Inflation, Disinflation, and Deflation

1. In the economy of Scottopia, policy makers want to lower the unemployment rate and raise real GDP by using monetary policy. Using the accompanying diagram, show why this policy will ultimately result in a higher aggregate price level but no change in real GDP.

![Diagram of Aggregate Price Level and Real GDP]

**Solution**

1. In the accompanying diagram, the economy of Scottopia is in long-run macroeconomic equilibrium at \( E_1 \). If policy makers want to lower the unemployment rate and raise real GDP, they will engage in expansionary monetary policy, which will shift \( AD_1 \) rightward to \( AD_2 \). In the short run, equilibrium moves to \( E_2 \); real GDP is higher and unemployment is lower. However, the aggregate price level has risen and over time, as workers are able to renegotiate wages, \( SRAS_1 \) will shift leftward to \( SRAS_2 \). In the long run, equilibrium moves to \( E_3 \) and the aggregate price level rises to \( P_3 \). The only result is that the increase in the money supply leads to an equal-percentage increase in the aggregate price level but no change in real GDP.

![Diagram of Aggregate Price Level and Real GDP]

2. In the following examples, would the classical model of the price level be relevant?
   a. There is a great deal of unemployment in the economy and no history of inflation.
   b. The economy has just experienced five years of hyperinflation.
c. Although the economy experienced inflation in the 10% to 20% range three years ago, prices have recently been stable and the unemployment rate has approximated the natural rate of unemployment.

2. a. The classical model of the price level is not well suited to an economy with a great deal of unemployment and no history of inflation. Increases in aggregate output can occur without an immediate change in the aggregate price level because it takes some time for workers and firms to react to changes in the aggregate price level by increasing nominal wages and the prices of some intermediate goods.
   b. When an economy has just experienced five years of hyperinflation, firms and workers will be very sensitive to any increase in the aggregate price level, so there would be little if any trade-off between inflation and unemployment. The classical model would be relevant.
   c. If the economy has some history of inflation but prices have recently been stable and the unemployment rate has approximated the natural rate, there may be a trade-off between inflation and unemployment; it would be short lived, however, because people would quickly adjust their expectations of inflation given their not-too-distant experiences of inflation. The classical model would be relevant.

3. The Federal Reserve regularly releases data on the U.S. monetary base. You can access that data at various websites, including the website for the Federal Reserve Bank of St. Louis. Go to http://research.stlouisfed.org/fred2/ and click on “Money, Banking, & Finance,” then on “Monetary Data,” then on “Monetary Base,” and then on “Board of Governors Monetary Base, Adjusted for Changes in Reserve Requirements” for the latest report. Then click on “View Data.”
   a. The last two numbers in the column show the levels of the monetary base in the last year. How much did it change?
   b. How did this help in the government’s efforts to finance its deficit?
   c. Why is it important for the central bank to be independent from the part of the government responsible for spending?

3. Answers will vary depending on when you look up the information.
   a. From February 2011 to February 2012, the monetary base grew from $2110.262 billion to $2691.57 billion, an increase of $581.31 billion.
   b. This $581.31 billion increase in the monetary base was created by the Fed and used to buy government securities—in effect paying off that amount of government debt by printing money.
   c. It is important for the central bank to be independent from the part of the government responsible for spending because it might be tempted to have the central bank print more money (creating inflation) whenever the government runs a budget deficit.

4. Answer the following questions about the (real) inflation tax, assuming that the price level starts at 1.
   a. Maria Moneybags keeps $1,000 in her sock drawer for a year. Over the year, the inflation rate is 10%. What is the real inflation tax paid by Maria for this year?
   b. Maria continues to keep the $1,000 in her drawer for a second year. What is the real value of this $1,000 at the beginning of the second year? Over the year, the inflation rate is again 10%. What is the real inflation tax paid by Maria for the second year?
c. For a third year, Maria keeps the $1,000 in the drawer. What is the real value of this $1,000 at the beginning of the third year? Over the year, the inflation rate is again 10%. What is the real inflation tax paid by Maria for the third year?

d. After three years, what is the cumulative real inflation tax paid?

e. Redo parts a through d with an inflation rate of 25%. Why is hyperinflation such a problem?

