AGGREGATE EXPENDITURE AND EQUILIBRIUM OUTPUT

Chapter 20
AGGREGATE EXPENDITURE AND EQUILIBRIUM OUTPUT

The level of GDP, the overall price level, and the level of employment—three chief concerns of macroeconomists—are influenced by events in three broadly defined “markets”:

- Goods-and-services markets
- Financial (money) markets
- Labor markets
AGGREGATE EXPENDITURE AND EQUILIBRIUM OUTPUT

The market for goods and services

- Planned aggregate expenditure
  - Consumption (C)
  - Planned Investment (I)
  - Government (G)
  - Net exports (EX-IM)
- Aggregate output (income) (Y)

The money market

- The supply of money
- The demand for money
- Interest rate (r)
AGGREGATE EXPENDITURE AND EQUILIBRIUM OUTPUT

Connections between the goods market and money market ($r \leftrightarrow Y$)

- Aggregate demand curve (a function of $P$&$Y$, negatively sloped)
- Aggregate supply curve (a function of $P$&$Y$, positively sloped)
- Equilibrium interest rate
- Equilibrium output (income)
- Equilibrium price level

The labor market

- The supply of labor
- The demand for labor
AGGREGATE OUTPUT AND AGGREGATE INCOME (Y)

**aggregate output**  The total quantity of goods and services produced (or supplied) in an economy in a given period

**aggregate income**  The total income received by all factors of production in a given period

**aggregate output (income) (Y)** A combined term used to remind you of the exact equality between aggregate output and aggregate income
AGGREGATE OUTPUT AND AGGREGATE INCOME ($Y$)

INCOME, CONSUMPTION, AND SAVING ($Y$, $C$, AND $S$)

FIGURE 8.2 Saving o Aggregate Income p Consumption
INCOME, CONSUMPTION AND SAVING (Y, C AND S)

• In a simple world with no government and a “closed” economy, that is no imports and exports

• Households receiving aggregate amount of income can do two things with this income:
  • Buy goods and services $\rightarrow$ consumption
  • Saving
saving \( (S) \)  The part of its income that a household does not consume in a given period

- Distinguished from savings, which is the current stock of accumulated saving

\[
\text{Saving} \equiv \text{income} - \text{consumption} \\
S \equiv Y - C
\]
AGGREGATE OUTPUT AND AGGREGATE INCOME ($Y$)

Household Consumption and Saving

Some determinants of aggregate consumption include:

- Household income
- Household wealth
- Interest rates
- Households’ expectations about the future

- The higher your income is, the higher your consumption is likely to be
  - People with more income tend to consume more than people with less income

consumption function The relationship between consumption and income
AGGREGATE OUTPUT AND AGGREGATE INCOME ($Y$)

FIGURE 8.3 A Consumption Function for a Household
AGGREGATE OUTPUT AND AGGREGATE INCOME (Y)

• The curve labeled as $c(y)$ meaning that $c$ as a function of $y$ or consumption is a function of income

• The curve has a positive slope
  • As income increases, so does consumption

• The curve intersects the c-axis above zero
  • Even at an income of zero, consumption is positive (borrow or live off its savings)
AGGREGATE OUTPUT AND AGGREGATE INCOME ($Y$)

**FIGURE 8.4 An Aggregate Consumption Function**

\[ C = a + bY \]

\[ \text{Slope} = \frac{\Delta C}{\Delta Y} = b \]
AGGREGATE OUTPUT AND AGGREGATE INCOME \((Y)\)

- Macroeconomics wants to know how aggregate consumption (the total consumption of all households) is likely to respond to changes in aggregate income.

- A positive relationship exists between aggregate consumption \((C)\) and aggregate income \((Y)\)
AGGREGATE OUTPUT AND AGGREGATE INCOME (Y)

• Because the aggregate consumption function is a straight line, we can write the following equation to describe it:

\[ C = a + bY \]

• Y → aggregate output (income)
• C → aggregate consumption
• a → a point at which the consumption function intersects the c-axis (constant)
• b → the slope of the line, \( \Delta C/\Delta Y \) (because consumption is measured on the vertical axis and income (Y) is measured on the horizontal axis)

• Every time income increases by (\( \Delta Y \)), consumption increases by \( b \) times \( \Delta Y \)
  • \( \Delta C = b \times \Delta Y \) and \( \Delta C/\Delta Y = b \)
AGGREGATE OUTPUT AND AGGREGATE INCOME ($Y$)

**marginal propensity to consume ($MPC$)** That fraction of a change in income that is consumed, or spent (or the fraction of a decrease in income that comes out of consumption)

\[
\text{marginal propensity to consume} = \text{slope of consumption function} = \frac{\Delta C}{\Delta Y}
\]

