Answers to Text Questions and Problems in Chapter 11

Answers to Review Questions

1. The aggregate demand curve relates aggregate demand (equal to short-run equilibrium output) to inflation. As inflation rises, the Bank of Canada tightens monetary policy by raising the real interest rate, which reduces aggregate demand and short-run equilibrium output. Thus the aggregate demand curve is downward sloping.

2a. For given levels of inflation and the real interest rate, an increase in government purchases raises aggregate demand and short-run equilibrium output. Thus an increase in government purchases shifts the ADI curve to the right.

b. Because it leads consumers to spend more, a cut in taxes stimulates aggregate demand at each level of inflation, shifting the ADI curve to the right.

c. A decline in planned investment spending by firms reduces aggregate demand at each level of inflation, shifting the ADI curve to the left.

d. For each level of inflation, a lower real interest rate stimulates consumption and investment spending, raising aggregate demand and output. Thus, an easier policy by the Bank of Canada shifts the ADI curve to the right.

3. Prices of commodities are set continuously in auction markets and therefore can adjust quickly to changes in supply or demand. However, most prices are not determined in auction markets but are set only periodically. In setting prices or wages for a longer period, individuals’ expectations of future inflation are important; the higher is expected inflation, the higher the future wage or price must be set in order to maintain the desired level of purchasing power. But expectations of inflation in turn depend in part on recent experience with inflation. So we have a vicious (or virtuous) circle, as high inflation leads to high expectations of inflation, which in turn leads to high actual inflation (and the reverse if inflation is low). Together with long-term contracts that “lock in” prices and wages for a period of time, expectations of inflation contribute to inflation inertia, or “stickiness”.

4. Expansionary gaps tend to raise inflation, and recessionary gaps tend to reduce it. If an expansionary gap exists, for example, firms are producing above normal capacity. Eventually they will respond by attempting to raise their relative price (that is, raising their own price faster than the rate of inflation). As all firms try to do this, inflation will tend to speed up. Likewise, a recessionary gap implies that firms are producing below normal capacity. To stimulate demand for their products, firms will try to reduce their relative prices, leading to an overall slowdown in inflation. Graphically, the link between output gaps and inflation is captured by movements of the short-run aggregate supply (IA) line. If an expansionary gap exists at the current intersection of the IA line and the ADI curve (which determines short-run equilibrium output), inflation rises and the IA line moves upward. If a recessionary gap exists in short-run equilibrium, inflation falls and the IA line moves downward. Inflation and the IA line adjust until the economy reaches long-run equilibrium at the intersection of the ADI curve and the long-run aggregate supply (LRAS) line.

5. In the diagram below, short-run equilibrium (point A) occurs at the intersection of the ADI curve and the IA line. As drawn, short-run equilibrium output is greater than potential output (that is, A is to the right of the LRAS line), and so an expansionary gap exists. The expansionary gap leads inflation to rise over time; the IA line, which shows the current rate of inflation, therefore also rises over time. The IA line continues to rise until it intersects the LRAS line and ADI curve at point B. At point B, called the long-run equilibrium point, output equals potential output and the inflation rate is stable.
6. The answer is ambiguous, as whether stabilization policy is useful depends largely on the speed at which self-correction takes place. The more slowly the economy adjusts, the more likely it is that stabilization policy will be useful. Thus if the economy has many long-term contracts or other barriers to rapid adjustment, or if the economy is initially far from full employment, then stabilization policy is more likely to be useful.

7. Oil prices played the largest role in increasing inflation during both the 1973–1974 and 1980–1981 periods. In 1973, not only did oil prices quadruple, but agricultural prices also sharply rose. Later in the decade, the Iranian Revolution of 1979 caused oil prices to double, leading to high inflation in the early 1980s.

8. An adverse inflation shock (which shifts the $IA$ line upwards) both raises inflation and creates a recessionary gap (with higher unemployment). Policymakers can respond only through monetary or fiscal policies that shift the $ADI$ curve. If they expand aggregate demand, shifting the $ADI$ curve to the right, they offset the recessionary impact but accept the higher rate of inflation permanently. If they do nothing, allowing the economy to self-correct, the surge in inflation will ultimately be eliminated but only at the cost of a potentially protracted recession and high unemployment. Thus an inflation shock creates a difficult dilemma for policymakers.

