ECON 202 - MACROECONOMIC PRINCIPLES

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Chapter 11 - The Income-Expenditure Model

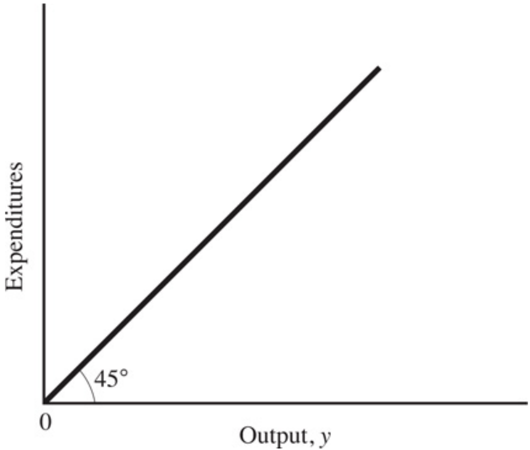
The Income-Expenditure Model - Topics

1. Discuss the income-expenditure model
2. Identify the two key components of the consumption function
3. Calculate equilibrium income in a simple model
4. Explain how government spending and taxes affect equilibrium income
5. Discuss the role of exports and imports in determining equilibrium income
6. Explain how the aggregate demand curve is related to the income-expenditure model

Income Expenditure Model

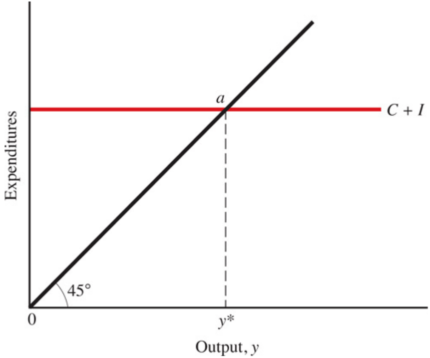
- The income-expenditure model was originally developed by the economist John Maynard Keynes in the 1930s and later extended and refined by many economists
- The model is based on the idea that higher expenditures are necessary to generate higher levels of income in the economy
- The model is useful for understanding economic fluctuations in the very short-run when prices do not change very much

Income Expenditure Model



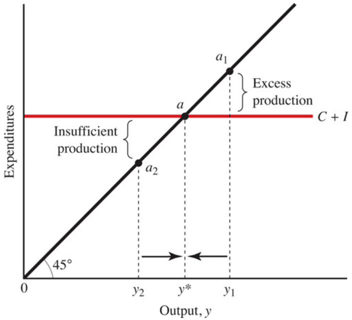
- At any point on the 45 degree line, the distance to the horizontal axis is the same as the distance to the vertical axis

Equilibrium Output



- At equilibrium output y*, output equals planned expenditures, C + I.

Adjustment to Equilibrium Output



- If output were higher (y1), it would exceed demand and production would fall
- If output were lower (y2), it would fall short of demand and production would rise

Consumption Function

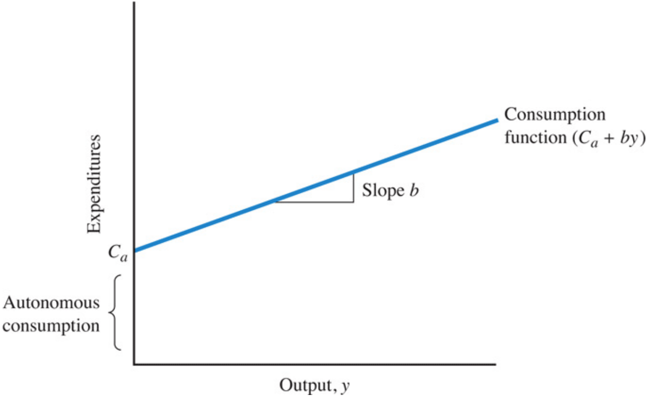
The Consumption Function

- The consumption function shows the relationship between desired spending and the level of income

$$C = C_a + b \times y$$

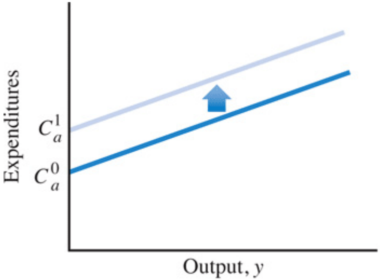
- C_a= autonomous consumption, does not depend on the level of income
- $b \times y$= the part of consumption that is dependent on income:
- b= marginal propensity to consume (MPC), or the fraction of additional income that is spent
- y= level of income in the economy

