Chapter 27: Expenditure Multiplier

The Keynesian model describes the economy in the very short run when prices are fixed.

Because each firm's price is fixed, for the economy as a whole:

1. The *price level* is fixed.

2. A*ggregate demand* determines real GDP.

What determines aggregate expenditure plans?

The components of aggregate expenditure sum to real GDP.

That is,

$$Y = C + I + G + X - M.$$

- Two components of aggregate expenditure, consumption and imports, are also influenced by real GDP.

- So there is a two-way link between aggregate expenditure and real GDP.

Two-Way Link Between Aggregate Expenditure and Real GDP

Other things remaining the same,

- An increase in real GDP increases aggregate expenditure.
- An increase in aggregate expenditure increases real GDP.

Disposable income (*YD)* is aggregate income or real GDP, *Y*, minus net taxes, *T*. That is,

$$YD = Y - T$$

- Disposable income changes when either real GDP changes or net taxes change.
- Disposable income, *YD*, is either spent on goods and services, *C*, or saved, *S*.

$$YD = C + S.$$

Consumption

Consumption expenditure is influenced by many factors but the most direct one is disposable income.

The relationship between consumption expenditure and disposable income, other things remaining the same, is the consumption function.

Let us write the consumption function as:

$$C = C_a + MPC \cdot YD = C_a + MPC \cdot (Y - T)$$

where C_a denotes the autonomous consumption

MPC is the marginal propensity to consume

The **marginal propensity to consume** (*MPC*) is the fraction of a change in disposable income spent on consumption.

That is, $MPC = \frac{\Delta C}{\Delta YD}$

Saving

We know that $YD = C + S$

Rearranging the above equation: $S = YD - C$

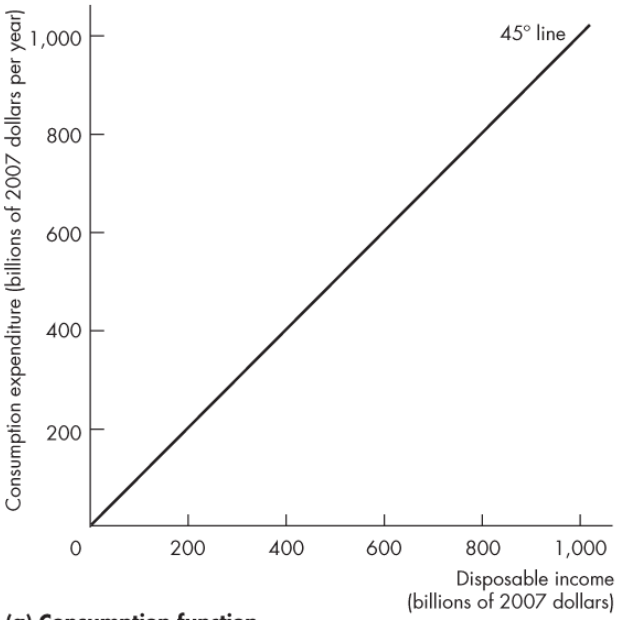
From the previous slide, we also know that $C = C_a + MPC \cdot YD$

The relationship between saving and disposable income, other things remaining the same, is the saving function.

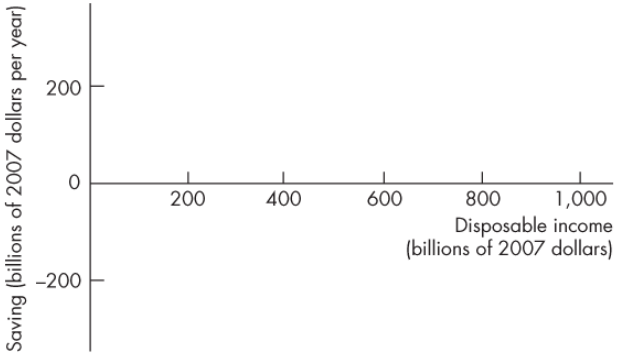
$$S = -C_a + (1 - MPC) \cdot YD$$

The marginal propensity to save (*MPS*) is the fraction of a change in disposable income that is saved.

