

# INTERMEDIATE MACROECONOMICS

## 2 – OUTPUT, AGGREGATE DEMAND & THE MULTIPLIER

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# Write down 3 take-aways from the reading (textbook Chapter 3)

## The Goods Market

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When economists think about year-to-year movements in economic activity, they focus on the interactions among *demand*, *production*, and *income*:

- Changes in the demand for goods lead to changes in production.
- Changes in production lead to changes in income.
- Changes in income lead to changes in the demand for goods.

Nothing makes the point better than this cartoon:



## 2 – Output, Aggregate Demand and the Multiplier

- What determines the level of output in the short-run?
- How is equality between output and income reached?
- How does fiscal policy affect GDP?



## Section 3: The roadmap

1. The composition of output.
2. Aggregate demand.
3. The determination of output.



## Section 1: The take-aways

- In the short-run, the level of production depends on the level of demand.
- An increase in demand leads to an increase in production *larger* than the initial increase in demand.
- *Multiplier* process:

demand → production → income → demand



# 2.1 THE COMPOSITION OF OUTPUT

## The Components of GDP

**Personal Consumption Expenditures**

- Goods can be durable (cars, furniture, large appliances) or non-durable (clothing, food, fuel)
- Services include banking, health care, and education

**Business Investment**

- Divided into two sub-components: fixed investment and change in private inventory

**Government Spending**

**Net Exports of Goods and Services**

the balance

# Who buys the output and what kind of goods?

- Consumption (C)
  - Private investment (I)
  - Government spending (G)
  - + Exports (X)
  - – Imports (IM)
  - Inventory investment
- Domestic purchases  
(C + I + G)
- Net Exports  
(X - IM)
-

**Table 3-1** The Composition of US GDP, 2018

		Billions of Dollars	Percent of GDP
	<b>GDP (Y)</b>	<b>20,500</b>	<b>100.0</b>
<b>1</b>	<b>Consumption (C)</b>	<b>13,951</b>	<b>68.0</b>
<b>2</b>	<b>Investment (I)</b>	<b>3,595</b>	<b>17.5</b>
	<b>Nonresidential</b>	<b>2,800</b>	<b>13.6</b>
	<b>Residential</b>	<b>795</b>	<b>3.8</b>
<b>3</b>	<b>Government spending (G)</b>	<b>3,522</b>	<b>17.2</b>
<b>4</b>	<b>Net exports</b>	<b>-625</b>	<b>-3.0</b>
	<b>Exports (X)</b>	<b>2,550</b>	<b>12.4</b>
	<b>Imports (IM)</b>	<b>-3,156</b>	<b>-15.4</b>
<b>5</b>	<b>Inventory investment</b>	<b>56</b>	<b>0.2</b>

Source: Survey of Current Business, February 2019, Table 1-1-5



# 2.2 AGGREGATE DEMAND





# Consumption

- Depends on disposable income ( $Y^D$ ):

$$C = C(Y^D)$$

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- *consumption function*
- a *behavioral* equation: describes the behavior of consumers.





