

## Adding government and trade To the simple macro model

### Learning objectives

- Understand how the government surplus is related to national income
- Understand how net exports are related to national income
- Recognize the difference between the marginal propensity to consume and the marginal propensity to spend
- Explain why net exports lead the economy to accumulate assets
- Understand the presence of government and foreign trade reduces the value of the simple multiplier
- Explain how the government can use its fiscal policy to influence the level of national income

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

$$Y = C + S + T$$

A government's fiscal policy is defined by its plans for taxes and spending. These influence the size of the national income.

Taxes reduce households' disposable income relative to national income. Net taxes are defined as total tax revenue received minus total government spending.  
(T-G)

Budget surplus: any excess of current revenue over current expenditure. T greater than G

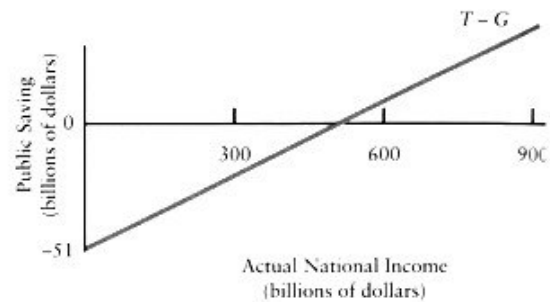
Budget deficit: any shortfall of current revenue below current expenditure. T less than G

Private saving: saving of the part of households.

Public saving. Saving on the part of governments equal to budget surplus.

FIGURE 23-1 The Public Saving (Budget Surplus) Function

National Income (Y)	Government Purchases (G)	Net Taxes (T = 0.1 × Y)	Public Saving (T - G)
150	51	15	-36
300	51	30	-21
525	51	52.5	1.5
600	51	60	9
900	51	90	39



Public saving, which is just equal to the budget surplus, is negative at low levels of national income but rises with national income. The slope of the public saving function is equal to the income-tax rate, 0.1. As national income rises, public saving rises by the income-tax rate times the change in national income. Thus, when national income rises by \$300 billion, public saving rises by \$30 billion.

### ***Introducing foreign Trade***

Export depend on spending decisions made by foreign households and firms that purchase Canadian goods and services. Typically, exports will not change as a result of changes in Canadian national income.

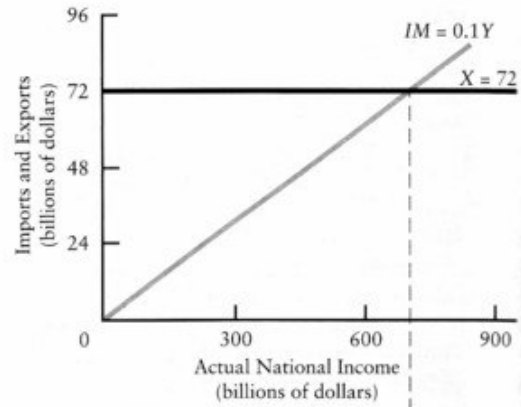
Imports depend on the spending decisions of Canadian households and firms. As consumption rises, imports will also increase.

There is a positive relationship between desired imports and national income. Since exports are autonomous with respect to national income, desired net exports are negatively related to national income.

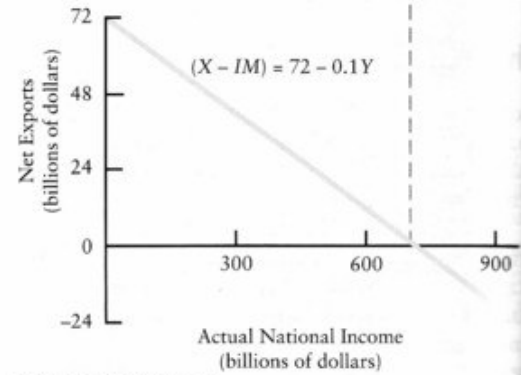
**FIGURE 23-2** The Net Export Function

National Income ( $Y$ )	Exports ( $X$ )	Imports ( $IM = 0.1 \times Y$ )	Net Exports
0	72	0	72
300	72	30	42
600	72	60	12
720	72	72	0
900	72	90	-18

Net exports, defined as the difference between exports and imports, fall as income rises. The data are hypothetical. They assume that exports are constant and that imports are 10 percent of national income. In part (i), exports are constant at \$72 billion while imports rise with national income. Therefore, net exports, shown in part (ii), decline with national income. The slope of the import function in part (i) is equal to the marginal propensity to import. The slope of the net export function in part (ii) is the negative of the marginal propensity to import.



