KEY CONCEPTS

aggregate demand (AD) curve
aggregate supply (AS) curve
constrained discretion
deflation
the Great Moderation
inflation expectations
inflation-output loops
inflation targets
leading economic indicators
the Lucas critique
monetary policy rules
rational expectations
rules versus discretion
stagflation
time consistency problem

REVIEW QUESTIONS

1. How is a monetary policy rule helpful for understanding U.S. monetary policy?
2. Why does the AD curve slope downward? Why does the AS curve slope upward? How is the AS/AD graph like a standard supply-and-demand diagram? How is it different?
3. What are some examples of shocks that shift the AD curve? What about the AS curve?
4. What is the fundamental source of transition dynamics in our AS/AD framework? Why does the economy take several periods before returning to its steady state following a shock?
5. Why do inflation-output loops appear counterclockwise?
6. Why are inflation expectations so important to modern monetary policy? What are several ways that central banks try to manage inflation expectations?

EXERCISES

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1. **A simple monetary policy rule:** Consider the policy rule used in the chapter: $R_t - \bar{r} = \overline{m}(\pi_t - \overline{\pi})$, where we assume $\bar{r} = 2\%$, $\overline{m} = 1/2$, and $\overline{\pi} = 2\%$.
   (a) Compute the level of the (nominal) interest rate implied by this rule when the inflation rate takes the following values: 10%, 5%, 2%, 1%.
   (b) Repeat part (a) when $\overline{m} = 1$ instead. Explain why you get different answers.
2. **Predicting the fed funds rate:** Obtain data on the inflation rate for the most recent 12-month period possible (the FRED database at the Federal Reserve Bank of St. Louis is an excellent resource). Use this inflation rate and this chapter's monetary policy rule to determine what fed funds rate the policy rule indicates. How does this rate compare with the current fed funds rate? If they are different, why do you think that's the case? (*Hint*: Be sure that you are comparing two nominal rates; our simple rule corresponds to a real rate.)

3. **A negative oil price shock:** It is common to blame some of the poor macroeconomic performance of the 1970s on the rise in oil prices. In the middle of the 1980s, however, oil prices declined sharply. Using the AS/AD framework, explain the macroeconomic consequences of a one-time negative shock to the inflation rate, as might occur because of a sharp decline in oil prices.

4. **The oil price shocks of 2006–2009:** Between 2006 and the middle of 2008, oil prices rose sharply—from around $60 to more than $140 per barrel. By the end of 2008, however, oil prices had fallen even more sharply, to just over $40 per barrel. Think of these events as two separate shocks.
   (a) What, precisely, are the two shocks? (For the purpose of this question, let's ignore the significant role played by the financial crisis itself.)
   (b) Using the AS/AD framework, explain how the macroeconomy would evolve in response to these shocks.

5. **A decline in foreign demand for U.S. goods:** Suppose the European and Japanese economies succumb to a recession and reduce their demand for U.S. goods for several years. Using the AS/AD framework, explain the macroeconomic consequences of this shock, both immediately and over time.

6. **Reinflation in Japan:** In the late 1990s and early 2000s, inflation was actually negative in Japan (look back at Figure 13.19). This question asks you to explore a change in policy to achieve a *higher* inflation rate.
   Consider an economy that begins with output at potential and an inflation rate of $\overline{\pi}$, so the economy begins in steady state. A new chair of the central bank decides to raise the long-run inflation target to $\overline{\pi}'$ (greater than the original $\overline{\pi}$). Show how the economy responds over time, using the AS/AD framework. Comment on your results.

7. **The slope of the AS curve:**
   (a) Why does the AS curve slope upward?
   (b) If the AS curve were more steeply sloped, how would the economy respond differently to aggregate demand shocks (shocks to $\overline{a}$)?
   (c) If the curve were more steeply sloped, how would the economy respond differently to aggregate supply shocks (shocks to $\overline{o}$)?
   (d) What kind of economic changes in the economy would lead the curve to be more steeply sloped?

8. **The slope of the AD curve:**
   (a) Why does the AD curve slope downward?
   (b) If the AD curve were more steeply sloped, how would the economy respond differently to aggregate demand shocks (shocks to $\overline{a}$)?
   (c) If the curve were more steeply sloped, how would the economy respond differently to aggregate supply shocks (shocks to $\overline{o}$)?
   (d) What kind of economic changes in the economy would lead the curve to be more steeply sloped?

9. **The Taylor rule:** John Taylor of Stanford University proposed the following monetary policy rule:

$$R_t - \bar{r} = \bar{m}(\pi_t - \bar{\pi}) + \bar{n}\tilde{Y}_t.$$

That is, Taylor suggests that monetary policy should increase the real interest rate whenever output exceeds potential.