That is, $MPS = \frac{\Delta S}{\Delta YD}$

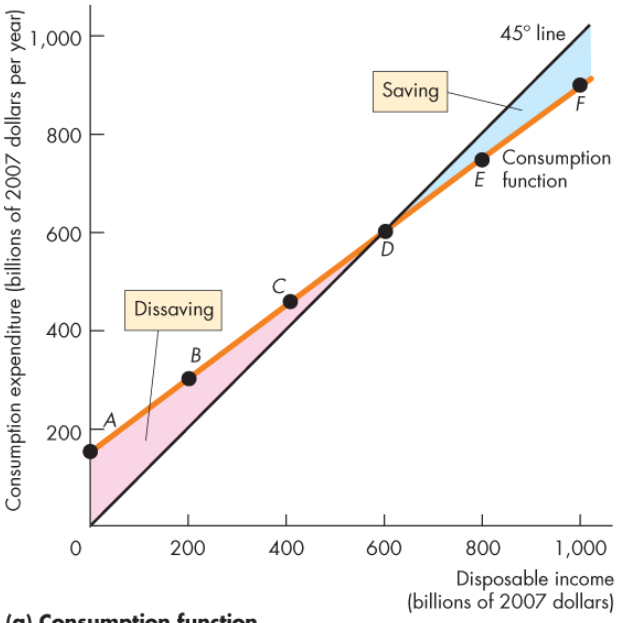


(a) Consumption function

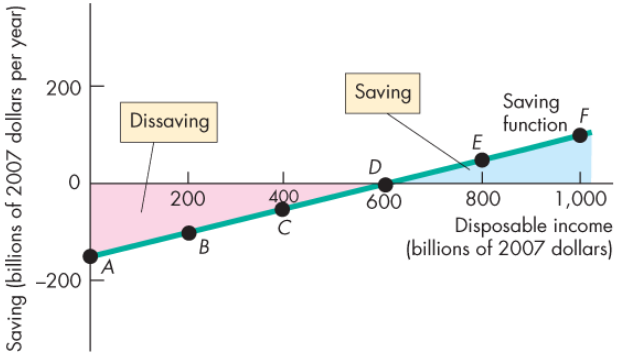


(b) Saving function

Disposable income	Planned consumption expenditure	Planned saving
(billions of 2007 dollars)		



(a) Consumption function



(b) Saving function

	Disposable income	Planned consumption expenditure	Planned saving
	(billions of 2007 dollars)		
A	0	150	–150
B	200	300	–100
C	400	450	–50
D	600	600	0
E	800	750	50
F	1,000	900	100

When consumption expenditure *exceeds* disposable income, saving is negative (dissaving).

When consumption expenditure is *less than* disposable income, there is saving.

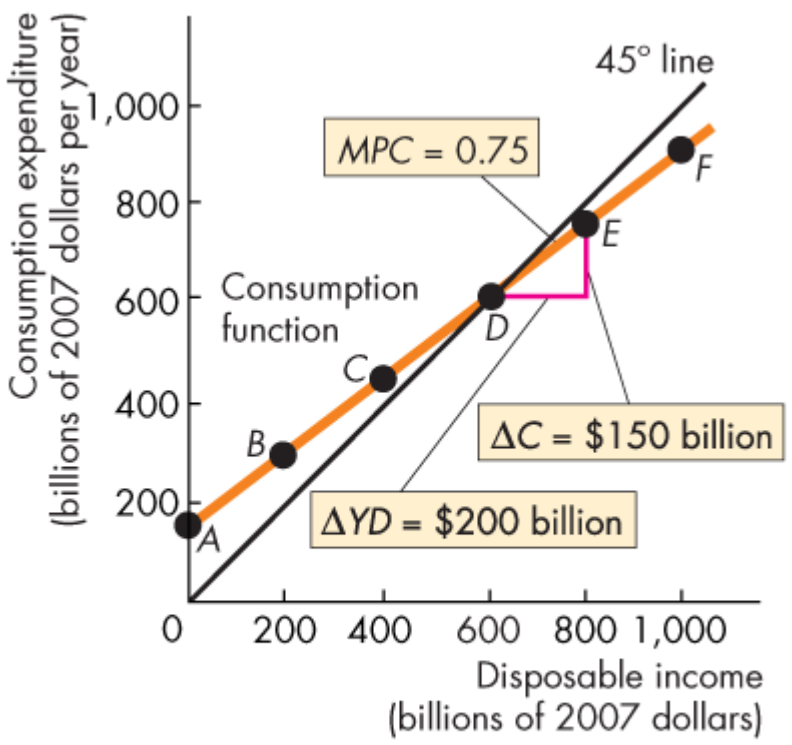
MPC is the slope of the consumption function.

In this example, when disposable income increases by $200 billion,

consumption expenditure increases by $150 billion.

Therefore,

$$MPC = \frac{\Delta C}{\Delta YD} = \frac{150}{200} = 0.75$$



(a) Consumption function

Import Function

In the short run, Canadian imports are influenced primarily by Canadian real GDP.

The import function can be written as:

$$M = MPI \cdot YD$$

The *marginal propensity to import* (MPI) is the fraction of an increase in real GDP spent on imports.

If an increase in real GDP of $100 billion increases imports by $25 billion,
then the marginal propensity to import is

$$MPI = \frac{\Delta M}{\Delta YD} = \frac{25}{100} = 0.25$$

Real GDP with a Fixed Price Level

When the price level is fixed, aggregate demand is determined by aggregate expenditure plans.

Aggregate planned expenditure is *planned* consumption expenditure plus *planned* investment plus *planned* government expenditure plus *planned* exports minus *planned* imports.

- Again, planned consumption expenditure and planned imports are influenced by real GDP. In particular, when real GDP increases, planned consumption expenditure and planned imports increase.
- Planned investment plus planned government expenditure plus planned exports are not influenced by real GDP.

In other words,

$$C = C_a + MPC \cdot YD$$
$$I = I_a$$
$$G = G_a$$
$$X = X_a$$
$$M = MPI \cdot YD$$

The relationship between aggregate planned expenditure and real GDP can be described by an *aggregate expenditure schedule*, which lists the level of aggregate expenditure planned at each level of real GDP.

The relationship can also be described by an *aggregate expenditure curve*, which is a graph of the aggregate expenditure schedule.

Actual Expenditure, Planned Expenditure, and Real GDP

Actual aggregate expenditure is always equal to real GDP.

Aggregate planned expenditure may differ from actual aggregate expenditure because firms can have unplanned changes in inventories.

