Chapter 12

The Aggregate Demand and Supply Model
Preview

- To develop the aggregate demand and aggregate supply model from the previous three chapters
- To understand developments in the 2007-2009 period using aggregate demand and supply analysis
Recap of the Aggregate Demand and Supply Curves

• The Aggregate Demand Curve
  – It shows the relationship between the inflation rate and the level of aggregate output when the goods market is in equilibrium
  – It slopes downward because a rise in inflation leads the monetary policy authorities to raise real interest rates to keep inflation from getting out of control, which lowers aggregate demand and thus the equilibrium level of aggregate output
Recap of the Aggregate Demand and Supply Curves (cont’d)

• Factors that Shift the AD Curve
  1. Autonomous monetary policy, $\bar{r}$
     \[ \bar{r} \uparrow \Rightarrow I \downarrow, C \downarrow, N X \downarrow \Rightarrow Y \downarrow \] (AD curve shifts to the left)
  2. Government purchases, $\bar{G}$
     \[ \bar{G} \uparrow \Rightarrow Y \uparrow \] (AD curve shifts to the right)
  3. Taxes, $\bar{T}$
     \[ \bar{T} \uparrow \Rightarrow C \downarrow \Rightarrow Y \downarrow \] (AD curve shifts to the left)
  4. Net exports, $\bar{N}X$
     \[ \bar{N}X \uparrow \Rightarrow Y \uparrow \] (AD curve shifts to the right)
  5. Autonomous consumption expenditure, $\bar{C}$
     \[ \bar{C} \uparrow \Rightarrow Y \uparrow \] (AD curve shifts to the right)
  6. Autonomous investment, $\bar{I}$
     \[ \bar{I} \uparrow \Rightarrow Y \uparrow \] (AD curve shifts to the right)
### TABLE 12.1  FACTORS THAT SHIFT THE AGGREGATE DEMAND CURVE

*Note:* Only increases (↑) in the factors are shown. The effect of decreases in the factors would be the opposite of those indicated in the “Shift” column.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Change</th>
<th>Shift in Demand Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomous monetary policy, $\bar{T}$</td>
<td>↑</td>
<td>←</td>
</tr>
<tr>
<td>Government purchases, $\bar{G}$</td>
<td>↑</td>
<td>→</td>
</tr>
<tr>
<td>Taxes, $\bar{T}$</td>
<td>↑</td>
<td>←</td>
</tr>
<tr>
<td>Autonomous net exports, $\bar{NX}$</td>
<td>↑</td>
<td>→</td>
</tr>
<tr>
<td>Consumer optimism, $\bar{C}$</td>
<td>↑</td>
<td>→</td>
</tr>
<tr>
<td>Business optimism, $\bar{I}$</td>
<td>↑</td>
<td>→</td>
</tr>
<tr>
<td>Financial frictions, $\bar{F}$</td>
<td>↑</td>
<td>←</td>
</tr>
</tbody>
</table>
Recap of the Aggregate Demand and Supply Curves (cont’d)

• Short- and Long-Run Aggregate Supply Curves
  – Wages and prices are sticky in the short run, but fully flexible in the long run
  – The LRAS curve is vertical at the potential output level, $Y^p$, which is determined by available factors of production (labor and capital) and technology, as well as the natural rate of unemployment
  – The short-run AS curve is upward sloping: As output rises relative to potential, inflation rises
Recap of the Aggregate Demand and Supply Curves (cont’d)

• Factors that Shift the Long-Run Aggregate Supply Curve
  – Shocks to the natural rate of unemployment
  – Shocks to technology
  – Shocks to long-run changes in the amounts of labor or capital that affect the amount of output that the economy can produce
Recap of the Aggregate Demand and Supply Curves (cont’d)