(a) What is the economic justification for such a rule?
(b) Combine this policy rule with the IS curve to get a new aggregate demand curve. How does it differ from the AD curve we considered in the chapter? Consider the response of short-run output to aggregate demand shocks and inflation shocks.

10. **A monetary policy rule that completely offsets aggregate demand shocks:** Our monetary policy rule responds only to shocks to the inflation rate. We saw in Section 13.5 that this means that aggregate demand shocks can cause the economy to undergo a "boom-recession" cycle. Create your own monetary policy rule that would insulate the aggregate economy completely from aggregate demand shocks—so that neither inflation nor output would change if an aggregate demand shock hit the economy. Explain why your policy works. (*Hint*: Assume that policymakers can observe the aggregate demand shocks directly.)

11. **Crowding out:** Consider a simplified version of the Taylor rule, where monetary policy depends only on short-run output:

$$R_t - \bar{r} = \bar{n}\tilde{Y}_t.$$

(a) Draw an IS-MP diagram, but instead of the usual MP curve, plot the simplified version of the Taylor rule. You might label this curve MPR for "monetary policy rule."
(b) Now consider the effect of a positive aggregate demand shock in the IS-MPR diagram. (An example might be a fiscal stimulus.) Compare and contrast the effect of this shock on the economy in the standard IS-MP diagram versus the IS-MPR diagram. Why is the result different?
(c) Economists refer to the result in the IS-MPR diagram as "crowding out." What gets crowded out and why?

12. **The coefficient on inflation in the nominal version of the policy rule:** Consider the policy rule for the nominal interest rate in equation (13.5). Draw a graph with the inflation rate on the horizontal axis and the nominal interest rate on the vertical.

(a) What is the slope of this line? Is it larger than 1 or less than 1?
(b) Suppose the slope were the reverse of what you answered in part (a): larger or less than 1. Explain what this implies about the response of nominal interest rates to inflation in a good monetary policy rule.

13. **Deflation:** The Japanese economy at the end of the 1990s and into the 2000s experienced several years of deflation (see Figure 13.19). Again, recall the

monetary policy rule used in the chapter: $R_t - \bar{r} = \overline{m}(\pi_t - \overline{\pi})$, where $\bar{r} = 2\%$, $\overline{m} = 1/2$, and $\overline{\pi} = 2\%$.

(a) Compute the level of the (nominal) interest rate implied by this policy rule when the inflation rate takes the following values: 1%, 0%, −1%.
(b) Is it possible for the nominal interest rate to be negative? Why or why not?
(c) What does your answer to part (b) mean about monetary policy during a deflation?
(d) If a central bank wants to end the deflation and stimulate the economy, as in the case of Japan in the late 1990s, what can it do?

14. **Analyzing remarks by the Federal Reserve chair:** Suppose your job is to explain Federal Reserve policy to the CEO of a corporation. Look at a speech by the Fed chair on www.federalreserve.gov/newsevents/. Write a brief memo to your CEO explaining one of the key points of the speech. Use the diagrams of the AS/AD framework if you like; your CEO is a former economics major. (Be sure to indicate which speech you're analyzing.)

15. **Can the Fed permanently increase employment?** "The Federal Reserve is obsessed with inflation, so much so that it ignores the fact that millions of American workers are unemployed. We need a Fed that fights for American jobs. We need a Fed that views any unemployment as too much unemployment, rather than worrying about whether inflation is 2% or 3%." In a one-page essay, discuss the merits and demerits of this viewpoint, using graphs and equations when helpful.

16. **Revisiting the inflation shock (hard):** Reread the inflation shock example (event #1) in Section 13.5. Suppose the size of the shock is $\bar{o}_0$.

(a) In the AS/AD graphs describing the response of the economy to the inflation shock, we labeled the initial response of inflation as π_1 and initial output as $\tilde{Y}_1$. What are the values of these key points in terms of the parameters of the model? That is, by how much does output fall, and what is the initial inflation rate?
(b) Now suppose the parameters of the AS and AD curves take the following values: $\bar{o}_0 = 2\%$, $\bar{a} = 0$, $\bar{b} = 1/2$, $\overline{m} = 1/2$, $\bar{v} = 1/2$, and $\overline{\pi} = 2\%$. Solve for the value of short-run output and the inflation rate for the first 3 years after the shock.
(c) Comment briefly on your results.

17. **Revisiting the effect of the booming European economy (hard):** Reread the aggregate demand shock example (event #3) in Section 13.5. Suppose the parameters of the AS and AD curves take the following values: $\bar{a} = 2\%$, $\bar{b} = 1/2$, $\overline{m} = 1$, $\bar{v} = 1/2$, and $\overline{\pi} = 3\%$. Solve for the value of short-run output and the inflation rate for the first 3 years after the shock. For this problem, assume the aggregate demand shock lasts for more than 3 years. Comment on your results.