(i) Export and import functions

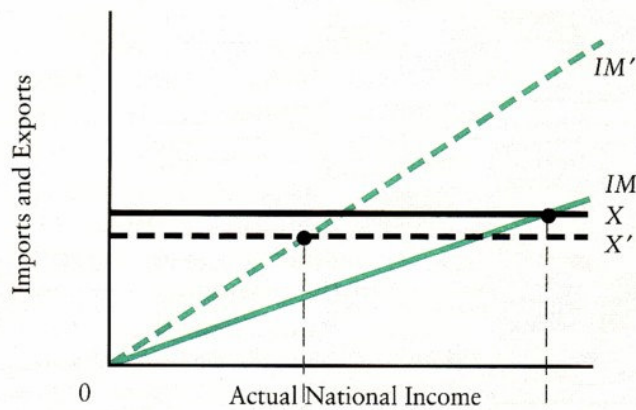


(ii) Net export function

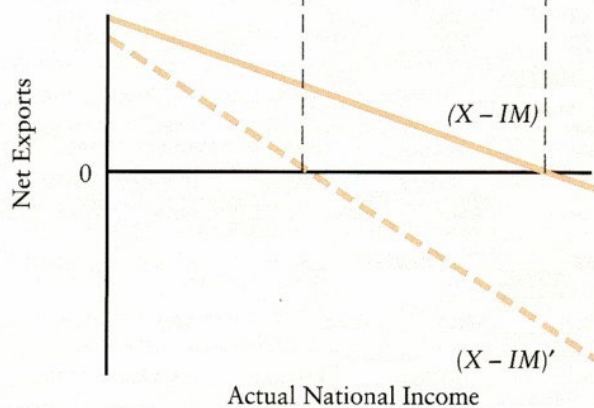
## Relative international prices

A rise in Canadian prices relative to those in other countries reduces Canadian net exports at any level of national income. A fall in Canadian prices increases net exports at any level of national income.

**FIGURE 23-3** Shifts in the Net Export Function

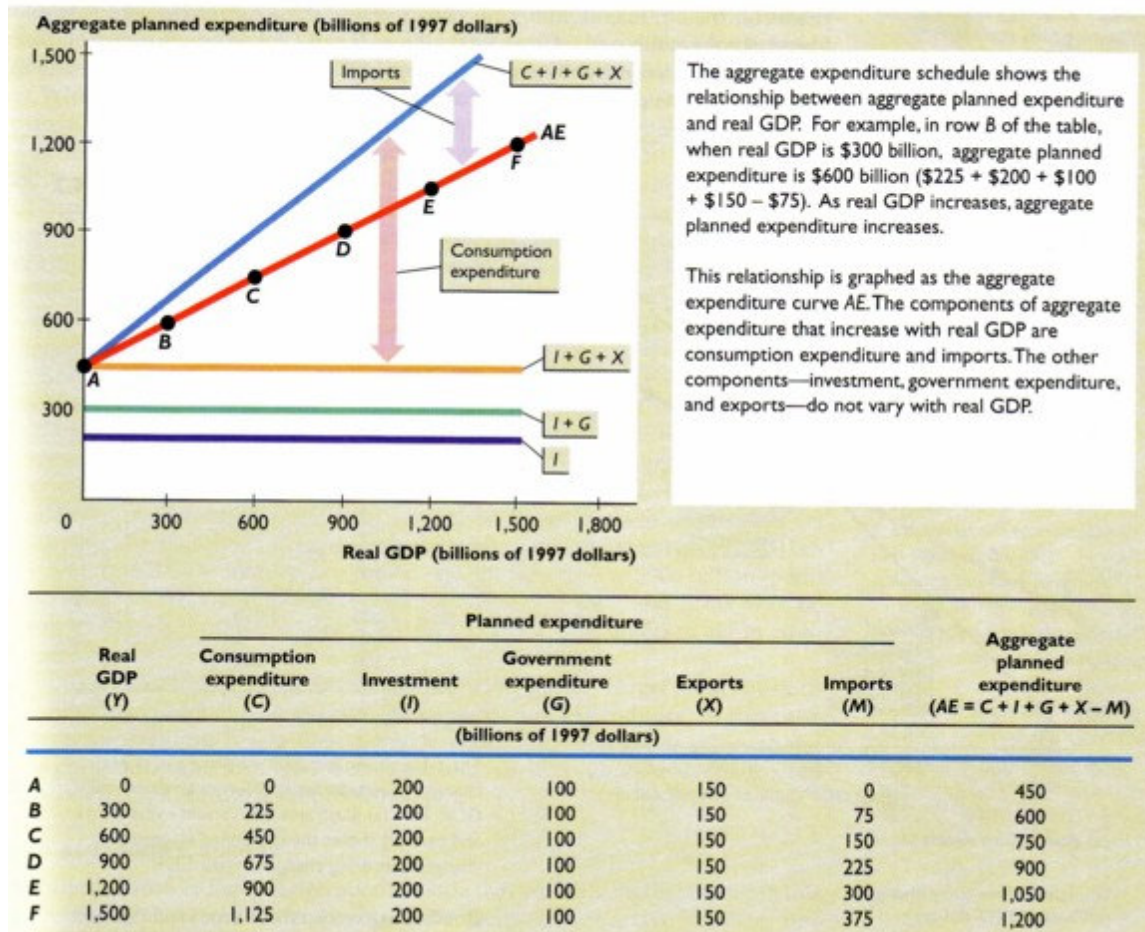


(i) Export and import functions



(ii) Net export function

**Changes in relative international prices shift the NX function.** A rise in Canadian prices relative to foreign prices, or a rise in the external value of the Canadian dollar, lowers exports from  $X$  to  $X'$  and raises the import function from  $IM$  to  $IM'$ . This shifts the net export function downward from  $(X - IM)$  to  $(X - IM)'$ . A fall in Canadian prices has the opposite effect.



## Practice

Each of the following headlines describes an event that will have an effect on desired aggregate expenditure. What will be the effect on equilibrium national income? In each case, describe how the event would be illustrated in the 45° line diagram.

- “Minister takes an axe to the Armed Forces.”
- “Russia agrees to buy more Canadian wheat.”
- “High-tech firms to cut capital outlays.”
- “Finance Minister pledges to cut income-tax rates.”
- “U.S. imposes import restrictions on Canadian lumber.”
- “Asian slump means smaller market for B.C. lumber.”
- “Weak dollar spurs exports from Ontario manufacturers.”

