Econ. 1A Chapter 13 AS-AD model

1. The purpose of chapter 13 is to develop the AS-AD model and to use this model to explain how RGDP (Y) and the price level (P) are determined and how they interact. We also can use this model to analyze how the behavior of producers, consumers and the government influences the economy’s short-run performance.

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y (RGDP, billion of 2009$)</td>
<td>14,779</td>
<td>15,052</td>
<td>15,471</td>
</tr>
<tr>
<td>P (GDP price index, 2009=100)</td>
<td>101.2</td>
<td>103.2</td>
<td>105.0</td>
</tr>
<tr>
<td>Unemployment rate (%)</td>
<td>9.6</td>
<td>8.9</td>
<td>8.1</td>
</tr>
</tbody>
</table>

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AS – AD model: The workhorse model of macroeconomics

2. Aggregate Supply (AS) is the relationship between the quantity of RGDP supplied (Yₙ) and the price level (P).

3. The quantity of RGDP supplied (Yₙ) is the total quantity of goods and services that firms plan to produce during a given time period. This quantity depends on the quantity of labor employed (L), the quantity of physical and human capital (K), and the state of technology (t).

   \[ Yₙ = F(L; K, N, E, t) \]

   \[ Yₙ = \text{RGDP} \]

   \[ L = \text{labor}, \ K = \text{physical and human capital}, \ N = \text{land}, \ E = \text{entrepreneurial talent}, \ t = \text{technology}. \]

Note: At any given time period, K, N, E and t are fixed. But L is determined by the supply and demand for labor. At full employment, labor market is in equilibrium, i.e., \( L_d = L_s = L_f \), \( Yₙ = Y_p \) = potential GDP.

4. The long-run aggregate supply curve (LRAS) shows the relationship between the aggregate price level (P) and quantity of aggregate supplied (Yₙ) when money wages (W) changes in step with the price level (P) to achieve full employment. It is vertical at potential output, \( Y_p \), because in the long run a change in the aggregate price level has no effect on quantity of aggregate supplied.

   \[ Yₙ = Y_p \]

   where \( Y_p \) = potential output, i.e., the level of RGDP the economy would produce if all prices, including money wage, were fully flexible.

5. Long-run: All prices are fully flexible and change in same proportion.

6. Why \( P \uparrow \rightarrow Yₙ = Y_p \) unchanged in the long-run?

   Because along LRAS the price level (P) and the money wage rate (W) change by the same percentage, the real wage rate (W/P) remain constant at its full employment equilibrium level.

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7. The short-run aggregate supply curve (AS) is the positive relationship between the quantity of RGDP supplied ($Y_s$) and the price level ($P$) when the money wage rate ($W$), the prices of other resources ($P_R$) and potential GDP ($Y_p$) remain the same during a given time period.

$$Y_s = Y(P; W, P_R, Y_p),$$

where $Y_s$ = quantity of RGDP supplied, $P$ = the price level (GDP deflator or CPI), $W$ = money wage rate, $P_R$ = the money price of other resources.

8. Short-run: Many prices, especially $W$, are sticky at some predetermined level.

9. Why $p \uparrow \rightarrow Y_s \uparrow$ in the short-run?

If the typical producer receives a higher price for his final goods and services and the production cost per unit of goods and services doesn’t rise in same proportion as the rise in the price of final goods and services due to many production costs are fixed. As a result, profit per unit of output rises and the producer increases output, then $Y$ increases in the short run, i.e., $p \uparrow \rightarrow Y_s \uparrow$
Changes in AS

10. L\(_t\)↑(↓), K↑(↓) or \(t↑(↓)\) → LRAS and AS shift rightward (leftward) by the same amount.

11. W↑(↓) or \(P_R↑(↓)\) → AS shifts leftward (rightward).

A Change in the Money Wage Rate

An Increase in Potential GDP

A rise in the money wage rate decreases aggregate supply. The aggregate supply curve shifts leftward from \(AS_0\) to \(AS_2\). A rise in the money wage rate does not change potential GDP.

