Short-Run Fluctuations

There are two key questions that we have not answered yet.

A. What forces push GDP away from its potential?

B. Why does it take the economy several years to return to potential GDP after a shock?

Forces that Push the Economy off its Growth Path

A. Differences between the long run and short run

   1. Prices are completely flexible in the long run but are unresponsive in the short run.

   2. GDP (Y) is at its potential (Y*) in the long run but is demand determined in the short run.

   3. As the economy transitions from the short run to the long run, prices gradually adjust and Y slowly returns to Y*.

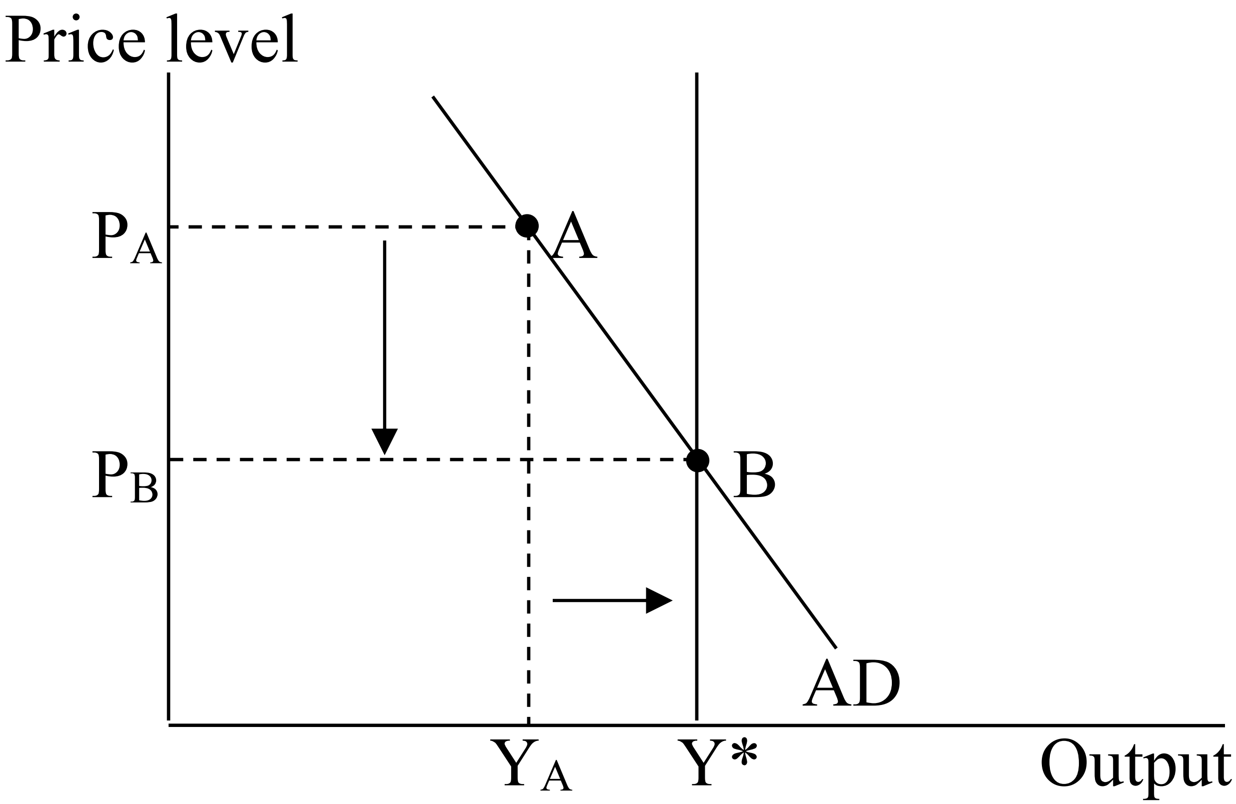
B. The aggregate demand (AD) curve