## Shifts in the AE curve

### Changes in consumption

Most individuals and businesses hold money. What money can buy—in real value—depends on the price level. The higher the price level, the less a given amount of money can purchase.

A rise in the price level lowers the real value of money: a fall in the price level raises the real value of money.

A rise in the domestic price level lowers wealth; this leads to a fall in desired consumption, and thus a downward shift in the AE curve. A fall in the domestic price level leads to a rise in wealth and desired consumption and thus to an upward shift in the AE curve.

## Changes in net exports

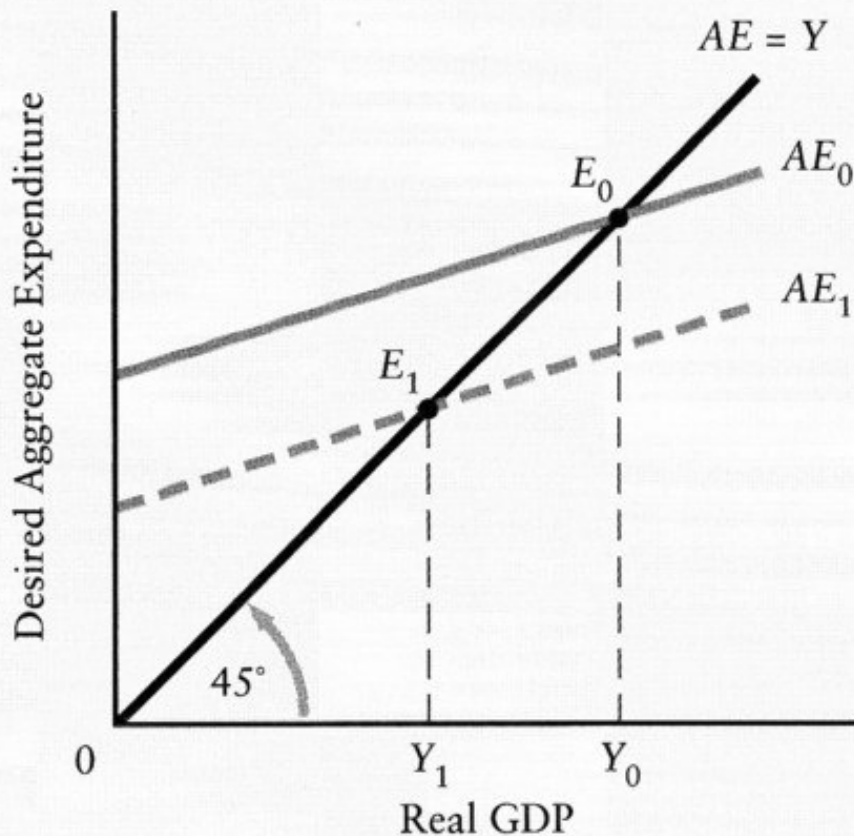
When the domestic price level rises, Canadian goods become more expensive relative to foreign goods. Canadian consumers reduce their purchases of Canadian-made goods and increase their purchases of foreign goods.

At the same time, consumers in other countries reduce their purchases of the now relatively more expensive Canadian-made goods.

A rise in the domestic price level shifts the net export function downward. A fall in the domestic price level shifts the net export function and hence the AE curve upward.



**FIGURE 24-1** Desired Aggregate Expenditure and the Price Level



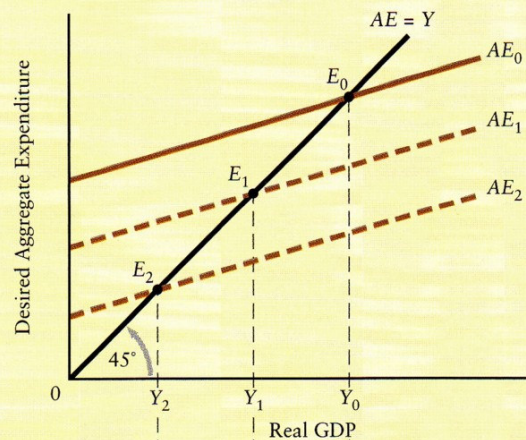
An exogenous change in the price level causes the  $AE$  curve to shift and thus causes equilibrium GDP to change. At the initial price level, the  $AE$  curve is given by the solid line  $AE_0$ , and hence equilibrium GDP is  $Y_0$ . An increase in the price level reduces desired aggregate expenditure and thus causes the  $AE$  curve to shift downward to the dashed line,  $AE_1$ . As a result, equilibrium GDP falls to  $Y_1$ .

## The aggregate demand curve

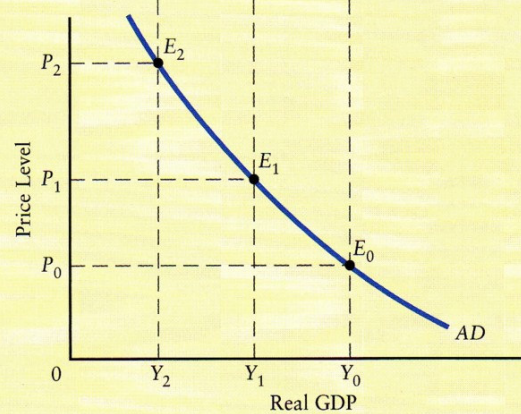
Recall that the AE curve relates real GDP to desired aggregate expenditure for a given price level, plotting real GDP on the horizontal axis.