4. 

a. The real inflation tax paid is $100 ($1,000 \times 0.10).

b. The price level at the end of the first year will be 1 \times 1.10 = 1.10. The real value of $1,000 at the beginning of the second year is $1,000/1.10 = $909.09. So the real inflation tax paid for the second year is $90.91 ($909.09 \times 0.10).

c. The price level at the end of the second year will be 1.10 \times 1.10 = 1.21. The real value of $1,000 at the beginning of the third year is $1,000/1.21 = $826.45. So the real inflation tax paid for the third year is $82.65 ($826.45 \times 0.10).

d. The cumulative real inflation tax paid for the three years is $100 + $90.91 + $82.65 = $273.56.

e. If the inflation rate is 25% and the aggregate price level equals 1 in year 1, the real inflation tax paid for the first year is $250 ($1,000 \times 0.25). At the beginning of the second year, the real value of $1,000 is $1,000/1.25 = $800. For the second year, the real inflation tax paid is $200 ($800 \times 0.25); and for the third year, it is $160 \left(\left(\frac{1,000}{1.25}\right)^2 \times 0.25\right). The cumulative real inflation tax paid for the three years is $250 + $200 + $160 = $610. Hyperinflation is such a big problem because it can quickly erode the purchasing power of money. In our examples, in just three years, an inflation rate of 10% created a real inflation tax of $273.56 on $1,000, but an inflation rate of 25% created a real inflation tax of $610 on $1,000.

5. 

The inflation tax is often used as a significant source of revenue in developing countries where the tax collection and reporting system is not well developed and tax evasion may be high.

a. Use the numbers in the accompanying table to calculate the inflation tax in the United States and India (Rp = rupees).

<table>
<thead>
<tr>
<th>Country</th>
<th>Inflation in 2010</th>
<th>Money supply in 2010 (billions)</th>
<th>Central government receipts in 2010 (billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>1.65%</td>
<td>Rp16,318</td>
<td>Rp7,943</td>
</tr>
<tr>
<td>United States</td>
<td>1.4</td>
<td>$1,838</td>
<td>$2,430</td>
</tr>
</tbody>
</table>

Sources: Bureau of Economic Analysis; Federal Reserve Bank of St. Louis; Controller General of Accounts (India); Reserve Bank of India; International Monetary Fund.

b. How large is the inflation tax for the two countries when calculated as a percentage of government receipts?

<table>
<thead>
<tr>
<th>Country</th>
<th>Inflation tax (billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>Rp269.24</td>
</tr>
<tr>
<td>United States</td>
<td>$25.7</td>
</tr>
</tbody>
</table>

a. The inflation tax is equal to: Inflation rate \times Money supply. For India, this is 0.165 \times Rp16,318 billion = Rp269.24 billion. For the United States, it is 0.014 \times $1,838 billion = $25.7 billion, as shown in the accompanying table.
b. The inflation tax as a percentage of government receipts is 3.4% in India ([Rp269.24/Rp9,743] \times 100). It is only 1.0% in the United States ([$25.7/2,430] \times 100). The inflation tax accounts for a much larger portion of government revenues in India, which is consistent with India having a less well developed tax collection and reporting system than the United States.

6. Concerned about the crowding-out effects of government borrowing on private investment spending, a candidate for president argues that the United States should just print money to cover the government’s budget deficit. What are the advantages and disadvantages of such a plan?

6. The main advantage to printing money to cover the deficit is to avoid the crowding-out effects—the reduction in private investment spending that occurs due to higher interest rates arising from government borrowing. However, the main disadvantage to printing money to cover the deficit is that it will result in inflation and individuals who currently hold money will pay an inflation tax (a reduction in the value of money held by the public). Rather than financing the budget deficit with an increase in actual taxes, printing money imposes an inflation tax.