9. Assume for concreteness that the economy starts at full employment, but with an inflation rate higher than the Bank of Canada would like. To reduce inflation, the Bank of Canada tightens monetary policy, shifting the $ADI$ curve leftward. In the short run, inflation is unchanged (the $IA$ line has not shifted), output is lower (a recession), and the real interest rate is higher (tighter money means that the Bank of Canada raises the real interest rate at any given level of inflation). The recessionary gap implies that over time inflation will fall; graphically, the $IA$ line shifts downward until long-run equilibrium is restored at the intersection of the $ADI$ curve, the $LRAS$ line, and the $IA$ line. In the long run inflation is lower and output returns to full employment. The real interest rate declines as inflation falls; indeed, in the long run it returns to its original full-employment value, consistent with equilibrium in the market for saving and investment.

10. First, because potential output cannot be precisely estimated, it would be better to think of $LRAS$ as being a thick band rather than a thin line. Second, potential output is not fixed, but continues to expand even during recessions. Third, net exports are not autonomous, but respond to changes in the exchange rate.

Answers to Problems
1. For each value of inflation, we need to find short-run equilibrium output. Suppose, for example, that inflation is 0.00, so that the real interest rate $r = 0.02$. Then $Y = 1000 - 1000(0.02) = 1000 - 20 = 980$. So if the rate of inflation $\pi = 0.00$, then short-run equilibrium output is 980. The same calculation can be repeated for each value of inflation to obtain:

<table>
<thead>
<tr>
<th>Inflation $\pi$</th>
<th>Real interest rate $r$</th>
<th>Short-run equilibrium output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.02</td>
<td>980</td>
</tr>
<tr>
<td>0.01</td>
<td>0.03</td>
<td>970</td>
</tr>
<tr>
<td>0.02</td>
<td>0.04</td>
<td>960</td>
</tr>
<tr>
<td>0.03</td>
<td>0.05</td>
<td>950</td>
</tr>
<tr>
<td>0.04</td>
<td>0.06</td>
<td>940</td>
</tr>
</tbody>
</table>

The $ADI$ curve, shown below, graphs the relationship above with the inflation rate on the vertical axis and short-run equilibrium output on the horizontal axis.
2. If potential output $Y^*$ is 960, then the Bank of Canada’s long-term objective is for an inflation rate equal to 2%. We can find this either through the table or through solving for the interest rate that allows output to equal potential output:

\[
Y = 1000 - 1000r
\]

\[
960 = 1000 - 1000r
\]

\[
1000r = 40
\]

\[
r = 0.04
\]

From the policy reaction function, the central bank will set a real interest rate of 4% when the inflation rate is 2%.

3a. We are told that the initial inflation rate is 4%. Putting this into the aggregate demand curve, short-run equilibrium output is $Y = 13,000 - 20,000(0.04) = 12,200$.

b. In the long run, output will equal potential output, or 12,000. At this level of output, the inflation rate can be found by substituting the level of potential output into the aggregate demand equation:

\[
Y = 13,000 - 20,000\pi
\]

\[
12,000 = 13,000 - 20,000\pi
\]

\[
20,000\pi = 1000
\]

\[
\pi = 0.05
\]

The long-run inflation rate is 5%.

4a. In short-run equilibrium, inflation just equals its initial value, 10%. To find short-run equilibrium output, substitute this value of inflation into the equation for the aggregate demand curve:

\[
Y = 1000 - 1000\pi
\]

\[
Y = 1000 - 1000(0.10)
\]

\[
Y = 900
\]

In the long run, inflation must adjust so that output equals potential output, which is 950. What value of inflation is consistent with $Y = 950$? To find out, substitute $Y = 950$ into the equation for the aggregate demand curve:

\[
950 = 1000 - 1000\pi
\]

\[
\pi = 0.05
\]

So in the long run, output equals potential output of 950, and inflation is 5%.
b. In the initial quarter, as we found in part a, inflation is 0.10 and output is 900. As potential output is 950, the output gap is 50.

In the second quarter, applying the equation for the adjustment of inflation yields:

This quarter’s inflation = 0.10 – 0.0004 × 50 = 0.10 – 0.02 = 0.08.

To find this quarter’s output, plug the current value of inflation into the equation for the aggregate demand curve:

\[ Y = 1000 – 1000 \times 0.08 = 920 \]

Finally, the output gap in the second quarter is 950 – 920 = 30.

Repeating this process, calculating first inflation (from the equation for inflation adjustment), then output (from the equation for the aggregate demand curve), then the output gap, we can find how these three variables change over time:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Inflation</th>
<th>Output</th>
<th>Output gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.10</td>
<td>900</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>0.08</td>
<td>920</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>0.068</td>
<td>932</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>0.063</td>
<td>937.4</td>
<td>12.6</td>
</tr>
<tr>
<td>5</td>
<td>0.059</td>
<td>941.2</td>
<td>8.8</td>
</tr>
</tbody>
</table>

You can see that inflation and output converge toward their long-run values (of 5% and 950, respectively) quickly at first, then more gradually.

