Chapter 3: Measuring the Macroeconomy

Question 3.1: Macroeconomic Concerns
During the 2016 US Presidential Election season, it was often said that, "the economy is terrible". As macroeconomists, if the economy is not doing well, does this mean we should be worried about…

A
The price of gasoline.

B
The unemployment rate.

C
The number of houses sold in a given year.

D
The general level of prices.

E
The well-being of citizens in an economy.

In the previous chapter, we learned how to explain price and quantity changes in the gasoline and housing markets. Many households spend considerable resources trying to make themselves better through purchases of transportation and housing. But to macroeconomists, they are just one piece of a big puzzle. Macroeconomists are interested in the health of the entire economy, not just one market or one person. Making a statement such as, “the economy is doing great”, can mean a lot of things. Therefore, it is important to understand what we are trying to achieve as macroeconomists.

This course will use three general goals to guide us and our goals correspond with three possible correct answers to the question above (B, D and E). In order to assess whether an economy is doing well or not, the first thing a healthy economy should have is **a high standard-of-living**.

High standard-of-living
A high standard-of-living can mean different things to different people. What goods, events, activities, etc. do you associate with a high standard-of-living?

In the discussion question above, money is often associated with a high standard-of-living, but money itself only improves our standard-of-living in that it can be converted into goods and services that we enjoy. Buying goods and services may improve our standard-of-living, but as many of the comments above likely suggest, there is more to life than all of our “stuff”. Health, family, friends and general happiness all contribute to our standard-of-living and are things we must consider when assessing whether an economy is doing well or not.

Although there are many components that go into measuring our standard-of-living, economist often use a single statistic that is meant to represent how well an economy is "doing". The **Gross Domestic Product (GDP)** is the market value of production in an economy. Using a single statistic to measure the standard-of-living in an entire economy may feel incomplete. However, in order to critically analyze the GDP, we must gain a complete understanding of how to calculate the GDP, how it is used and recognize the benefits and costs of using the GDP to measure an economy’s health.

Measuring the market value of production (GDP) can provide important information into the health of an economy. But as we learned in the previous chapter, when the price of goods such as housing fluctuate drastically, it can lead to significant economic problems. An economy that has a lot of production, but volatile prices is not necessarily healthy. Therefore, a second goal of macroeconomists is to make sure the **price level in an economy is stable.**

Examining whether an economy has stable prices brings up two important questions. First, what does it mean to have stable prices? Second, how are all prices in an economy measured? We will answer both of these questions and in the process, learn about how to calculate statistics you hear often in the news such as the **Consumer Price Index (CPI)** and the **GDP Deflator.**

Question 3.2: A Healthy Economy

An economy has GDP growth of 10% per year, price levels are considered stable, but the unemployment rate is 25% (1 out of every 4 potential workers do not have a job). How do you feel about this economy?

A

This economy is not healthy and nobody is doing well.

B

This economy is not healthy. Some people are probably doing well, but they could be better off.

C

This economy is only beneficial to the richest people in the economy.

D

This economy is doing fine since 75% of the labor is working. Only the unemployed suffer.

E

This economy is doing well. Because it is growing so rapidly, there will be enough resources for everyone to be well off.

In the hypothetical economy above, our first two goals are being achieved. There is a high standard-of-living, as measured by GDP and stable prices. However, there is a very high unemployment rate of 25%. (The current unemployment rate in the US is near 5%.) It is likely that some people are doing very well in this economy since production is increasing and prices are stable. Even people who are unemployed may find that there are more unemployment benefits available when the economy is doing well.

Regardless of how well any particular citizen is in this economy, the high unemployment rate is harmful to everyone. It is straightforward to think that the unemployed workers would be better off with a job. However, those with a job and even the richest also benefit when the economy has a lower unemployment rate. A lower unemployment rate would mean higher incomes for more workers, which lead to more goods and services bought and sold, and potentially higher profits for business owners.

The final goal of macroeconomics is for the **economy to be at full-employment**. When an economy is at full-employment, no workers are unemployed as a result of fluctuations in overall economic activity. Examining this goal means that we first need to know the different ways someone can become unemployed. There are many reasons as to why someone can be out of a job, but the lack of a job loss is not always indicative of an unhealthy

economy. Additionally, we need to learn how to calculate the unemployment rate and determine how much unemployment constitutes full-employment.

An economy that has a high standard-of-living, stable prices and full-employment is considered a healthy economy. Our policy recommendations as macroeconomists will try to fulfill all of these goals. In some cases, it will be straightforward to reach our goals. In other cases, we will have to make trade-offs and sacrifice one goal for another. Before getting there, lets figure out how to measure these goals.

Chapter 3.1: Well-Being and the Gross Domestic Product

Defining GDP

As we briefly mentioned above, it is hard to think of one, all-encompassing statistic that represents the well-being of an entire economy, but some statistics are more representative of an economy than others. The Gross Domestic Product (GDP) is a commonly used measure that helps us learn whether we are achieving our first goal of macroeconomics: *Reaching and maintaining a high standard-of-living*.

GDP is the total value of all final goods and services produced for a marketplace during a given period (usually a year), within a country's borders.

Try saying that two times fast (or just once). This is a loaded definition, but the details of GDP are what make it a valuable measure of the economy. Read it a few times and you will recognize that the GDP measures how much an economy produces. But let's quickly go through the nuances of the definition of GDP and better understand what it is capturing.

Value: In order to measure the production in an economy, the amount of production is converted into a dollar amount that reflects its value. This is more practical than trying to add up the millions of products in the country and ending up with a complicated set of numbers.

Question 3.3: Intermediate Goods

Which of the following transactions count towards GDP?

