

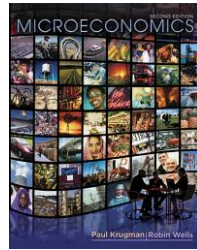


Economics 202 Principles Of Macroeconomics

Professor Yamin Ahmad

Lecture 8: The Keynesian Model

- Fixed Prices and Expenditure Plans
- Consumption and Savings Function
- Multipliers



Big Concepts...

- Aggregate Planned Expenditures and Real GDP
- Consumption/Savings Functions
- Equilibrium Expenditure
- Multiplier
- Relationship between AE and Aggregate Demand

Note: These lecture notes are incomplete without having attended lectures



The Aggregate Implications of Fixed Prices

- In the very short run, prices are fixed and the aggregate amount that is sold depends only on the aggregate demand for goods and services.
- In this very short run, to understand real GDP fluctuations, we must understand aggregate demand fluctuations.

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Expenditure Plans

- The four components of aggregate expenditure—consumption expenditure, investment, government purchases of goods and services, and net exports—sum to real GDP.
- **Aggregate planned expenditure** equals *planned* consumption expenditure plus *planned* investment plus *planned* government purchases plus *planned* exports minus *planned* imports.

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Fixed Prices and Expenditure Plans

A two-way link exists between aggregate expenditure and real GDP:

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

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Consumption Function and Saving Function

Consumption and saving are influenced by:

- Disposable income
- Wealth
- Expected future income
- The real interest rate

Disposable income is aggregate income (GDP) minus taxes plus transfer payments.

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Fixed Prices and Expenditure Plans

To explore the two-way link between real GDP and planned consumption expenditure, we focus on the relationship between consumption expenditure and disposable income when the other factors are constant.

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

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Consumption and Savings Functions

	Disposable Income (YD)	Planned Consumption Expenditure (C)	Planned Private Saving (S _p)
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Trillions of dollars per year

A	0	1.5	-1.5
B	2	3.0	-1.0
C	4	4.5	-0.5
D	6	6.0	0
E	8	7.5	0.5
F	10	9.0	1.0

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Consumption and Savings Functions

- Figure 1 illustrates the consumption function and the saving function.

- Consumption Function:

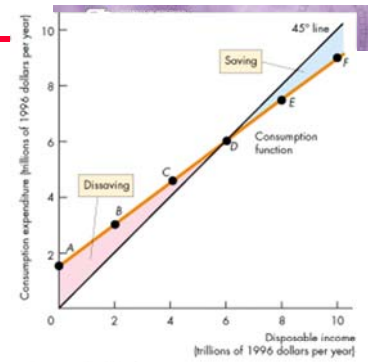
$$C = C_0 + c_1 * YD$$

$$= 1.5 + 0.75 * YD$$

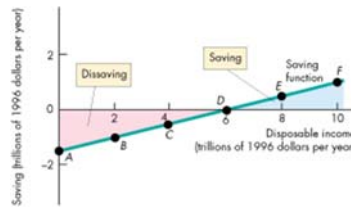
- Savings Function:

$$S_p = S_0 + s_1 * YD$$

$$= -1.5 + 0.25 * YD$$



(a) Consumption function



(b) Saving function

Note: These lecture notes are incomplete without having attended lect

Marginal Propensity to Consume

- The marginal propensity to consume (*MPC*) is the fraction of a change in disposable income spent on consumption.
- It is calculated as the change in consumption expenditure, ΔC , divided by the change in disposable income, ΔYD , that brought it about.

- That is:

$$MPC = \Delta C / \Delta YD$$

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Marginal Propensity to Save

- The marginal propensity to save (*MPS*) is the fraction of a change in disposable income that is saved.
- It is calculated as the change in saving, ΔS , divided by the change in disposable income, ΔYD , that brought it about.

