Chapter 12. Aggregate Expenditure and Output in the Short Run

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ECON 203 502
Principles of Macroeconomics
Aggregate expenditure model: A macroeconomic model that focuses on the short-run relationship between total spending and real GDP, assuming that the price level is constant.

In any particular year, the level of GDP is determined mainly by the level of aggregate expenditure.


- The book systematically analyzed the relationship between changes in aggregate expenditure and changes in GDP.
Aggregate Expenditure (AE)

Keynes identified four components of aggregate expenditure that together equal GDP:

1. **Consumption** (C): This is spending by households on goods and services.

2. **Planned investment** (I): This is planned spending by firms on capital goods and by households on new homes.

3. **Government purchases** (G): This is spending by local, state, and federal governments on goods and services.

4. **Net exports** (NX): This is spending by foreign firms and households on goods and services produced in the United States minus spending by U.S. firms and households on goods and services produced in other countries.

\[ AE = C + I + G + NX \]
Notice that planned investment spending, rather than actual investment spending, is a component of aggregate expenditure.

**Inventories**: Goods that have been produced but not yet sold.

Actual investment will equal planned investment only when there is no unplanned change in inventories.

In this chapter, we will use investment \( I \) to represent planned investment.
Macroeconomic Equilibrium

For the economy as a whole, macroeconomic equilibrium occurs where total spending, or aggregate expenditure, equals total production, or GDP:

$$\text{Aggregate expenditure} = \text{GDP}$$

The Relationship between Aggregate Expenditure and GDP

<table>
<thead>
<tr>
<th>If . . .</th>
<th>then . . .</th>
<th>and . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>aggregate expenditure is equal to GDP</td>
<td>inventories are unchanged</td>
<td>the economy is in macroeconomic equilibrium.</td>
</tr>
<tr>
<td>aggregate expenditure is less than GDP</td>
<td>inventories rise</td>
<td>GDP and employment decrease.</td>
</tr>
<tr>
<td>aggregate expenditure is greater than GDP</td>
<td>inventories fall</td>
<td>GDP and employment increase.</td>
</tr>
</tbody>
</table>
Consumption follows a smooth, upward trend, interrupted only infrequently by brief recessions.
Consumption

Five most important variables that determine the level of consumption:

1. **Current Disposable Income**: Disposable income is the income remaining to households after they have paid the personal income tax and received government transfer payments.

2. **Household Wealth**: A household’s wealth is the value of its assets minus the value of its liabilities.

3. **Expected Future Income**: Most people prefer to keep their consumption fairly stable from year to year, even if their income fluctuates significantly.

4. **The Price Level**: The price level measures the average prices of goods and services in the economy.

5. **The Interest Rate**
   - Nominal interest rate is the stated interest rate on a loan or a financial investment
   - Real interest rate is the nominal interest rate minus the inflation rate.
The Consumption Function

The Relationship between Consumption and Income, 1960-2010

(a) Consumption and income, 1960-2010
(b) The consumption function
The Consumption Function

**Consumption function**: The relationship between consumption spending and disposable income.

**Marginal propensity to consume (MPC)**: The slope of the consumption function

- MPC represents the amount by which consumption spending changes when disposable income changes.

\[
MPC = \frac{\text{Change in consumption}}{\text{Change in disposable income}} = \frac{\Delta C}{\Delta YD}
\]

We can also use the MPC to determine how much consumption will change as income changes:

\[
\text{Change in consumption} = \text{Change in disposable income} \times MPC
\]
The Relationship between Consumption and National Income

Disposable income = National income + (Government transfer payments - Taxes)

- Net taxes = Taxes - Government transfer payments
- Disposable income = National income - Net taxes
- National income = Disposable income + Net taxes
The Relationship between Consumption and National Income

