ECON 303: Intermediate Macroeconomics Lecture Notes

Aina Katsikas, M.S.

Department of Economics, University of Nevada, Reno

Summer 2022: First Session

Course Outline

These lecture notes are adapted from Macroeconomics by Acemoglu, Laibson & List 3rd edition.

1. Week 1
    - Economic Growth
        - The Power of Economic Growth
        - What fuels Economic Growth?
        - The Malthusian Model
        - The Solow Growth Model
    - World Development
        - Proximate vs. Fundamental Causes of Prosperity
        - Institutions and Economic Development
2. Week 2
    - Employment and Unemployment
        - Measuring Employment and Unemployment
        - Equilibrium in the Labor Market
        - Voluntary and Frictional Unemployment
        - Wage Rigidity and Structural Unemployment
        - Cyclical Unemployment and the Natural Rate of Unemployment
    - Credit Markets

1 Week 1

1.1 Economic Growth

The United States real Gross Domestic Product (GDP) per capita today is about 25x what it was in 1820. In the 1800s, only a small fraction of the population lived in urbanized areas, most

individuals worked in agriculture. The United States has experienced significant economic growth over the past 200 years. This has contributed to the growth in real GDP per capita. In this unit, we'll address how and why we have achieved this kind of significant economic growth.

Quick Review from Previous Topics: Real vs. Nominal GDP

Real GDP is the total value of production (final goods and services), using market prices from a specific base year to determine the value of each unit that is produced.

Nominal GDP is the total value of production (final goods and services), using current market prices to determine the value of each unit that is produced.

Real GDP is the GDP of a country after being adjusted for inflation. For example, if a country's GDP is $100 in 2001 and $500 in 2021, this could be due to inflation. This increase in GDP may not accurately reflect economic growth. Therefore, we adjust for inflation to get a more "true" estimate of the GDP. After adjusting for inflation, the real GDP is typically lower than the nominal GDP. The inflated GDP value is also referred to as "nominal GDP." To compute this year's real GDP, we multiply this year's production by the base year's prices. The base year is typically a year way back in the past, as designated by the Bureau of Economic Analysis. For example, the currently designated base year is 2012.

The GDP Deflator is 100 times the ratio of nominal GDP to real GDP in the same year. It is a measure of how prices of goods and services produced in a country have risen since the base year. For example, computing the GDP deflator of 2020, assuming a base year of 2009, looks like this:

$$GDPDeflatorof2020 = \frac{NominalGDPof2020}{RealGDPof2020} * 100$$

$$GDPDeflatorof2020 = \frac{900,000}{700,000} * 100$$

$$GDPDeflatorof2020 = 128.6$$

Therefore, this can be interpreted as "Prices have increased by 28.6% since 2009." The "base year" used in adjusting for inflation is commonly referred to as "constant dollars."

The Power of Economic Growth

The U.S. economy has significantly grown from 1820 to 2016. Economists like to measure this in terms of real GDP per capita. The "per capita" metric of something is measured as the total amount (of whatever we are measuring) divided by the total population. For example, the GDP per capita in the United States is computed as:

$$RealGDPperCapita = \frac{TotalRealGDP}{Population}$$

Economic growth is the increase in real GDP per capita of an economy. As we can tell from the graph below, the growth in real GDP has not been constant. We can see that there has been an increase in GDP overall, but there have been several downward trends, such as the Great Depression in the 1930s. These downward trends are referred to as "contractions." However, these contractions are typically temporary, as was the Great Depression.

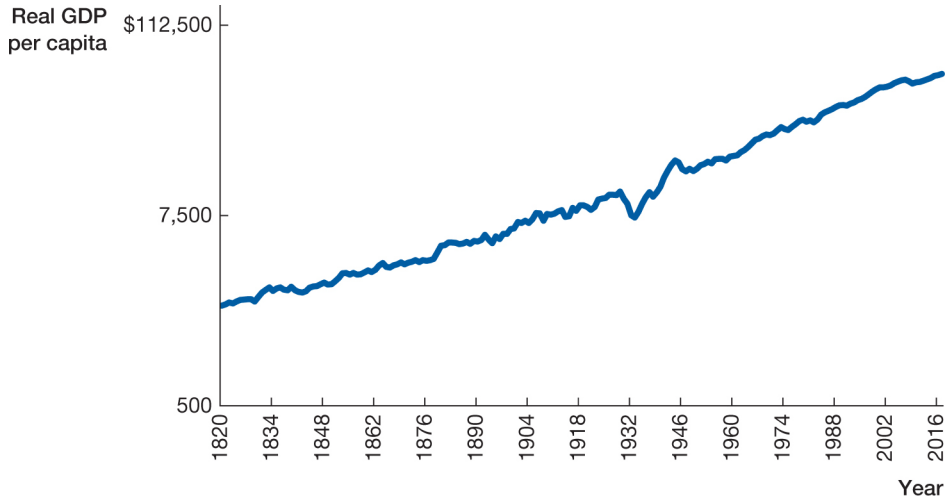

Figure 1.1: Real GDP per Capita in the United States (2011 Constant Dollars)

Real GDP per capita has increased significantly. For example, it was $2,806 in 1820 compared to $14,655 in 1950 and $50,752 in 2014. These values are all in 2011 constant dollars.

A growth rate is the change in quantity between two dates, relative to the baseline quantity (quantity at the initial date). This is the formula to compute a growth rate (in percent):

$$Growth_{t,t+1} = \frac{y_{t+1} - y_t}{y_t} * 100$$

Where:

- y_{t+1} = GDP in next period
- y_t = GDP in previous period

Let's do an example and compute the growth rate of the real GDP per capita from 2005 to 2006.

$$Growth_{2005,2006} = \frac{\$51,374 - \$50,512}{\$50,512} * 100$$

$$Growth_{2005,2006} = 0.017 * 100$$

$$Growth_{2005,2006} = 1.7\%$$

Therefore, the real GDP per capita grew by 1.7% from 2005 to 2006. It is important to note that the annual growth rate of real GDP per capita can be positive over a period, even if there are some economic contractions in that period. For example, we can see this in the graph below, the annual growth rate of real GDP per capita from 1950 to 2014 was 2.03%. However, there were several economic fluctuations in that time period. This 2.03% represents the average annual growth rate in those 64 years.

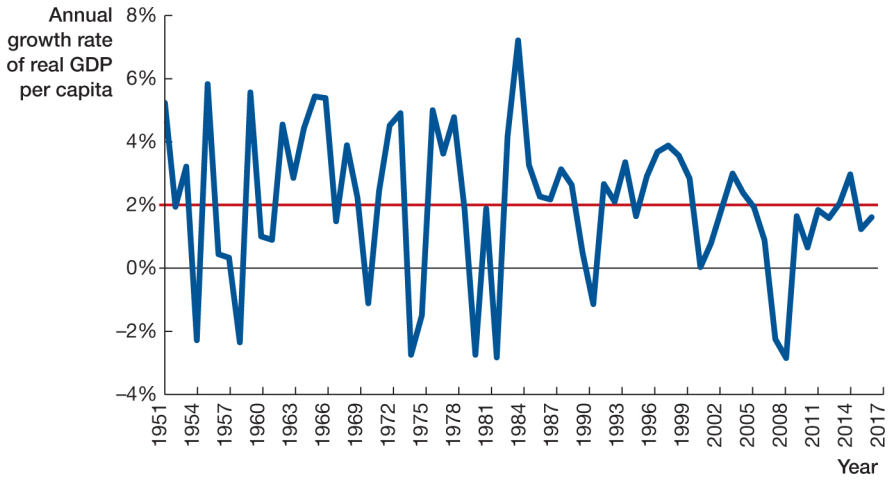

Figure 1.2: The Annual Growth Rate of Real GDP per Capita in the United States Between 1950 and 2014 (2011 Constant Dollars)

Now that we understand the concept of a growth rate, we can understand the idea of exponential growth. **Exponential growth** is where the growth process can be described by a constant growth rate. More importantly, exponential growth is the idea that new growth builds on past growth, with compounding effects. This is one reason why we see such a vast difference in GDP per capita values across countries. Some countries experience exponential growth but others do not. Exponential growth is computed differently from just a straightforward growth rate. For example, the formula that we use to compute the new GDP given an exponential growth rate is the following:

$$NewGDP = (initialGDP) * (1 + g)^n$$

Where:

- g = constant growth rate
- n = number of years

For example, let's compute the GDP after 15 years, assuming a constant growth rate of 5%, and an initial starting GDP of $2.

$$NewGDP = (2)(1 + 0.05)^{15}$$
$$NewGDP = (2)(1.05)^{15}$$
$$NewGDP = 2 * 2.0789$$
$$NewGDP = 4.1578$$

Therefore, the GDP after 15 years, with a constant growth rate of 5%, will have increased by 2.0789. Then we multiply this value and the initial starting GDP of 2.0, to get the new GDP after 15 years of 4.1578.

I want to show you why the exponential growth rate is so important to understand, and why countries benefit so much from this idea of exponential growth. Let's do an example, using the same formula, and compute the exponential growth after two individual years (from year 1 to year 2, and from year 2 to year 3), given a constant growth rate of 5%, and a initial starting GDP in 2.0.

$$NewGDP = (2)(1 + 0.05)^{1}$$
$$NewGDP = (2)(1.05)^{1}$$
$$NewGDP = 2 * 1.05$$
$$NewGDP = 2.10$$

Year 2 GDP is 2.10. Now we'll compute the new GDP after the second year. This time, our "initial GDP" is 2.10. This is because we are now measuring the growth from year 2 to year 3. Year 2 is now the initial year.

$$Year3GDP = (2.10)(1 + 0.05)^{1}$$
$$Year3GDP = (2.10)(1.05)^{1}$$
$$Year3GDP = 2.10 * 1.05$$
$$Year3GDP = 2.205$$

We can see that from Year 2 to Year 3, GDP increased by 2.205 - 2.10 = 0.105. From Year 1 to Year 2, GDP only increased by 2.10 - 2.0 = 0.100. Therefore, even though both increases correspond to a 5% growth rate, there was a compounding effect resulting in a higher increase from Year 2 to Year 3 compared to the increase from Year 1 to Year 2.

When there is exponential growth, it is much better to represent this on a graph using a proportional scale. The figure on the top is using a proportional scale whereas the figure on the bottom is using a nonproportional scale.

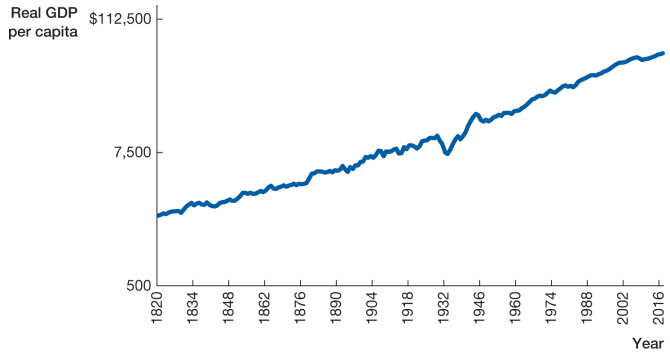

Figure 1.3: Real GDP per Capita in the United States (2011 Constant Dollars) (Proportional Scale)

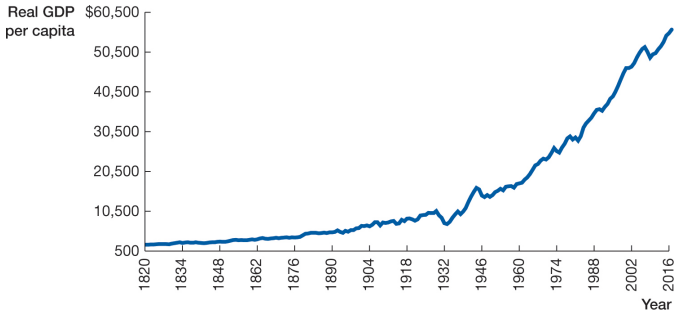

Figure 1.4: The Annual Growth Rate of Real GDP per Capita in the United States Between 1950 and 2014 (2011 Constant Dollars) (Nonproportional Scale)

A constant growth rate of 10% with an initial value of 1000 would yield a final value of 1100. However, a constant growth rate of 10% with an initial value of 100,000 would you hold a final value of 110,000. Those two increments are vastly different, one is 100, the other is 10,000, however they are the same with regards to the proportion of the base value, which is 10%. Therefore, the proportional scale on a graph shows this change where the constant growth rate of 10% corresponds to the same distance on the Y axis regardless of whether we start at an initial value of 1000 or an initial value of 100,000. Therefore, using a non-proportional scale could be misleading. You can see in the non-proportional scale figure that it seems as though the GDP is accelerating, even though the growth rate is constant.

It is important to understand the general patterns of GDP grows across several countries. From looking at the table below, we can compare GDP growth for various countries. This year should

be "2014" instead of "2017." The implied annual growth rate shows how much on average each country needed to grow each year in order to reach the 2014 level given the starting 1960 level.

Country	Real GDP per Capita		Implied (Average) Annual Growth
	1960	2017	
United States	$17,600.11	$56,153.42	2.07%
United Kingdom	$11,959.49	$42,137.82	2.25%
France	$10,465.52	$40,975.05	2.43%
Mexico	$5,741.75	$18,360.42	2.01%
Spain	$5,741.40	$37,232.80	3.35%
Nicaragua	$4,476.47	$5,360.22	0.32%
Ghana	$2,816.50	$5,153.55	0.37%
Singapore	$2,663.43	$79,842.57	6.16%
Brazil	$2,463.11	$14,108.92	3.29%
Democratic Republic of the Congo	$2,422.75	$798.68	–2.03%
Guatemala	$2,418.48	$7,473.34	2.06%
Kenya	$1,749.13	$2,987.50	0.94%
South Korea	$1,175.10	$37,725.07	6.37%
China	$1,154.19	$13,051.32	4.56%
India	$1,033.67	$6,281.54	3.23%
Rwanda	$962.58	$1,948.49	1.24%
Botswana	$427.35	$16,235.75	6.60%

Figure 1.5: GDP per capita and growth in selected countries parentheses PPP adjusted 2011 constant dollars

In this case PPP stands for "purchasing power parity." Purchasing power parity is the application of evaluating GDP in each country by looking at a specific basket of goods to get a fair comparison of the cost of living standards across countries. The implied annual growth rate in the third column shows how much on average each country needed to grow each year in order to reach the 2014 level given the starting 1960 number. From these comparisons, we can see how countries stack up against each other. For example, both the United States and the United Kingdom show an average annual growth rate of about 2% in this time period. There's also been an even greater increase in GDP per capita for Singapore, Spain, South Korea, Botswana, and China. All five of these countries were significantly poor in the United States in 1960, but they closed the gap by 2014.

We can also see that other nations who did not fare well in closing this wealth gap, such as Mexico, Brazil and India. Other countries, such as Guatemala, Kenya, Ghana, Rwanda, and Nicaragua have become relatively poor over the same time.

We can see that Nicaragua's GDP actually declined at a rate of 0.32% per year, while the democratic republic of Congo has seen a decline of 2.03% per year. As a result, both countries are worse off in 2014 compared to 1960, and this is mostly due to the decades of Civil War and political turmoil. We can see that Nicaragua's GDP is increasing at a decreasing rate, whereas the

Democratic republic of Congo's GDP decreased overall in that same time.

Catch-up growth refers to the idea where a relatively poor nation increases its income by taking advantage of knowledge and technologies already invented by other countries, that are more advanced. These countries are trying to "catch up" to other countries, by benefiting from their technological advances. Japan is a good example of "catch up" growth because Japan's initial growth was very high. During the period between 1911 to 1940, Japan was the fastest-growing economy in the world. It invested heavily. After the Second World War, however, Japan's economy was destroyed. The country rebuilt a sustainable environment for economic growth during the 1950s and began importing machinery and technology from the United States. It clocked incredible growth rates in the period between 1960 to the early 1980s.

Even as Japan's economy powered forward, the United States' economy, which was a source for much of Japan's infrastructural and industrial underpinnings, hummed along. Then by the late 1970s, when the Japanese economy ranked among the world's top five, its growth rate had slowed down. It saw high growth in GDP as it "caught up" to other nations. However, this declined in later years once Japan "caught up" to other countries.

Sustained growth refers to the idea where a country's real GDP per capita grows at a positive and steady rate for long periods of time. The U.S. and the U.K. are good examples of sustained growth because they have maintained positive, steady rates of growth.

What fuels economic growth?

In order to understand the drivers behind economic growth, we first need to understand the aggregate production function. This function links the two factors of production, which is physical capital (K) and efficiency units of labor (H). It also takes into account a country's technology level (A). Technology captures the level of productivity that comes from innovations as well as the efficiency of production. When technology improves, the aggregate production function increases. This is because, if we improve our technology, but are using the same levels of physical capital and labor, we'll be able to produce more overall, just because the technology has improved.

$$Y = A * F(K, H)$$

The stock of physical capital in a country includes the value of all equipment, such as machines, cars, planes, and computers. It also includes the value of structures, like buildings. This physical capital stock can be increased by investment, known as physical capital accumulation. This is the basic idea that after building one structure, you can build the next. You don't have to start "from scratch." Therefore, you can accumulate capital, and your overall value of capital stock will build overtime.

The national income accounting identity is computed as the following:

$$Y = C + I + G + X - M$$

Where:

- Y = GDP
- C = consumption (household expenditures on consumption of goods and services)
- I = investment (expenditures on investment goods by private agents)
- G = government purchases of goods and services
- X = exports
- M = imports

In a closed economy, there are no exports or imports, therefore X = M = 0. Another way to interpret investment in a closed economy is to understand that investment comes directly from savings. In a closed economy, all income is either consumed or saved. Therefore, any investments would come from savings. We can further interpret this as, household savings will be then allocated to firms that will use them for investments. For example, banks take money deposit by households and lend this out to firms for investments. Consequently, nations with high overall savings rates can accumulate and invest in physical capital rapidly, and therefore increase in the aggregate production function, therefore increasing GDP.

The Importance of Savings

The national savings rate plays a huge role in economic growth. Although the government can invest its tax revenues into public infrastructures, the resources for these investments come from household savings. To understand the national savings rate, we need to understand the individual decisions that each household makes in choosing between consumption and savings. This is an important optimization decision to understand. Each household faces different priorities that influences decisions to consume income today versus save it for tomorrow. As with all optimization problems, these choices are affected by prices. In this case, the relevant price of savings is the interest rate. The interest rate determines the rate of return that a household expects on their savings.

Higher interest rates typically encourage higher savings. Also, expectations of future income growth will have an impact on the saving decision. For example, households that expect a significant increase in income in the future may have less reason to save money today. This is because, if they have optimistic expectations, they may be less likely to save for a "rainy day" today. These kind of trades determine the saving rate of an economy. The **saving rate** designates the fraction of income that is put towards savings.

We can compute the saving rate of an economy as the quotient of total saving and GDP. For example, the total savings in the economy in 2013 was 2.18 trillion, well the GDP was 16.8 trillion. Therefore, the saving rate was 12.98%.

$$SavingRate = \frac{Totalsaving}{GDP}$$

$$SavingRate = \frac{2.18trillion}{16.8trillion}$$
$$SavingRate = 0.1298$$

What contributes to sustained growth?

Technology is the primary driver of sustained growth. There is one reason why physical capital and labor cannot contribute to sustained growth, and that is the idea of diminishing marginal returns. Diminishing marginal returns is the idea that with every incremental increase in physical capital, comes a slightly smaller increase in overall GDP. Therefore, although more physical capital results in a higher GDP, it comes at a slower rate. The same goes for labor, although each new worker results in a higher output, it comes at a slower rate. This is very similar to the idea of "too many cooks in the kitchen." Those capital and labor exhibits diminishing marginal returns.

Technological change is the process of new technologies, goods, and services being invented, and using the economy. This enables the economy to achieve a higher level of real GDP given the physical capital and labor. Some examples of this might be the improvement in the computational power of computers, or the advent of the transistor, or the improvement in lighting technologies. Technological change can contribute to sustained growth because it occurs at a constant rate, rather than constant increments. New technology grows at an exponential rate, because it builds on previous technology. Therefore, technology does not suffer from diminishing marginal returns like physical capital and labor do.

The Malthusian Model

The Malthusian model is a dismal one, but it is one type of population growth model. The theory rests on the idea that food is necessary for subsistence, and that the world cannot simply provide enough food for its growing population. Thomas Malthus was a British philosopher, who was active in producing work in the late 1700s. Malthus argued that when the standards of living improved, couples within produce more children, increasing the fertility rate of a nation, but because real GDP cannot grow as fast as a population, this will then put downward pressures on the real GDP per capita. This will then contribute to a fall in real GDP per capita, which would trigger famines, wars, and overall higher mortality. He referred to this process as the **Malthusian cycle**. Although this seems ludicrous to an individual in the current century, this was actually a good representation of the world before 1800.

Around this time, fertility began to decline. We saw this primarily as countries transitioned from an agriculture based to an industry based economy. Families had fewer children, and societies underwent a process known as demographic transition. **Demographic transition** refers to the overall decline in fertility and number of children per family. Until the demographic transition in the nineteenth century, there were recurring Malthusian cycles. Many historians view this transition as a key ingredient in modern growth because it enables economies that experienced reduced fertility to break out of this Malthusian cycle and instead experience economic growth.

The Industrial Revolution

The **Industrial Revolution** was a gradual process. It was a series of innovations implemented in the production process that begin at the end of the 18th century in Britain. It is the start of the arrival of new machines and methods of production, starting in textile manufacturing and spreading to other sectors. The industrial revolution is important because it is a starting point of industrialization at that spread to many other countries. Countries that are rich today are those that have managed to achieve steady growth rate of the past 200 years. They are also the ones that benefited from the technologies brought about by this industrial revolution.

Many of the technologies that we take for granted today have been available to us over the past 250 years, including telecommunication, computers, electricity, etc. These advances are the result of exponential growth and technology since the Industrial Revolution. An important foundation that fuels this technological growth is investment in research and development (RD). The United States invests 2.79% of its real GDP in RD every year. Other countries invest even more, such as Israel at 4.66%, Switzerland at 3.0% and Sweden at 3.70%.

The Solow Growth Model

The Solow growth model is the primary model that economists use to formally study how GDP is determined. It is named after the economist, Robert Solow. The Solow model consists of three building blocks.

1. The aggregate production function. This function essentially links the GDP to three factors: physical capital, efficiency units of labor, and technology. Efficiency units of labor include the knowledge available to the economy and the efficiency of production, it has the potential to shift the entire aggregate production function.

$$Y = A * F(K, H)$$

2. The physical capital accumulation function. This function takes into account the value of physical capital in an economy, but also factors in the cost of depreciation, and also factors in the effect of investments.

$$K_{now} = K_{lastyear} - K_{depreciated} + I$$

$$K_{now} = K_{lastyear} - (Depreciationrate * K_{lastyear}) + I$$

$$K_{now} = (1 - d) * K_{lastyear} + I$$

Where:

- K_{now} is the physical capital stock this year.
- $K_{lastyear}$ is the physical capital stock last year.
- $(1 - d)$ is the fraction of physical capital stock that is not depreciate between the two years.
- $d * K_{lastyear}$ is the decline in the value of physical capital due to depreciation.
- I is the value of investments.

3. The household savings function. This function determines investments based on the savings rate and the total economy's output.

$$I = s * Y$$

Where:

- I is investment in the economy
- s aggregate savings rate
- Y total GDP

We can plug the aggregate production function into the household savings function and represent this in a graph.

$$I = s * A * F(K, H)$$

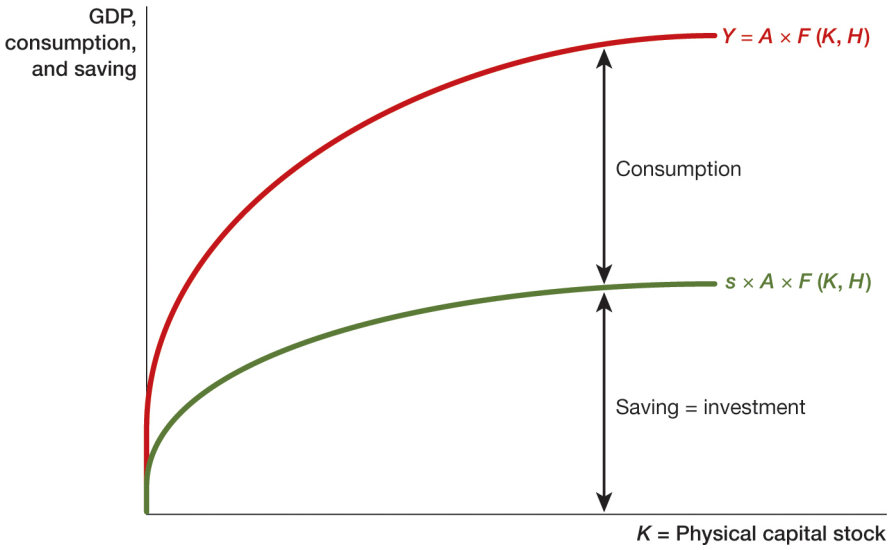

Figure 1.6: Aggregate Income and Aggregate Savings

The red curve represents the aggregate production function, which is represented by the relationship between the stock of physical capital for given levels of efficiency units of labor and technology. The green curve represents the relationship between investments and physical capital stock given the savings rate of household. It is the GDP times the savings rate. Therefore, the distance between the green curve and the X axis represents the aggregate saving or investment given a certain level of physical capital.

Steady State Equilibrium in the Solow Model

The **steady state equilibrium** is a natural situation that occurs when physical capital stock this year equals physical capital stock last year.

$$K_{now} = K_{lastyear} = K$$

We can combine this equation with the physical capital accumulation function to get the following:

$$K_{now} = (1 - d) * K_{lastyear} + I$$

$$K = (1 - d) * K + I$$

$$K = K - d * K + I$$

$$d * K = I$$

Therefore, the physical capital stock of the economy will only remain constant over time if the amount of investment (I) equals depreciated value of the physical capital stock, which is the depreciation rate of the economy(d) times the a capital stock (K).

Knowing this, we can put all of these ingredients together to determine the steady state equilibrium.

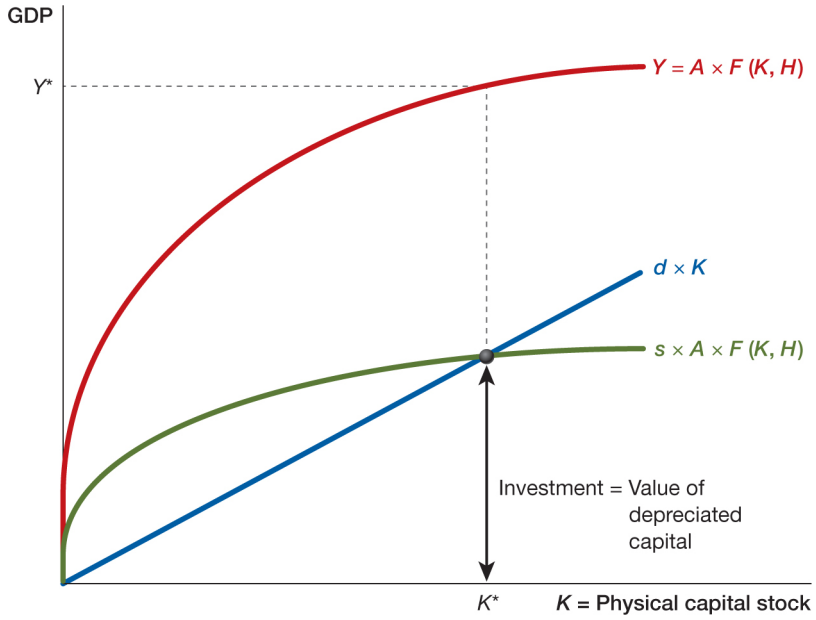

Figure 1.7: Steady State Equilibrium in the Solow Model

The steady state equilibrium is represented at the intersection of the green and blue curves. This point is the intersection of the savings curve and the investment necessary to replenish depreciated capital curve. Therefore, at the steady state equilibrium, we have a physical capital stock of K* and a GDP of Y*. Once we have the steady state equilibrium determined, we can use it to study the determinants of GDP.

Determinants of GDP

We have already discussed how the saving rate is a crucial determinant of the GDP. Let's see what happens graphically if the saving rate increases. We can compare two economies with the same aggregate production function, population and labor, but have different savings rates. In the graph below, the green line indicates a higher savings rate. The red line indicates a lower savings rate. By assumption, both economies have the same rate of depreciation. The economy with the higher savings rate will have a steady state equilibrium to the right and above the economy with the red savings rate. An increased saving rate indicates that the physical capital stock increases to the new amount of K**, and the GDP also increases to the new amount of Y**.