Equilibrium expenditure is the level of aggregate expenditure that occurs when aggregate *planned* expenditure equals real GDP.

Suppose:

$C = 0 + 0.7 (Y – T)$

$T = 0$

$I = 240$

$G = 270$

$X = 340$

$M = 0 + 0.2 (Y – T)$

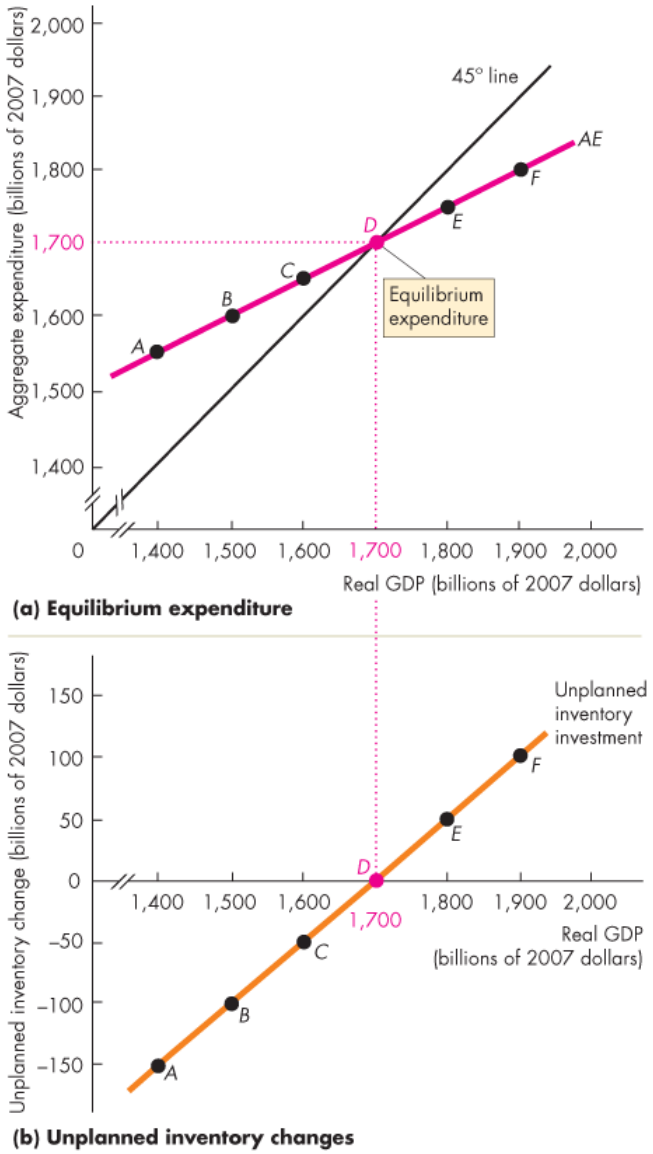
Aggregate planned expenditure (AE) $= C + I + G + X - M$

$= 850 + 0.5 Y$

	Real GDP	AE	Unplanned Inventory Change (*Y* - *AE*)
A	1400	1550	-150
B	1500	1600	-100
C	1600	1650	-50
D	1700	1700	0
E	1800	1750	50
F	1900	1800	100

- Equilibrium occurs at the point at which the *AE* curve crosses the 45° line in part (a).

- Equilibrium occurs when there are no unplanned changes in business inventories in part (b).



Convergence to Equilibrium

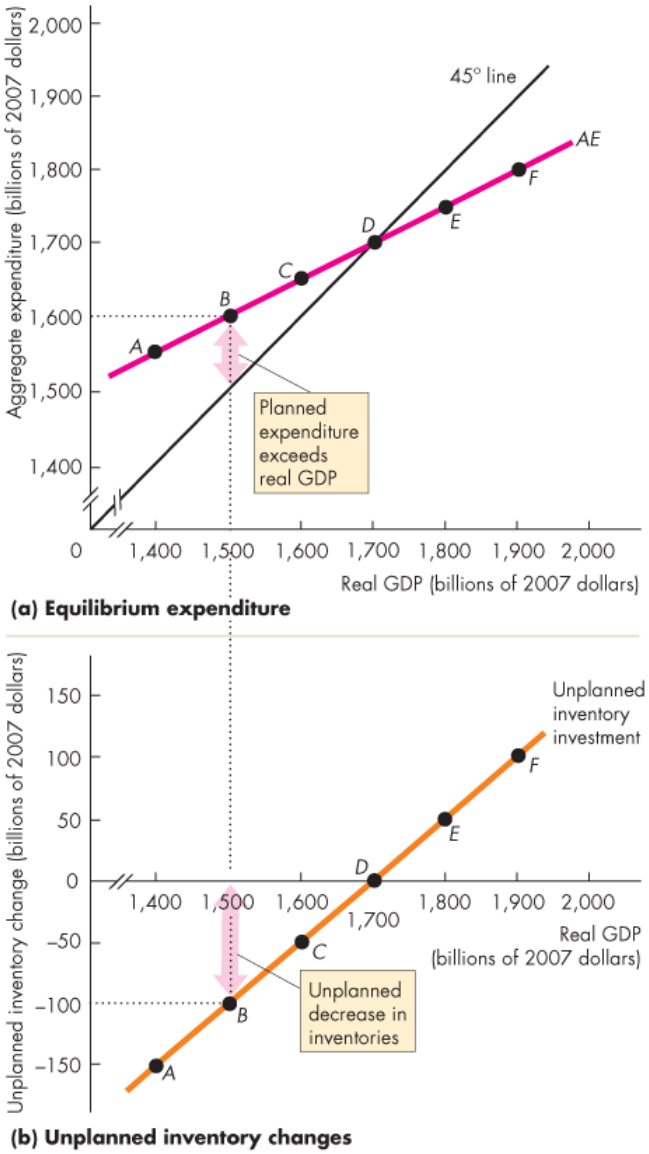
From Below Equilibrium

If aggregate planned expenditure exceeds real GDP,

then there is an unplanned decrease in inventories.