• Factors that Shift the Short-Run Aggregate Supply Curve
  1. Expected inflation, $\pi^e$
     - Higher expected inflation leads to an upward and leftward shift in the short-run AS curve
  2. Price shocks, $\rho$
     - Supply restriction or workers pushing for higher wages leads to an upward and leftward shift in the short-run AS curve
  3. Persistent output gap, ($Y > Y^p$)
     - A persistently positive output gap ($Y > Y^p$) leads to an upward and leftward shift in the short-run AS curve
TABLE 12.2  FACTORS THAT SHIFT THE SHORT-RUN AGGREGATE SUPPLY CURVE

<table>
<thead>
<tr>
<th>Factor</th>
<th>Change</th>
<th>Shift in Supply Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected inflation, $\pi^e$</td>
<td>$\uparrow$</td>
<td>$\uparrow$</td>
</tr>
<tr>
<td>Price shocks, $\rho$</td>
<td>$\uparrow$</td>
<td>$\uparrow$</td>
</tr>
<tr>
<td>Output gap, $(Y - Y^p)$</td>
<td>$\uparrow$</td>
<td>$\uparrow$</td>
</tr>
</tbody>
</table>

*Note: Only increases (↑) in the factors are shown. The effect of decreases in the factors would be the opposite of those indicated in the “Shift” column.*
Equilibrium in Aggregate Demand and Supply Analysis

• **General equilibrium** in the economy occurs when all markets are simultaneously in equilibrium at the point where the quantity of aggregate output demanded equals the quantity of aggregate output supplied.

• Graphically, general equilibrium is the point where the $AD$ curve intersects with the $AS$ curve.

• Short-run and long-run equilibriums exist because there are two $AS$ curves—one for the short run and one for the long run.
Short-Run Equilibrium

• Graphically, a short-run equilibrium occurs when the aggregate demand curve $AD$ and the short-run aggregate supply curve $AS$ intersect.
FIGURE 12.1  Short-Run Equilibrium
Box: Algebraic Determination of the Equilibrium Output and Inflation Rate

- The \(AD\) curve (Ch. 10):
  \[ Y = 11 - 0.5\pi \]
- The short-run \(AS\) curve (Ch. 11) with \(\pi_{L} = 2\%\)
  \[ \pi = 2 + 1.5(Y - 10) \]
- Substituting in for \(\pi\) from the \(AS\) curve into the \(AD\) curve so that equilibrium \(Y\) is:
  \[ Y = 11 - 0.5 \times [2 + 1.5(Y - 10)] \]
- Collecting terms in \(Y\) so that \(Y^* = 10\), which is substituted into the short-run \(AS\) curve to yield the equilibrium inflation rate:
  \[ \pi^* = 2 + 1.5(10 - 10) = 2 \]
Long-Run Equilibrium

- In aggregate supply and demand analysis, even when the economy is at the intersection of the aggregate demand curve and the short-run aggregate supply curve, the equilibrium will move over time if output differs from its potential level ($Y^* \neq Y^p$).
- If the current level of inflation changes from its initial level, the short-run aggregate supply curve will shift as wages and prices adjust to a new expected rate of inflation.
Short-Run Equilibrium over Time

- What happens to the short-run equilibrium over time if the short-run equilibrium output is initially above potential output?
  - Tightness in labor markets drives up wages, which result in higher inflation and inflation expectations, thus the AS curve shifts up and to the left over time until output returns to its potential level.
Short-Run Equilibrium over Time

- What happens to the short-run equilibrium over time if the short-run equilibrium output is initially below potential output?
  - Excess slack in labor markets drives down wages, which result in lower inflation and inflation expectations, thus the AS curve shifts down and to the right over time returns to its potential level.
FIGURE 12.2 Adjustment to Long-Run Equilibrium in Aggregate Supply and Demand Analysis (a)

(a) Initial short-run equilibrium above potential output

Step 1. Excess tightness in the labor market increases expected inflation and shifts the AS curve upward until...