A

Tires sold by Goodyear to Toyota for a Toyota Camry.

B

Tires sold by Tire Discounters to a family driving a Toyota Camry.

C

A diamond ring purchased from Jared's.

D

A diamond from De Beers to Jared's that is used to create a diamond ring.

Final Goods and Services: The word "final" may come off as a simple term, as it suggests that non-final goods do not count in the calculation of GDP. But it is an important concept. When goods and services are purchased by the actual user of the product, it is considered a **final good or service**. Goods that are produced, and then used in production of another good are called **intermediate goods**. There are many examples of intermediate good production in many economies. *Tires* on a car, *charcoal* in a water filter and *cheese* on a pizza are examples of intermediate goods since they are used to produce other goods. If we were to include both the production of tires and the car in the GDP, we would be double counting the tires.

To show that double counting can occur, imagine that an individual buys a computer from BestBuy for $400. The $400 is added to GDP since it is a final product sold to the end consumer. But the computer did not just magically

appear. It was constructed from a number of other parts that had their own production process.

Imagine that the simple process to build a computer went something like this:
Step 1: Raw materials are gathered and sold for $50 to a parts manufacturer.
Step 2: The manufacturer turns the raw materials into computer parts. The computer parts are sold to Dell for $200.
Step 3: Dell uses the computer parts to construct a computer. They sell the computer to Best Buy for $350.
Step 4: Best Buy puts the computer on the shelves and it is sold to an individual for $400.

In the creation of the computer, there are $1000 worth of transactions ($50 in step 1, $200 in step 2, $350 in step 3 and $400 in step 4). But it would be unreasonable to add $1000 to the GDP when the computer is only sold for $400. This is because the intermediate goods and services are wrapped into the final $400 price and already include $200 worth of computer parts produced in step 2 (as well as the $50 in raw materials). By only adding the final good or service to the GDP, we eliminate the possibility of double counting the intermediate goods used in the creation of the final product.

Revisit question 3.3 above. Would you change your answer after reading this section? Answers (B) and (C) are sales of products to final users. The tire in answer (A) is counted when the Toyota Camry is sold to a buyer, so it **should not** be counted when the tire is sold to Toyota. If the Toyota Camry owner replaces the tires, buying new tires will count towards GDP (answer B).

The same idea applies to a diamond ring. A diamond sold to a jeweler does not count towards GDP since the value of the diamond ring takes into account the intermediate sale of the diamond from De Beers to the jeweler.

Question 3.4: Production

Which of the following transactions count towards GDP?

A

The selling of an empty plot of land.

B

The real estate fees associated with the sale of an empty plot of land.

C

Purchasing 1000 shares of Apple stock.

D

Purchasing an Apple iPhone.

Produced: For a good or service to be counted towards GDP, it must actually be produced. This may seem obvious, but there are many purchases made that do not directly involve production such as stocks, bonds and land.

In question 3.4, the plot of land (A) and the Apple stock (C) are not produced and *do not count towards GDP.*

Question 3.5: Market Transactions

Which of the following transactions count towards GDP?

A

Exterminator services from No More Mr. Mice Guy, a legitimate small business.

B

Paying Uncle Bob Roy $10 for every mouse he catches in your dorm room.

C

Getting tutored in economics by your roommate in exchange for tutoring for history.

D

Enrolling in a GRE Prep Class.

E

Day care services for Ms. Johnson's 2-year old child.

F

Ms. Johnson taking the day off of work to take care of her sick 2-year old child.

For a marketplace: In order for production to count towards GDP, the production must be sold in a recognized and legal market, not the "underground economy". The sale of illegal goods and services are not counted towards GDP. Neither are under-the-table payments made for babysitting, or lawn care. Selling goods or services on Craigslist (or in the Classified section of the newspaper) does not count towards GDP.

Because the government does not track under-the-table transactions, the size of the underground economy is unknown. Some reports have estimated the value of the underground economy in the US at $2 trillion.

In question 3.5, the activities where a formal transaction takes place is included in the GDP. The exterminator service (A) is a small business available to anyone and any service they charge for is included in GDP. Uncle Bob Roy (B) will probably be paid in cash and he will not be paying taxes on his income. His services do not count towards GDP.

A formal GRE Prep Class (D) is tracked by the government and included in GDP, whereas the exchange of tutoring services between roommates (C) is done without recognition by the government and not counted towards GDP.

A mother who enrolls her child in day care services (E) is taking part in a market transaction. When the mother provides the same service for her child at home, the service is not recognized by the government and does not count towards GDP. This means that home activities such as yard work, cooking, laundry and child care count as GDP when the services are purchased from a formally recognized company, but do not count towards GDP when done by homeowners.

Question 3.6: Used Goods

Which of the following transactions count towards GDP?

A

Buying a used car from a licensed car dealer.

B

Buying a used car from your friend.

C

Buying Oprah's mansion in Santa Barbara county.

D

Realtor fees associated with the services of buying Oprah's mansion.

E

Buying a newly constructed condo.

During a given period: Once the time period that we are interested in is defined, we only are concerned with production within that time frame. For example, if we are interested in annual GDP in a country, any production that takes place outside of the year we are measuring does not count.

The most relevant transactions not counted in GDP because of this part of the definition are used goods. In question 3.6, the only new good is the condo (E). The other three goods (the used cars and Oprah's mansion) were already counted towards GDP in the year they were produced. Counting the sales of the used goods again would be double counting. However, services associated with the purchase of used goods are produced in the current year and counted towards GDP. This means that realtor fees (D) and commission for a used car salesperson are part of GDP.