To restore inventories, firms hire workers and increase production.

Real GDP increases.

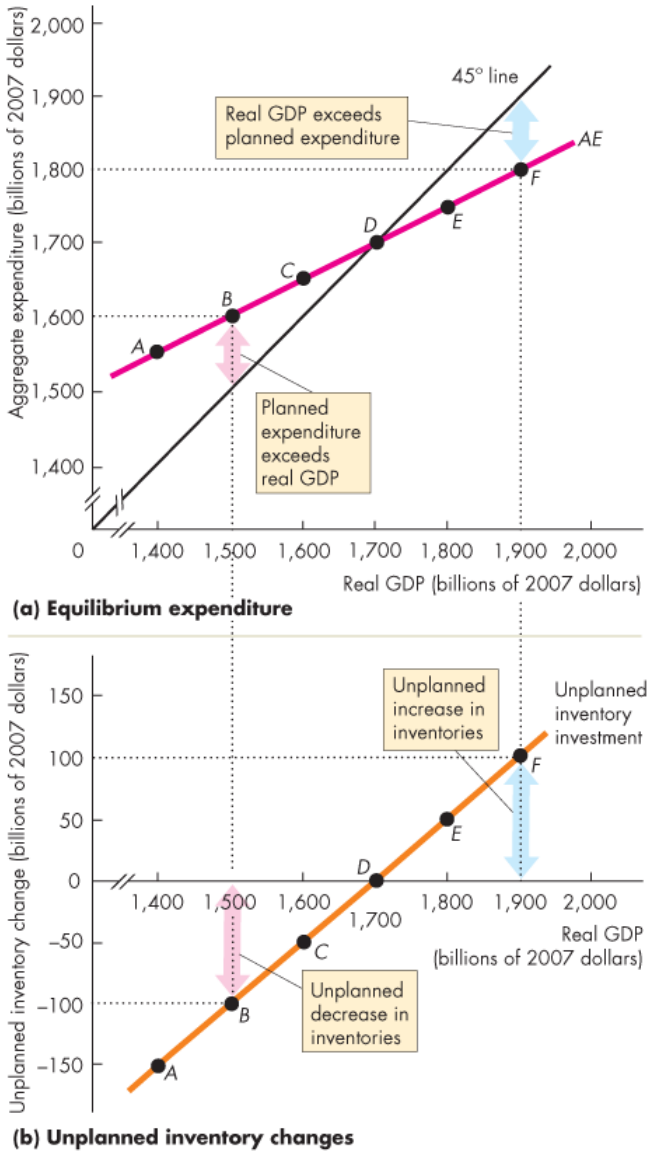


If aggregate planned expenditure is <u>less than</u> real GDP (the *AE* curve is below the 45° line),

then there is an unplanned increase in inventories.

To reduce inventories, firms fire workers and decrease production.

Real GDP decreases.

