Chapter 35
Extending the Analysis of Aggregate Supply

CHAPTER OVERVIEW

• During the early years of the Great Depression, many economists suggested that the economy would correct itself in the long run without government intervention.

• John Maynard Keynes remarked, “in the long run we are all dead!”

• This chapter explains the difference between long-run and short-run aggregate supply;

• it examines the unemployment-inflation relationship and assesses the effect of taxes on aggregate supply.

OBJECTIVES

• Explain the difference between the short-run and long-run aggregate supply curves and their significance for economic policy.

• Distinguish between demand-pull and cost-push inflation using the extended aggregate demand-aggregate supply model.
• Explain and construct a traditional short-run Phillips Curve using the aggregate demand-aggregate supply model.

• Differentiate between the short-run and long-run Phillips Curves.

• Identify the supply side shocks to the U.S. economy in the 1970s and 1980s.

• Use an aggregate demand aggregate supply graph to show how supply side shocks led to stagflation in the 1970s and 1980s.

• Explain why we may observe continued levels of inflation in the economy using the AD-AS model.

• Explain why demand management policies cannot eliminate stagflation.

• Explain two possible effects of taxation on aggregate supply.

• Explain the Laffer Curve concept and list three criticisms of this theory.

• Define and identify terms at the end of the chapter.
Introduction

• **Learning objectives**
  
  – About the relationship between short-run aggregate supply and long-run aggregate supply.
  
  – How to apply the “extended” (short-run/long-run) AD-AS model to inflation, recessions, and economic growth.
  
  – About the short-run trade off between inflation and unemployment (the Phillips Curve).
  
  – Why there is no long-run trade off between inflation and unemployment.
  
  – The relationship between tax rates, tax revenues, and aggregate supply.
  
• Recent focus on the long-run adjustments and economic outcomes has renewed debates about stabilization policy and causes of instability.

• This chapter makes the distinction between short run and long run aggregate supply.

• The extended model is then used to glean new insights on demand-pull and cost-push inflation.

• The relationship between inflation and unemployment is examined; we look at how expectations can affect the economy, and assess the effect of taxes on aggregate supply.
Short-Run and Long-Run Aggregate Supply

- **Definition: Short-run and long-run.**
  - For macroeconomics the short-run is a period in which wages (and other input prices) do not respond to price level changes.
    * Workers may not be fully aware of the change in their real wages due to inflation (or deflation) and thus have not adjusted their labor supply decisions and wage demands accordingly.
    * Employees hired under fixed wage contracts must wait to renegotiate regardless of changes in the price level.
    * Input prices inflexible
    * Upward sloping aggregate supply
      - See Figure 35.1a.
    * Output prices are fully flexible.
  - In the long run,
    * See Figure 35.1b
    * Nominal wages are fully responsive to price level changes.
    * Input prices fully flexible

- **Short-run aggregate supply curve** $AS_1$, 
  - see Figure 35.1a.
– The curve is constructed with three assumptions:

1. The initial price level is given at $P_1$.
2. Nominal wages have been established on the expectation that this specific price level will persist.
3. The price level is flexible both upward and downward.

* Observe from point $a_1$ that at price level $P_1$, the economy is operating at its full-employment output $Q_f$.
* the economy is operating at its natural rate of unemployment

– If the price level rises from $P_1$ to $P_2$,

* See Figure 35.1a
* higher product prices with constant wages will bring higher profits and increased output from $Q_f$ to $Q_2$
* The economy moves from $a_1$ to $a_2$ on curve $AS_1$.
* hire more workers and the economy is operating beyond its natural rate of unemployment

– If the price level falls from $P_1$ to $P_3$,

* See Figure 35.1a
* lower product price with constant wages will bring lower profits and decreased output from $Q_f$ to $Q_3$
* The economy moves from $a_1$ to $a_3$ on curve $AS_1$.
* Reduce production and employment and thus the unemployment rate is higher than the natural rate of unemployment
• **Long run aggregate supply**
  
  – See Figure 35.1b
  
  – In the long run, nominal wages are fully responsive to price level changes.
  
  – Input prices fully flexible
  
  – Suppose the initial price level is given at $P_1$.
  
