The Consumption Function

The *consumption function* is an equation which describes how a household's level of consumption varies with its disposable income. In order to fully understand the consumption function, we need to understand a few ideas about household income and how they choose to use that income.

A household's *disposable income* is their income after net taxes

$$Disposable\ Income = Y_d = Income - (Taxes - Transfer\ Payments)$$

Out of each additional dollar a household earns, they can choose to either save or consume it. The fraction of each dollar that a household chooses to consume is referred to as the *marginal propensity to consume*. The fraction of each dollar that a household chooses to save is the *marginal propensity to save*.

$$Marginal\ Propensity\ to\ Consume = \text{MPC} = \frac{\text{Change in consumption}}{\text{Change in desposable income}} = \frac{\Delta \text{C}}{\Delta \text{Y}_\text{D}}$$

$$Maginal\ Propensity\ to\ Save = MPS = \frac{\Delta S}{\Delta Y_D}$$

Example 1. Given the following consumption schedule,

Consumption	Disposable Income
\$600	\$1,000
\$900	\$1,500
\$1200	\$2,000

What is the marginal propensity to consume?

We can go a bit further here. Assuming that there are lump sum taxes (i.e. no tax rate), this means that out of each additional dollar you earn you must either spend or save the entire dollar. As a result the MPC and MPS must always add up to equal 1

$$National\ Income = Y = C + S + T$$
$$\Delta \text{Y} = \Delta \text{C} + \Delta \text{S} + \Delta \text{T}$$
$$\text{(assume } \Delta \text{T} = 0) \ \Delta \text{Y} = \Delta \text{C} + \Delta \text{S}$$
$$\text{(divide both sides by } \Delta \text{Y)} \ 1 = MPC + MPS$$

What happens when your disposable income is zero? You must still consume in order to survive (food, clothes, etc.). This amount that you consume when your income is zero is called *autonomous consumption*. With this, we are ready to derive the consumption function:

$$Consumption\ Function = C = C_{auto} + MPC \cdot Y_D$$

Example 2. When David has no income, he spends \$500. If his income increases to \$2000, he spends \$1900. What is his consumption function?

The Aggregate Expenditure Model

The *aggregate expenditure (or income-expenditure) model* is a macroeconomic model that focuses on the relationship between total spending and real GDP, assuming the price level is constant. To fully investigate this model we first need to define the *aggregate expenditure function*.

$$Aggregate\ expenditure = AE = C + I_{Planned} + G + NX$$
$$AE = C_{auto} + MPC \cdot Y_D + I_{Planned} + G + NX = AE_{Auto} + MPC \cdot Y_D$$

Remember when dealing with this formula that C here is referring to the consumption function. Also of note is a new term, $I_{planned}$, which in this model refers to *planned investment*. Planned investment refers to the investment spending businesses intend to carry out in a given time period. In this chapter it is given, but in general (and as we will see in later chapters), it is a function if the interest rate, *r*. Missing in this equation is *unplanned investment*, which refers to unplanned changes to inventories firms make during a given time period. *Actual investment spending*, then, is the sum of these two

$$Actual\ Investment = I_{planned} + I_{Unplanned}$$

Now if we add unplanned investment to our equation for aggregate expenditure we get:

$$AE + I_{Unplanned} = C + I_{planned} + I_{unplanned} + G + NX = GDP$$

Example 3: In an economy without government purchases, government transfers, or taxes, aggregate autonomous consumer spending is $750 billion, planned investment spending is $300 billion, and the marginal propensity to consumer is .75. What is the equation for planned aggregate spending?

