THE IS CURVE

Week 4

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1. The Components of Expenditure

Planned Expenditures or Demand for G&S

- At the aggregate level, there are two sides in the market for Goods&Services:
  - The Demand side: G&S are demanded, which is translated into a a set of "Planned Expenditures"
  - The Supply side: G&S are produced and supplied at a certain market price.

- The total amount of planned expenditures on G&S, (D) is given by:[1]

$$D = C + I + G + NX \tag{1}$$

C : Personal consumption; I : Investment expenditures; G : Government purchases of G&S; and NX : Net exports of G&S

[1]The textbook uses Y^{pe} instead of D. For simplicity we choose D for "demand".

Personal Consumption Expenditure

In a developed market economy, personal consumption expenditures are explained by three fundamental variables:[2]

$$C = \overline{C} + c \cdot \underbrace{(Y - T)}_{=Y_D} - b \cdot r \tag{2}$$

- $\overline{C}$: exogenous amount of consumption expenditure
- Y : income (or GDP, or simply "output")
- T : income taxes minus income transfers to households
- Y_D : disposable income
- r : real interest rate
- c : parameter (known as the "marginal propensity to consume")
- b : parameter

[2] In eq. (2), where we have b the textbook uses c, and where we use c, the textbook uses mpc. Our notation is easier to manage.

Investment Expenditure

- In a developed market economy, the level of investment depends upon:
  - $\overline{I}$: exogenous investment (the textbook calls it "Autonomous" investment)
  - r_i : real interest rate for investments

- r_i is given by the sum of the market real interest rate (r) and a spread ($\overline{f}$) (the textbook calls it a financial friction) :

$$r_i = r + \overline{f} \tag{3}$$

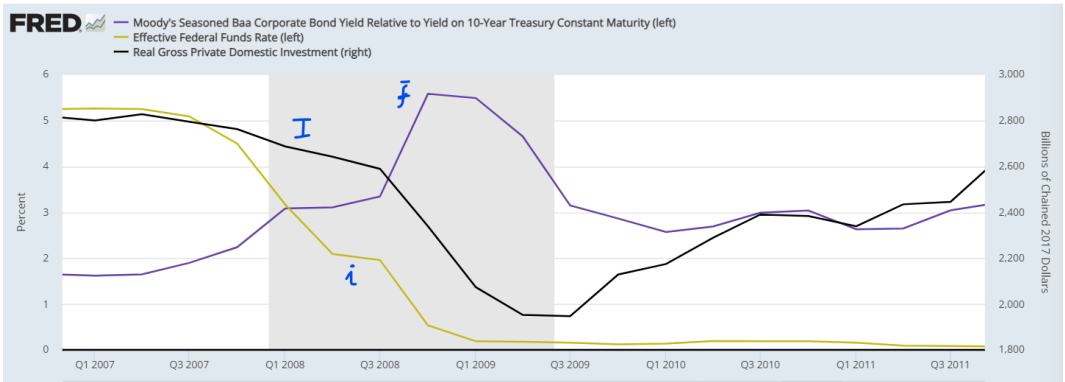
- Then, the demand for investment will be given by

$$I = \overline{I} - d \cdot (r + \overline{f}) \tag{4}$$

  where d is a parameter.

Financial Frictions and Investment

For example, in the great financial crisis of 2007-2010, the inverse relationship between $(\overline{f})$ and I can be easily spotted in the figure below: $\uparrow \overline{f}$, $\downarrow I$, despite (i) coming down to 0%. And $\downarrow \overline{f}$, $\uparrow I$, despite i remaining at 0%.



Government Expenditures and Income Taxes

The level of government expenditures on G&S (G) is exogenously determined (they are the result of a political decision in the Parliament). So,

$$G = \overline{G} \tag{5}$$

The level of income taxes (T) increases with income, so we could describe taxes with the following tax function:

$$T = \overline{T} + t \cdot Y \tag{6}$$

where t is the marginal income tax rate. However, for simplicity, we will assume that the level of income taxes is also exogenously determined:

$$T = \overline{T} \tag{7}$$

This simplification will not significantly change our results in this course.

Net Exports

As with planned investment spending, we can think of net exports as being made up of two components, autonomous net exports and the part of net exports that is affected by changes in real interest rates:

$$NX = \overline{NX} - x \cdot r \tag{8}$$

where x is a parameter.

Why are net exports negatively dependent on the real interest rate?

Next slide.

Why r affects Net Exports?

