ECON 421: Business Fluctuations

Spring 2015
Tu 6:00PM–9:00PM
Section 102

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Based on
Macroeconomics, Blanchard and Johnson [2011]

Notes 05

Preface

Before diving into this material,

- Take stock of the techniques and relationships established so far:
  - Several methodologies are used to calculating GDP and the price level.
  - MPC (c_1) determines the multiplier and level of output in goods market.
  - Money demand (M^d) is directly related to output (Y) inversely related to the interest rate (i).
- Look forward to what's next:
  - In order to understand the Federal Reserve's influence over the economy,
  - Combine the two markets established:
    1. **Goods Market**: $Y = C + I + G$
    2. **Money Market**: $M^s = M^d = Y * L(i)$
  - To do so, first consider the influence of the interest rate (i) on the goods market,
  - Then consider the influence of output (Y) on the interest rate (i).
  - The model will incorporate all of the concepts we've considered in its determination of output (Y).

Notes 05

A More Realistic Goods Market

$$Y = C(\underset{+}{Y_D}) + I + G$$
$$Y = C(\underset{+}{Y} - T) + I(\underset{+}{Y}, \underset{-}{i}) + G$$

- The first equation says that investment is independent of the overall size of the economy and the interest rate.
- Since investment is comprised of purchases intended to increase the productive capacity of firms,
  - It is only natural that firms would invest more in larger economies,
  - And thus the $+$ under the Y in the I function.

Notes 05

A More Realistic Goods Market

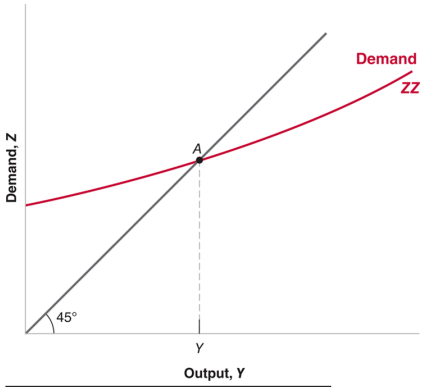
$$Y = C(\underset{+}{Y_D}) + I + G$$
$$Y = C(\underset{+}{Y} - T) + I(\underset{+}{Y}, \underset{-}{i}) + G$$

Firms can fund their own investments or they can borrow money to invest in factories and equipment.

- If they invest their own money, then they are foregoing the opportunity to earn interest, i, by investing in bonds.
- If they borrow money, they must pay at a rate of i.
- Investment is more attractive when interest rate (i) is lower. Thus ($-$) below the i in the investment function.

IS Relation[1]

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



- In the past $C(Y_D)$ was translated into $c_0 - c_1 Y_d$. Thus assuming linearity.
- This assumption is no longer made, thus $C(Y_D)$ might be non-linear and is thusly illustrated on the right.
- As noted in the practice problems at the end of chapter 3, the marginal propensity to consume (MPC) plus the marginal propensity to invest (MPI) must sum to less than 1.

[1] I am not convinced that the non-linearity modification offers any illumination to students.

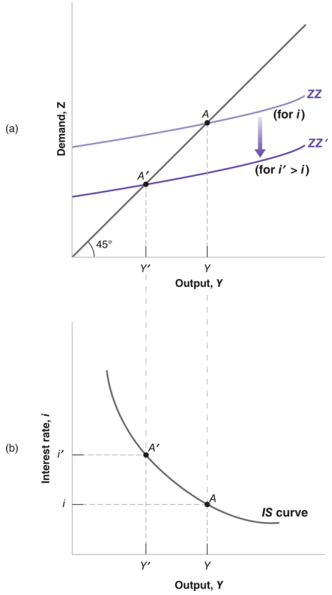
Practice Problem

Consider the following economy:

$$\begin{aligned} C &= 200 + .25Y_D \\ I &= 150 + .25Y - 1000i \\ G &= 250 \\ T &= 200 \end{aligned}$$