- That is:

$$MPS = \Delta S_p / \Delta YD$$

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Fixed Prices and Expenditure Plans

- The *MPC* plus the *MPS* equals one.
- To see why, note that,

$$\Delta C + \Delta S_p = \Delta YD.$$

- Divide this equation by ΔYD to obtain,

$$\Delta C / \Delta YD + \Delta S_p / \Delta YD = \Delta YD / \Delta YD,$$

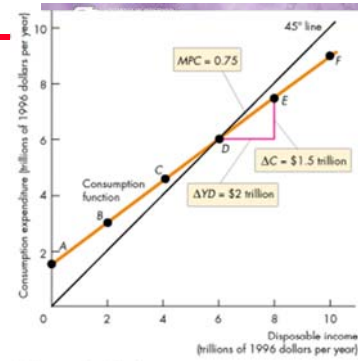
or

$$MPC + MPS = 1.$$

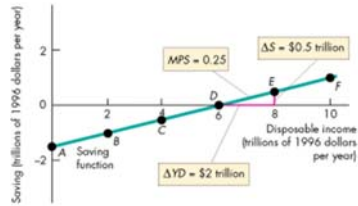
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Slopes and Marginal Propensities

- Figure 2 shows that the MPC is the slope of the consumption function and the MPS is the slope of the saving function.



(a) Consumption function

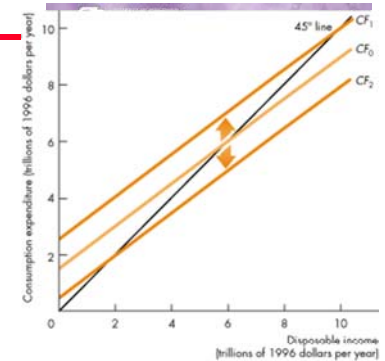


(b) Saving function

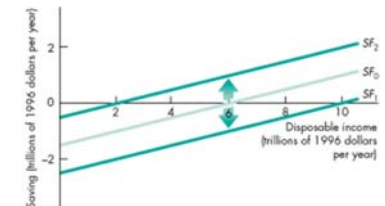
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Other Influences on Consumption Expenditure and Saving

- When an influence other than disposable income changes—the real interest rate, wealth, or expected future income—the consumption function and saving function shift.
- Figure 3 illustrates these effects.



(a) Consumption function

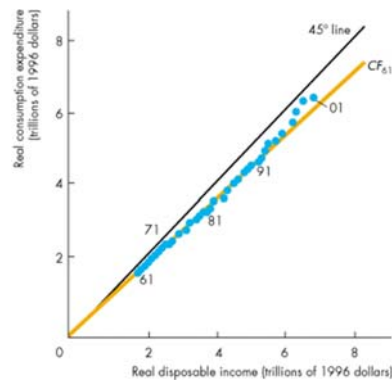


(b) Saving function

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The U.S. Consumption Function

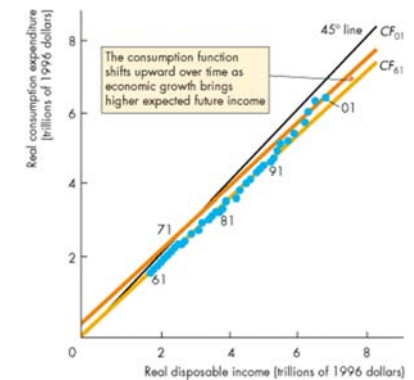
- In 1960, the U.S. consumption function was CF_{61} .
- The dots show consumption and disposable income for each year from 1961 to 2001.



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The U.S. Consumption Function

- The consumption function has shifted upward over time because economic growth has created greater wealth and higher expected future income.
- The assumed MPC in the figure is 0.9.



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Consumption as a Function of Real GDP

- Disposable income changes when either real GDP changes or when net taxes change.
- If tax rates don't change, real GDP is the only influence on disposable income, so consumption expenditure is a function of real GDP.
- We use this relationship to determine equilibrium expenditure.