Simple example. Suppose the ECB raises interest rates in the EuroZone:

$$\uparrow r_{(ZE)}$$

- This leads to financial investments denominated in € becoming more internationally attractive: they now have a higher return.
- Higher demand for Euros in the foreign exchange markets, leads to an appreciation of the Euro against other currencies.
- An appreciated € leads to G&S produced in the EuroZone becoming relatively more expensive than before: decrease of NX from the Euro countries.
- So:

$$\uparrow r \Rightarrow \text{national currency appreciates } \Rightarrow\downarrow NX$$

2. Goods Market Equilibrium

The Goods Market Equilibrium

This equilibrium will occur when the total value of G&S produced in the economy (Y) equals the total amount of planned expenditure or aggregate demand (D):

$$D = Y \tag{9}$$

Knowing that

$$D = C + I + G + NX$$

we get

$$Y = C + I + G + NX \tag{10}$$

Deriving the IS Curve: I

Using the behavioral equations for C, I, G, NX, and substituting them into eq. (10), we get

$$Y = \underbrace{\overline{C} + c \cdot (Y - \overline{T}) - b \cdot r}_{=\mathrm{C}} + \underbrace{\overline{I} - d \cdot (r + \overline{f})}_{=I} + \underbrace{\overline{G}}_{=\mathrm{G}} + \underbrace{\overline{NX} - x \cdot r}_{=\mathrm{NX}}$$

Rearranging better the previous equation, we get:

$$Y = \overline{C} + \overline{I} - d \cdot \overline{f} + \overline{G} + \overline{NX} - c \cdot \overline{T} + c \cdot Y - (b + d + x) \cdot r$$

To simplify the exposition, let's group together all the elements with an over bar, and call it the **Autonomous Aggregate Demand**:

$$\overline{A} = \overline{C} + \overline{I} - d \cdot \overline{f} + \overline{G} + \overline{NX} - c \cdot \overline{T}$$

Deriving the IS Curve: II

Now we get a very simple equation

$$Y = \overline{A} + c \cdot Y - (b + d + x) \cdot r$$

which can be solved for Y:

$$Y = \frac{1}{1-c} \cdot \overline{A} - \frac{(b + d + x)}{1-c} \cdot r \tag{11}$$

But we can simplify it even further:

$$Y = m \cdot \overline{A} - m \cdot \phi \cdot r \tag{12}$$

$\frac{1}{1-c} = m \longrightarrow$ "m" for multiplier
$b + d + x = \phi \quad \longrightarrow$ "ϕ" for lack of imagination ...

IS Curve: Definition

Definition: IS curve. For a given set of parameters $\{c, b, d, x\}$, the level of aggregate demand and GDP (D, Y) is positively affected by the level of autonomous aggregate demand $(\overline{A})$, and negatively by the level of the real interest rate (r):

$$Y = m \cdot \overline{A} - m \cdot \phi \cdot r \tag{13}$$

Notice that, ***to simplify things***, we define:

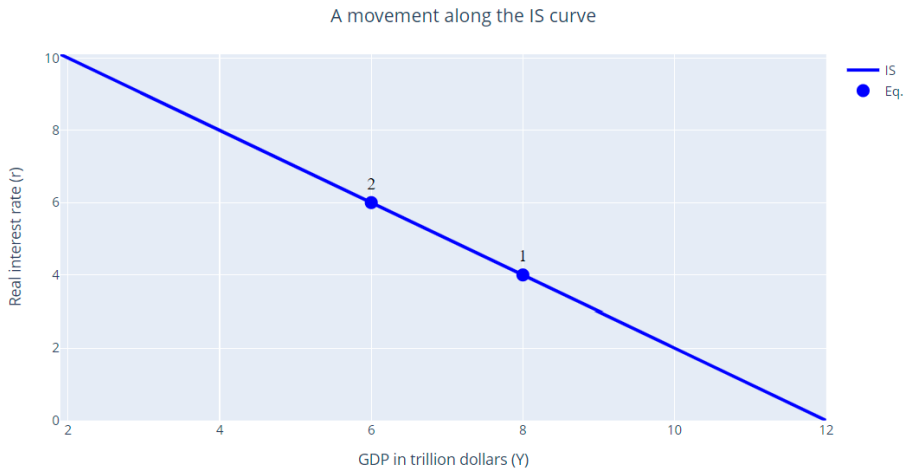
$\frac{1}{1-c} = m > 1$

$b + d + x = \phi > 0$

$\overline{A} = \overline{C} + \overline{I} - d \cdot \overline{f} + \overline{G} + \overline{NX} - c \cdot \overline{T}$

IS Curve: Graphical Representation

For a given level of $(\overline{A})$, an increase in (r) will cause a reduction in aggregate demand (D), which will lead to a decline in GDP (Y).



3. Factors That Shift the IS Curve

Factors That Shift the IS Curve

- You should recall that the autonomous aggregate demand is given by: [3]

$$\overline{A} = \overline{C} + \overline{I} - d \cdot \overline{f} + \overline{G} + \overline{NX} - c \cdot \overline{T}$$

- A change in any of these components of $\overline{A}$ will force the IS curve to shift.
- For example, consider an increase in public spending: $\Delta\overline{G} > 0$
- Aggregate demand will increase by:

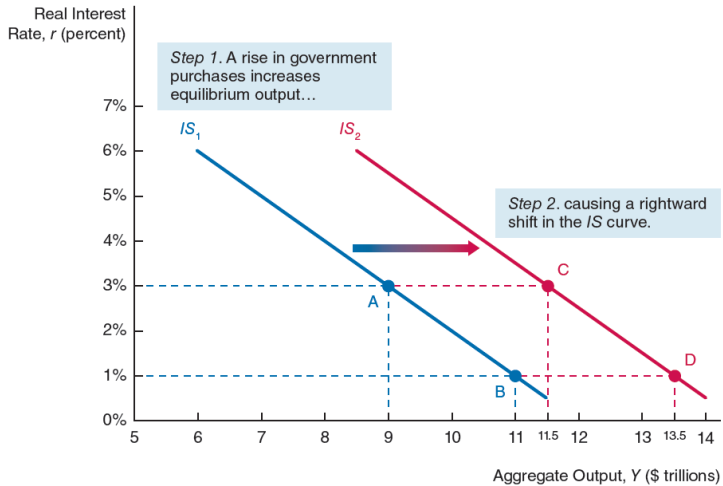
$$\Delta Y = m \cdot \Delta\overline{G} \quad , \quad m > 1 \tag{14}$$

- That is: $\overline{G} \Rightarrow \uparrow \overline{A} \Rightarrow \uparrow Y$: the IS curve shifts to the right
- A reduction in $\overline{T}$ would produce a similar impact.

[3] Notice that you do not need to memorize this expression. Try to understand which ones have a negative/positive impact upon $\overline{A}$.

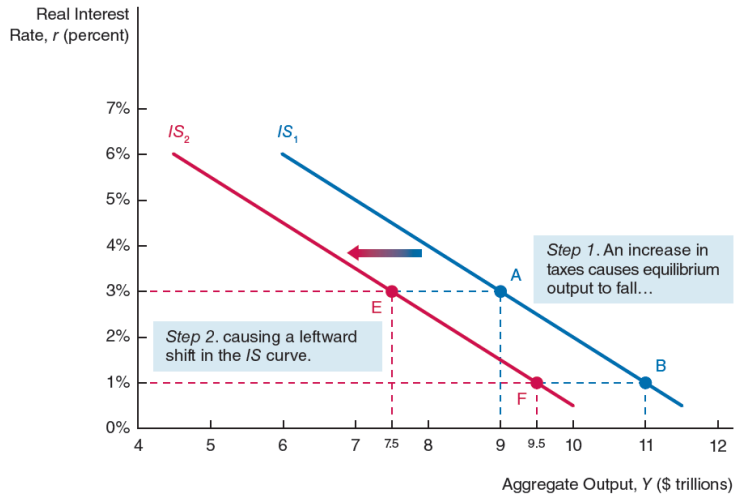
An Increase in Public Spending

An increase in public spending shifts the IS to the right



An increase in Taxes

An increase in $\overline{T} \Rightarrow \downarrow \overline{A} \Rightarrow \downarrow Y$: the IS shifts to the left:



The Multiplier

- We saw that an increase in public spending/income taxes, will shift the IS curve leading to an increase/decline in aggregate demand and GDP.
- But **by how much**? It will depend upon the value of the multiplier m:

$$\Delta Y = \underbrace{\frac{1}{1-c}}_{m=\text{multiplier}} \cdot \Delta \overline{A}$$

- Where $\overline{A} = \overline{C} + \overline{I} - d \cdot \overline{f} + \overline{G} + \overline{NX} - c \cdot \overline{T}$
- As $0 < c < 1$, then

$$m = \frac{1}{1-c} > 1$$

- One shock upon $\overline{A}$ is **amplified/multiplied** through the other components of expenditure (Consumption, in particular): the higher c is, the higher will be m.

Summary

SHIFTS IN THE *IS* CURVE FROM AUTONOMOUS CHANGES IN $\overline{C}$, $\overline{I}$, $\overline{G}$, $\overline{T}$, $\overline{NX}$, AND $\overline{f}$

Variable	Change in Variable	Shift in *IS* Curve	Reason
Autonomous consumption expenditure, $\overline{C}$	$\uparrow$	$\rightarrow$	$C\uparrow Y\uparrow$
Autonomous investment, $\overline{I}$	$\uparrow$	$\rightarrow$	$I\uparrow Y\uparrow$
Government spending, $\overline{G}$	$\uparrow$	$\rightarrow$	$G\uparrow Y\uparrow$
Taxes, $\overline{T}$	$\uparrow$	$\leftarrow$	$T\uparrow \Rightarrow C\downarrow Y\downarrow$
Autonomous net exports, $\overline{NX}$	$\uparrow$	$\rightarrow$	$\overline{NX}\uparrow Y\uparrow$
Financial frictions, $\overline{f}$	$\uparrow$	$\leftarrow$	$I\downarrow Y\downarrow$

Note: Only increases ($\uparrow$) in the variables are shown; the effects of decreases in the variables on planned expenditure and aggregate output would be the opposite of those indicated in the last two columns.

4. Readings

Readings

- Read Chapter 9 of the adopted textbook:

  Frederic S. Mishkin (2015). *Macroeconomics: Policy & Practice*, Second Edition, Pearson Editors.