Step 2. The economy returns to the potential level of output.
FIGURE 12.2 Adjustment to Long-Run Equilibrium in Aggregate Supply and Demand Analysis (b)

(b) Initial short-run equilibrium below potential output

Step 1. Excess slack in the labor market decreases expected inflation and shifts the AS curve downward until...

Step 2. The economy returns to the potential level of output.
Short-Run Equilibrium over Time (cont’d)

• According to the aggregate demand and supply model, regardless of where output is initially, it eventually returns to potential output.

• This is called the **self-correcting mechanism** because the short-run aggregate supply curve shifts up or down to restore the economy to full employment (aggregate output at potential) over time.
Changes in Equilibrium: Aggregate Demand Shocks

- Demand shocks are factors that cause the aggregate demand curve to shift
- Positive demand shocks cause a rightward shift in the $AD$ curve
- Results: Although the initial short-run effect of the rightward shift in the aggregate demand curve is a rise in both inflation and output, the ultimate long-run effect is only a rise in inflation because output returns to its initial level at $Y^p$. 
FIGURE 12.3  Positive Demand Shock

Step 1. AD shifts to right...

Step 2. Increasing output and inflation...

Step 3. Shifting AS upward until...

Step 4. The economy returns to long-run equilibrium, with inflation permanently higher.

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Application: The Volcker Disinflation, 1980-1986

- When Paul Volcker became the Chairman of the Federal Reserve in 1979, the inflation rate exceeded 10%. Volcker was determined to get inflation down by raising the federal funds rate.

- High real interest rates brought inflation down from 13.5% in 1980 to 1.9% in 1986, while the unemployment rate initially soared.

- Our aggregate demand and supply analysis correctly predicts what happened in this period.
FIGURE 12.4  The Volcker Disinflation

(a) Aggregate Demand and Aggregate Supply Analysis

Step 2. Lowering output to $Y_2$ and inflation to $\pi_2$...

Step 3. Which shifts aggregate supply downward.

Step 1. Monetary policy tightening decreases aggregate demand...

Step 4. Output increases to potential output $Y^p$ and inflation declines further to $\pi_3$.

(b) Unemployment and Inflation, 1980–1986

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployment Rate (%)</th>
<th>Inflation (Year to Year) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>7.1</td>
<td>13.5</td>
</tr>
<tr>
<td>1981</td>
<td>7.6</td>
<td>10.3</td>
</tr>
<tr>
<td>1982</td>
<td>9.7</td>
<td>6.2</td>
</tr>
<tr>
<td>1983</td>
<td>9.6</td>
<td>3.2</td>
</tr>
<tr>
<td>1984</td>
<td>7.5</td>
<td>4.3</td>
</tr>
<tr>
<td>1985</td>
<td>7.2</td>
<td>3.6</td>
</tr>
<tr>
<td>1986</td>
<td>7.0</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Application: Negative Demand Shocks, 2001-2004

• In the early 2000s, a series of negative shocks to aggregate demand occurred in the U.S. economy (sharp falls stock prices, weakening consumer and business confidence, and rises in interest rates on corporate bonds).

• As a result of the leftward shift of the AD curve, unemployment rose and inflation fell.

• But by 2004, the self-correcting mechanism began to come into play: The short-run AS curve shifted downward so that output returned to its potential level and unemployment dropped back to its natural rate level.
FIGURE 12.5  Negative Demand Shocks, 2001-2004

(a) Aggregate Demand and Aggregate Supply Analysis


(b) Unemployment and Inflation, 2000–2004

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployment Rate (%)</th>
<th>Inflation (Year to Year) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>4.0</td>
<td>3.4</td>
</tr>
<tr>
<td>2001</td>
<td>4.7</td>
<td>2.8</td>
</tr>
<tr>
<td>2002</td>
<td>5.8</td>
<td>1.6</td>
</tr>
<tr>
<td>2003</td>
<td>6.0</td>
<td>2.3</td>
</tr>
<tr>
<td>2004</td>
<td>5.5</td>
<td>2.7</td>
</tr>
</tbody>
</table>
Changes In Equilibrium: Aggregate Supply (Price) Shocks

