

IS-LM Model

Part 1

Exogenous and Endogenous

- An **exogenous** variable is a variable that is **not** affected by other variables in the model.
- **Endogenous** variables have values that are determined by other variables in the model.
- Hence, **exogenous var. determines endogenous var.**
- Which variables in Keynesian Cross are endogenous and which are exogenous?
- $Y = C + I + G + X - M$

Keynesian Model

The Keynesian model was developed in four stages by analyzing four models. Each model has a value in itself.

In this course, we will study only 3 models.

The characteristics of each are:

- **Keynesian Cross : P and i are exogenous (constant).**
- **IS-LM model : P is constant and i is endogenous.**
- **AS-AD model : P and i are endogenous.**

where P is price level.

When P is constant...

- This means that there is **no inflation** in the economy.
- The following conclusions can be drawn
 - Nominal Output and Real Output are equal.
 - Nominal Interest Rate and Real Interest Rate are equal.
This follows from the Fisher Equation: $i = r + \pi$.
- Given the conclusion above, **we have $i = r$** .
- Thus, you can use i or r to plot any related graph.
- Most of the slides will use i in graph plotting, though.

EXTRA – Say’s Law

- Jean-Baptiste Say: “...as the value we can buy is equal to the value we can produce, the more men can produce, the more they will purchase.”
- **Say's law** states that “**supply creates demand**”.
- It also gives rise to **supply-side economics**, which is about boosting Aggregate Supply to boost the economy.
- Both Say’s law and supply-side economics are cornerstones of **Classical Economics**.
- Supply-side policies: lower producers’ tax, decrease regulation, promote R&D, subsidize production.

EXTRA – Keynes' Law

- In Keynesian Economics, Say's law no longer applies.
- **Keynes' law: "demand creates supply"**.
- You can see this concept in Keynesian Cross:
 - first, we find AE which represents aggregate demand;
 - then, we set $Y = AE$, i.e. we produce what we demand.
- So, Keynesian is **demand-side economics**, which is about boosting Aggregate Demand to boost the economy.
- Demand-side policies: lower consumers' tax, increase government spending, lower interest rate.
- Thus, expansionary Fiscal and Monetary policies are demand-side policies, aiming to boost aggregate demand.