The aggregate demand (AD) curve relates equilibrium real GDP to price level, again plotting GDP on the horizontal axis.

**FIGURE 24-2** Derivation of the AD Curve



(i) Aggregate expenditure



(ii) Aggregate demand

Equilibrium GDP is determined by the AE curve for each given price level; the level of equilibrium GDP and its associated price level are then plotted to yield a point on the AD curve. When the price level is  $P_0$ , the AE curve is  $AE_0$ , and hence equilibrium GDP is  $Y_0$ , as shown in part (i). Plotting  $Y_0$  against  $P_0$  yields the point  $E_0$  on the AD curve in part (ii).

An increase in the price level to  $P_1$  causes the AE curve to shift downward to  $AE_1$  and causes equilibrium GDP to fall to  $Y_1$ . Plotting this new level of GDP against the higher price level yields a second point,  $E_1$ , on the AD curve. A further increase in the price level to  $P_2$  causes the AE curve to shift downward to  $AE_2$ , and thus causes equilibrium GDP to fall to  $Y_2$ . Plotting  $P_2$  and  $Y_2$  yields a third point,  $E_2$ , on the AD curve.

Thus, a change in the price level causes a shift in the AE curve but a movement along the AD curve.

## Shifts in the AD curve

Any change –other than a change in the price level— that causes the AE curve to shift will also cause the AD curve to shift. Such a shift is called an aggregate demand shock.

For a given price level, a rise in the amount of desired aggregate expenditure associated with each level of national income shifts the AE curve upward and the Ad curve to the right.

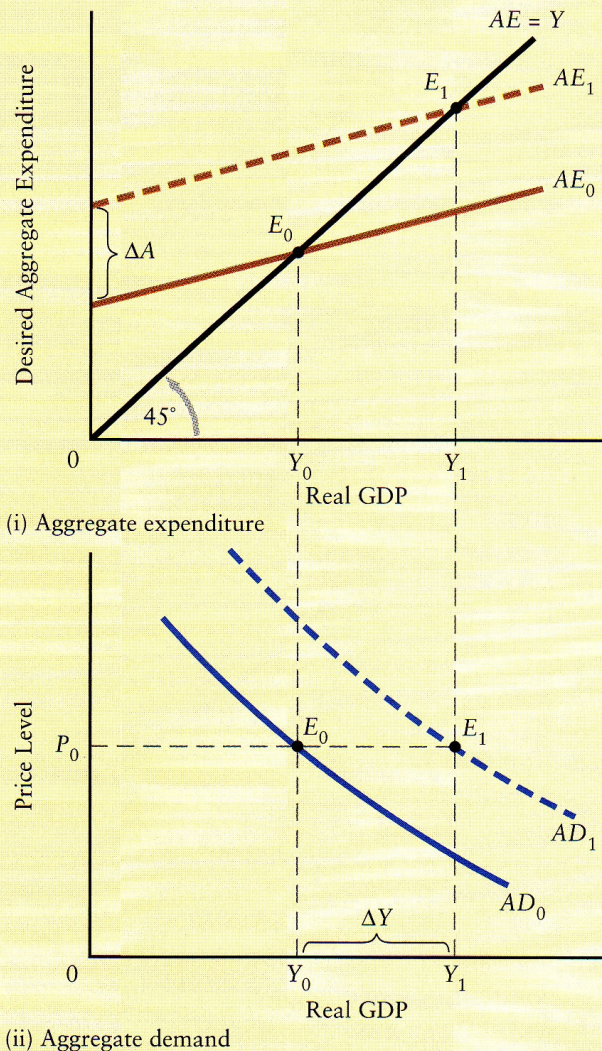
A fall in desired aggregate expenditure shifts the AE curve downward and the AD curve to the left.

### The simple multiplier and the AD curve

The simple multiplier measures the horizontal shift in the AD curve in response to a change in autonomous expenditure.



**FIGURE 24-3** The Simple Multiplier and Shifts in the AD Curve



A change in autonomous expenditure changes equilibrium GDP for any given price level. The simple multiplier measures the resulting horizontal shift in the AD curve. The original AE curve is  $AE_0$  in part (i). Equilibrium is at  $E_0$ , with GDP of  $Y_0$  at price level  $P_0$ . This yields point  $E_0$  on the curve  $AD_0$  in part (ii).

The AE curve in part (i) then shifts upward from  $AE_0$  to  $AE_1$ , due to an increase in autonomous expenditure of  $\Delta A$ . Equilibrium GDP now rises to  $Y_1$ , with the price level still constant at  $P_0$ . Thus, the AD curve in part (ii) shifts to the right to point  $E_1$ , indicating the higher equilibrium GDP of  $Y_1$  associated with the same price level  $P_0$ . The magnitude of the shift,  $\Delta Y$ , is equal to the simple multiplier times  $\Delta A$ .

If the price level remains constant and firms are willing to supply everything that is demanded at that price level, the simple multiplier will also show the change in equilibrium income that will occur in response to a change in autonomous expenditure.