1. What is output if the interest rate is 10%?
2. What is output if the fed lowers the interest rate to 5%?

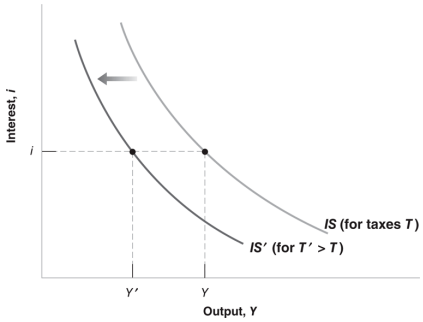
$$\begin{aligned} Y &= C + I + G \\ Y &= \underbrace{200 + 0.25Y - 0.25(200)}_{C} \\ &\quad + \underbrace{150 + 0.25Y - 1000i}_{I} + \underbrace{250}_{G} \\ Y &= \frac{550 - 1000i}{(1 - 0.5)} = 1100 - 2000i \\ Y|_{i=0.1} &= 900 \\ Y|_{i=0.05} &= 1000 \end{aligned}$$



The nexus of the goods market and the money market will be illustrated in the (Y, i) space.

- To trace out the IS curve, begin with the Keynesian cross diagram at a given interest rate.
- Then vary the interest rate.
- An increase in the interest rate decreases the level of investment for any level of output.
- This shifts the ZZ curve downwards and output decreases.
- Therefore, the IS curve has a negative slope in $Y - i$ space.

Shifts of the IS Curve



Suppose taxes increase.

- At a given interest rate, say i, disposable income decreases.
- This leads to a decrease in consumption (C), i.e. a decrease in the demand for goods and, in turn, a decrease in equilibrium output (Y).
- The equilibrium level of output decreases from Y to Y' at the constant interest rate of i.
- Put another way, the IS curve shifts to the left: At a given interest rate, the equilibrium level of output is lower than it was before the increase in taxes.

LM Relation

So far, we have assumed that the aggregate price level is 1 ($P = 1$).

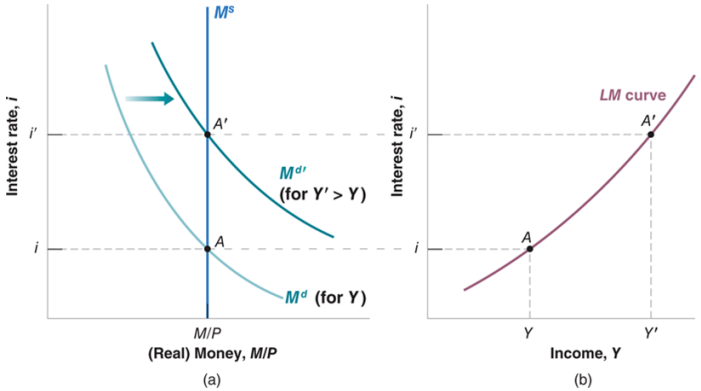
- Allowing the price-level to vary means that Nominal GDP is now expressed as PY and real GDP is Y.
- The money marekt equilibirum is now expressed:

$$\frac{M}{P} = YL(i)$$

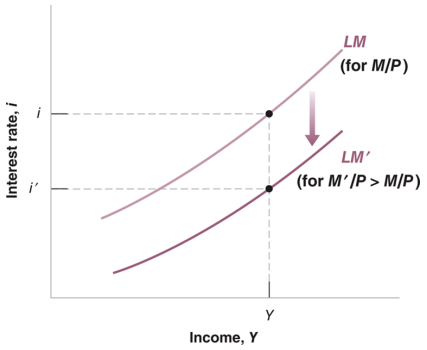
- For now, the assumption that P is fixed is maintained. Future chapters will relax it.

In order to graph the Liquidity-Money relation $\frac{M}{P} = YL(i)$ in the Y, i space, consider the effect of a change in Y in the money market equilibrium graph.

- increase in nominal income would increase the interest rate.
- Since P is fixed, an increase in real income will have the same effect. Thus, the LM curve has a positive slope in Y, i space.