Overview of IS-LM Model

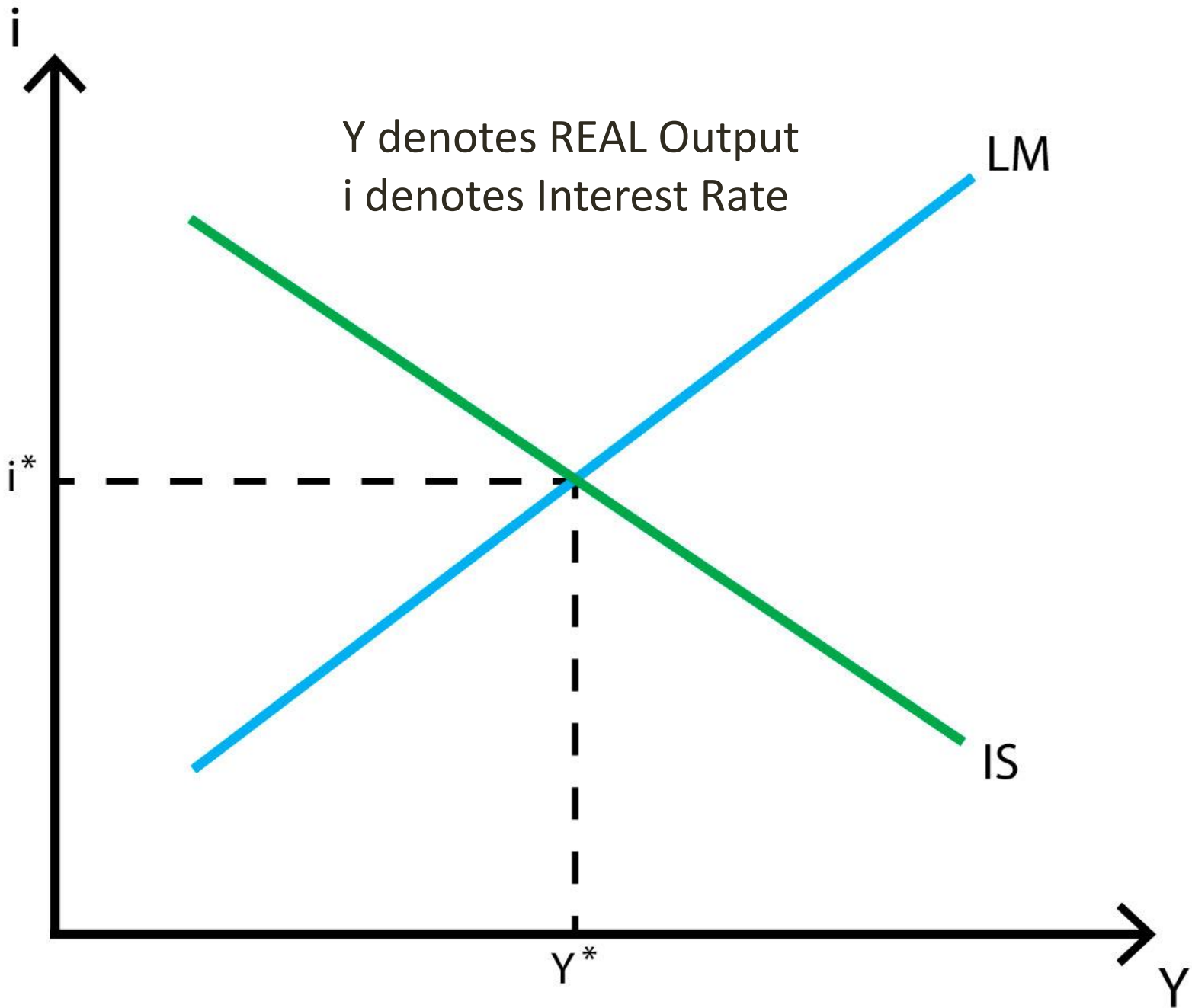
- IS-LM Model or “Investment-Saving and Liquidity Preference-Money Supply” Model.
- It is a model with the **general equilibrium**: there exists a common “price” that clears two or more markets.
- Two markets in this model are 1. the goods and services market and 2. the money market.
- The “price” that clears two markets is the interest rate.
- **Hence, IS-LM shows the relationship between interest rates and assets (commodity and money) market.**

Overview of IS-LM Model

- Like Keynesian Cross, IS-LM is for short-run analysis.
- We note that the price (and wage) is sticky in short run.
- Therefore, we assume that price level is constant, and hence the inflation rate is zero ($\pi = 0$).
- From Fisher Equation ($i = \pi + r$), this implies

Real Interest Rate (r) = Nominal Interest Rate (i).

- IS-LM is a **closed-economy** model. It has an open-economy version, called Mundell-Fleming Model.
- The model is used to analyze SHORT-RUN economic fluctuations and study the impacts of policies.



The IS Curve

- The IS curve shows a negative relationship between i and Y in the commodity market.
- The curve is derived from a closed-economy Keynesian Cross, i.e. $Y = C + I + G$.
- Unlike Keynesian Cross that we studied before, **we now assume that investment depends on interest rate.**
- That is, $I = I(i)$, and $dI/di < 0$: **higher interest rates discourage investors from investing.**
- Hence, we can write the IS curve as follows

$$Y = C(Y - T) + I(i) + G.$$

Investment Function

- $I = I_0 - I_1 \cdot (i)$
- I_0 denotes autonomous investment.
- $-I_1$ denotes the slope of the investment function, and the sensitivity of investment to changes in interest rate.
- This is because $\frac{dI}{di} = -I_1$, meaning that when interest rate increases by 1 unit, investment will decrease by I_1 units.
- e.g. $I = 10 - 100(i)$
- When $i = 1\%$, $I = 9$. When $i = 2\%$, $I = 8$.
- Larger I_1 implies that investment is sensitive to interest rate.