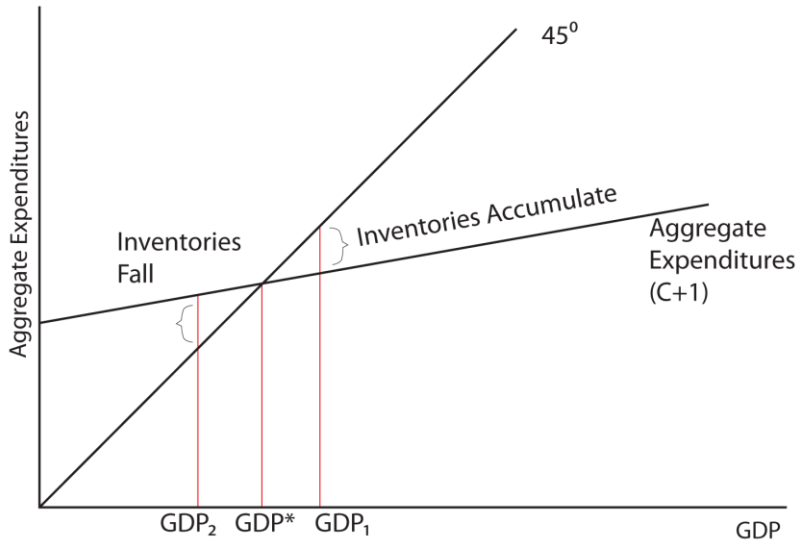
Aggregate Expenditure Model Equilibrium

In the previous section we described how aggregate expenditures plus unplanned investment equals GDP. What are the implications of this for the economy? For instance, if aggregate expenditures are larger than GDP, this means that unplanned inventories must be negative in order for this formula to hold. However, if this is true, that means that there are unexpected decreases in inventories. How are firms going to respond to this? By increasing production to meet this demand for expenditures. By producing more goods though, this leads to an increase in GDP, which in turn leads to a decrease in GDP. We can summarize the logic as follows:

- When AE $< GDP$, inventories will↑ and GDP and total employment will↓
- When AE $> GDP$, inventories will↓ and GDP and total employment will↑

Therefore, the only time when GDP is not changing is when *aggregate expenditures are equal to GDP*. This is what we call the *macroeconomic equilibrium* of this model:

$$Macroeconomic\ Equilibrium: GDP = AE$$



We can illustrate these ideas graphically. If we place the function $AE = Y$ on the graph containing the

aggregate expenditures function, it represents all of the possible equilibrium points in the economy. The macroeconomic equilibrium is thus the point where the aggregate expenditures function intersects with this line, often referred to as the *45° line*.

Note however that the macroeconomic equilibrium here does not correspond to the economy being at full employment. In fact, it is possible for the economy to be in equilibrium, but be below full employment GDP, in which case we are in a *recession*, or above full employment GDP, in which case we are in a *boom*. In these cases we cannot get to full employment by moving along the current aggregate expenditures line. Instead we have to shift the aggregate expenditures function.

Example 4: If planned aggregate expenditures are above potential GDP, and planned aggregate expenditures equal GDP then
A) actual inventory investment will be less than planned inventory investment
B) actual inventory investment will be greater than planned inventory investment
C) the economy is in expansion
D) the economy is at full employment

The Multiplier and Shifting the Aggregate Expenditures Function

The *multiplier effect* describes how changes in autonomous expenditures lead to changes in real GDP. This is best illustrated with an example:

> A University decides to build a new residence hall worth $100 million, provided by the government. Construction workers earn $100 million in income, and if we assume the MPC is 0.8, they spend 80 percent—or $80 million—dining out, going to the movies, shopping, and buying new cars. The increased spending of $80 million becomes income to the owners and employees of the restaurants, movie theatres, shopping malls, and car dealers. In turn, these people spend 80 percent of the new $80 million, or $64 million, on other goods and services. The $64 million becomes income to others in the community, and the process continues. The following Table shows the impact of the multiplier through various rounds.

Round	Initial change in Govt. exp.	Change in Output	Change in Consumption
1	100	100.00	80.00
2	0	80.00	64.00
3	0	64.00	51.20
4	0	51.20	40.96
5	0	40.96	32.77
6	0	32.77	26.21
7	0	26.21	20.97
8	0	20.97	16.78
9	0	16.78	67.11
10 to infinity	0	67.11	
Totals	**100**	**500**	**400**

The above table can be summarized as follows and introduces you to the multiplier process.

Initial change in Government purchases	= ΔG (which is equal to 100 above)
First change in consumption	MPC x ΔG
Second change in consumption	= MPC^2 x ΔG
Third change in consumption	= MPC^3 x ΔG
Fourth change in consumption	= MPC^4 x ΔG

$\Delta Y = (1 + MPC + MPC^2 + MPC^3 + MPC^4 + \ldots..) \Delta G$
So that the government-purchase multiplier is
$\Delta Y/\Delta G = 1 + MPC + MPC^2 + MPC^2 + \ldots$. This expression is in the form of an *infinite geometric series*, and with $0 < MPC < 1$, it can be written as:
$\Delta Y/\Delta G = 1/(1\text{-}MPC)$

In general, the multiplier can be described with the following formula:

$$Multiplier = \frac{\Delta Y}{\Delta AE_{Auto}} = \frac{1}{1 - MPC}$$

Tutorial: Determining how spending needs to change to reach full employment GDP
Step 1: Determine the MPC (if applicable)
You may not always be given the MPC to use for the multiplier. If not use the information in the question to determine the MPC