# Consumption

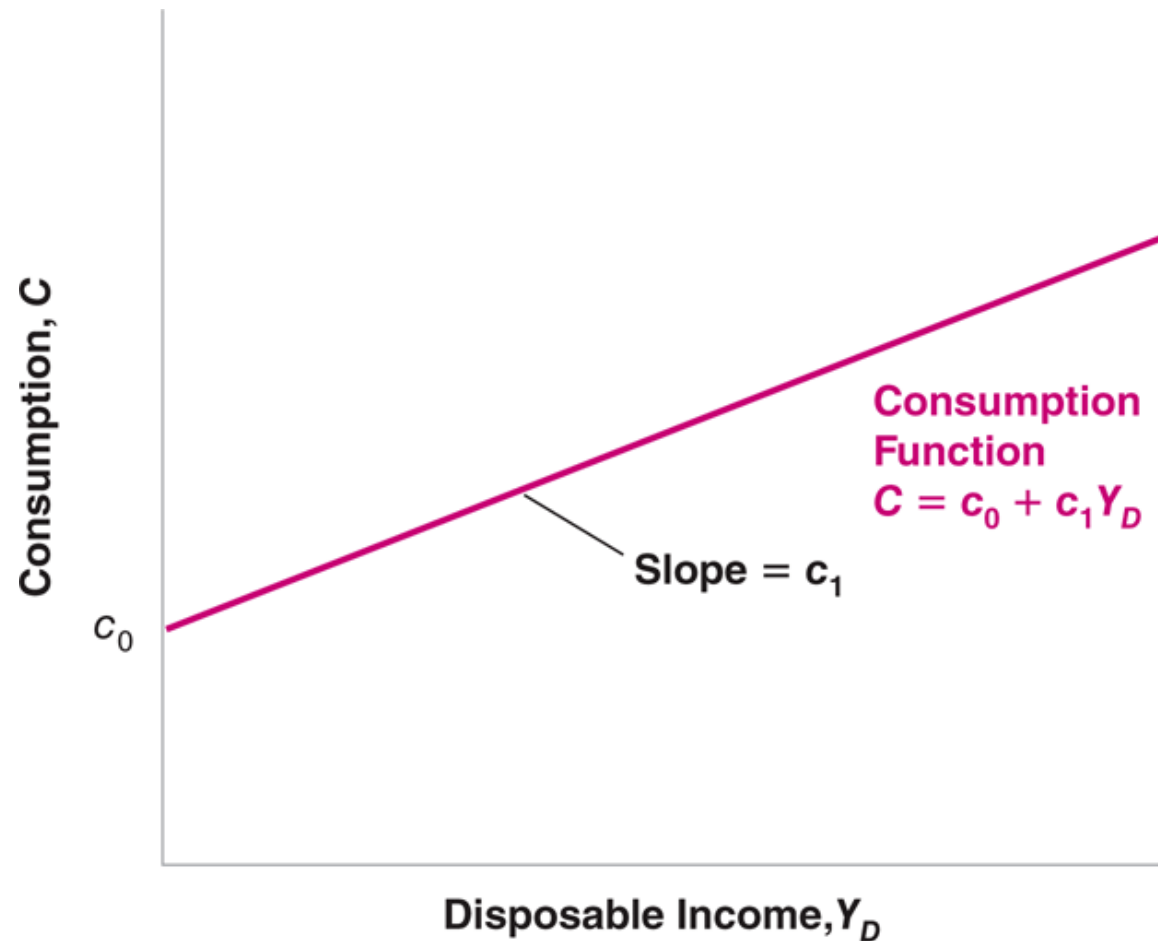
- Assume a *linear* relation between  $C$  and  $Y_D$ :

$$C = c_0 + c_1 Y_D$$

- $c_1$  = propensity to consume.
- $c_0$  = autonomous consumption.



# A linear consumption function



- A 1 dollar increase in  $Y_D$  increases consumption by  $c_1$  dollars.
- An increase in  $c_0$  shifts the entire line up.

# Consumption

- Finally, disposable income is

$$Y_D = Y - T$$

- $Y$  = income.
  - $T$  = taxes minus government transfers
- Replace  $Y_D$  in the consumption function:

$$C = \underbrace{c_0}_{\text{Autonomous consumption}} + \underbrace{c_1(Y - T)}_{\text{Induced consumption}}$$



# Investment

- For now, we take investment as given (*exogenous*):