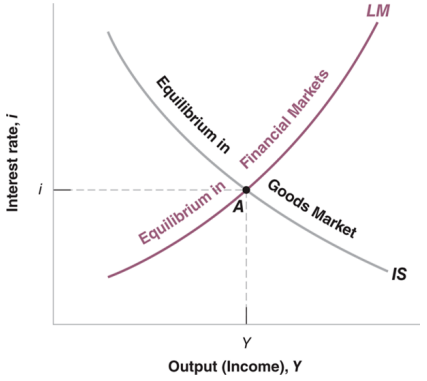


Deriving the LM Curve Shifts of the LM Curve



- Notice that each point on the LM curve represents an equilibrium in the money market.
- Equilibrium in financial markets implies that,
  - For a given real money supply,
  - An increase in the level of income, which increases the demand for money,
  - leads to an increase in the interest rate.
- This relation is represented by the upward-sloping LM curve. An increase in the money supply shifts the LM curve down; while a decrease in the money supply shifts the LM curve up.

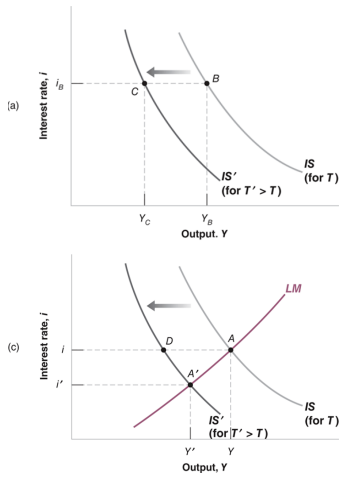
IS-LM



The equilibrium values of i and Y are those that

- Satisfy simultaneously the goods market equilibrium condition and
- Satisfy the money market equilibrium condition.
- Graphically, these values are determined by the point of intersection of the IS and LM curves, as illustrated in Figure 5.1.

Fiscal Policy



Changes in $(Y^* \text{ and } i^*)$ can be brought about only as the result of shifts in the IS, the LM, or both.

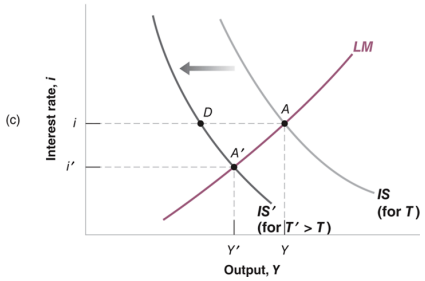
- An increase in the money supply shifts the LM curve down, increasing equilibrium output and reducing the equilibrium interest rate.
- An increase in taxes (or a reduction in government spending),shifts the IS curve leftward, reducing equilibrium output and equilibrium interest rate.
- The IS curve shift leads to a decrease in the equilibrium level of output and the equilibrium interest rate

- An increase in taxes has an ambiguous effect on investment, since the output effect tends to reduce investment, but the interest rate effect tends to increase it.
- More generally, although deficit reduction increases public (government) saving, it does not necessarily increase investment, because private saving is endogenous.

Leftward Shift of IS

A leftward shift in the IS (anything that lowers output in chapter 3)

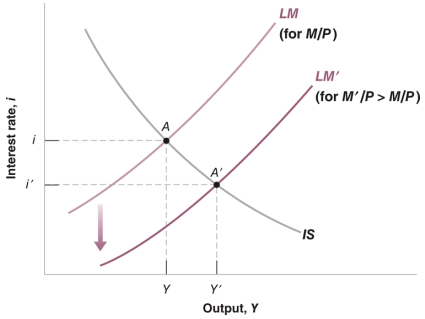
- Lowers the interest rate (i) and,
- Lowers output (Y).



Rightward Shift of the LM

A rightward shift in the LM (e.g. due to an increase in the money supply)

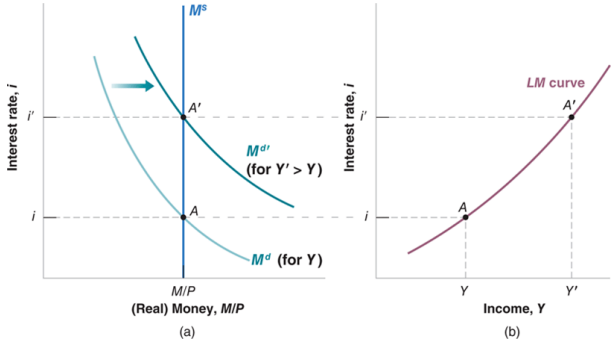
- Lowers the interest rate (i) and,
- Increases output (Y).