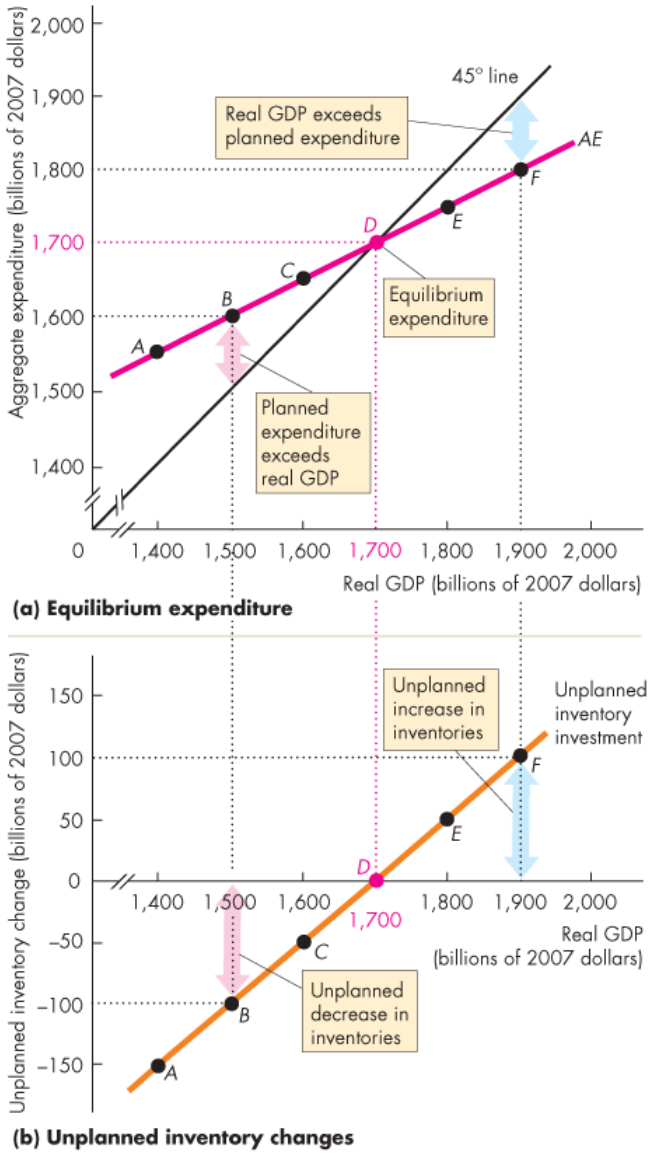


If aggregate planned expenditure equals real GDP (the *AE* curve intersects the 45° line),

then there is no unplanned change in inventories.

And firms maintain their current production.

Real GDP remains constant.



Aggregate planned expenditure (AE) = C + I + G + X - M = 850 + 0.5 Y

What is the equilibrium Y?

Equilibrium condition: $Y = AE$

$Y = 850 + 0.5\,Y$

$0.5\,Y = 850$

$Y = 1700$

The Multiplier

- When autonomous expenditure changes, so does equilibrium expenditure and real GDP.

- But the change in equilibrium expenditure is *larger* than the change in autonomous expenditure.

- The **multiplier** is the amount by which a change in autonomous expenditure is magnified or multiplied to determine the change in real GDP.

The Basic Idea of the Multiplier

Suppose that

$$C = C_a + MPC \cdot (Y - T)$$
$$I = I_a$$
$$G = G_a = 0$$
$$X = X_a = 0$$
$$M = MPI \cdot YD = 0 \cdot (Y - T)$$

Equilibrium: $Y = C + I + G + X - M$

- An increase in autonomous investment increases aggregate expenditure and real GDP.
- The increase in real GDP leads to an increase in induced expenditure.
- The increase in induced expenditure leads to a further increase in aggregate expenditure and real GDP.
- So real GDP increases by more than the initial increase in autonomous expenditure.

$\Delta Y = \Delta I + MPC \cdot \Delta I + MPC^2 \cdot \Delta I + MPC^3 \cdot \Delta I + MPC^4 \cdot \Delta I + MPC^5 \cdot \Delta I + \ldots$

$\Delta Y = \Delta I \cdot (1 + MPC + MPC^2 + MPC^3 + MPC^4 + MPC^5 + \ldots)$

$$\Delta Y = \Delta I \cdot \left(\frac{1}{1 - MPC}\right)$$

$\left(\frac{1}{1-MPC}\right)$ is the multiplier

An alternative way of deriving the above equation:

$\Delta Y = \Delta I + MPC \cdot \Delta I + MPC^2 \cdot \Delta I + MPC^3 \cdot \Delta I + MPC^4 \cdot \Delta I + MPC^5 \cdot \Delta I + \ldots$

Multiply by *MPC* to obtain

$MPC \cdot \Delta Y = MPC \cdot \Delta I + MPC^2 \cdot \Delta I + MPC^3 \cdot \Delta I + MPC^4 \cdot \Delta I + MPC^5 \cdot \Delta I + \ldots$

Subtract the second equation from the first to obtain

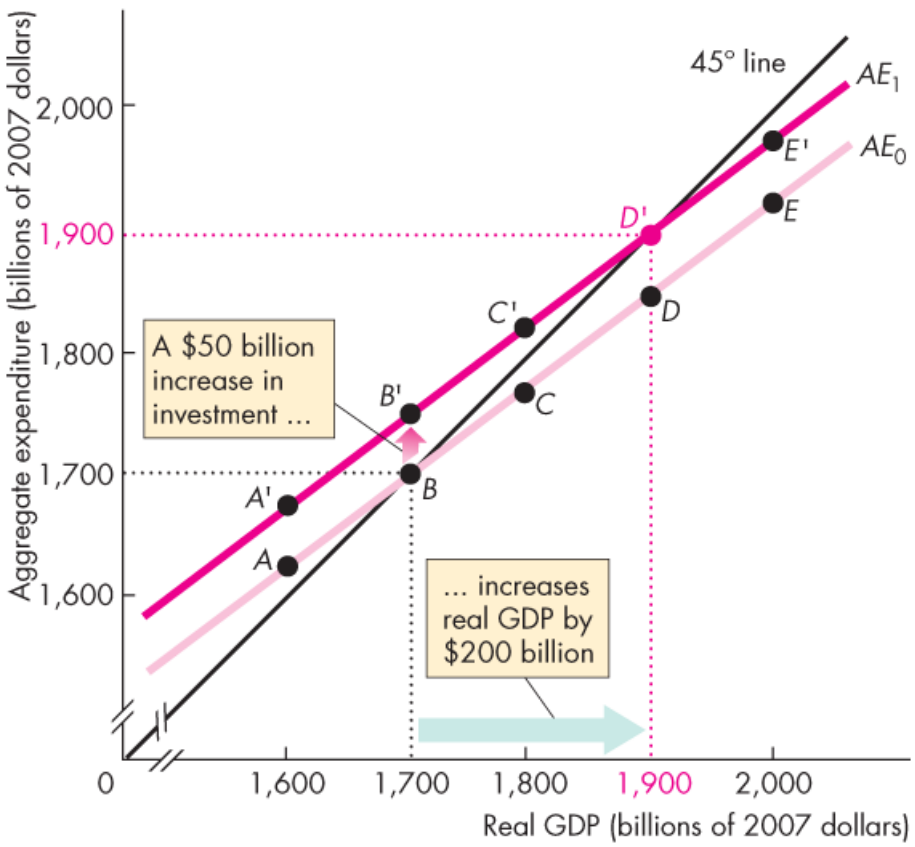
$\Delta Y - MPC \cdot \Delta Y = \Delta I$