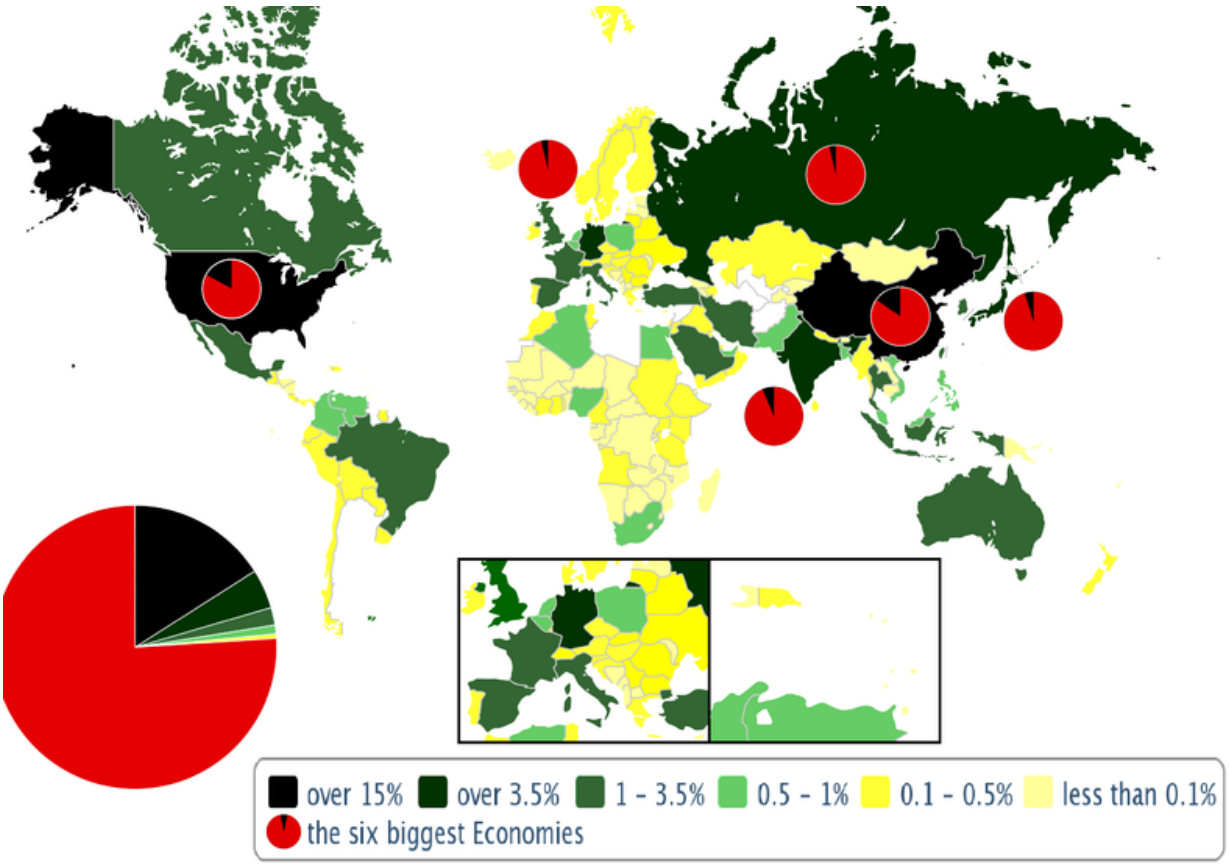
Within a country's border: GDP counts all the production of a country. A Mexican restaurant in San Diego adds to the US GDP, not Mexico's (even though Tijuana, Mexico is only about 10 miles away). However, if the owner of the restaurant is a citizen of Mexico, his services count towards Mexico's **Gross National Product (GNP)**. GNP is the value of production by citizens in a country, regardless of where they are located. A professor from China working for a university in Paris counts towards France's GDP, but adds to China's GNP.

There are many nuances to be aware of when examining the GDP, but the definition is in the name. Gross Domestic Product is the total (gross) amount of production (product) in a country's borders (domestic).

Reporting the GDP

Now that we know that GDP measures the total amount of production in an economy, we can better understand what all the numbers thrown around on TV about the economy mean. In the United States, the Bureau of Economic Analysis (BEA), releases quarterly estimates of the GDP. Their most updated estimates are available in Table 1.1.5 of the National Income and Product Account (NIPA) tables.

In the second quarter of 2017, the BEA reported that the US GDP was 19.250 trillion dollars. This means that had the production in the second quarter of 2017 taken place for an entire year, there would be 19.250 trillion dollars worth of production. To really understand how large the US GDP is, it needs to be compared to the the GDP in other countries.



Share of World GDP PPP 2011, World Bank, ICP

Figure 3.1.01

The map above color codes countries based on the fraction of the global GDP contributed by a particular country. The six largest economies based on GDP make up roughly 75% of the global GDP with the remaining countries making up the rest. The United States is responsible for between 20-25% of the total GDP in the world, with China following closely and growing every year. If you were to combine Japan, Germany, the United Kingdom, France and Italy into one single economy, that mega-economy would still be smaller the US economy. The actual US GDP amount of over 19 trillion may be eye-popping, but to get a sense of the relative size of the economy, the box above provides a telling visual.