$$I = \bar{I}$$



# Taxes and government spending

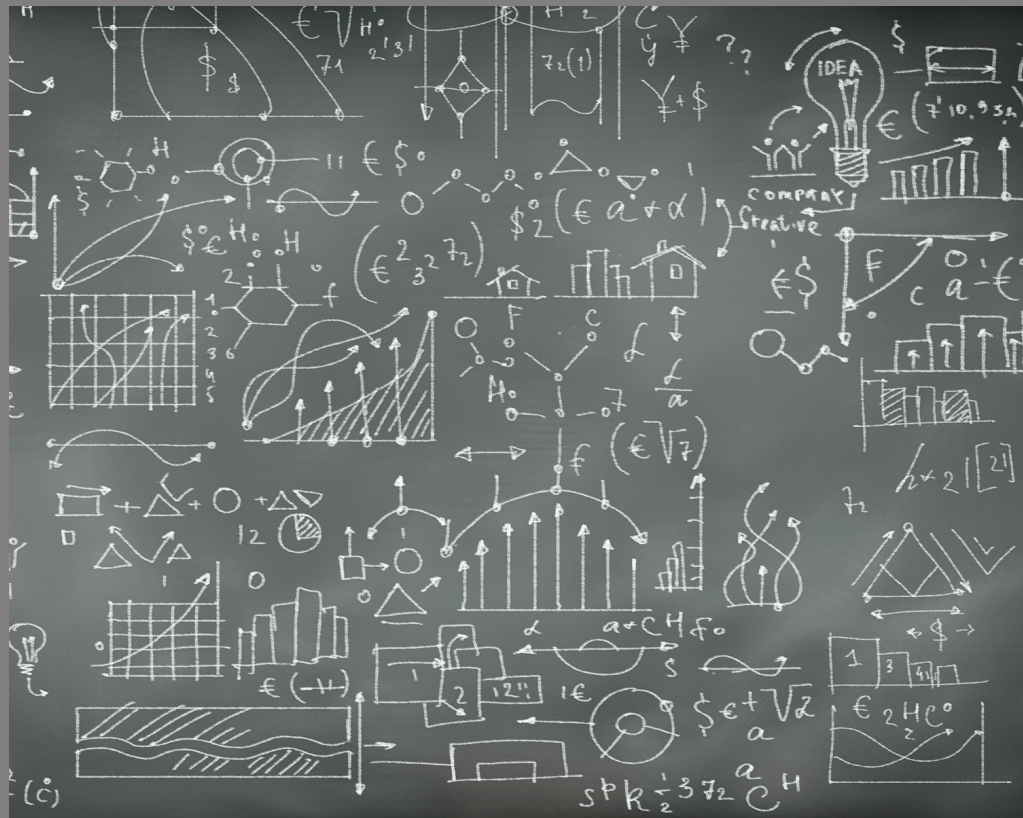
- Government spending (G) and taxes (T) are exogenous

$$T = \bar{T}$$
$$G = \bar{G}$$

- Chosen by the Government at its discretion.
- They are the tools of *fiscal policy*.



# 2.3 THE DETERMINATION OF OUTPUT





# Previously on Econ 204...

- The components of GDP
  - $Y = C + I + G + (X - IM) + \text{Inventory inv.}$
- Aggregate demand in a closed economy
  - $Z = C + I + G$
- A simple theory of what determines aggregate demand:
  - Consumption function  $C = C(Y_D)$
  - Exogenous investment  $I = \bar{I}$
  - Exogenous fiscal policy  $G = \bar{G}; T = \bar{T}$

# Clicker question

Which is the biggest component of US GDP?

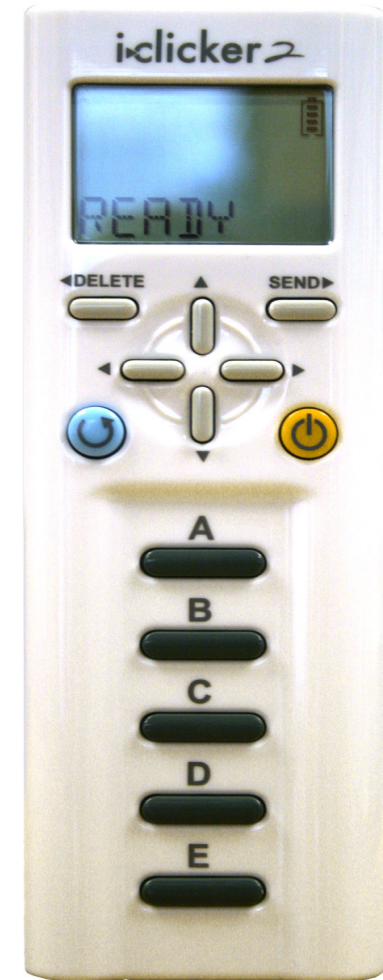
- A. Consumption (C)
- B. Private investment (I)
- C. Government spending (G)
- D. Net Exports ( $X - IM$ )



# Clicker question

The condition for equilibrium in the goods market is...