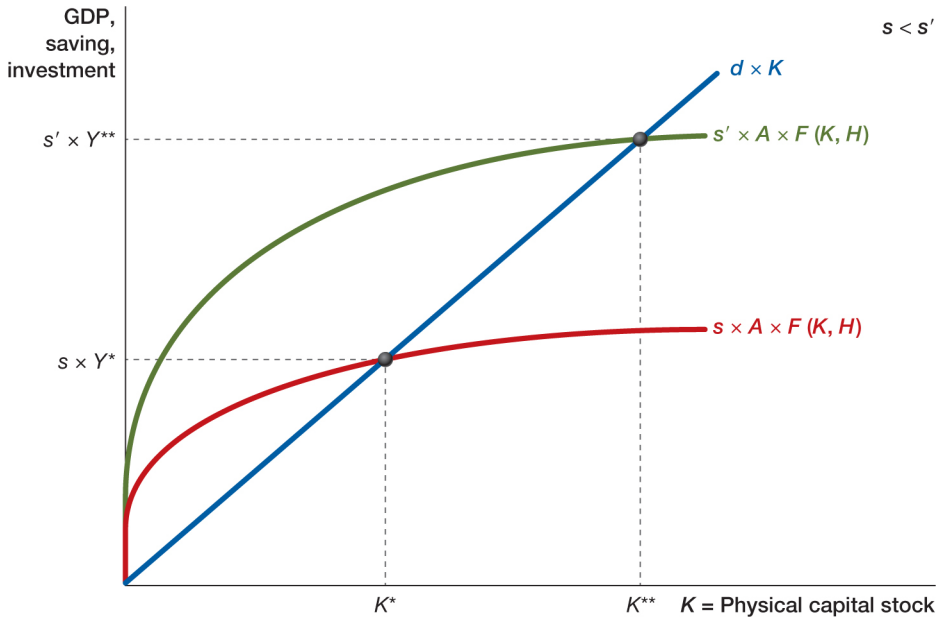

Figure 1.8: The Impact of the Saving Rate on the Steady State Equilibrium

Although a higher saving rate can increase the household saving function, household savings can also increase by an improvement in human capital or better technology, represented by A in the aggregate production function. This means that we can increase savings overall, not by actually increasing the saving rate, but by increasing our total output via improving technology or bettering human capital. If technology or human capital improves, this means that we can produce more efficiently given the same level of physical capital. Labor becomes more efficient when this happens. Therefore, the aggregate production function increases. We can see this represented by the new H_2 value in the aggregate production function in the graph below. This implies that hire human capital leads to both hire city state equilibrium physical capital stock as well as a higher real GDP for the country. Assuming there is not a change in population, then a higher real GDP translates into a higher real GDP per capita.

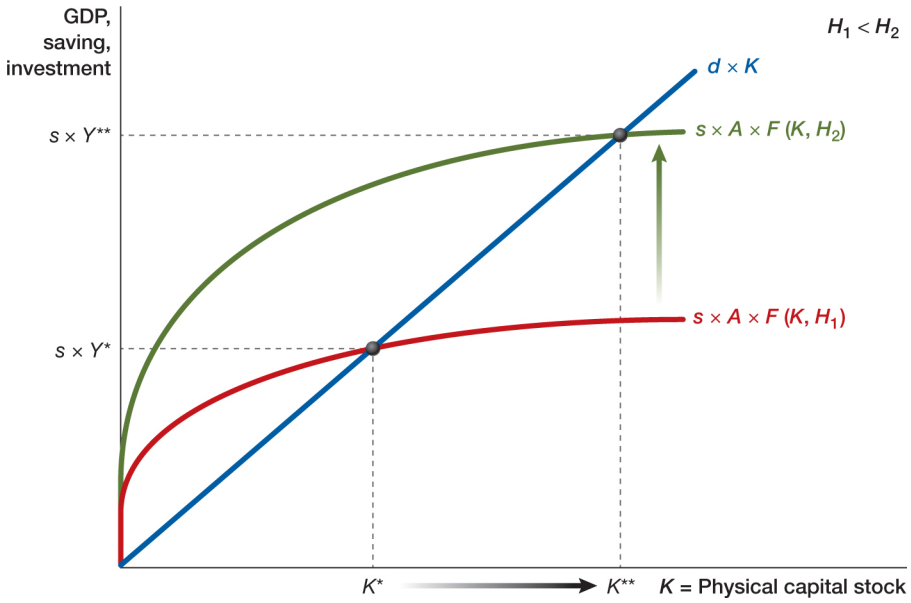

Figure 1.9: The Impact of Human Capital and Technology on the Steady State Equilibrium

It is important to remember that although savings is a crucial part of GDP, it is not responsible for sustained growth. Technology is at the root of a sustained growth. This is because there is a maximum to how much an economy can save and therefore a limit to what GDP it can achieve. For example, the maximum saving rate for an economy is 100%. However, technological improvements do not have these kind of caps. Therefore, technological improvements can provide the kind of sustained GDP growth that saving rate increases cannot. We can see this in the figures below. The top figure represents what higher saving rates can provide an economy. The bottom figure represents what technological improvements can provide an economy.

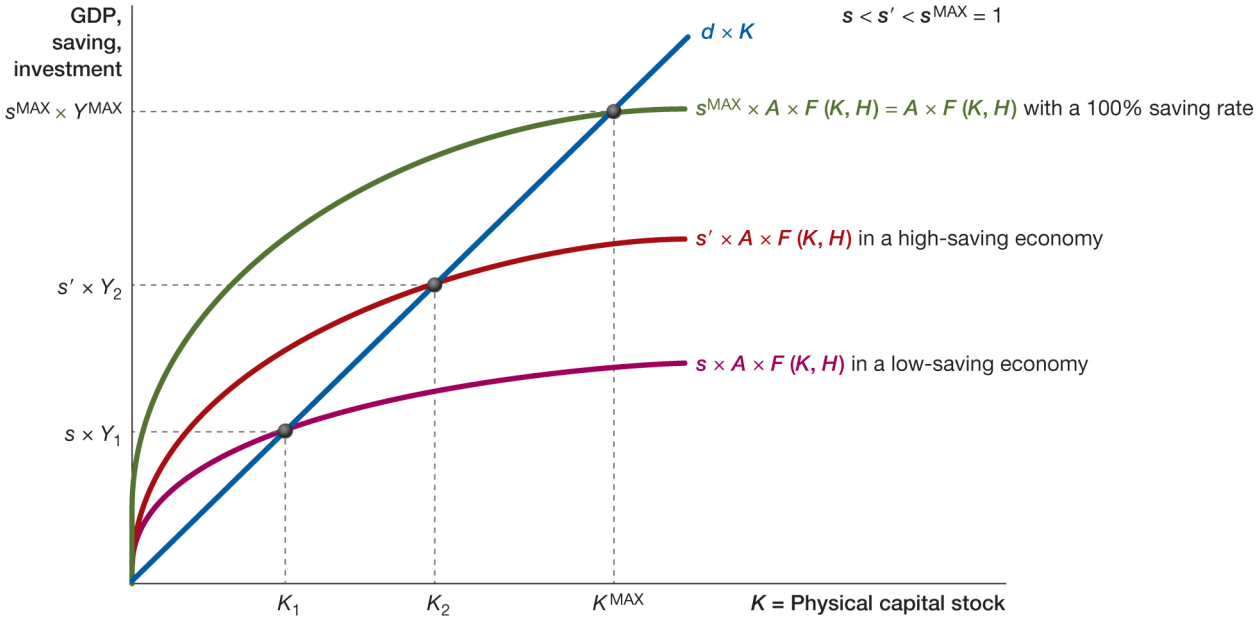

Figure 1.10: Three Economies with Different Saving Rates in the Solow Model

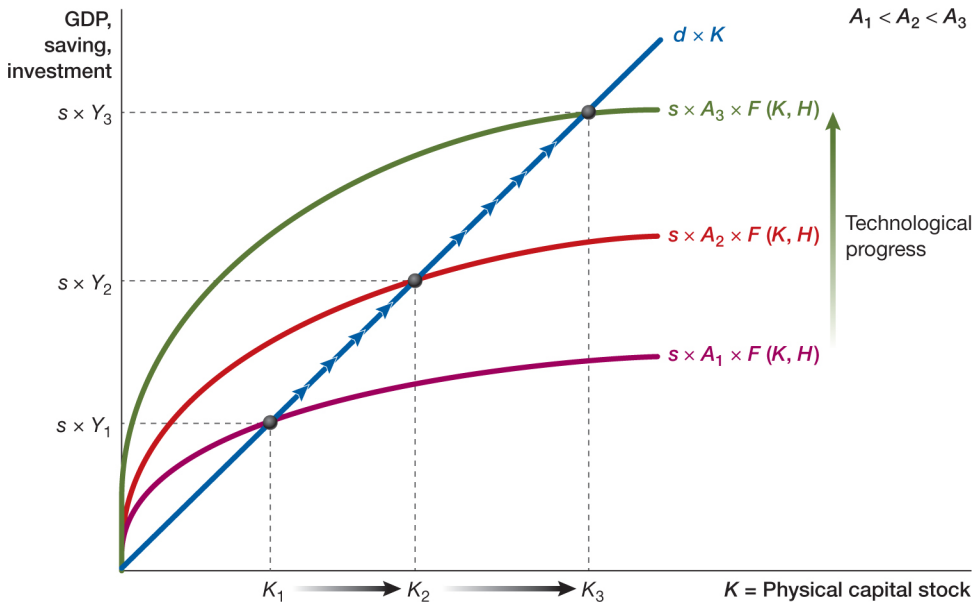

Figure 1.11: Sustained Growth Driven by Technological Change

1.2 World Development

We can see that different countries have varying PPP-adjusted GDP per capita, and in this unit, we are going to discuss why certain countries are more developed than others. One interesting thing to note is that countries around the equator tend to have reduced real PPP-adjusted GDP per capita compared to countries that are further from the equator. For example, the democratic republic of Congo, had a PPP-adjusted GDP per capita of $859. Compared to Finland, with a PPP-adjusted GDP per capita of $38,897. This has led social scientist to believe that countries around the equator are doomed to an economy of poverty.

Proximate vs. Fundamental Causes of Prosperity

The **proximate causes of prosperity** include factors such as human and physical capital, and technology. These proximate causes of prosperity would explain why certain countries have a higher real GDP per capita compared to others. However, they do not explain why these factors of production are so much higher compared to other countries. Why is human capital in Finland so much better than human capital in the Democratic Republic of Congo? Therefore, these are just the proximate causes of prosperity.

To really understand the drivers of prosperity, we need to know why certain factors of production are better in other countries compared to others. Therefore, we are looking to understand the **fundamental causes of prosperity.** These fundamental causes would explain the root cause for the disparity in the proximate causes of prosperity.

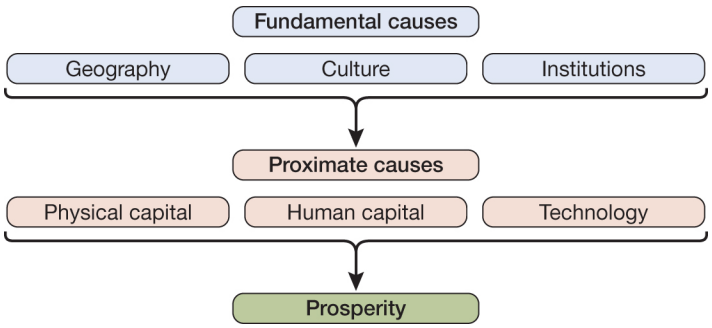

Figure 1.12: Proximate vs. Fundamental Causes of Prosperity

Societies are prosperous when they have abundant human and physical capital, however these do not explain the deep rooted factors of prosperity. Fundamental causes, such as geographic, cultural and institutional factors have an impact on prosperity.

Geography

One theory claims that geography is a fundamental cause of prosperity. The reasoning behind this is that various areas of the world experience a variety of climates due to their geography. For example, countries around the equator experience tropical weather compared to other parts of the world. According to this hypothesis, some countries have unfavorable climates that are beyond their control. For example, some countries may be in areas where the soil is inhospitable for agriculture, or lack running water to irrigate crops. If the geography of a country is a fundamental cause of prosperity, then poor nations have little reason to expect an improvement in living standards. There are also some theories that tropical zone countries suffer from the transmission of deadly diseases, such as malaria and dengue fever, which spread more easily in a tropical climate.

Culture

Another potential fundamental cause of prosperity is culture. Culture hypothesis claims that different societies respond differently to incentives due to shared experiences, religious teachings and social norms. Culture is viewed as a key determinant of the values of an economy. Therefore, it can have a significant influence on the prosperity of an economy. For example, some societies may value investment and hard work in the adoption of new technologies whereas other societies are rather suspicious of new technologies.

Institutions

Another potential fundamental cause of prosperity is institutions. The institutions hypothesis claims that the different institutions across countries contribute to how societies organize themselves and shake the incentives of its individuals and businesses. These institutions are at the root of the differences in prosperity across the world.

The best definition of institutions is from Douglass North, an economist that was awarded the Nobel prize in 1993. He defined "institutions" as the rules of the game in a society or, more for-

mally, the humanly devised constraints that shape human interaction.

By this definition, institutions are determined by the individuals of a society and can place constraints on behaviors. Institutions can shape behaviors by determining incentives. For example, institutions can place constraints on individual behaviors via formal regulations such as laws. It is illegal to sell alcohol to minors. Institutions can also influence behaviors via informal regulations, such as social norms. For example, it is socially unacceptable to attend a wedding without contributing a gift to the bride and groom.

The economy can generate a higher GDP and achieve greater prosperity if markets allocate individuals to occupations for which their productivity is the highest. Laws and regulations can encourage firms to invest in physical capital and technology. When the education system enables individuals to invest in their human capital, the productivity of an economy as a whole increases significantly. We could also see how institutions may destroy an economy, such as trade restrictions.

One interesting case study to emphasize the institutions hypothesis is the study of north and south Korea. The Korean peninsula is divided into by the 38th parallel. To the south is the Republic of Korea, also known as South Korea. South Korea has had one of the fastest growing economies in the past 60 years. To the north of the 38th parallel is the Democratic People's Republic of Korea, commonly known as North Korea. Living standards in North Korea are similar to those in sub-Saharan Africa. In 2015, the real GDP per capita in North Korea was $1,720 (in PPP-adjusted 2011 constant dollars). In the same year, the real GDP per capita of South Korea was $35,360 (in PPP-adjusted 2011 constant dollars). What explains this disparity? Geography? No, the two share similar geographies. Culture? Highly unlikely. There are very few significant differences between the cultures, certainly not before 1947 when the country was split into two. The segregation of Korea into two countries was not something that citizens willingly agreed to.

After 1947, North Korea was led by Kim Il-Sung, a leader of anti-Japanese communist partisans during World War II, and he established himself as a dictator. The country implemented a rigid form of communism, in which resources are allocated through central planning, private property is outlawed, and markets are banned. Freedoms were curtailed in the marketplace and also in every other aspect of citizens lives, except for those who remain in the elite circle around Kim Il-Sung. Today, the dictatorship continues under the rule of his grandson, Kim Jong-Un.

South Korea, on the other hand, was led by anti-communist ideals. South Korea supported market-based economics, providing incentives to businesses for investment and industrialization and investing in the education of South Koreans.

This is what we would call a "natural experiment" that allowed us to see the divergence in economic outcomes due to the differences in institutions. We can see in the graph below how economic prosperity has sharply diverged between the two countries.

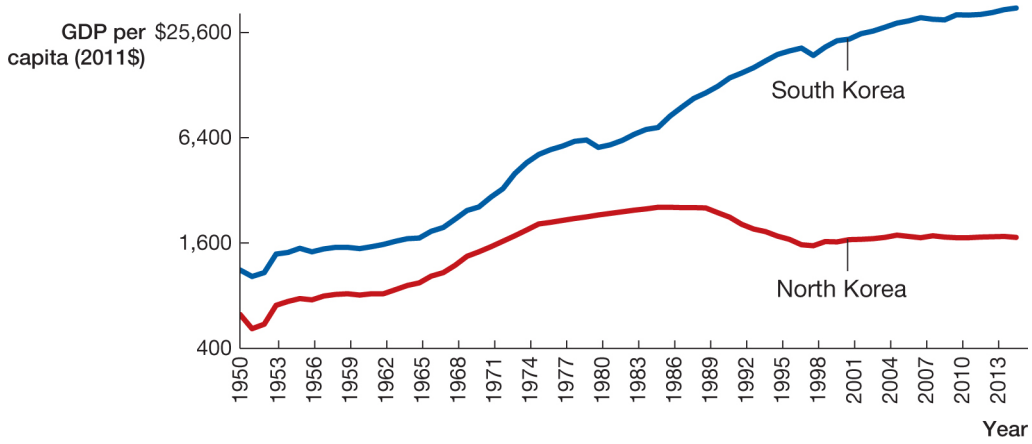

Figure 1.13: GDP per capita in North and South Korea (in PPP-adjusted 2011 constant dollars)

Institutions and Economic Development

As in the case study of north and South Korea, we can see how crucial institutions are in economic development. One reason why South Korea has such a successful economy is because of its private property rights. These **private property rights** mean that individuals can own businesses and assets and their ownership is secure. Individuals are incentivized to own property and businesses because they know the government will protect them from theft. This creates an environment that encourages development.

North and South Korea are good examples of extractive versus inclusive economic institutions. **Economic institutions** are the aspects of the societies rules that concern economic transactions. This can include the judicial system that overseas financial arrangements, how businesses can borrow money and other regulations that shape occupations and businesses.

Inclusive economic institutions protect private property, uphold law and order, allow and enforce private contracts and allow free entry into new lines of business and occupations. South Korea is a great example of an inclusive economic institution. They are inclusive because they encourage the participation of the great majority of the population in economic activities in a way that best makes use of their talents and skills.

Extractive economic institutions do not protect private property rights, do not uphold contracts and interfere with the workings of markets. They also erect significant entry barriers into businesses and occupations. The main idea of these institutions is that they work to extract resources from the rest of the society. North Korea is a great example of this. However, societies that are ruled by monarchs and dictators as well as several that hold elections for parliaments have still had extractive economic institutions. For example, some market economies with extractive economic institutions include Myanmar, Pakistan, Argentina, Guatemala, Peru, the Democratic republic of Congo, Egypt and Kenya. Even if the specific forms of these institutions differ from the extreme form of central planning communism in North Korea, they sure the fact that they failed to enforce property rights and instead privilege a few at the expense of many.

Extractive economic institutions rely on certain political institutions. Without the political elites take control of the state, North Korea would not be able to maintain its system of widespread poverty. This underscores the important role of political institutions. **Political institutions** are the aspects of the society's rules that concern the allocation of political power and the constraints on the exercise of political power. Extractive economic institutions are likely to be supported by certain types of political institutions, which concentrate political power in the hands of only a few. Inclusive economic institutions tend to coexist with different types of political institutions they distribute political power more equally in society so that no single individual can use that power for their own benefit at the expense of the rest of society.

Economic institutions can affect economic outcomes. For example, in an extractive economic institution, if a farmer who expects his output to be taken away or entirely taxed away, what incentive would he have to work? Little to none. Extractive economic institutions distort the incentives that businesses need to undertake investments and innovations.

We can see how extractive economic institutions hurt markets for entrepreneurs on the graphs below.

The return to entrepreneurship blue curve shows the number of entrepreneurs with at least the return indicated on the Y axis. It is obtained by ranking potential entrepreneurs from higher to lower return to entrepreneurship. The opportunity cost curve in red indicates the value to a potential entrepreneur of her best alternative activity. For example, if an entrepreneur chose another occupation. The intersection of the two curves gives the equilibrium number of entrepreneurs for example all potential entrepreneurs with returns greater than or equal to $50,000 choose entrepreneurship. The reason for the downward sloping curve is because as there are lower returns to entrepreneurship, there are fewer entrepreneurs with at least that return.

This illustrates how extractive economic institutions affect overall entrepreneurship in the economy. This individuals returned entrepreneurship is $75,000, which was initially above the opportunity cost schedule. However, with insecure property rights, she can only make $25,000, which is less than the opportunity cost of $50,000. This makes entrepreneurship appear less attractive. There are several factors contributing to this reduction and returned entrepreneur ship, insecure property rights it's just one of them. Another one that we have already talked about is lack of protection for contractual agreements. Entrepreneurships rely on contracts to borrow money, and rely on the courts to uphold these business arrangements. Without these institutions, it is difficult to promote reliable contracts.

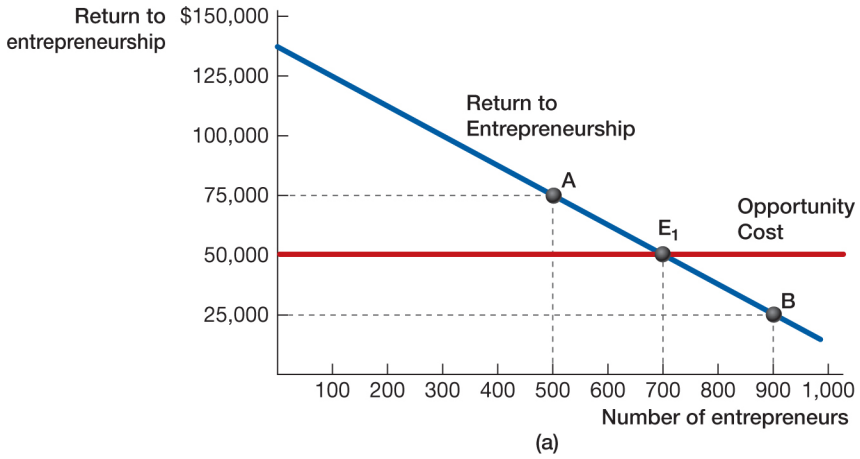

Figure 1.14: How Extractive Economic Institutions Reduce the Number of Entrepreneurs

Extractive economic institutions shift the return to entrepreneurship curve to the left. This is due to two potential reasons. One is weak property rights prevent entrepreneurs from capturing their full returns. Secondly, a lack of legal protection will prevent entrepreneurs from forming reliable contracts with business partners, which can reduce profitability by making supplies more expensive and revenues more unstable.

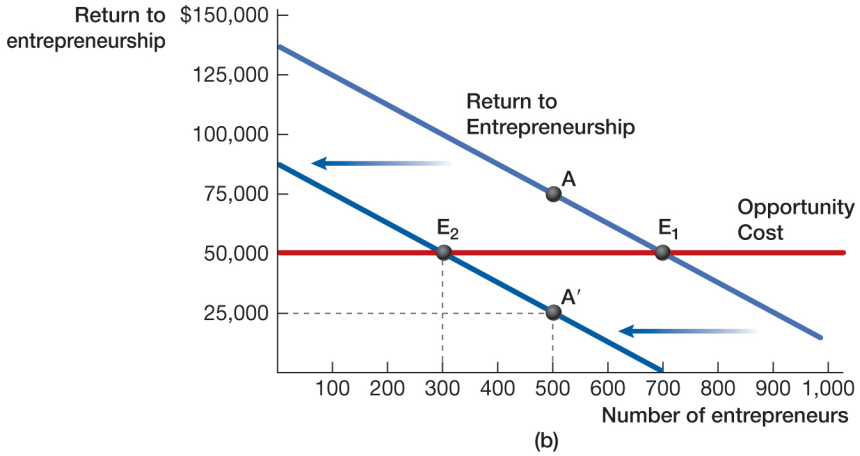

Figure 1.15: How Extractive Economic Institutions Reduce the Number of Entrepreneurs

Extractive economic institutions also shift the opportunity cost schedule upward because they introduced entry barriers that make entry into entrepreneurship more expensive. We can think of the cost of entry into entrepreneurship as the opportunity cost. As the opportunity cost increases, more entrepreneurs are discouraged from entering the market. This graph shows the overall impact of extractive economic institutions on the equilibrium number of entrepreneurs resulting from a leftward shift of the return to entrepreneurship curve and an upward shift of the opportunity cost schedule.

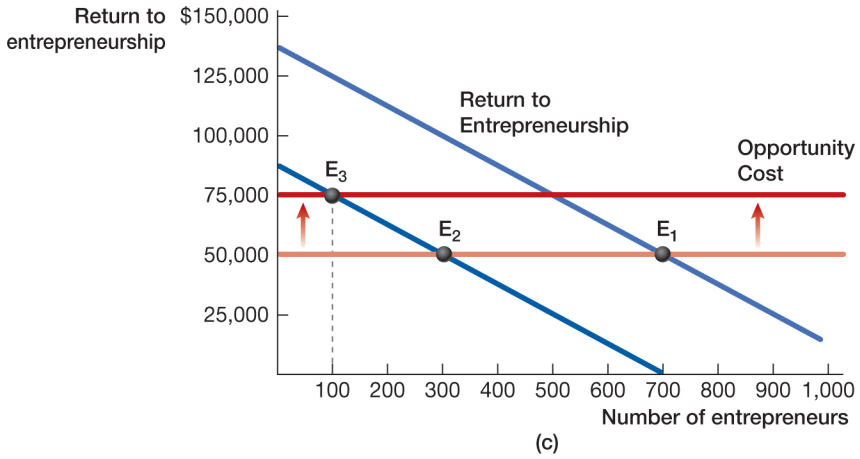

Figure 1.16: How Extractive Economic Institutions Reduce the Number of Entrepreneurs

In conclusion, extractive economic institutions discourage entrepreneur ship via two mechanisms:

1. By creating insecure property rights and limiting legal back up, they make entrepreneurship less profitable and shift the return to entrepreneurship schedule to the left.

2. By directing entry barriers, they make entry more costly and shift the opportunity cost schedule upward.

2 Week 2

2.1 Employment and Unemployment

Measuring Employment and Unemployment

Unemployment can have significant economic and social costs, therefore it is very important to measure its presence in an economy. To do so, economists have agreed on a standard, though imperfect, method of defining employment and unemployment. In the United States, the standard is set by the Bureau of Labor Statistics in the Department of Labor, which tracks the official employment statistics for the US economy.

First, we need to define the population of potential workers. The population of potential workers includes the general population, but excludes three groups:

1. children under 16 years of age

2. people on active duty in the military

3. people who are living in institutions where the residents have restricted mobility (for example, facilities that provide long-term medical care or prisons)

The number of potential workers in the United States in January 2020 was 259.5 million people. This is also known as the civilian non-institutional population 16 years and older. Potential workers can be divided into three sub groups: employed workers, unemployed workers and those not in the labor force. People who have full-time or part-time pay jobs are considered to be employed workers. People who do not have a paid job, have actively looked for work in the prior four weeks, and are currently available for work are considered unemployed workers. Laid off workers are only considered unemployed if they are actively looking for a new job. Similarly, students and parents who don't have a paid job are only considered unemployed if they are actively looking for a job and are currently available to work, even part-time. In January 2020, there were 6.5 million unemployed workers in the United States. The labor force is the sum of all employed and unemployed workers.

Finally, all potential workers who do not fit the criteria for being unemployed or unemployed are classified as not in the labor force. People in this category of potential workers who do not have a paid job and are not looking for one, such as stay at home parents, disabled workers, many retirees and many students.

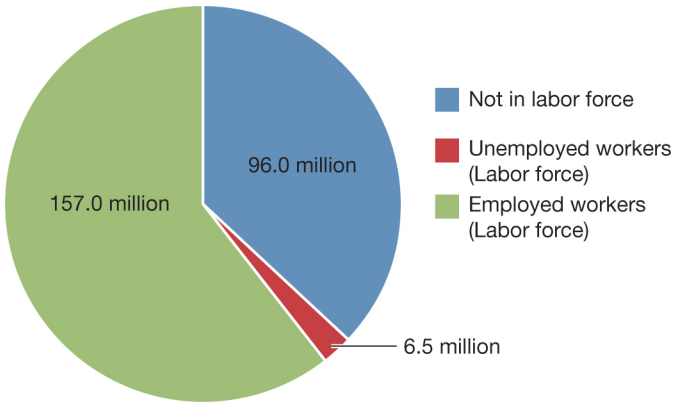

Figure 2.1: The Composition of the U.S. Population of Potential Workers (January 2020)

Using these definitions, we can compute the unemployment rate. The unemployment rate is defined as a percentage of the labor force that is unemployed.

$$UnemploymentRate = 100\% * \frac{Unemployed}{LaborForce}$$

$$UnemploymentRate = 100\% * \frac{6.5million}{163.5million}$$

$$UnemploymentRate = 4.0\%$$

Similarly, the labor force participation rate is defined as the percentage of potential workers who are in the labor force.

$$LaborForceParticipationRate = 100\% * \frac{LaborForce}{PotentialWorkers}$$

$$LaborForceParticipationRate = 100\% * \frac{163.5million}{259.5million}$$

$$LaborForceParticipationRate = 63\%$$

Although these two metrics are the most popular methods to measure the health of the labor force, they overlook two groups of important workers: discouraged workers and the underemployed.

Discouraged workers are potential workers who would like to have a job but have given up searching for one. Because they are not actively looking for work, these workers are not included in the unemployment rate. Instead, discouraged workers are counted officially as out of the labor force entirely. They were 350,000 discouraged workers in the United States in January 2020.