The Consumption Function

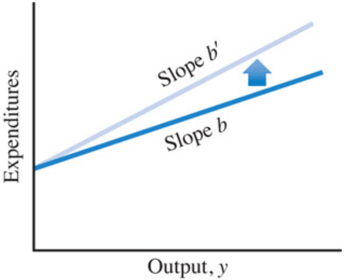


- The consumption function relates desired consumer spending to the level of income

Changes in the Consumption Function

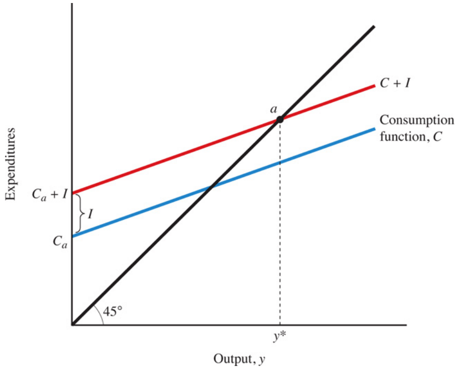


(A) An increase in autonomous consumption from C_a^0 to C_a^1 shifts up the entire consumption function.



(B) An increase in the MPC from b to b' increases the slope of the consumption function.

Equilibrium Output and the Consumption Function in a Closed Economy



- Equilibrium output is determined where the C + I line intersects the 45 line
- At that level of output, y*, desired spending equals output: $y* = \frac{C_a + I}{1 - b}$

Formula for Equilibrium Output

- output=planned expenditures$\rightarrow y = C + I$
- $C = (C_a + b \times y)$, so that
- $y = (C_a + b \times y) + I$. Rearranging
- $y - by = C_a + I$, so that
- $y^* = \frac{C_a + I}{1 - b}$

Savings and Investment

Savings and Investment in a Closed Economy without a Government

- Savings equals output minus consumption

$$S = y - C$$

- Output is determined by demand, C + I, or

$$y = C + I$$

- Subtracting consumption from both sides of the equation results in:

$$y - C = I$$

- The left side shows that $y - C$ equals savings, S, therefore

$$S = I$$

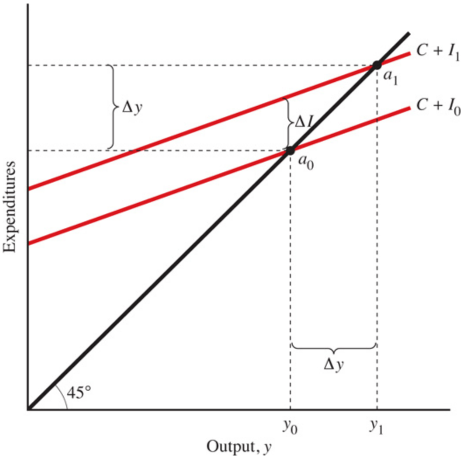
Investment Divided into 3 Components

- Remember that with a foreign sector (open economy) and a government we had:

$$I = S + (T - G) + (Im - Ex),$$

  - where S is private savings
  - (T-G) is government budget surplus/deficit
  - (Im-Ex) is borrowing/lending from rest of the world

Understanding the Multiplier



- When investment increases by ΔI from I_0 to I_1, equilibrium output increases by Δy from y_0 to y_1
- Change in output Δy is $\left(\frac{1}{1-b}\right)$ greater than change in investment ΔI

Multiplier for Investment

- For the original level of investment at I_0we have

$$y_0 = \frac{C_a + I_0}{1 - b}$$

- For the new level of investment I_1we have

$$y_1 = \frac{C_a + I_1}{1 - b}$$

- The difference in output is then

$$\begin{aligned}
\Delta y &= y_1 - y_0, \\
\rightarrow \quad \Delta y &= \frac{C_a + I_1}{1 - b} - \frac{C_a + I_0}{1 - b}, \\
\rightarrow \quad \Delta y &= \frac{I_1 - I_0}{1 - b}, \\
\rightarrow \quad \Delta y &= \frac{1}{1 - b}\Delta I,
\end{aligned}$$

Alternative Derivation of Multiplier

- $\Delta y = \$1 + (\$1 \times b) + \left(\$1 \times b^2\right) + \left(\$1 \times b^3\right) + ...$ or
- $\Delta y = \$1 \times \left(1 + b + b^2 + b^3 + ...\right)$
- This is an infinite series which can be written as