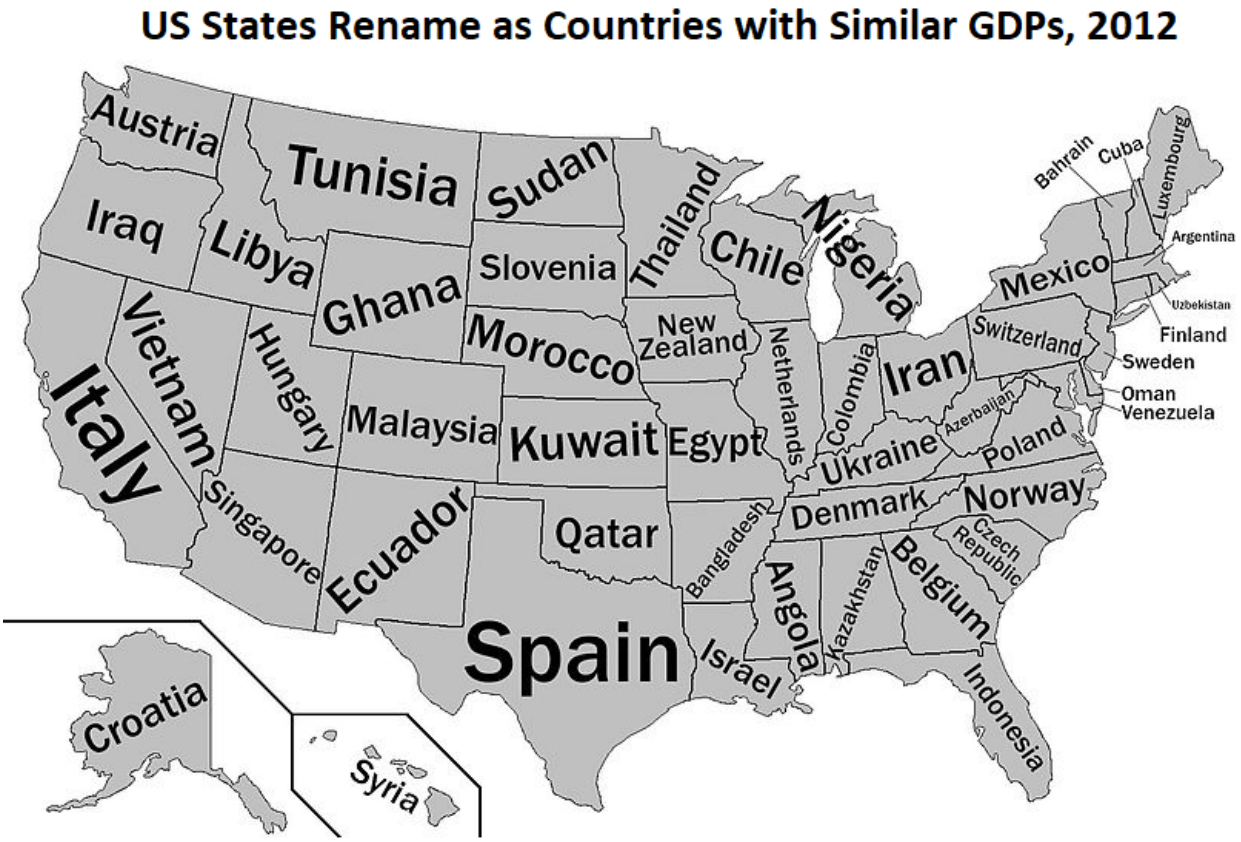


Figure 3.1.02

Another way of showing the relative size of the US GDP is by comparing the size of a state's GDP to entire countries. The map above replaces the names of states in the US with countries that have similar sized GDP levels. For example, California's GDP is roughly the same size as Italy, the 8th largest GDP in the world. Even less populated states like Utah had the same amount of production as Hungary in 2012.

The pictures above are a way of looking at the relative sizes of the GDP across the world. However, it is possible for a country to have a large GDP and a large population, causing the average citizen to be relatively poor. When you think of wealthy countries, you may not think of Russia or Turkey, even though they have relatively large GDPs. Instead, you may think of Switzerland, Norway or Sweden.

The table below from the World Bank shows the GDP per capita in 2015 around the world. The GDP per capita is calculated by dividing a country's GDP by the number of people living in the country. Luxembourg has a GDP per capita of over $100,000, nearly twice the amount of the US ($56,115).

Another way of describing this difference is that the average citizen in Luxembourg produces over $100,000 in goods and services every year. There is something to be said about producing a lot as a country and having a large GDP, but in order to use the GDP as a measure of well-being, the GDP per capita is more appropriate.

Country	GDP per Capita, 2017
Qatar	$124,900
Luxembourg	$109,100
Singapore	$90,500
Bermuda	$85,700
Ireland	$72,600
Norway	$70,600
Kuwait	$69,700
United Arab Emirates	$68,200
Switzerland	$61,400
Hong Kong	$61,000
United States	$59,500
Saudi Arabia	$55,300
Netherlands	$53,600
Iceland	$52,100
Sweden	$51,300
Germany	$50,200
Australia	$49,900
Taiwan	$49,800
Denmark	$49,600
Austria	$49,200
Canada	$48,100

Figure 3.1.03

If you are only interested in examining how a single country is growing and changing, the GDP measure can be useful. In Table 1.1.7 of the National Income and Product Account (NIPA) tables, the percentage change in growth in GDP over the past year is reported. This information is helpful in determining recent trends in overall production over the past year. In years when the GDP is falling, the table will report a negative percentage change.

We will learn how to calculate the percentage change in GDP below after learning how to measure GDP.

Reporting GDP

Defining GDP and examining the size of GDPs around the world is done relatively quickly in the sections above. Gathering the information needed to measure and calculate GDP is more complex. The BEA uses considerable resources gathering data that helps measure the GDP. They receive information from a number of surveys, including the Census Monthly Trade Report, the Census Manufacturers' Shipments, the Federal Budget and Monthly Treasury Statement and the Bureau of Labor Statistics wage report. The information from these sources are consolidated into the National Income and Product Accounts (NIPAs) tables which include calculation of the GDP.