  – If the price level rises from $P_1$ to $P_2$,
    
    * The economy moves from $a_1$ to $a_2$ on the short-run aggregate supply curve $AS_1$.
    
    * At $a_2$, the economy is producing at more than its potential output.
    
    * High demand for productive inputs will drive input prices to rise.
    
    * High demand for labor will drive up nominal wages.
    
    * the short-run aggregate supply curve will then shifts leftward from $AS_1$ to $AS_2$.
    
    - Refer to figure 29.6
    
    * The economy moves from $a_2$ to $b_1$.
  
  – If the price level falls from $P_1$ to $P_3$,
    
    * The economy moves from $a_1$ to $a_3$ on the short-run aggregate supply curve $AS_1$.
    
    * At $a_3$, the economy is producing at less than its potential output.
    
    * lower demand for productive inputs will drive input prices to drop.
lower demand for labor will drive down nominal wages.

* the short-run aggregate supply curve will then shifts rightward from $AS_1$ to $AS_3$.
* The economy moves from $a_3$ to $c_1$

Thus, the long run aggregate supply curve is a vertical line at the full employment level of real GDP, $Q_1$, formed by long-run equilibrium points $a_1, b_1, c_1$.

**Extended AD-AS Model**

- Extend to include the distinction between the short run and long run aggregate supply curves.
- See Figure 35.2
- In the short run, equilibrium occurs wherever the downsloping AD curve and upsloping short-run AS curve interest.
  * This can be at any level of output, not simply the full-employment level.
  * Either a negative GDP gap or a positive GDP gap is possible in the short run.

- But in the long run,
  * The short-run AS curve adjusts.
  * Equilibrium occurs at point $a$ where aggregate demand $AD_1$ intersects both the vertical long run supply curve $AS_L$ and the short run supply $AS_1$ at full employment output $Q_f$. 
Applying the Extended AD-AS Model

- **Demand-pull inflation:**

  - An increase in AD pulls up the price level.
  - In the short run,
    * Suppose the initial price level is given at $P_1$ and output level $Q_f$ at point $a$.
    * An increase in demand shift $AD_1$ to $AD_2$.
      - See Figure 29.8
      - The shift might result from an increase in investment spending or a rise in net exports, etc.
    * it drives up the price level from $P_1$ to $P_2$, and increases real output from $Q_f$ to $Q_2$ at point $b$.
    * A positive GDP gap of $Q_2 - Q_f$ occurs.
  - in the long run,
    * See Figure 35.3
    * applying the extended AD-AS model,
    * An increase in the price level leads to an increase in nominal wages and thus a leftward shift of the short-run AS curve.
    * only price level rises.
    * The economy is achieving its full-employment real output $Q_f$ at point $a$ with the price level at $P_3$.
• Cost-push inflation

– Cost-push inflation arises from factors that increase the cost of production at each price level,
  * E.g., high energy prices would spread through the economy, driving up production and distribution costs.
  * see Figure 29.10 or or PPT 29-21.
– shifting the AS curve leftward and raising the equilibrium price level.
– In the short run,
  * see Figure 35.4 or or PPT 35-8.
  * Suppose the initial price level is given at $P_1$ and output level $Q_f$ at point $a$.
  * Suppose oil producers reduce the supply of oil to boost its prices by, say, 100%.
  * The per-unit production cost will go up.
  * The AS curve shifts leftward from $AS_1$ to $AS_2$, the economy moves from $a$ to $b$,
  * This shifts the short run supply to the left, not as a response to a price level increase, but as its initiating cause.

• Cost-push inflation creates a dilemma for policymakers.

– Without some expansionary stabilization policy,
  * Real output declines from $Q_f$ to $Q_2$ at point $b$. 
* Encounter recession and obtain a recession, negative GDP gap, $Q_2 - Q_f$.
* Widespread layoffs, plant shutdowns, and business failures eventually occur.
* At some points the demand for oil, labor, and other inputs will decline so much that oil prices and nominal wages will decline.
* The per-unit production cost will go down and shift the AS curve shifts rightward from $AS_2$ to $AS_1$.
* The price level will return to $P_1$ and the full-employment level of output will be restored at $Q_f$.