Similarly, we count all paid workers as employed, even if they would like to work more hours. Many workers in difficult economic situations would like to work more hours but do not have the option to do so. Although such workers are underemployed, they are not included in the official unemployment statistic. There were 4 million underemployed workers in the United States in January 2020.

The unemployment rate fluctuates with the economy. When the overall economy suffers from a recession, a period in which GDP falls, the unemployment rate tends to rise. During typical recessions, the unemployment rate reaches a level between 6% and 9%. When the economy is healthy and expanding, the unemployment rate eventually reaches a level between 3% and 5%. For example, the 2009 recession lead to a sharp rise in the unemployment rate and a peak rate of 10% in October 2009. During the Great Depression of the 1930s, the unemployment rate reached 25%. During the Covid recession, the unemployment rate rose to a peak of 14.7% in April. You can see the trends of the unemployment rate in the graph below.

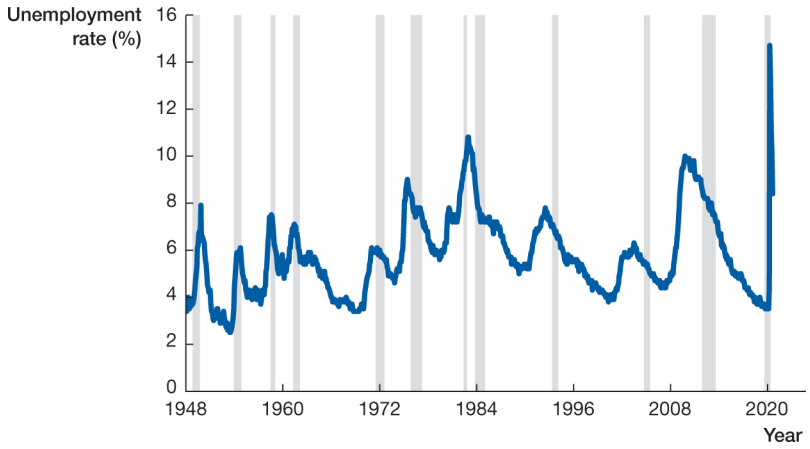

Figure 2.2: The U.S. Unemployment Rate Since 1948

It is also noteworthy to mention that the unemployment rate is never close to zero. Since 1948, the U.S. unemployment rate has gone below 3% during only one period, the early 1950s. Even during the economic boom in the 1990s, the unemployment rate reached a low value of 4%. It is a necessary attribute of a well functioning modern economy to have some unemployment.

Equilibrium in the Labor Market

Just like with any other market, we can analyze the dynamics of the labor market. In this market, the price of labor is the wage rate. Households supply labor, while firms demand labor. Firms are on the demand side because they need to hire workers for production. Optimizing firms try to maximize profits, therefore they demand the quantity of labor that produces the greatest feasible profit. Profit is calculated as revenues minus costs. How does a firm determine the profit maximizing quantity of labor? It compares the revenue that a worker produces with the cost of employing that worker.

Let's consider the example of a barber shop. If the shop has one barber, and that barber can produce $25 of revenue per hour from providing haircuts, this $25 is the value of the marginal product of labor of this worker. This represents the contribution of an additional worker to a firm's revenues. Let's assume the market wage for barbers is $15 per hour. Therefore, by employing this barber, the barbershop earns $10 in profit per hour. This is because $25 - $15 is $10 per hour.

If a barbershop considers hiring another barber, although this sounds like a good idea, there may not be enough customers to keep both barbers completely busy. For example, let's say the first barber has a fully booked out schedule but the second barber does not. Therefore, the second barber can only generate $20 in revenue per hour. The barbershop will gain $5 in profit per hour, because $20 - $15 = $5 per hour. So, it would still be a good decision to hire this second barber even if they are not as occupied as the first barber because the shop still makes a $5 profit.

What if the barbershop wants to hire a third barber? Although the third barber will increase sales a bit more, it will do so at a reduced margin compared to the second barber. Suppose that this third barber's value of marginal product of labor is $10 per hour. Because the market wage is

$15 per hour, then the barbershop loses money ($5) on the third hire. Therefore, it would be in the shop's best interest to not hire this third barber.

This is the idea of the diminishing marginal product of labor. This means that each additional worker creates less marginal output than the worker hired before them. For example, additional barbers will increase the number of haircuts that the barbershop can offer, but each additional barber will not be as productive as the one before it. If the barbershop faces a constant price for haircuts, the lower marginal output of additional workers also translates into diminishing value of marginal product of labor. Because the value of the marginal product of each additional barber is diminishing, hiring more barbers increases the total revenue of the barbershop by a reduced amount with each new hire.

Another important takeaway is that a firm hires workers up until the point that it cannot increase profits by hiring an additional worker. The firm keeps hiring as long as the revenue that an additional worker brings in for the firm is at least as great as the cost of employing that worker, which is equal to the market wage. We can see this in the graph below, which plots the value of the marginal product of labor against the number of workers employed. Because the value of the marginal product decreases as the number of workers employed increases, the curve is slopes downward.

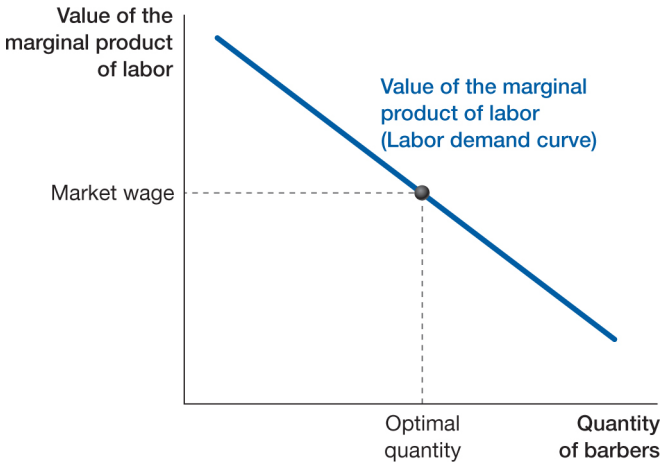

Figure 2.3: The Value of the Marginal Product of Labor is the Labor Demand Curve

The profit maximizing firm will hire the amount of labor at the point where the value of the marginal product of labor is either equal to or greater than the market equilibrium wage. As we change the market wage, the quantity of labor demanded moves along the curve depicting the value of the marginal product. The firm adjusts the number of workers and employers to make the value of the marginal product equal to the wage. Therefore, the downward sloping curve also represents the labor demand curve in addition to the value of the marginal product of labor because it shows how the quantity of labor demanded varies with the wage. A movement along the demand curve occurs when the wage changes and no other economic variables change other than the quantity of labor demanded.

Shifts in the Labor Demand Curve

There are a variety of things that can shift the labor demand curve entirely. Any change that affects the schedule relating the quantity of labor and the value of the marginal product of labor will shift the labor demand curve. We'll cover four factors that can shift the labor demand curve.

1. Changing output markets

   When the demand for haircuts shifts to the right, then the quantity of haircuts demanded at any given price increases, and therefore the price of haircuts increases. Accordingly, there is a rightward shift in the demand for haircuts which causes a rise in the value of the marginal product of barbers and a rightward shift in the demand curve for barbers.

2. Changing productivity

   When changes in productivity increase the value of the marginal product of labor, the labor demand curve shifts to the right. For example, if there are improvements in technology that can improve the productivity of barbers, this would shift the labor demand curve to the right. Technological progress can contribute to this.

3. Changing input markets

   When the cost of inputs goes down, businesses can purchase more of these inputs. This usually increases the marginal product of labor, which would shift the labor demand curve to the right. For example, if mechanical hair clippers suddenly became cheaper, barbers could purchase more of these items and potentially cut hair faster, which would improve their productivity. This would increase each barber's value of marginal product and shift the labor demand curve to the right.

The Supply of Labor

The labor supply curve represents the relationship between the quantity of labor supplied and the wage. It is derived from the principles of optimization. In this case, workers optimally allocate their limited time between paid work, leisure and other activities, which might include a home production such as childcare and cooking. If market wages are higher, it makes sense for workers to spend more time working outside the home. This kind of reasoning implies that as the wage increases, quantity of labor supplied increases. Therefore, the labor supply curve is upward sloping. It is possible for the labor supply curve to be completely vertical if the wage is high enough.

Figure 2.4: Upward Sloping Labor Supply Curve

In reality, the slope is much more smooth compared to this kinked version above. The vertical portion of the labor supply curve captures the fact that it becomes much harder to increase the quantity of labor supplied if almost all people who are interested in working have already found a full-time job. In other words, this is the idea that once wages reach a certain point, you can't use wages to attract more workers. In other words, wages have an implicit ceiling of appeal to increase your labor supplied. Is certainly true for certain occupations. For example, higher-paying occupations such as attorneys at law may not be affected by a small increase in salary. However, low-paying occupations such as service industries may attract more workers from an increase in wage.

Shifts in the Labor Supply Curve

A movement along the labor supply curve occurs when the wage changes and no other economic variables change. Any change that affects the entire schedule relating the quantity of labor supplied and the wage will shift the labor supply curve. We'll discuss three factors that can shift the labor supply curve.

1. Changing tastes

   Changing tastes or norms can affect people's willingness to take a paying job. For example, before World War II, working for pay outside the home was frowned upon if you were a married woman. However, this changed after the war.

2. Changing opportunity cost of time

   Innovations have changed the time needed for home production, such as vacuum cleaners. These can lower the opportunity cost of working outside the home by freeing up time that was previously needed for home production activities. This changes the opportunity cost of time and has been a factor contributing to the rise in female labor force participation.

3. Changing population

Increases in the size of the population which increase the number of potential workers in the economy, can also shift the labor supply curve to the right. One factor increase in population is immigration. For example, the United States experiences a net immigration inflow of roughly 1,000,000 people each year.

Putting Together Labor Supply and Demand

Equilibrium in a labor market is the point of intersection between the labor supply and labor demand curves. **At the competitive equilibrium wage, w*, the quantity of labor supplied is equal to the quantity of labor demanded.** In this case, all workers can work as many hours as they wish at this wage, and all firms are able to hire as many hours of labor as they need to. In contrast, at a wage above w*, the quantity of labor supplied would exceed the quantity of labor demanded and push the wage down. At a wage below w*, the quantity of labor demanded would exceed the quantity of labor supplied and push the wage up. This labor market equilibrium is also referred to as the equilibrium employment. We also referred to the equilibrium wage is the market clearing wage. This means that every worker who wants a job can find one.

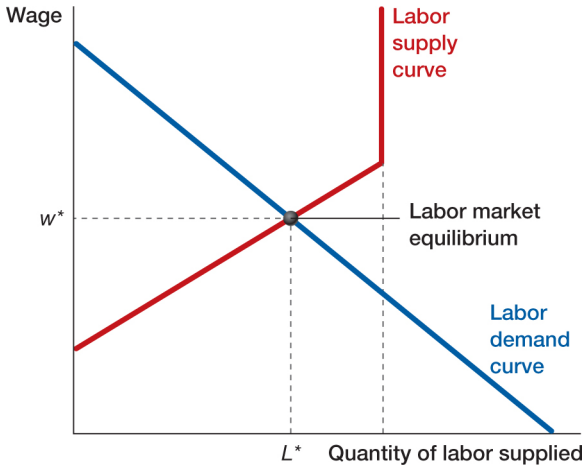

Figure 2.5: Competitive Equilibrium in the Labor Market

The market demonstrated in this graph is sometimes referred to as a "frictionless" labor market. In these kinds of markets, firms can instantly hire and fire workers, both workers and firms have complete information about each other and the wage adjusts instantly to clear the market.

Voluntary & Frictional Unemployment

Voluntary Unemployment

Official unemployment statistics are probably counting some workers who are voluntarily unemployed. They are willing to work, but only for a wage that is above the market clearing wage of w*. Therefore, at the equilibrium wage, they are happy to remain unemployed. Although this is

not common, it does occur.

Frictional Unemployment

Up until now we have assumed that the job market is frictionless. This implies that a worker could instantly find an employer if she is looking for work. However, this is not the case in reality. The job search process requires significant legwork in finding the employer that fits best for you. It takes time to find the right match, this contributes to friction in the job market. Frictional unemployment refers to unemployment that arises because workers have imperfect information about available jobs and need to engage in a time-consuming process and job search.

Wage Rigidity and Structural Unemployment

Structural unemployment occurs when the quantity of labor supplied exceeds the quantity of labor demanded. This can occur when the wage is fixed above the market clearing wage. This is an example of wage rigidity, where the wages are held fixed above the competitive equilibrium level. Good examples of this are minimum wage laws.

In the United States, we have federal national minimum wage laws. In January 2020, the federal minimum wage was $7.25 per hour. Each state can set their own minimum wage, so long as it is above this level. Washington has the highest minimum wage of $13.50 per hour.

Minimum wages will prevent the quantity of labor supplied to equal the quantity of labor demanded. For example, if the minimum wage is above the market clearing wage, then there will be a higher quantity of labor supplied than labor demanded. This means that if minimum wages are higher than the equilibrium wage, there will be far more people willing to work than there are positions open for hiring. Firms will not be able to meet this supply and therefore we'll still see unemployment occurring. These unemployed workers are willing to work at wages lower than the minimum wage, however employers are legally unable to higher them at these lower wages. Therefore, we see an unemployed population when minimum wages are higher than the market-clearing wage of w*. These workers are considered to be involuntarily unemployed. This is because the minimum wage laws are preventing them from obtaining full employment.

Minimum wage laws can have advantages and disadvantages. In the overall workforce in the U.S., including all education levels, only 1% of workers are paid the minimum wage. Therefore, the impact of the minimum wage on the labor market is modest. The minimum wage does prevent the market from reaching equilibrium for some types of low skilled workers but has little impact on the overall general labor market. We can see the effect of minimum wage laws on the labor market in the graph below. When the minimum wage is above the market clearing wage, the quantity of labor supplied exceeds the quantity of labor demanded, creating unemployment. The quantity of labor demanded is the point on the labor demand curve that intersects with a horizontal minimum wage line.

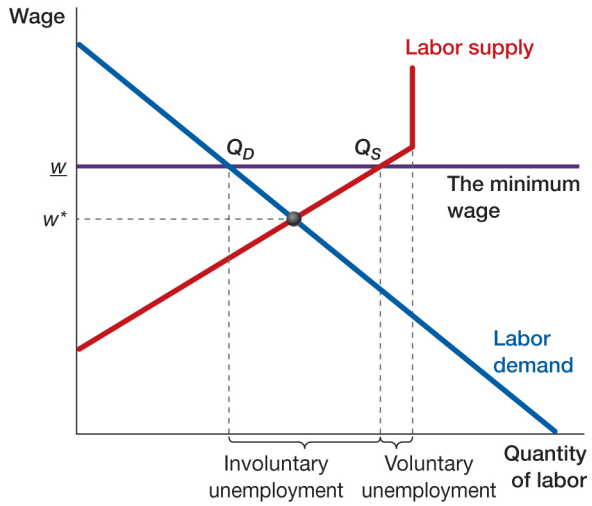

Figure 2.6: Labor Supply and Labor Demand in a Market with a Minimum Wage

Labor Unions and Collective Bargaining

Labor unions use collective bargaining to negotiate higher wages for their members. Collective bargaining has the same effect on unemployment as do minimum wage laws. If they can keep the negotiated wage above the market clearing equilibrium wage, the unions can cause the quantity of labor supplied to exceed the quantity of labor demanded, thus creating structural unemployment. In 2018, 10.5% of all employed workers in the United States are members of labor unions. In Italy, in comparison, 34.4% of all employed workers are members of labor unions.

Efficiency Wages

In 1914, the Ford motor company doubled its daily wage for most of their employees from $2.34 per hour to five dollars per hour. Why did they do this? They explained that they wanted the business to be on a lasting foundation, and that they were building for the future. This is an example of an efficiency wage. Efficiency wages are implemented by employers to increase motivation and productivity. This is a good guard against workers who may slack off on the job. A firm might be incentivized to pay higher wages to improve productivity in the workplace. Although a higher wage does not improve profits for the firm, it can increase productivity for the company in a variety of ways.

First, efficiency wages reduce worker turnover. Recruiting new workers is costly to the company. If workers are paid more than the equilibrium wage, they are motivated to keep their job because they would face lower wages elsewhere. Second, the fear of losing a high paying job motivates employees to work harder than they otherwise would, improving their productivity and increasing their overall hourly output. Third, some employees are grateful for a higher wage, leading them to reciprocate this generosity in the form of improved productivity in the workplace. Finally, higher wages improve the quality of the pool of workers who apply for the job in the first place. It's important to remember that all of these rest on the assumption that a higher wage would motivate an individual to work more productively. The main difference between efficiency wages

and minimum wages, although both are above the equilibrium wage, is that a firm voluntarily chooses to provide an efficiency wage. A firm does not voluntarily choose to provide a minimum wage, they are mandated to do so by the government.

Downward Wage Rigidity

Downward wage rigidity arises when workers resist a cut in their wage and firms respond to this resistance by holding wages fixed, and instead of firing workers. For example, if there is an outside force that shift the labor demand curve to the left, such as replacing workers with robots, this would reduce a firms demand for labor. Therefore, this SHOULD reduce the market equilibrium wage. However, in the case of downward wage rigidity, a firm may just fire workers instead of reducing their wages. We can see this demonstrated in the graph below. Instead of reducing the wage paid, the firm instead reduces the number of workers hired. Therefore, the quantity of labor demand it moves from L1 to L2.

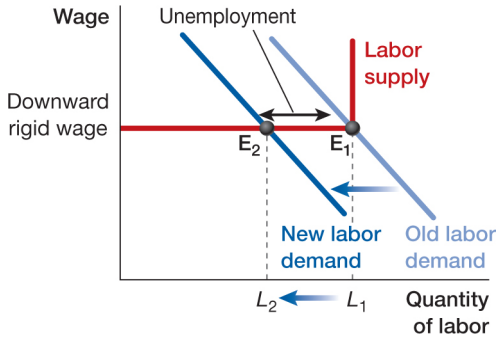

Figure 2.7: Shifts in Labor Demand Affect Equilibrium in the Labor Market

Cyclical Unemployment and the Natural Rate of Unemployment

The long run rate of unemployment is the average historical rate of unemployment. In the United States, the long run rate of unemployment hovers around 5.8%. The long run rate of unemployment includes frictional unemployment, as well as long-term structural unemployment. Long-term structural unemployment is considered to be economically inefficient. Structural unemployment is what we just talked about where the quantity of labor supplied exceeds the quantity of labor demanded. More people want to work than firms are able to hire.

This is different from the natural rate of unemployment, which is 4%. The natural rate of unemployment is the point at which a health economy hovers around. At 4% unemployment, an economy can still experience economic growth. The long run rate of unemployment is typically higher than the natural rate of unemployment.

When the current unemployment rate deviates from the long run rate of unemployment, this is cyclical unemployment. Cyclical unemployment rises in recessions and falls in economic booms.

The long run rate of unemployment should not be confused with the rate of unemployment that is socially optimal. This is because the long run rate of unemployment include some of inefficient sources of unemployment, such as structural unemployment. Structural unemployment is caused by things like downward wage rigidity. In these cases, firms would rather fire workers and reduce their wages. In these kinds of economies, there will be a relatively high level of structural unemployment and therefore a high long-term average rate of unemployment.

2.2 Credit Markets

Credit markets are an important component of the economy as a whole. Entrepreneurs, private investors, and individuals just like us can borrow money from institutions to invest. For example, every year, hundreds of thousands of entrepreneurs in the United States borrow money to start new businesses. Many more businesses that are already in operation also borrow funds to expand their existing operations. Consumers can also borrow to purchase big ticket items like homes and automobiles. Economic agents that borrow funds are referred to as **debtors**. The funds that they borrow is **credit**. Borrowed money comes at a price, debtors need to pay interest on their borrowed funds. The original amount of borrowed money is referred to as principal. The interest rate is the additional payment, above and beyond the repayment of principal, that a borrower needs to make. We can also say that the interest rate is the annual cost of a $1 loan. A rise in interest rates can contribute to a fall in the quantity of credit demanded. As the interest rate increases, fewer individuals are willing to pay the high price to acquire credit.

Real and Nominal Interest Rates

In order to distinguish between real and nominal interest rates, we need to learn about inflation. The inflation rate plays a role in household and business decisions to borrow money. The inflation rate is the annual growth rate of the overall price level. For example, suppose you borrowed $500,000 at a 10% nominal interest rate to finance your company. At that nominal interest rate, you will have to pay $50,000 in annual interest in one year. Suppose you can sell one energy solar panel for $25,000, therefore you will need to sell 2 of these to cover the cost of your annual interest payments. Suppose that inflation causes all prices to double and now you only need to sell one panel for the cost of $50,000. This inflation makes it easier to pay back your loan. Holding all else equal, the higher the inflation rate, the higher the prices of the goods that the firm sells.

The nominal interest rate is the rate of what you owe on a loan, in nominal dollars. However, we can compute the real interest rate, which is what you owe in real dollars, after adjusting for inflation. In order to do this, you need to subtract the inflation rate from the nominal interest rate. This equation is referred to as the fisher equation. His research emphasizes the distinction between the nominal and real interest rates. The Fisher equation states that the real interest rate is equal to the nominal interest rate minus the inflation rate.

$$NominalInterestRate - InflationRate = i - \pi$$

$$r = i - \pi$$

Where π represents the inflation rate, i represents the nominal interest rate and r represents the real interest rate.

Optimizing economic agents will use the real interest rate when thinking about the economic cost of a loan because they want to know how borrowing will generate real growth and what they owe. The relationship between the nominal and real interest rates is similar to the relationship between nominal and real GDP.

The Credit Demand Curve

The credit demand curve is the schedule that reports the relationship between the quantity of credit demanded and the real interest rate. The quantity of credit demanded is plotted on the X axis and the real interest rate is plotted on the Y axis. As the real interest rate increases, the quantity of credit demanded decreases. This is a movement along the credit demand curve. The credit demand curve slopes downward because the higher the real interest rate is, the lower the quantity of credit demanded will be.

There are two things to note about this relationship:

1. When the credit demand curve is relatively steep, the quantity of credit demanded does not change that much in response to variation in the real interest rate.
2. When the credit demand curve is relatively flat, the quantity of credit demanded is relatively sensitive to variation in the real interest rate.

It is important to remember that all loans are made at a nominal interest rate, however it is relevant to consider the real interest rate after adjusting for inflation. The real interest rate plays an important role in analysis for long-term borrowing, like mortgages or 10-year corporate loans.

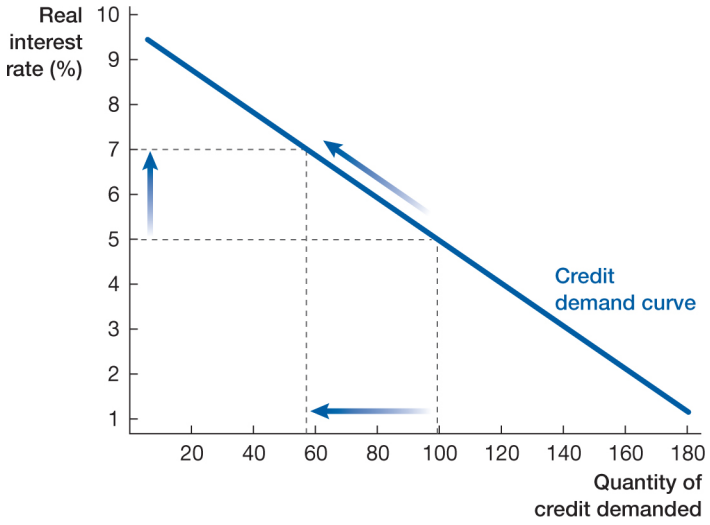

Figure 2.8: The Credit Demand Curve

There are several factors that can shift the credit demand curve.

1. **Changes in perceived business opportunities for firms.** Businesses borrow to fund expansions. If a business thinks that it will grow its customer base, it may need to borrow money to expand its operations. Therefore, that business' credit demand curve will shift to the right. If other businesses are experiencing similar expansions, then the entire market credit demand curve will shift to the right.

2. **Changes in household preferences or expectations.** Households borrow for many reasons, such as buying homes or long-term investments. If they would like to consume more of these goods, then they will tend to borrow more. They'll be more willing to borrow when they're optimistic about the future. An increase in borrowing due to a changes in household preferences will shift the market credit demand curve to the right. If households become pessimistic about the future, they may cut their desired borrowing at any interest rate, shifting the market demand curve to the left.

3. **Changes in government policy.** Government borrowing from the credit market can fluctuate between each year. And 2007, the US federal government run a deficit of $0.4 trillion, meaning that it borrowed this from the credit market. During the 2020 recession, the government borrowed over $3 trillion. An increase in the government borrowing shifts the market credit demand curve to the right. Finally, the government tax policies can also shift the credit demand curve. Sometimes the government stimulates investment in physical capital by lowering taxes on profits or explicitly introducing subsidies for physical capital investment. Such tax cuts or subsidies also shift the market credit demand curve to the right. This is because they encourage investment in physical capital, which would influence businesses to take out loans to fund these investments.

The Credit Supply Curve

So who is supplying all of this credit? People who save their money in savings accounts with banking institutions can receive payment for this in the form of an interest rate. How much money are the savers willing to lend? Saving results from a natural trade-off: people can spend their income on consumption today or can save it for consumption in the future. Saving requires giving something up today, people only save if they get something worthwhile in the future. The real interest rate is the compensation that people receive for saving their money because a dollar saved today has 1 + r dollars of purchasing power in a year, where r is the real interest rate. The real interest rate is the opportunity cost of current consumption. It is what you are giving up in terms of future purchasing power. Consequently, a higher real interest rate increases the opportunity cost of current consumption and encourages a higher level of saving.

The credit supply curve is the schedule the reports the relationship between the quantity of credit supplied and the real interest rate, which is upward sloping. A higher real interest rate encourages more saving, increasing the amount of funds that banks can lend and thereby increasing the quantity of credit supplied.

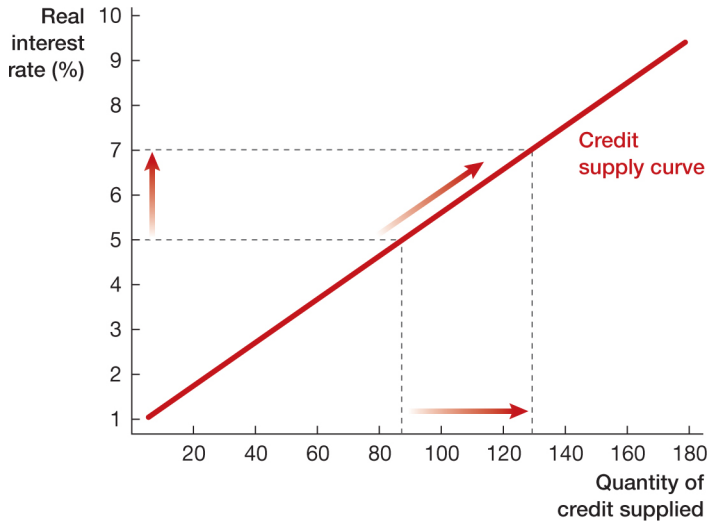

Figure 2.9: The Credit Supply Curve

The quantity of credit supplied is plotted on the x axis and the real interest rate is plotted on the y axis. As the real interest rate increases, the quantity of credit supplied increases. This is a movement along the credit supply curve.

It's important to distinguish between movements along the credit supply curve and shifts of the credit supply curve. Movements along the credit supply curve correspond to responses to changes in the real interest rate. Shifts in the credit supply curve are driven by changes in the saving motives of economic agents, assuming the real interest rate is the same.

1. **Changes in the saving motives of households.** Households save for many reasons, like retirement. However, these motives can change over time, shifting the credit supply curve.

For example, if household predict economic hardship in the future, they will save more because they want to build up wealth to be better prepared. This shifts the credit supply curve to the right.

2. **Changes in the saving motives of firms.** If firms are producing positive earnings, meaning that their revenues are higher than their costs, they can either pass these earnings back to shareholders in the form of shareholder dividends or retain these earnings. If they choose to retain these earnings, they may deposit them into a bank account and save them for future investment. Retained earnings fluctuate over time. When firms are nervous about the future, they may hold onto retained earnings instead of paying them out as dividends. This shifts the credit supply curve to the right.