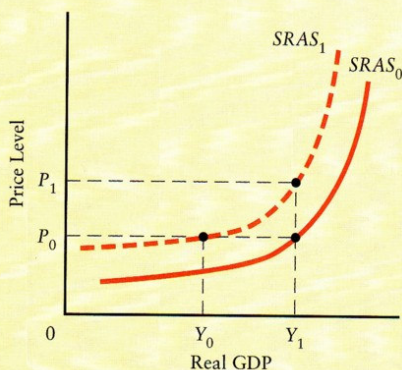
## The supply side of the Economy

Aggregate supply refers to the total output of goods and services that firms would like to produce.

An aggregate supply curve relates aggregate supply to price level.

The short-run aggregate supply (SRAS) relates the price level to the quantity of output that firms would like to produce and sell on the assumption that technology and the prices of all factors of production remain constant.

**FIGURE 24-4** The Short-Run Aggregate Supply Curve



The SRAS curve is positively sloped, indicating that firms will provide more aggregate output only at a higher price level. The SRAS curve is drawn for a given level of technology and factor prices. Any change in technology or factor prices will shift the SRAS curve.

A shift up and to the left reflects a decrease in supply; a shift down and to the right reflects an increase in supply. Starting from  $(P_0, Y_1)$  on  $SRAS_0$ , suppose that there is an increase in input prices. At price level  $P_0$ , only  $Y_0$  would be produced. Alternatively, to get output  $Y_1$  would require a rise to price level  $P_1$ . The new supply curve is  $SRAS_1$ , which may be viewed as being above and to the left of  $SRAS_0$ . An increase in supply, caused by a decrease in input prices or an improvement in technology, would shift the SRAS curve downward and to the right, from  $SRAS_1$  to  $SRAS_0$ .

## The increasing slope of the SRAS curve

### 3 phases

1) When output is low (below potential output), firms typically have excess capacity—some plant and equipment are idle. When firms have excess capacity, only a small increase in the price of their output may be needed to induce them to expand production.

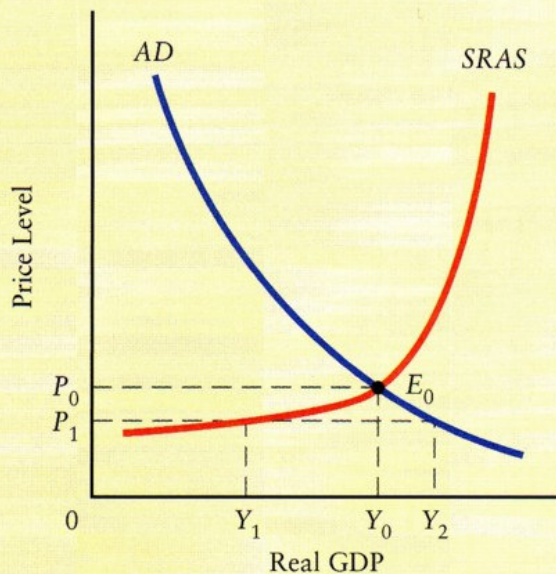
2) Once output is pushed above normal capacity, unit costs tend to rise quite rapidly.

3) The more output is expanded beyond normal capacity, the more that unit costs rise and hence the larger is the rise in price that is necessary to induce firms to increase output.



# Macroeconomic equilibrium

**FIGURE 24-5** Macroeconomic Equilibrium



Macroeconomic equilibrium occurs at the intersection of the *AD* and *SRAS* curves and determines the equilibrium values for real GDP and the price level. Given the *AD* and *SRAS* curves in the figure, macroeconomic equilibrium occurs at  $E_0$ .

If the price level were equal to  $P_1$ , the desired output of firms would be  $Y_1$ . However, at  $P_1$ , the level of output that is consistent with expenditure decisions would be  $Y_2$ . Hence, when the price level is less than  $P_0$ , the desired output of firms will be less than the level of real GDP that is consistent with expenditure decisions. This causes upward pressure on the price level.

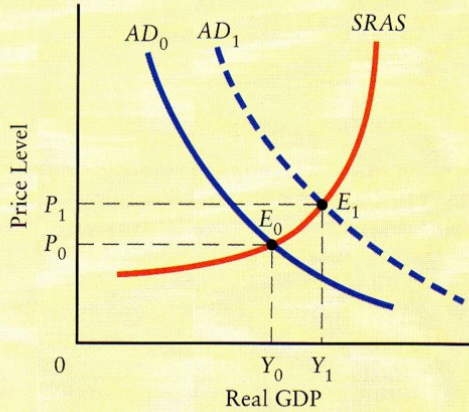
Similarly, for any price level above  $P_0$ , the desired output of firms exceeds the level of output that is consistent with expenditure decisions. This causes downward pressure on the price level.

The only price level where the supply decisions of firms are consistent with desired expenditure is at macroeconomic equilibrium. At  $P_0$ , firms wish to produce  $Y_0$ . When they do so, they generate a real GDP of  $Y_0$ ; when real GDP is  $Y_0$ , decision makers wish to spend exactly  $Y_0$ , thereby purchasing the nation's output. Hence, all decisions are consistent with each other.