Price level (GDP price index, 2005 = 100)

\(P\)

0 120 130 140

LRAS\(_0\) \(\text{Initial level of potential GDP}\)

LRAS\(_1\) \(\text{New level of potential GDP}\)

\(AS_0\) \(\text{Increase in AS when potential GDP increases}\)

\(AS_2\) \(\text{W↑(↓) W\(_0\)}\)

\(C\)

\(Y\)

Real GDP (trillions of 2005 dollars)

12.5 13.0 13.5 14.0 14.5 15.0 15.5

0 120 130 140

\(P\)

\(UR=\text{NUR}\)
13. **Aggregate Demand (AD)** is the *negative* relationship between the quantity of RGDP demanded \((Y_d)\) and the price level \((P)\) when other things remain the same during a given time.

\[ Y_d = Y(P; \text{Ex}, M_s, G, \text{Tax}, TR, Y^*) \]

where \(Y_d\) is quantity of RGDP demanded, \(P\) is the price level, \(\text{Ex}\) = expectation, \(M_s\) is the quantity of money, \(G\) = government purchase, \(\text{Tax} = \) taxes, \(TR\) = transfer payments, \(Y^* = \) RGDP in foreign country.

14. **The quantity of RGDP demanded** \((Y_d)\) is \(Y_d = C + I + G + X - M\). \(Y_d\) is the total quantity of final goods and services produced in this economy that people, businesses, governments and foreign plan to buy during a given time period.

15. **Law of AD**: \(P \uparrow \rightarrow Y_d \downarrow\). This is due (1) wealth effect; and (2) substitution effect.

(1) Wealth effect: \(P \uparrow \rightarrow \text{real wealth} (A/P) \downarrow \rightarrow \text{to restore} \ A\), people will decrease consumption \((C)\) and increase saving \((S)\) → \(Y_d \downarrow\).

(2) Substitution effect:

(i) \(P \uparrow \rightarrow (M/P) \downarrow \rightarrow \text{via money market} \rightarrow i \uparrow \rightarrow I \downarrow \rightarrow Y_d \downarrow\).

(ii) \(P \uparrow \rightarrow P > P^* \rightarrow \text{domestic goods are more expensive than foreign good} \rightarrow M \uparrow \) and \(X \downarrow \rightarrow (X-M) \downarrow \rightarrow Y_d \downarrow\).
Changes in AD

16. An increase in the expected future income ($Y^*$), inflation rate ($\pi$) and future profits will increase AD and AD curve shifts rightward.

17. An increase in $M_s$, or G or TR or $Y^*$ and a decrease in Tax will increase AD and shift AD rightward. A decrease in $M_s$, or G or TR or $Y^*$ and an increase in Tax will decrease AD and shift AD leftward.

Note that

1. **Monetary policy**: The Fed conducts the monetary policy to influence the economy by changing federal funds rate and adjusting quantity of money ($M_r$).

2. **Fiscal policy**: The government’s attempt to influence the economy by setting and changing taxes (Tax), making transfer payments (TR), and purchasing goods and services (G).

18. **AS – AD model**

**Assumptions**

a. Other things remain the same
   
   AS: $W, p_r, M_s, G, Tax, TR$ and $Y^*$ remain the same.

b. Given time period.

c. The laws of AS and AD apply.
Table:

<table>
<thead>
<tr>
<th>P(GDP deflator)</th>
<th>Y_d</th>
<th>Y_s</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>12.0</td>
<td>14.0</td>
</tr>
<tr>
<td>115</td>
<td>12.5</td>
<td>13.5</td>
</tr>
<tr>
<td>110</td>
<td>13.0</td>
<td>13.0</td>
</tr>
<tr>
<td>105</td>
<td>13.5</td>
<td>12.5</td>
</tr>
<tr>
<td>100</td>
<td>14.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>

Understanding the Business Cycle

19. **Macroeconomic Equilibrium**: when the quantity of RGDP demanded equals the quantity of RGDP supplied. At the point of intersection of AD and AS curves, i.e., \( Y_s = Y_d = 13 \), \( P = 110 \).

20. Three are three types of macroeconomic equilibrium

1. **Full employment equilibrium**: When \( Y_s = Y_d = Y_p \) (potential RGDP) & UR = NUR → full employment.
2. **Above full employment equilibrium**: When \( Y_s = Y_d > Y_p \) & UR < NUR → inflationary gap.
3. **Below full-employment equilibrium**: When \( Y_s = Y_d < Y_p \) & UR > NUR → recessionary gap.