$(1 - MPC)\, \Delta Y = \Delta I$,

$$\Delta Y = \Delta I \cdot \left(\frac{1}{1 - MPC}\right)$$

Graphical illustration of the multiplier effect:

An increase in autonomous expenditure



Why Is the Multiplier Greater than 1?

- The multiplier is greater than 1 because an increase in autonomous expenditure induces further increases in aggregate expenditure.

The Size of the Multiplier

- The size of the multiplier is the change in equilibrium expenditure divided by the change in autonomous expenditure.

Another example. Suppose that:

$C = 0 + 0.7 (Y – T)$

$T = 0$

$I = 100$

$G = 200$

$X = 0$

$M = 0 + 0.2 (Y – T)$

Find the AE.

- $AE = 300 + 0.5Y$

Find the equilibrium Y.

- $Y = 600$

Suppose G increases by 50. What is the new Y?

- $Ynew = 700$

What is the size of the multiplier?

- *2 —— Y increase by 100 as a result of an increase in G of 50.*

How does an increase in the *MPI* (marginal propensity to import) affects the size of the multiplier?

- It reduces the size of the multiplier.

Aggregate Expenditure and Aggregate Demand

The **aggregate expenditure curve** is the relationship between aggregate planned expenditure and real GDP, with all other influences on aggregate planned expenditure remaining the same.

The **aggregate demand curve** is the relationship between the quantity of real GDP demanded and the price level, with all other influences on aggregate demand remaining the same.

Deriving the Aggregate Demand Curve

The next slides illustrates the effects of a change in the price level on the *AE* curve, equilibrium expenditure, and the quantity of real GDP demanded.

Deriving the Aggregate Demand Curve

Wealth Effect: The higher the price level, other things remaining the same, the smaller the purchasing power of wealth and hence, the lower is aggregate planned expenditure.

Substitution Effects: For a given expected future price level, a rise in the price level makes current g&s more expensive relative to future g&s and results in a delay in purchases – an intertemporal substitution. Also, it makes Canadian-produced g&s more expensive relative to foreign-produced g&s, leading to increase in Canadian imports and decrease in Canadian exports – an international substitution.

Thus, both wealth and substitution effects (due to a rise in the price level) reduce aggregate planned expenditure at each level of real GDP.

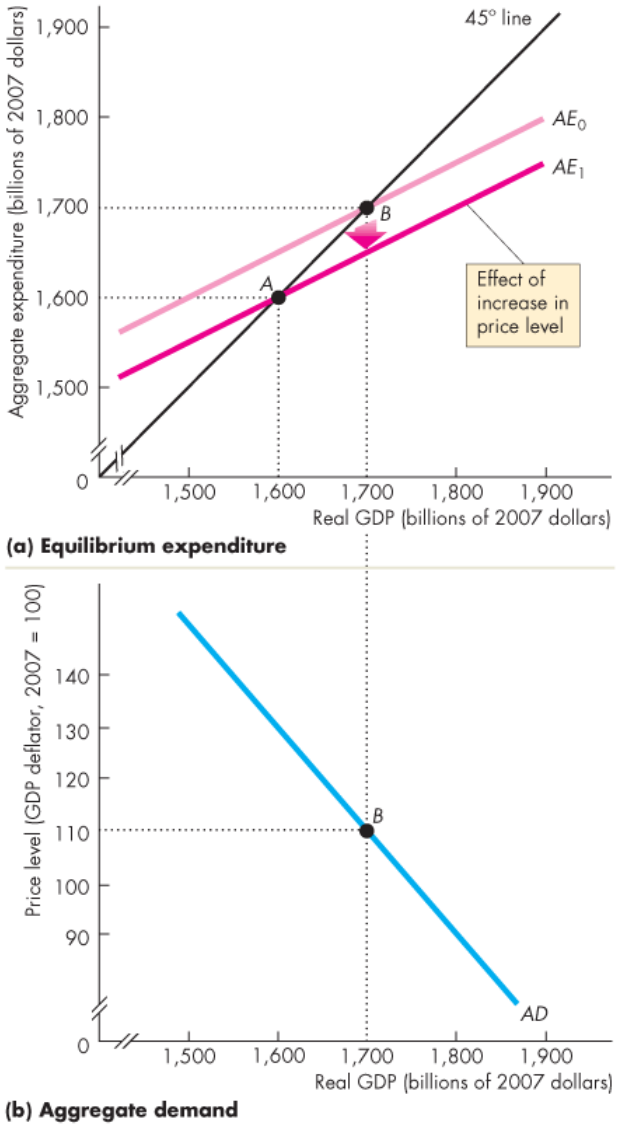
- When the price level rises, the aggregate expenditure curve shifts downward.

