Chapter 8: Aggregate Expenditure and Equilibrium Output

Week 4

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John Maynard Keynes

Figure 1: John Maynard Keynes (1883-1946)
Basic Assumptions

Basic Assumptions in Aggregate Expenditure (Keynesian Cross) Model

(a) **Vision:** Short run

(b) **Prices:** Wages, Interests, Rents, Prices are *STICKTY* or fixed

(c) **Agents:** Household and Business Sectors, No Government Sector.

(d) **Scope:** Closed Economy, No Trade (thus no export and import)

(e) **Variables:** Planned Investment (I) is *exogenous* but C, Y are *endogenous*.
Figure 2: The Circular Flow Diagram with Households and Firms
Learning Objectives

- Understanding Consumption(Saving) Function both in Algebra and Geometry.
  (2012Mid1 M28 ; M29; M30 ; M31; M32; M33; )

- Understanding Equilibrium Level of Aggregate Income both in Algebra and Geometry.
  (PEQ4 Page168; 2012Mid1 M23-M27 Page 195-196; M34 Page 198 ; E3 Page 201)
Consumption and Saving Function

Let $b = MPC$ (Definition e.g. M28, $S = Y - C = Y - (a + bY) = -a + (1 - b)Y$ e.g. M30; $b = \frac{\Delta C}{\Delta Y}$ and $1 - b = \frac{\Delta S}{\Delta Y}$ e.g. M29)

- **E**: Zero Saving $Y_2 = C_2 \Rightarrow S_2 = 0$
- **S**: Saving $Y_3 > C_3 \Rightarrow S_1 > 0$ by the amount $|CD|$ or $|C'D'|$ e.g. M32
- **D**: Dissaving $Y_1 < C_1 \Rightarrow S_2 < 0$ by the amount $|AB|$ or $|A'B'|$
Let $b = \text{MPC} (\text{Definition e.g. M28,})$

$S = Y - C = Y - (a + bY) = -a + (1 - b)Y \text{ e.g. M30;}$

$b = \frac{\Delta C}{\Delta Y}$ and $1 - b = \frac{\Delta S}{\Delta Y} \text{ e.g. M29}$

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Aggregate Expenditure Model

Practice Essay Question 4

Consumption and Saving Function

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Aggregate Expenditure Model
Practice Essay Question 4

Aggregate Expenditure Line

\[ AE = C + I = a + bY + I = (a + I) + bY \], so Y-intercept is \( a + I \) and slope is \( b(MPC) \)

Equilibrium:
\[ Y_3 = AE = C + I \Rightarrow S_3 = I(\frac{FG}{FG'}) \]
(no unplanned inventories or no change in inventories)

Disequilibrium
\[ Y_5 < C_5 + I \Rightarrow S_5(\frac{MN}{MN'}) < I(\frac{FG}{FG'}) \]
(unplanned inventories < 0 or inventories are falling)

Disequilibrium
\[ Y_4 > C_4 + I \Rightarrow S_4(\frac{PQ}{P'Q'}) > I(\frac{FG}{FG'}) \]
(unplanned inventories > 0 or inventories are rising) e.g. M34
Aggregate Expenditure Model
Practice Essay Question 4

Aggregate Expenditure Line

\[ AE = C + I = a + bY + I = (a + I) + bY, \text{ so} \]
\[ \text{Y-intercept is } a + I \text{ and slope is } b(MPC) \]

Equilibrium:
\[ Y_3 = AE = C + I \Rightarrow S_3 = I(FG) = F'G' \]
(no unplanned inventories or no change in inventories)

Disequilibrium
\[ Y_5 < C_5 + I \Rightarrow S_5(MN) < I(FG) \]
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Disequilibrium
\[ Y_4 > C_4 + I \Rightarrow S_4(PQ) > I(FG) \]
(unplanned inventories > 0 or inventories are rising) e.g. M34
Aggregate Expenditure Model

Practice Essay Question 4

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\[ AE = C + I = a + bY + I = (a + I) + bY, \] so
Y-intercept is \( a + I \) and slope is \( b(MPC) \)

Equilibrium:
\[ Y_3 = AE = C + I \Rightarrow S_3 = I(|FG| = |F'G'|) \]
(no unplanned inventories or no change in inventories)

Disequilibrium
\[ Y_5 < C_5 + I \Rightarrow S_5(|MN| = |M'N'|) < I(|FG|) \]
(unplanned inventories \(< 0 \) or inventories are falling)

Disequilibrium
\[ Y_4 > C_4 + I \Rightarrow S_4(|PQ| = |P'Q'|) > I(|FG|) \]
(unplanned inventories \(> 0 \) or inventories are rising) e.g. \( M34 \)
Aggregate Expenditure Model

Practice Essay Question 4

Aggregate Expenditure Line

\[ AE = C + I = a + bY + I = (a + I) + bY, \] so
Y-intercept is \( a + I \) and slope is \( b(MPC) \)

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Disequilibrium
\[ Y_4 > C_4 + I \Rightarrow S_4(|PQ| = |P'Q'|) > I(|FG|) \]
(unplanned inventories > 0 or inventories are rising) e.g. M34
Comparative Statics: Everything else staying the same, we analyze how a change in one parameter would affect curves and therefore outcome equilibrium.

- Autonomous(a) $\uparrow \Rightarrow$ C(S) Line shifts up(down) parallel $\Rightarrow$ AE Line shifts up parallel $\Rightarrow$ Equil. Y ↑; Equil. C ↑; Equil. S ↔ and vice versa.
  Graphics; (The paradox of thrifty), e.g. *PEQ4 Part 2 (c)*

- MPC(b) $\uparrow \Rightarrow$ C(S) Line rotates up(down) $\Rightarrow$ AE Line rotates up $\Rightarrow$ Equilibrium Y ↑; Equil. C ↑; Equil. S ↔ and vice versa.
  Graphics e.g. *M33*

- Planned Investment(I) $\uparrow \Rightarrow$ AE Line shifts up parallel $\Rightarrow$ Equilibrium Y ↑ ; Equil. C ↑; Equil. S ↑ and vice versa.
  Graphics; (Investment Multiplier Effect), e.g. *PEQ4 Part 1 (c)*

Back
The change to C(S) lines with an increase in \( a \):

\[
C_1 = a + bY \\
C_2 = a' + bY
\]

The change to AE lines with an increase in \( a \):

\[
C_2 + I
\]

Back
Comparative Statics: Change in MPC or MPS

The change to C(S) lines with an increase in MPC

\[ C_2 = a + b_2 Y \]
\[ C_1 = a + b_1 Y \]

The change to AE lines with an increase in MPC

\[ C_2 + I = a + b_2 Y \]

Back
Comparative Statics: Change in Planned Investment

The change to AE lines with an increase in $I$

Multiplier Effect given an increase in $I$

Initial change in $I = I_2 - I_1$

$Y_1$ $Y_2$ $Y$

$AE$

$C + I_2 = AE_2$

$C + I_1 = AE_1$

$0$

$C + I_1 = AE_1$

$C + I_2 = AE_2$

$(I_2 - I_1)/(1-MPC)$

Zheng Zhang

Chapter 8: Aggregate Expenditure and Equilibrium Output
28. The fraction of a change in income that is consumed or spent is called

A. the marginal propensity of income
B. the marginal propensity to save
C. the marginal propensity to consume
D. average consumption

Back
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Back
29. Suppose saving is $2000 when income is $10,000 and MPC equals 0.8. When income increases to $15,000, saving is

A $4,000
B $3,000
C $2,400
D $5,000
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29. Suppose saving is $2000 when income is $10,000 and MPC equals 0.8. When income increases to $15,000, saving is

A  $4,000  
B  $3,000  
C  $2,400  
D  $5,000

Back
Solution: Let $S_1 = $2000, $Y_1 = 10,000$, $Y_2 = 15,000$, so we have

$$1 - MPC = \frac{\Delta S}{\Delta Y}$$

$$1 - 0.8 = \frac{S_2 - S_1}{Y_2 - Y_1}$$

$$0.2 = \frac{S_2 - 2,000}{15,000 - 10,000}$$

Rearranging terms, $S_2 = $3,000
30. Assume the economy has only households and firms, and the saving function is $S = -20 + 0.3Y$, then consumption at an income level of 114 would be

A  100
B  90
C  110
D  50

Back
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A. 100
B. 90
C. 110
D. 50

Back
Consumption and Saving Function: Example

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Solution: **Method 1:** By using the relationship between consumption and saving function

\[ C = 20 + 0.7Y \]  
so if \( Y = 114 \), then \( C = 20 + 0.7 \times 114 = 99.8 \approx 100 \)

*Back*
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Solution: **Method 1:** By using the relationship between consumption and saving function
\[ C = 20 + 0.7Y \] so if \( Y = 114 \), then
\[ C = 20 + 0.7 \times 114 = 99.8 \approx 100 \]

**Method 2:** Plugging \( Y = 114 \) into \( S \),
\[ S = -20 + 0.3Y = -20 + 0.3 \times 114 = 14.2 \]
So \( C = Y - S = 114 - 14.2 = 99.8 \approx 100 \)

*Back*
31. Assume that a consumption function is $C = 200 + .2Y$. The marginal propensity to save is

A 0.8.
B 0.75.
C 0.25.
D 0.2.

Back
31. Assume that a consumption function is $C = 200 + .2Y$. The marginal propensity to save is

A 0.8.

B 0.75.

C 0.25.

D 0.2.

Back
32. Refer to the information provided in Figure 8.2 below to answer the question that follows. At point C, Jerry’s
A consumption equals his income.
B consumption is greater than his income.
C saving is zero.
D saving is positive.
32. Refer to the information provided in Figure 8.2 below to answer the question that follows. At point C, Jerry’s
A consumption equals his income.
B consumption is greater than his income.
C saving is zero.
D saving is positive.
33. Refer to the information provided in Figure 8.1 below to answer the question that follows.

Refer to Figure 8.1. An increase in MPC

A makes the consumption function flatter.
B makes the saving function flatter.
C shifts the consumption function upward.
D shifts the saving function downward.
E makes the saving function steeper.
33. Refer to the information provided in Figure 8.1 below to answer the question that follows.

Refer to Figure 8.1. An increase in MPC

A makes the consumption function flatter.

B makes the saving function flatter.

C shifts the consumption function upward.

D shifts the saving function downward.

E makes the saving function steeper.
34. Suppose actual investment is greater than planned investment. Given this information, we know with certainty that

A. the economy is in equilibrium.
B. firms’ inventories are not changing.
C. output will tend to fall.
D. saving is negative ($S < 0$).

*Back*
34. Suppose actual investment is greater than planned investment. Given this information, we know with certainty that

A  the economy is in equilibrium.
B  firms’ inventories are not changing.
C  output will tend to fall.
D  saving is negative ($S < 0$).

Back
Part 1 [Macroeconomic Equilibrium] Assume consumption is represented by the following: $C = 400 + .75Y$. Also assume that planned investment (I) equals 100.
a. Given the information, calculate the equilibrium level of income.
a. Given the information, calculate the equilibrium level of income. We are given $C = 400 + 0.75Y$; $I = 100$.

Using **Equilibrium Condition**: $Y = C + I$ National Income=Aggregate Expenditure, we get

$$Y = 400 + 0.75Y + 100^*$$

$$0.25Y = 500$$

$$Y = 2000$$

*Move 0.75Y to the left*
Further thought: now let’s try to derive a general formula for the level of equilibrium income using \( C = a + \text{MPC} \times Y \) and \( I \):

\[
Y = a + \text{MPC} \times Y + I
\]

\[
(1 - \text{MPC}) \times Y = a + I
\]

\[
Y = \frac{a + I}{1 - \text{MPC}} \quad \text{or} \quad \frac{a + I}{\text{MPS}}
\]
Remark I

Equilibrium level of income can be split into two parts: one is $\frac{a}{MPS}$ which can be interpreted as the aggregate output supported by autonomous consumption and the other is $\frac{I}{MPS}$ which, in a similar fashion, is interpreted as the output supported by planned investment. The marginal consuming behavior by households as a fraction of their incomes then gives rise to multiplier effect. Back
Remark II
This result is also useful in computation, for example, in your Homework Question 9, if I know $a = 0$ and $I = 75$ and $MPS = 0.25$, I can calculate equilibrium level $Y = 75/0.25 = 300$. So I know the trull level is on the left side of equilibrium point, then unplanned inventories have to fall and aggregate output will increase to equilibrium level. And also, in your quiz, you are given a similar question without specifying $a$, but actually it’s not necessary, because you can see $Y \geq \frac{I}{MPS}$ so you can judge which is greater, equilibrium level or real level. Back
b. Given the information, calculate the level of consumption and saving that occurs at the equilibrium level of income.
b. Given the information, calculate the level of consumption and saving that occurs at the equilibrium level of income. 

**Method 1:** Without doing calculation, using equilibrium condition gives $S = I = 100^\dagger$, then $C = Y - S = 2000 - 100 = 1900$

**Method 2:**

$C = 400 + 0.75Y; \Rightarrow C = 400 + 0.75 \times 2000 = 1900^\ddagger$

$S = Y - C = 2000 - 1900 = 100$

*Back*

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^\dagger this only holds for basic model without government and closed economy

^\ddagger plug Y back in consumption function
c. Suppose planned investment increases by 100. Calculate the new equilibrium level of income. Given your answer, what is the size of the multiplier for this economy?
c. Suppose planned investment increases by 100. Calculate the new equilibrium level of income. Given your answer, what is the size of the multiplier for this economy?