<table>
<thead>
<tr>
<th>National Income or GDP (billions of dollars)</th>
<th>Net Taxes (billions of dollars)</th>
<th>Disposable Income (billions of dollars)</th>
<th>Consumption (billions of dollars)</th>
<th>Change in National Income (billions of dollars)</th>
<th>Change in Disposable Income (billions of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,000</td>
<td>$1,000</td>
<td>$0</td>
<td>$750</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>3,000</td>
<td>1,000</td>
<td>2,000</td>
<td>2,250</td>
<td>$2,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>5,000</td>
<td>1,000</td>
<td>4,000</td>
<td>3,750</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>7,000</td>
<td>1,000</td>
<td>6,000</td>
<td>5,250</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>9,000</td>
<td>1,000</td>
<td>8,000</td>
<td>6,750</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>11,000</td>
<td>1,000</td>
<td>10,000</td>
<td>8,250</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>13,000</td>
<td>1,000</td>
<td>12,000</td>
<td>9,750</td>
<td>2,000</td>
<td>2,000</td>
</tr>
</tbody>
</table>

Change in consumption = $1,500

\[ MPC = \frac{\text{Change in consumption}}{\text{Change in national income}} = \frac{1,500}{2,000} = 0.75 \]
The Relationship between Consumption and National Income

If we calculate the slope of the line between points A and B, we get a result that will not change whether we use the values for national income or the values for disposable income.

- Using the values for national income:

\[
\frac{\Delta C}{\Delta Y} = \frac{5,250 \text{ billion} - 3,750 \text{ billion}}{7,000 \text{ billion} - 5,000 \text{ billion}} = 0.75
\]

- Using the corresponding values for disposable income from the table:

\[
\frac{\Delta C}{\Delta YD} = \frac{5,250 \text{ billion} - 3,750 \text{ billion}}{6,000 \text{ billion} - 4,000 \text{ billion}} = 0.75
\]

National income and disposable income differ by a constant amount, so changes in the two numbers always give us the same value.
For the economy as a whole, we can write the following:

- National income = Consumption + Saving + Taxes
  
  \[ Y = C + S + T \]

- Change in national income = Change in consumption + Change in saving + Change in taxes
  
  \[ \Delta Y = \Delta C + \Delta S + \Delta T \]

To simplify, we can assume that taxes are always a constant amount, in which case \( \Delta T = 0 \)

\[ \Delta Y = \Delta C + \Delta S \]
Marginal propensity to save (MPS): The amount by which saving changes when disposable income changes.

We can measure the MPS as the change in saving divided by the change in disposable income (again ignoring the difference between national income and disposable income).

\[ \frac{\Delta Y}{\Delta Y} = \frac{\Delta C}{\Delta Y} + \frac{\Delta S}{\Delta Y} \]

or,

\[ 1 = MPC + MPS \]

When taxes are constant, MPC plus MPS must always equal 1 because additional income not consumed must instead be saved.
Fill in the blanks in the following table.

- For simplicity, assume that taxes are zero.

<table>
<thead>
<tr>
<th>National Income and Real GDP (Y)</th>
<th>Consumption (C)</th>
<th>Saving (S)</th>
<th>Marginal Propensity to Consume (MPC)</th>
<th>Marginal Propensity to Save (MPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9,000</td>
<td>$8,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10,000</td>
<td>8,600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11,000</td>
<td>9,200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12,000</td>
<td>9,800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13,000</td>
<td>10,400</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Investment is subject to larger changes than is consumption.
• Investment declined significantly during the recessions.
Planned Investment

The four most important variables that determine the level of investment

1. **Expectations of Future Profitability:** The optimism or pessimism of firms about the economy is an important determinant of investment spending.

2. **Interest Rate:** Borrowing takes the form of issuing corporate bonds or receiving loans from banks.
   - A higher real interest rate results in less investment spending, and a lower real interest rate results in more investment.

3. **Taxes:** Firms focus on the profits that remain after paying taxes.
   - Investment tax incentives provide firms with tax reductions to increase their spending on new investment goods.

4. **Cash flow:** The difference between the cash revenues received by a firm and the cash spending by the firm.
   - The greater its cash flow and the greater its ability to finance investment.
Government Purchases

Total government purchases include all spending by federal, local, and state governments for goods and services.
- It excludes transfer payments by the federal or by local governments.

- Government purchases grew steadily for most of the 1979-2011 period, with the exception of the early 1990s.
- During 1990s, the federal budget deficit caused real government purchases to fall for three years.
**Net Exports**

**Net exports**: Spending by foreign firms and households on goods produced in the United States - Spending by U.S. firms and households on goods produced in other countries.

Net Exports

- Net exports were negative in most years between 1979 and 2011.
- Net exports have usually increased when the U.S. economy is in recession and decreased when the U.S. economy is expanding.
- Although they fell during most of the 2001 recession.

