The Production Function

**Definition**

*Production function*: The relationship between the level of output of a good and the factors of production that are inputs to production.

*Stock of capital* ($K$): The total of all machines, equipment, and buildings in an entire economy.

*Labor* ($L$): Human effort, including both physical and mental effort, used to produce goods and services.

- When there are only two factors of production, capital and labor, the production function is written as follows:

  \[ Y = AF(K, L) \]

- With capital fixed, output increases with labor input, but at a decreasing rate.
Total Factor Productivity (TFP)

Definition

Total Factor Productivity ($A$): measure of productivity; a higher value of $A$ means that the same inputs lead to more output.

- Basically TFP is a “catch-all” for anything that effects output other than $K$ and $L$.
  - Workweek of labor and capital
  - Quality of labor and capital
  - Regulation
  - Infrastructure
  - Competition
  - Specialization
  - Innovation
  - Strategy (entrepreneurial methods/new management techniques)
Labor Market Equilibrium: Wages and The Demand and Supply of Labor

- Together, the demand and supply curves determine the level of employment in the economy and the level of real wages.
- This is the labor market equilibrium: The quantity demanded for labor equals the quantity supplied.

**Definition**

- **Real wage**: The wage rate paid to employees adjusted for changes in the price level.
- **Labor demand curve**: A graph that illustrates the amount of labor that firms want to employ at each given wage rate.
- **Labor supply curve**: A graph that illustrates the amount of labor that households want to supply at each given wage rate.
The Classical View of the Labor Market

- Classical economists assumed that the wage rate adjusts to equate the quantity demanded with the quantity supplied, thereby implying that unemployment does not exist.

**Definition**

Classical models: Economic models that assume wages and prices adjust freely to changes in demand and supply.

Full-employment output: The level of output that results when the labor market is in equilibrium and the economy is producing at full-employment.

- At equilibrium, the people who are not working have chosen not to work at that market wage. There is always full-employment in this sense.

- Classical economists believe that the labor market always clears.
Some economists argue that the unemployment rate is not a good measure of whether the labor market is working well. The economy is dynamic and at any given time some industries are expanding and some are contracting.

A positive unemployment rate as measured by the government does not necessarily indicate that the labor market is working poorly. The measured unemployment rate may sometimes seem high even though the labor market is working well.

Economists who view unemployment this way do not see it as a major problem. There are other views of unemployment, as we will now see.
Explaining the Existence of Unemployment and Social (Implicit) Contracts

**Definition**

- **Sticky wages**: The downward rigidity of wages as an explanation for the existence of unemployment.
- **Social (implicit) contracts**: Unspoken agreements between workers and firms that firms will not cut wages.
- **Relative-wage explanation of unemployment**: An explanation for sticky wages (and therefore unemployment): If workers are concerned about their wages relative to other workers in other firms and industries, they may be unwilling to accept a wage cut unless they know that all other workers are receiving similar cuts.
- **Explicit contracts**: Employment contracts that stipulate workers’ wages, usually for a period of 1 to 3 years.
- **Cost-of-living adjustments (COLAs)**: Contract provisions that tie wages to changes in the cost of living. The greater the inflation rate, the more wages are raised.
The classical idea that wages adjust to clear the labor market is consistent with the view that wages respond quickly to price changes.

In the absence of sticky wages, the AS curve will be vertical.

In this case, monetary and fiscal policy will have no effect on real output.

Indeed, in this view, there is no unemployment problem to be solved!
Efficiency Wage Theory

Definition

Efficiency wage theory: An explanation for unemployment that holds that the productivity of workers increases with the wage rate. If this is so, firms may have an incentive to pay wages above the market-clearing rate.

- Empirical studies of labor markets have identified several potential benefits that firms receive from paying workers more than the market-clearing wage. Among them are lower turnover, improved morale, and reduced “shirking” of work.

- Even though the efficiency wage theory predicts some unemployment, the behavior it is describing is unlikely to account for much of the observed large cyclical fluctuations in unemployment over time.
The standard unemployment benefits are managed by states and typically last for 26 weeks. In the recent recession the federal government has provided extended benefits to the unemployed, offering as much as an additional 47 weeks.

Part of the debate surrounding the so-called fiscal cliff in Congress involved whether these benefits should be continued.

In 2012 the average duration of unemployment was 39.4 weeks. Following the 1980–1982 recession, the average duration peaked at 20.0 weeks in 1983, and following the 1990–1991 recession, it peaked at 18.8 weeks in 1994.
Imperfect Information

- Firms may not have enough information at their disposal to know what the market-clearing wage is.
- In this case, firms are said to have imperfect information.
- If firms have imperfect or incomplete information, they may simply set wages wrong – wages that do not clear the labor market.
The authors of a recent paper conducted an interesting experiment to try to figure out what long-term unemployment does to one’s eventual job prospects.

They sent out fictitious job resumes to real job postings in 100 U.S. cities. Over 12,000 resumes were sent in response to 3,000 job postings. Fictitious job applicants were randomly assigned unemployment durations of 1 to 36 months. The researchers then tracked “call backs” to these resumes.