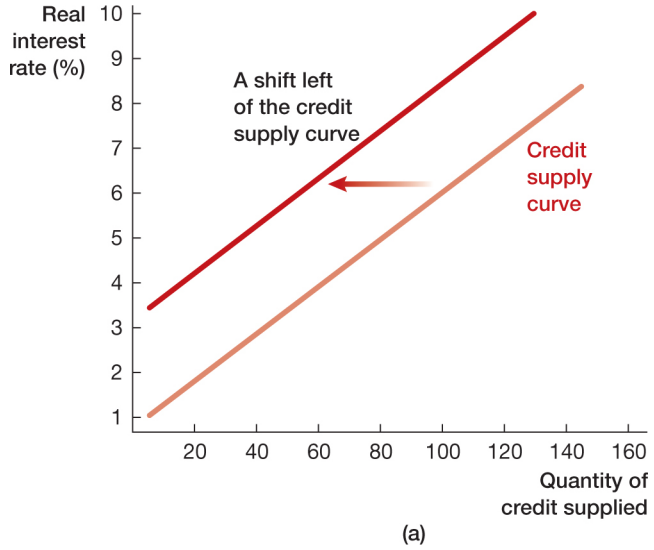

Figure 2.10: Shifts in the Credit Supply Curve

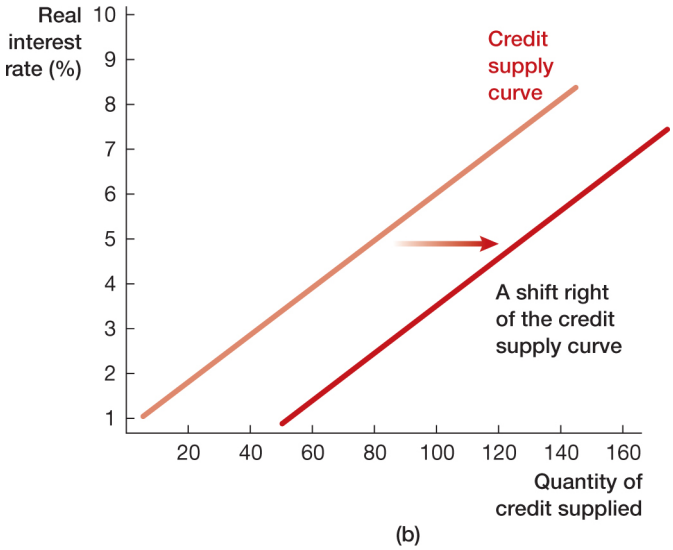

Figure 2.11: Shifts in the Credit Supply Curve

Equilibrium in the Credit Market

We can combine the credit supply curve and credit demand curve to find the equilibrium of the credit market. In this graph, we are assuming that all borrowers have the same risk of not really paying their loans. This simplification allows us to find a single equilibrium real interest rate in the credit market.

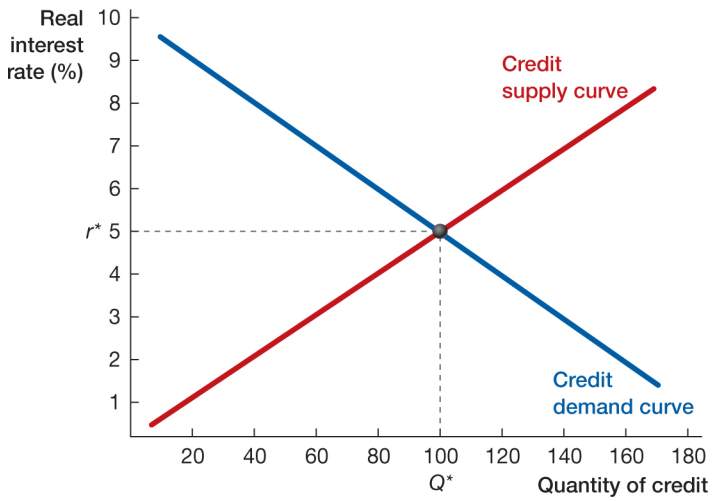

Figure 2.12: Credit Market Equilibrium

The equilibrium is the point at which the two curves intersect. The intersection determines the total quantity of credit in the market (Q*) and the equilibrium real interest rate (r*). At the equilibrium real interest rate, the quantity of credit demanded is equal to the quantity of credit supplied. A real interest rate above this level would lead to an excess supply of credit, which would put downward pressure on the real interest rate. If the real interest rate below the equilibrium level would lead to an excess demand for credit, creating upward pressure on the real interest rate.

A shift in the credit demand curve can affect the market equilibrium. Assume the government introduces a tax credit for business investment expenditures so that every dollar a firm invests will reduce their tax by $.30. Such a tax credit reduces the cost of investment for firms and thus increases the net benefit of investment. An optimizing firm's willingness to borrow in the credit market will increase. Consequently, the credit demand curve shifts to the right. The new equilibrium point has a higher real interest rate and a greater quantity of credit supplied and demanded.

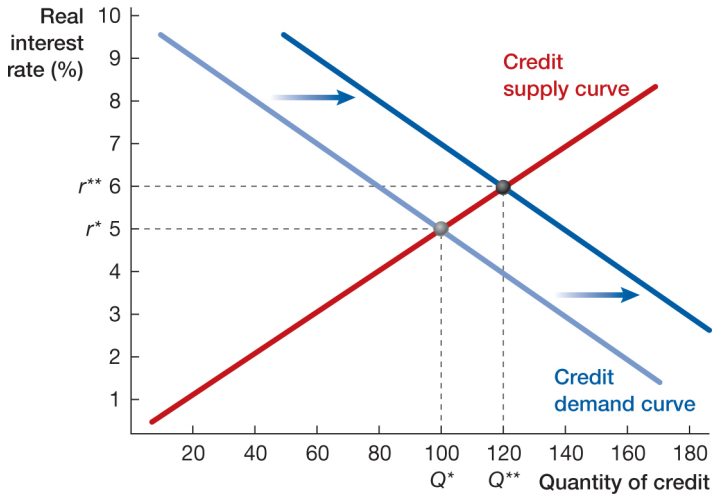

Figure 2.13: Credit Market Equilibrium

Banks and Financial Intermediation: Putting Supply and Demand Together

Banks are the organizations that provide the market for lenders and borrowers interact. They are called financial intermediaries. They channel funds from suppliers of financial capital, (the savers), to users of financial capital, like borrowers.

Financial capital comes in many different forms, including credit and equity. When a saver turns her savings into credit, she loans her savings to another party in exchange for the promise of repayment of her loan with interest. When a saver transfers savings into equity, she uses her savings to become a shareholder in a company, which means that she has obtained an ownership share and a claim on the future profits of the company. These profits are paid out as dividends to the company shareholders.

Assets and Liabilities on the Balance Sheet of a Bank

We can look at the assets and liabilities for a bank on its balance sheet. Assets include the investments of a bank, such as government securities and money owed to by borrowers. Liabilities include claims that depositors and other lenders have against the bank. Assets are what the bank owns, liabilities are what the bank owes.

An example of a balance sheet is below, for Citibank in December 2019. Everything is in billions of dollars. Stockholders' equity is the difference between total assets and total liabilities.

Assets		Liabilities and stockholders' equity	
Reserves	$175	Demand deposits	$1,071
Cash equivalents	$721	Short-term borrowing	$437
Long-term investments	$1,055	Long-term debt	$249
		Total liabilities	$1,757
		Stockholders' equity	$194
Total assets	$1,951	**Total liabilities + Stockholders' equity**	$1,951

Figure 2.14: Credit Market Equilibrium

Assets can be split into 3 categories:

1. **Bank reserves** include vault cash or paper money held by Citibank, and Citibank's holdings of reserves at the Federal Reserve Bank. The federal reserve bank is a government-operated bank that private banks use to make transfers within the US financial system. Citibank reserves at the Federal Reserve bank as deposits are owned by Citibank and are available at any moment's notice.

2. **Cash equivalents** are riskless, liquid assets that Citibank can immediately access, like deposits with other private banks. An asset is riskless if its' value does not fluctuate. An asset is liquid if it can quickly and easily be converted into cash, with little or no loss in value.

3. **Long-term investments** mostly comprise of loans to households and firms but also include things like the value of the real estate that the bank uses for its operations.

Liabilities and stockholders' equity can be split into 3 categories:

1. **Demand deposits** are funds "loaned" to the bank by depositors. Most depositors do not think of this as a loan from the bank, but rather as a deposit to a checking account. These are demand deposits because the depositor can access the funds on demand by withdrawing the money from the ATM or bank teller. They are liabilities for Citibank because it owes this money to us depositors.

2. **Short-term borrowing** comprises short-term loans that Citibank has obtained from other financial institutions. All these loans are part of Citibank's liabilities and need to be repaid in the next year. Heavy reliance on short-term debt generated some fragility in the banking system. If lenders worry that Citibank will have difficulty paying back this debt, Citibank might have trouble borrowing new funds and would therefore lack the funds needed to conduct its operations.

3. **Long term debt** is debt that needs to be repaid in a year or more to an institution that loaned money to Citibank. This proportion contrasts sharply with the asset side of the balance sheet, as 54% of the assets are long-term. The difference between long-term debt and long-term assets introduces a sort of risk for the bank.

4. **Stockholders' equity** is the difference between the bank's total assets and its' total liabilities. This difference is equal to the estimated value of the company, or what the total value of Citibank shares should be worth if the accountants got everything right.

The Role of Banks

Banks have three roles:

1. Banks identify probable lending opportunities.

   Banks bring together creditors and lenders. Given their willingness to lend, banks attract a large number of borrowers.

2. Banks transform short term liabilities like deposits, into long-term investments in a process called maturity transformation.

   Maturity is the time until debt must be repaid. Demand deposits have a zero year maturity because the individual who made the deposit can take back her money at any time. In contrast, when banks lend to borrowers, such loans can have maturity, ranging from several years to 30 years. The transfer of short term liabilities like demand deposits into long-term investments is called maturity transformation. Banks do not lend out the entire amount of deposits. They hold some fraction of it as reserves in some other form of cash-like security.

3. Banks manage risk by using diversification strategies and also by transferring risk compositors to the bank stockholders and in some cases to the government.

   Banks manage risk via two mechanisms. First, they hold a diversified portfolio. A bank invests in mortgages, in addition to a diverse set of assets, such as business loans and government debt. A diversified portfolio is useful because all the diverse assets of the bank are unlikely to underperform at the same time. Second, stockholders bear all the risk that the bank faces. This can hold true so long as stockholders' equity is greater than zero. In other words, as long as the banks assets exceed its liabilities, every change in the value of the assets is absorbed by stockholders. When the value of the banks assets falls below the value of its liabilities, stockholders' equity goes to zero. Now the bank owes more than it owns. At that moment, the government shuts down the bank. The Federal Deposit Insurance Corporation (FDIC) will step in and take control of the bank. Bank takeover will typically protect all deposits, and all depositors will be covered. However, the stockholders are still wiped out. The next business day the bank opens as usual, but it will probably be owned by a different bank. A bank becomes insolvent when the value of the banks assets is less than the value of its liabilities. Bank failures during the 2008 crisis cost the FDIC over $100 billion.

In a bank panic, depositors rapidly withdrawal large amounts of money all at once. This can cause a run on the bank. This is when a bank experiences an extraordinarily large volume of withdrawals driven by the concern that the bank will run out of liquid assets to pay withdrawals.

Bank runs have various economic costs. More importantly, a run on the bank would cause a bank to liquidate long-term illiquid assets prematurely. Thankfully, all deposits at or below the maximum of $250,000 are covered in full by the FDIC.

3 Week 3

3.1 U.S. Monetary System

Money

Money is the asset that people use to make and receive payments when buying and selling goods and services. Money makes exchanges easier. For example, a worker can agree to give up 25 hours of their time in exchange for a paycheck and then use that earned money to purchase an iPhone. It would be difficult for that worker to go directly to Apple and ask to exchange 25 hours of labor for an iPhone. Money makes this exchange easier.

Money has several roles:

1. It is a medium of exchange.

   A medium of exchange can facilitate trade. It can be exchanged in return for goods and services. Money allows for a universally acceptable way of buying and selling goods and services.

2. It is a store of value.

   Money enables people to transfer purchasing power into the future.

3. It is a measure of relative value, or a unit of account.

   Money provides a unit of measurement of value. For example, if we didn't have money, how would we describe the value of an item? We could say that 1 computer is worth 10,000 apples, but that makes the market very complicated. A universal unit of value is necessary for the market to function properly. Modern economies use money as the **unit of account**, which is a universal measurement that is used for expressing the worth or price of different goods and services.

Modern societies use **fiat money** which is something that is used as legal tender by government decree and is not backed by a physical commodity, like gold or silver. For example, a dollar bill is valuable only because other people will accept it as money. We can trust that this paper currency will be used for these purposes in the future.

We define the **money supply** as all the currency in circulation. It includes checking and savings accounts and most other types of bank accounts. This is often referred to as "M2." At the end of 2020, the M2 supply was $19 trillion.

Money, Prices and GDP

Let's recap on a few concepts we learned in week 1:

Nominal GDP is the total value of production, using prices from the year in which the output was produced. Real GDP is the total value of production using fixed prices taken from a particular base year, which may or may not be the year in which the output was produced. The inflation rate is the growth rate of the overall price level in the economy.

Let's consider a scenario. Assume that in 2020, an economy produced 10 basketballs at a price of $50 per ball, for a total sales value of $500. In 2021, total sales rise to $550. Therefore, nominal GDP has risen by $50. There are two possible causes for this $50 increase:

1. The price of soccer balls is still $50 per ball but the number of soccer balls produced has increased to 11 balls.
2. The price of soccer balls has risen to $55 per ball, and the number of soccer balls produced is still 10.

Nominal GDP has increased by $50 in either scenario. However, real GDP has only increased in the first scenario. In scenario 1, inflation is 0 and real GDP has grown by 10%. In scenario 2, inflation is at 10% because the price of the soccer balls has increased by 10% but the production quantities remain the same.

Increases in nominal GDP can arise because of an increase in the price level, an increase in the level of real GDP or a combination of the two. We can express the growth rate of nominal GDP as the sum of the growth rate in prices (the inflation rate) and the growth rate in real GDP: Growth rate of nominal GDP = growth rate of prices + growth rate of real GDP.

The Quantity Theory of Money

The money supply (M2) and the nominal GDP tend to grow at the same rate. From 1980 to 2019, the money supply (M2) and nominal GDP have both grown at an average rate of 6% each year. This is because nominal GDP represents the total volume of transactions in a year and the money supply is the medium of exchange for these transactions. However, the money supply does not need to equal nominal GDP because money can be used more than once in a year. However, the growth rates of each (money supply and nominal GDP) tend to move together over the long run.

The **quantity theory of money** (QTM) assumes that the growth rate of the money supply and the growth rate of nominal GDP are the same over the long run. Although this may not hold true for every year, it is a good approximation for the economy in the long run. The quantity theory of money equation looks like this: Growth rate of money supply = Growth rate of nominal GDP. We can break this down even further to look like this:

Growth rate of money supply = Inflation rate + Growth rate of real GDP

And we can rearrange this to get the inflation rate on the left hand side:

Inflation rate = Growth rate of money supply - Growth rate of real GDP

This is the inflation equation. It states that in the long run, inflation is equal to the gap between the money supply and the growth rate of real GDP. When this gap widens, the inflation rate increases. If the growth rate of money exceeds the growth rate of real output, you'll have excess money in the economy, which will drive prices up and create inflation.

Inflation

Inflation occurs when the growth rate of money supply exceeds the growth rate in real GDP. The QTM predicts that the inflation rate should rise one-for-one with the growth rate of money supply minus the growth rate of real GDP. Therefore, if the growth rate of money supply increases by 1% or the growth rate of real GDP decreases by 1%, then the inflation rate should increase by 1%.

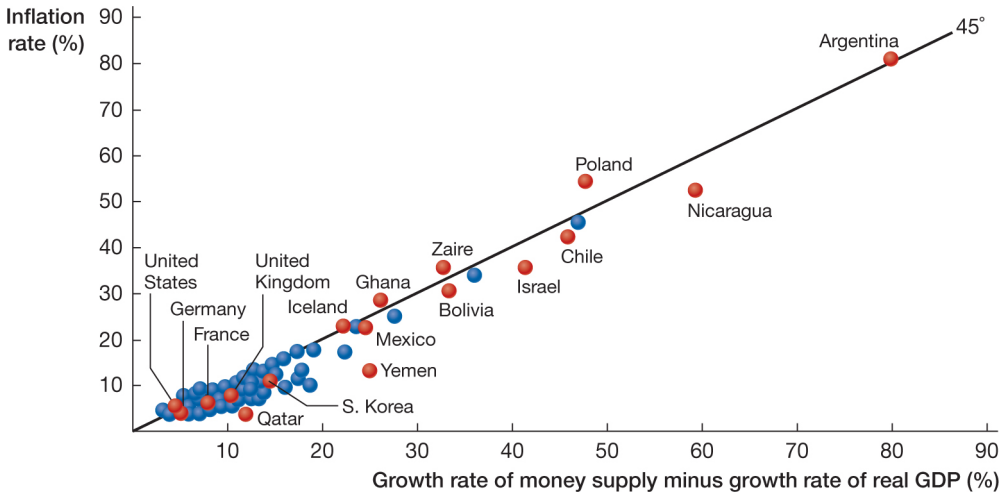

Figure 3.1: Testing the Long-Run Prediction of the Quantity Theory of Money

We can see the QTM in action in the graph above. It empirically evaluates the long-run predictions of the QTM using data from 1960 to 1990 for 110 countries. The y-axis plots the annualized inflation rate for each country. The x-axis plots the difference between the annualized growth rate of money and the annualized growth rate of real GDP. Each country is represented by a single point in the figure. The 45-degree line starts at the origin with a slope of 1, and represents the relationship predicted by the inflation equation. Most of the countries fall close to this 45-degree line, which has a slope of 1. This confirms the inflation equation.

Argentina is an extreme case of inflation where inflation averaged 80% per year from 1960 to 1990. Argentina experienced this because prices rose quickly in the 1980s, pulling up the three-decade average. Hyperinflationary episodes are related to an extremely rapid growth of the money supply in which the price level is more than doubling each year. This is almost always in part due to poor government policies. When a government prints currency and uses it to make purchases, this increases currency in circulation and thereby increases the money supply. We saw this in the

great German hyperinflation of 1922 - 1923.

The Consequences of Inflation

Inflation would be irrelevant if nominal wages always increased at the same rate. However, this isn't always the case. If your contract with your employer holds a fixed wage for 3 years, but then inflation rises unexpectedly in that time frame, you'll endure the consequences. Retirees with fixed pensions can also face consequences due to inflation. Pension payments are fixed values that do not automatically rise with the overall level of prices. A rise in inflation hurts the retiree because it diminishes their buying power.

The Social Costs of Inflation

There are 2 primary social costs of inflation:

1. **A high inflation rate creates logistical costs.** Imagine trying to run a restaurant where you need to update your menu prices every day. That would be annoying! The cost of changing prices is referred to as "menu costs" and can be costly if occurring repeatedly.

2. **Inflation sometimes leads to counterproductive policies like price controls.** Price controls in response to inflation can cause a variety of issues, including supply disruptions. Firms are unable to profitably sell goods and services at the prices set by government. This devastated Venezuela and led to widespread unemployment and starvation during their period of hyperinflation. Even when goods are available, price caps cause the quantity demanded to exceed the quantity supplied.

The Social Benefits of Inflation

There are 2 primary social benefits of inflation:

1. **Government revenue is generated when the government prints currency.** The government generates revenue each time is prints money for itself. This is referred to as **seigniorage.** It's not a major source of revenue, but it does provide something. It generates roughly $40 billion of implicit revenue for the U.S. government each year.

2. **Sometimes inflation can stimulate economic activity.** We can look at an example of workers' nominal wages. A real wage is the nominal wage divided by the overall price index. A rise in overall price index causes a fall in the real wage when the nominal wage is fixed. A fall in the real wage implies that labor is less expensive and firms can therefore hire more workers. Inflation also lowers the real interest rates, which stimulates borrowing to fund consumption and investments. An increase in either of these leads to an increase in GDP. Modest inflation stimulates the economy by cutting real wages and cutting real interest rates.

The Federal Reserve

Each country has a central bank that runs its' monetary system. Ours is the federal reserve. The **central bank** is the government institution that monitors financial institutions, controls certain key

interest rates and indirectly controls the money supply. These activities are described as **monetary policy**. The Federal Reserve bank is an independent regulatory bank that operates largely autonomously from the rest of the federal government. It's commonly referred to as "the Feds."

The Fed's most important policy decisions are determined by the Federal Open Market Committee, which is composed of the presidents of the 12 regional Federal Reserve Banks and the 7 members of the Board of Governors. The Fed pursues two objectives in its dual mandate: 1) low and predictable levels of inflation and 2) maximum levels of employment. The first goal entails pursuing price stability, which is understood as an inflation rate of 2%.

How does the Fed achieve these two goals? They do so via 3 types of activities:

1. Regulation

   The Fed regulates private banks. They audit financial statements, requiring each bank to report its assets and liabilities. The central bank will step in if it notices that a private bank's portfolio is too risky. The Fed aims to ensure that shareholders' equity is adequate to safely absorb future losses in the case of a recession. These are referred to as "stress tests" that came about in 2011 in response to the 2008 recession. These stress tests are important to protect against future economic crises.

2. Interbank Transfers

   The Fed oversees when one bank transfers money to another. When a depositor writes a check and the recipient of that check deposits the proceeds at a different bank, the Fed processes this transaction using bank reserves. Bank reserves are the deposits that a private bank makes at the central bank plus cash that the private bank holds in its vault - referred to as vault cash. Bank reserves are not part of M2. M2 is the money supply that households and non-bank firms can use to buy goods and services. The Fed is like a bank for banks. Let's say a customer at JPMorgan Chase writes a check for $100 million to a customer at Citibank. The Fed will clear this check by transferring $100 million from Chase to Citibank. In order to do this, Chase must hold at least $100 million in reserves at the Fed.

3. Countercylical Monetary Policy

   The Fed influences economic activity by lowering interest rates when the economy is growing too slowly and raising them when it is growing too fast. Lowering interest rates increases borrowing, consumption and investment. Raising interest rates decreases borrowing, consumption and investment.

Bank Reserves and the Monetary System

Private banks need liquidity, meaning that it will need funds that can be used immediately to conduct transactions. A private bank has enough liquidity if it has sufficient funds to conduct its day to day business and meet its regulatory liquidity coverage ratio. This rule requires large banks to to hold at least a certain amount of risk-free liquid assets such as reserves and U.S. Treasury securities. Banks will first go to their reserves at the central bank for liquidity. If they don't have enough there, they can borrow from other banks. Although it is possible that all banks unexpectedly face large net withdrawals, most of the time the need for liquidity is not an aggregate

phenomenon but only specific to a limited set of banks.

The **federal funds market** is where banks can obtain overnight loans of reserves from each other. This is where banks borrow and lend reserves to one another. In this market, banks typically make one-day loans so the federal funds market is referred to as an overnight market. These loans of bank reserves are held at the Federal Reserve Bank. The interest rate in this market is the **federal funds rate.** Each day, the bank assesses its liquidity needs for the upcoming day and lends accordingly.

The Demand Side of the Federal Funds Market

We can plot the demand for reserves below. These are reserves held on deposit by private banks at the Federal Reserve Bank. The federal funds rate is plotted on the y-axis and the quantity of reserves is plotted on the x-axis. The demand curve for reserves plots the total quantity of reserves held by private banks. Therefore, if one bank has $10 billion in reserves and loans out $1 billion of reserves to another bank, the net quantity of reserves demanded is:

[$10 billion - $1 billion] + $1 billion = $10 billion

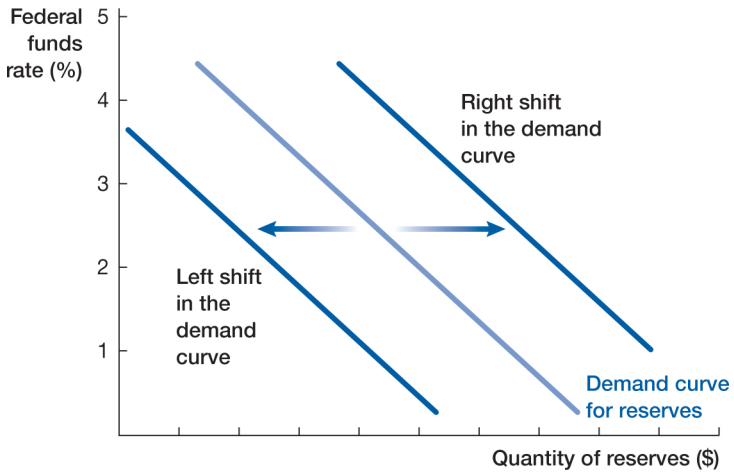

Figure 3.2: The Demand Curve in the Federal Funds Market

The demand curve relates the total quantity of reserves demanded by private banks at each level of the federal funds rate. It slopes downward because banks choose to hold more reserves as the cost of holding those reserves (the interest rate they pay to borrow reserves), falls. Therefore, a lower interest rate increases the quantity of reserves demanded. Changes in the federal funds rate (assuming nothing else changes,) generates movements along the demand curve for reserves. Changes in anything other than the federal funds rate will prompt a shift in the reserves demand curve. There are 5 things that can shift the demand curve:

1. Economic expansion or contraction.

   Private banks need money to make new loans to businesses in a booming economy. Reserves provide liquidity to fund these loans. An expansion in loan originations prompts a

rightward shift in the reserves demand curve. A contraction in private banks' loans originations prompts a shift to the left in the demand curve for reserves.

2. Changing liquidity needs.

   If banks expect a flood of withdrawals, like in the case of a bank run, this increases the demand for reserves. Paying out depositors requires liquidity which is exactly what the reserves provides. Therefore, if the bank expects this flood of withdrawals, the demand curve shifts to the right.

3. Changing deposit base.

   The demand for reserves is linked to the total value of bank account balances. When a bank has large quantity of deposits, it faces the risk that many depositors will make withdrawals at the same time. The liquidity to pay out these withdrawals is paid out by bank reserves. Therefore, an expansion in the quantity of bank account balances prompts a shift to the right in the demand curve for reserves. Conversely, the demand curve for reserves shifts to the left as a consequence of a contraction in bank account balances.

4. Changing interest on reserves (IOR)

   The interest rate paid by the Fed for having reserves on the deposit at the Fed can change. The Fed pays interest when private banks hold reserves at the Fed. Before January 2020, the interest rate paid by the Fed to private banks with reserves on deposit at the Fed was 1.55%. When the Fed raises this, reserves become more beneficial to private banks, shifting the demand curve for reserves to the right. When the Fed lowers the IOR, reserves become less valuable and therefore shift the demand curve for reserves to the left. In March 2020, the Fed cut the IOR down to 0.1%. This caused the demand for reserves to shift to the left. The IOR is not the same as the federal funds rate.

The Supply Side of the Federal Funds Market and Equilibrium in the Federal Funds Market

The supply curve of reserves is a vertical line as set by the Fed. The Fed may move this curve to the right or left. The point where the supply and demand curves cross in the federal funds market is the **federal funds market equilibrium**. At this point, the quantity of reserves demanded is equal to the quantity of reserves supplied by the Fed. The equilibrium federal funds rate is the point at which the demand curve of private banks crosses the vertical supply curve of reserves set by the Fed.

If the Fed wants to increase the level of reserves that private banks hold, it buys government bonds from the private banks and in return it gives the private banks more electronic reserves. If the Fed wishes to decrease the level of reserves, it sells government bonds to the private banks and in return the private banks give back some of their reserves. These transactions of buying and selling bonds shifts the vertical supply curve and controls the level of reserves at the Fed held by private banks. These are **open market operations**. They are one of the Fed's most important monetary policy tools.

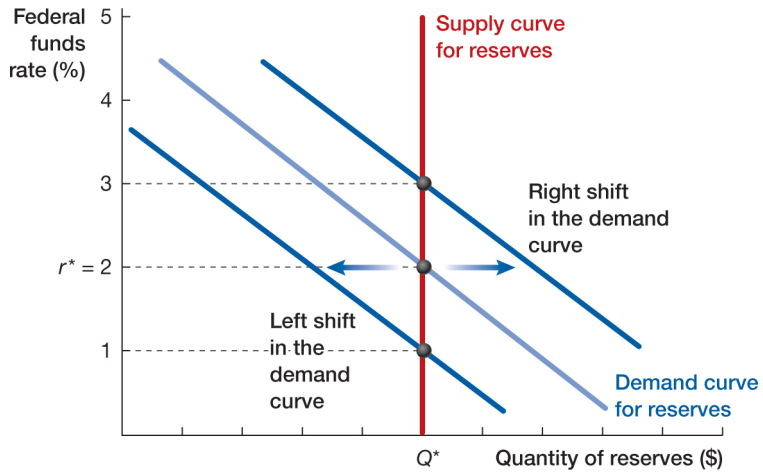

Figure 3.3: Equilibrium in the Federal Funds Market

There are 2 methods that the Fed controls the Federal Funds Rate.

1. **Changing the Quantity of Reserves**

   The Fed can pick the level of reserves that achieves a particular federal funds rate. Even if the demand curve shifts, the Fed can change the supply to hold the federal funds rate. When the demand curve shifts to the left, the Fed reduces the supply of reserves to keep the federal funds rate from falling. The Fed can raise the federal funds rate by shifting the supply curve for reserves to the left. The Fed can lower the federal funds rate by shifting the supply curve for reserves to the right.