- A. Consumption equals output.
- B. Output equals demand.
- C. Exports equal imports.
- D. Government spending equals taxes.



# The determination of output

- Demand composition + behavioral equations = a simple *model* of the economy.
- Our model of a (closed) economy:

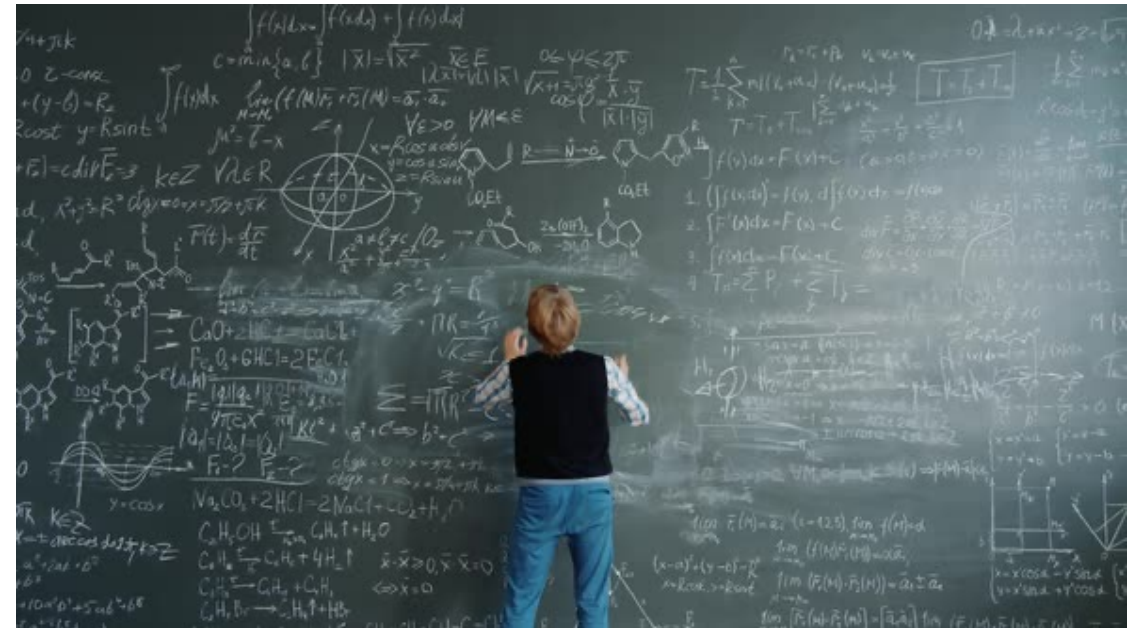
$$Z = C + I + G$$

$$C = c_0 + c_1(Y - \bar{T})$$

$$I = \bar{I}$$

$$T = \bar{T}$$

$$G = \bar{G}$$





# The determination of output

- Plug the behavioral equations into the demand composition equation:

$$Z = c_0 + c_1(Y - \bar{T}) + \bar{I} + \bar{G}$$

- Equilibrium in the goods market

$$Y = Z$$

- (an *equilibrium condition*)

- *Now we are ready to solve the model!*



# The determination of output

- Plug the demand equation in the equilibrium condition:

$$Y = Z \rightarrow Y = c_0 + c_1(Y - \bar{T}) + \bar{I} + \bar{G}$$

- Solve for Y:

$$Y = [c_0 + \bar{I} + \bar{G} - c_1\bar{T}] \frac{1}{1 - c_1}$$

$$Y = \text{Autonomous Demand} * \text{Multiplier}$$

# The determination of output: Example

- $c_1 = 0.6$

- $\rightarrow \text{multiplier} = \frac{1}{1 - 0.6} = 2.5$

- an increase in autonomous spending by \$1 billion will increase output by  $2.5 \times \$1 \text{ billion} = \$2.5 \text{ billion}$ .