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Import Function

- In the short run, imports are influenced primarily by U.S. real GDP.
- The **marginal propensity to import** is the fraction of an increase in real GDP spent on imports.
- In recent years, NAFTA and increased integration in the global economy have increased U.S. imports.
- Removing the effects of these influences, the U.S. marginal propensity to import is probably about 0.2.

Note: These lecture notes are incomplete without having attended lectures



Real GDP with a Fixed Price Level

- 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.

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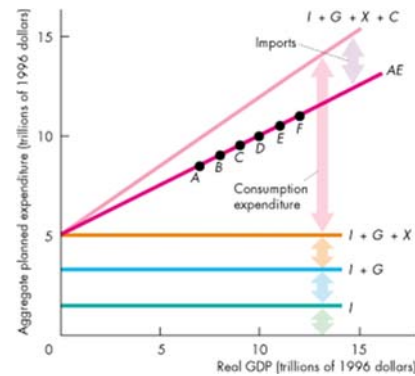
Aggregate Expenditure Schedule

Planned Expenditure							
	Real GDP (Y)	Consumption Expenditure (C)	Investment (I)	Government Purchases (G)	Exports (X)	Imports (M)	AE = C+I+G+X-M
	TRILLIONS OF DOLLARS						
	0	0	1.5	1.8	1.7	0	5.0
A	7	4.9	1.5	1.8	1.7	1.4	8.5
B	8	5.6	1.5	1.8	1.7	1.6	9.0
C	9	6.3	1.5	1.8	1.7	1.8	9.5
D	10	7.0	1.5	1.8	1.7	2.0	10.0
E	11	7.7	1.5	1.8	1.7	2.2	10.5
F	12	8.4	1.5	1.8	1.7	2.4	11.0

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Aggregate Planned Expenditure and Real GDP

- Figure 5 shows how the aggregate expenditure curve is built from its components.



Note: These lecture notes are incomplete without having attended lectures

Real GDP with a Fixed Price Level

- Consumption expenditure minus imports, which varies with real GDP, is **induced expenditure**.
- The sum of investment, government purchases, and exports, which does not vary with GDP, is **autonomous expenditure**.
- Consumption expenditure and imports can have an autonomous component.

Note: These lecture notes are incomplete without having attended lectures

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.

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Real GDP with a Fixed Price Level

Definition: Equilibrium Expenditure

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

Note: These lecture notes are incomplete without having attended lectures



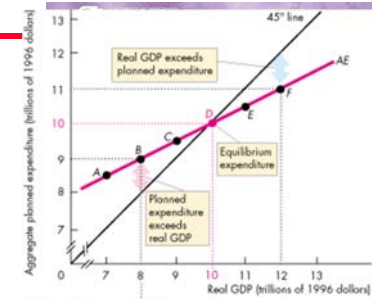
Equilibrium Expenditure

	Real GDP (Y)	Aggregate Planned Expenditure (AE)	Unplanned Inventory Change (Y-AE)
Trillions of Dollars			
A	7	8.5	-1.5
B	8	9.0	-1.0
C	9	9.5	-0.5
D	10	10.0	0
E	11	10.5	0.5
F	12	11.0	1.0

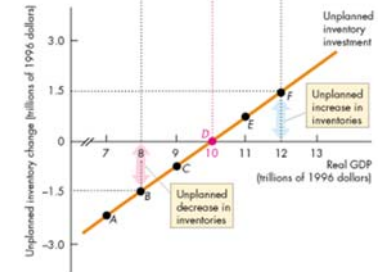
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Real GDP with a Fixed Price Level

- Figure 6 illustrates equilibrium expenditure, which occurs at the point at which the aggregate expenditure curve crosses the 45° line and there are no unplanned changes in business inventories.