– With some expansionary stabilization policy,

* Government can counter this recession, negative GDP gap and attendant high unemployment by using fiscal policy and monetary policy to increase AD to $AD_2$
* An increase in AD to $AD_2$ will further raise inflation by increasing the price level from $P_2$ to $P_3$, and increases real output from $Q_2$ to $Q_r$ at point $c$.
* More inflation will occur.

– Two generalizations:

* If government attempts to maintain full employment when there is cost-push inflation an inflationary spiral may occur.
* If government takes a hands-off approach to cost push inflation, a recession will occur. The recession may eventually undo the initial rise in per unit production costs, but in the meantime unemployment and loss of real output will occur.
- **Recession and the extended AD-AS model.**

- see Figure 35.5 or or PPT 35-9.

- Equilibrium occurs at point \( a \) where aggregate demand \( AD_1 \) intersects both the vertical long run supply curve \( AS_{LR} \) and the short run supply \( AS_1 \) at full employment output \( Q_f \) and with the initial price level is given at \( P_1 \).

- Suppose that investment spending declines dramatically, reduce \( AD \) to \( AD_2 \).

- Real output declines from \( Q_f \) to \( Q_1 \), indicate a recession has occurred.

- If we assume that prices and wages are downwardly flexible, the price level falls from \( P_1 \) to \( P_2 \).

- The decline in the price level reduces nominal wages, which then eventually shifts the aggregate supply curve to the right from \( AS_1 \) to \( AS_2 \).

- The negative GDP gap evaporates without the need for expansionary fiscal or monetary policy.

- The price level declines to \( P_3 \) and output returns to the full employment level \( Q_f \).

- This is the most controversial application of the extended AD-AS model. The key point of dispute is how long it would take in the real world for the necessary price and wage adjustments to take place to achieve the indicated outcome.

* Economists recommend active monetary policy, and perhaps fiscal policy, to counteract recession.
• **Ongoing Inflation in the Extended AD-AS Model**

  – Ongoing economic growth causes continuous rightward shifts of the AS curve that, by themselves, would tend to cause ongoing deflation.

  – At the same time, central banks engineer ongoing increases in the money supply in order to cause slightly faster continuous rightward shifts in the AD curve.

• **Economic Growth and Aggregate Supply**

  * The Aggregate demand aggregate supply framework can also be used to illustrate growth,

    - as seen in Figure 35.6

  * As the Aggregate Supply schedule shifts outward this results in economic growth.

  * The outward shift of the production possibilities curves from AB to CD is equivalent to the rightward shift of the economy’s long-run AS curve from $AS_{LS1}$ to $AS_{LS2}$

• **Economic Growth and the Extended AD-AS model**

  * However, in recent decades aggregate demand has shifted outward by an even greater amount.

  * Nominal GDP rises faster than real GDP.

  * This also results in inflation,
· as shown in figure 35.7.

* Suppose the economy initially are with aggregate demand curve $AD_1$, long run supply curve $AS_{LR1}$ and the short run supply $AS_1$.

· Suppose the initial price level is given at $P_1$ and output level $Q_1$.

* Suppose that economic growth shifts the long run supply curve to $AS_{LR2}$

· The economy’s potential output has increased from $Q_1$ to $Q_2$.

* With no change in AD, the increase in long-run AS would expand real GDP and lower the price level.

· Thus, economic growth is deflationary, other things equal.

* However, the Federal Reserve has expanded the nation’s money supply over the years such that the increases in AD have more than matched the increases in AS.

* the increases in AD and the increases in AS have increased output from $Q_1$ to $Q_2$ and boosted the price level from $P_1$ to $P_2$.

· The actual U.S. experience: economic growth, accompanied by mild inflation.
The Phillips Curve and the Inflation - Unemployment Tradeoff

• Both low inflation and low unemployment are major goals.
  – But are they compatible?
  – What explains situations in which high unemployment and high inflation coexist?

• the extended AD-AS model support the following:
  1. Under normal circumstances, there is a short-run trade-off between the rate of inflation and the rate of unemployment.
  2. AS shocks can cause both higher rates of inflation and higher rates of unemployment.
  3. There is no significant trade-off between inflation and unemployment over long periods of time.