• The AS curve can shift from two types of supply shocks:
  1. Temporary supply (price) shocks that do not shift the LRAS curve
  2. Permanent supply shocks that cause the LRAS curve to shift
Temporary Supply Shocks

- Negative (unfavorable) supply shock
  - Shifts the short-run AS curve up and to the left, initially causing a situation of rising inflation and falling output—*stagflation* (stagnation and inflation)
  - Results: *Although a temporary negative supply shock leads to an upward and leftward shift in the short-run aggregate supply curve, which raises inflation and lowers output initially, the ultimate long-run effect is that output and inflation are unchanged.*
Step 1. A temporary negative supply shock shifts AS upward...

Step 2. Increasing inflation and decreasing output.
Temporary Supply Shocks (cont’d)

• Positive (favorable) supply shock
  – Shifts the short-run AS curve down and to the right, initially causing a situation of falling inflation and rising output
  – A temporary positive supply shock shifts the short-run aggregate supply curve downward and to the right, leading initially to a fall in inflation and a rise in output
  – In the long run, however, output and inflation will be unchanged (holding the aggregate demand curve constant)

• In 1973, the U.S. was hit by negative supply shocks that shifted the short-run AS curve up and to the left:
  1. OPEC oil embargo
  2. Increases in food prices due to crop failures around the world
  3. Wage hikes immediately after the termination of U.S. wage and price controls

• In 1979 the short-run AS curve shifted up and to the left again due to poor harvests and a doubling of oil prices (as a result of the Iranian revolution)

(a) Aggregate Demand and Aggregate Supply Analysis

Step 1. A temporary negative supply shock shifts AS upward...

Step 2. Increasing inflation and decreasing output.


<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployment Rate (%)</th>
<th>Inflation (Year to Year) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>4.8</td>
<td>6.2</td>
</tr>
<tr>
<td>1974</td>
<td>5.5</td>
<td>11.0</td>
</tr>
<tr>
<td>1975</td>
<td>8.3</td>
<td>9.1</td>
</tr>
<tr>
<td>1978</td>
<td>6.0</td>
<td>7.6</td>
</tr>
<tr>
<td>1979</td>
<td>5.8</td>
<td>11.3</td>
</tr>
<tr>
<td>1980</td>
<td>7.1</td>
<td>13.5</td>
</tr>
</tbody>
</table>

Permanent Supply Shocks

- Permanent negative supply shocks
  - Decrease potential output and shift the long-run AS curve to the left
  - A permanent negative supply shock leads initially to both a decline in output and a rise in inflation
  - However, in contrast to a temporary supply shock, in the long run the negative supply shock, which results in a fall in potential output, leads to a permanent decline in output and a permanent rise in inflation
Permanent Supply Shocks (cont’d)

- Permanent positive supply shocks
  - Increase potential output and shift the long-run AS curve to the right
  - A permanent positive supply shock lowers inflation and raises output both in the short run and the long run
Step 1. A permanent negative supply shock shifted the LRAS curve leftward and the AS curve upward...

Step 2. So the economy returns to long-run equilibrium with output permanently lower and inflation permanently higher.

- In the late 1990s, two permanent positive supply shocks hit the U.S. economy:
  1. Changes in the health care industry substantially reduced medical care costs relative to other goods and services
  2. The computer revolution raised productivity and the potential growth rate of the economy
- These shocks led to a rightward shift in the LRAS curve, resulting in rising aggregate output, lowering unemployment along with falling inflation
FIGURE 12.9 Positive Supply Shocks, 1995-1999

(a) Aggregate Demand and Aggregate Supply Analysis

Step 1. A permanent positive supply shock shifts LRAS rightward and AS downward...

Step 2. and leads to a permanent rise in output and a permanent decrease in inflation.