Monetary Policy Rules Affect slope of LM

The traditional LM curve is derived by varying income

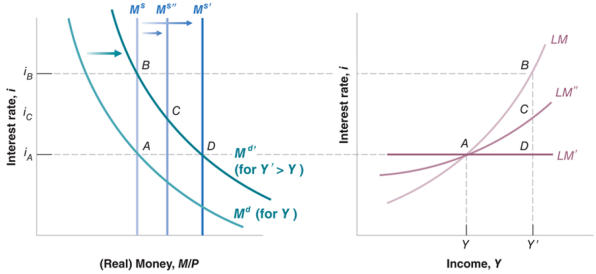
- And hence money demand.
- This traces out the implications for the interest rate, under the assumption that the money supply is fixed.
- Hence, the traditional LM curve corresponds to a strict money-targeting rule.



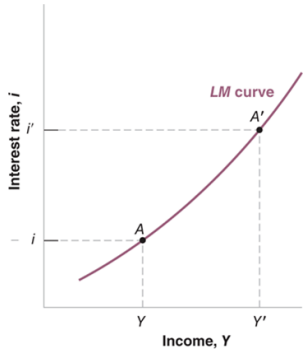
Strict Interest Rate Rules

A strict interest rate rule implies, on the other hand, that

- The LM curve is horizontal,
- Changes in income (and hence money demand) are fully accommodated by the Fed at the target interest rate.



Intermediate Rules



An intermediate rule (i.e. some mix of money supply and interest rate increases in response to an increase in income)

- Produces an LM curve with a slope flatter than the traditional LM curve,
- but still positively sloped.

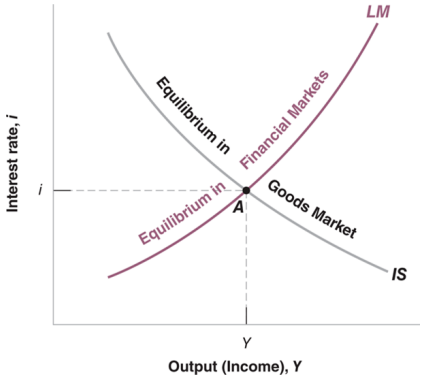
Dynamics

So far we have ignored the element of time. Suppose the government increases taxes:

- First disposable income, Y_D, falls.
- This leads to lower Investment, I,
- and lower production, Y. But how long does this process take? We can never know for sure but our best forecasts come from considering the data.

Dynamics

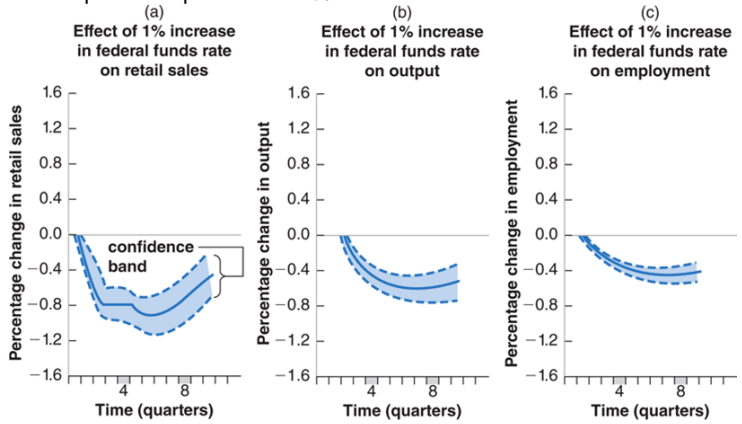
Suppose the federal reserve decides to implement a 1% increase in the federal funds rate. What responses do we expect?