Although there is a lot of work that goes into the BEA's GDP figures, they report the GDP in a straightforward, and informative way. The most common approach to reporting GDP is called the **Expenditure Approach**. The Expenditure Approach breaks down GDP based on the amount of final good purchases by four general groups: households, firms, government and foreigners.

3.7: Spending in the Economy

Which group spends the most in the US economy?

A

Households and individuals

B

Businesses and firms

C

Federal and Local Governments

D

Foreign investors and firms

Let's find out the answer below!

The Expenditure Approach

The snapshot of table 1.1.5. from BEA below shows the GDP in the US in the four quarters of 2016. Notice how the column on the furthest right is the GDP estimate of 18,869 billion (18.869 trillion) from the fourth quarter of 2016.

Line		2016			
		I	II	III	IV
1	**Gross domestic product**	18281.6	18450.1	18675.3	18869.4
2	**Personal consumption expenditures**	12498	12692.7	12832.2	13008.9
3	Goods	4008.7	4085.4	4111.9	4187.5
4	Durable goods	1366.6	1390	1414	1440.9
5	Nondurable goods	2642	2695.4	2697.9	2746.6
6	Services	8489.3	8607.3	8720.3	8821.4
7	**Gross private domestic investment**	3036.8	2987.5	3017.2	3101.4
8	Fixed investment	2994.8	3002.5	3013.1	3049
9	Nonresidential	2292.4	2304.7	2313.8	2324.2
10	Structures	486	487.3	500.5	501.3
11	Equipment	1066.3	1058.7	1049.3	1053.5
12	Intellectual property products	740.1	758.7	763.9	769.4
13	Residential	702.4	697.8	699.3	724.8
14	Change in private inventories	41.9	-15	4.1	52.4
15	**Net exports of goods and services**	-507.4	-492.4	-460	-545.2
16	Exports	2179	2209.7	2276.3	2264.8
17	Goods	1410.9	1437.2	1495.4	1476
18	Services	768.1	772.5	780.9	788.8
19	Imports	2686.3	2702.2	2736.2	2810
20	Goods	2185.7	2199.4	2222.7	2294.6
21	Services	500.7	502.7	513.5	515.4
22	**Government consumption expenditures and gross investment**	3254.3	3262.3	3285.9	3304.3
23	Federal	1233.8	1239.2	1251.8	1253.2
24	National defense	731.4	729.3	736	732
25	Nondefense	502.4	509.9	515.8	521.2
26	State and local	2020.5	2023.1	2034.1	2051.1

Figure 3.1.04

Consumption (C)

The table contains 26 total lines that breakdown the GDP in specific categories based on the group that is purchasing a final product. In line 2, the amount of GDP that comes from personal consumption expenditures is reported. **Consumption (C)** captures all the spending by individuals and

households. In quarter four of 2016, this amounted to just over 13 trillion dollars, which is approximately 69% of the total GDP. More directly, this means that 69% of the production in the US economy is bought by individuals and households, making household consumers the biggest group of spenders in the US economy.

Consumption is broken down into two major sub-categories: goods and services. Goods are tangible items that individuals and households obtain ownership of when they are purchased. For example, you became the owner of the computer you are currently using when you bought it from a retailer (assuming you are using your personal computer). A good like a computer is not purchased that frequently because it does not break down often or become used up in a short amount of time. In other words, it is a *durable good* that lasts a long time (longer than 3 years) and is bought infrequently. Line 4 shows the amount of durable goods purchased by consumers in the fourth quarter of 2016 was 1.414 trillion dollars.

Durable Goods

Give an example of a durable good other than a computer.

A number of goods fall into the BEA's definition of a durable good in addition to computers. Automobiles, furniture, appliances, tools, cameras, bicycles, boats, instruments, jewelry and phones are all considered durable goods. These differ from *non-durable goods* (line 5), which are goods that do not have a long useful life (less than 3 years), are purchased frequently and/or immediately consumed. An obvious non-durable good would be milk. You certainly do not want to consume milk that has been on the shelf at a grocery store (or in your refrigerator) for more than a few weeks.

Non-Durable Goods

Give an example of a non-durable good other than milk.

In addition to milk, food and beverages bought at a grocery store are also considered non-durable goods. Clothing, gasoline, medication, office

supplies, tobacco and toilet paper are also examples of non-durable goods. All consumer goods account for 22.2% of GDP, with non-durable goods accounting for approximately 14.6% of GDP and durable goods accounting for 7.6% of GDP.

The largest spending sub-category is found on line 6, under *services*. In the fourth quarter of 2016, 8.8 trillion dollars worth of services were produced, accounting for nearly 47% of the total GDP. This is why you may have heard the US economy referred to as a "service based economy".

In general, services are purchases that consumers do not gain ownership of. A service cannot be consumed like food or something that you buy, own and can set aside for later use like a lawn mower. An example of a service would be a ticket to watch a movie in a theater. Buying the ticket entitles you to a showing of the movie, but you do not gain ownership of the theater or the movie itself. You are purchasing the service of entertainment.

The same idea applies to health care. By going to the doctor, you are receiving the service of becoming healthier, but you do not gain ownership or consume the doctor or hospital.

Going out to a restaurant or ordering a pizza is also considered a service since a high fraction of the price of a meal pays for the service of creating the meal, cleaning dishes and using the restaurant as a place to eat. An article from Marketwatch finds that the ingredients for a meat pizza cost about $1.90, but the average price paid for a pizza is $14.00, a 636% markup.

How does this work with GDP? If you went to the store and bought the pizza ingredients for the same price the restaurant pays and made your own pizza, the GDP would increase by $1.90. By going to the pizza parlor, you are paying $14.00 for the service of having someone (or some firm) buy the ingredients and make the pizza for you. Instead of trying to separate

ingredients from the service portion of the pizza, the BEA puts the entire $14.00 pizza into the services category.