(b) Unemployment and Inflation, 1995–1999

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployment Rate (%)</th>
<th>Inflation (Year to Year) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>5.6</td>
<td>2.8</td>
</tr>
<tr>
<td>1996</td>
<td>5.4</td>
<td>3.0</td>
</tr>
<tr>
<td>1997</td>
<td>4.9</td>
<td>2.3</td>
</tr>
<tr>
<td>1998</td>
<td>4.5</td>
<td>1.6</td>
</tr>
<tr>
<td>1999</td>
<td>4.2</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Conclusions (Aggregate Demand and Supply Analysis)

1. A shift in the AD curve affects output only in the short run and has no effect in the long run. Furthermore, the initial change in inflation is lower than the long-run change in inflation when the short-run AS curve has fully adjusted.

2. A temporary supply shock affects output and inflation only in the short run and has no effect in the long run.

3. A permanent supply shock affects output and inflation both in the short and the long run.

4. The economy has a self-correcting mechanism that returns it to potential output and the natural rate of unemployment over time.
Application: Negative Supply and Demand Shocks and the 2007-2009 Financial Crisis

• By July 2008, the U.S. economy had suffered negative supply and demand shocks that led rising inflation and falling output
  – The negative supply shock due to rising oil prices shifted the short-run AS curve upward and to the left
  – The negative demand shock from a financial crisis shifted the AD curve to the left

• After July 2008, falling oil prices led the short-run AS curve to shift down and to the right, while aggregate demand continued to fall

• By the end of 2009, unemployment continued to rise while inflation fell
FIGURE 12.10 Negative Supply and Demand Shocks and the 2007-2009 Crisis

(a) Aggregate Demand and Aggregate Supply Analysis

Step 1. A negative supply shock shifted AS upward and a negative demand shock shifted AD leftward...

Step 2. leading to an increase in inflation and a decline in output.

Step 3. Worsening financial crisis shifted AD further leftward, while AS shifted down...

Step 4. leading to a further decline in output and a fall in inflation.

(b) Unemployment and Inflation During the Perfect Storm of 2007–2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployment Rate (%)</th>
<th>Inflation (Year to Year) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>4.6</td>
<td>2.5</td>
</tr>
<tr>
<td>2007</td>
<td>4.6</td>
<td>4.1</td>
</tr>
<tr>
<td>2008, June</td>
<td>5.5</td>
<td>5.0</td>
</tr>
<tr>
<td>2008, Dec.</td>
<td>7.2</td>
<td>0.1</td>
</tr>
<tr>
<td>2009, June</td>
<td>9.5</td>
<td>-1.2</td>
</tr>
<tr>
<td>2009, Dec.</td>
<td>10.0</td>
<td>2.8</td>
</tr>
</tbody>
</table>

• Aggregate demand and supply analysis can also help us understand business cycle episodes in foreign countries such as:
  – The U.K. economy during the 2007-2009 financial crisis
  – The Chinese economy during the 2007-2009 financial crisis
Application: The United Kingdom and the 2007-2009 Financial Crisis

• The United Kingdom suffered a negative supply shock in 2007 due to the rise in the oil price level, causing the short-run AS curve to shift up and to the left, which in turn raise inflation.

• After July 2008, oil prices fell (and with output below potential), so that the short-run AS curve shifted down.

• Meanwhile, a negative demand shock due to a financial crisis in the U.S. caused the AD curve for the U.K. to shift to the left, further lowering output and raising the unemployment rate while inflation fell.
FIGURE 12.11  U.K. Financial Crisis, 2007-2009

(a) Aggregate Demand and Aggregate Supply Analysis

Step 1. A negative supply shock shifted AS upward, increasing inflation and reducing output.

Step 2. A negative demand shock shifted AD leftward, while AS shifted down as oil prices fell...

Step 3. Leading to decreased inflation and output.