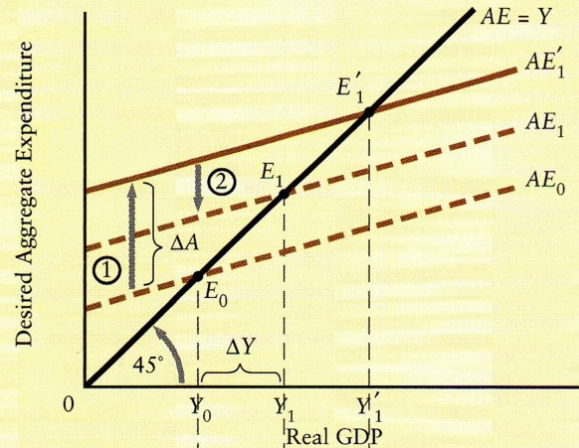
# Aggregate demand shocks

**FIGURE 24-6** Aggregate Demand Shocks

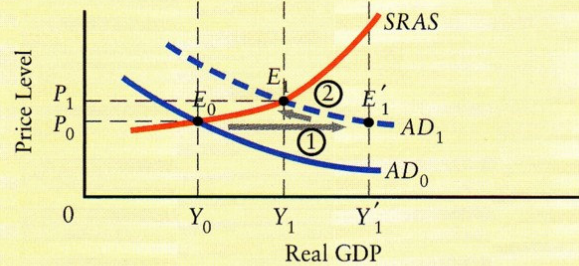


Shifts in aggregate demand cause the price level and real GDP to move in the same direction. An increase in aggregate demand shifts the AD curve to the right, from  $AD_0$  to  $AD_1$ . Macroeconomic equilibrium moves from  $E_0$  to  $E_1$ . The price level rises from  $P_0$  to  $P_1$ , and real GDP rises from  $Y_0$  to  $Y_1$ , reflecting a movement along the SRAS curve.

**FIGURE 24-7** The Multiplier When the Price Level Varies



(i) Aggregate expenditure



(ii) Aggregate demand and supply

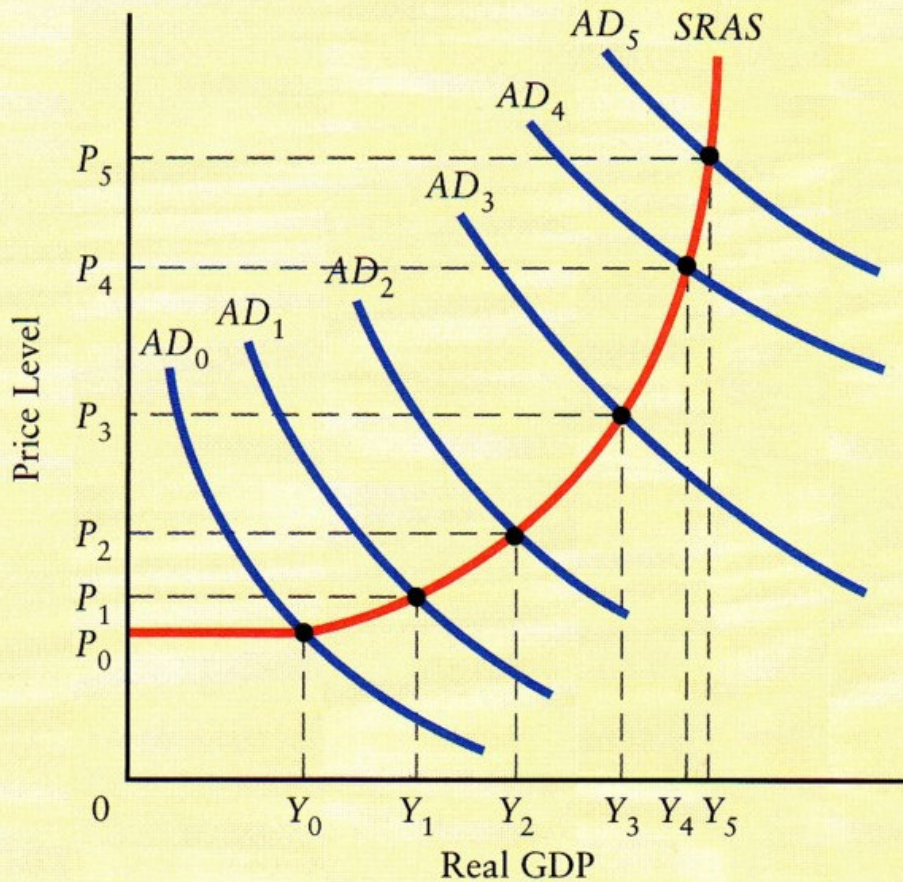
An increase in autonomous expenditure causes the AE curve to shift upward, but the rise in the price level causes it to shift part of the way down again. Hence, the multiplier is smaller than when the price level is constant. Originally, equilibrium is at point  $E_0$  in both part (i) and part (ii). Desired aggregate expenditure then shifts by  $\Delta A$  to  $AE'_1$ , shifting the AD curve to  $AD_1$ . These shifts are shown by arrow 1 in both parts. But the adjustment is not yet complete.

The shift in the AD curve raises the price level to  $P_1$  because the SRAS curve is positively sloped. The rise in the price level shifts the AE curve down to  $AE_1$ , as shown by arrow 2 in part (i). This is shown as a *movement along* the new AD curve, as indicated by arrow 2 in part (ii). The new equilibrium is thus at  $E_1$ . The amount  $Y_0Y_1$  is  $\Delta Y$ , the actual increase in real GDP. The multiplier, adjusted for the effect of the price increase, is the ratio  $\Delta Y/\Delta A$  in part (i).