5. In each part below, point A in the diagram corresponds to the initial situation, and point B shows the short-run effects of the change. From point B, the IA line adjusts up or down as needed to achieve long-run equilibrium (adjustment not shown). Long-run equilibrium in each figure is labeled point C.

a. An increase in autonomous consumption shifts the ADI curve right, increasing output in the short run (point B). In the long run (point C), inflation rises to a higher level and output returns to potential.

b. A reduction in taxes increases consumer spending and hence aggregate demand. The graph and the results in the short run and the long run are the same as in part a.

c. An easing of monetary policy lowers the real interest rate set by the Bank of Canada at each level of inflation. The aggregate demand curve shifts right. The graph and results are the same as in part a.
d. A sharp drop in oil prices is a favorable inflation shock. The IA line shifts downward, reducing inflation and raising output (point B). If potential output is unchanged, an expansionary gap exists at point B, and inflation will begin to rise. In the long run, the economy returns to point A, with output and inflation as originally.

![Diagram showing IA and ADI curves]

e. Increased government purchases raise aggregate demand and shift the ADI curve right. The graph and results are the same as in part a.

6. In the figure below, the economy is initially at point A when it is hit by both an inflation shock (shifting IA up to IA$^2$) and a shock to potential output (reducing $Y^*$ and shifting LRAS leftward to LRAS$^2$). The ADI curve is unchanged. The short-run equilibrium is at the intersection of ADI and IA$^2$, point B. Inflation has risen and output has declined.

![Diagram showing IA, LRAS, and ADI curves]

The figure shows point B to the left of LRAS$^2$, so that there is a recessionary gap even relative to the new, lower level of potential output. This need not be the case; if the inflation shock is smaller, the short-run equilibrium could be to the right of LRAS$^2$, though still to the left of LRAS. Either way, however, the short-run effect of the combination shock is a recession plus higher inflation. In the long run, inflation and the IA curve will adjust as needed to bring the economy to long-run equilibrium at point C. Note that at point C output is permanently lower than it was at point A, as potential output has dropped. With no change in aggregate demand, inflation is also permanently higher at point C than at point A.

If the Bank of Canada responds to the oil price increase by tightening policy, the ADI curve will shift left (not shown in the graph), along with the leftward shift of LRAS and the upward shift of IA. Inflation will not increase as much, either in the short run or the long run, but the short-run decline in output will be even worse. Output in the long run will equal the new, lower level of potential output, whether the Bank of Canada responds or not (monetary policy cannot affect potential output and thus cannot affect output in the long run).
Sample Homework Assignment

1. For each of the following, use an $ADI–IA$ graph to show the short-run effects on output and inflation. Assume the economy starts in long-run equilibrium.
   a. A tightening of monetary policy by the Bank of Canada.
   b. A decrease in government purchases due to federal budget cuts.
   c. A decrease in autonomous net exports due to decreased demand for Canadian products abroad.

2. Assume that planned aggregate expenditure in the country Lambda depends on real GDP and the real interest rate according to the following equation:
   \[ PAE = 2000 + 0.75Y - 1000r \]
   The Central Bank of Lambda has announced that it will set the real interest rate according to the following policy reaction function:

<table>
<thead>
<tr>
<th>Rate of inflation</th>
<th>Real interest rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>0.04</td>
<td>0.05</td>
</tr>
</tbody>
</table>

   For the rates of inflation given, find short-run equilibrium output in Lambda and graph the $ADI$ curve.

3. An economy is described by the following equations:
   \[ C = 800 + 0.3(Y - T) - 1000r \]
   \[ I = 1000 - 400r \]
   \[ G = 1000 \]
   \[ NX = 40 \]
   \[ T = 1000 \]
   The central bank’s policy reaction function is the same as in question 2 above.
   a. Find an equation that relates \( PAE \) to output and the real interest rate.
   b. Make a table showing the relationship between short-run equilibrium output and inflation for inflation rates between 0% and 4%.
   c. Graph the $ADI$ curve for the economy.

Multiple Choice Quiz

1. The main shortcoming of the basic Keynesian model is that it does not explain
   a. output.
   b. aggregate demand.
   c. aggregate supply.
   d. inflation.
   e. interest rates.
2. The slope of the aggregate demand curve is
   a. variable.
   b. negative.
   c. positive.
   d. zero.
   e. infinite.

3. Which of the following will not shift the aggregate demand curve?
   a. An increase in autonomous consumption.
   b. An increase in taxes.
   c. An increase in potential output.
   d. An increase in net exports.
   e. A change in the Bank of Canada’s monetary policy.