   1. The AD curve is the relationship between the price level (P) and output (Y) demanded.

   2. The short run level of Y is determined from the AD curve given P.

   3. In the long run, P adjusts so Y returns to Y*.

4. Graph of an aggregate demand curve



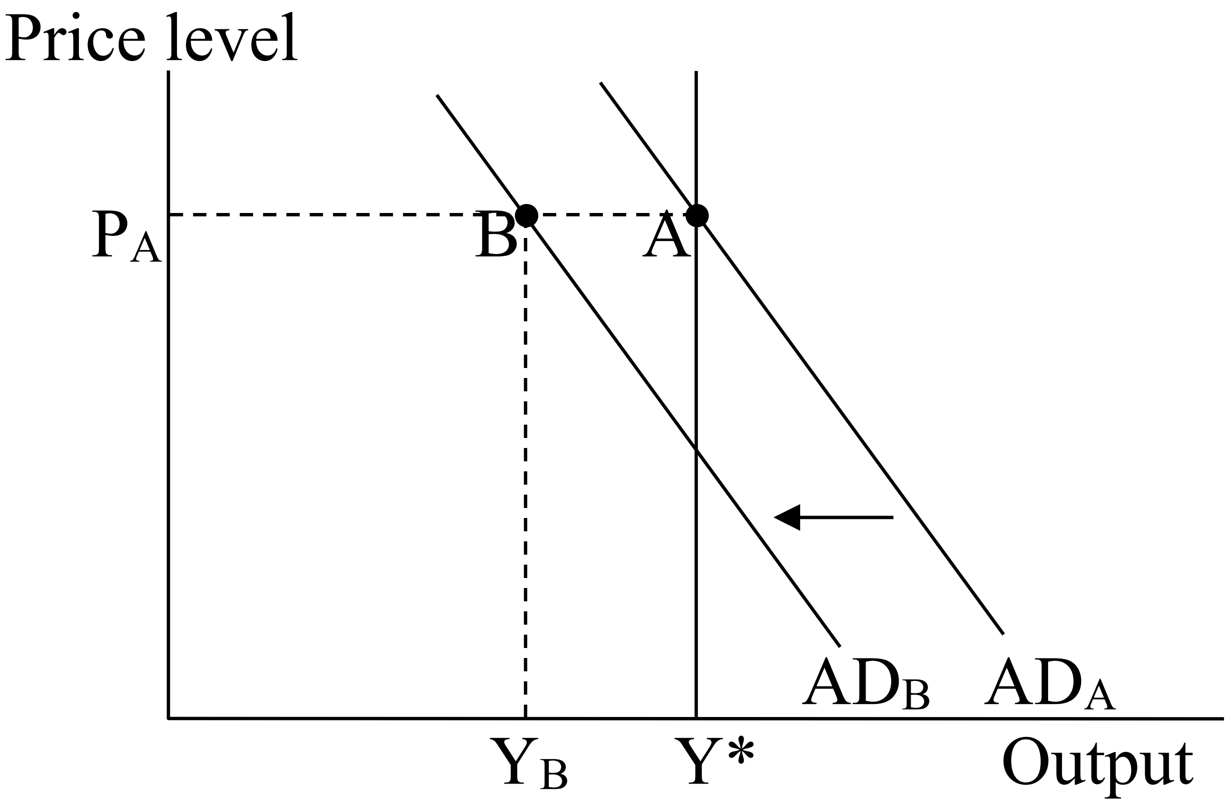
a. In the short run, the price level (P_A) and the AD curve's position determines output (Y_A).

b. In the long run, P adjusts to P_B so that Y returns to Y*.

C. Events that move the Y away from Y*

1. Any event that shifts the AD curve

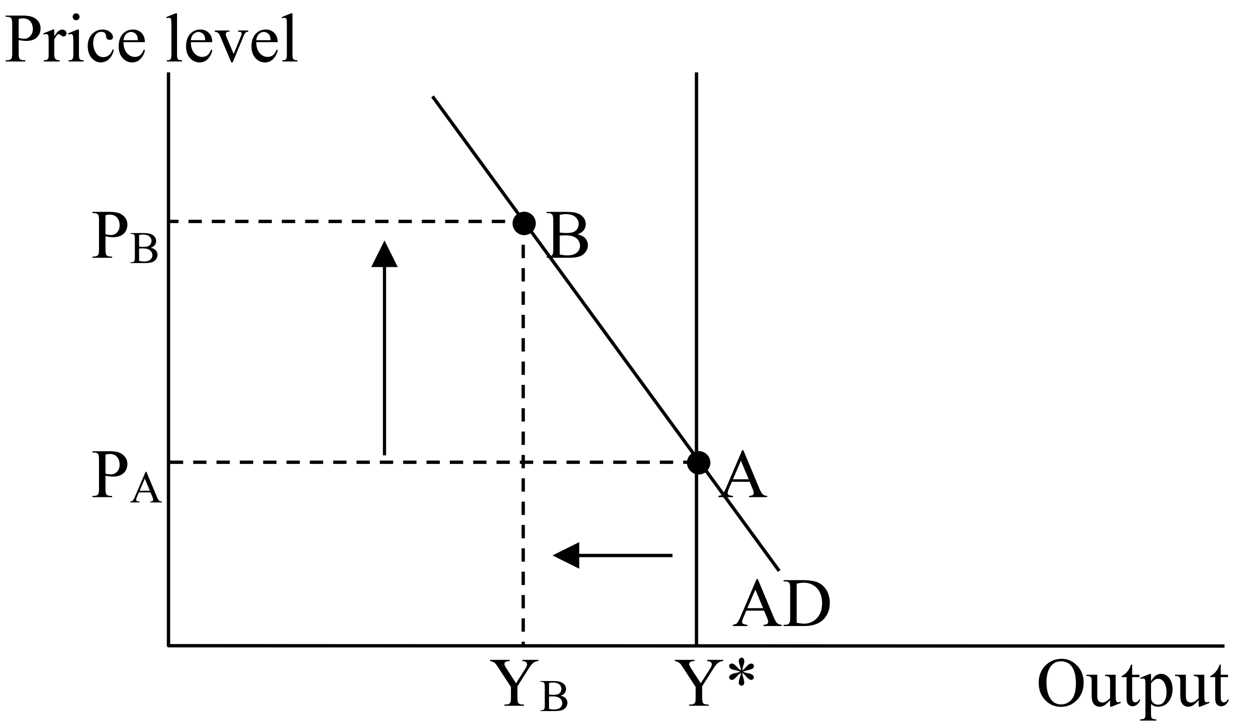
a. Ex. Suppose AD curve shifts leftward to AD_B. In the short run, Y falls from Y* to Y_B while P remains at P_A.