Step 2: Determine ΔY
The change in GDP in these questions can be defined as follows:

$$\Delta Y = Y_{FE} - Y_E$$

Where Y_E is equilibrium GDP

Step 3: Solve for ΔAE_{Auto}

Example 5: Using the table below, answer questions A – D (the numbers are in billions):

Real GDP($)	Consumption($)	Planned Investment($)	Government Purchases($)	Net Exports($)
4000	3500	350	450	-100
5000	4300	350	450	-100
6000	5100;	350	450	-100
7000	5900	350	450	-100

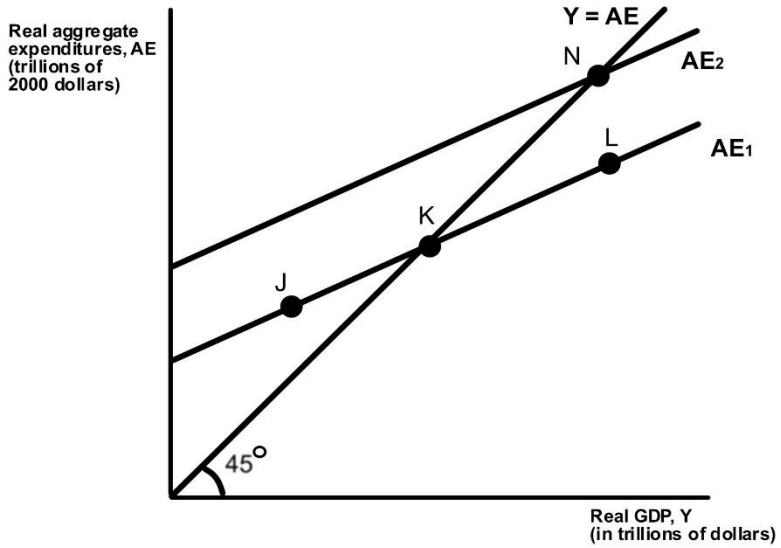
A) What is the equilibrium level of real GDP?
B) What is the MPC?
C) If potential GDP is $7000 billion, is the economy at full employment? If not, what is the condition of the economy**?**
D) If the economy is not at full employment, by how much should government spending increase so that the economy can move to the full employment level of GDP?

Practice Questions

1. On the 45-degree line diagram, for points that lie above 45-degree line,
A) planned aggregate expenditure is greater than GDP.
B) planned aggregate expenditure is equal to GDP.
C) planned aggregate expenditure is less than GDP.
D) planned aggregate expenditure is less than aggregate income.

2. How does a decrease in government spending affect the aggregate expenditure line?
A) It shifts the aggregate expenditure line downward.
B) It increases the slope of the aggregate expenditure line.
C) It shifts the aggregate expenditure line upward.
D) It decreases the slope of the aggregate expenditure line.

3. Suppose that the level of GDP associated with point N is potential GDP. If the U.S. economy is currently at point K,



A) Firms are operating above capacity.
B) The economy is at full employment.
C) The economy is in recession.
D) The level of unemployment is equal to the natural rate.

Use the following information to answer the next seven questions:
- When Y_D = 0, C = 400
- When Y_D = 1000, C = 1000
- Iplanned = 250
- G = 350

4. What is autonomous consumption in this model?
a) 350 b) 250 c) 1000 d) 400

5. What is autonomous expenditure in this model?
a) 350 b) 250 c) 1000 d) 400

6. What is the MPC?
a) .6 b) .4 c) .8 d) 1

7. What is the consumption function?
a) C = 1000 + $.6Y_D$
b) C = 400 + $.4Y_D$
c) C = 350 + $.6Y_D$
d) C = 400 + $.6Y_D$

8. What is the aggregate expenditure function?
a) C = 1000 + $.6Y_D$
b) C = 400 + $.4Y_D$
c) C = 350 + $.6Y_D$
d) C = 400 + $.6Y_D$

9. Suppose potential GDP is 4000. Is this market operating at full employment?
a) Yes, the market is at full employment
b) No, the market is in recession
c) No, the market is in expansion
d) Not enough information

10. If the government wanted to reach full employment, how much would it need to spend to achieve this goal?
a) 0
b) -450
c) 600
d) 1500

11. If the MPC is 0.95, then a $10 million increase in disposable income will
A) increase consumption by $200 million.
B) increase consumption by $9.5 million.
C) increase consumption by $105 million.
D) decrease consumption by $950 million.

12. If an increase in autonomous expenditure of $10 million results in a $50 million increase in equilibrium real GDP, then the MPC is:
A) 0.5 B) 0.75 C) 0.8 D) 0.9

13. If the consumption function is defined as C = 5500 + 0.9Y, what is the value of the multiplier?
A) 0.1 B) 0.9 C) 9 D) 10