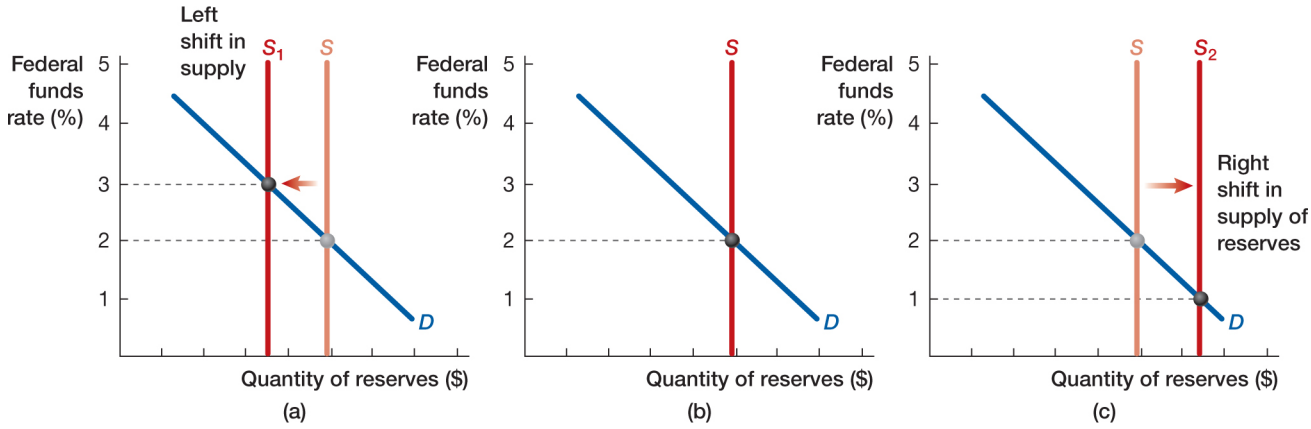

Figure 3.4: Shifts in the Federal Funds Rate Induced by a Shift in the Supply of Reserves

2. **Changing Interest on Reserves (IOR)**

   The Fed can change the IOR which shifts the demand curve for reserves. A rise in IOR shifts the demand curve for reserves to the right. A fall in IOR shifts the demand curve for reserves to the left. By changing the IOR, the Fed can shift the demand curve for reserves, causing the equilibrium federal funds rate to rise or fall. Accordingly, shifts in the demand curve for reserves translate to changes in the federal funds rate.

Historically speaking, the Fed has shifted the quantity of reserves to influence interest rates.

The Fed's Influence on the Money Supply and the Inflation Rate

It's important to clarify that the bank reserves are actually not part of the money supply. The money supply includes deposits by households and firms at private banks and currency in circulation.

The Fed can influence the money supply and the inflation rate. If the inflation rate is around the targeted 2%, then the Fed won't worry about it. However, in the long run, the inflation rate is approximately the growth rate of the money supply minus the growth rate of real GDP. The Fed will try to slow down the rate of money supply growth if the inflation rate starts to rise above the Fed's inflation target. The money supply increases when banks make new loans. Consider a home buyer who takes out a $200,000 mortgage from Citibank. The person selling the home receives these funds, which increases the money supply by $200,000. The origination of many new loans causes the money supply to grow rapidly. When the Fed attempts to slow down the growth of the money supply, it does this by slowing down the growth of loans from private banks to households and firms.

The federal funds rate influences the long-term interest rates that affect the quantity of new loans demanded by households and firms. By raising the federal funds rate, it indirectly raises the interest rate that consequently affects households and firms.

The Relationship Between the Federal Funds Rate and the Long-Term Real Interest Rate

The Fed can influence the long term real interest rate. Investment depends on this rate, which is the long term nominal interest rate minus the long term inflation rate. The "long term" period refers to 10+ years. The long term real interest rate is relevant because most investments are 10+ years. In contrast, the federal funds rate is a short-term nominal interest rate. To understand the impact of the federal funds rate on the long-term real interest rate, it is also useful to think about the real interest rate that is anticipated when the loan is made. This is potentially different from the real interest rate that is realized over the life of the loan. Therefore, we must distinguish between a realized real interest rate and an expected real interest rate. The realized real interest rate is defined as:

Realized real interest rate = Nominal interest - Realized inflation rate

Note that realized inflation is the inflation that actually occurred over a particular period of time. When the loan is first issued, the borrower doesn't yet know what the realized inflation rate will be. So the borrower won't be able to compute the realized real interest rate until the loan ends. However, we can hold expectations of what the realized real interest rate will be:

Expected real interest rate = Nominal interest rate - Expected inflation rate

When making loans, borrowers do not know what the realized inflation rate will be. The expected real interest rate depends on the economic agents' inflation expectations, which are beliefs

about future inflation rates. These beliefs can be based on past experiences, rationality and overall expectations.

A fall in the federal funds rate implies that private banks are able to borrow reserves in the federal funds market at a lower interest rate. This implies that the supply of credit from private banks shifts to the right.

The long term nominal interest rate falls because a long-term loan is effectively made up of many short-term loans. For example, we can think of a 10-yr loan as ten 1-yr loans lined up after each other. When the federal fund rate drops, the first 1-year loan becomes less expensive for the private bank to make. Several of the 1-year loans that are linked together in the first few years are affected. The nominal interest rate for the long-term loan is like the average of these ten 1-year loans. If several of the 1-year loans decline because of a change in the federal funds rate, then the long-term nominal rate will also fall.

We now need to determine how changes in the long-term nominal interest rate affect the long-term expected real interest rate. Let's say inflation expectations don't change in response to a change in the federal funds rate. In this case, when nominal interest rates fall, then the expected real interest rate falls. Therefore, a fall in the federal funds rate lowers the long-term nominal interest rate and consequently lowers the expected long-term real interest rate.

We can also observe how changes in the long-term real interest rates influence household and firm investment decisions. For example, a fall in the mortgage rate will increase demand for home buying and building, etc. Likewise, a fall in corporate borrowing rates will stimulate corporate investment, increasing employment and output.

3.2 Short-Run Fluctuations

Economic Fluctuations and Business Cycles

The US economy has grown substantially over the last 100 years. However, this growth has not been steady. We have had ups and downs. The short run changes in the growth rate of real GDP are economic fluctuations or commonly referred to as business cycles. The graph below plots the real level of GDP in blue for the United States from 1929 to 2020, using 2012 as the base year for prices. Real dollars hold the overall price level fixed, implying that the effects of inflation are removed from plots of real variables. The plot of real GDP starts at 1929 because that is when high-quality data is first available. The exhibit plots a trend line and the red line represents the smoothed out path of the economy, which eliminates temporary downward fluctuations. Although an economy without fluctuations is not feasible, government policies can reduce the severity of fluctuations. In the graph, we can see two major deviations from the trend, and those are the Great Depression and World War II from 1941 to 1945. During the Great Depression, US economy fell far below train GDP. During World War II, the US economy surged ahead of the trend GDP.

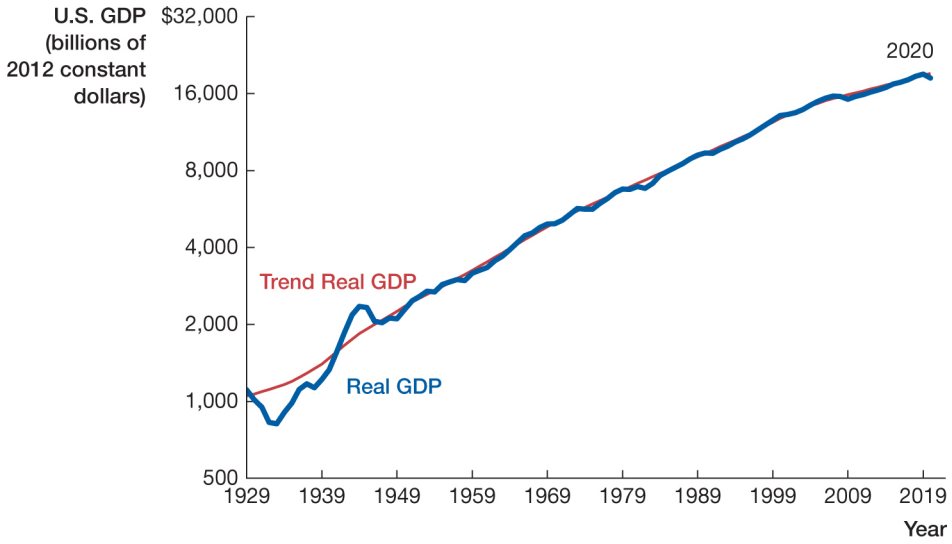

Figure 3.5: Real GDP vs. Trend Real GDP (1929-2020)

Alternatively, we can view the same data by looking at the percentage deviation from real GDP trend. When the difference is positive, real GDP is above its trend line. When it is negative, real GDP is below its trend line. We could easily see two big events standing out, and that is the Great Depression and World War II. The recession of 2007 - 2009 is also visible. The recovery from the 2007 recession was slow, so real GDP remained well below its trend line for several years after the recession ended in 2009.

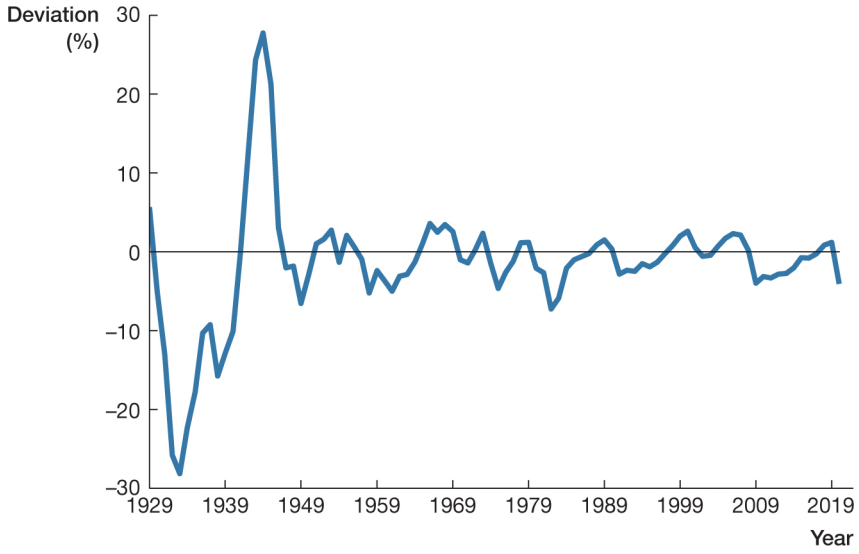

Figure 3.6: Percentage Deviation between U.S. Real GDP and its Trend Line (1929-2020)

We refer to periods of growth in GDP as expansions or booms, and episodes of negative GDP growth are referred to as downturns, contractions or recessions. **Economic expansions** are the periods between our sessions. Accordingly, an economic expansion begins at the end of one recession and continues until the start of the next recession. Recessions are periods that last at least two quarters for which real GDP falls.

We can see the dates of the 15 US recessions that have occurred since 1929 and the decline in real GDP for each recession in the chart below. The peak is the High Point a real GDP, just before a recession begins. The truth is the low point of real GDP during the recession, which corresponds to the end of the recession. Since 1929, a recession has occurred about once every six years, and the average recession link has been about one year.

Starting Month	Ending Month	Duration (months)	Decline in Real GDP from Peak to Trough
August 1929	March 1933	43	26.3%
May 1937	June 1938	13	3.3%
February 1945	October 1945	8	12.7%[1]
November 1948	October 1949	11	1.5%
July 1953	May 1954	10	1.9%
August 1957	April 1958	8	3.0%
April 1960	February 1961	10	0.3%
December 1969	November 1970	11	0.2%
November 1973	March 1975	16	3.1%
January 1980	July 1980	6	2.2%
July 1981	November 1982	16	2.5%
July 1990	March 1991	8	1.3%
March 2001	November 2001	8	0.3%
December 2007	June 2009	18	4.3%
February 2020	NA	NA	NA

Figure 3.7: U.S. Recessions (1929-2020)

Economic fluctuations have three key properties:

1. Co-movement of many aggregate macroeconomic variables

   Mini aggregate macro economic variables grow or contract together during economic booms or recessions. This pattern is referred to as co-movement. For example, consumption and investment move together. We can see this in the plot below, which graphs real consumption growth on the X axis and real investment growth on the Y axis. Each point represents a single year of historical data. The points tend to cluster around an upward sloping line. This means that consumption and investment display co-movements. When consumption growth is high, investment growth tends to be high as well. When consumption growth is low, investment growth tends to be low. We could also see that investment is more volatile than consumption, it has a much wider range compared to the range of real consumption growth. This variation in investment growth occurs because firms drastically cut investment in an economic recession. However, it is optimal for households to try to smooth consumption overtime. We can see the same pattern with employment and GDP. These two metrics also move together with consumption and investment, and unemployment moves negatively with GDP. For example, this implies that during contractions, real consumption, real investment, employment, and real GDP all fall together.

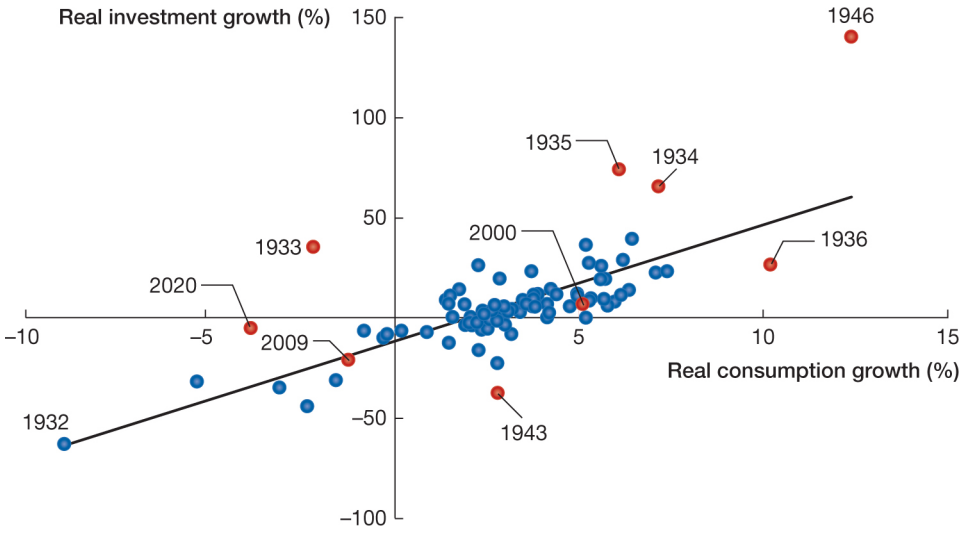

Figure 3.8: Real Consumption Growth vs. Real Investment Growth (1929-2020)

2. Limited predictability of turning points

   A turning point in a recession is either the end or the beginning of a recession. An important feature of these fluctuations is that there is limited predictability on when turning points will occur. For example, recessions can range from a short period of 6 months to a long period of 43 months. The 2008 per session was 18 months long. Since 1929, the shortest expansion was one year compared to the longest expansion of 11 years. Because recessions and expansions have such variable lengths, they do not follow a repetitive, easily predictable cycle. Even with the tools of modern econometrics, it is impossible to accurately predict in advance when a recession will end. This is the idea of limited predictability. It is difficult to foresee when a recession will end. Limited predictability is important to acknowledge because many early theories of business cycles assumed that economic fluctuations had a systematic structure with predictable swings in economic growth.

3. Persistence in the rate of economic growth

   Even though recessions begin and end at unpredictable times, economic growth is not random. When the economy is growing, it will keep growing the following quarter. When the economy is contracting, it will keep contracting the following quarter. This is the idea of persistence. Therefore, if an economy is in a recession this quarter, we can predict that it will still be in a recession next quarter.

The Great Depression

The Great Depression is one of the most infamous economic contractions. It is known for its severity, and it stands out among the rest. The term depression is used to describe a prolonged recession with a sustained unemployment rate of 20% or more. Although the US economy has experienced many recessions, the 1929 contraction qualifies as a depression. For example, unemployment during the 2008 recession peaked at 10%. Unemployment during the 2020 recession

peaked at 14.8% in April 2020. However this extremely high rate of unemployment was short-lived. The Great Depression started in 1929, coinciding with a crash in the US stock market. From 1929 to 1933 the crisis worsened as stock markets around the world continue to decline. Millions of US farmers in homeowners went bankrupt. Real GDP fell 12.3% below it's 1929 level, and unemployment eventually rose to 25% in 1933. The unemployment rate hovered above 20% from 1932 to 1935. Thousands of banks closed down in the same period. This decline was driven by failing banks that either went out of business altogether or were acquired by stronger competitors. These same happenings occurred in other developed countries, however the US contraction was among the most severe.

The Great Depression, although unfortunate event, illustrates the three properties of economic fluctuations. First, it features strong co-movements between economic metrics, such as real consumption, real investment, real GDP, the unemployment rate and stock prices. Real consumption, real investment and real GDP all fell during this period. The unemployment rate increased during this period. The Down Jones Industrial Average, an important stock index, took a hit during this period. We can view these co-movements in the figures below.

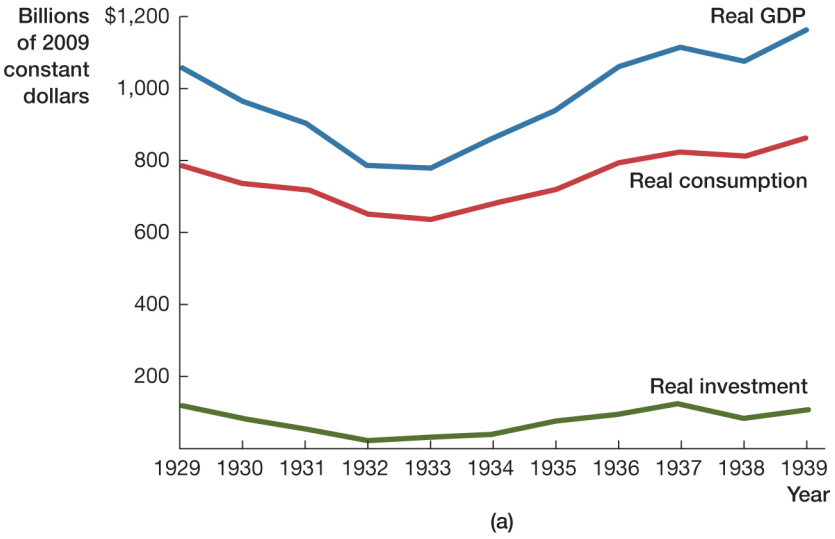

Figure 3.9: The Great Depression and Its Effects on GDP, Unemployment and the Stock Market

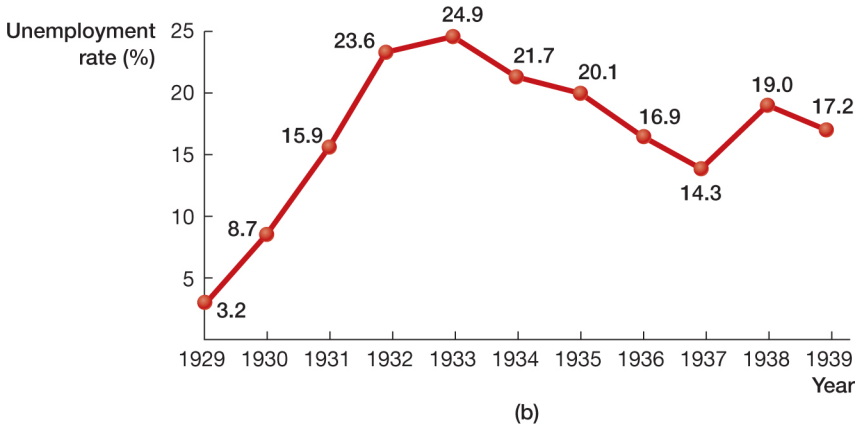

Figure 3.10: The Great Depression and Its Effects on GDP, Unemployment and the Stock Market

Figure 3.11: The Great Depression and Its Effects on GDP, Unemployment and the Stock Market

The Great Depression also demonstrates limited predictability; or in this case, no predictability. The great crash of October 24, 1929 came as a complete surprise surprise to most economists. The preeminent economic forecast of the late 1920s was Irving Fisher, Yale professor who repeatedly commented on the strength of the economy at the time. In fact, one week before the crash, Fisher stated that "stock prices have reached what looks like a permanently high plateau." Fisher maintained his optimism. He was later proved wrong by the severity of the Depression. No leading economic forecaster predicted the Great Depression. What's ironic is that on January 18, 1930, shortly after the crash, forecasters at Harvard stated that: "there are indications that the most severe phase of the recession is over." In reality, the Great Depression had barely begun.

Finally, the Great Depression also demonstrates the third property of economic fluctuations, and that is persistence. The Great Depression lasted longer than a typical recession. The period of negative growth of real GDP lasted for four years, starting in 1929 and ending in 1933.

Macroeconomic Equilibrium and Economic Fluctuations

The topic of economic fluctuations is one of the most contentious topics that incites disagreement among economists. However, despite the disagreement, the economic field has developed a substantial body of knowledge on economic fluctuations.

Labor Demand and Fluctuations

Economists like to use the labor market to evaluate the nature of economic fluctuations. We can see how the variety of forces that impact the economy can shift the demand for labor. We can look at a labor market with downward wage rigidity. In the case of downward wage rigidity, firms are unable or unwilling to cut nominal wages due to contractual restrictions or because they are concerned that wage cuts would reduce worker morale and adversely affect productivity. We can see in the graph below that this dynamic of downward wage rigidity is strong enough to produce a two part labor supply curve that is first flat, due to a downward rigid wage and the vertical, due to a limited supply of potential workers. The two part labor supply curve has a right angle where the flat portion intersects the vertical portion.

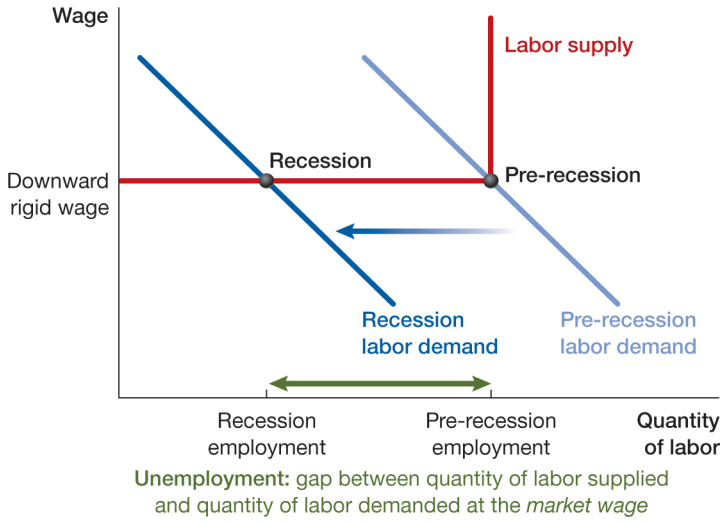

Figure 3.12: Recession Dynamics of Labor Demand and Employment

The labor market equilibrium is at the intersection of the labor supply and labor demand curves. It is the key building block we will use to construct a model of economic fluctuations. Employment fluctuations correspond to changes in the labor market equilibrium. The graph above demonstrates the consequences of a leftward shift in the labor demand curve, which reduces the equilibrium quantity of labor employed. Before a recession begins, the original equilibrium is given by the point labeled "pre-recession. "After an economic shock has shifted the labor demand curve to the left, the new equilibrium features a lower quantity of labor demanded. Firms typically achieve this reduction in employment by cutting back on hiring and allowing the number of employees to shrink through attrition. However, this type of adjustment is not sufficient to get them quickly to their desired level of employment, as shown by the points "recession" in the exhibit. They may also engage in massive layoffs or even shut down some of their plants. Because firms are not hiring, unemployed workers are unable to find jobs. Accordingly, downward rigid wages produce unemployment. At the market wage, the number of workers that are willing to work exceeds the

number of jobs that firms are willing to fill. The number of unemployed workers is represented by the green bar near the X axis.

As employment declines, so does real GDP. There is less labor producing goods and services. Accordingly, employment and real GDP fall together. This is another demonstration of co-movement among economic aggregates. In reality, fall employment is only one adjustment that occurs during an economic contraction. Laying off workers makes the physical capital that I was previously using, less productive.

The rate of utilization of physical capital is called capacity utilization, and recessions are usually accompanied by a reduction in capacity utilization. For example, during the 2008 recession, capacity utilization in the United States dropped down to 67% from a normal rate of 75% to 80%. Although these shifts in the supply of labor can cause fluctuations in employment, the most important source of fluctuations are shift in the demand for labor. We need to understand why the demand for labor fluctuates. We know to three theories that explain some of the reasons for fluctuations in the labor market.

There are three factors that can shift the labor demand curve:

1. Changes in the output price for a firm's products

   When the price of the output good goes down, the value of the marginal product of labor also declines. This implies that the firm would hire fewer workers regardless of wages, shifting the labor demand curve to the left.

2. Changes in productivity or technology

   When the marginal product of labor falls, the labor demand curve shifts to the left.

3. Changes in the costs of a firms inputs

   Businesses use labor and other factors of production to produce goods and services. When the cost of these goods increases, the firms purchase less of them. This typically decreases the marginal product of labor, shifting the labor demand curve to the left. A change in the credit market equilibrium can also influence labor demand by affecting the firm's cost of financing the acquisition of physical capital.

Now that we understand the reasons for why the labor demand curve can shift, we can dive deeper into the three schools of thought that emphasize different drivers as key sources of aggregate economic fluctuations. These theories are all based on the idea that mechanisms that affect the labor demand curve are drivers of economic fluctuations.

The three schools of thought are:

1. Real business cycle theory

2. Keynesian theory

3. Financial and monetary theories

Real Business Cycle Theory: emphasizes changing productivity and technology.

Research and development leads firms to invent more valuable products, such a smart phones replacing traditional cell phones. This increases the value of the marginal product of labor that designs, manufactures, assembles and transports these valuable products, inducing firms to expand their operations and leading them to increase the demand for labor. Firms will also likely seek to increase their production capacity, raising the level of investment in the economy. These changes will lead to higher household income for three reasons: 1) employment increases, 2) wages rise and 3) rising corporate earnings make the corporations' stockholders' wealthier. All three of these will increase household consumption. Therefore, technological improvements can lead to increases in labor demand and therefore lead to increases in aggregate economic activity, including investment and conception. Arthur Cecil Pigou, a classical economist, held this view. His idea was that technology is a root cause in economic fluctuations. This idea was revived in what came to be known as the real business cycle theory.

Productivity shocks can also trigger economic fluctuations. For example, during the 2020 recession, there was a negative productivity shock. Consumers experienced a decline in the safety of the marketplace and workers experienced a decline in the safety in the workplace. For example, if diners can't eat a meal safely in a restaurant, this makes restaurants less productive in servicing customers. If restaurants are required to space out customers, this reduces the firm's productivity. This shifted the quantity of labor demanded sharply to the left.

Proponents of the real business cycle theory emphasize the importance of changing prices, especially the price of oil. The increase in the price of oil can also be viewed as a decrease in productivity of firms that use oil. Because almost all firms use oil to some degree, changes in the price of oil function like technology changes. Oil price changes can be abrupt, including large increases in the price of oil, this factor can explain recessions. A substantial increase in the price of oil may make firms less profitable, prompting the labor demand curve to shift left.

Keynesian Theory: emphasizes changing beliefs about the future

John Maynard Keynes was an academic, stock market trader, and they frequent adviser to the British government. He was active in the early 1900s. He was 46 years old at the start of the Great Depression. He developed theories to explain the causes of the Great Depression. His work culminated in his book: The General Theory of Employment, Interest and Money. His ideas had big implications for government policy. He was controversial at the time and remains so today. However, he made significant contributions to modern macroeconomics.

Keynes believed in the idea of animal spirits. These are psychological factors that lead to changes in the mood of consumers or businesses, thereby affecting consumption, investment and GDP. From his perspective, the animal spirits in an economy can fluctuate sharply even as the underlying fundamental features of the economy did not change much. For example, a period of heightened optimism could provide a period of deep pessimism, even though the economic fundamentals such as physical and human capital, remain the same. Animal spirits are one example of a broader phenomenon, and that is changing sentiments. Changes in sentiments lead to changes

in household consumption and firm investment. For example, when United Airlines becomes pessimistic of future demand for air travel, it may cut back its hiring quantities. It also may cut back on its demand for a new plane. This that affects plane manufacturers as well as workers. We can demonstrate this in the national income accounting identity.

$$Y = C + I + G + X - M$$

Recall that C stands for consumption, I stands for investment, G stands for government expenditure, X stands for exports and M stands important. Y stands for real GDP. A change in the behavior of United airlines may cause a decline in the investment in GDP. However, this decline could be offset by an increase in consumption, government expenditures, or the difference between exports and imports. However, during a time of pessimism, household are unlikely to increase their consumption. The applications for employment are displayed in the last graph we looked at. A left shift in the labor demand curve will reduce employment. This shift is further fueled by household pessimistic sentiments. One household are pessimistic, they save up for a rainy day savings. This translates to a decline in the demand for goods and services, ultimately shifting the labor demand curve to the left.