b. The AD curve shifts due to include changes in monetary or fiscal policy or exogenous shifts in C, I, or (X – IM).

2. Any event that shifts the price level

   a. Ex. Suppose P rises from P_A to P_B. In the short run, Y falls from Y^* to Y_B.



   b. Changes in world prices, especially oil prices, are the most common sources of price shocks.

Aggregate Demand and Spending Decisions

A. In the short run, spending decisions by people determine the amount of goods produced by firms.

B. Firms usually operate with some excess capacity so that they can meet unexpected demand increases.

C. Thus, spending decisions (NOT resource constraints) determine Y in the short run.

D. Aggregate demand is the sum of all spending (and output) in the economy given P.

E. While firms adjust prices as production changes, the adjustment in prices lags production changes so prices are "sticky" in the short run.

Balancing Income and Spending: the Consumption Function

A. Income (Y), disposable income (Y_d), and taxes (T).

1. Recall, the definition for disposable income

$$Y_d = Y - T \tag{1}$$

2. We will assume taxes are given by a proportional income tax so that the government's tax revenue is

$$T = t \times Y \tag{2}$$

where $0 \leq t \leq 1$ is the income tax rate.

3. When we substitute (2) into (1), the relationship between Y and Y_d is as follows

$$Y_d = (1 - t) \times Y$$