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**Macroeconomic Equilibrium**

![Diagram of Macroeconomic Equilibrium](attachment:image.png)

(a) Macroeconomic equilibrium

Macroeconomic equilibrium occurs at the intersection of the AD and AS curves. Macroeconomic equilibrium might be below full employment, at full employment, or above full employment.

![Diagram of Three Types of Macroeconomic Equilibrium](attachment:image.png)

(b) Three types of macroeconomic equilibrium

1. Below full-employment equilibrium
2. Full-employment equilibrium
3. Above full-employment equilibrium

UR > NUR → inflationary gap

UR < NUR → recessionary gap

UR = NUR → full employment
21. 
(1) Inflationary gap: A gap exists when \( Y > Y_p \) and that brings a rising price level, i.e., \( P^\uparrow \).
(2) Recessionary gap: A gap exists when \( Y < Y_p \) and that brings a falling price level, i.e., \( P^\downarrow \).

22. Using macroeconomic policy to close the recessionary or inflationary gap.

Economists generally believe government can use macroeconomic policy, i.e., monetary policy and fiscal policy, to manage short-run economic fluctuations and adverse events in the economy. In other words, government can use macroeconomic policy to smooth out the business cycle.

(1) If there is a recessionary gap we can use expansionary fiscal policy (i.e., \( \text{Tax}^\downarrow, \ G^\uparrow, \ TR^\uparrow \)) and expansionary monetary policy (i.e., \( M^\uparrow \)) to close the recessionary gap.

At \( E_1, \ Y_1 < Y_p \), there is a recessionary gap of \( Y_1 - Y_p < 0 \). An expansionary fiscal policy or monetary policy shifts \( AD \) rightward. The recessionary gap can be closed by shifting \( AD_1 \) to \( AD_2 \) moving the economy to a full macroeconomic equilibrium \( E_2 \).
(2) If there is an inflationary gap we can use contractionary fiscal policy (i.e., $\text{Tax}^\uparrow$, $G_1$, TR$\downarrow$) and contractionary monetary policy (i.e., M$\downarrow$) to close the inflationary gap.

At $E_1$, $Y_1 > Y_p$, there is an inflationary gap of $Y_1 - Y_p > 0$. A contractionary fiscal policy or monetary policy shifts AD leftward. The inflationary gap can be closed by shifting $AD_1$ to $AD_2$ moving the economy to a full macroeconomic equilibrium $E_2$.

23. Business cycle
The business cycle occurs because AD and AS fluctuate but the money wage rate ($W$) does not adjust quickly enough to keep RGDP = potential GDP i.e., $Y = Y_p$.

Aggregate Demand (AD) Fluctuations

24. Fluctuations in AD:

(1) Positive demand shock:
Cause: $A^\uparrow \rightarrow AD^\uparrow$
Effect:
(a) Full macroeconomic equilibrium: $P = P_1 = 1$, $Y = Y_p$, and UR = NUR.
(b) Short-run effect: $AD^\uparrow \rightarrow P^\uparrow (P_2 = 2 > P_1 = 1)$; $Y^\uparrow (Y_2 > Y_p)$ → inflationary gap → $W_1 = 30$ remains the same → the economy moves up along AS curve.
(c) Long-run effect: the economy cannot produce $Y_2 > Y_p$ forever because $P^\uparrow$ and $W_1 = 30$ remain the same → ($W/P)_\downarrow [(30/2) < (30/1)]$ → UR $\downarrow$ NUR → there is a shortage in labor market → workers demand higher wages $W^\uparrow (W_2 = 90 > W_1 = 30) \rightarrow AS_\downarrow \rightarrow P^\uparrow (P_3 = 3 > P_2 = 2 > P_1 = 1)$; $Y_\downarrow (Y = Y_p < Y_2)$ and UR$^\uparrow (UR = \text{NUR})$. 