(a) Equilibrium expenditure

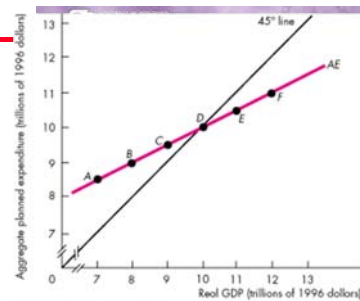


(b) Unplanned inventory changes

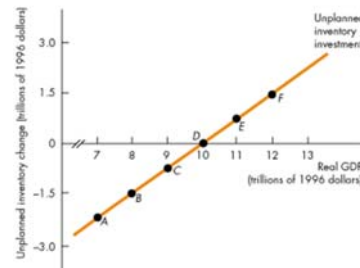
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Convergence to Equilibrium

- Figure 6 also illustrates the process of convergence toward equilibrium expenditure.



(a) Equilibrium expenditure

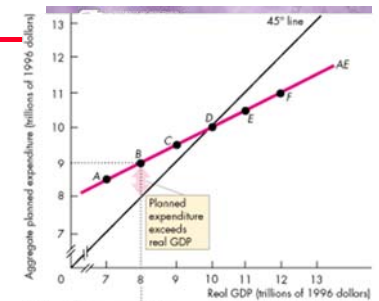


(b) Unplanned inventory changes

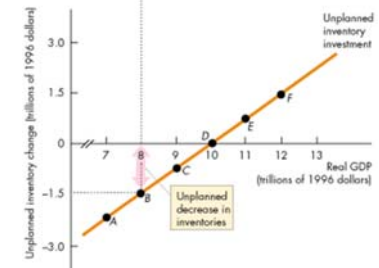
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Real GDP with a Fixed Price Level

- If aggregate planned expenditure is greater than real GDP (the AE curve is above the 45° line), an unplanned decrease in inventories induces firms to hire workers and increase production, so real GDP increases.



(a) Equilibrium expenditure

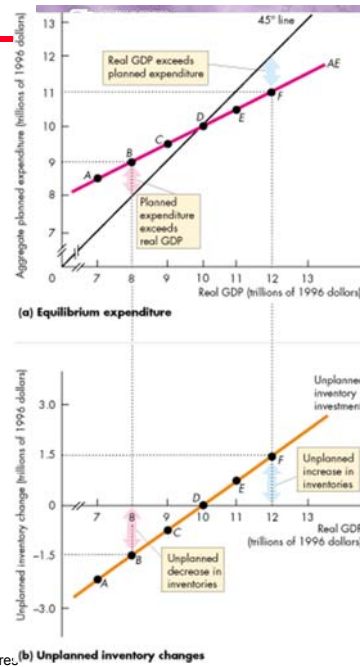


(b) Unplanned inventory changes

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Real GDP with a Fixed Price Level

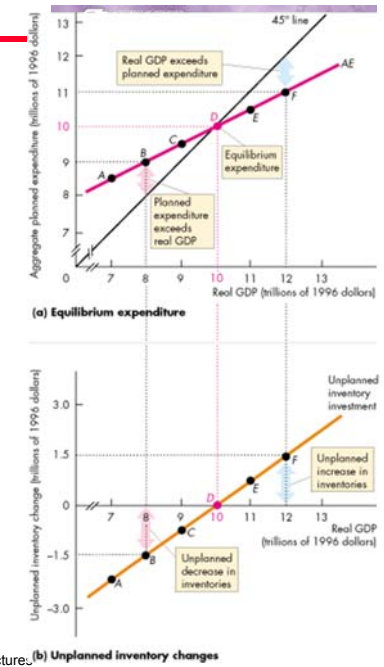
- If aggregate planned expenditure is less than real GDP (the AE curve is below the 45° line), an unplanned increase in inventories induces firms to fire workers and decrease production, so real GDP decreases.



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Real GDP with a Fixed Price Level

- If aggregate planned expenditure equals real GDP (the AE curve intersects the 45° line), no unplanned changes in inventories occur, so firms maintain their current production and real GDP remains constant.