The result? Call backs decreased dramatically as a response to unemployment duration. This effect was especially strong in cities that had strong job markets. The researchers suggested that employers were likely inferring low worker quality based on long duration of unemployment.
Minimum Wage Laws

Definition

Minimum wage laws: Laws that set a floor for wage rates – that is, a minimum hourly rate for any kind of labor.

- Currently, the federal minimum wage was $7.25 per hour. If some teenagers can produce only $6.90 worth of output per hour, no firm would be willing to hire them.
  - In the 2014 State of the Union address, President Obama called on Congress to raise the national minimum wage from $7.25 to $10.10 an hour. LINK
- More on minimum wage:
  - City Council raises Chicago minimum wage to $13 by 2019
  - San Francisco became the second U.S. city to raise its minimum wage to $15 an hour after Seattle.
- The aggregate labor market is very complicated, and there are no simple answers to why there is unemployment. Which argument or arguments will win out in the end is an open question.
The Labor Market & Production Function

Aggregate Supply

State and Local Minimum Wage Rates: 2015

Top # = state's hourly minimum wage rate
Bottom # = minimum cash wage for tipped employees

- Nevada: If a Nevada employer offers a qualified health plan, the minimum wage is $7.25 an hour.

Source: Restaurant.org/Advocacy
Do European Soccer Stars Change Clubs to Reduce Their Taxes?

- What evidence is there that taxes on high paid soccer stars in Europe affect their location decisions among countries?
  - In 2009, a Portuguese soccer star moved from Manchester United in the United Kingdom to Real Madrid in Spain. Many speculated that the reason he moved was to avoid a top United Kingdom tax rate of 50 percent in favor of a flat 24 percent rate (with no deductions) created to entice foreigners to locate in Spain. While this is an interesting anecdote, is there any other evidence that the very top earners will move to countries with lower tax rates?
  - In an interesting study, economists Henrik Jacobsen Kleven, Camille Landais, and Emmanuel Saez used changes in the market for international soccer stars to test for the effects of tax rates. Prior to 1995, the top European soccer clubs had limits on the number of foreign players on any one team. The European Court of Justice, however, ruled that these limits violated the treaty of the European community. The economists found that prior to 1995, taxes on high earners did not have much effect on mobility of soccer stars, but after 1995, top tax rates did matter.
  - This type of evidence suggests that countries may not only be in competition for top athletes, but also for other highly paid individuals – from tennis players to corporate executives.
Aggregate Supply and Time Frame

- Aggregate supply refers to the quantity of goods and services that firms are willing and able to supply.
- The relationship between this quantity and the price level is different in the long- and short-run.
  - So we will develop both a short-run and long-run aggregate supply curve.

**Definition**

**Long-run aggregate supply curve**: A curve that shows the relationship in the long run between the price level and the quantity of real GDP supplied.
In the long run, the level of real GDP is determined by the number of workers, the level of technology, and the capital stock (factories, machinery, etc.).

- None of these elements are affected by the price level.

- So the long-run aggregate supply curve does not depend on the price level; it is a vertical line, at the level of potential or full-employment GDP.
Short-Run Aggregate Supply Curve

- While the LRAS is vertical, the SRAS is upward sloping. Why?
  - As prices of final goods and services rise, prices of inputs – such as the wages of workers or the price of natural resources – rise more slowly.
  - A secondary reason is that some firms are slow to adjust their prices when the price level rises or falls.
- Economists tend to believe that some firms and workers fail to accurately predict changes in the price level.
- Based on this, there are three potential explanations for why the SRAS curve is upward-sloping:
  1. Contracts make some wages and prices “sticky”
  2. Firms are often slow to adjust wages
  3. Menu costs make some prices sticky
Why is the SRAS Curve Upward Sloping?

1. Contracts make some wages and prices “sticky”
   - Prices and wages are said to be “sticky” when they do not respond quickly to changes in demand or supply.
   - Some firms and workers fail to predict price level changes, and hence do not correctly build them into long-term contracts.

2. Firms are often slow to adjust wages
   - Annual salary reviews are “normal”, for example.
   - Also, firms dislike cutting wages – it’s bad for morale.

3. Menu costs make some prices sticky
   - Altering prices is sometimes costly in itself. Firms have menu costs when it costs them money to change prices, for example by having to print new catalogs. A small “optimal” change in price may not be worth the hassle for a firm to perform.
There is disagreement among economists about how sticky wages and prices actually are. To examine this, it is best to look at individual worker-level data. Some recent studies have done this, finding firms are reluctant to cut workers (nominal) wages. Instead, they:

- Offer lower salaries to new hires
- Fire current workers
- Decreases raises or freeze pay

The graph shows the percentage of workers with no wage change in a given year.
Shifts of the SRAS Curve vs. Movements along It

- The short-run aggregate supply curve describes the relationship between the price level and the quantity of goods and services firms are willing to supply, holding constant all other variables that affect the willingness of firms to supply goods and services.
- A change in the price level not caused by factors that would otherwise affect short-run aggregate supply results in a movement along a stationary SRAS curve.
- But some factors cause the SRAS curve to shift; we will consider them in turn.
SRAS Shifts: Factors of Production and Technology

- An increase in the availability of the factors of production, like labor, allows more production at any price level.
- A decrease in the availability of factors such as labor decreases SRAS.
- Improvements in technology allow productivity to improve, and hence the level of production at any given price level.
SRAS Shifts: Expected Future Prices

- If workers and firms believe the price level will rise by a certain amount, they will try to adjust their wages and prices accordingly.