7. The accompanying scatter diagram shows the relationship between the unemployment rate and the output gap in the United States from 1990 to 2004. Draw a straight line through the scatter of dots in the figure. Assume that this line represents Okun’s law:

Unemployment rate = \( b - (m \times \text{Output gap}) \)

where \( b \) is the vertical intercept and \( -m \) is the slope

What is the unemployment rate when aggregate output equals potential output? What would the unemployment rate be if the output gap were 2%? What if the output gap were –3%? What do these results tell us about the coefficient \( m \) in Okun’s law?
7. The accompanying figure shows a line drawn through the dots relating the unemployment rate and the output gap for the United States from 1990 to 2004. Your line may be slightly different from the one drawn here. The line passes through the vertical axis at an unemployment rate of about 5.5%, as indicated by point A. So the unemployment rate when output equals potential output is 5.5%. At an output gap of 2%, the predicted unemployment rate is 4.5%, as shown by point B. At an output gap of −3%, the predicted unemployment rate is 7%, as shown by point C. The pattern of all three points fits Okun’s law with a coefficient \( m \) equal to 0.5: Unemployment rate = 5.5% − (0.5 × Output gap).

8. After experiencing a recession for the past two years, the residents of Albernia were looking forward to a decrease in the unemployment rate. Yet after six months of strong positive economic growth, the unemployment rate has fallen only slightly below what it was at the end of the recession. How can you explain why the unemployment rate did not fall as much although the economy was experiencing strong economic growth?

Solution

8. There are two primary reasons why Albernia is experiencing a jobless recovery, a recovery in which the unemployment rate falls only slowly, if at all. The first reason is that a company that experiences a sudden increase in demand for its products may cope by having its workers put in longer hours, rather than by hiring more workers. The second reason is that the number of workers looking for jobs is affected by the availability of jobs. As the economy adds jobs, some people who had not been actively looking for work during the recession may begin doing so.

9. Due to historical differences, countries often differ in how quickly a change in actual inflation is incorporated into a change in expected inflation. In a country such as Japan, which has had very little inflation in recent memory, it will take longer for a change in the actual inflation rate to be reflected in a corresponding change in the expected inflation rate. In contrast, in a country such as Zimbabwe, which has recently had very high inflation, a change in the actual inflation rate will immediately be reflected in a corresponding change in the expected inflation rate. What does this imply about the short-run and long-run Phillips curves in these two types of countries? What does this imply about the effectiveness of monetary and fiscal policy to reduce the unemployment rate?
9. Countries such as Japan will find that they can sustain an unemployment rate lower than the NAIRU for longer periods of time before the expected rate of inflation increases than can countries such as Zimbabwe. So Japanese monetary and fiscal policy will be more effective than Zimbabwean monetary and fiscal policy in reducing unemployment below the NAIRU. However, given a sufficiently long period of higher-than-expected inflation, the Japanese people will revise their expected rate of inflation upward, and the Japanese short-run Phillips curve will shift upward. So the long-run Japanese Phillips curve is still vertical. In contrast, Zimbabwe will find that its short-run Phillips curve is practically vertical: because people are primed to quickly revise their inflationary expectations, an unemployment rate below the NAIRU will quickly cause an acceleration of inflation. So Zimbabwean monetary and fiscal policy are largely ineffective even in the short run in reducing unemployment below the NAIRU.

10. a. Go to www.bls.gov. Click on link “Subject Areas”; on the left, under “Inflation & Prices,” click on the link “Consumer Price Index.” Scroll down to the section “CPI Tables,” and find the link “Consumer Price Index Detailed Report, Tables Annual Averages 2009 (PDF).” What is the value of the percent change in the CPI from 2008 to 2009?

b. Now go to www.treasury.gov and click on “Resource Center.” From there, click on “Data and Charts Center.” Then click on “Interest Rate Statistics,” followed by “TextView.” In the scroll-down windows, select “Daily Treasury Bill Rates” and “2009.” Examine the data in “4 Weeks Bank Discount.” What is the maximum? The minimum? Then do the same for 2007. How do the data for 2009 and 2007 compare? How would you relate this to your answer in part (a)? From the data on Treasury bill interest rates, what would you infer about the level of the inflation rate in 2007 compared to 2009? (You can check your answer by going back to the www.bls.gov website to find the percent change in the CPI from 2006 to 2007.)

c. How would you characterize the change in the U.S. economy from 2007 to 2009?