# Understanding the multiplier effect

demand → production → income → demand



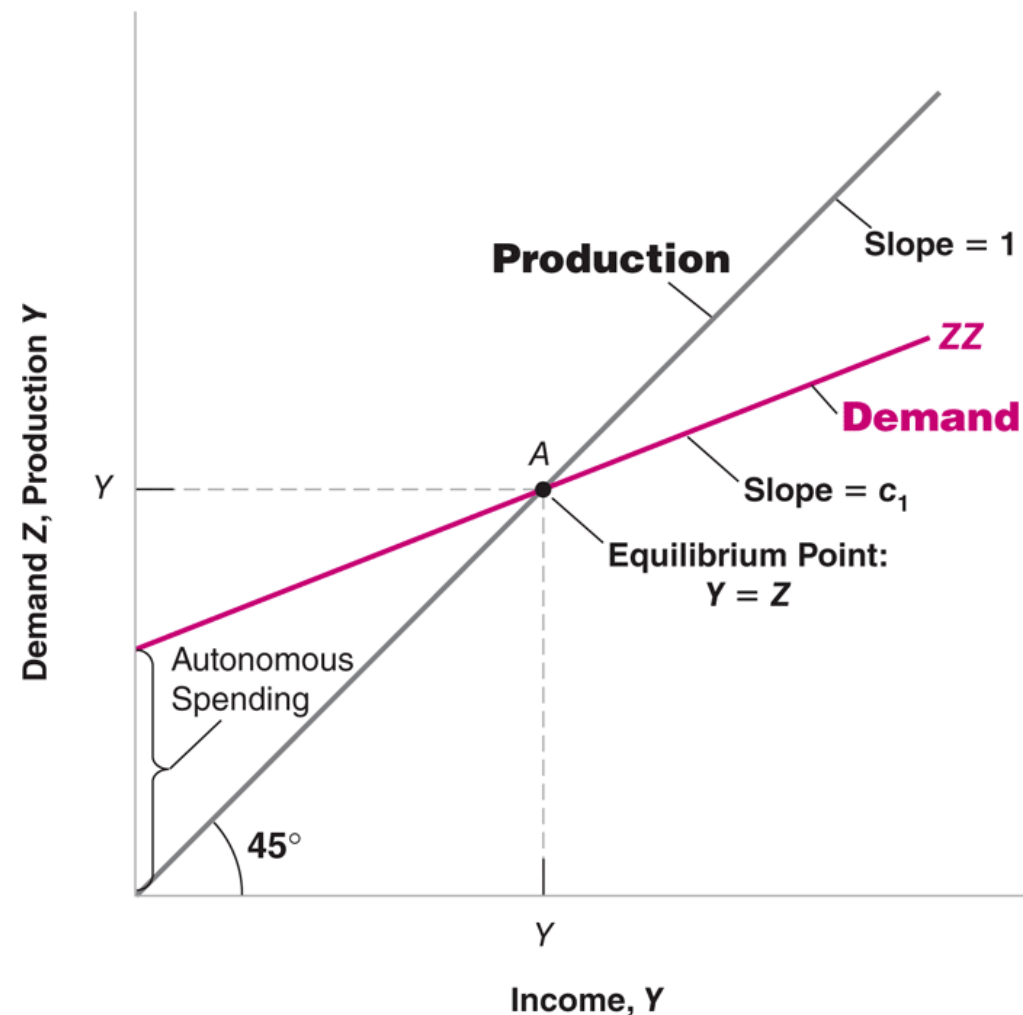
- A virtuous cycle that gets weaker at each round (because  $c_1 < 1$ ) and eventually settles at  $\Delta Y = \Delta AD * [1/(1-c_1)]$ .
- The propensity to consume ‘filters’ the effect of income on demand.
- The higher the propensity to consume, the higher the multiplier.



# Graphical determination of output

Equilibrium output is determined by the condition that production is equal to demand.