Another dimension of Keynesian theory is that a modest shock could generate a cascade of consequential effects that ultimately causes a much larger contraction. For example, an increase in the pessimism among airlines will have a series of immediate effects such as reduce hiring. However, this kid cascade into a series of even larger effects, such as reduce hiring at aircraft manufacturers. This cascade can produce ripple effects to more firms, which each start to cut back on hiring and shipped their own labor demand curves to the left. The pessimism might also spread to households, which start to reduce their demand for goods and services. The economic mechanisms that caused an initial shock can be amplified by consequential effects. These consequential effects are called multipliers, or self reinforcing feedback. According to Keynes, this cycle could have significant effects and damage the economy with another wave of layoffs. This cascade of effects will amplify the impact of the initial shock.

Sentiments can be powerful catalysts of economic change. When a large number of economic actors (households or businesses) become pessimistic, this has a cascade of effects. Consumers may reduce their spending on goods and services. Firms may reduce their investing in plants and equipment. Labor demand drops and shifts to the left, reducing employment. This notion of a self-fulfilling prophecy highlights that a change in expectations driven by animal spirits might turn out to be rational. With households and firm speaking becoming pessimistic about the economy, the economy will contract as a result of this behavior. Pessimism ends up justifying itself in these cases.

Keynes also had the idea that economy might remain in a recession because of a lack of aggregate demand, (the economy's overall demand for goods and services.) Aggregate demand drives hiring decisions of firms and consequently determines the labor demand curve. Falling levels of aggregate demand cause a leftward shift in the labor demand curve. Keynes argued that a leftward shift in the labor demand curve could generate longer economic contractions that might not be self-correcting. A long contraction might be reinforced by multipliers and self-fulfilling prophecies. Consumers might not spend, firms might not hire, and these contractionary forces would

reinforce each other. Because of these beliefs, Keynes believed that the government had an important role to play in stimulating aggregate demand.

Financial and Monetary Theories from Milton Friedman: emphasize changes in prices and interest rates

Monetary and financial factors are other forces that drive economic fluctuations. Money supply affects nominal GDP. Typically, a fall in nominal GDP will not only affect the aggregate price level but also real GDP. Changes in the money supply (M2) will also drive business cycles. The major proponent of this view has been one of the few macroeconomists to rival Keynes, and that is Milton Friedman. To understand how monetary factors drive fluctuations in real GDP, consider a scenario in which contractionary monetary policy cause the money supply (M2) to fall. The fall in money supply will cause the price level to fall, as supported by the quantity theory of money. They fall in the price of what reduces employment because of downward wage rigidity. A drop in aggregate price levels implies that firms have cut their output prices, reducing their nominal value of marginal product of labor. Consequently, each firm demands a lower quantity of labor at a given nominal wage. In other words, a fall in prices shifts the labor demand curve to the left. Without the downward wage rigidity, firms would cut nominal wages in line with the fall in our prices. This will enable them to maintain their level of employment before the decrease in the money supply. However, the downward wage rigidity implies that firms will not reduce wages but will rather lay off the number of workers employed.

Contractionary monetary policies cause the real interest rates to rise. The real interest rate is the price that a firm pays for another one of its inputs, physical capital. A rise in the real interest rate will therefore makes production more costly. Because physical capital is needed by labor, the rising cost for physical capital leads firms to hire less labor. This implies a leftward shift in the demand for labor.

Disruptions in the credit market can also cause economic fluctuations. The previous unit, we saw how the supply and demand of credit determines the equilibrium interest rate and the amount of credit in the economy. Disruptions to the credit market, such as bank failures, will reduce the amount of investment in consumption, thereby lowering real GDP and employment. Therefore, a leftward shift in the supply of credit will shift firms' labor demand curves to the left.

Multipliers and Economic Fluctuations

Multipliers can amplify the effects of any economic shock. The figure below demonstrates a simple self reinforcing feedback loop that arises in a contract economy with multipliers. A shock to consumption causes firms to reduce labor demand, shifting the labor demand curve to the left. This shift leads to layoffs, reducing household income and further reducing household consumption. This cycle continues in its way, increasing the depth of the economic contraction with each loop around the circle.

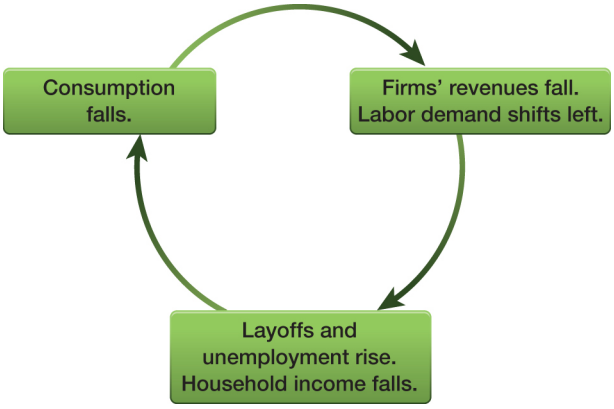

Figure 3.13: Multipliers in a Contracting Economy

We can see the effects of multipliers on wages and unemployment in the graph below in the case of downward rigid wages. Labor supply is plotted a two part curve, and labor demand is plotted and blue. The economy begins at the equilibrium labeled "pre-recession." The shock causes the labor demand curve to shift to the left. The economy is now at a new temporary equilibrium, point 2. This is the temporary equilibrium because it does not take into account multiplier effects. The first wave of layoffs leads unemployed workers to cut back their demand for goods and services, leading the businesses that provide these goods to further reduce their labor demand, causing another leftward shift in the labor demand curve. This moves the economy to the full blown recession equilibrium point three: trough. The trough is the low point of real GDP in a recession. The second shift to the left demonstrates the multiplier effects. The graph below demonstrates 2 shifts in the labor demand curve:

1. The initial shock to labor demand, which is the first shift to the left
2. A second leftward shift of labor demand due to the layoffs resulting from the initial shock

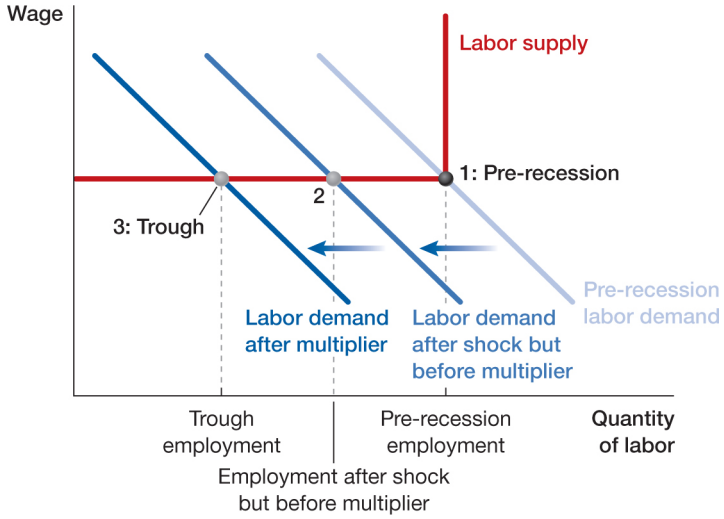

Figure 3.14: Multipliers in an Economy with Downward Rigid Wages

We can further see the multiplier effects in the figure below. This new figure adds mechanisms, to provide a more complete picture of the factors that impact an initial negative shock. These mechanisms include declines in asset prices, such as the value of stocks, bonds and housing. It also includes the rising rates of mortgage defaults, rising rates of household bankruptcies and generating defaults of numerous types of consumer credit.

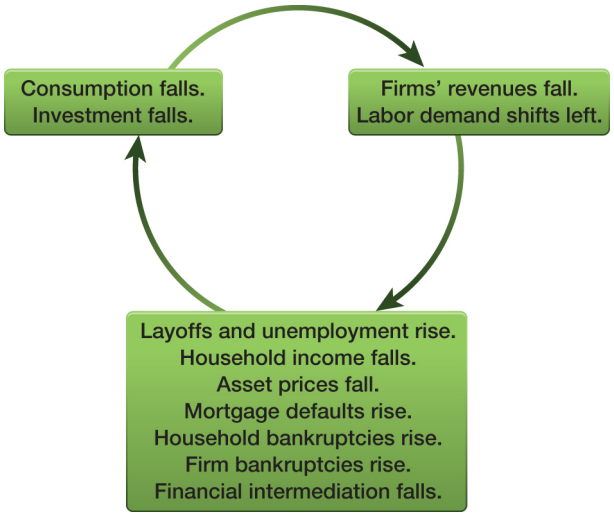

Figure 3.15: Additional Multipliers

Equilibrium in the Medium Run: Partial Recovery and Full Recovery

There are many forces that can reverse the effects of a recession in a few years. This is the 2 to 3 year time horizon known as the medium run. The short run is a few quarters and the long run is a decade or more. We can divide the recovery mechanism into two categories:

1. The labor demand curve shifts back to the right due to market forces
2. The labor demand curve shifts back to the right to expansionary government policies

Let's start with the first recovery mechanism, that the labor demand curve shifts back to the right due to market forces. Here are a few reasons that could explain this rebound:

1. Labor demand partially recovers when excess inventory has been sold off.
2. Labor demand partially recovers with household that have postponed expenditures eventually grow frustrated with the inconvenience of the delayed purchase and come back into the market.
3. Labor demand partially recovers with physical and human capital shift from firms that went bankrupt during the downturn to healthier firms.
4. Labor demand partially recovers when technological advances encourage firms to expand. Labor demand partially recovers as the baking system recuperates and businesses are able to use credit to finance their activities.

Now we will review the second recovery mechanism, that the labor demand curve shifts back to the rate due to expansionary government policies. Here are a few reasons that could explain this type of rebound:

1. The central bank can use monetary policy to shift labor demand to the right by lowering interest rates.

2. Labor demand shifts to the right as overall inflation rises and therefore firms' output prices rise.

3. The government uses fiscal policy such as spending and taxes to shift the labor demand curve to the right.

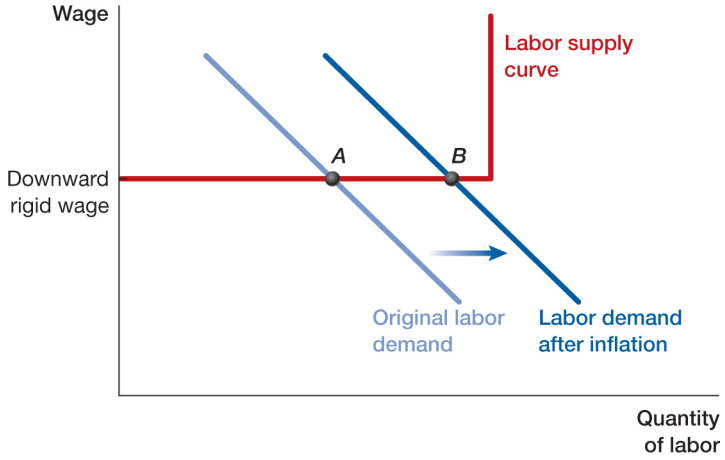

Figure 3.16: The Effect of Inflation on the Labor-Market Equilibrium

We can see these forces in full effect in the graph below. Initially, the economy is at point 1. The combination of downward rigid wages and multipliers creates a rapid contraction in labor demand, which moves the economy to point 2. This is the trough of employment. The labor demand curve then starts to shift back toward its pre-recession level due to both market mechanisms and government intervention. Inflation then shifts the labor demand curve to the right. At the beginning of the recovery, the equilibrium remains at the rigid wage and the economy shifts from point 2 to point 3. Eventually, the rightward shifts in labor demand lead the economy to point 4. At this point, the downward wage rigidity is no longer a constraint because the market clearing wage is above the downward rigid wage. The post recession wage is above the pre-recession wage, and the economy is at full employment. At this point, the equilibrium wage has risen above the downward rigid wage.

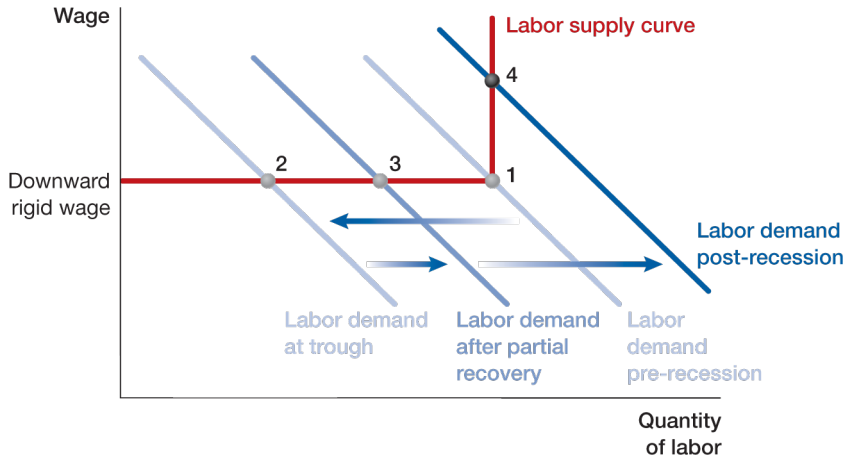

Figure 3.17: The Effect of Inflation on the Labor-Market Equilibrium

Modeling Expansions

Economists also like to model expansions, in the case where many firms become optimistic about future demand. In this case, the aggregate labor demand curve will shift to the right, as shown in the graph below. Wage rigidity does not play a role if the economy is expanding. The multiplier effect will continue to be present, amplifying the initial shift in the rightward movement. For example, increases in labor demand will tend to raise household income, causing households to consume more, triggering another round of multiplier effects.

However, economic expansions also have a dark side. If the labor demand curve shifts to the right when the labor market is already close to full employment, they will be little room for the economy to grow. In this case, the boom is likely to generate substantial wage inflation and very little employment and output growth. This raises a trade-off known as the Phillips curve. The Phillips curve is a positive relationship between employment growth and inflation. The Phillips curve indicates that wages tend to rise faster (wage inflation) when unemployment is low. Therefore, we need to have some level of inflation to keep unemployment low. According to the Phillips curve, an inflation rate of 0% means that unemployment will be extremely high.

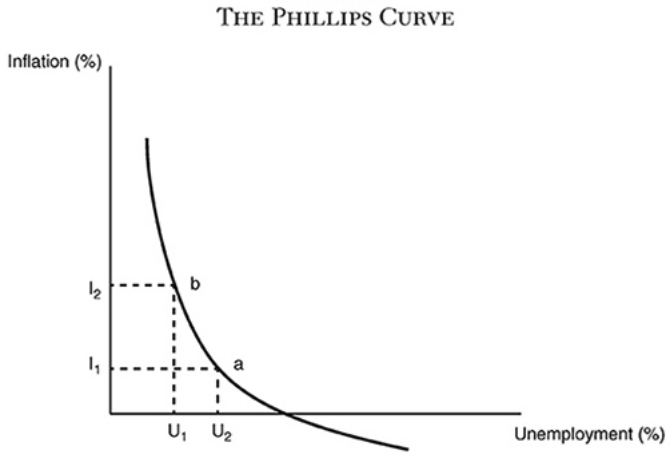

Figure 3.18: The Phillips Curve

The Phillips curve trade-off is especially unfavorable when an economy is approaching full employment. Economic booms can lead to another problem. The optimism that originally triggered the boom may get reversed at some point. Such a reversal involves the leftward shift and labor demand.

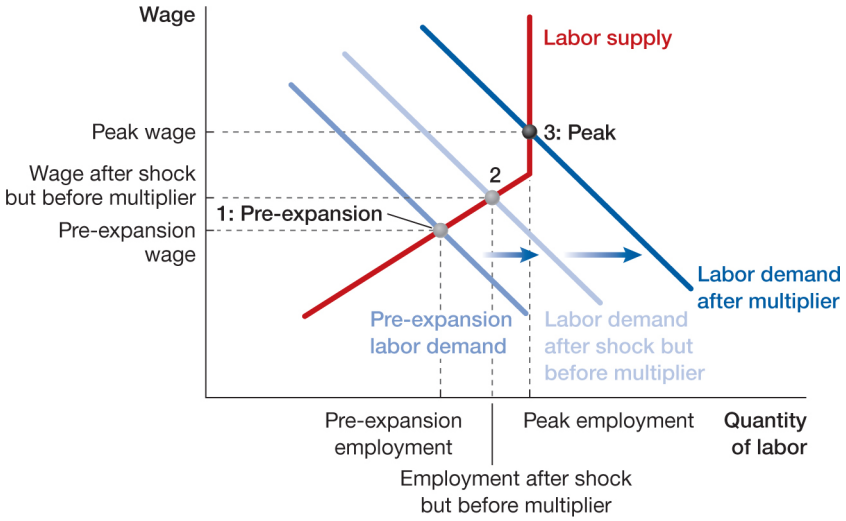

Figure 3.19: Rightward Shift in the Labor Demand Curve

4 Week 4

4.1 Countercyclical Macroeconomic Policy

The Role of Countercyclical Policies in Economic Fluctuations

Now that we know why economic growth fluctuates, we can discuss the governments efforts to reduce this fluctuations using countercyclical policies. **Countercyclical policies** attempt to

reduce the intensity of economic fluctuations and smooth growth rates of employment, GDP, and prices. During a recession, expansionary policy aims to reduce the severity of the downturn by shifting the labor demand curve to the right and expanding economic activity. On the other hand, contractionary policy is sometimes used to slow down the economy when it grows too fast or overheats. There are two categories of countercyclical policies:

1. **Countercyclical monetary policy**, led by the Fed, attempts to reduce economic fluctuations by manipulating bank reserves and interest rates.

2. **Countercyclical fiscal policy**, led by the legislative branch and signed into law by the executive branch, aims to reduce economic fluctuations by manipulating government expenditures and taxes.

Both of these categories work to shift the labor demand curve. During a recession, these policies are used to stimulate the economy with the goal of shifting the labor demand curve to the right. During a runaway boom, these policies are used to slow the economy by shifting the labor demand curve to the left. We can plot the effects of countercyclical policy on a labor market during a recession in the graph below.

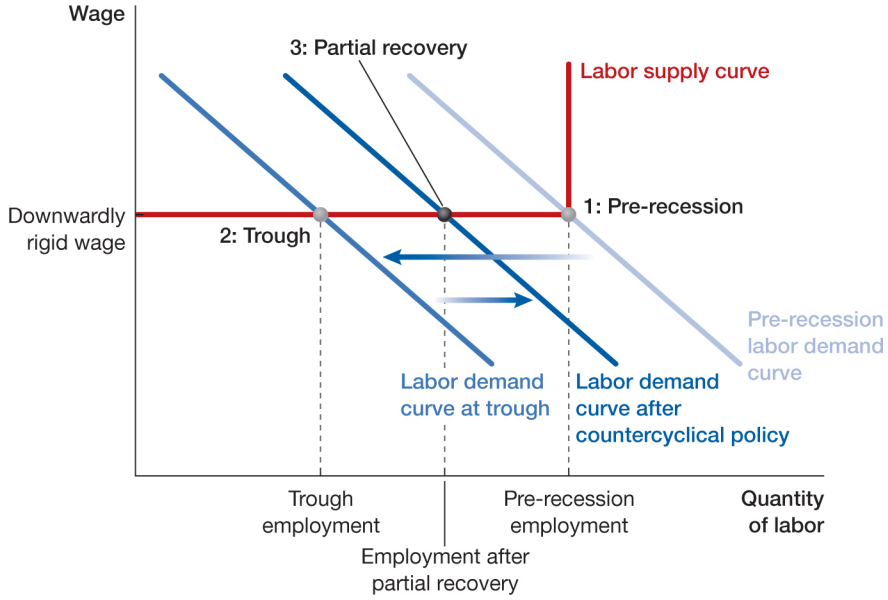

Figure 4.1: The Effect of Countercyclical Policy on the Labor Market

At point 1, the economy starts at four employment. Then a negative shop shift the labor demand curve to the left. We assume that there is downward wage rigidity, so the negative labor demand shock takes us along the flat portion of the labor supply curve to point 2. At this point, the level of employment is lower. Successful expansionary policy can shield economy for the full impact of the recession by shifting the labor demand curve back to the right, taking the economy to point 3.

Policymakers may use contractionary policy to reduce economic growth during a boom. Why would policymakers intentionally adopt a policy that reduces GDP growth and the level of employment? In some situations, the negative effects on GDP and employment are a byproduct of

another policy goal. For example, when inflation is consistently above the feds target rate of 2%, the Fed will raise interest rates to suppress borrowing. This slows the growth of the money supply and reduces the inflation rate. The rising interest rates will shift the labor demand curve to the left, causing employment to fall as a byproduct of the Fed's efforts to reduce inflation. Contractionary policy may target an overheating economy to cool it off before it implodes. Like we talked about before, excessively optimistic sentiments can result in unsustainable economic expansion. It could suddenly implode and have severe effects due to multiplier forces. Therefore, contractionary policy aims to reduce the risk of an extreme contraction by cooling off the economy before it overheats. This "cooling off" is achieved by slowly pushing the labor demand curve to the left. This is sometimes referred to as "leaning against the wind."

Countercyclical Monetary Policy

The Fed response to economic contractions by implementing expansionary monetary policies. This includes increase in the quantity of bank reserves and lowering interest rates. The Fed influences short-term interest rates, especially the federal funds rate. The federal funds rate is the interest rate that banks used to make loans to each other, using reserves on deposit at the federal reserve bank. When the Fed wants to stimulate the economy, it lowers short term interest rates. Consequently, this causes long-term interest rates to fall. The long-term interest rate is related to the long-term average of short term interest rates.

A fall in long-term interest rates encourage his household to buy more durable goods, like cars, because a lower interest rate implies a lower cost of a car loan. Consequently, households demand more durable goods, firms then try to hire more workers, and this ultimately shifts the labor demand curve to the right. On the other hand, a full in long-term interest rates causes firms to engage in more investment in plants and equipment, like building a new factory. Lower interest rates implies a lower cost of a commercial loan to fund these kind of investment projects. Firms need workers to operate these new projects, shifting the labor demand curve to the right. In many ways, expansionary monetary policy shifts the labor and increases employment. To better understand monetary policy, we need to discuss how the Fed lowers short-term interest rates and expense access to credit. The most powerful tool used in this process is the control of big reserves in the federal funds rate.

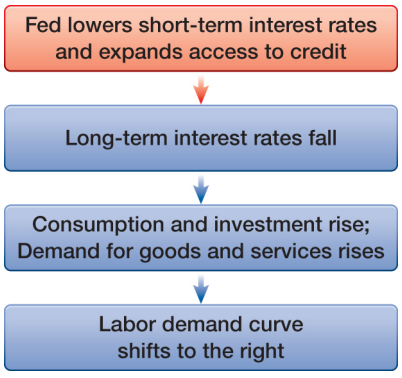

Figure 4.2: Expansionary Monetary Policy

Controlling the Federal Funds Rate

The Fed controls the federal funds rate in two ways:

1. Changing interest on Baker reserves held at the Fed by private bank, which we referred to as interest on reserves (IOR)
2. Changing the total supply of bank reserves held at the Fed by private banks, known as open market operations

Lowering the IOR shifts the demand curve for reserves to the left, consequently decreasing at the equilibrium interest rate and the federal funds market, decreasing the federal funds rate. A shift to the left of the demand curve for reserves held at the Fed drives down the federal funds rate. We can see this mechanism in action in the graph below.

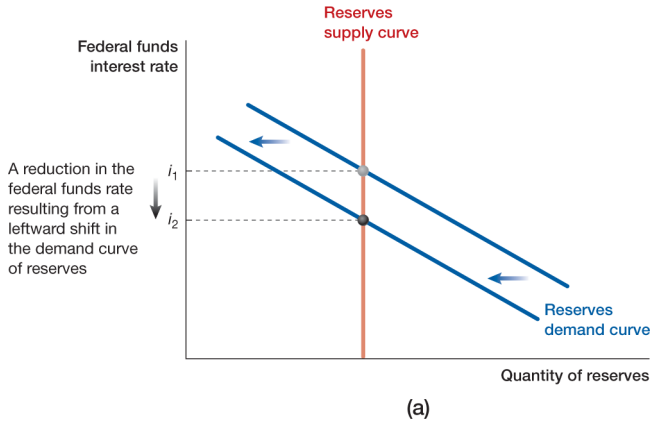

Figure 4.3: The Federal Funds Market

In the open market operations, the Fed transacts with private banks to increase or reduce bank reserves held at the Fed. For example, by increasing the supply a bank reserves available to private banks, the Fed consequently decreases the federal funds rate. We can see this mechanism in the graph below. A shift to the right in the supply of reserves held at the Fed drives down the federal funds rate.

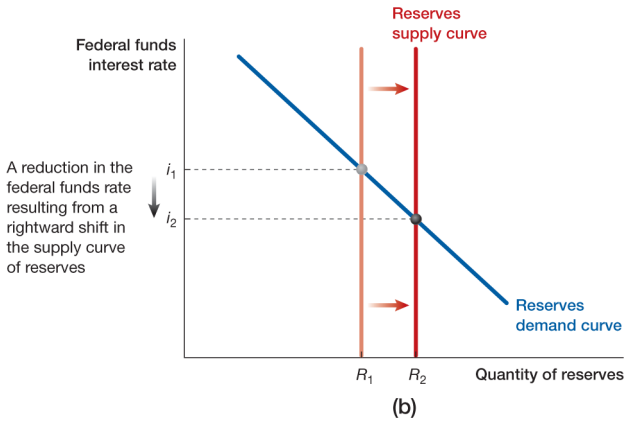

Figure 4.4: The Federal Funds Market

To understand the process of an open market operation, suppose that the Fed wants to increase bank reserves held on deposit at the Fed by $1 billion. So, the Fed will find a bag, let's say Citibank, that is willing to sell the Fed $1 billion in bonds in exchange for $1 billion in bank reserves that Citibank will have a deposit at the Fed. The Fed does not use paper currency in this transaction. It's like the Fed has issued an IOU to a private bank, which takes the form of $1 billion in reserves that Citibank holds on deposit at the Fed. Now, Citibank has $1 billion more in big reserves on deposit at the Fed and owns $1 billion less in bonds. Those bonds that Citibank sold to the Fed. On the assets side of its balance sheet, Citibank has an extra $1 billion in bank reserves that it received in exchange for the $1 billion in bonds that are now owned by the Fed and now appear on the feds balance sheet. Total assets at Citibank are unchanged, though the composition of those assets are tilted away from bonds and toward bank reserves. We can see this on Citibank's balance sheet in the figure below.

Before:	Assets		Liabilities and Shareholders' Equity	
	Reserves:	$200 billion	Deposits and other liabilities:	$1800 billion
	Bonds and other investments:	$1800 billion	Shareholders' equity:	$200 billion
	Total assets:	$2,000 billion	Liabilities + shareholders' equity:	$2,000 billion
After:	**Assets**		**Liabilities and Shareholders' Equity**	
	Reserves:	$201 billion	Deposits and other liabilities:	$1,800 billion
	Bonds and other investments:	$1,799 billion	Shareholders' equity:	$200 billion
	Total assets:	$2,000 billion	Liabilities + shareholders' equity:	$2,000 billion

Figure 4.5: Balance Sheet of Citibank Before and After a $1 Billion Bond Sale to the Fed

The feds balance sheet has also changed. The feds assets now include $1 billion more in bonds, this amount represents the bonds that the Fed bought from Citibank. The feds liabilities also show a corresponding increase. The feds liabilities now include $1 billion more in the form of reserves, these are the reserves for the Fed electronically created and then exchange with Citibank.

Before:	Assets		Liabilities and Shareholders' Equity	
	Treasury bonds:	$5,000 billion	Reserves:	$4,000 billion
	Other bonds:	$1,000 billion	Currency:	$2,000 billion
	Total assets:	$6,000 billion	Total liabilities:	$6,000 billion
After:	**Assets**		**Liabilities and Shareholders' Equity**	
	Treasury bonds:	$5,001 billion	Reserves:	$4,001 billion
	Other bonds:	$1,000 billion	Currency:	$2,000 billion
	Total assets:	$6,001 billion	Total liabilities:	$6,001 billion

Figure 4.6: Balance Sheet of the Fed Before and After a $1 Billion Bond Purchase from Citibank

Note that reserves held at the Fed or an asset to the Citibank, which can draw on the reserves.