- Widely-held expectations of future price-level increases are self-fulfilling.
SRAS Shifts: Adjustments to Errors in Past Expectations

- Workers and firms sometimes make incorrect predictions about the price level.
- As time passes, they will attempt to compensate for these errors.
- Suppose everyone failed to predict an increase in the price level. Prices rise, therefore so does output.
- Then once firms and workers notice the rising prices, they update their expectations and increase their price demands, decreasing short-run aggregate supply.
SRAS Shifts: Unexpected Changes in Prices of Resources

- A supply shock is an unexpected event that causes the short-run aggregate supply curve to shift.

- Example: Oil prices increase suddenly. Firms immediately anticipate rising input prices, and as a consequence will only produce the same amount of output if their own prices rise.

- Unexpected input price increases decrease SRAS; unexpected input price decreases would shift SRAS to the right instead.
In the long run, we expect the economy to produce at the level of potential GDP; i.e., the LRAS level.

So the long-run macroeconomic equilibrium occurs when the AD and SRAS curves intersect at the LRAS level.

Our next task is to explain why long-run macroeconomic equilibrium cannot occur at any other level of output.
Long-Run Macroeconomic Equilibrium

- Suppose that interest rates rise. AD moves left because:
  - Firms and households reduce their planned investments, decreasing aggregate demand.
  - Workers lose their jobs, and firms experience decreases in sales.
  - Workers become willing to accept lower wages, and firms expect lower prices for their output.
- So the SRAS curve moves to the right, with goods and services sold for lower prices, until we return to full-employment.
Does It Matter What Causes AD to Fall?

- GDP has four components; an decrease in any of the four could cause a recession. Does it make any difference which component causes the recession?
  - Most post-WWII recessions in the U.S. have been preceded by falls in residential construction.
  - Recent research suggests that recessions caused by financial crises tend to be larger and more long-lasting than declines due to other factors.
Suppose that firms become more optimistic about the future.

- They increase their investment, shifting $AD$ to the right.
- Unemployment falls below its natural rate, forcing employers to pay more; the increased demand for goods raises prices.
- Firms and workers raise their expectations about the price level, shifting $SRAS$ to the left – restoring long-run equilibrium.
Supply Shock

- In the previous analyses, $AD$ moved suddenly. What if instead $SRAS$ moved suddenly? We call this a supply shock.

- For example, suppose a sudden increase in oil prices shifts $SRAS$ to the left.
  - This causes stagflation, a combination of inflation and recession, usually resulting from a supply shock.

- With the lower level of output, people are unemployed and products go unsold.
  - Workers accept a lower wage, and firms decrease prices in order to clear inventories.

- With the decrease in expectations about prices, $SRAS$ moves to the right, restoring long-run equilibrium.

- How long does it take to restore full employment?
  - It depends on the severity of the supply shock, but it is likely to take several years.

- An alternative to waiting this long is to use fiscal or monetary policy to increase aggregate demand.
  - This will result in permanently higher prices but may be worth the cost.
Forecasts for Returning to Potential GDP

- After the 2007-2009 recession, different groups estimated how long it would take to return to potential GDP.
- In 2011, the White House and the Congressional Budget Office estimated that we would return to full employment by 2016.
- The Federal Reserve disagreed, believing it would take even longer.
- For comparison, the second worst post-Depression recession was in 1981–1982; recovery then took less than three years.
Forecasts for Returning to Potential GDP

- How accurate were these forecasts? It turns out, they were too optimistic.
- Economists still disagree about why the U.S. economy was taking so long to return to potential GDP; we will discuss this in later chapters.

<table>
<thead>
<tr>
<th>2011 Estimates of 2013 Output Gap</th>
<th>Actual Output Gap</th>
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<tbody>
<tr>
<td>White House</td>
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<tr>
<td>3.8%</td>
<td>5.4%</td>
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<tr>
<td>CBO</td>
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<tr>
<td>2.7%</td>
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<tr>
<td>Federal Reserve</td>
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</tr>
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<td>2.1%</td>
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The usual cause of inflation is total spending increasing faster than production.

- $AD$ moves further right than does $LRAS$.
- $SRAS$ moves to the right; but the anticipated rise in the price level causes it to move less far than $LRAS$.
- Long-run equilibrium is restored but with a higher price level.