4. The tendency for inflation to change relatively slowly is called
   a. inflation inertia.
   b. disinflation.
   c. inflation shock.
   d. equilibrium.
   e. inflation constancy.

5. The slope of the long-run aggregate supply curve is
   a. variable.
   b. negative.
   c. positive.
   d. zero.
   e. infinite.

6. The slope of the short-run aggregate supply curve is
   a. variable.
   b. negative.
   c. positive.
   d. zero.
   e. infinite.

7. Which of the following is not a potential source of inflation?
   a. Excessive aggregate demand.
   b. An inflation shock.
   c. An aggregate supply shock.
   d. A shock to potential output.
   e. A fall in net exports.

8. A war and associated military buildup will cause
   a. \( ADI \) to shift right.
   b. \( ADI \) to shift left.
   c. \( LRAS \) to shift right.
   d. \( LRAS \) to shift left.
   e. both \( ADI \) and \( LRAS \) to shift right.
9. Which of these was the biggest contributor to the rise of inflation in the mid-1970s and early 1980s?
   a. Increases in government spending on the military.
   b. Bank of Canada policy.
   c. Increases in government spending on social programs.
   d. Oil price increases.
   e. It has never been determined.

10. A substantial reduction in the rate of inflation is called
   a. an inflation shock.
   b. disinflation.
   c. inflation inertia.
   d. deflation.
   e. a price war.

**Problems/Short Answer**

1. Use an $\text{ADI–IA}$ graph to show the effects on short-run equilibrium output if the demand for Canadian products abroad increases.

2. Assume that aggregate demand in the country Lambda depends on real GDP and the real interest rate according to the following equation:
   $\text{ADI} = 500 + 0.8Y - 1000r$
   The Central Bank of Lambda has announced that it will set the real interest rate according to the following policy reaction function:

<table>
<thead>
<tr>
<th>Rate of inflation</th>
<th>Real interest rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>0.03</td>
<td>0.06</td>
</tr>
<tr>
<td>0.05</td>
<td>0.08</td>
</tr>
</tbody>
</table>

   For the rates of inflation given, find short-run equilibrium output in Lambda and graph the $\text{ADI}$ curve.

**Answer Key to Extra Questions in Instructor’s Manual**

**Sample Homework Assignment**

1a. The $\text{ADI}$ curve shifts left.
1b. The $\text{ADI}$ curve shifts left.
1c. The $\text{ADI}$ curve shifts right.
2. 

<table>
<thead>
<tr>
<th>Rate of inflation</th>
<th>Real interest rate</th>
<th>Short-run equilibrium output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.01</td>
<td>7960</td>
</tr>
<tr>
<td>0.01</td>
<td>0.02</td>
<td>7920</td>
</tr>
<tr>
<td>0.02</td>
<td>0.03</td>
<td>7880</td>
</tr>
<tr>
<td>0.03</td>
<td>0.04</td>
<td>7840</td>
</tr>
<tr>
<td>0.04</td>
<td>0.05</td>
<td>7800</td>
</tr>
</tbody>
</table>

\[
\pi \\
\begin{array}{c|c}
\pi & 0.04 \\
\hline
0.01 & 0.02 \\
0.03 & 0.04 \\
0.00 & 0.03 \\
\end{array}
\]

\[Y \quad 7840 \quad 7880 \quad 7920 \quad 7960 \quad 8000\]

3a. \[PAE = 2540 + 0.3Y - 1400r\]

b. 

<table>
<thead>
<tr>
<th>Rate of inflation</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>3609</td>
</tr>
<tr>
<td>0.01</td>
<td>3589</td>
</tr>
<tr>
<td>0.02</td>
<td>3569</td>
</tr>
<tr>
<td>0.03</td>
<td>3549</td>
</tr>
<tr>
<td>0.04</td>
<td>3529</td>
</tr>
</tbody>
</table>

c. 

\[
\pi \\
\begin{array}{c|c}
\pi & 0.04 \\
\hline
0.01 & 0.02 \\
0.03 & 0.04 \\
0.00 & 0.03 \\
\end{array}
\]

\[Y \quad 3529 \quad 3549 \quad 3569 \quad 3589 \]

\[AD\]
Multiple Choice

1. d
2. b
3. c
4. a
5. e
6. d
7. e
8. a
9. d
10. b

Problems/Short Answer

1. The $ADI$ curve shifts left.

2. 

\[ \pi \]

\[ \begin{array}{ccc}
0.05 & 0.03 & 0.01 \\
2250 & 2350 & 2450 \end{array} \]