These reserves are a liability to the Fed, who is on the hook to pay out reserves if Citibank requests these reserves. Historically, the stock of reserves, including both banks vault cash and the reserves that banks hold at the Fed, fluctuated between $40 billion and $80 billion. During the 2008 recession, the Fed significantly expanded the quantity of reserves that banks held on deposit at the Fed. From 2008 to 2020, the quantity of reserves exploded, exceeding $3 trillion during the 2028 recession. This reflects a new way of conducting monetary policy. The Fed expanded reserves to lower the federal funds rate but also lower long-term real interest rates. Reduce interest rates are exactly what the Fed achieved with this huge expansion in its balance sheet, a type of policy that came to be known as quantitative easing. Before the 2008 recession, the federal funds rate was 5.25%. By early 2009, it was only 0.1%. The federal funds rate remained near zero from 2009 to 2015, at which point the Fed began slowly raising the federal funds rate. During the 2020 recession, the Fed again lowered the federal funds rate to nearly 0. Long-term interest rates also demonstrated a sharp downward trajectory during this period. At the start of the 2008 recession, the interest rate on 10 year treasury bonds was 4%. During the 2008 recession, the 10 year treasury bond interest rates fell below 2.5%. During the 2020 recession, the long-term interest rate fell below 1%.

Other Tools of the Fed

1. **Quantitative Easing**

   We have talked about how the Fed increases or decreases reserves by buying and selling bonds. During the 2008 recession, the Fed significantly expanded the reserves of private banks by buying both short term bombs and long-term bonds from private banks. Purchasing long-term bonds in an open market operation pushes up the price on the long-term bonds and thereby drives down long-term interest rates. The interest rate is the fixed coupon that the bond pays divided by the price of the bond. Therefore, a higher bond price implies a lower interest rate. Long-term bonds come with a term to maturity of between 10 years and 30 years. Quantitative easing is achieved when the central bank creates a large quantity of bank reserves to buy long-term bonds, simultaneously increasing the quantity of bank reserves and pushing down the interest rate on long term bonds. Quantitative easing played a key role in a huge run up in big reserves that occurred from 2008 to 2015 and again in the second enormous run up and bank reserves that occurred during the 2020 recession. In both cases, the Fed created trillions of dollars in bank reserves, which the Fed used to purchase long-term bonds.

2. **"Lender of last resort"**

   The Fed can act as a lender of last resort during a financial crisis. It can provide loans to banks through the discount window, although the discount window is an expensive alternative to the federal funds market, it is necessary during a financial crisis. During a crisis, private banks are afraid to lend it to one another on the federal funds market because they are unsure if they can pay it back. In the circumstances, the feds discount window becomes the lender of last resort. Because the Fed is not legally allowed to take risks in losing these loans, it always takes assets as a collateral from banks. For example, immediately after the investment bank Lehman Brothers went bankrupt in September 2008, an even larger financial firm, the American international group, suffered a liquidity crisis. The American

International Group (AIG) desperately needed cash because to make billions of dollars in payments to other financial firms, including many of the largest banks in the US, Europe and Asia. AIG was having trouble raising funds because investors did not want to lend to AIG. If AIG failed, this would've crippled the global financial system. This could cause hundreds of interconnected financial institutions to fail. The Fed stepped in and loaned 200 and billion dollars to AIG. AIG eventually recovered, and the Fed got back all of its loans with interest. AIG was able to pay off its debts to other financial institutions, averting a global financial meltdown.

Now that we understand the key tools that the Fed uses to conduct countercyclical monetary policy, we need to understand the several important factors that influence how the Fed uses these tools.

Expectations, Inflation and Monetary Policy

The effectiveness of monetary policy depends on expectations about interest rates and inflation. The federal funds rate is the annualized interest rate on overnight loans between the banks. The interest rate is relevant for consumers' and firms' investment decisions. For example, the real mortgage interest rate is the long-term expected real interest rate:

Long-term expected real interest rate = Long-term nominal interest rate - Long term expected inflation rate

For the Fed to lower the long-term real interest rate, it must either lower the long-term nominal interest rate or raise the long-term expectations of the inflation rate, or both. To do this, the Fed can announce that it will maintain an expansionary monetary policy in the future, by continuing to hold down the federal funds rate and prop up the inflation rate. In general, the feds effort to influence today's expectations about the future monetary policy is referred to as forward guidance.

Household believe that the federal funds rate will remain low for several years, then the long-term nominal interest rate will also remain low. Think of a 10 year nominal interest rate has been tied to the market expectations of the average interest rate for overnight loans over the next 10 years. If the Fed announces that it will continue to keep the federal funds rate low for an extended period of time, in the market will believe that the interest rate for overnight loans will also tend to be low over the next 10 years. Consequently, today's long-term nominal interest rate will be low as well.

A similar analysis applies to long-term expectations of inflation. The impact of inflationary expectations on the long-term expected real interest rate implies that the Fed might wish to create expectations of inflation. The Fed may announce forward guidance and continue to conduct an expansionary monetary policy for an extended period of time. If the market believes the announcement, then inflationary expectations will rise. Provided that the nominal interest rate does not rise one for one with inflation, the long-term expected real interest rate will decline.

Zero Lower Bound

When an interest rate of zero, economists say that it is at the zero lower bound. Zero is a barrier, the nominal interest rates cannot cross the barrier. A negative nano interest rate is simply not possible. Negative interest rate would imply that a borrower borrower repays less money than they borrowed. Lending money at a negative interest rate is a bad deal for banks.

The 1990s and 2000s were referred to as lost decades for the Japanese economy. Japan central bank massively increase in supply a bank reserves, thereby lowering Japan's version of the federal funds rate, the interest rate for inter-bank loans, approximately to 0. This example ignores the fact that storing money is not free. The bank leaves money and it's volt, someone might steal it. Banks would rather buy a government bond with a slightly negative interest rate, and then leave money in cash in a vault. The small negative interest rate is the price of security. Even if a government bond were stolen, if you cannot cash it in, and a legitimate owner would retain legal ownership and the right to collect the money from the government. Because of these considerations, governments manage to sell bonds with interest rates that are slightly negative. But interest rates cannot get too negative because then it would be profitable to build a bigger vault, fill it with cash, and hire an armed guard for it.

The zero lower bound is a problem for monetary policy because of the nominal interest rate is zero, and the inflation rate is negative, then the real interest rate will be positive. For example, if expected inflation is -1% one, and the nominal then the real interest rate will be 1%.

Nominal interest rate - Expected inflation rate = 0% - (-1%) = 1%.

If the inflation rate keeps falling, the real interest rate will rise, discouraging investments and shifting the labor demand curve to the left.

Contractionary Monetary Policy: Reducing Inflation

When the economy is overheating, the Fed implements contractionary monetary policy to cool things off. For example, when inflation runs out of control, the feds begins to enact contractionary monetary policy. The Fed will shrink make reserves, to raise the federal funds rate. Contractionary monetary policy slows down growth of bank reserves, reduces borrowing, raise interest rates and slows down growth in the money supply. It prevents inflation from rising. Controlling inflation is not always easy. When's prices begin rising quickly, the public begins to expect a high inflation rate in the future and the central bank loses its' reputation.

Policy Trade-Offs

There are always trade-offs between expansionary and contractionary policy. Many central banks estimate the federal funds rate in a way that is approximately described by the following formula:

Federal funds rate = Long-run federal funds rate target + 1.5*(inflation rate - inflation rate target)
+ 0.5 * (output gap in percentage points)

This is called the Taylor rule. This equation relates the federal funds rate to its long run target at 2.5%, the inflation rate, the inflation rate target of 2%, and the output gap in percentage points. The output gap is the difference between GDP and the trend GDP divided by trend GDP:

Output gap = (GDP- trend GDP)/trend GDP

I want to emphasize two components of the Taylor rule:

1. the Fed raises the federal funds rate as inflation rises. A higher inflation rate causes the Fed to raise the federal funds rate. Every percentage point increase in the inflation rate will translate into a 1.5 percentage point increase in the federal funds rate.

2. the Fed raises the federal funds rate as the output gap increases. A larger output gap leads the Fed to raise the federal funds rate. For every percentage point increase in the output gap, there will be a half percentage point increase in the federal funds rate.

We can see the Taylor role in action if we take December 2020 as an example. Inflation was running at 1.5%, and the economy was almost 3% below its trend GDP level. We can plug these numbers into the Taylor rule:

federal funds rate = 2.5% + 1.5 * (1.5% - 2%) + 0.5 * (-3%) = 0.25%.

The Taylor rule predicts a federal funds rate of 0.25 percentage points, which is far below the long run target of 2.5 percentage points. The actual federal funds rate in late 2020 was in the range of 0 to 0.25%, which is the level predicted by the Taylor role. The Taylor rule is a rule of thumb. Monetary policy is as much an art as it is a science. The Taylor role is a good starting point for deliberations.

Countercyclical Fiscal Policy

Fiscal policy is passed through the legislative branch. Expansionary fiscal policy uses higher government expenditures and lower taxes to increase the growth rate of real GDP. Expansionary fiscal policy aims to shift the labor demand curve to the right. Contractionary fiscal policy is lower government expenditures and raise taxes to reduce the growth rate of real GDP. It aims to shift the demand curve to the left.

Fiscal Policy over the Business Cycle: Automatic and Discretionary Outcomes

Fiscal policy can be divided into automatic and discretionary outcomes:

1. Automatic countercyclical components

   These are aspects of fiscal policy they do not require delivered action, but I'll already in place for recessions. For example, food assistance programs and unemployment insurance programs are already in place to lessen the impact of a recession. These are automatic stabilizers.

2. Discretionary countercyclical components

   These are deliberate aspects of fiscal policy that governments have to vote onto an act. For example, the cares act was passed in February 2020 to lessen the impact of the pandemic. This typically increases government spending. Some economists worry that too much fiscal stimulus and response for recession will shift the labor demand curve too far to the right, potentially causing inflation to rise above the 2% target.

Government deficits change during a recession. For example, in the 2008 recession, the government deficit rose by 10.3 percentage points of GDP from 2007 to 2009. During the 2020 recession, the government deficit rose by 12.4 percentage points of GDP in a single year. The government deficit was 6.3% of GDP in 2019 and ended at 18.7% of GDP in 2020. When the government borrows money to pay back these deficits, future taxpayers are implicitly responsible for paying back the governments deaths. The basic idea behind fiscal policy is at higher government spending and lower taxation play a crucial role in recessions by alleviating economic distress and increasing household spending.

To understand how the government spending and stimulate the economy, we need to learn about the government expenditure multiplier. First, let's remember the national income accounting identity:

$$Y = C + I + G + X - M$$

It's a government spends money, like providing household with stimulus checks, this is going to have a cascade of affects. For example, that household will now spend that money at a business, purchases goods and services. Then, that business would need to hire more people to accommodate for this increase in demand. Therefore, the government expenditures can have multiplying effect. We can measure the value of this multiplying effect in the government expenditure multiplier. If a $1 change in government expenditure causes an M dollar change in GDP, then the government expenditure multiplier is M. Therefore, $m/$1 = m. For example, if M = 1, then a one dollar increase in government expenditure generates a one dollar increase in GDP. We can look at a scenario in which M = two, and that is if government expenditures lead to an increase in consumption. For example, let's say a $1 increase in government expenditure leads to a $1 increase in consumption. The new national income identity would look like this:

$$(Y+2) = (C+1) + I + (G+1) + X - M$$

Therefore, GDP increases by two dollars. Therefore, the government expenditure multiplier is 2/1 = 2. This is because the government spent one dollar, but this increase GDP by two dollars.

There are trade-offs to government expenditures. For example, some economists argue that expenditures create a crowding out effect. This is the idea that government spending leads to more government borrowing, which sucks at resources that could've been used by other households and firms. In other words, government expenditures crowd out private economic activity like consumption and investment. Crowding out occurs when a rising government expenditure partially or even fully displaces expenditures by households and firms. The new national income accounting identity would look like this:

$$(Y) = C + (I-1) + (G+1) + X - M$$

Therefore the government multiplier in this case is (-1+1)/1 = 0.

Taxation-Based Fiscal Policy

In addition to government spending, the government can also lower taxes to stimulate economic growth. For example, a tax cut would provide household with more spending money. There is a government taxation multiplier that we can evaluate to understand the entire impact of government taxation policies. The new national income accounting identity would look like this:

$$(Y+1) = (C+1) + I + G + X - M$$

The government taxation multiplier is computed as \$m/\$1 = m. Let's say that there is a one dollar decrease in taxation, and this leads to a two dollar increase in household incomes and consequently a two dollar increase in consumption. Therefore, GDP increases by two dollars. Therefore, the government taxation multiplier would be two dollars divided by one dollar equals two.

$$(Y+2) = (C+2) + I + G + X - M$$

$$\$2/\$1 = 2$$

Tax cuts might generate crowding out effect because as consumers try to spend more, resources that would have previously gone to investment might now be redirected to consumption. As consumers try to spend more, the extra goods might be provided by an increase in imports, lowering net exports. If the crowding out effects are large, the government taxation multiplier will be significantly reduced.

$$(Y+2) = (C+2) + I + G + X - (M+1)$$

Critics of expansionary tax policy argue that optimizing consumers might not use the entirety of their tax cut immediately. This is because consumption offers diminishing returns, therefore a 5th slice of pizza is not worth it to a consumer. Consumers might also recognize that the government will have to raise taxes in the future and therefore prepare for by dedicating their current tax cuts to savings.

Economists believe that the government taxation multiplier is between zero and two. Universal payments to household, like the stimulus checks in 2020, had a low multiplier of 0.5. This meant that the universal stimulus payments did not generate multiplying effects in terms of additional household consumption.

There are also other fiscal policies that directly affect the labor market, such as providing unemployment insurance to unemployed workers. These benefits support household spending in the limits the negative multiplier affects from following employment.

Some forms of government spending are seen as a waste. For example, funneling money into public infrastructure projects that are useless and unnecessary, such as a bridge to nowhere. Although these projects may improve political popularity with constituents, because they provide

jobs, they do not necessarily provide any other benefits. In these cases, senators will apply for federal grant funding to fund these kinds of projects.

Another important dimension to understand about public spending projects, is that they are slow to start. It takes a long time to build a bridge. This lag can be costly especially during a recession. In contrast, taxation-based physical policy can advance more quickly.

5 Week 5

5.1 Macroeconomics and International Trade

Benefits and Processes of Trade

We are each uniquely good at certain things and unskilled at other things. For example, economists specialize in economic analysis while Apple engineers specialize in developing technology products. Engineers and economists can benefit from each other by engaging in trade. For example, economists earn money by performing economic analysis, and then can use that money to purchase an iPhone. This is the idea of specialization. In a market system, people develop specialized skills in their chosen industry and trade with others. By trading, we can earn gains from specialization. These are economic gains that society can obtain by having some individuals specialize in the production of certain goods and services and then trade with others for Neil goods. Specialization does not work without trade. Economic professors cannot create their own iPhones or harvest their own agriculture, they need to rely on others who specialize in these skills to provide these goods, and then engage in trade with them. Without opportunities for trade, life is bleak.

Absolute Advantage and Comparative Advantage

Just like individuals can trade, so can countries. Certain countries are better at producing specific goods and services compared to others. For example, Honolulu is great at producing surfing lessons compared to Reno Nevada. We can discuss these advantages in terms of comparative and absolute advantages.

Absolute advantage is when a producer can produce a good or service at a higher quantity in the same amount of time compared to other producers. For example, let's evaluate apple iPhone sales if Steve Jobs was the sales person compared to some random Chuck. We can evaluate the number of iPhones sold as the production, and the two producers in this case our Steve Jobs and Chuck. In one year, Steve Jobs can sell 2000 iPhones while Chuck can only sell 1000 iPhones in the same time. Steve Jobs has an absolute advantage because he can sell more iPhones than Chuck . This is due to a variety of reasons. Steve was known for being charismatic and energetic. Chuck was not known for anything, really. We can see that Steve Jobs had an absolute advantage at selling iPhones because he can produce a higher quantity of sales in the same time when comparing him to Chuck.

Steve Jobs also has other tasks to do for Apple, such as design. In one year, jobs can produce

1000 designs. In one year, Chuck can only produce one design. Therefore, Steve Jobs has an absolute advantage in both tasks. He can sell more iPhones, in addition to producing more product designs. However, he only has time to do one task. Which task should Apple ask him to do?

	Steve Jobs	Chuck Chores
Sales	2,000 sales/year	1,000 sales/year
Design	1,000 design ideas/year	1 design idea/year

Figure 5.1: Steve Jobs vs. Chuck

To answer this question accurately, we need to consider the opportunity cost per unit of production. In other words, if we ask Steve Jobs to just focus on design tasks, how many sales is he giving up to do that? This brings in the idea of a comparative advantage. A **comparative advantage** is when a producer has a lower opportunity cost per unit produced compared to other producers. In other words, how expensive is it for a producer to produce goods? How much are they giving up?

In the case of Steve Jobs, for every 1000 designs he produces, he gives up 2000 sales per year. We can simplify this in the math computations below:

$$\frac{QuantityGivingUpofOtherGood}{QuantityProducingofFocusedGood}$$

$$\frac{QuantityGivingUpofSales}{QuantityProducingofDesigns} = \frac{2000}{1000}$$

$$Opportunitycostof1design = 2sales$$

This equation is telling us that for every one design idea that Steve Jobs produces, he gives up 2 sales. This is because he can only dedicate his time to one or the other. Steve jobs WOULD have a comparative advantage in producing designs if the opportunity cost of Steve producing designs is lower than the opportunity cost of other workers producing designs. Therefore, we need to compute Chuck's opportunity cost of producing designs and compare it to Steve Jobs' opportunity cost of producing designs to decide who has a comparative advantage in designs. If we ask Chuck to just focus on designs, how many sales would he be giving up in the process? We can compute this below.

$$\frac{QuantityGivingUpofOtherGood}{QuantityProducingofFocusedGood}$$

$$\frac{QuantityGivingUpofSales}{QuantityProducingofDesigns} = \frac{1000}{1}$$

$$Opportunitycostof1design = 1000sales$$

Therefore, if we ask Chuck to just focus on producing designs, he would be giving up 1000 sales for every one design that he produced. The opportunity cost of 1 design is 1000 sales. Therefore, Steve Jobs has an opportunity cost of 2 sales for every one design idea he produces. In comparison, Chuck has an opportunity cost of 1000 sales for every one design idea produced. Therefore, Steve Jobs has a comparative advantage in producing designs. It would be optimal for Apple to dedicate jobs to focusing on designs and dedicating Chuck to focus on sales. We can also compute the opportunity cost of designs for each worker just to support our argument even more.

Steve Jobs' opportunity cost for producing sales is computed below:

$$\frac{QuantityGivingUpofOtherGood}{QuantityProducingofFocusedGood}$$

$$\frac{QuantityGivingUpofdesign}{QuantityProducingofSales} = \frac{1000}{2000}$$

$$Opportunitycostof1sale = 0.5designs$$

Therefore, for every one sale that Steve Jobs produces, he gives up half of a design.

Chuck ' opportunity cost for producing sales is computed below:

$$\frac{QuantityGivingUpofOtherGood}{QuantityProducingofFocusedGood}$$

$$\frac{QuantityGivingUpofdesign}{QuantityProducingofSales} = \frac{1}{1000}$$

$$Opportunitycostof1sale = 0.001designs$$

Therefore, for every one sale that Chuck produces, he gives up 0.001 of a design.

Chuck has a comparative advantage in sales because he has a lower opportunity cost. He does not give up as many designs compared to Steve Jobs. It makes sense for Apple to dedicate Steve Jobs to designs and Chuck to sales.

Comparative advantage is the idea that opportunity cost, not absolute advantage, should determine how to designate workers to various tasks. If we only looked at absolute advantage, we would not have a decisive conclusion because Steve Jobs has an absolute advantage in both tasks.

Absolute advantage ask the question: how much can you produce? Comparative advantage asks the question: how much does it cost you to produce? Comparative advantage is used to make the final decision in choosing which goods and services to specialize in producing.

Trade allows workers to gain from specialization. Without trade, we could not realize the gains of comparative advantage. For example, if Steve Jobs tried to produce both sales and design, he would not be maximizing his full potential. It's better for him to focus on design and Chuck to focus on sales, and then the company can benefit from these specializations. Workers tend to choose occupations that benefit their comparative advantage. The career choices of individuals are consequences of comparative advantages. One of the great implications of comparative advantage is that market prices will often induce individuals to choose occupations that align with their comparative advantages.

This idea of comparative advantage is not only present in individual work situations but can also be evaluated on the international level. For example, some countries have a comparative advantage in producing certain goods compared to others. Let's evaluate the productivity of iPhones for U.S. workers compared to Chinese workers. iPhones are made in China, they are assembled on a Chinese assembly line. However, the components of the iPhone come from all over the world. For example, Samsung manufactures iPhone screens, which is based out of South Korea. Toshiba manufactures the memory chips for the iPhone, which is based out of Japan. However, the final components come together in China and other than shipped to Apple stores. In China, an estimated $8.46 is earned per iPhone for the price of labor. Apple captures the rest of the $999 sticker price for each iPhone sale. Why does Apple, a US-based company, hire Chinese workers to do the job? Let's look at the numbers.

The exhibit below demonstrates that 1 U.S. worker can assemble 20,000 iPhones per year compared to a Chinese worker that could only assemble 5000 iPhones per year. One US worker could produce 10 innovations per year compared to one Chinese worker that can produce one innovation per year. Therefore, the US worker has an absolute advantage in both tasks compared to the Chinese worker. The reasons behind these differences are due to a variety of reasons. For example, US workers typically have more education and therefore greater human capital. This makes the US worker more productive in a range of tasks. In addition, US workers have greater access to physical capital, such as robotic assembly lines, that boost their productivity. If we only looked at absolute advantage, we would conclude that the US should produce in both tasks. However, we need to look at comparative advantage to make a smart decision.

	U.S. Worker	Chinese Worker
Assembly	20,000 iPhones/year	5,000 iPhones/year
R&D	10 innovations/year	1 innovation/year

Figure 5.2: Productivity in Assembly and RD

Let's compute the opportunity cost for R&D for the U.S. worker.

$$\frac{QuantityGivingUpofOtherGood}{QuantityProducingofFocusedGood}$$

$$\frac{QuantityGivingUpofAssembly}{QuantityProducingofR\&D} = \frac{20000}{10}$$
$$Opportunitycostof1R\&D = 2000assemblies$$

Therefore, the opportunity cost of producing 1 unit of R&D is 2000 iPhone assemblies. Therefore, for every one unit of RD that a US worker produces, they give up 2000 potential iPhone assemblies.

The opportunity cost of producing one unit of R&D for Chinese workers:

$$\frac{QuantityGivingUpofOtherGood}{QuantityProducingofFocusedGood}$$
$$\frac{QuantityGivingUpofAssembly}{QuantityProducingofR\&D} = \frac{5000}{1}$$
$$Opportunitycostof1R\&D = 5000assemblies$$

Therefore, the opportunity cost of producing 1 unit of R&D is 5000 iPhone assemblies for Chinese workers. Therefore, for every one unit of R&D that a Chinese worker produces, they give up 5000 potential iPhone assemblies.

The US worker has a lower opportunity cost for R&D compared to a Chinese worker. Therefore, the US worker has a comparative advantage in R&D, and should focus on that. International trade helps us to benefit from each country's specializations.

We can benefit from trade by embracing imports and producing exports. Imports include the goods and services that a country brings in from another country. Exports include the goods and services that we produce and sell to other countries. For example, the US imports wheat from Russia and Ukraine, as well as other countries. The U.S. exports items like the Apple iPhone to other countries.

Some economies do not engage in trade, they do not accept imports or produce exports. These economies are closed economies. Closed economies do not read with the rest of the world. Open economies trade freely with the rest of the world. In 2019, the United Kingdom imports measured about 32% of GDP. In the same year, Singapore and Hong Kong had imports totaling 145% and 175% of GDP, respectively. We can view the import trends of the US over the decades in the graph below.

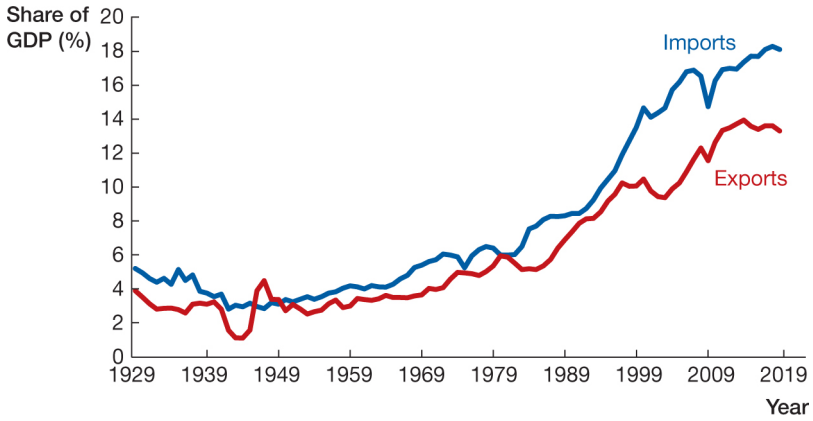

Figure 5.3: U.S. Imports and Exports as a Share of GDP

Many countries, including the United States, implement a variety of trade barriers to reduce imports. The most common type of trade barrier is a tariff, which are special taxes only on imports. The average US tariff on all imported products was 1.6% in 2019. In recent years, the average US tariff on agricultural products has been 62%. Tariffs on tobacco and sugar have been higher, sometimes exceeding 100%. These tariffs discourage international trade. Due to tariffs and trade barriers, US sugar imports have fallen by 80% in the last 30 years. Some developing countries used tariffs to raise revenue, because they are more socially accepted than tax systems. Developed countries used tariffs to protect domestic producers. Powerful domestic producers lobby governments to impose tariffs to drive out foreign competition and increase domestic industries profits.

In some cases, these tariffs can lead to trade wars that create inefficiencies. In the 1960s, Germany and France restricted the import of US chickens. The US then in retaliated with a punitive tariff on imports of European light trucks. Today, Mercedes-Benz assembles light trucks at a factory in Germany, then Mercedes-Benz partially disassembles the trucks by removing the engines and bumpers. The trucks are than exported to the United States, where Mercedes-Benz does not need to pay the US tariff because the trucks are not fully assembled. The trucks are than assembled at a warehouse in South Carolina. This sounds like an inefficient waste of time.

The Current Account and the Financial Account

Trade is a wonderful thing. Bilateral trade, which is trade between two specific countries, like the trade that the US does with China, will rarely be balanced. For example, in 2019, we imported $451.6 billion in goods from China. We exported $106.5 billion in goods to China. In other words, we imported more than we exported with China. Some might say this is a serious problem, but a good economist we just recognize that bilateral trade is not always equal, and that's OK. There are some countries that export more than they import.

When a country imports more than they export, this produces a trade deficit. This means that the country is spending more on imports than the country earns on exports. Exports minus imports is defined as net exports, or the trade balance. When the trade balance is positive, the country is running a trade surplus. When the trade balance is negative, the country is running a trade deficit.

There are several mechanisms for which payments can flow from one country to another. Trade flows represent one of these mechanisms. There are several other mechanisms that we will learn about. But first, let's clearly state the definition of a domestic resident. A domestic resident is a person who resides in the United States, regardless of if they are a US citizen. For example, a Chinese citizen living in the United States is defined as a domestic resident of the United States. A US citizen residing in China is defined as a Chinese resident.

Income-Based Payments FROM Foreigners

There are three ways that domestic residents can receive income-based payments from foreigners:

1. Exports: receiving payments from the sales of goods and services to foreigners.

   When a foreign resident receives the good or service produced by a domestic resident, the domestic resident will receive payment for it.

2. Factor payments from foreigners: receiving income from assets or factors of production that the domestic resident owns in foreign countries.

   If a US resident owns stock in Tata steel, a large company in India, Tata steel will then pay a dividend, which is considered a factor payment from abroad. Likewise, if a US company owns a plant in China and that plant generates earnings, those earnings would count as a factor payment from abroad. If a US engineer spends one day working in Italy, and then receives payment for that work, that is a factor payment from abroad. In this case, the relevant factor of production is human capital.

3. Transfers from foreigners: receiving transfers from individuals who reside abroad.

   These are gifts from foreign residents or foreign governments. For example, after Hurricane Katrina in 2005, China sent tons of emergency supplies to New Orleans, valued at $5 million. These contributions are transfers from abroad.

We will review the several mechanisms that US residents can make income based payments to foreigners.

Income-Based Payments TO Foreigners

1. Imports: Making payments to foreigners in return for their goods and services.

2. Factor payments to foreigners: Paying income on assets that foreign residents on in the domestic economy.

3. Transfers to foreigners: Making transfers to individuals who reside abroad or to foreign governments.

The Current Account vs. the Financial Account

The **current account** is the sum of net exports, net factor payments from abroad, and the transfers from abroad. We can see this in the equations below:

Net exports = payments from abroad for exports - payments to foreigners for imports
Net factor payments from abroad = factor payments from abroad - factor payments to foreigners
Net transfers from abroad = transfers from abroad - transfers to foreigners
Current account = net exports + net factor payments from abroad + net transfers from abroad

We can see an example of these computations in the figure below.