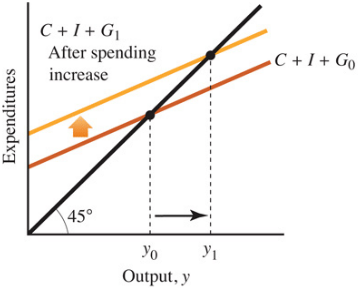
$$\Delta y = \$1 \times \frac{1}{1-b}$$

Government Spending and Taxation

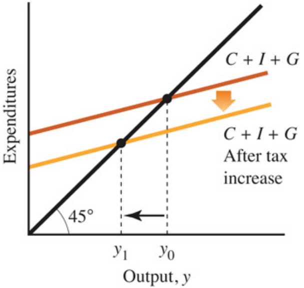
- Both the level of government spending and the level of taxation, through their influence on the demand for goods and services, affect the level of GDP in the short run
- Using taxes and spending to influence the level of GDP in the short run is known as Keynesian fiscal policy
- Government purchases of goods and services are a component of total spending:

$$\text{Planned Expenditures} = C + I + G$$

Government Spending and Taxation



(A) An increase in government spending leads to an increase in output.



(B) An increase in taxes leads to a decrease in output.

Fiscal Multipliers

- Multiplier for government spending

$$\Delta Y = \left(\frac{1}{1-b}\right) \times \Delta G$$

- Investment multiplier

$$\Delta Y = \left(\frac{1}{1-b}\right) \times \Delta I$$

- Consumption multiplier

$$\Delta Y = \left(\frac{1}{1-b}\right) \times \Delta C$$

- Tax multiplier

$$\Delta Y = \left(\frac{-b}{1-b}\times\right) \times \Delta T$$

Government Spending and Taxes

- $C_a + b \times (y - T)$
- output = planned expenditures or

$$
\begin{aligned}
y &= C + I + G, \\
&\rightarrow \quad y = (C_a + b \times (y - T)) + I + G, \\
&\rightarrow \quad y - by = (C_a - bT) + I + G, \\
&\qquad y^* = \frac{C_a - bT + I + G,}{1 - b}
\end{aligned}
$$

- Using this formula and the method just outlined, we can find the multiplier for changes in government spending and the multiplier for changes in taxes

Proof

Government spending multiplier:

$$y_0^* = \frac{C_a - bT + I + G_0,}{1-b}$$

$$y_1^* = \frac{C_a - bT + I + G_1,}{1-b}$$

Then

$$\begin{aligned}
\Delta y = y_1 - y_0 &= \frac{C_a - bT + I + G_1}{1-b} - \frac{C_a - bT + I + G_0,}{1-b}, \\
&= \frac{G_1 - G_0}{1-b}, \\
\rightarrow \Delta y &= \left(\frac{1}{1-b}\right) \times \Delta G.
\end{aligned}$$

Proof (cont.)

Tax multiplier:

$$y_0^* = \frac{C_a - bT_0 + I + G,}{1-b}$$

$$y_1^* = \frac{C_a - bT_1 + I + G,}{1-b}$$

Then

$$\begin{aligned}
\Delta y = y_1 - y_0 &= \frac{C_a - bT_1 + I + G}{1-b} - \frac{C_a - bT_0 + I + G,}{1-b}, \\
&= \frac{-bT_1 - (-bT_0)}{1-b}, \\
&= \frac{-b \times (T_1 - T_0)}{1-b}, \\
\rightarrow \Delta y &= \left(\frac{-b}{1-b}\right) \times \Delta T.
\end{aligned}$$

Government Spending and Taxation

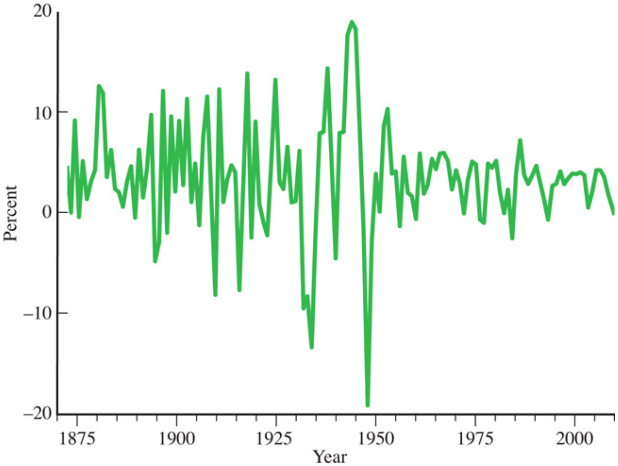
- Although it is very simple, our income-expenditure model illustrates some important lessons:
  1. An increase in G will increase total planned expenditures for goods and services
  2. Cutting taxes will increase the after-tax income of consumers $\rightarrow$ increase in planned expenditures for goods and services
- Policymakers need to take into account the multipliers for government spending and taxes as they develop policies