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Practice Example 1:

Suppose that:

- $C = 680 + 0.8(Y - T)$
- $T = 100$
- $I = 150$
- $G = 250$

- Calculate the equation for the AE (Aggregate Expenditure) curve
- What is real GDP in equilibrium?

Note: These lecture notes are incomplete without having attended lectures



The Multiplier

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

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The Basic Idea of the Multiplier

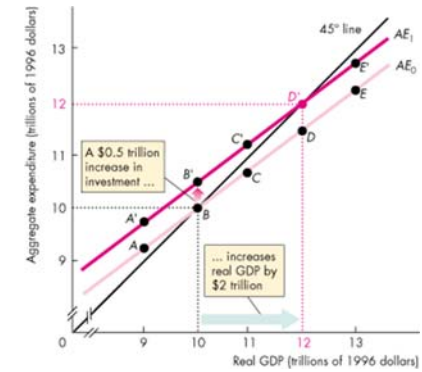
- An increase in investment (or any other component of autonomous expenditure) increases aggregate expenditure and real GDP and the increase in real GDP leads to an increase in induced expenditure.
- The increase in induced expenditure leads to a further increase in aggregate expenditure and real GDP.
- So real GDP increases by more than the initial increase in autonomous expenditure.

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The Multiplier Effect

- Figure 7 illustrates the multiplier.
- The Multiplier Effect:
 - The amplified change in real GDP that follows an increase in autonomous expenditure is the *multiplier effect*.

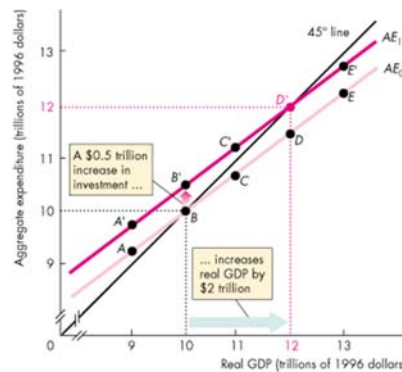


Note: These lecture notes are incomplete without having attended lectures



The Multiplier Effect

- When autonomous expenditure increases, inventories make an unplanned decrease, so firms increase production and real GDP increases to a new equilibrium.



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The Multiplier

- Why Is the Multiplier Greater than 1?
 - The multiplier is greater than 1 because an increase in autonomous expenditure induces further increases in expenditure.
- The Size of the Multiplier
 - The size of the multiplier is the change in equilibrium expenditure divided by the change in autonomous expenditure.

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The Multiplier

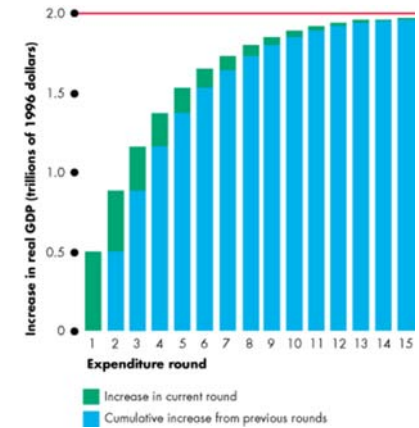
- Ignoring induced imports and income taxes, the marginal propensity to consume determines the magnitude of the multiplier.
- The multiplier equals $1/(1 - MPC)$ or, alternatively, $1/MPS$.

Note: These lecture notes are incomplete without having attended lectures



The Multiplier

- Figure 8 illustrates the multiplier process and shows how the *MPC* determines the magnitude of the amount of induced expenditure at each round as aggregate expenditure moves toward equilibrium expenditure.