	Payments from Foreigners	Payments to Foreigners	Net Payments
Trade in goods and services	2,514	3,125	−611
Factor payments	1,170	900	+270
Transfer payments	147	309	−162
Current account	3,831	4,334	−503

Figure 5.4: The Current Account of the United States in 2019

Let's say a U.S. consumer buys a Chinese laptop that costs $1000. In the U.S. current account, this would be a $1000 payment to foreigners. Let's say the Chinese producer then uses that $1000 to purchase a US treasury bond worth $1000 from the US government. At the end of the transactions, the United States has one new laptop and owns one less treasury bond. Therefore, the US has imported goods worth $1000. In the financial account, the US has transferred to China a treasury bond worth $1000. The financial account is the increase in domestic assets held by foreigners minus the increase in foreign assets held domestically.

The **financial account** is the accounting system that records the asset purchases that domestic residents and foreigners make. Financial account is defined so that the net flows in a financial account offset the net flows in the current account. The following two equations give the definition of the financial account and describe its relationship to the current account:

Financial account = increase in domestic assets held by foreigners - increase in foreign assets held domestically

Current account + Financial account = 0

A change in the current account balance will be matched by a change in the opposite direction in the financial account. When foreigners receive the payments in the current account, they can buy any type of US asset in the financial account. They could also just hold a payment in dollars, instead of purchasing an asset. In either case, the current account deficit is exactly offset by a financial account surplus.

In 2019, foreigners received $503 billion in debt payments in the US current account, which is called a current account deficit for the United States. To pay for this current account deficit, US

made that transfer is a $503 billion in assets to foreigners. Therefore, US residents got BMWs, Sony TV sets, and other imported goods. In exchange, foreign producers obtain bank deposits and other securities worth $503 billion from the United States.

When a country runs a current account deficit, this is similar to when a household spends more than it earns. To fund this extra spending, the household either borrows or spends down assets that had previously been accumulated. For example, if you spend $1000 more than you earn, you could finance this deficit by selling some of your assets. If you do not have assets to sell, you could borrow to finance this debt.

Just like an individual household, an entire country can only spend more than earns if it finds a way to finance this extra spending. The country must either sell assets to foreigners or borrow from foreigners. Hence, current account deficits must match financial account flows. In other words, when a country makes a net purchase of goods and services from foreigners, the country must sell assets to foreigners to pay the bill.

Remember the national income accounting identity that we talked about before:

$$Y = C + I + G + NX$$

Wear Y represents GDP, C represents consumption, I represents investment, G represents government expenditure and X represents net exports. We can arrange this identity to look like this:

$$Y - C - G - I = NX$$

We can further simplify this by acknowledging that savings as income minus consumption and government expenditure, therefore S = Y - C - G:

$$S - I = NX$$

To further understand this, suppose that Boeing manufactures and exports one airplane to a Japanese airline. Assuming that every other component of the US GDP does not change, this includes imports, consumption, government expenditure and investment, what must adjust in the US national accounts? The production of the plane implies that GDP increases by the value of the plane. What else changes? Let's say the Japanese airline writes an IOU to Boeing, and that Boeing is owed money from this Japanese company, which counts as Boeing saving the proceeds of the sale. This counts as a capital outflow from the United States to Japan. A capital outflow occurs when a country, like the United States, makes an investment in a foreign country, Japan. Effectively, Japan has written an IOU to the United States. Putting these together, the national accounting identity implies that:

$$S - I = NX = \text{net capital flows}$$

Net capital outflows include the difference between investment by the home country in foreign countries (S) and foreign investment in the home country (I). Net capital outflows are like net exports, so when the US exports more, net capital outflows will increase. When the U.S. imports more, capital outflows will decline. The relationship between capital outflows and exports has an important consequence because it links exports to the real interest rate. We can see this in the

figure below.

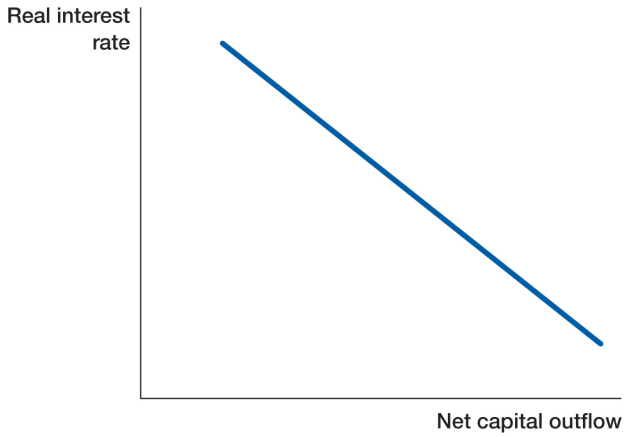

Figure 5.5: Net Capital Outflows and the Real Interest Rate

When the real interest rate rises, the U.S. becomes more attractive to global investors. As capital pours in, the net capital outflows decrease and net exports therefore decrease. The opposite happens when the real interest rate decreases. Since net capital outflows are equal to net exports, there is a negative relationship between net exports and the real interest rate. To conclude, a rising real interest rate discourages net capital outflows and reduces net exports. A falling real interest-rate encourages net capital outflows and increases net exports.

5.2 Open Economy Macroeconomics

Exchange Rates

The nominal exchange rate is the price of one country's currency in units of another country's currency. Most people refer to it as just the exchange rate, but we will call it the nominal exchange rate. The formula for the nominal exchange rate is below. We can compute the exchange rate for one U.S. dollar in terms of Chinese Yuan.

$$e = \frac{Units of Foreign Currency}{1 Unit of Domestic Currency}$$

$$e = \frac{6.46 Yuan}{1 USD}$$

$$e = 6.46 Yuan per dollar$$

We can also complete the exchange rate for Yuan, in other words, how many dollars can we purchase with one unit of Yuan?

$$e = \frac{1 Unit of Domestic Currency}{Units of Foreign Currency}$$

$$e = \frac{1 USD}{6.46 Yuan}$$

$$e = 0.15 dollars Per Yuan$$

The domestic currency exchange rate, e, is the number of units of foreign currency that can be purchased with one unit of domestic currency. The higher the value of e, the more units of foreign currency a dollar can buy. In this case, the dollar is our domestic currency. When a nominal exchange rate increases, the domestic currency is appreciating against the foreign currency. When the dollar appreciates against Yuan, implying that e is rising, Yuan is depreciating against the dollar, implying that 1/e is falling. When a nominal exchange rate decreases, the domestic currency is depreciating against the foreign currency. When the domestic currency is depreciating, that means that we cannot buy as many units Yuan with one dollar as we could before.

Exchange rates can influence producer decisions. For example, a toy store may want to purchase toys manufactured in China because they are cheaper because of the exchange rate. For example, in January 2021, the Yuan per dollar exchange rate was 6.46. Every 1 USD was worth 6.46 Yuan. Therefore, if a toy cost 20 Yuan:

$$Dollar Cost = Yuan Cost * \frac{Dollars}{Yuan}$$

$$= 20 * \frac{1}{6.46}$$

$$= \$3.10$$

Therefore, the toy costs $3.10. If that same toy is sold for five dollars in the US, then the toy store may choose to import toys from China because they are cheaper.

Some exchange rates fluctuate over the years, some do not. It depends on whether the exchange rate is fixed, flexible or managed.

1. **Fixed exchange rates** are fixed by government entities. The government fixes a value for the exchange rate and intervenes to maintain that value. For example, since 1987, one US dollar has always been able to buy 3.75 Saudi Arabian rivals.

2. **Floating or flexible exchange rates** are not fixed, and fluctuate depending on market forces. For example, the euro per dollar exchange rate fluctuates. The government does not intervene in this foreign exchange market.

3. **Managed exchange rates** are in between floating in a fixed exchange rates. In these cases of managed exchange rates, the government actively intervenes to influence the exchange rate. In this case, the government intervenes to influence its movement. The government does not fix the value, but it attempts to adjust its value. Managed exchange rates can be flat for periods of time, but they are not flat for long. When they do change, those movements are typically small, slow movements in one direction or another. For example, the Chinese government allowed the dollar to depreciate against the Yuan from 2005 to 2008. Starting in 2017, the Chinese government has taken a light role in managing the exchange rate, nudging its value on a daily basis but does not pin it down or influence its long run value.

The Foreign Exchange Market

The foreign exchange market is the global financial markets in which currencies are traded and nominal exchange rates are determined. For example, let's say Chinese airline wants to purchase Boeing airplanes from the US. In order to do this, the airline needs to go to the foreign exchange market to buy US dollars, and then go to Boeing to purchase the airplanes. As with other markets, the supply and demand curves determine the equilibrium price, which is the equilibrium exchange rate any foreign exchange market. We can see this in the graphs below. It is important to remember that most global trade is conducted in dollars. When firms purchase US products, we accept payment in US dollars. When US firms purchase foreign products, we typically pay them in US dollars.

The X axis represents the quantity of dollars available for transactions in the foreign exchange market. We use the Yuan per dollar exchange rate on the Y axis to represent the value or price of a dollar, this is how many Yuan a single dollar will buy. We are expressing the nominal exchange rate as units of foreign currency per US dollar. The dollar demand curve represents the relationship between the quantity of dollars demanded and the exchange rate. The demand curve represents traders trying to buy dollars in the foreign exchange market with Yuan. The Chinese airlines' demand for dollars is reflected in this demand curve. Of course, millions of other economic agents are also trying to obtain dollars by selling Yuan. The market does not solely consist of this one Chinese airline. All of these agents together make up the entire dollar demand curve.

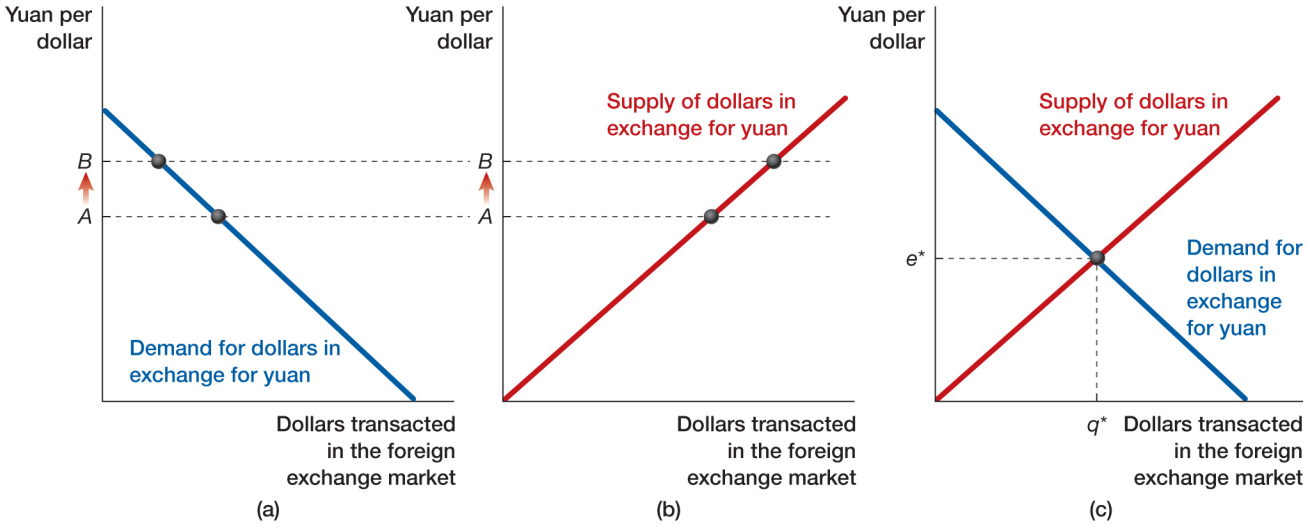

Figure 5.6: The Foreign Exchange Market Under a Flexible Exchange Rate Regime

To understand why the demand curve for dollars in exchange for Yuan is downward sloping, we need to think about the appreciation of the dollar. A dollar appreciation would move the exchange rate from point a to point B. This implies that each dollar can by a higher quantity of Yuan then it could before. On the flipside, each Yuan can buy fewer dollars than before. Therefore, if the dollar appreciates, then these Boeing manufactured airplanes are now more expensive for the Chinese airline. This higher price leads the airlines to reduce the quantity of airplanes demanded, and therefore not demand as many U.S. dollars consequently. Therefore, if the dollar appreciates, this will lead to a reduction in the quantity of dollars demanded.

The dollar supply curve is the red line. It represents the relationship between the quantity of dollars supplied and the exchange rate. Traders who are trying to obtain Yuan by selling dollars are represented in this supply curve. For example, Chinese manufacturers that export their products to the United States are paid in dollars, and they need to exchange these dollars for Yuan so they can pay their workers.

The supply curve slopes upward because when the dollar appreciates, this implies that the prices of all Chinese products are suddenly less expensive to US consumers. An appreciation of the dollar enables US consumers to pay fewer dollars for each good they import from China. Therefore, US consumers and companies will increase their purchases of Chinese goods. This implies greater revenues for Chinese manufacturers and a greater quantity of dollars supplied by them to the foreign exchange market. A rising Yuan per dollar exchange rate leads to a greater quantity of dollars supplied, so the supply curve is upward sloping.

Now that we have covered our supply and demand curves, we know that putting them together gives us an intersection point. This intersection is the equilibrium exchange rate. The quantity supplied equals the quantity demanded at this exchange rate. In the last panel of the three graphs, we are assuming that the Yuan per dollar exchange rate is flexible. This point, e* is the equilibrium exchange rate of Yuan per dollar and q* is the equilibrium quantity of dollars transacted in the

foreign exchange market.

So what happens if the Chinese airline suddenly experiences an increase in demand for air travel and consequently needs to buy more airplanes from Boeing? Well, its demand curve for aircraft would shift to the right, so it would demand more airplanes. Therefore, its demand for US dollars would increase by a significant amount. Let's say they need to buy 5 airplanes, each costing $200 million. We can see what this would look like in the graph below:

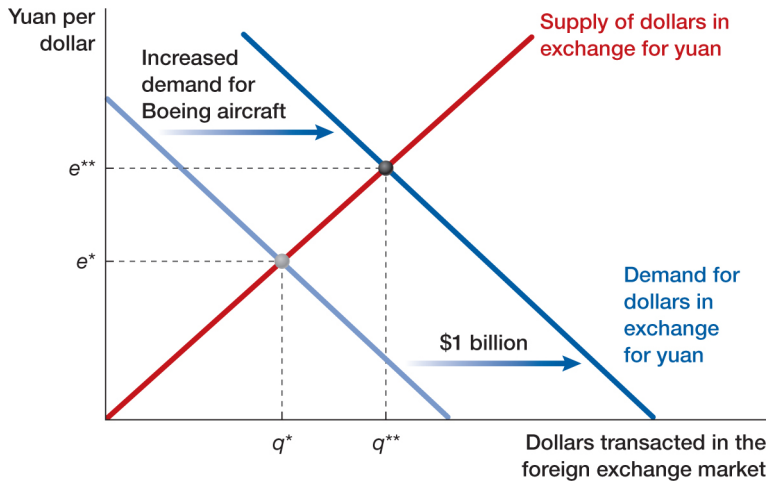

Figure 5.7: The Foreign Exchange Market After a Rightward Shift in the Dollar Demand Curve

Under a flexible exchange rate, the rightward shift in the dollar demand curve will cause the equilibrium exchange rate to increase, implying that the dollar will now buy more Yuan. In response to the increase demand for aircraft, the dollar would appreciate against the Yuan.

So what do managed or fixed exchange rates look like? In these cases, the government pegs the exchange rate. In other words, it fixes the exchange rate at a certain point. Chinese authorities have historically chosen an exchange rate that makes the Yuan substantially undervalued relative to the dollar. This means that the dollar is overvalued relative to the Yuan. We can see this in the graph below. The exchange rate is pegged at the level shown by the solid purple line. The dollar is overvalued because the dollar is worth more Yuan than it would've been under a flexible exchange rate regime. The flexible equilibrium is still represented by e*.

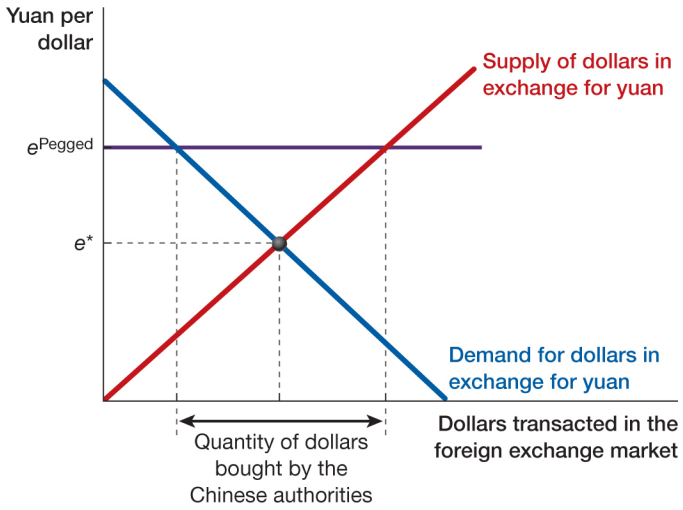

Figure 5.8: The Foreign Exchange Market Under a Pegged Exchange Rate That Overvalues the Dollar Relative to the Yuan

At the pegged exchange rate, the quantity of dollars supplied to the yuan-per-dollar foreign exchange market exceeds the quantity demanded. However, simply announcing a target exchange rate will not have much of an impact on the exchange rate in the foreign exchange market. This is because, in order to maintain this exchange rate, Chinese authorities would need to soak up this excess supply of dollars by buying dollars and selling yuan. In order to maintain the pegged rate above the market clearing exchange rate, in other words, to keep the dollar overvalued, Chinese authorities we need to continuously purchase dollars and sell yuan. This is exactly what they did. Between 1990 and 2014, the Chinese central bank increases its holdings of foreign reserves from 30 billion to 4 trillion. Most of the reserves are in dollars. So why did the Chinese government do all of this? This is because an overvalued dollar increases the net exports of Chinese goods.

Are there any incentives for a government to peg their exchange rate to maintain an overvalued amount for their domestic currency? Let's look at the Mexican peso as an example. Why would the Mexican government want the peso to be overvalued and the dollar to be undervalued? Let's say that the Mexican borrowers owe $1 million to US banks. If the peso per dollar exchange rate is 20, then Mexican borrowers need 20 billion pesos to pay back their dollar-denominated debts. Let's say this exchange rate of 20 pesos per dollar is actually under the market clearing price. Let's say the government pegged the exchange rate at this level of 20 pesos per dollar, because the market clearing exchange rate is 30 pesos per dollar instead. If the Mexican government instead implemented a flexible exchange rate regime, then they would owe $30 billion instead of just $20 billion. In a flexible exchange rate regime, the government would freely allow the dollar to appreciate and the peso to depreciate, and this would increase the amount in debts owed by Mexican borrowers. In this case, it would make sense to fix the peso at an undervalued rate.

A overvalued exchange rate looks like the graph below. The pegged exchange rate is below the market clearing equilibrium. In this case, the government has the exchange rate at 20 pesos per US dollar, but the authentic market clearing point would be 30 pesos per dollar.

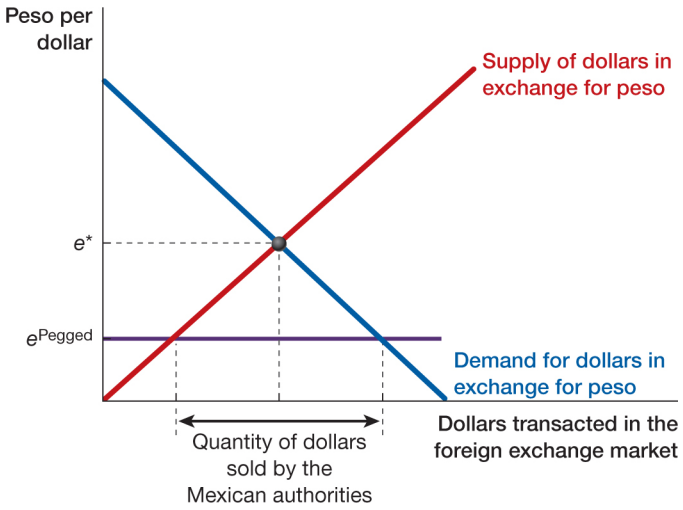

Figure 5.9: The Foreign Exchange Market Under a Pegged Exchange Rate That Overvalues the Peso Relative to the Dollar

An overvalued peso has other benefits for Mexico. For example, an undervalued dollar and overvalued peso means that Mexican consumers pay less to import goods from the United States. For example, suppose an iPhone cost $500 to import into Mexico. If the Mexican exchange rate is 20 pesos per dollar, and the local cost is 10,000 pesos. If the exchange rate is instead 30 pesos per dollar, and the local cost for the iPhone is now 15,000 pesos. An overvalued peso means it is cheaper for locals to import goods from the US.

The Real Exchange Rate and Exports

Up until now, we have only been talking about the nominal exchange rate. Now will learn about the real exchange rate. The real exchange rate is the ratio of the dollar price of a basket of goods and services in the United States, divided by the dollar price of the same basket of goods and services in a foreign country. This gives us a better comparison of the purchasing power of the dollar. Let's see an example.

We can compare the dollar price of a toy manufactured in China to the dollar price of the same toy manufactured in the United States. In other words, we are interested in the following ratio:

(Dollar price of a U.S. toy)/(Dollar price of a Chinese toy)

If the ratio is greater than one, the US toys are more expensive than Chinese toys and therefore firms will purchase from the Chinese supplier. However, if the ratio is less than one, then a US toy is less expensive than a Chinese toy and the firm will buy from the US supplier. To compute the dollar price of the Chinese toy, we need to take the Chinese price and multiply it by the number of dollars per yuan. Recall that e is the yuan per dollar nominal exchange rate. The number of dollars per yuan is given by one over e. Thus, the dollar price of Chinese toys can be calculated as:

Dollar price of Chinese toy = Yuan price of Chinese toy * (Dollars/Yuan)

Dollar price of Chinese toy = Yuan price of Chinese toy * (1/e)

For example, if a Chinese toy has a price of 20 Yuan and the nominal exchange rate is 6.46 per dollar, then the dollar price of the Chinese toy is:

$$Dollarpriceof Chinesetoy = 20 * \frac{1}{6.46}$$

$$Dollarpriceof Chinesetoy = \$3.10$$

Therefore, the dollar price of the toy manufactured in China is $3.10. We can rewrite our initial equation by plugging in for the computations we just did.

$$\frac{DollarPriceOfU.S.Toy}{DollarPriceOfChineseToy} = \frac{DollarPriceOfU.S.Toy}{YuanPriceOfChineseToy * \frac{1}{e}}$$

$$\frac{DollarPriceOfU.S.Toy}{DollarPriceOfChineseToy} = \frac{DollarPriceOfU.S.Toy * e}{YuanPriceOfChineseToy}$$

This ratio represents the relative price, adjusted for the exchange rate, of US and Chinese toys. This is the real exchange rate.

The real exchange can affect net exports. When they Yuan per dollar real exchange rate appreciates, US goods become more expensive relative to Chinese codes. Therefore, US stores would rather import goods from China and Chinese stores would rather buy local products instead of importing goods from the US.

Yuan-per-Dollar Real Exchange Rate	China	United States
Goes up (dollar appreciates and the yuan depreciates)	Import less from United States Export more to United States	Export less to China Import more from China
Goes down (dollar depreciates and the yuan appreciates)	Import more from United States Export less to United States	Export more to China Import less from China

Figure 5.10: The Relationship Between the Real Exchange Rate and Trade Flows

We can plot a net exports curve against the real exchange rate, these two have a negative relationship. When the Yuan per dollar real exchange rate appreciates, US exports to China tend to fall and US imports from China tend to increase. Recall that net exports are exports - imports. On the graph below, there is a real exchange rate equilibrium value of E*. When the real exchange rate is above this point, net exports are negative, a trade deficit. When the real exchange rate is below the start, net exports are positive, a trade surplus.

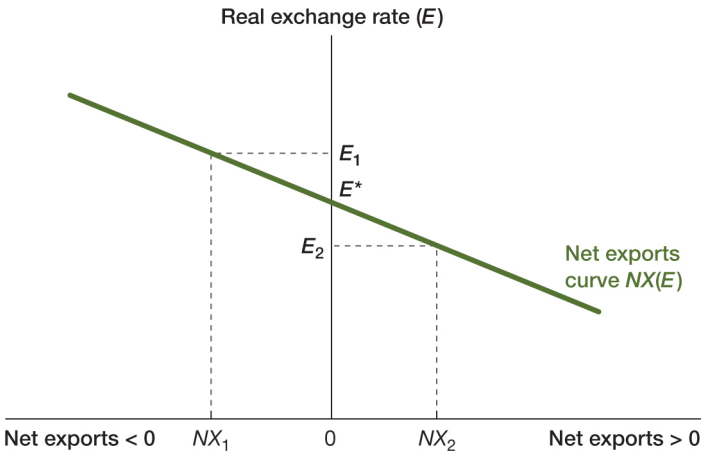

Figure 5.11: The Real Exchange Rate and Net Exports

We talked about monetary policy in the last chapter. Expansionary monetary policy can affect net capital outflows and net exports under a flexible exchange rate regime. Expansionary monetary policy increases the supply of credit, leading to a lower real interest rate. This causes the economy to move along the downward sloping line summarizing the relationship between the real interest rate and net capital outflows in panel b. Remember that a lower real interest rate increases net capital up close and it exports. These two are identical according to the national accounting identity, S - 1 = NX = net capital outflows. Lower real interest rates lead to more capital outflows as investors seek greater returns abroad, and because of the national accounting identity, more capital outflow implies greater net exports. As we move along the downward sloping line in panel be, we are simultaneously moving along the downward sloping line in panel C. The fall in the real interest rate and the rise in net capital outflows bring about a reduction in the real exchange rate. The fall in interest rates simultaneously causes the real exchange rate to depreciate, capital outflows to increase, and the exports to increase. In equilibrium, net exports rise, as reflected in panels b and c. Net exports rise both because the real exchange rate has fallen and because rising capital outflows must be accompanied by rising net exports.

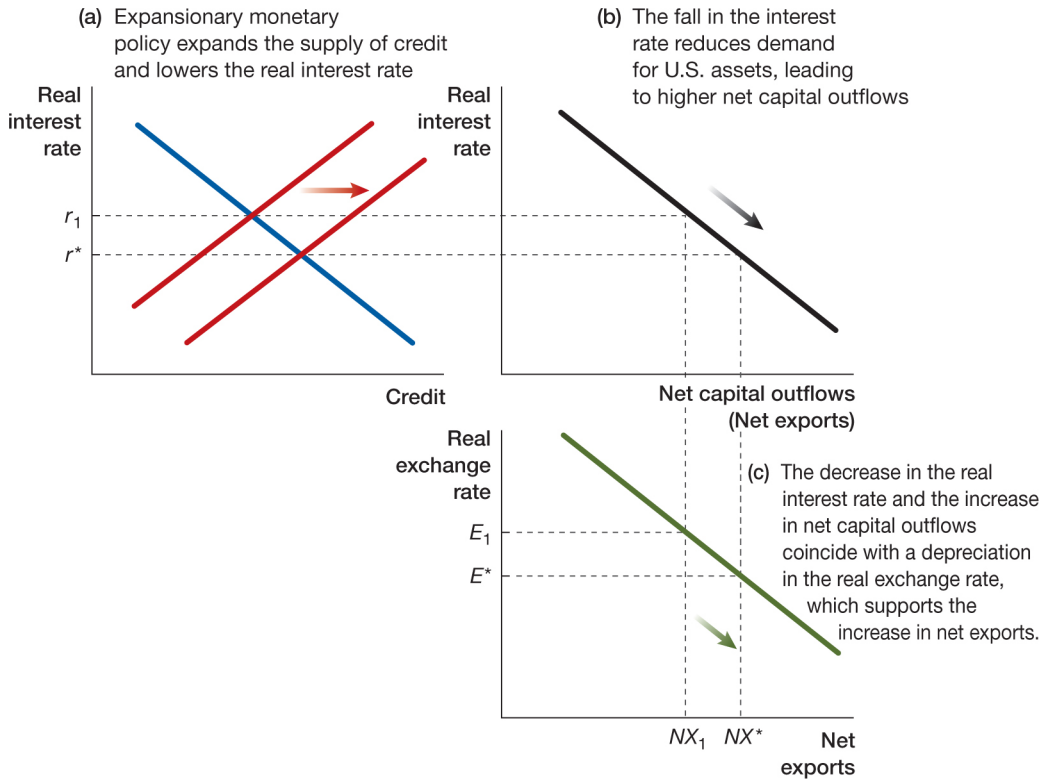

Figure 5.12: The Effects of Expansionary Monetary Policy Under a Flexible Exchange Rate