• The Phillips Curve
  – The Phillips Curve is named after A.W. Phillips, who developed his theory in Great Britain by observing the British relationship between unemployment and wage inflation.
  – It suggests an inverse relationship between the rate of inflation and the rate of unemployment.
    * see Figure 35.8.
    * Figure 35.8b reveals the facts for the 1960s nicely fitting the theory.
− The basic idea is that given the short run aggregate supply curve, an increase in aggregate demand will cause the price level to increase and real output to expand,

* As real output rises, the unemployment rate falls.

− the reverse for a decrease in AD.

* see Figure 35.9.


− Manipulation of AD through fiscal and monetary measures would simply move the economy along the Phillips Curve.

* An expansionary fiscal and monetary policy that boosted AD and lowered the unemployment rate would simultaneously increase inflation.

* A restrictive fiscal and monetary policy could reduce the rate of inflation but only at the cost of a higher unemployment rate and forgone production.

• Economists agree that there is a short-run trade-off between the rate of inflation and the rate of unemployment.

− Given short-run AS, increases in AD increase real output and reduce the unemployment rate.

− As the unemployment rate falls and dips below the natural rate, the excessive spending produces demand-pull inflation.

− When recession sets in and the unemployment rate increases, the weak AD that caused the recession also leads to lower inflation rate.
Aggregate Supply Shocks and The Phillips Curve

- Economists reject the idea of a stable, predictable Phillips Curve.
  
  - This tradeoff between output and inflation does not occur over long time periods.


  * See Figure 35.10

  * In the 1970s the economy experienced increasing inflation and rising unemployment: stagflation.
    
    - A term that combines “stagnation” and “inflation”.

  * At best, the data in Figure 35.10 suggest a less desirable combination of unemployment and inflation.

  * At worse, the data imply no predictable trade off between unemployment and inflation.

- Adverse aggregate supply shocks can cause both higher rates of inflation and higher rates of unemployment.

- Adverse aggregate supply shocks may have been caused by a series of adverse aggregate supply shocks.
– Rapid and significant increases in resource costs.

– The most significant of these supply shocks was a quadrupling of oil prices by the Organization of Petroleum Exporting Countries (OPEC).

– Other factors included agricultural shortfalls, a greatly depreciated dollar, wage increases and declining productivity.

• Leftward shifts of the short run aggregate supply curve make a difference.

– Large increase in resource costs that jolt an economy’s short-run AS curve leftward.

– Leftward shifts of the short run AS curve increases the price level and reduces real output and thus the rate of unemployment rises.

– The Phillips Curve trade off is derived from shifting the aggregate demand curve along a stable short- run aggregate supply curve. (See Figure 35.8)

– The “Great Stagflation” of the 1970s made it clear that the Phillips Curve did not represent a stable inflation/unemployment relationship.

  * The U.S. unemployment rates shot up from 4.9% in 1973 to 8.5% in 1975, while
  
  * the U.S. price level rose by 21% in the same period.
  
  * In 1978, when OPEC increased oil prices by > 100%, the U.S. price level rose by 26% over the 1978-1980 period while
  
  * the U.S. unemployment rates increased from 6.1% to 7.1%. 
• **Stagflation’s Demise**

  – Another look at Figure 35.10 reveals a generally inward movement of the inflation/unemployment points between 1982 and 1989.

  – The recession of 1981-1982, largely caused by a tight money policy, reduced double-digit inflation and raised the unemployment rate to 9.5% in 1982.

  – With so many workers unemployed, wage increases were smaller and in some cases reduced wages were accepted.

  – Firms restrained their price increases to try to retain their relative shares of diminished markets.

  – Foreign competition throughout this period held down wages and price hikes.

  – Deregulation of the airline and trucking industries also resulted in wage and price reductions.

  – A significant decline in OPEC’s monopoly power produced a stunning fall in the price of oil.

  – All these factors combined to reduce per-unit production costs and to shift the short-run AS curve rightward.

    * Employment and output expanded, and the unemployment rate fell from 9.6% in 1983 to 5.3% in 1989.