The three most important variables that determine the level of net exports:

- The price level in the United States relative to the price levels in other countries
- The growth rate of GDP in the United States relative to the growth rates of GDP in other countries
- The exchange rate between the dollar and other currencies
Keynesian Cross

The 45 Degree line diagram is sometimes referred to as the Keynesian cross.

- Points such as A and B, at which the quantity produced equals the quantity sold, are on the 45 degree line.
- Points such as C, at which the quantity sold is greater than the quantity produced, lie above the line.
Every point of macroeconomic equilibrium is on the 45 degree line, where planned aggregate expenditure equals GDP.

- At points above (below) the line, planned aggregate expenditure is greater (less) than GDP.
Relationship between Planned Aggregate Expenditure and GDP

- All points of macroeconomic equilibrium must lie along the 45 degree line.
- However, only one of these points will represent the actual level of equilibrium real GDP during any particular year.

The aggregate expenditure function: the amount of planned aggregate expenditure that will occur at every level of national income, or GDP.
Macroeconomic equilibrium occurs where the aggregate expenditure (AE) line crosses the 45 degree line.

- The lowest upward-sloping line, C, represents the consumption function.

- The quantities of planned investment, government purchases, and net exports are assumed to be constant.

- So, the total of planned aggregate expenditure at any level of GDP is the amount of consumption at that level of GDP plus the sum of the constant amounts of planned investment, government purchases, and net exports.

- We successively add each component of spending to the consumption function line to arrive at the line representing aggregate expenditure.
Macroeconomic Equilibrium

1. An unplanned decrease in inventories...
2. ...results in increasing production.
3. An unplanned increase in inventories...
4. ...results in decreasing production.
Macroeconomic equilibrium occurs where the AE line crosses the 45 degree line.

- In this case, that occurs at GDP of $10 trillion.

- If GDP is less than $10 trillion, the corresponding point on the AE line is above the 45 degree line, planned aggregate expenditure is greater than total production, firms will experience an unplanned decrease in inventories, and GDP will increase.

- If GDP is greater than $10 trillion, the corresponding point on the AE line is below the 45 degree line, planned aggregate expenditure is less than total production, firms will experience an unplanned increase in inventories, and GDP will decrease.
Macroeconomic equilibrium can occur at any point on the 45 degree line. Ideally, we would like equilibrium to occur at potential GDP.

- At potential GDP, firms will be operating at their normal level of capacity, and the economy will be at the natural rate of unemployment.

- At the natural rate of unemployment, the economy will be at full employment: Everyone in the labor force who wants a job will have one, except the structurally and frictionally unemployed.

- For equilibrium to occur at the level of potential GDP, planned aggregate expenditure must be high enough.
Showing a Recession on the 45 Degree Line Diagram
Showing a Recession on the 45 Degree Line Diagram

When the aggregate expenditure line intersects the 45 degree line at a level of GDP below potential GDP, the economy is in recession.

- The figure on last slide shows that potential GDP is $10 trillion.
- But because planned aggregate expenditure is too low, the equilibrium level of GDP is only $9.8 trillion, where the AE line intersects the 45 degree line.
- As a result, some firms will be operating below their normal capacity, and unemployment will be above the natural rate of unemployment.
- We can measure the shortfall in planned aggregate expenditure as the vertical distance between the AE line and the 45 degree line at the level of potential GDP.
The Important Role of Inventories

Whenever planned aggregate expenditure is less than real GDP, some firms will experience unplanned increases in inventories.

- If firms do not cut back their production promptly when spending declines, they will accumulate inventories.
- Firms will have to sell their excess inventories before they can return to producing at normal levels, even if spending has already returned to normal levels.
- In fact, almost half of the sharp decline in real GDP during the first quarter of 2009 resulted from firms cutting production as they sold off unintended accumulations of inventories.
A Numerical Example of Macroeconomic Equilibrium

We can capture some key features contained in the quantitative models that economic forecasters use by looking at several hypothetical combinations of real GDP and planned aggregate expenditure.