## The importance of the shape of the SRAS curve

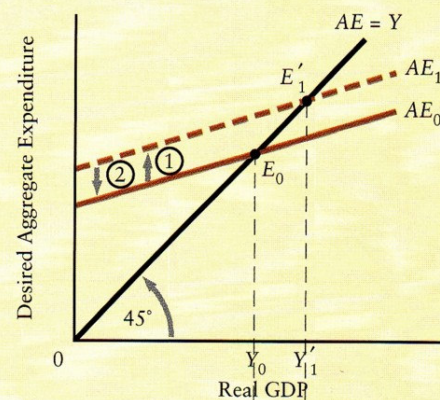
**FIGURE 24-8** The Effects of Increases in Aggregate Demand



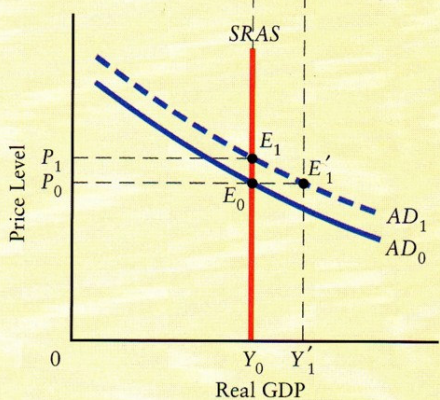
The effect of increases in aggregate demand is divided between increases in real GDP and increases in prices, depending on the slope of the *SRAS* curve. Because of the increasing slope of the *SRAS* curve, increases in aggregate demand up to  $AD_0$  have virtually no impact on the price level. Successive further increases bring larger price increases and relatively smaller output increases. By the time aggregate demand is at  $AD_4$  or  $AD_5$ , virtually all of the effect is on the price level.



**FIGURE 24-9** Demand Shocks When the SRAS Curve Is Vertical



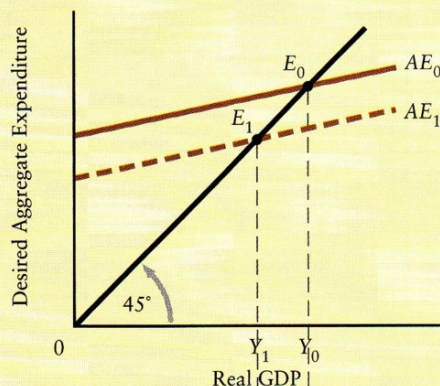
(i) Aggregate expenditure



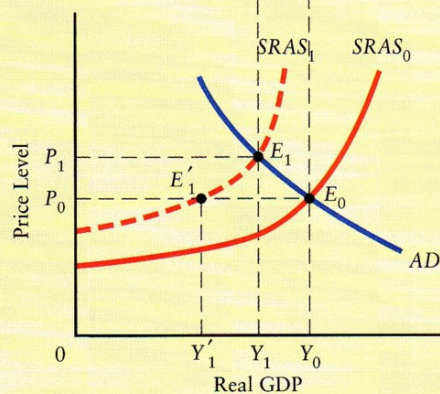
(ii) Aggregate demand and supply

In the extreme case where the SRAS curve is vertical, the effect of an increase in autonomous expenditure is solely to increase price level. An increase in autonomous expenditure shifts the AE curve upward from  $AE_0$  to  $AE_1$ , as shown by arrow 1 in part (i). Given the initial price level  $P_0$ , equilibrium would shift from  $E_0$  to  $E'_1$  and real GDP would rise from  $Y_0$  to  $Y'_1$ . However, the price level does not remain constant. This is shown by the SRAS curve in part (ii). Instead, the price level rises to  $P_1$ . This causes the AE curve to shift back down all the way to  $AE_0$ , as shown by arrow 2 in part (i), and equilibrium GDP stays at  $Y_0$ . In part (ii), the new equilibrium is at  $E_1$  with GDP at  $Y_0$  and the price level at  $P_1$ .

**FIGURE 24-10** Aggregate Supply Shocks



(i) Aggregate expenditure

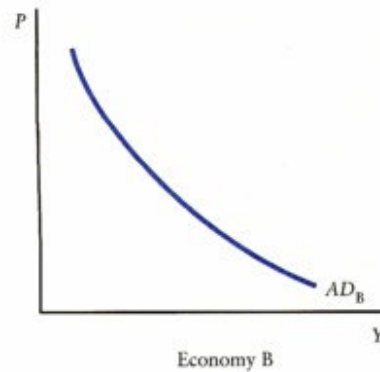
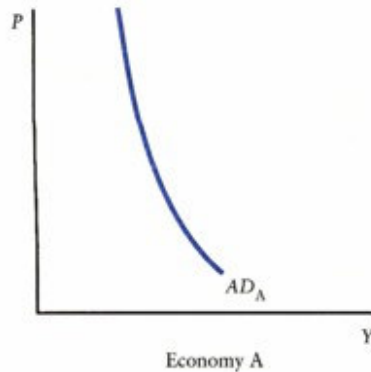


(ii) Aggregate demand and supply

Aggregate supply shocks cause the price level and real GDP to move in opposite directions. The original equilibrium is at  $E_0$ , with GDP of  $Y_0$  appearing in both parts of the figure. The price level is  $P_0$  in part (ii), and at that price level, the desired aggregate expenditure curve is  $AE_0$  in part (i).