(b) Unemployment and Inflation, 2006–2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployment Rate (%)</th>
<th>Inflation (Year to Year) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>5.4</td>
<td>2.3</td>
</tr>
<tr>
<td>2007</td>
<td>5.3</td>
<td>2.3</td>
</tr>
<tr>
<td>2008, June</td>
<td>5.3</td>
<td>3.4</td>
</tr>
<tr>
<td>2008, Dec.</td>
<td>6.4</td>
<td>3.9</td>
</tr>
<tr>
<td>2009, June</td>
<td>7.8</td>
<td>2.1</td>
</tr>
<tr>
<td>2009, Dec.</td>
<td>7.8</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Source: Office of National Statistics, UK.
www.statistics.gov.uk/statbase/tsdtimezone.asp
Application: China and the 2007-2009 Financial Crisis

- The financial crisis in the United States and its subsequent economic downturn substantially reduced its demand for Chinese exports.
- The negative demand shock due to shrinking exports shifts China’s $AD$ curve to the left, resulting in a decline in both inflation and economic growth.
- A massive fiscal stimulus package by the Chinese government and easy monetary policy by the People’s Bank of China shifted the $AD$ curve to the right, resulting in rising output growth and inflation.
FIGURE 12.12 China and the Financial Crisis, 2007-2009

(a) Aggregate Demand and Aggregate Supply Analysis

Step 1. A negative demand shock shifted $AD$ leftward...

Step 2. Decreasing output and lowering inflation.

Step 3. A fiscal stimulus package increased $AD$...

Step 4. And restored long-run equilibrium values for inflation and output.

(b) Chinese Output Growth and Inflation, 2006–2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Output Growth (%)</th>
<th>Inflation (Year to Year) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>11.8</td>
<td>1.5</td>
</tr>
<tr>
<td>2007</td>
<td>12.4</td>
<td>4.8</td>
</tr>
<tr>
<td>2008, June</td>
<td>11.2</td>
<td>7.9</td>
</tr>
<tr>
<td>2008, Dec.</td>
<td>4.4</td>
<td>3.9</td>
</tr>
<tr>
<td>2009, June</td>
<td>11.1</td>
<td>-1.1</td>
</tr>
<tr>
<td>2009, Dec.</td>
<td>10.4</td>
<td>-0.3</td>
</tr>
</tbody>
</table>

Aggregate Demand Curve

• The Aggregate demand curve in Chapter 10:

\[ Y = \left[ \bar{C} + \bar{I} + \bar{G} + \bar{NX} - mpc \times \bar{T} \right] \times \frac{1}{1 - mpc} - \frac{c + d + x}{1 - mpc} \times (\bar{r} + \lambda \pi) \]

• Four immediate implications:
  1. The AD curve slopes downward
  2. The more willing monetary policy makers are to raise interest rates when faced by inflation, the steep the AD curve is
  3. \( \bar{C}, \bar{I}, \bar{G}, \bar{NX} \) and \( mpc \times \bar{T} \) all shift the AD and IS curve by the same amount and in the same direction
  4. An autonomous tightening (easing) of monetary policy shifts the AD curve to the left (right).
Aggregate Supply Curves

• Short-run aggregate supply curve (Chapter 11):
  \[ \pi = \pi_{-1} + \gamma(Y - Y^p) + \rho \]

• Long-run aggregate supply curve (Chapter 11):
  \[ Y = Y^p \]
• Short-run equilibrium is solved by substituting the short-run AS curve into the AD curve:

\[ Y = \left[ \bar{C} + \bar{I} + \bar{G} + \bar{NX} - \text{mpc} \times \bar{T} \right] \times \frac{1}{1 - \text{mpc}} - \frac{c + d + x}{1 - \text{mpc}} \times (\bar{r} + \lambda[\pi_{-1} + \gamma(Y - Y^P) + \rho]) \]

\[ Y \left[ 1 - \text{mpc} + \lambda\gamma(c + d + x) \right] = \bar{C} + \bar{I} + \bar{G} + \bar{NX} - \text{mpc} \times \bar{T} \]