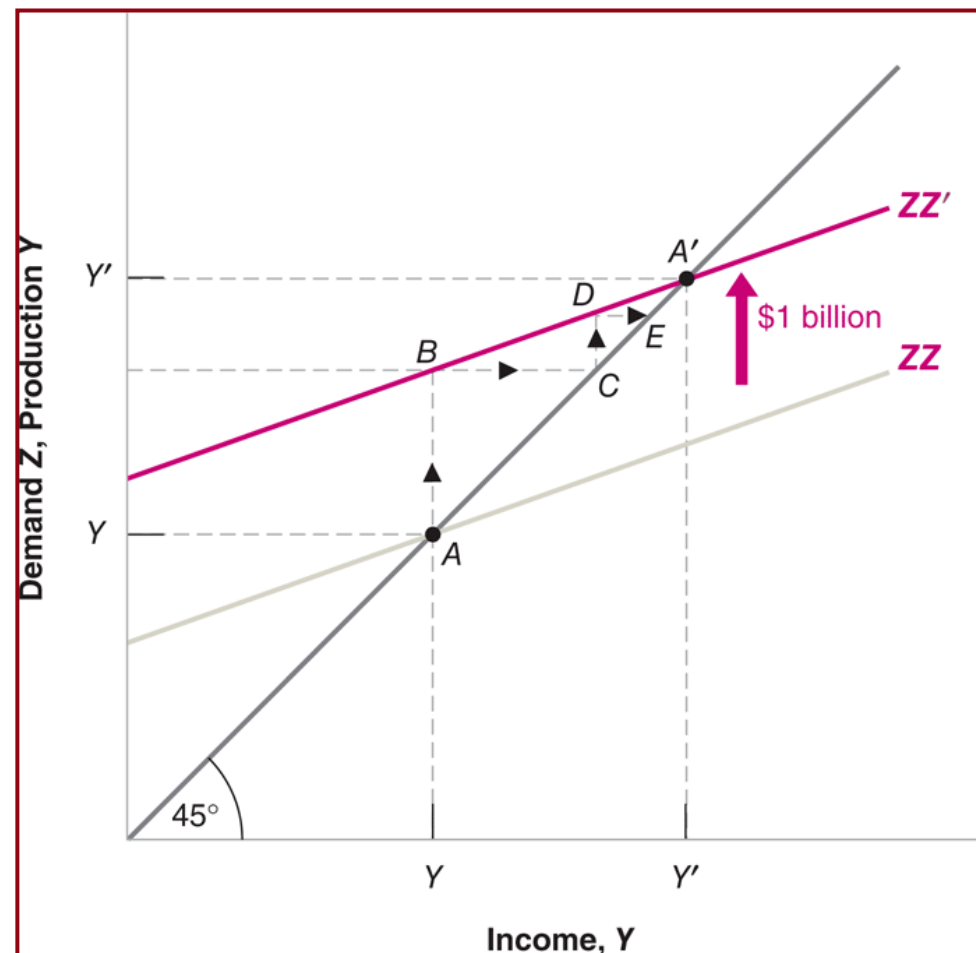
1. Production equals income by definition (gray 45 degrees line)  $Y=Y$
2. Demand is a function of income:  
 $Z = (c_0 + I + G - c_1T) + c_1Y$   
(red positive sloped line)
3. In equilibrium, production equals demand:  
 $Y=Z$  (equilibrium point)



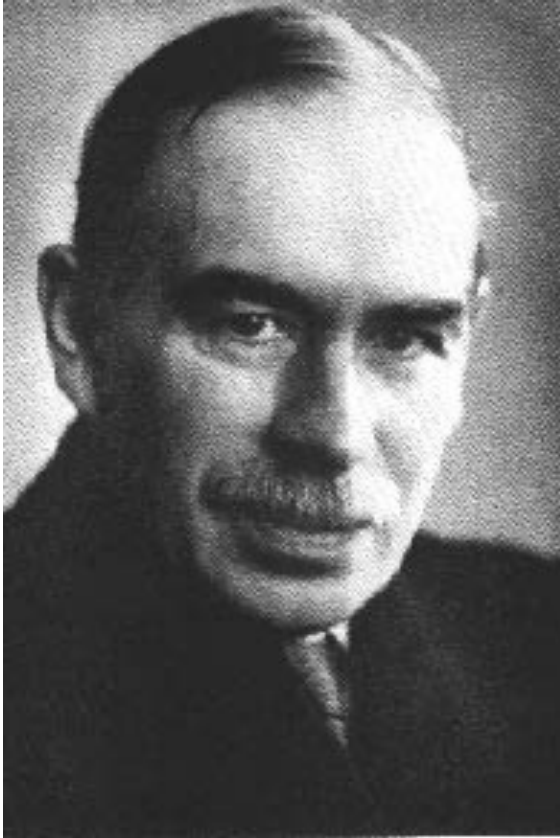
# Graphical determination of output

- Suppose  $c_0$  increases by \$1 billion.