Now that you know what the BEA means when they list consumption on the NIPA tables, test your knowledge in question 3.8.

3.8: Consumption Spending

Which of the following goods or services would be considered part of consumption (C) by the BEA?

A

Having a lawn care business mow your lawn.

B

Hiring a friend to babysit.

C

The purchase of a used home.

D

The commission on a used home sale.

E

Rent on an apartment.

F

The purchase of brand new home.

There are three correct answers in question 3.8. Having a lawn care company mow your lawn is a service and part of consumption. You purchased the service of someone mowing your lawn from a formal business. This differs from answer B, which is a service, but since it is a non-market transaction, it is not captured by GDP.

Answer C can also be ruled out since used goods do not count. However, when a used home is bought, a real estate agent provides the services of negotiation, guidance and paperwork. The real estate commission fee is counted towards GDP, even if the price of the used home is not.

Related to housing, renting an apartment is counted as a service and is part of consumption, as rent is providing shelter. So answers A, D and E all are examples of consumption. This means that purchasing a brand new home (F), is not part of consumption. As we saw in the previous chapter, homes are used as both a place to live and as an investment for savings that can possibly increase your wealth. Because of that, we count the construction of a new home towards our next spending category, investment.

A NOTE ON IMPUTED RENT

Some of you may have noticed from question 3.8 that renting a home or apartment counts as service, but we have not said anything about someone who owns a home and does not pay rent. It would be inconsistent to go through a neighborhood of identical homes and only count homes being rented towards GDP. Therefore, the BEA estimates imputed rent for owner-occupied homes. If every home on a street would rent for $1000 per month, then $1000 per month in imputed rent is added to the GDP. By imputing rent, the BEA does not overestimate GDP when a household that was formerly occupied by an owner is put up for rent. Check out the BEA for more information about imputed rent.

Investment (I)

The second category of spenders in the expenditure approach of the GDP is spending by firms, businesses and investors. Spending of this nature is called Gross Private Domestic Investment (line 7 on Table 1.1.5) or **investment (I)**. In quarter four of 2016, investment spending was 3.10 trillion dollars, or 16.4% of total GDP.

There are three general sub-categories that make up investment spending. *The first sub-category of investment is capital goods and services (also called Nonresidential Fixed Investment, line 9).* Approximately $2.32 trillion of the $3.10 trillion in investment spending comes from capital goods and services.

Capital goods and services are products where the final user is a firm or business. An example of capital is a John Deere tractor purchased by a farm. The final user of the tractor, a capital good, is the farm and thus is counted towards the investment portion of GDP. Line 11 on Table 1.1.5. reports the total amount of nonresidential equipment, which is what a tractor would fall under. If a farm built a new structure to store their product in, it would be captured in line 10 under nonresidential structures.

The software program used by your professor to create lecture slides was likely purchased by the university (a firm) and is also considered nonresidential equipment. Intellectual property rights, such as research and development in entertainment recently became part of nonresidential investment (line 12).

The second sub-category of investment is new home purchases. As we saw in question 3.8, new homes are not counted as consumption, but they are counted as a residential investment (line 13) and in the fourth quarter of 2016 amounted to 725 billion dollars. One way to think of this concept is that homes are an investment for a household.

The last sub-category of investment is changes in private inventory (line 14). This category appears to come out of nowhere, but it will play an important role in our theoretical analysis later in the book. In order to understand what changes in private inventory are capturing, we first need to define what is meant by **inventory**.

When you think of the term inventory, the terms stock room, shelves and storage may come to mind. If so, you are thinking about inventory correctly. We will specifically define inventory as unsold goods in the economy and we can see how unsold goods are captured by the GDP.

Imagine that there are $4000 worth of computers on shelves at Best Buy in 2017. Over the course of the year, $3000 in computers are sold to consumers.

The sales increase GDP by $3000 (specifically, durable good consumption increases). There are $1000 in computers that are unsold. This means that private inventories rise by $1000. Overall, the $4000 in computers that made it to shelves of Best Buy are added to the GDP in 2017, with $3000 added to consumption (C) and $1000 added to investment (I) through an increase in private inventories. In simpler terms, we could say too many computers were produced in 2017 since computer production was greater than computer spending.

Fast forward to 2018. Best Buy places the $1000 worth of 2017 computers on the shelves and they are sold. The BEA captures this purchase by increasing consumption by $1000. However, the computers were not produced in 2018, so overall GDP in 2018 should not change because of the computer sales. The computers added to private inventories in 2017, but they were taken out of private inventories in 2018. The decrease in private inventories is exactly equal to the increase in consumption in 2018. Therefore, the total change in GDP in 2018 from the computer sales is $0, but the consumption component (C) increases by $1000, while the investment component (I) decreases by $1000.

Because the change in inventory in the fourth quarter of 2016 was positive (52 billion), that means that not all production meant for consumers ended up being sold. This differs from quarter two of 2016 when the change in inventory was negative (-15 billion). In this quarter, more was bought than sold, but firms were able to use old inventory to meet the demand for sales.

Let's test our knowledge of how well we know what goes into the investment category of spending with a couple of questions.

3.9: Changes in private inventory

In 2017, $500 worth of shirts are produced by Calvin Klein. That same year, $700 worth of shirts are sold. This means that consumption spending in 2017.....by.....and private inventories.....by..... Overall GDP in 2017.....by.....