B. The <u>income identity</u> says income equals total spending in the economy. (spending balance)

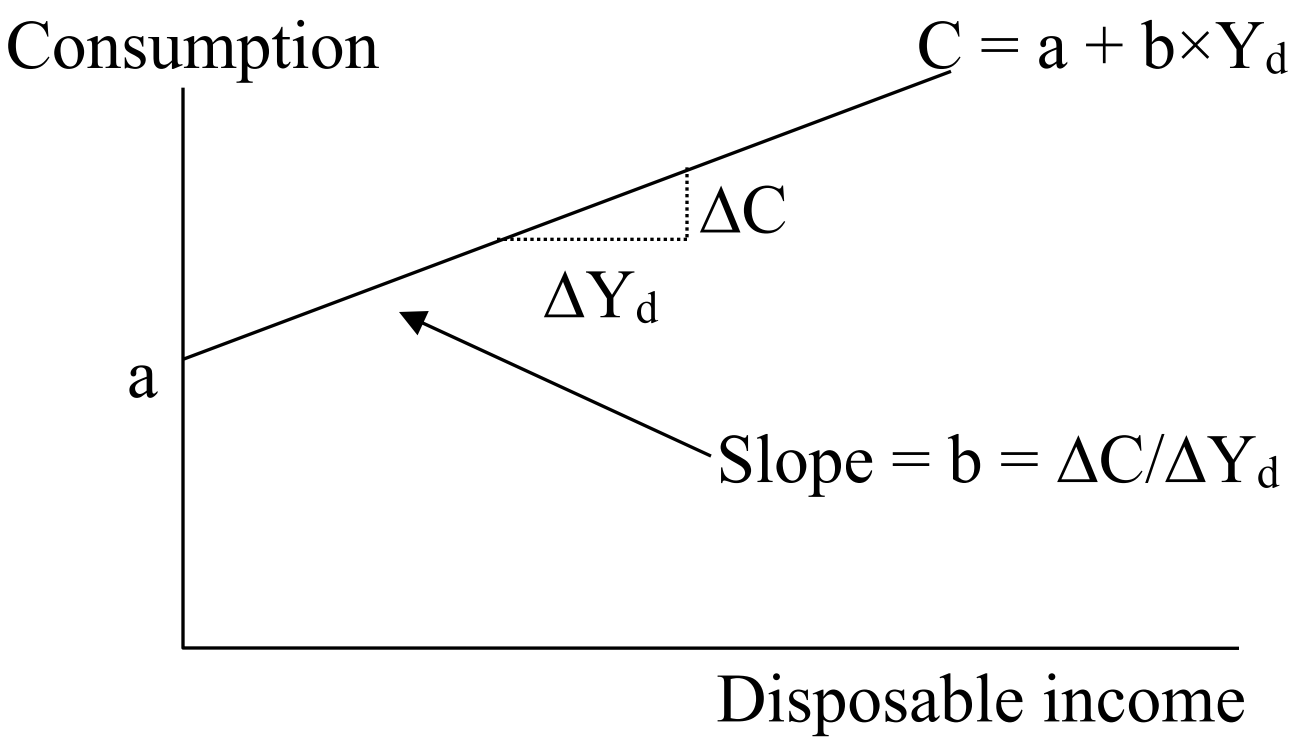
$$Y = C + I + G + (X - IM)$$

C. The consumption function is a description of total consumption demanded in the economy:

$$C = a + b \times Y_d.$$

1. There is a stable positive relationship between C and Y_d.
   a. C is dependent on Y_d.
   b. Y_d is independent of C.
2. Autonomous consumption, (*a*)
   a. *a* captures all influences on C except Y_d.
   b. *a* is the intercept on the consumption function.
   c. $a > 0$.
   d. *a* is shifted by changes in expectations or net worth.

3. Marginal propensity to consume, (MPC = b).
    a. *b* is the fraction of additional Y_d that is consumed.
    b. *b* is the slope of the consumption function.
    c. $0 \leq b \leq 1$.
4. Consumption function graph

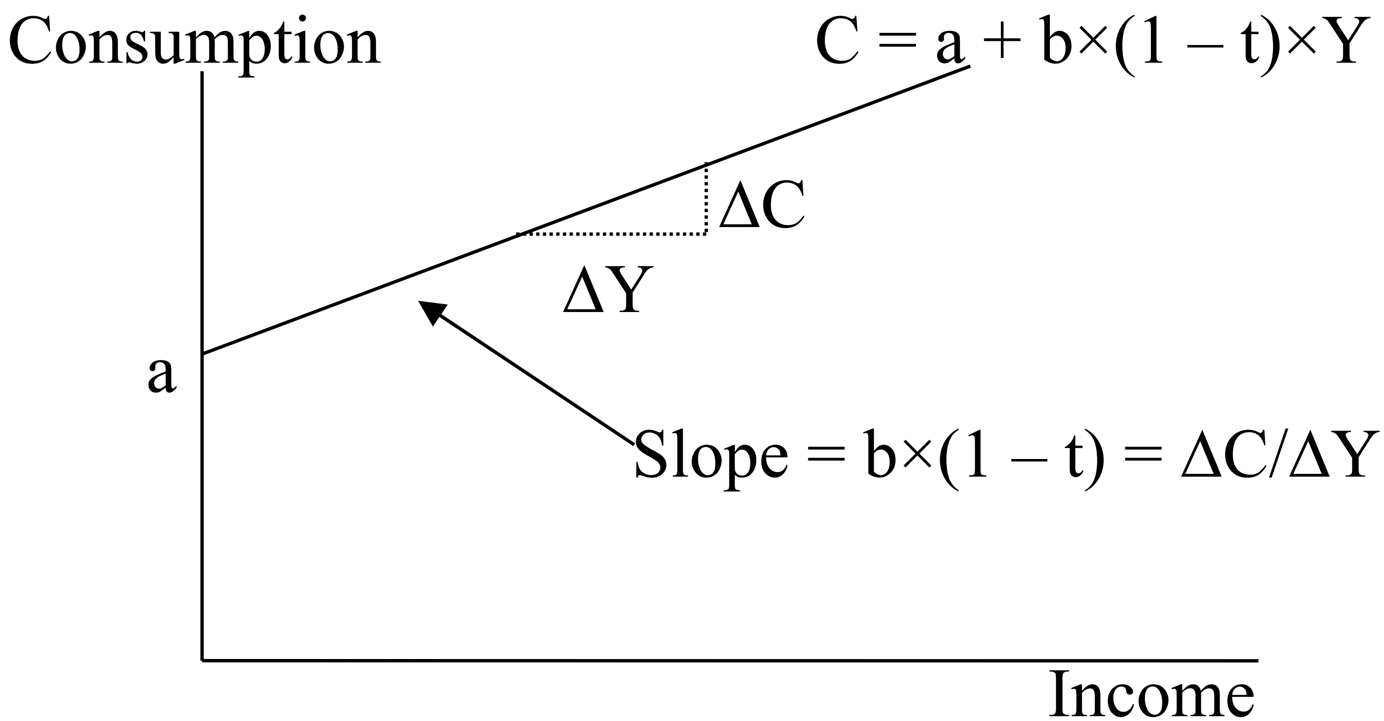


5. By substituting in $Y_d = (1 - t) \times Y$ into the consumption function, C can be written in terms of income (Y):

$$C = a + b \times (1 - t) \times Y.$$

   a. $b \times (1 - t)$ is the slope of the consumption function (when Y is on the X-axis).

   b. Consumption function graph



A Basic Model of Income Determination

A. Initial assumptions

1. C is a function of *a*, *b*, *t*, and Y.
2. I, G, and (X – IM) are determined outside the model. (i.e., exogenous variables)
3. C and Y are determined inside the model. (i.e, endogenous variables)