Suppose initially that the price level is 110 and the equilibrium *Y* is 1700.

A rise in price level from 110 to 130 …

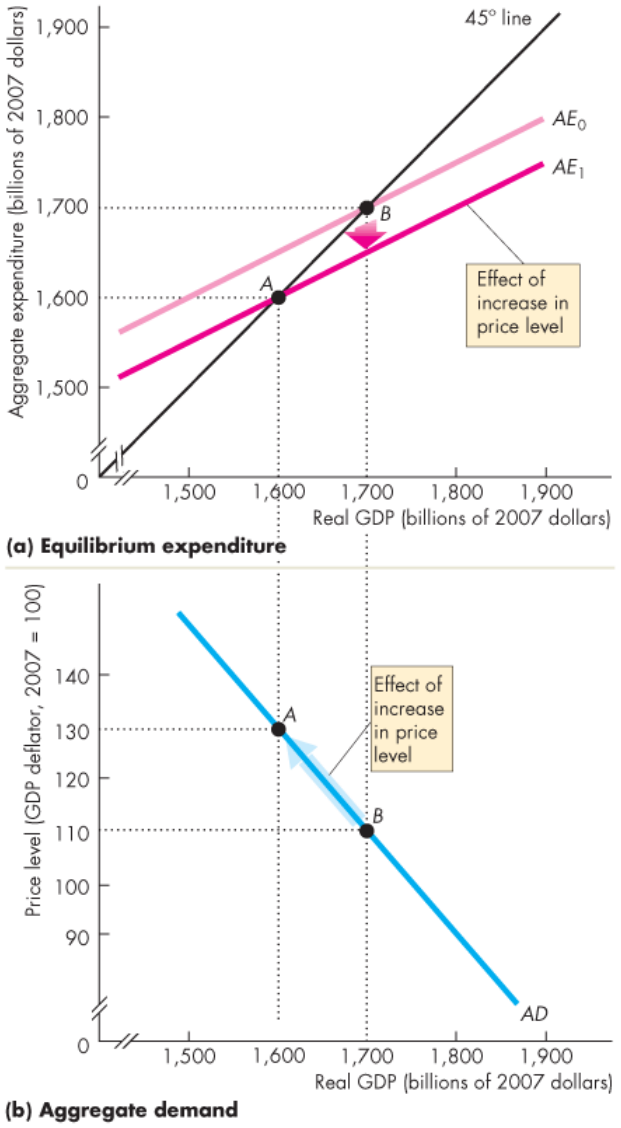
shifts the *AE* curve from AE_0 downward to AE_1 and …

decreases equilibrium expenditure from $1,700 billion to $1,600 billion.



The same rise in the price level that lowers equilibrium expenditure …

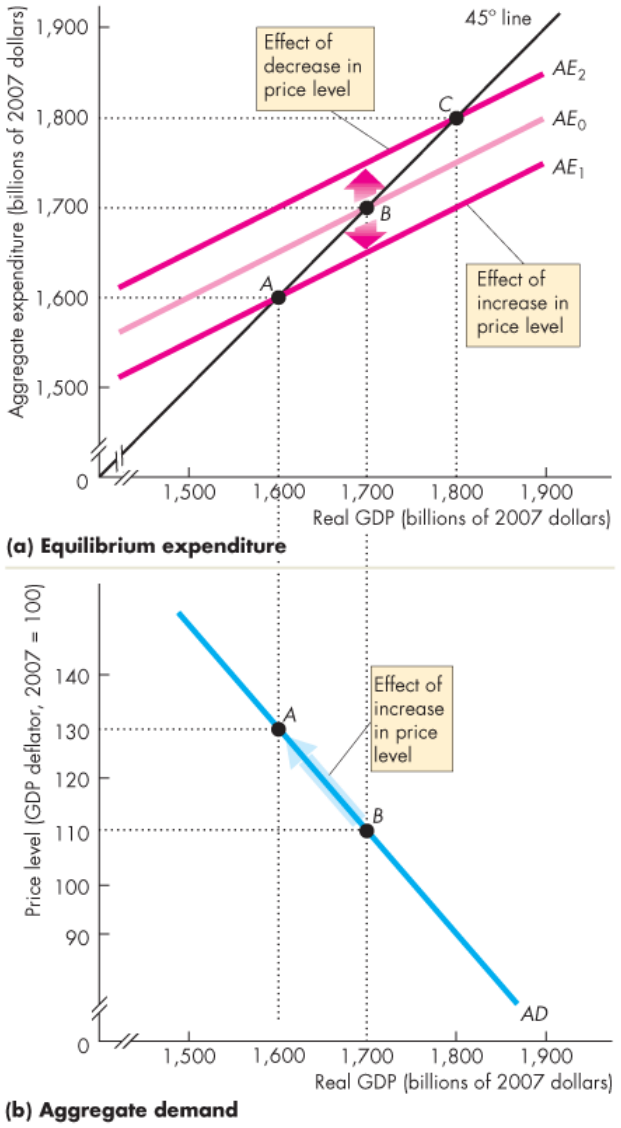
brings a movement along the *AD* curve from point *B* to point *A*.