• **Global Perspective 35.1** portrays the “misery index” in 1992-2007 for several nations. The index adds unemployment and inflation rates.
Long-Run Phillips Curve

- The hypothesis questions the existence of a long-run inverse relationship between the rate of unemployment and the rate of inflation.
  - Figure 35.11 explains how a short-run tradeoff exists, but not a long-run tradeoff.
- This view is that the economy is generally stable at its natural rate of unemployment (or full-employment rate of output).
  - Any rate of inflation is consistent with the natural rate of unemployment prevailing at that time.
    * the natural rate of unemployment is the unemployment rate when cyclical unemployment rate is zero.
    * is the rate when the economy achieves it potential output.

- **Short-Run Phillips Curve**
  - In the short run we assume that people form their expectations of future inflation on the basis of previous and present rates of inflation and only gradually change their expectations and wage demands.
  - Refer to figure 35.11
  - We begin at point $a_1$,
    * Nominal wages are set on the assumption that the 3% inflation rate will continue and a 5% natural rate of unemployment.
* Workers will negotiate wage contracts so that their new wages could offset the increase in inflation.

- Suppose the Fed has decided to move the AD curve to the right even faster than before and the inflation rate rises to 6%.

* Higher product prices raise business profits and thus firms hire more workers to increase output.

* In the short run, the economy moves to $b_1$,
  - to get a lower rate of unemployment (4%) and a higher rate of inflation (6%).

- The move from point $a_1$ to $b_1$ is consistent both with an upward-sloping AS curve and with the inflation-unemployment trade-off of Phillips Curve, and we obtain the following principle:
  * when the actual rate of inflation is higher than expected, profits temporarily rise and the unemployment rate temporarily falls.

- **Long-Run Vertical Phillips Curve**

  - Fully anticipated inflation by labor in the nominal wage demands of workers generates a vertical Phillips Curve. This occurs over time.

  - At point $b_1$, workers will recognize that their nominal wages have not increased as fast as inflation and demand higher wages.

  * Business profits will fall and thus the motivation to employ more workers and increase output has disappeared.
– unemployment rate then returns to its natural level at point $a_2$
  * The economy now faces a higher actual and expected rate of inflation – 6%.
– The short-run Phillips Curve shifts upward from $PC_1$ TO $PC_2$
– The scenario repeats if AD continues to increase
  * In the short run, the economy could move from $a_2$, to $b_2$,
  * Thereafter, it will move to $a_3$ and the short-run Phillips Curve shifts upward from $PC_2$ to $PC_3$
– The economy is characterized by the vertical line through $a_1$, $a_2$, and $a_3$ – the long-run vertical Phillips curve.
  * This shows the long-run relationship between unemployment and inflation in which the unemployment-rate-inflation-rate trade-offs simply does not exist in the long run.

• **Disflation**

– The economy now is at point $a_3$ where the inflation rate us 9%.
– Suppose AD shifts to the right faster than AS so that inflation rate drop from 9% to 6%.
  * Business profits will fall because prices are rising less rapidly than wages.
  * Firms reduce their employment and thus the unemployment rate rises.
  * In the short run, the economy could move from $a_3$ to $c_3$, and we obtain the following principle:
when the actual rate of inflation is lower than expected,
profits temporarily fall and the unemployment rate
temporarily rises.

– Firms and workers eventually adjust their expectations to the
new 6% rate of inflation, and thus newly negotiated wage
increases decline.

* Profits are restored, employment rises, and the
unemployment rate falls back to its natural rate of 5% at $a_2$,
* The short-run Phillips Curve shifts downward from $PC_3$ to
$PC_2$.

– The scenario repeats if AD shifts to the right faster than AS
declines

* In the short run, the economy could move from $a_2$ to $c_2$,
* Thereafter, it will move to $a_1$ and the short-run Phillips
Curve shifts downward from $PC_2$ to $PC_1$

• Interpretations of the Phillips Curve have
changed dramatically over the past three decades

– The original idea of a stable tradeoff between inflation and
unemployment has given way to other views that focus more on
long-run effects.

– Most economists accept the idea of a short-run tradeoff-where
the short run may last several years-while recognizing that in
the long run such a tradeoff is much less likely.
Taxation and Aggregate Supply

- Economic disturbances can be generated on the supply side, as well as on the demand side of the economy.
  - “Supply-side” economists or “Supply-siders” stress that changes in AS are an active force in determining the level of inflation, unemployment, and economic growth.
  - advocate policies that can either impede or promote rightward shifts of the short-run and long-run AS curves to promote output growth.
  - Certain government policies may reduce the growth of aggregate supply.