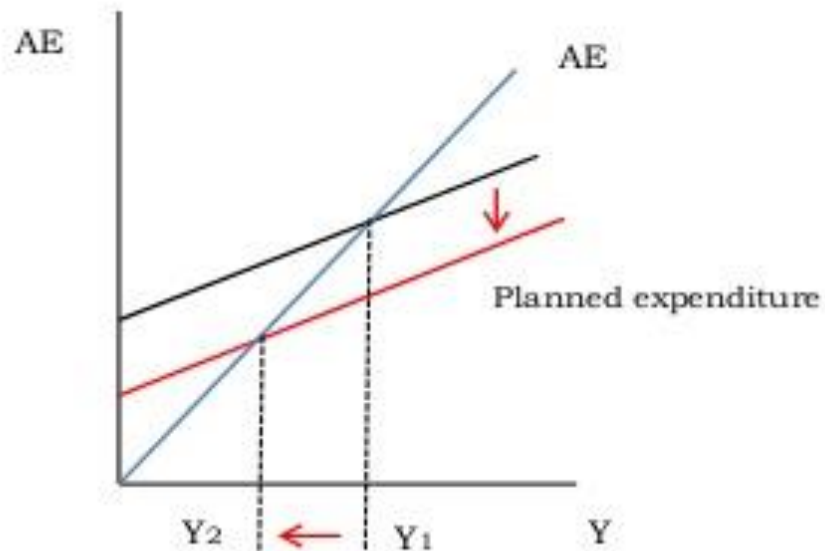
*****CAUTION*****

- $I = I_0 - I_1 \cdot (i)$
- This investment function is NOT the same as the one we studied before.
- RECALL: $I = I_0 + I_1 \cdot (Y)$
- This is called the “induced investment” function.
- I_1 is Marginal Propensity to Invest or MPI.
- **To simplify the IS-LM model, we will NOT consider “induced investment” anymore.**

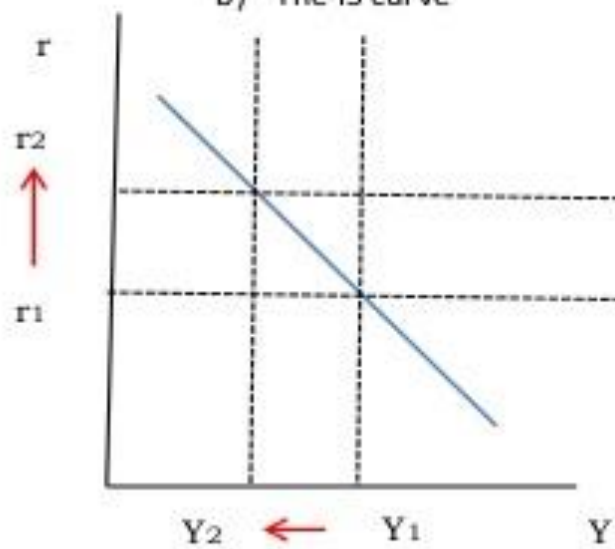
The IS Curve

- The IS curve is a LOCUS of “points”.
- Each “point” is an equilibrium in Keynesian Cross at each level of interest rate.
- $Y_1 = C(Y - T) + I(i_1) + G$
- $Y_2 = C(Y - T) + I(i_2) + G$
- Suppose i increases from i_1 to i_2 . Higher interest rate discourages investors and hence reduces AE.
- As a result, when AE falls, Y also falls from Y_1 to Y_2 .
- This negative relationship between i and Y is depicted in the IS curve.