\[-(c + d + x) \times (\bar{r} + \lambda[\pi_{-1} - \gamma Y^P + \rho]) \]

\[ Y = \left[ \bar{C} + \bar{I} + \bar{G} + \bar{NX} - \text{mpc} \times \bar{T} - (c + d + x) \right. \]

\[ \times (\bar{r} + \lambda[\pi_{-1} - \gamma Y^P + \rho]) \left] \right) \times \frac{1}{1 - \text{mpc} + \lambda\gamma(c + d + x)} \]
• The inflation rate in the short run:

\[
\pi = \pi_{-1} - \gamma Y^p + \rho + \left[ \bar{C} + \bar{I} + \bar{G} + \bar{NX} - mpc \times \bar{T} - (c + d + x) \right] \\
\times \left( \bar{r} + \lambda [ \pi_{-1} - \gamma Y^p + \rho ] \right) \times \frac{\gamma}{1 - mpc + \lambda \gamma (c + d + x)}
\]

\[
\pi = \left[ \bar{C} + \bar{I} + \bar{G} + \bar{NX} - mpc \times \bar{T} - (c + d + x) \times \bar{r} \right] \\
\times \frac{\gamma}{1 - mpc + \lambda \gamma (c + d + x)} + (\pi_{-1} - \gamma Y^p + \rho) \\
\times \left[ \frac{1 - mpc}{1 - mpc + \lambda \gamma (c + d + x)} \right]
\]
Aggregate Demand and Supply Model (cont’d)

• To obtain the long-run equilibrium, we solve for the long-run inflation rate by substituting $Y^p$ for $Y$ in the $AD$ curve:

$$Y^p = \left[ \bar{C} + \bar{I} + \bar{G} + \bar{NX} - mpc \times \bar{T} - (c + d + x) (\bar{r} + \lambda \pi) \right] \times \frac{1}{1 - mpc}$$

$$\pi = \left[ \bar{C} + \bar{I} + \bar{G} + \bar{NX} - mpc \times \bar{T} - (c + d + x) \bar{r} \right] - (1 - mpc) Y^p \right] \times \frac{1}{(c + d + x) \lambda}$$
Aggregate Demand and Supply Model (cont’d)

• There are 5 implications for aggregate output:
  1. Increases in $\overline{C}$, $\overline{I}$, $\overline{G}$, and $\overline{NX}$, or decreases in $\overline{T}$ and $\overline{r}$, lead to higher aggregate output in the short run, but not in the long run.
  2. The more aggressively monetary policy makers respond to inflation (a higher $\lambda$), the less impact demand shocks have on aggregate output in the short run.
  3. Positive price shocks, $\rho$, and increases in expected inflation, $\pi_{-1}$, lead to a decline in aggregate output in the short run, but not in the long run.
• There are 5 implications for aggregate output:
  4. A rise in $Y^p$ leads to a rise in aggregate output in both the short and long run.
  5. The more aggressively monetary policy makers respond to inflation, the larger are the effects of price shocks and changes in expected inflation on aggregate output in the short run.
Aggregate Demand and Supply Model (cont’d)

• There are 5 implications for inflation:
  1. Increases in \(\bar{C}, \bar{I}, \bar{G}, \) and \(\bar{NX}\), or decreases in \(\bar{T}\) and \(\bar{r}\), lead to higher inflation in both the short and the long run.
  2. Positive price shocks, \(\rho\), and increases in expected inflation, \(\pi_{-1}\), lead to higher inflation in the short run, but not in the long run.
  3. A rise in \(Y^p\) leads to a decline in inflation in both the short and long run.
  4. The more aggressively monetary policy makers respond to inflation (a higher \(\lambda\)), the less impact demand shocks have on inflation in the short run.
  5. The more aggressively monetary policy makers respond to inflation, the smaller are the effects of price shocks and changes in expected inflation on inflation in the short run.