LRAS

As₂ (W₂ = 90)
As₁ (W₁ = 30)

AD₂ (A₂ > A₁)
AD₁ (A₁)

UR = NUR

the ECONOMY

w

LS₁

LD₁

w₁ = \frac{W₁}{P₁} \quad \frac{30}{1} = 30 \quad \frac{W₁}{3F₁} \quad \frac{90}{3} = 30

w₂ = \frac{W₁}{2P₁} = \frac{30}{2} = 15

LABOR MARKET

production function

Y = f(L, K, N)

Business cycle

1 2 3 4 5 6

time
(2) Negative demand shock

Cause: \( A \downarrow \rightarrow AD \downarrow \)

Effect:

(a) Full macroeconomic equilibrium: \( P = P_3 = 3, Y = Y_p \) and \( UR = NUR \).

(b) Short-run effect: \( AD \downarrow \rightarrow P_1 \ ((P_2 = 2 < P_3 = 3)); Y \downarrow (Y_3 < Y_p) \rightarrow \) recessionary gap \( W_2 = 90 \) remains the same \( \rightarrow \) the economy moves down along AS curve.

(c) Long-run effect: the economy cannot produce \( Y_3 < Y_p \) forever because \( P_1 \) and \( W_2 = 90 \) remains the same \( \rightarrow (W/P) \uparrow [[90/2 > (90/3)] \rightarrow UR > NUR \rightarrow \) there is a surplus in labor market \( \rightarrow \) workers will accept lower wages \( W_1 \ ((W_1 = 30 < W_2 = 90) \rightarrow AS \uparrow \rightarrow P \downarrow (P_1 = 1 < P_2 = 2 < P_3 = 3); Y \uparrow (Y = Y_p > Y_3) \) and \( UR \downarrow (UR = NUR) \).
Aggregate Supply Fluctuations

26. Fluctuations in AS:

(1) Negative Supply Shock
   Cause: \( P_R \uparrow \) (oil price rises) \( \rightarrow \) \( AS \downarrow \)
   Effect:
   (a) Full macroeconomic equilibrium: \( P = P_0 = 110, Y = Y_p = 13 \) and \( UR = NUR \).
   (b) Short-run effect: \( AS \downarrow \rightarrow P \uparrow \) and \( (P_1 = 115 > P_0 = 110) \); \( Y \downarrow \) and \( Y_1 = 12.75 < Y_p = 13 \), \( Y_1 \) and \( UR > NUR \), the economy experiences recession and \( P \uparrow \), the economy experiences inflation \( \rightarrow \) the economy moves along AD curve. →
   A combination of recession and inflation is called stagflation.

(2) Positive Supply Shock
   Cause: \( P_R \downarrow \) (oil price rises) \( \rightarrow \) \( AS \uparrow \)
   Effect:
   (a) Full macroeconomic equilibrium: \( P = P_0 = 110, Y = Y_p = 13 \) and \( UR = NUR \).
   (b) Short-run effect: \( AS \uparrow \rightarrow P \downarrow \) and \( (P_1 = 105 < P_0 = 110) \); \( Y \uparrow \) and \( Y_1 = 13.25 > Y_p = 13 \), \( Y_1 \) and \( UR < NUR \), the economy experiences expansion and moves above full employment.

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An Oil Price Cycle

![Diagram of Aggregate Supply Fluctuations](image-url)

- **Part (a):** A rise in the price of oil decreases aggregate supply and shifts the AS curve leftward to \( AS_1 \). Real GDP decreases to \( 12.75 \) trillion, and the price level rises to 115.

- **Part (b):** A fall in the price of oil increases aggregate supply and shifts the AS curve rightward to \( AS_2 \). Real GDP increases to \( 13.25 \) trillion, and the price level falls to 105.
27. We have seen that the economy is self-correcting in the long run; it will eventually trend back to potential GDP. Most economists believe that the process of self-correction takes several years – typically a decade or more. In particular, if RGDP (Y) is below potential GDP (Yp), the economy can suffer an extended period of depress aggregate output and high unemployment before it return to normal. This belief is the background to one of the most famous quotations in economics. JM Keynes's declaration, “In the long run we are all dead.” Economists usually interpret Keynes as having recommended that government does not wait for the economy to correct itself. Instead, it is argued by many economists, but not all, that government should use monetary and fiscal policy to get the economy back to potential GDP, (i.e., full employment).

Output Gap = [(Y - Yp)/Yp]x100%

The GDP Gap, 1949 to 2019
(Percentage of potential gross domestic product)

Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis.