free, agents soak up unlimited amounts of it. This breaks the usual transmission mechanism for monetary policy (interest rates).

3. (10 points) Show that fiscal policy is highly effective and explain the economic intuition.

Answer: Shift the IS curve and we get an expansion that is bigger than in “normal” times. The reason is that interest rates stay at zero. The usual dampening effect of rising interest rates is not present in a liquidity trap.

7. Inflation Expectations

Recall the IS/LM 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.