<table>
<thead>
<tr>
<th>Real GDP (Y)</th>
<th>Consumption (C)</th>
<th>Planned Investment (I)</th>
<th>Government Purchases (G)</th>
<th>Net Exports (NX)</th>
<th>Aggregate Expenditure (AE)</th>
<th>Unplanned Change in Inventories</th>
<th>Real GDP Will …</th>
</tr>
</thead>
<tbody>
<tr>
<td>$8,000</td>
<td>$6,200</td>
<td>$1,500</td>
<td>$1,500</td>
<td>$-500</td>
<td>$8,700</td>
<td>$-700</td>
<td>increase</td>
</tr>
<tr>
<td>9,000</td>
<td>6,850</td>
<td>1,500</td>
<td>1,500</td>
<td>$-500</td>
<td>9,350</td>
<td>$-350</td>
<td>increase</td>
</tr>
<tr>
<td>10,000</td>
<td>7,500</td>
<td>1,500</td>
<td>1,500</td>
<td>$-500</td>
<td>10,000</td>
<td>0</td>
<td>be in equilibrium</td>
</tr>
<tr>
<td>11,000</td>
<td>8,150</td>
<td>1,500</td>
<td>1,500</td>
<td>$-500</td>
<td>10,650</td>
<td>$+350</td>
<td>decrease</td>
</tr>
<tr>
<td>12,000</td>
<td>8,800</td>
<td>1,500</td>
<td>1,500</td>
<td>$-500</td>
<td>11,300</td>
<td>$+700</td>
<td>decrease</td>
</tr>
</tbody>
</table>
The Multiplier Effect

1. A $100 billion increase in planned investment...

2. ...results in a $400 billion increase in equilibrium real GDP.
The Multiplier Effect

The economy begins at point A, at which equilibrium real GDP is $9.6 trillion.

- A $100 billion increase in planned investment shifts up aggregate expenditure from $AE_1$ to $AE_2$.
- The new equilibrium is at point B, where real GDP is $10.0 trillion, which is potential real GDP.
- Because of the multiplier effect, a $100 billion increase in investment results in a $400 billion increase in equilibrium real GDP.
The increase in planned investment spending has had a multiplied effect on equilibrium real GDP.

It is not only investment spending that will have this multiplied effect; any increase in autonomous expenditure will shift up the aggregate expenditure function and lead to a multiplied increase in equilibrium GDP.

**Autonomous expenditure**: An expenditure that does not depend on the level of GDP.

- In the aggregate expenditure model we have been using, planned investment spending, government spending, and net exports are all autonomous expenditures.

- But consumption actually has both an autonomous component and a nonautonomous component, which does depend on the level of GDP.
**The Multiplier Effect**

**Multiplier**: The increase in equilibrium real GDP divided by the increase in autonomous expenditure.

**Multiplier effect**: The process by which an increase in autonomous expenditure leads to a larger increase in real GDP.

<table>
<thead>
<tr>
<th>Additional Autonomous Expenditure (investment)</th>
<th>Additional Induced Expenditure (consumption)</th>
<th>Total Additional Expenditure = Total Additional GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round 1 $100 billion</td>
<td>$0</td>
<td>$100 billion</td>
</tr>
<tr>
<td>Round 2 0</td>
<td>75 billion</td>
<td>175 billion</td>
</tr>
<tr>
<td>Round 3 0</td>
<td>56 billion</td>
<td>231 billion</td>
</tr>
<tr>
<td>Round 4 0</td>
<td>42 billion</td>
<td>273 billion</td>
</tr>
<tr>
<td>Round 5 0</td>
<td>32 billion</td>
<td>305 billion</td>
</tr>
<tr>
<td>Round 10 0</td>
<td>8 billion</td>
<td>377 billion</td>
</tr>
<tr>
<td>Round 15 0</td>
<td>2 billion</td>
<td>395 billion</td>
</tr>
<tr>
<td>Round 19 0</td>
<td>1 billion</td>
<td>398 billion</td>
</tr>
<tr>
<td>Round n 0</td>
<td>0</td>
<td>$400 billion</td>
</tr>
</tbody>
</table>
We can calculate the value of the multiplier in our example by dividing the increase in equilibrium real GDP by the increase in autonomous expenditure:

\[
\frac{\Delta Y}{\Delta I} = \frac{\text{Change in real GDP}}{\text{Change in investment spending}} = \frac{$400 \text{ billion}}{$100 \text{ billion}} = 4
\]

With a multiplier of 4, each increase in autonomous expenditure of $1 will result in an increase in equilibrium GDP of $4.
A Formula for the Multiplier

During the multiplier process, each round of increases in consumption is smaller than the previous, so eventually, the increases will come to an end, and we will have a new macroeconomic equilibrium.