**marginal propensity to save ($MPS$)** That fraction of a change in income that is saved (or the fraction of a decrease in income that comes out of saving)

\[
MPC + MPS = 1
\]
FIGURE 8.5 An Aggregate Consumption Function Derived from the Equation $C = 100 + .75Y$
AGGREGATE OUTPUT AND AGGREGATE INCOME ($Y$)

C = 100 + .75Y

<table>
<thead>
<tr>
<th>$Y$ (AGGREGATE INCOME) (Billions of Dollars)</th>
<th>$C$ (AGGREGATE CONSUMPTION) (Billions of Dollars)</th>
<th>$S$ (AGGREGATE SAVING) (Billions of Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
<td>-100</td>
</tr>
<tr>
<td>80</td>
<td>160</td>
<td>-80</td>
</tr>
<tr>
<td>100</td>
<td>175</td>
<td>-75</td>
</tr>
<tr>
<td>200</td>
<td>250</td>
<td>-50</td>
</tr>
<tr>
<td>400</td>
<td>400</td>
<td>0</td>
</tr>
<tr>
<td>600</td>
<td>550</td>
<td>50</td>
</tr>
<tr>
<td>800</td>
<td>700</td>
<td>100</td>
</tr>
<tr>
<td>1,000</td>
<td>850</td>
<td>150</td>
</tr>
</tbody>
</table>

FIGURE 8.6 Deriving a Saving Function from a Consumption Function
To analyze the relationship between consumption and saving functions (Y=C+S), we will use device of the 45 degree line as a way of comparing C and Y.

The 45 degree line shows all the points at which the value on the horizontal axis (Y) equals the value on the vertical axis (C).

Where the consumption function is above the 45° line, consumption exceeds income, and saving is negative.

Where the consumption function crosses the 45° line, consumption is equal to income, and saving is zero.

Where the consumption function is below the 45° line, consumption is less than income, and saving is positive.

Note that the slope of the saving function is ΔS/ΔY, which is equal to the marginal propensity to save (MPS).
AGGREGATE OUTPUT AND AGGREGATE INCOME ($Y$)

PLANNED INVESTMENT ($I$)

**investment** Purchases by firms of new buildings and equipment and additions to inventories, all of which add to firms’ capital stock
AGGREGATE OUTPUT AND AGGREGATE INCOME ($Y$)

**Actual versus Planned Investment**

*change in inventory*  Production minus sales

*desired, or planned, investment*  Those additions to capital stock and inventory that are planned by firms

*actual investment*  The actual amount of investment that takes place; it includes items such as unplanned changes in inventories
AGGREGATE OUTPUT AND AGGREGATE INCOME (Y)

FIGURE 8.7  The Planned Investment Function
AGGREGATE OUTPUT AND AGGREGATE INCOME ($Y$)

• We will take the amount of investment that firms together plan to make each period ($I$) as fixed at some given level.

• We assume that this level does not vary with income.

• Planned investment is a horizontal line.
AGGREGATE OUTPUT AND AGGREGATE INCOME ($Y$)

**PLANNED AGGREGATE EXPENDITURE ($AE$)**

planned aggregate expenditure ($AE$) The total amount the economy plans to spend in a given period

planned aggregate expenditure $\equiv$ consumption + planned investment

$$AE \equiv C + I$$
EQUILIBRIUM AGGREGATE OUTPUT (INCOME)

**equilibrium** Occurs when there is no tendency for change

- In the macroeconomic goods market, equilibrium occurs when planned aggregate expenditure is equal to aggregate output

\[
\text{aggregate output} \equiv Y
\]
\[
\text{planned aggregate expenditure} \equiv AE \equiv C + I
\]

equilibrium: \( Y = AE \) or \( Y = C + I \)
EQUILIBRIUM AGGREGATE OUTPUT (INCOME)

\[ Y > C + I \]

aggregate output > planned aggregate expenditure
inventory investment is greater than planned actual investment is greater than planned investment

\[ C + I > Y \]

planned aggregate expenditure > aggregate output
inventory investment is smaller than planned actual investment is less than planned investment
### TABLE 8.1 Deriving the Planned Aggregate Expenditure Schedule and Finding Equilibrium (All Figures in Billions of Dollars) The Figures in Column 2 Are Based on the Equation $C = 100 + .75Y$.