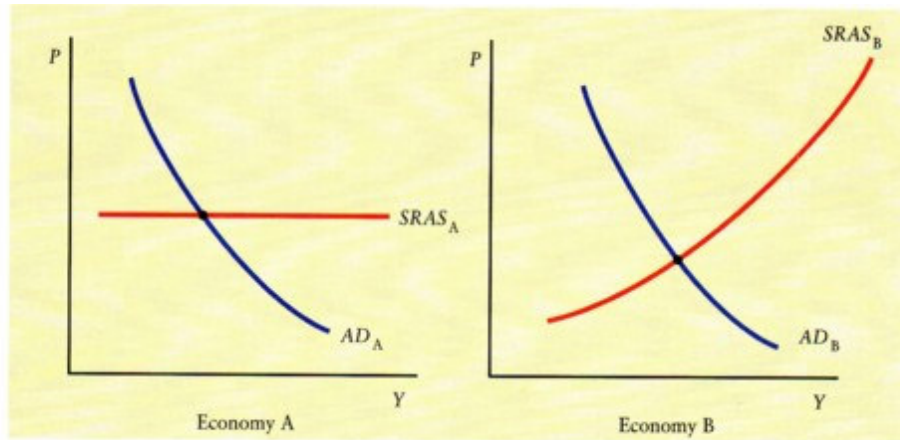
A negative aggregate supply shock now shifts the SRAS curve in part (ii) to  $SRAS_1$ . At the original price level of  $P_0$ , firms are now only willing to supply  $Y'_1$ . The fall in supply, with no corresponding fall in demand, causes a shortage that leads to a rise in the price level. The new equilibrium is reached at  $E_1$ , where the AD curve intersects  $SRAS_1$ . At the new and higher equilibrium price level of  $P_1$ , the AE curve has fallen to  $AE_1$ , as shown in part (i).

## Practice problem



3. Consider the diagrams above showing the  $AD$  curves in two economies. Economy A is Autarkland—it does not trade with the rest of the world (*autarky* is a situation in which a country does not trade with other countries). Economy B is Openland—it exports to and imports from the rest of the world.
- Explain why an increase in the domestic price level (for a given exchange rate) reduces net exports in Openland. How would you illustrate this with the  $AE$  curve in the  $45^\circ$  line diagram?
  - Explain why the  $AD$  curve is steeper in Autarkland than in Openland.
  - If there are never any net exports in Autarkland, why isn't the  $AD$  curve vertical? Explain what other aspect of the economy generates a downward-sloping  $AD$  curve.
4. The economy of Neverland has the following  $AD$  and  $SRAS$  schedules. Denote  $Y_{AD}$  as the level of real GDP along the  $AD$  curve; let  $Y_{SRAS}$  be the level of real GDP along the  $SRAS$  curve. GDP is shown in billions of 1992 dollars.
- | Price Level | $Y_{AD}$ | $Y_{SRAS}$ |
|-------------|----------|------------|
| 90          | 1100     | 750        |
| 100         | 1000     | 825        |
| 110         | 900      | 900        |
| 120         | 800      | 975        |
| 130         | 700      | 1050       |
| 140         | 600      | 1125       |
- Plot the  $AD$  and  $SRAS$  curves on a scale diagram.
  - What is the price level and level of real GDP in Neverland's macroeconomic equilibrium?
  - Suppose the level of potential output in Neverland is \$950 billion. Is the current equilibrium level of real GDP greater than or less than potential?
5. Each of the following events is either a *cause* or a *consequence* of a shift in the  $AD$  or  $SRAS$  curve. Identify which it is and, if it is a cause, describe the effect on equilibrium real GDP and the price level.
- OPEC's actions significantly increased the world price of oil in 1979–80.
  - During 1996–99, Canadian real GDP was growing at a healthy pace but inflation showed no signs of rising.
  - World commodity prices declined sharply in 1997–98. Many of these commodities are both produced in Canada and are used as important inputs for Canadian firms.
  - The end of the Cold War led to large declines in defence spending in many countries (including Canada).
  - Canadian exports increased in response to a falling external value of the Canadian dollar in the mid 1990s.
  - Several provinces lowered their personal income-tax rates in the late 1990s.
  - The federal government reduced its level of government purchases ( $G$ ) in the late 1990s.





6. The diagrams above show the  $AD$  and  $SRAS$  curves in two different economies.
- Explain what aspect of firms' behaviour might give rise to the horizontal  $SRAS$  curve in Economy A.
  - Explain what aspect of firms' behaviour gives rise to the upward-sloping  $SRAS$  curve in Economy B.
  - In which economy is output demand determined? Explain.
  - Consider the effects of an increase in autonomous expenditure. Which economy has the larger multiplier? Explain your reasoning.

This is a challenging question and involves algebraically solving the system of two equations given by the  $AD$  and  $SRAS$  curves. The equations for the curves are given by:

$$AD: \quad Y_{AD} = 710 - 30P + 5G$$

$$SRAS: \quad Y_{SRAS} = 10 + 5P - 2P_{OIL}$$

where  $Y$  is real GDP,  $P$  is the price level,  $G$  is the level of government purchases, and  $P_{OIL}$  is the world price of oil.

- Explain the various terms in the  $AD$  curve. What is the value of the simple multiplier? (Hint: the simple multiplier is the change in equilibrium real GDP when some autonomous component of expenditure, like  $G$ , changes by \$1.)
- Explain the various terms in the  $SRAS$  curve. Explain why the price of oil enters negatively.
- Solve for the equilibrium value of real GDP and the price level.
- Using your solution to part c, what is the effect of a change in  $G$  on equilibrium  $Y$  and  $P$ ?
- Using your solution to part c, what is the effect of a change in  $P_{OIL}$  on equilibrium  $Y$  and  $P$ ?