The total change in equilibrium real GDP equals
the initial increase in planned investment spending = $100 billion

Plus the first induced increase in consumption = $100 billion

Plus the second induced increase in consumption = $(MPC \times $100 billion) = MPC^2 \times $100 billion$

Plus the third induced increase in consumption = $(MPC \times (MPC^2 \times $100 billion)) = MPC^3 \times $100 billion$

Plus the fourth induced increase in consumption = $(MPC \times (MPC^3 \times $100 billion)) = MPC^4 \times $100 billion$

And so on …
We have also derived a general formula for the multiplier:

\[
\text{Multiplier} = \frac{\text{Change in equilibrium real GDP}}{\text{Change in autonomous expenditure}} = \frac{1}{1 - MPC}
\]

In this case, the multiplier is \(1/(1 - 0.75)\), or 4, so a $100 billion increase in planned investment spending results in a $400 billion increase in equilibrium GDP.
Summarizing the Multiplier Effect

1. The multiplier effect occurs both when autonomous expenditure increases and when it decreases.

2. The multiplier effect makes the economy more sensitive to changes in autonomous expenditure than it would otherwise be.
   - Because of the multiplier effect, a decline in spending and production in one sector of the economy can lead to declines in spending and production in many other sectors of the economy.

3. The larger the MPC, the larger the value of the multiplier.
   - The larger the MPC, the more additional consumption takes place after each rise in income during the multiplier process.

4. The formula for the multiplier, \( \frac{1}{1 - MPC} \), is oversimplified.
   - It ignores some real-world complications, such as the effect that increases in GDP have on imports, inflation, interest rates, and individual income taxes.
   - These effects combine to cause the simple formula to overstate the true value of the multiplier.
The Paradox of Thrift

John Maynard Keynes argued...

if many households decide at the same time to increase their saving and reduce their spending, they may make themselves worse off by causing aggregate expenditure to fall, thereby pushing the economy into a recession.

The lower incomes in the recession might mean that total saving does not increase, despite the attempts by many individuals to increase their own saving.

Keynes referred to this outcome as the paradox of thrift because what appears to be something favorable to the long-run performance of the economy might be counterproductive in the short run.
The Aggregate Demand Curve

Increases in the price level cause aggregate expenditure to fall, and decreases in the price level cause aggregate expenditure to rise.

There are three main reasons for this inverse relationship between changes in the price level and changes in aggregate expenditure:

1. A rising price level decreases consumption by decreasing the real value of household wealth.

2. If the price level in the United States rises relative to the price levels in other countries, U.S. exports will become relatively more expensive, and foreign imports will become relatively less expensive, causing net exports to fall.

3. When prices rise, firms and households need more money to finance buying and selling. If the central bank does not increase the money supply, the result will be an increase in the interest rate, which causes investment spending to fall.
The Aggregate Demand Curve

The Effect of a Change in the Price Level on Real GDP

(a) The effect of a higher price level on real GDP

(b) The effect of a lower price level on real GDP

1. An increase in the price level causes the $AE$ line to shift down...

2. ...and equilibrium GDP to fall.

1. A decrease in the price level causes the $AE$ line to shift up...

2. ...and equilibrium GDP to rise.
The Aggregate Demand Curve

In panel (a), an increase in the price level results in declining consumption, planned investment, and net exports and causes the aggregate expenditure line to shift down from $AE_1$ to $AE_2$.

- As a result, equilibrium real GDP declines from $10.0$ trillion to $9.8$ trillion.

In panel (b), a decrease in the price level results in rising consumption, planned investment, and net exports and causes the aggregate expenditure line to shift up from $AE_1$ to $AE_2$.

- As a result, equilibrium real GDP increases from $10.0$ trillion to $10.2$ trillion.
Aggregate demand (AD) curve: A curve that shows the relationship between the price level and the level of planned aggregate expenditure in the economy, holding constant all other factors.

- When the price level is 97, real GDP is $10.2 trillion.
- An increase in the price level to 100 causes consumption, investment, and net exports to fall, which reduces real GDP to $10.0 trillion.