A fall in price level from 110 to 90 …

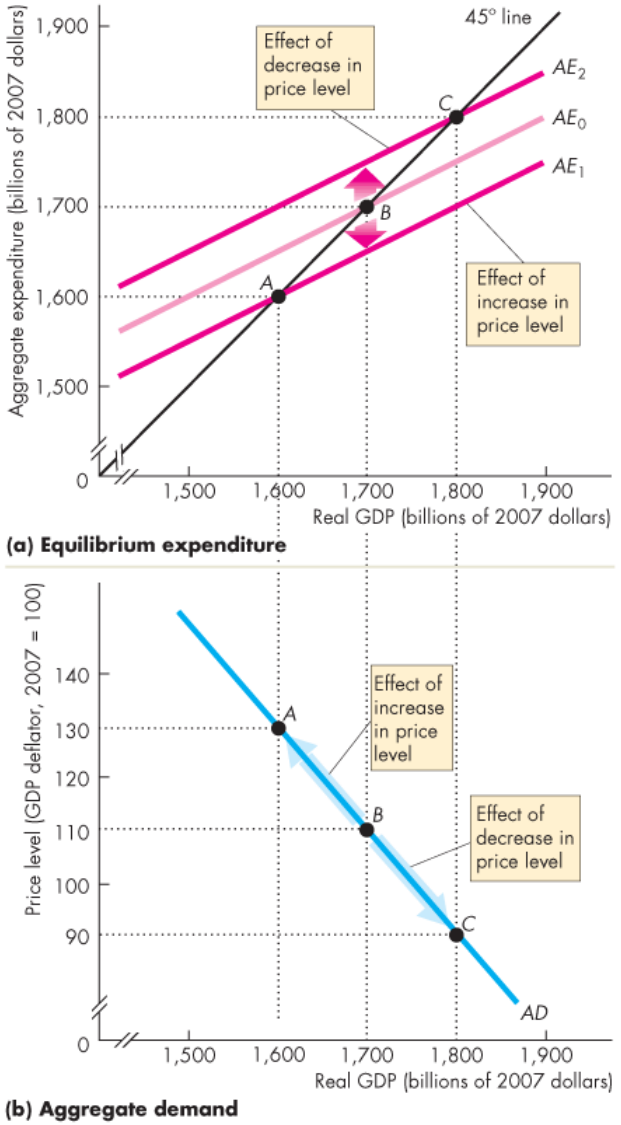
shifts the *AE* curve from AE_0 upward to AE_2 and …

increases equilibrium expenditure from
$1,700 billion to $1,800 billion.

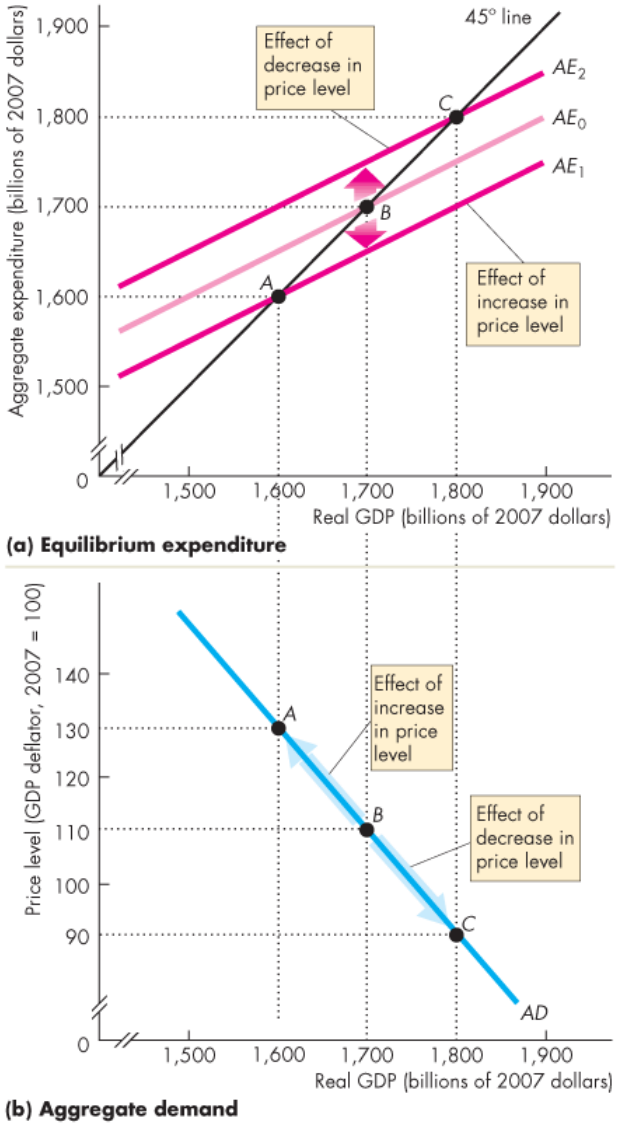


The same fall in the price level that increases equilibrium expenditure …

brings a movement along the *AD* curve to from point *B* to point *C*.



Points *A*, *B*, and *C* on the *AD* curve correspond to the equilibrium expenditure points *A*, *B*, and *C* at the intersection of the *AE* curve and the 45° line.



Changes in Aggregate Expenditure and Aggregate Demand

An increase in investment.

The *AE* curve shifts upward …

…and the *AD* curve shifts rightward …

by an amount equal to the change in investment multiplied by the multiplier.