- We expect a leftward shift of the LM curve.
- This implies
  1. higher interest rates,
  2. lower output,
  3. and as we will see in the next chapter lower unemployment.

Dynamics

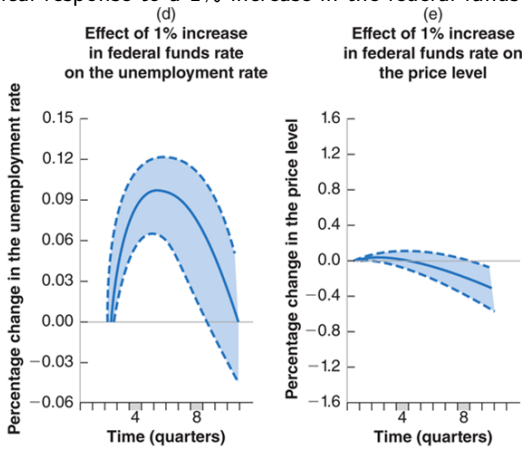
Empirical response to a 1% increase in the federal funds rate.[2]



[2] Graphic reproduced from Cristiano (1996)

Dynamics

Empirical response to a 1% increase in the federal funds rate.[3]



[3] Graphic reproduced from Cristiano (1996)

Consider the following IS-LM Model:

$$C = 200 + 0.25Y_D$$
$$I = 150 + 0.25Y - 1000i$$
$$G = 250$$
$$T = 200$$
$$(M/P)^d = 2Y - 8000i$$
$$(M/P)^s = 1600$$

1. Derive the IS relation. (Hint: You want an equation with Y on the left side and everything else on the right.)
2. Derive the LM relation. (Hint: It will be convenient for later use to rewrite this equation with i on the left side and everything else on the right.)
3. Solve for equilibrium real output. (Hint: Substitute the expression for the interest rate given by the LM equation into the IS equation and solve for output.)
4. Solve for the equilibrium interest rate. (Hint: Substitute the value you obtained for Y in 3. into either the IS or LM equations and solve for i. If your algebra is correct, you should get the same answer from both equations.)

Solutions

1. Derive each relation:
   $Y = C + I + G = 200 + .25(Y - 200) + 150 + .25Y - 1000i + 250$
   $Y = 1100 - 2000i$
   $i = Y/4000 - 1/5$
2. $M/P = 1600 = 2Y - 8000i$
3. Substituting from part (2) into part (1) gives Y=1000.
4. Substituting from part (3) into part (2) gives i=5%.

Consider the following IS-LM Model:

$$C = 200 + 0.25Y_D$$
$$I = 150 + 0.25Y - 1000i$$
$$G = 250$$
$$T = 200$$
$$(M/P)^d = 2Y - 8000i$$
$$(M/P)^s = 1600$$

5. Solve for the equilibrium values of C and I, and verify the value you obtained for Y by adding C, I, and G.
6. Now suppose that the money supply increases to M/P = 1,840. Solve for Y, i, c, and T, and describe in words the effects of an expansionary monetary policy.
7. Set M/P equal to its initial value of 1,600. Now suppose that government spending increases to G = 400. Summarize the effects of an expansionary fiscal policy on Y, i, and C.

Solutions

5. $C = 400$, $I = 350$, $G = 250$, $C + I + G = 1000$
6. $Y = 1040$, $i = 3\%$, $C = 410$, $I = 380$. A monetary expansion reduces the interest rate and increases output. Consumption increases because output increases. Investment increases because output increases and the interest rate decreases.
7. $Y = 1200$, $i = 10\%$, $C = 450$, $I = 350$. A fiscal expansion increases output and the interest rate. Consumption increases because output increases. Investment is affected in two ways: the increase in output tends to increase investment, and the increase in the interest rate tends to reduce investment. In this example, these two effects exactly offset one another, and investment does not change.

Comments, questions, or concerns?

References

Olivier Jean Blanchard and David Johnson. *Macroeconomics*. Prentice Hall, 6th edition, 2011. ISBN 9780133061635.