A

increased; $500, decreased; $200; increased; $700

B

increased; $700; decreased; $200; increased; $500

C

increased; $200; increased; $500; increased; $500

D

decreased; $500; increased; $200; decreased $700

In the scenario above, first notice that $700 in shirts were sold. This means that consumption will increase by $700 in 2017. Since only $500 shirts were produced, workers had to take $200 worth of shirts out of inventory to meet the quantity of shirts demanded. That means that private inventories decreased by $200 in 2017.

Overall, GDP in 2017 increased by $500 because that is the value of the shirt production in 2017. The extra $200 in shirts from inventory were produced in an earlier year. Another way of thinking about the total change in GDP is that consumption increased by $700 and investment decreased by $200, leading to a total change in GDP of $700-$200=$500.

3.10: Investment Spending

Which of the following transactions are counted towards investment spending?

A

A private university purchases furniture for a new faculty member.

B

New office buildings are constructed at the offices for Google.

C

Steel is purchased by Ford to be used in the production of cars.

D

An airline buys blankets for passengers to use on red-eye flights.

E

The government buys a new playground for a public park.

There are two correct answers to question 3.10. Answer A is an example of a firm purchasing a capital good. The final user of the furniture is an employee and the value of the furniture is considered investment. The new office building built by Google (B) is a nonresidential structure and is also counted towards the investment portion of GDP.

The last three answers do not count towards investment. Steel used for the production of cars is an example of an intermediate good. The value of the steel is captured in the final value of the car when it is sold to a consumer. A similar argument applies to blankets for airline passengers. The airlines purchase the blanket, but the cost of the blanket (and other amenities on a flight) are wrapped into the ticket price. It may not sound like a low priced amenity like a blanket is relevant, but just because a blanket might be cheap does not mean it is not noticed by the airline. Imagine that the blankets are made from high-quality silk and are very expensive. Airlines would not ignore this large expense when pricing tickets and they do not ignore small expenses either.

Answer E is an example of a government expenditure. This is a different category of GDP and we will discuss it right now!

Government Purchases (G)

Unsurprisingly, the government influences the GDP of many countries around the world. It is important to put aside any emotional feelings about the government. Regardless of whether you support high taxes for the rich or limited government intervention, a minimum role of the government is important.

After some time, even the most anti-government establishments would move towards some from of organization that represents a basic government. We can think of the general role of the government as being to provide necessary goods and services (G) that are difficult for private firms to profit from.

Government Goods and Services

What are some examples of goods and services purchased by the government?

In the discussion above, there are a variety of possible answers. The Federal Government purchases goods and services associated with national defense (line 24 in NIPA Table 1.1.5.), which accounts for nearly 4% of the total GDP. A private firm could try to provide national defense, but collecting money and balancing the point of national defense (protecting the country) versus the incentives of a firm (maximizing profit) may not be in the best interest of citizens. The Federal Government also provides funding for highway infrastructure and research and development through the National Science Foundation (line 25).

Local governments provide similar goods and services that citizens find valuable, but are difficult for private firms to produce. Examples include police and fire protection, parks and recreation services and public education.

Total purchases of goods and services by the government accounts for 17.5% of the total GDP, with 6.6% of the GDP coming from purchases by the Federal Government and 10.9% coming from state and local governments.

It is important to recognize that in order for government spending to count towards GDP, the government must actually be purchasing a good or service. This means that safety net programs, such as unemployment benefits, welfare programs, Medicare and Medicaid, do not count towards the GDP because income is being transferred from one group of citizens (tax payers) to another group (unemployed, low-income or elderly).

Net Exports (NX)

If you have been following along with NIPA Table 1.1.5., you may have noticed that consumption (C), investment (I) and government purchases (G) add up to 103% of GDP. That means that the final component of spending, Net Exports (NX), or net spending by foreigners, can be either positive or negative.

Net Exports are broken down into two components, the amount of money that enters a country from foreign buyers and the amount of money that leaves the country and goes to foreign sellers. If a product is produced inside a country and sold to a foreign buyer, that product is being exported out of the country and money is coming back in. The value of exports (X) are added to the GDP (line 16 of NIPA Table 1.1.5.). Imports (M) are products that come into a country from a foreign producer. Money leaves the home country, which means that imports are subtracted from GDP (line 19).

Putting these two components together, Net Exports (NX) = Exports (X) - Imports (M).

The US often runs a trade deficit, which means that the value of exports is less than the value of imports. This is consistent with the value of Net Exports (NX) in quarter 4 of 2016 being around -500 billion dollars.

The expenditure approach is an intuitive way to separate groups of spenders in the economy. In our future analysis, we will often use the identity, **Y = C + I + G + NX**. It allows us to identify how the overall GDP is changed by events that affect consumers, firms, governments and foreigners. Get a head start on our analysis in a few chapters by thinking about policy changes or events that could change each of these components.

Other Methods of Reporting GDP

The expenditure approach helps us understand GDP (production) in the economy from a particular angle. But it is not the only way to think about

production. Remember our discussion of intermediate goods above? We bought a $400 computer from Best Buy, but there were $1000 worth of transactions that took place surrounding the computer. There were $50 in raw materials sold to a parts manufacturer, $200 in parts sold to Dell, a $350 computer sold to Best Buy, then finally the $400 computer was sold to you.

During this discussion, you may have noticed something. Each intermediate step was adding value to the eventual final computer. If we take the *value added* at each step of the production process, we would end up getting the same increase in GDP as if we took the final value of the computer. The table below describes this concept:

Step	Product	Value-Added
1	Raw Materials	$50 - 0 = $50
2	Parts	$200 - 50 = $150
3	Dell Computer	$350 - 200 = $150
4	Best Buy Computer	$400 - 350 = $50

In the first step, $50 in raw materials are gathered. In step 2, $150 in value is added to the process by turning the raw material into parts. We can think of the $150 made by the parts manufacturer as "firm profit" (although it does not take into account operating costs like labor). Dell also made $150 in profit by turning the $200 in parts into a $350 computer. Best Buy added $50 to the final value of the computer by offering the service of centralizing where people could go to buy a computer.