B. Algebraic solution for Y and C.

1. Two initial equations

   a. Income identity

   $$Y = C + I + G + (X - IM)$$

   b. Consumption function

   $$C = a + b \times (1 - t) \times Y$$

2. Combine these two equations to get

$$Y = a + b \times (1 - t) \times Y + I + G + (X - IM).$$

3. Solving for Y

$$Y = a + b \times (1 - t) \times Y + I + G + (X - IM)$$

$$Y - b \times (1 - t) \times Y = a + I + G + (X - IM)$$

$$Y \times [1 - b \times (1 - t)] = a + I + G + (X - IM)$$

$$Y^{**} = [a + I + G + (X - IM)]/[1 - b \times (1 - t)].$$

4. C is determined by plugging in Y**.

$$C^{**} = a + b \times (1 - t) \times Y^{**}.$$

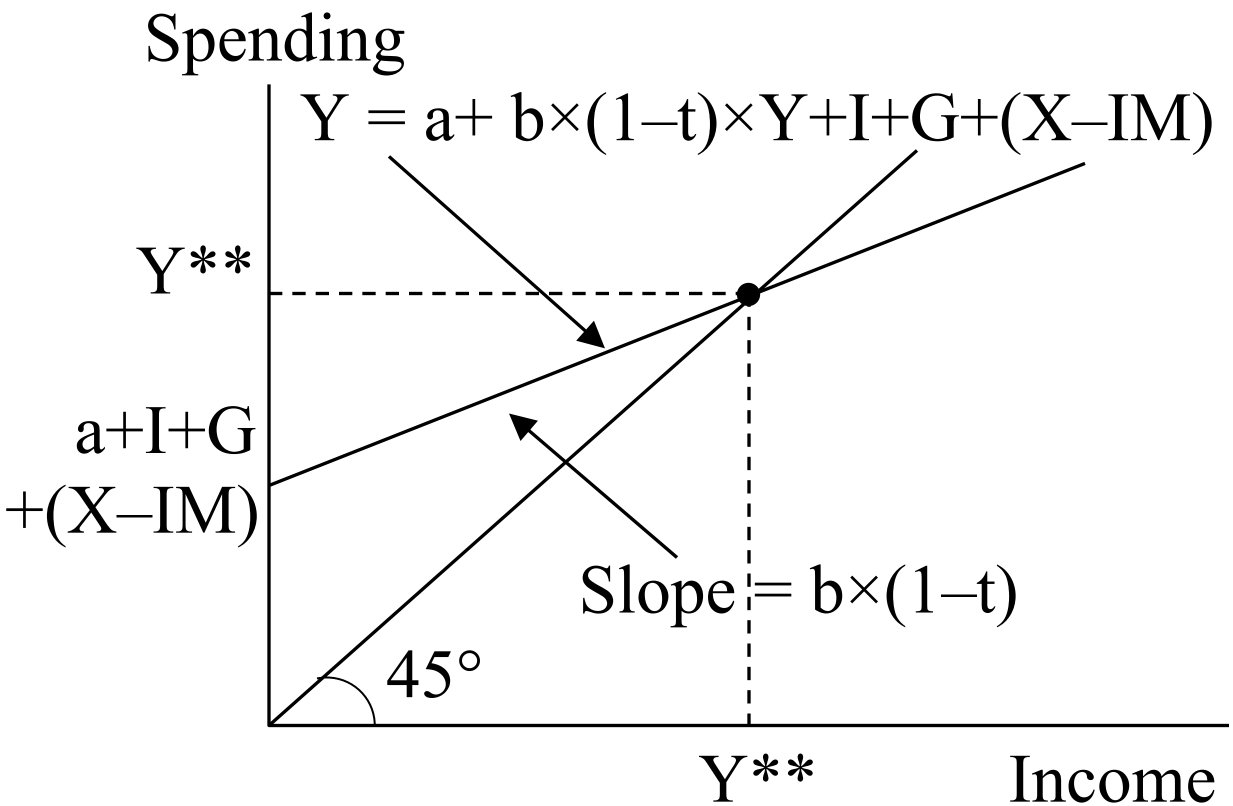
C. Graphical analysis of spending balance

1. At spending balance, income = spending
2. The income-spending graph has 2 intersecting lines.
   a. Spending line

   $$Y = a + b \times (1 - t) \times Y + I + G + (X - IM)$$

   b. A 45° line that signals all the points where spending equals income.

3. Income-spending graph



a. Income = spending at Y**

b. a + I + G + (X – IM) is the intercept.

c. b×(1 – t) is the slope.

d. Factors that shift the spending line up (down)

1. An increase (decrease) in <u>net worth</u> (assets – liabilities) causes *a* (autonomous consumption) to rise (fall).

2. <u>Expectations</u> of higher (lower) Y in the future increases (decreases) capital demand in the future, which causes I to rise (fall).