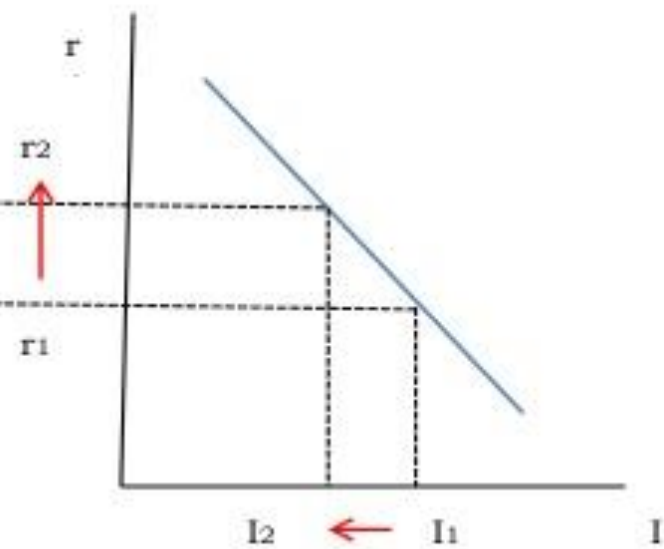
a) The Keynesian cross



b) The IS curve

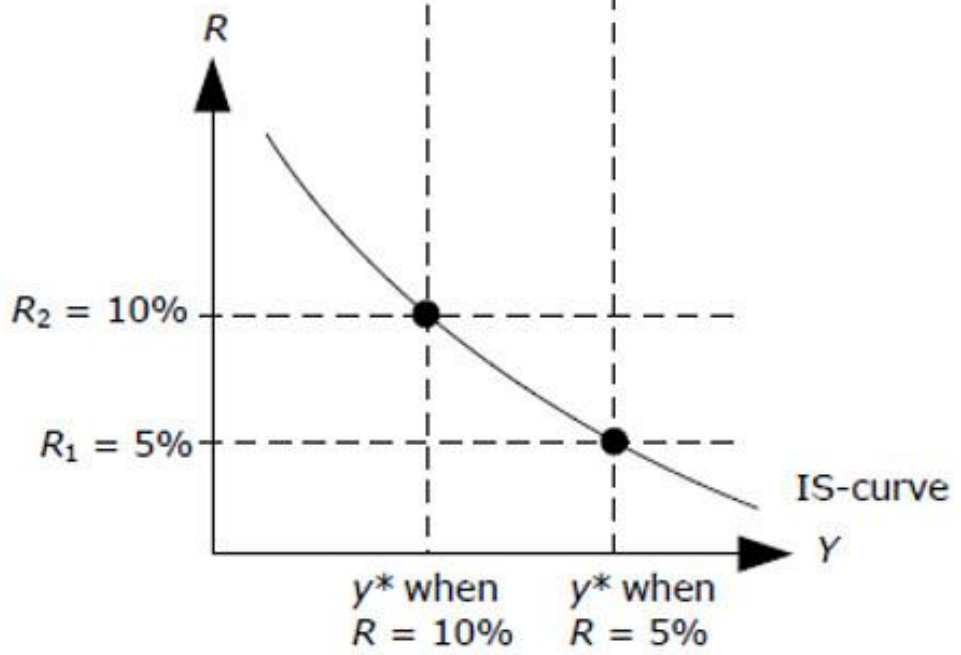
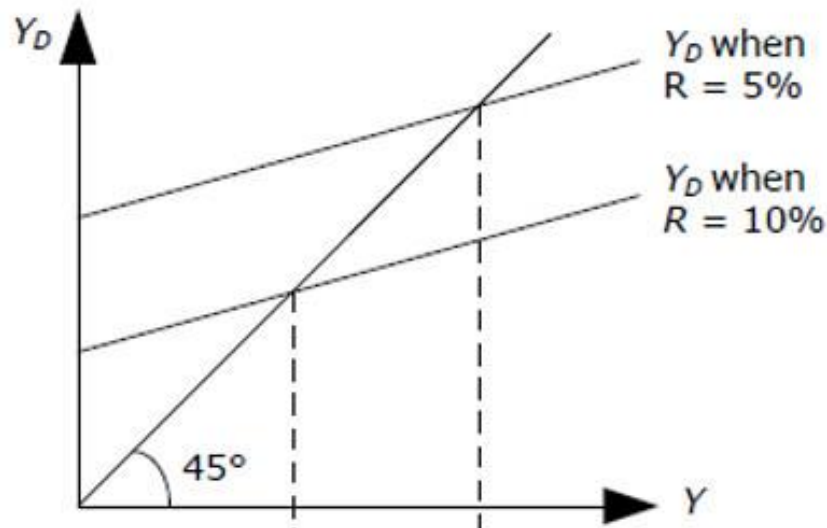