*An increase in autonomous spending has a more than one-for-one effect on equilibrium output.*



# Another way to determine output



John Maynard  
Keynes  
(*General Theory of  
Employment,  
Interest and  
Money*, 1936)

## THREE STEPS:

1. Define aggregate saving.
2. Restate the equilibrium condition as  $\text{saving} = \text{investment}$
3. Use the  $\text{saving} = \text{investment}$  condition to determine equilibrium level of output.

# Another way to determine output (1/3)

## DEFINITION OF SAVINGS:

- Private saving ( $S$ ) is

$$S \equiv Y_D - C$$

$$S \equiv Y - T - C$$

- Public saving =  $T - G$ .
  - Public saving  $> 0 \rightarrow$  Budget surplus
  - Public saving  $< 0 \rightarrow$  Budget deficit



## Another way to determine output (2/3)

- Equilibrium condition:

$$Y = C + I + G$$

- Subtract  $T$  from both sides and move  $C$  to the left side:

$$Y - T - C = I + G - T$$

- The left side of the equation is simply  $S$ , so

$$S = I + G - T$$

↓

$$I = S + (T - G)$$

***IS relation*** : “Investment equals Saving”.

# Another way to determine output (3/3)

- Start from definition of saving:

$$S = Y - T - C$$

- Plug in the consumption function :

$$S = Y - T - c_0 - c_1(Y - T)$$

- Rearrange,

$$S = -c_0 + (1 - c_1)(Y - T)$$

- In equilibrium,  $I = S + (T - G)$ , so:

$$I = -c_0 + (1 - c_1)(Y - T) + (T - G)$$

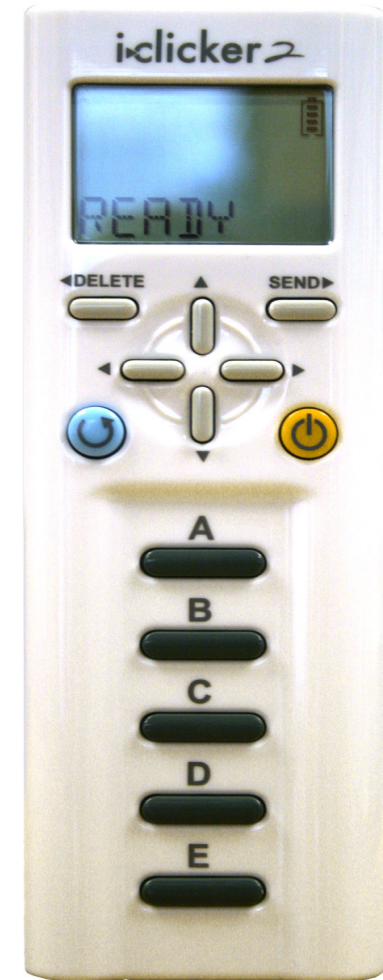
- Solve for output:

$$Y = \frac{c_0 + \bar{I} + \bar{G} - c_1\bar{T}}{1 - c_1}$$

# Clicker question

Say that  $c_1$  decreases. What is the effect on total private saving  $S$ ?

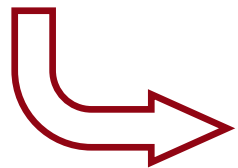
- A. Private saving will increase.
- B. Private saving will decrease.
- C. Private saving will stay the same.
- D. It is not possible to say.



# The paradox of thrift

- Individually, 'thrift' will increase your wealth.
- True for the economy as well?
- Suppose  $c_1$  decreases (increased 'aggregate thrift').
- $Y = \frac{AD}{(1-c_1)} \rightarrow$  output will actually *decrease*!
- **Why?** Total saving can't change, because in equilibrium it must remain equal to (exogenous) investment:

$$S = \bar{I} - (\bar{T} - \bar{G})$$



The result of a higher propensity to save is that  $Y$  decreases and  $S$  remains the same!



# QUESTIONS & ANSWERS

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