3. Lower (higher) <u>interest rates</u> decrease (increase) borrowing costs for investment goods so I rises (falls).

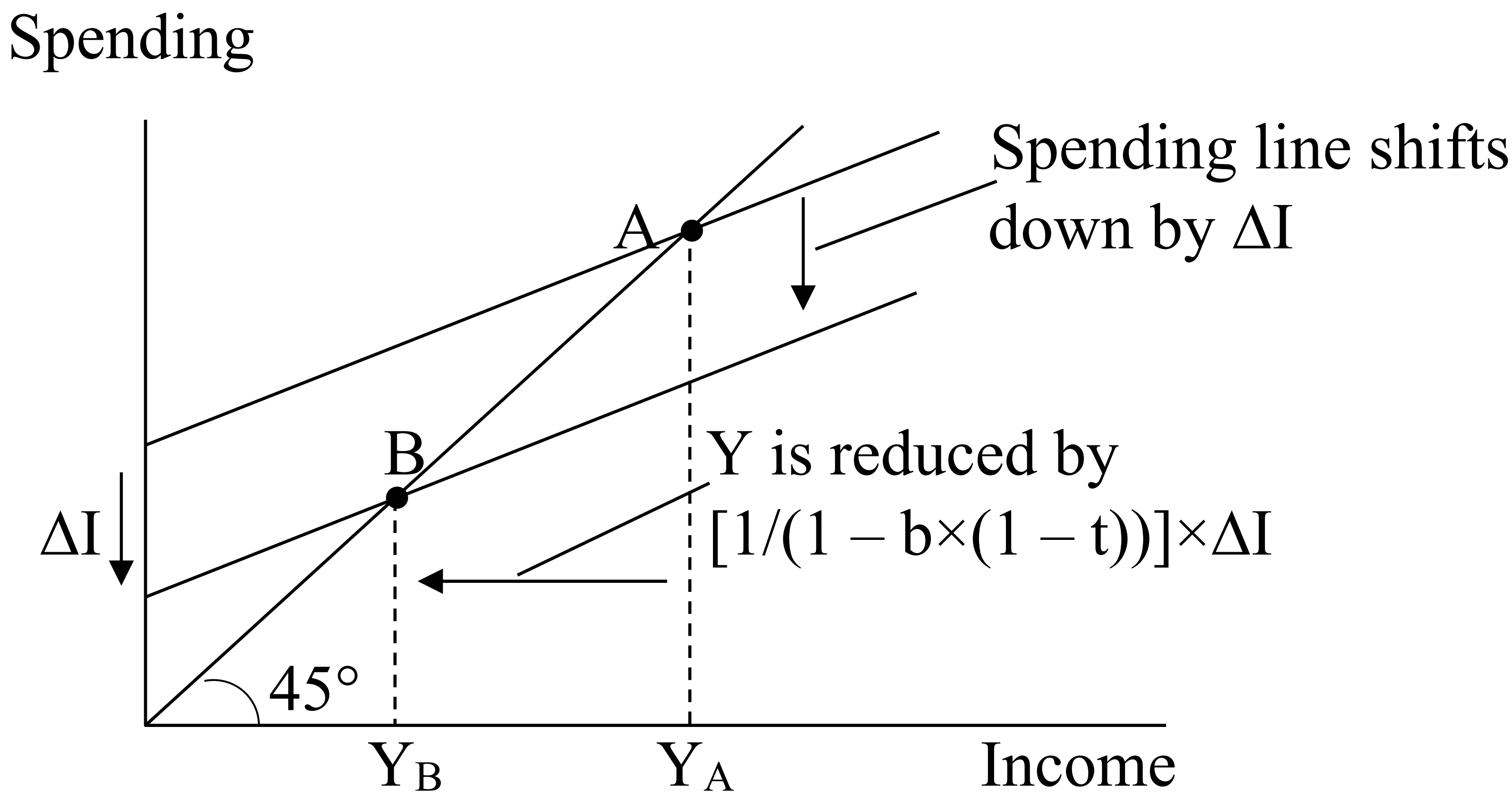
4. An increase (decrease) in <u>foreign income</u> causes X to rise (fall) because foreigners have more (less) money to spend on U.S. exports.

5. A lower (higher) <u>exchange rate</u> makes U.S. goods less (more) costly overseas and foreign goods more (less) costly in the U.S. so X rises (falls) and IM falls (rises).

D. The effect of a decrease in I on Y. [The exact same results hold for a change in a, G or (X – IM).]

1. The drop in I, decreases Y, causing C to fall due to the MPC (*b*), which causes Y to decline further.
2. $Y\downarrow > I\downarrow$
3. The larger the MPC, the greater the fall in Y.

4. The impact of a fall in I on the income-spending graph.



a. The spending line shifts down by ΔI.

b. Y is reduced by

$$\Delta Y = [1/(1 - b \times (1 - t))] \times \Delta I$$

5. The spending multiplier

$$\Delta Y = [1/(1 - b\times(1 - t))]\times\Delta I$$

   a. A large MPC (b) and a small marginal tax rate (t) will maximize the size of the spending multiplier.