Balanced Budget Multiplier

- Increasing T and G by equal amounts will $\uparrow Y$
- G has larger multiplier than taxes T
- Increase of y due to $\uparrow G$ outweighs the decrease of y due to $T \uparrow$
- Balanced budget multiplier

$$\begin{aligned} BBM &= \frac{1}{1-b} + \frac{-b}{1-b}, \\ &\rightarrow BBM = \frac{1-b}{1-b}, \\ &\rightarrow BBM = 1 \end{aligned}$$

Growth Rates of U.S. GDP, 1871–2011



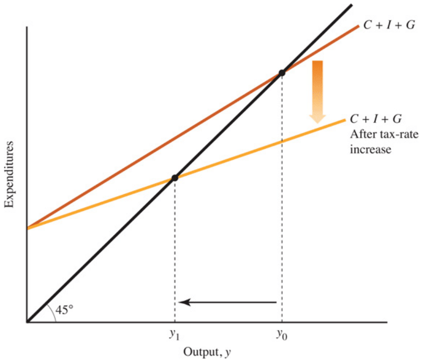
- The U.S. economy has been much more stable after World War II than before. The reason is that government taxes and transfer payments, which help to reduce fluctuations in real GDP, grew sharply after the

Automatic Stabilizers

Understanding Automatic Stabilizers

- Automatic stabilizers are taxes and transfer payments that stabilize GDP without requiring policymakers to take explicit actions
  - When income is high, the government collects more taxes and pays out less transfer payments $\rightarrow C \downarrow$
  - When output is low, the government collects less taxes and pays out more in transfer payments $\rightarrow C \uparrow$
- Automatic stabilizers prevent
  - C from falling as much in bad times (reduce multiplier when y is low)
  - C from rising as much in good times (reduce multiplier when y is high)
  - Automatic stabilizers reduce the multiplier!

Understanding Automatic Stabilizers



Understanding Automatic Stabilizers

- If consumption depends on after-tax income, we have the following consumption function:

$$C = C_a + \overbrace{b \times (1-\tau)}^{\text{slope}} \times y$$

- Adjusted $MPC = b \times (1-\tau)$
- An increase in tax rates decreases the slope of the $C + I + G$ line
- The tax lowers output and **reduces** the multiplier
- New Multiplier: $\frac{1}{1-b\times(1-\tau)}$ ¡ $\frac{1}{1-b}$

Exports and Imports

- To modify our model to include the effects of exports and imports, we need to take two steps:
  - Add exports, X, to other sources of spending as another source of demand for U.S. products
  - Subtract imports, M, from total spending by U.S. residents.
- Consumers will import more goods as income rises

$$M = m \times y$$

- The fraction m is known as the marginal propensity to import
- We subtract this fraction from b, the overall marginal propensity to consume, to obtain the MPC for spending on domestic goods, b–m

Equilibrium Output with Government Spending, Taxes, and the Foreign Sector

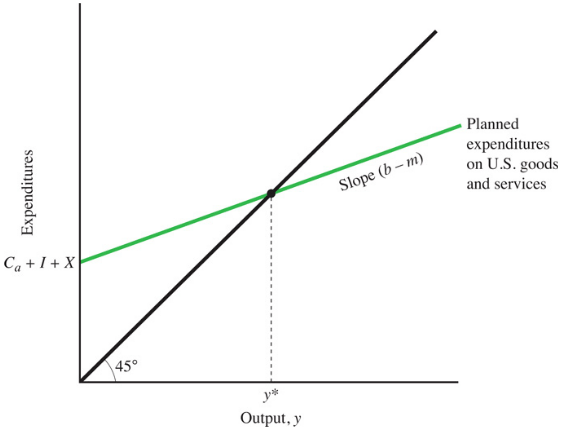
- Output equals planned expenditures

$$y = C + I + G + X - M$$

- Substituting $C = C_a + b(y - T)$ and $M = m \times y$ we get

$$\begin{aligned} y &= (C_a + b(y - T)) + I + G + X - m \times y, \\ &\rightarrow \quad y - by + my = (C_a - bT) + I + G + X, \\ &\rightarrow \quad y^* = \frac{C_a - bT + I + G + X}{1 - b + m}, \\ &\rightarrow \quad y^* = \frac{C_a - bT + I + G + X}{1 - (b - m)}, \end{aligned}$$