Solution

10. a. The percent change in the CPI from 2008 to 2009 was −0.4%.

b. In 2009, the Treasury bill 4-week bank discount was very low, with a maximum of 0.26% and a low of 0.01%—virtually zero. In 2007, the equivalent rate was much higher, with a high of 5.15% and a low of 2.34%. The very low Treasury bill rates in 2009 are consistent with the very low inflation rate for 2009. Given the rates in 2007 were well above zero, one should expect that the 2007 inflation rate was also above zero. Indeed, it was, at 2.8%.

c. From the data, it appears that the United States experienced a fall in inflation from 2007 to 2009 as the inflation rate fell. It was also a period of a severe fall in GDP. In 2009, the United States was in liquidity trap territory.
11. The accompanying table provides data from the United States on the average annual rates of unemployment and inflation. Use the numbers to construct a scatter plot similar to Figure 31-5. Discuss why, in the short run, the unemployment rate rises when inflation falls.

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployment rate</th>
<th>Inflation rate</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>
<tr>
<td>2005</td>
<td>5.1</td>
<td>3.4</td>
</tr>
<tr>
<td>2006</td>
<td>4.6</td>
<td>3.2</td>
</tr>
<tr>
<td>2007</td>
<td>4.6</td>
<td>2.9</td>
</tr>
<tr>
<td>2008</td>
<td>5.8</td>
<td>3.8</td>
</tr>
<tr>
<td>2009</td>
<td>9.3</td>
<td>-0.4</td>
</tr>
<tr>
<td>2010</td>
<td>9.6</td>
<td>1.6</td>
</tr>
</tbody>
</table>


12. The accompanying figure shows a negative relationship between the unemployment rate and the inflation rate: when the unemployment rate rises, the inflation rate falls. This should come as no surprise: the short-run aggregate supply curve says that as the aggregate price level rises (that is, as there is inflation), aggregate output rises. And from Okun’s law we know that as aggregate output rises above potential output (that is, as the output gap increases), unemployment falls. In other words, as inflation rises, unemployment falls. So there is a negative relationship between the inflation rate and the unemployment rate.

12. The economy of Brittania has been suffering from high inflation with an unemployment rate equal to its natural rate. Policy makers would like to disinflate the economy with the lowest economic cost possible. Assume that the state of the economy is not the result of a negative supply shock. How can they try to minimize the unemployment cost of disinflation? Is it possible for there to be no cost of disinflation?
12. A major obstacle to achieving disinflation is that the public has come to expect continuing inflation. To reduce inflation, it is often necessary to keep the unemployment rate above the natural rate for an extended period of time so that the public can adjust its expectations to a lower inflation rate. The harder it is to change the public’s expectations, the higher will be the unemployment cost associated with disinflation. To minimize the cost of disinflation, the public must believe that policy makers are committed to a lower inflation rate and will do what is necessary to achieve a lower rate. Policy makers in Britain can announce their policy to reduce inflation in advance, in time for firms and workers to build lower inflation expectations into their wage contracts. As long as policy makers are perceived as credible, the cost of disinflation will be minimized. It is possible but unlikely for policy makers to reduce inflation without increasing unemployment; it would require that they be seen as absolutely committed and able to disinflate the economy. If this were the case, expectations would adjust and inflation would fall immediately upon announcement of the policy.

13. Who are the winners and losers when a mortgage company lends $100,000 to the Miller family to buy a house worth $105,000 and during the first year prices unexpectedly fall by 10%? What would you expect to happen if the deflation continued over the next few years? How would continuing deflation affect borrowers and lenders throughout the economy as a whole?

Solution

Over the first year, as prices fall 10%, the value of the Millers’ house will fall from $105,000 to $94,500. Since they borrowed $100,000 to buy it, the value of the house is now less than the amount they owe. If they sold the house, they would not be able to pay off their mortgage. The Millers are worse off. The mortgage company is better off because as the Millers pay off their mortgage, the mortgage company will be able to lend to more potential homeowners. As the deflation continues, it will become harder and harder for the Millers to pay off their mortgage. Assuming wages are falling with deflation, the Millers will have to work more hours to pay off the mortgage. The Millers will cut back on their consumer spending. At some point, the Millers will decide to walk away from the house and default on the mortgage. Both the Millers and the mortgage company will lose, as will the economy. The Millers will find it difficult to borrow at all because they defaulted on the mortgage, and the mortgage company will be reluctant to lend for fear that the borrower will default. Continuing deflation would be extremely detrimental to the economy. Individuals and firms will be reluctant to borrow, fearing that the value of their assets will fall even though the value of their debt remains fixed, and lenders will be reluctant to lend, fearing that the borrowers will default and they will own assets whose value is less than the amount they lent.