They argue that:

- The U.S. tax transfer system has negatively affected incentives to work, invest, innovate and assume entrepreneurial risks.
  * High tax rates impede productivity growth and hence slow the expansion of long-run AS.
  * To induce more work government should reduce marginal tax rates on earned income.
  * Unemployment compensation and welfare programs have made job loss less of an economic crisis for some people. Many transfer programs are structured to discourage work.
- The rewards for saving and investing have also been reduced by high marginal tax rates. A critical determinant of investment
spending is the expected after-tax return.

- Lower marginal tax rates may encourage more people to enter the labor force and to work longer. The lower rates should reduce periods of unemployment and raise capital investment, which increases worker productivity. Aggregate supply will expand and keep inflation low.

- Supply-siders focus on marginal tax rates - the rate on extra dollars of income - to affect the benefits from working, saving, or investing more.
  - In 2008, the marginal tax rates varied from 10 to 35% in the U.S., see Table 4.1.

- **Taxes and Incentive to Work**
  - Lower marginal tax rates on earned incomes induce more work, and therefore increase aggregate inputs of labor.
  - Lower marginal tax rates increase the after-tax wage rate and make leisure more expensive and work more attractive.

- **Incentive to Save and Invest**
  - High marginal tax rates reduce the rewards for saving and invest.
  - Thus, supply-siders recommend lower marginal tax rates on interest earned from saving.
  - They recommend lower tax rates on income from capital to ensure that there are ready investment outlets for the economy’s enhanced pool of saving.
• **The Laffer Curve** is an idea relating tax rates and tax revenues. It is named after economist Arthur Laffer, who originated the theory. (See Figure 35.12)

  – As tax rates increase from zero, tax revenues increase from zero to some maximum level (at m) and then decline.
  – Tax rates above or below this maximum rate will cause a decrease in tax revenue.
  – Laffer argued that tax rates were above the optimal level and by lowering tax rates government could increase the tax revenue collected.

    * Supply-side tax cuts need not produce Federal budget deficits.
  – Higher tax rates discourage economic activity, thereby shrinking the tax base.
  – lower tax rates stimulate incentive to work, save, and invest, innovate, and accept business risks, thus would trigger an expansion of real output and income enlarging the tax base.

    * The main impact would be on supply rather than aggregate demand.
  – CONSIDER THIS: **Sherwood Forest**

    * Laffer likened the paying of taxes to passing through Sherwood Forest.

      - To avoid Robin Hood’s “taxation,” people avoided going through the forest whenever possible.
· If Robin Hood had confiscated only a portion, his band’s revenue might have been higher as less people would have avoided or evaded the forest (taxes).

* Similarly, taxpayers will lower their taxable income by reducing work hours, retiring earlier, saving less, and engaging in tax avoidance and tax evasion activities.

• **Supply side economists offer two additional reasons for lowering the tax rate**

  – Tax avoidance (legal) and tax evasion (illegal) both decline when taxes are reduced.

  – Reduced transfers-tax cuts stimulate production and employment, reducing the need for transfer payments such as welfare and unemployment compensation.

• **Criticisms of the Laffer Curve**

  – There is empirical evidence that the impact on incentives to work, save and invest are small.

  – Tax cuts also increase demand, which can fuel inflation. Demand impacts may exceed supply impacts.

  – The Laffer Curve (Figure 35.12) is based on a logical premise, but where the economy is actually located on the curve is an empirical question and difficult to determine. It may be hard to know in advance the impact of a tax cut on supply.
LAST WORD: Do Tax Increases Reduce Real GDP?

• Christina Romer and David Romer, two Economists at the University of California-Berkeley, find evidence that suggests a tax increase will reduce real GDP.

• By identifying the reason for the tax change, in conjunction with output movements, they hope to identify a causal relationship between these tax changes and output movements.

• Their results suggest that a tax increase of 1 percent of real GDP lowers real GDP by 2 to 3 percent. The evidence also suggests that these output deviations are relatively permanent.

• However, it does appear that the intent of the tax increase matters. If the tax increase is to reduce the deficit this tends to have a less negative effect on economic activity.