Note: These lecture notes are incomplete without having attended lectures



The Multiplier Math

$$\Delta Y = \Delta I + c_1 \Delta I + c_1^2 \Delta I + c_1^3 \Delta I + c_1^4 \Delta I + c_1^5 \Delta I + \dots$$

Multiply by c_1 to obtain

$$c_1 \Delta Y = c_1 \Delta I + c_1^2 \Delta I + c_1^3 \Delta I + c_1^4 \Delta I + c_1^5 \Delta I + \dots$$

c_1^n approaches zero as n becomes large so $c_1^{(n+1)}$ also approaches zero.

Subtract the second equation from the first to obtain

$$\Delta Y - c_1 \Delta Y = \Delta I, \text{ or } (1 - c_1) \Delta Y = \Delta I,$$

so that

$$\Delta Y = \Delta I / (1 - c_1).$$

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Imports and Income Taxes

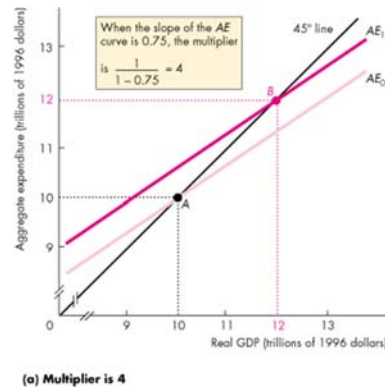
- Income taxes and induced imports both reduce the size of the multiplier.
- Including income taxes and induced imports, the multiplier equals $1/(1 - \text{slope of the } AE \text{ curve})$.

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The Multiplier

- Figure 9 shows the relation between the multiplier and the slope of the AE curve.
- In part (a) with no imports (or imports are autonomous) and no income taxes, the slope of the AE curve is 0.75 and the multiplier is 4.

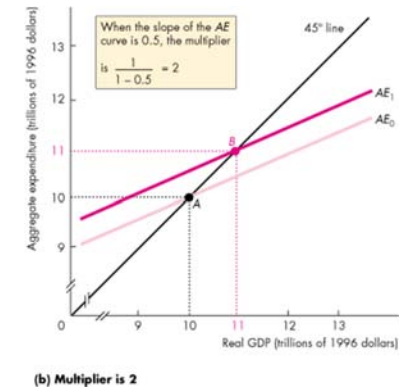


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The Multiplier

- In part (b), when you include *either* income taxes or induced imports, the slope of the AE curve is 0.5 and the multiplier is 2.



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To Summarize:

- The multiplier is larger:
 - The greater the marginal propensity to consume (c_1)
 - The smaller the marginal tax rate (t_1)
 - The smaller the marginal propensity to import (m_1)
- Note: Autonomous/Lump sum taxes, T_0 and autonomous imports M_0 do not affect the value of the multiplier

Note: These lecture notes are incomplete without having attended lectures



Practice Example 2:

Consider once again the scenario in example 1.

- $C = 680 + 0.8(Y - T)$
- $T = 100$
- $I = 150$
- $G = 250$

Suppose that firms increase investment by 100. What happens to real GDP in equilibrium? How much does it change by?

Note: These lecture notes are incomplete without having attended lectures

Business Cycle Turning Points

- Turning points in the business cycle—peaks and troughs—occur when autonomous expenditure changes.
- An increase in autonomous expenditure brings an unplanned decrease in inventories, which triggers an expansion.
- A decrease in autonomous expenditure brings an unplanned increase in inventories, which triggers a recession.

Note: These lecture notes are incomplete without having attended lectures

The Multiplier and the Price Level

- In the *equilibrium expenditure model*, the price level is constant.
 - But real firms don't hold their prices constant for long.
 - When they have an unplanned change in inventories, they change production *and prices*.
 - And the price level changes when firms change prices.
- The *aggregate supply-aggregate demand* model explains the simultaneous determination of real GDP and the price level.
- The two models are related.

Note: These lecture notes are incomplete without having attended lectures

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.