<table>
<thead>
<tr>
<th>AGGREGATE OUTPUT (INCOME) (Y)</th>
<th>AGGREGATE CONSUMPTION (C)</th>
<th>PLANNED INVESTMENT (I)</th>
<th>PLANNED AGGREGATE EXPENDITURE (AE) $C + I$</th>
<th>UNPLANNED INVENTORY CHANGE $Y - (C + I)$</th>
<th>EQUILIBRIUM? $(Y = AE?)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>175</td>
<td>25</td>
<td>200</td>
<td>− 100</td>
<td>No</td>
</tr>
<tr>
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<td>250</td>
<td>25</td>
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<tr>
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<td>400</td>
<td>25</td>
<td>425</td>
<td>− 25</td>
<td>No</td>
</tr>
<tr>
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<td>475</td>
<td>25</td>
<td>500</td>
<td>0</td>
<td>Yes</td>
</tr>
<tr>
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<td>550</td>
<td>25</td>
<td>575</td>
<td>+ 25</td>
<td>No</td>
</tr>
<tr>
<td>800</td>
<td>700</td>
<td>25</td>
<td>725</td>
<td>+ 75</td>
<td>No</td>
</tr>
<tr>
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<td>850</td>
<td>25</td>
<td>875</td>
<td>+ 125</td>
<td>No</td>
</tr>
</tbody>
</table>
EQUILIBRIUM AGGREGATE OUTPUT (INCOME)

FIGURE 8.8 Equilibrium Aggregate Output
EQUILIBRIUM AGGREGATE OUTPUT (INCOME)

THE SAVING/INVESTMENT APPROACH TO EQUILIBRIUM

• Because aggregate income must either be saved or spent, by definition, \( Y \equiv C + S \)

• The equilibrium condition is \( Y = C + I \), but this is not an identity because it does not hold when we are out of equilibrium

• By substituting \( C + S \) for \( Y \) in the equilibrium condition, we can write:

\[
C + S = C + I
\]

• Because we can subtract \( C \) from both sides of this equation, we are left with:

\[
S = I
\]

• Thus, only when planned investment equals saving will there be equilibrium
FIGURE 8.10  The $S = I$ Approach to Equilibrium
EQUILIBRIUM AGGREGATE OUTPUT (INCOME)

ADJUSTMENT TO EQUILIBRIUM

• The adjustment process will continue as long as output (income) is below planned aggregate expenditure (Y<AE)

• If AE>Y, reduction in unplanned inventory
  • Firms will respond to unplanned inventory reductions by increasing output

• If firms increase output, income must also increase, consumption increases and so forth, until equilibrium is restored, with higher Y than before
EQUILIBRIUM AGGREGATE OUTPUT (INCOME)

ADJUSTMENT TO EQUILIBRIUM

• If AE<Y, increase in unplanned inventories
  • Firms will respond to unplanned inventory increases by decreasing output

• As output falls, income falls, consumption falls and so forth, until equilibrium is restored, with Y lower than before
THE MULTIPLIER

**multiplier**  The ratio of the change in the equilibrium level of output to a change in some autonomous variable

**autonomous variable**  A variable that is assumed not to depend on the state of the economy—that is, it does not change when the economy changes
FIGURE 8.11 The Multiplier as Seen in the Planned Aggregate Expenditure Diagram
THE MULTIPLIER

THE MULTIPLIER EQUATION

• Equilibrium will be restored only when saving has increased by exactly the amount of the initial increase in I.

• The marginal propensity to save may be expressed as:

\[ MPS = \frac{\Delta S}{\Delta Y} \]

• Because \( \Delta S \) must be equal to \( \Delta I \) for equilibrium to be restored, we can substitute \( \Delta I \) for \( \Delta S \) and solve:

\[ \Delta Y = \Delta I \times \frac{1}{MPS} \]

\[ \text{or} \]

\[ \text{multiplier} = \frac{1}{MPS} \]

\[ \text{multiplier} = \frac{1}{1 - MPC} \]
DERIVING THE MULTIPLIER ALGEBRAICALLY

• Recall that our consumption function is:

\[ C = a + bY \]

where \( b \) is the marginal propensity to consume.

• In equilibrium:

\[ Y = C + I \]

• Now we solve these two equations for \( Y \) in terms of \( I \). By substituting the first equation into the second, we get:

\[ Y = \left( a + bY \right) + I \]
DERIVING THE MULTIPLIER ALGEBRAICALLY

• This equation can be rearranged to yield:
  \[ Y - bY = a + I \]
  \[ Y(1 - b) = a + I \]

• We can then solve for \( Y \) in terms of \( I \) by dividing through by \( (1 - b) \):

\[
Y = (a + I) \left( \frac{1}{1 - b} \right)
\]
DERIVING THE MULTIPLIER ALGEBRAICALLY

• Now look carefully at this expression and think about increasing \( I \) by some amount, \( \Delta I \), with a held constant

• If \( I \) increases by \( \Delta I \), income will increase by

\[
\Delta Y = \Delta I \times \frac{1}{1 - b}
\]

• Because \( b \equiv MPC \), the expression becomes

\[
\Delta Y = \Delta I \times \frac{1}{1 - MPC}
\]
DERIVING THE MULTIPLIER ALGEBRAICALLY

The multiplier is

\[ \frac{1}{1 - MPC} \]

• Finally, because \( MPS + MPC = 1 \), \( MPS \) is equal to \( 1 - MPC \), making the alternative expression for the multiplier \( 1/MPS \)