WORKED EXERCISES

9. The Taylor rule:

(a) Taylor's rule features a key property that—at least on the surface—makes it appear preferable to the simple policy rule considered in this chapter. In particular, it says that the central bank should respond directly to short-run output. If the economy goes into a recession, this rule dictates a lowering of interest rates to stimulate the economy. In contrast, our policy rule changes interest rates only *after* the softening of the economy has affected inflation. This exercise asks you to consider how this direct response to output changes the model relative to the indirect response we've been considering.

(b) To derive the new AD curve, we substitute the Taylor rule into the basic IS curve. Recall that the equation for the IS curve is $\tilde{Y}_t = \bar{a} - \bar{b}(R_t - \bar{r})$. Making the substitution for the interest rate term gives

$$\tilde{Y}_t = \bar{a} - \bar{b}\bar{m}(\pi_t - \bar{\pi}) - \bar{b}\bar{n}\tilde{Y}_t.$$

We can then collect the $\tilde{Y}_t$ terms on the left side to get

$$(1 + \bar{b}\bar{n})\tilde{Y}_t = \bar{a} - \bar{b}\bar{m}(\pi_t - \bar{\pi}).$$

Finally, dividing by $1 + \bar{b}\bar{n}$ leads to our new AD curve:

$$\tilde{Y}_t = \frac{\bar{a}}{1 + \bar{b}\bar{n}} - \frac{\bar{b}\bar{m}}{1 + \bar{b}\bar{n}}(\pi_t - \bar{\pi}).$$

Two things to notice about this equation: First, if $\bar{n} = 0$, we are back to our original AD curve, just as you'd expect. Second, because $1 + \bar{b}\bar{n}$ is greater than 1, the new AD curve shows *more muted responses* to aggregate demand shocks and to changes in the inflation rate—the new AD curve is steeper.

Why is this? The policy rule now says to stimulate the economy whenever there is a recession. This softens the impact of aggregate demand shocks and makes the central bank less harsh in fighting inflation. Notice also, however, that the overall form of the AD curve is just the same as the one we studied in the chapter. The difference is really just a matter of degree (muting the effects). This is why we are somewhat justified in sticking with the simpler formulation in the main text.

13. Deflation:

(a) From equation (12.5), the nominal interest rate is given by

$$\begin{aligned} i_t = R_t + \pi_t &= \bar{r} + \pi_t + \bar{m}(\pi_t - \bar{\pi}) \\ &= 2\% + \pi_t + 1/2 \times (\pi_t - 2\%) \\ &= 1\% + 3/2 \times \pi_t. \end{aligned}$$

Using this formula, we get the following results:

Inflation	Nominal interest rate
1%	2.5%
0%	1.0%
−1%	−0.5%

(b) It's *not* possible for the nominal interest rate to be negative. Think about it. The nominal interest rate is the rate that the bank pays you for the privilege of having access to your money. Suppose the bank tried to charge you 0.5% per year on your savings account instead of paying interest, so the effective nominal interest rate was −0.5%. You could always keep your money under your mattress or in a lockbox in the bank and earn a zero nominal interest rate. (Well, in highly dangerous circumstances, we could imagine banks charging you a fee for protecting the property right you have to your money, but those circumstances don't apply here.)

(c) The fact that nominal interest rates can't be negative poses a dilemma for a country like Japan during a deflation. The policy rule says to stimulate the economy with negative interest rates, but the most Japan can do is lower the interest rate to zero. In fact, this is basically what the Bank of Japan did—short-term nominal interest rates were reduced to extremely low levels.

Notice that with a deflation, the economy would like to create some inflation. The problem is that it appears difficult to make monetary policy sufficiently "loose" to achieve this goal.

(d) At some level, governments are good at generating inflation, so deflation should not be a serious problem. Japan tried to use fiscal policy to stimulate the economy and created large budget deficits and a large national debt. One thing the government could do is print money to pay for its government spending. We know from the quantity theory of money that if the central bank prints enough money, it should be able to generate inflation. Another way the central bank can stimulate the economy is to reduce long-term interest rates by buying 10-year bonds instead of short-maturity bonds.

Many observers worried in the early 2000s that a problem similar to Japan's could someday affect the United States, particularly when the inflation rate was low. Overall, however, most economists believe there are enough tools at the disposal of the U.S. government and the central bank for creating inflation that deflation should not be a serious problem. This reasoning is being tested once again in recent years as the Great Recession puts downward pressure on inflation at a time when inflation is already quite low.