6. The same spending multiplier holds for a change in *a*, G and (X – IM).

7. Example I

   Let b = 0.8 and t = 0.25

   Suppose I falls by 20. Calculate the change in Y?

$$\begin{aligned}\Delta Y &= [1/(1 - b\times(1 - t))]\times\Delta I \\ &= [1/(1 - 0.8\times(1 - 0.25))]\times(-20) \\ &= [1/(1 - 0.6)]\times(-20) \\ &= 2.5\times(-20) \\ &= -50\end{aligned}$$

8. Example II

Let b = 0.75 and t = 0.20

Suppose the government wants Y to rise by 125. How much will it have to increase G?

$$\Delta Y = [1/(1 - b\times(1 - t))]\times\Delta G$$
$$125 = [1/(1 - 0.75\times(1 - 0.2))]\times\Delta G$$
$$125 = [1/(1 - 0.6)]\times\Delta G$$
$$125 = 2.5\times\Delta G$$
$$\Delta G = 125/2.5$$
$$\Delta G = 50$$

A Model of Income Determination with Variable Net Exports

A. Initial assumptions

1. I and G are determined outside the model.
2. C, Y, and (X – IM) are determined inside the model.

B. Net exports

1. Exports (X) are independent of Y.

$$X = X$$

2. Imports (IM) rise as Y_d increases. [Recall, $Y_d = (1 - t) \times Y$]

$$IM = m \times (1 - t) \times Y$$

where *m* is the marginal propensity to import, which is the fraction of additional Y_d that is spent on imports.