We are given \( C' = 400 + 0.75Y' \); \( I' = 100 + 100 = 200 \).

\[
Y' = 400 + 0.75Y' + 200
\]

\[
0.25Y' = 600
\]

\[
Y' = 2400
\]

Multiplier = \( 1 / (1 - \text{MPC}) = 1 / (1 - 0.75) = 4 \)

Back
d. Will the level of saving and consumption change as the economy adjusts to this change in planned investment?
d. Will the level of saving and consumption change as the economy adjusts to this change in planned investment?

Method 1: \( S' = I' = 200 \) and
\[
C' = Y' - I' = 2400 - 200 = 2200 \text{ (compare the result with } Q(b) \text{)}
\]

Method 2:
\[
C' = 400 + 0.75Y' \implies C' = 400 + 0.75 \times 2400 = 2200
\]
To compute \( S' \),
\[
S' = Y' - C' = 2400 - 2200 = 200
\]
Yes, both \( C \) and \( S \) will rise as \( Y \) rises.

Back
Remark

(a) Have you noticed that $\Delta Y = \Delta I \times \text{Multiplier}$ where
$\Delta Y = Y' - Y = 2,400 - 2,000 = 400$ and
$\Delta I = I' - I = 200 - 100 = 100$ So this gives a shortcut to calculate the new equilibrium level of income given a change in Investment:
Let’s do $Q(c)$ again Using $\Delta I = 100$,
$\Delta Y = \Delta I \times \text{Multiplier} = 100 \times 4 = 400$. Therefore,
we can figure out $Y' = Y + \Delta Y = 2000 + 400 = 2400$. In the future, you can take this shortcut.

(b) Can you draw this change in I in the Keynesian Cross? What’s the relationship between two curves?

Back
Part 2. [Macroeconomic Equilibrium] Assume consumption is represented by the following: \( C = 200 + 0.75Y \). Also assume that planned investment (I) equals 300.
a. Given the information, calculate the equilibrium level of income.
a. Given the information, calculate the equilibrium level of income.

\[ C = 200 + 0.75Y; \quad I = 300 \]

Using equilibrium condition \( Y = C + I \), we get

\[ Y = 200 + 0.75Y + 300 \]

\[ 0.25Y = 500 \]

\[ Y = 2000 \]
b. Given the information, calculate the level of consumption and saving that occurs at the equilibrium level of income.
b. Given the information, calculate the level of consumption and saving that occurs at the equilibrium level of income.

**Method 1:** Without doing calculation, using the equilibrium condition that \( S = I = 300 \) and then \( C = Y - S = 2000 - 300 = 1700 \)

**Method 2:** \( C = 200 + 0.75Y; \) \( C = 200 + 0.75 \times 1700 \)
\( S = Y - C = 2000 - 1700 = 300 \)

*Back*
c. Now suppose that individuals decide to increase their saving so that autonomous consumption falls by 100. The consumption function is now $C = 100 + 0.75Y$. Calculate the new equilibrium level of income, the new level of consumption, and the new level of saving.
c. Now suppose that individuals decide to increase their saving so that autonomous consumption falls by 100. The consumption function is now $C = 100 + 0.75Y$. Calculate the new equilibrium level of income, the new level of consumption, and the new level of saving.

We are given $C' = 100 + 0.75Y$; $I = 300$

Then using equilibrium condition $Y' = C' + I$ gives

\[
Y' = 100 + 0.75Y' + 300
\]

\[
0.25Y' = 400
\]

\[
Y' = 1600
\]

Plugging $Y$ back in consumption function, we get $C' = 1300$; $S' = Y' - C' = 300$

Back
d. Based on your analysis in Part (c), did the level of saving change as a result of this increased desire to save? Explain.
d. Based on your analysis in Part (c), did the level of saving change as a result of this increased desire to save? Explain.

Saving did not change as a result of this increased desire to save. This is simply a numerical application of the paradox of thrift. With I unchanged, the level of saving will return to its original level (while consumption falls).

Back
(a) Comparing the result of *Part I Q(a)* and *Part 2 Q(a)*, we found the levels of equilibria for two model are the same, is it a coincidence? Can you draw graph to show this? In addition, in economics, we call the study of contrasting two models with the same set-up and different parameters *Comparative Statics*. 

(b) Does a change in *autonomous consumption* affect an economy the same way a change in *investment* does? Look at *Q(c)* again and suppose, instead, the investment falls by 100 and other things stay the same, How would Y, C and I change respectively?

*Back*