c) The investment function



Movement along the IS curve

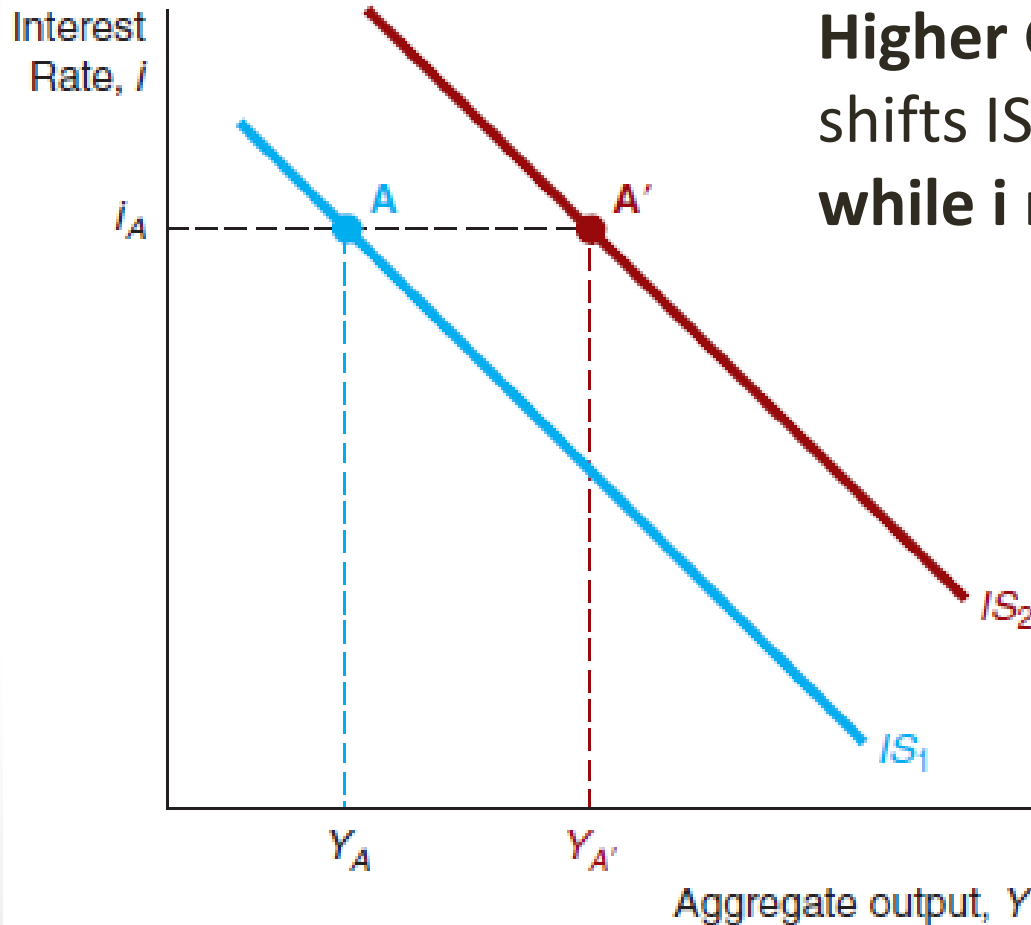
- IS equation: $Y = C(Y - T) + I(i) + G$
- Movement along the curve is due to the change in i , **while keeping G and T constant.**
- Higher interest rate discourages investors.
- As a result, investment falls, and output falls.
- $i \uparrow \gg I \downarrow \gg AE \downarrow \gg Y \downarrow$ (negative relationship)
- However, when G or T changes, we have shift in IS curve.



Shift in the IS curve

- Shift in the curve is due to the change in G or T , while **keeping i constant.**
- When the government increases its spending, this increases demand in the economy. Production increases to match the higher demand.
- $G \uparrow \gg AE \uparrow \gg Y \uparrow$ (higher $G \gg$ IS shifts to the right)
- When the government lowers net taxes, this increases demand in the economy. Production increases to match the higher demand.
- $T \downarrow \gg AE \uparrow \gg Y \uparrow$ (lower $T \gg$ IS shifts to the right)