3. The net exports function

$$(X - IM) = X - m \times (1 - t) \times Y$$

C. Algebraic solution for Y, C and (X – IM).

1. Three initial equations

   a. Income identity

$$Y = C + I + G + (X - IM)$$

   b. Consumption function

$$C = a + b \times (1 - t) \times Y$$

   c. Net exports function

$$(X - IM) = X - m \times (1 - t) \times Y$$

2. Combine these three equations and solve for Y**

$$Y = a + b \times (1 - t) \times Y + I + G + X - m \times (1 - t) \times Y$$

$$Y - b \times (1 - t) \times Y + m \times (1 - t) \times Y = a + I + G + X$$

$$Y \times [1 - (b - m) \times (1 - t)] = a + I + G + X$$

$$Y^{**} = [a + I + G + X]/[1 - (b - m) \times (1 - t)]$$

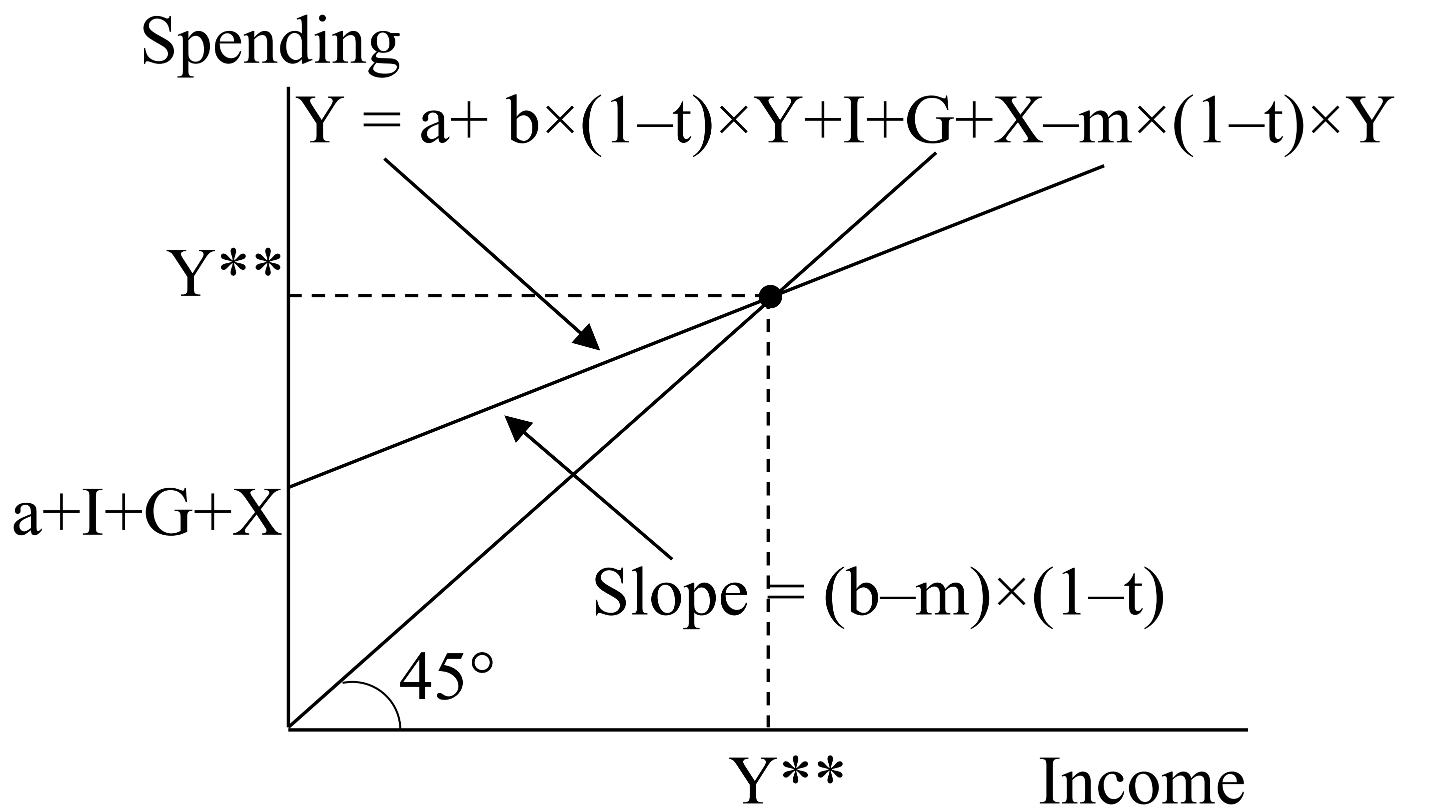
3. C** is determined by plugging in Y**

$$C^{**} = a + b\times(1 - t)\times Y^{**}$$

4. (X – IM) is determined by plugging in Y**

$$(X - IM)^{**} = X - m\times(1 - t)\times Y^{**}$$

D. Income-spending graph with variable net exports



1. $a + I + G + X$ is the intercept.
2. $(b - m)\times(1 - t)$ is the slope.
3. Slope of the spending line is flatter with variable net exports, $[(b - m)\times(1 - t)]$, than in the original model with fixed net exports, $[b\times(1 - t)]$. That is,

$$(b - m)\times(1 - t) < b\times(1 - t)$$

4. The spending multiplier with variable net exports is

$$\Delta Y = [1/(1 - (b - m)\times(1 - t))]\times\Delta I$$

   a. The spending multiplier with variable net exports is smaller than the spending multiplier with fixed net exports.

   b. The same spending multiplier holds for a change in *a*, G, or X.

   c. A large MPC (b), a small marginal tax rate (t), and a small marginal propensity to import (m) will maximize the size of the spending multiplier.

E. An example of the open-economy spending multiplier

Let G rise by 50

$b = 0.85$, $m = 0.05$, and $t = 0.25$

Calculate change in Y?

$$
\begin{aligned}
\Delta Y &= [1/(1 - (b - m)\times(1 - t))]\times\Delta G \\
&= [1/(1 - (0.85-0.05)\times(1 - 0.25))]\times 50 \\
&= [1/(1 - 0.8\times 0.75)]\times 50 \\
&= [1/(1 - 0.6)]\times 50 \\
&= 2.5\times 50 \\
&= 125
\end{aligned}
$$

Numerical Problem

Suppose that the economy is given by

$$Y = C + I + G + (X - IM)$$

$$C = a + b\times(1 - t)\times Y$$

$$X - IM = X - m\times(1 - t)\times Y$$

Let $I = 900$, $G = 1200$, $X = 500$, $a = 200$,
$b = 0.9$, $t = 0.25$, and $m = 0.1$.

A. Calculate equilibrium GDP?

$$Y = a + b\times(1 - t)\times Y + I + G + X - m\times(1 - t)\times Y$$

$$Y = [a + I + G + X]/[1 - (b - m)\times(1 - t)]$$

$$Y = [200+900+1200+500]/[1-(0.9-0.1)\times(1-0.25)]$$

$$Y = [2800]/[1 - (0.8)\times(0.75)]$$

$$Y = 2800\times 2.5$$

$$Y^{**} = 7000$$

B. Calculate consumption?

$$C = a + b \times (1 - t) \times Y^{**}$$

$$C = 200 + 0.9 \times (1 - 0.25) \times 7000$$

$$C = 200 + 0.675 \times 7000$$

$$C^{**} = 4925$$

C. Calculate net exports?

$$(X - IM) = [X - m \times (1 - t) \times Y^{**}]$$

$$(X - IM) = [500 - 0.1 \times (1 - 0.25) \times 7000]$$

$$(X - IM) = [500 - 525]$$

$$(X - IM) = -25$$

D. Calculate private savings?

$$S_p = Y_d - C^{**}$$

$$S_p = (1 - t) \times Y^{**} - C^{**}$$

$$S_p = 0.75 \times 7000 - 4925$$

$$S_p = 5250 - 4925$$

$$S_p = 325$$

E. Calculate government savings?

$$S_g = t \times Y^{**} - G$$

$$S_g = 0.25 \times 7000 - 1200$$

$$S_g = 1750 - 1200$$

$$S_g = 550$$

F. Calculate direct foreign investment in the U.S.?

$$S_w = -(X - IM)^{**}$$

$$S_w = 25$$