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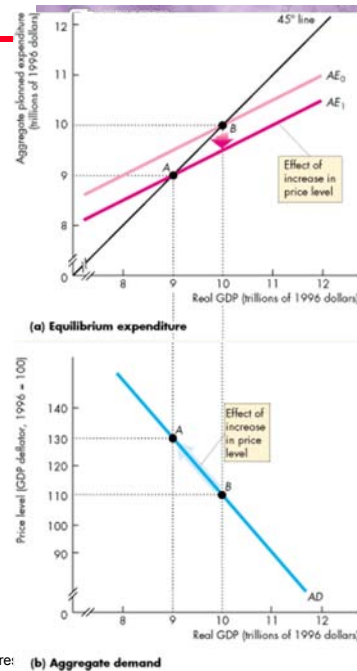
Aggregate Expenditure and the Price Level

- When the price level changes, a wealth effect and substitution effect change aggregate planned expenditure and change the quantity of real GDP demanded.
- Figure 10 on the next slide illustrates the effects of a change in the price level on the *AE* curve, equilibrium expenditure, and the quantity of real GDP demanded.

Note: These lecture notes are incomplete without having attended lectures

The Multiplier and the Price Level

- In Figure 10(a), a rise in price level from 110 to 130 shifts the AE curve from AE_0 downward to AE_1 and decreases the equilibrium level of real output from \$10 trillion to \$9 trillion.

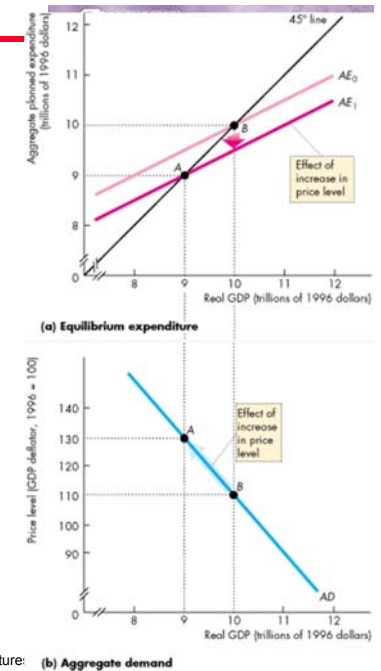


Note: These lecture notes are incomplete without having attended lecture:

(b) Aggregate demand

The Multiplier and the Price Level

- In Figure 10(b), the same rise in the price level that lowers equilibrium expenditure, brings a movement along the AD curve to point A.

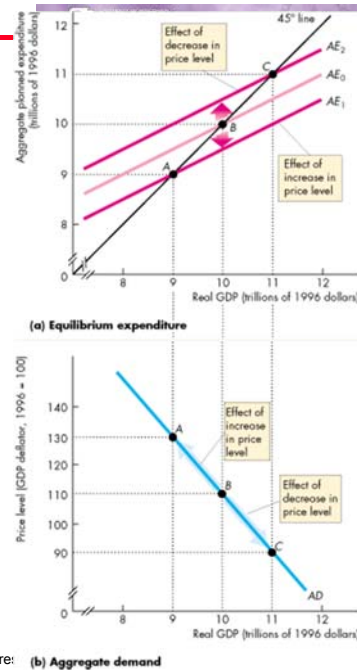


Note: These lecture notes are incomplete without having attended lecture:

(b) Aggregate demand

The Multiplier and the Price Level

- A fall in price level from 110 to 90 shifts the AE curve from AE_0 upward to AE_2 and increases equilibrium real GDP from \$10 trillion to \$11 trillion.