U.S. Equilibrium Output in an Open Economy



U.S. Equilibrium Output in an Open Economy

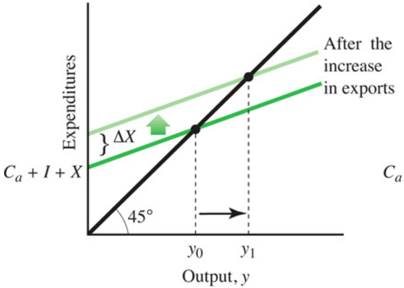
- Output equals planned expenditures: $y = C + I + G + X - M$
- Substituting $C = C_a + b\,(y - T)$ and $M = m \times y$ we get

$$y = C_a + b(y - T) + I + G + X - my$$

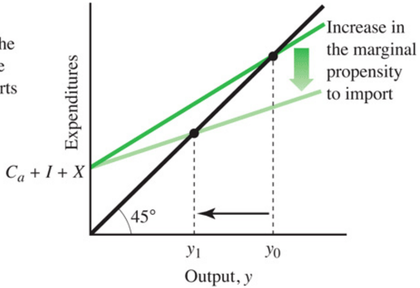
- so that the new expenditure function is:

$$y = \overbrace{C_a + I + G + X - bT}^{\text{intercept}} + \overbrace{(b - m)}^{\text{slope}}y$$

How Increases in Exports and Imports Affect GDP



(A) An increase in exports will increase the level of GDP.



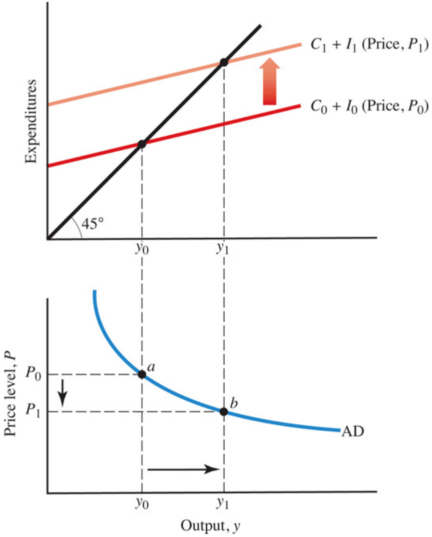
(B) An increase in the marginal propensity to import will decrease the level of GDP.

Locomotive Effect

- From the early 1990s until quite recently, the United States was what economists term the "locomotive" for global growth
- Our demand for foreign products increased. U.S. imports increased along with output during this period
- The increased demand fueled exports in foreign countries and promoted their growth
- Studies have shown that the increase in demand for foreign goods was actually more pronounced for developing countries than for developed countries
- Conclusion: The United States was truly a locomotive, pulling the developing countries along

Income Expenditure Model and AD Curve

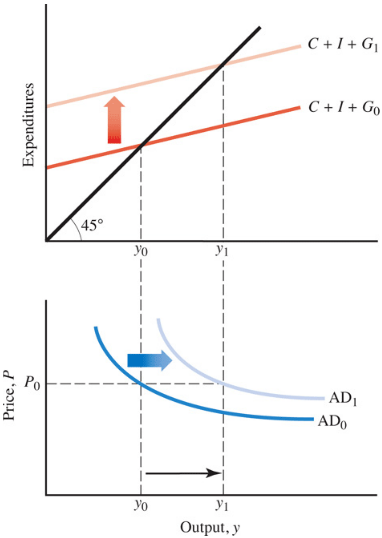
The Income-Expenditure Model and the Aggregate Demand Curve



Income Expenditure Model and AD Curve

- As the price level falls from P_0 to P_1, planned expenditures increase, which increases the level of output from $y_0$to y_1
- The aggregate demand curve shows the combination of prices and equilibrium output

The Income-Expenditure Model and the Aggregate Demand Curve



The Income-Expenditure Model and the Aggregate Demand Curve

- As government spending increases from G_0 to G_1, planned expenditures increase, which raises output from y_0 to y_1
- With the price level unchanged at P_0, the increase in government spending shifts the aggregate demand curve to the right from AD_0 to AD_1