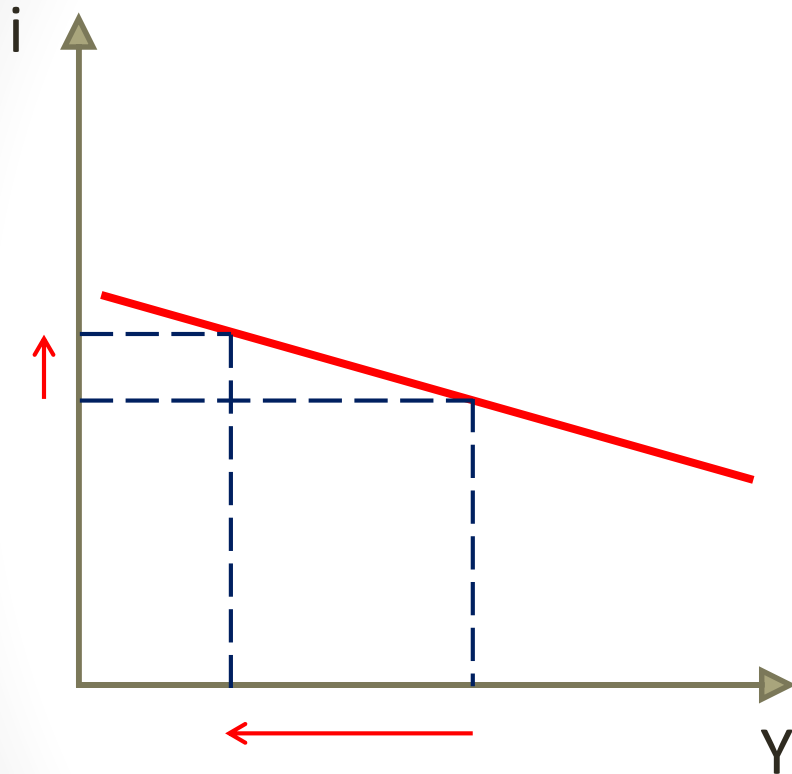
Shift in the IS curve



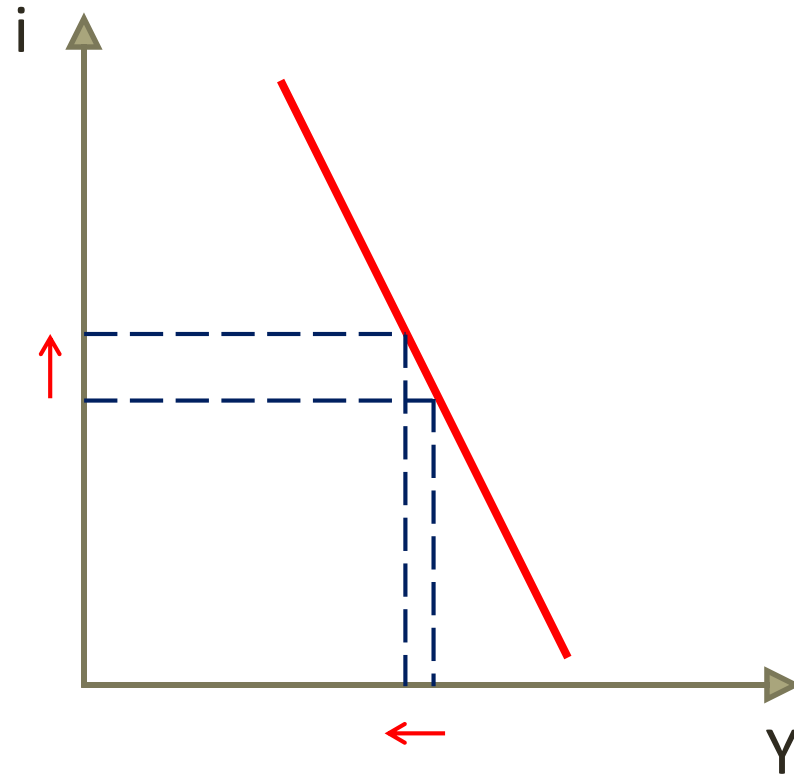
Higher G or Lower T
shifts IS curve to the right,
while i remains the same.

(a) Shift of the
IS curve

Slope of the IS curve



An increases in i causes
large reduction in Y
>> **FLAT** IS curve



An increases in i causes
small reduction in Y
>> **STEEP** IS curve

Slope of the IS curve

- The slope depends on 1.) the sensitivity of investment to changes in interest rate, and 2.) the multiplier.
- If investment is sensitive to changes in interest rate, then a decrease in interest rate causes a LARGE increase in investment (and hence output). That is, IS will be flat.
- If the multiplier is large, then an increase in investment causes a LARGE increase in output. That is, IS will be flat.