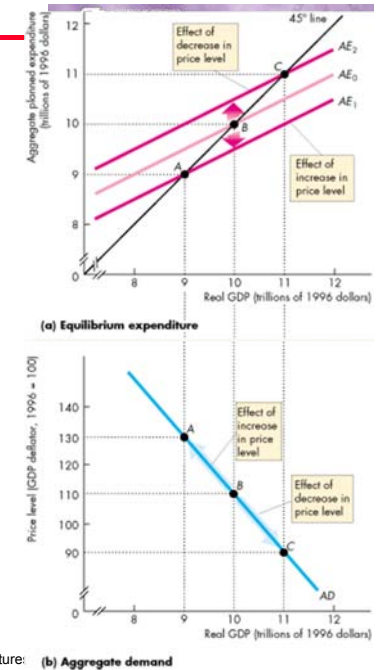


Note: These lecture notes are incomplete without having attended lecture:

(b) Aggregate demand

The Multiplier and the Price Level

- The same fall in the price level that raises equilibrium expenditure brings a movement along the AD curve to point C.

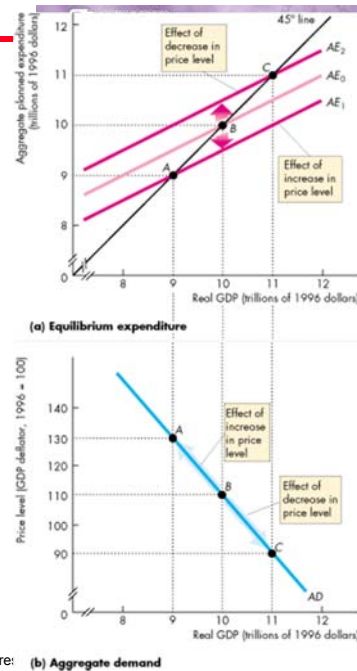


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(b) Aggregate demand

The Multiplier and the Price Level

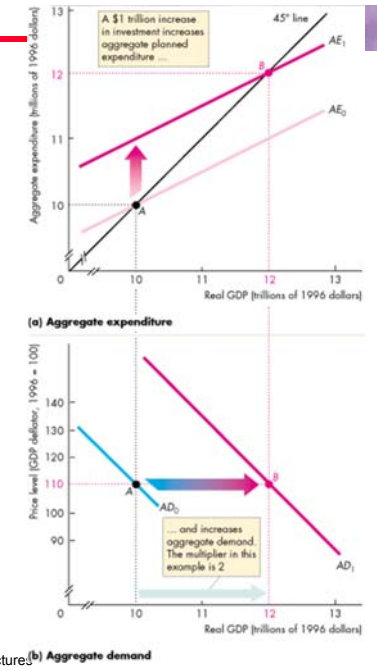
- Points A, B, and C on the AD curve correspond to the equilibrium expenditure points A, B, and C at the intersection of the AE curve and the 45° line.



Note: These lecture notes are incomplete without having attended lecture:

The Multiplier and the Price Level

- Figure 11 illustrates the effects of an increase in autonomous expenditure.
- An increase in autonomous expenditure shifts the aggregate expenditure curve upward and shifts the aggregate demand curve rightward by the multiplied increase in equilibrium expenditure.



Note: These lecture notes are incomplete without having attended lecture:



Review Questions:

- Which components of Aggregate Expenditure are influenced by real GDP?
- What is the difference between autonomous expenditure and induced expenditure?
- Define the marginal propensity to consume (mpc). What does it tell you? What is autonomous consumption, and what does it tell you?
- How do we calculate the effects of real GDP on consumption expenditure and imports by using the mpc and the mpi?
- What is the relationship between aggregate planned expenditure (AE) and real GDP at expenditure equilibrium?
- How does equilibrium expenditure come about? What adjusts to achieve equilibrium?
- If real GDP and AE are greater than equilibrium expenditure, what happens to firms' inventories? How do firms change production? What happens to real GDP? (What happens if real GDP and AE are less than equilibrium expenditure?)
- What is the multiplier? What does it determine? Why does it matter?
- How do the mpc, the mpi and the marginal tax rate influence the size of the multiplier?
- How do fluctuations in autonomous expenditure influence real GDP? If autonomous expenditure decreases, which phase of the business cycle does the economy enter?

Note: These lecture notes are incomplete without having attended lectures