Adding up all the value added at each step of the production process yields, $50 + $150 + $150 +$50, or $400. This is the exact same amount as the final price of the computer. Using the expenditure approach, we thought of GDP as the amount of final production in an economy. Using the **value-added approach**, the GDP can also be thought of as the amount of "firm profit".

Another way of measuring GDP is through the **factor-payments approach**. To understand this approach, isolate the $150 that Dell made by converting the computer parts into an actual computer. Dell has to pay employees a wage, office space is rented and paid to landlords, any interest on loans are paid to banks and shareholders/owners are given the rest after the operating expenses are paid. The employees, landlords, bank employees and owners all end up getting income from the $150 that Dell makes. This suggests that household income is equivalent to the amount of "firm profit" using the value-added approach, which is equal to total production using the expenditure approach.

Moving forward, GDP will be used interchangeably with household income, "firm profit" and production and all of these terms are represented by **Y**. We have thrown a lot of numbers and definitions out there, but lets figure out how GDP is actually calculated in a simple economy.

Calculating GDP

The measuring and meaning of GDP is somewhat complicated. However, when it comes to calculating GDP in a simple economy, the process is more straightforward. Imagine that in the economy of University Town, three general goods are produced: food, housing and clothing. The table below shows the quantities that are purchased and the prices of the goods in year 1:

Good	$Quantity_{Yr1}$	$Price_{Yr1}$
Food	1000	2
Housing	200	10
Clothing	500	5

In order to calculate what we call the **nominal GDP**, we need to figure out the market value of the goods and services produced in this economy. This is done by calculating the total revenue generated from each good or service, then summing them up. Specifically,

$$\text{Nominal GDP}_{Yr1} = Q_{Yr1}^{Food} \times P_{Yr1}^{Food} + Q_{Yr1}^{Housing} \times P_{Yr1}^{Housing} + Q_{Yr1}^{Clothing} \times P_{Yr1}^{Clothing}$$

$$\text{Nominal GDP}_{Yr1} = 1000 \times 2 + 200 \times 10 + 500 \times 5 = 2000 + 2000 + 2500 = 6500$$

$$\text{Nominal GDP}_{YrA} = Q_{YrA} \times P_{YrA} \text{ for all goods and services produced}$$

The total amount of dollars transacted in University Town in Year 1 was $6500. This is the **nominal GDP** in year 1. Whenever we want to know the nominal GDP in an economy, we need to figure out the total amount paid of each good an add them all together, remembering the nuances of what GDP captures. Give year 2 a try.

Question 3.11: Nominal GDP

Show Correct Answer

Show Responses

Good	$Quantity_{Yr1}$	$Price_{Yr1}$	$Quantity_{Yr2}$	$Price_{Yr2}$
Food	1000	2	1500	3
Housing	200	10	300	15
Clothing	500	5	1000	10

What is the nominal GDP in year 2 in University Town?

A

2800

B

11000

C

19000

D

28000

The nominal GDP in year 2 is,

$$\text{Nominal GDP}_{Yr2} = Q_{Yr2}^{Food} \times P_{Yr2}^{Food} + Q_{Yr2}^{Housing} \times P_{Yr2}^{Housing} + Q_{Yr2}^{Clothing} \times P_{Yr2}^{Clothing}$$

$$\text{Nominal GDP}_{Yr2} = 1500 \times 3 + 300 \times 15 + 1000 \times 10 = 4500 + 1500 + 10000 = 19000$$

There is a noticeable increase in the market value of goods and services produced in this economy between year 1 ($6500) and year 2 ($19000). Think for a moment why the nominal GDP increased so much between the two years. In year 2, both the quantity and prices of the goods in University Town have increased. The quantity of food increased to 1500, while the price increased to 3. A similar pattern occurred for housing and clothing.

The calculation of nominal GDP over time only involves multiple quantities and prices. However, when measuring GDP we should separate out increases in production (quantity) versus increases in prices. If prices had doubled, but production remained the same, the economy is not twice as healthy.

We can examine changes in GDP driven by production by holding prices constant and calculating changes in the GDP caused by changes in quantity. The **Real GDP** is defined as GDP, holding prices fixed at the prices in the base year. The base year can be any year, but in our example above, it is intuitive to think of the base year as year 1. Whatever the base year happens to be, we will calculate the real GDP by always keeping the prices equal to their base year levels, then looking at the real GDP when quantity changes.

Good	QuantityYr1	PriceYr1	QuantityYr2	PriceYr2
Food	1000	2	1500	3
Housing	200	10	300	15
Clothing	500	5	1000	10

We can define the real GDP in year 2 as,

$$\text{Real GDP}_{Yr2} = Q_{Yr2}^{Food} \times P_{\mathbf{BaseYr}}^{Food} + Q_{Yr2}^{Housing} \times P_{\mathbf{BaseYr}}^{Housing} + Q_{Yr2}^{Clothing} \times P_{\mathbf{BaseYr}}^{Clothing}$$

Calculating this specifically in our example, real GDP in year 2 is,

$$\text{Real GDP}_{Yr2} = 1500 \times 2 + 300 \times 10 + 1000 \times 5 = 3000 + 3000 + 5000 = 11000$$

The real GDP in year 2 tells us that if the prices did not change between year 1 and year 2, the GDP would have increased from $6500 in year 1 to $11000 in year 2. The real GDP did not quite double between years 1 and 2, while the nominal GDP more than tripled since we allowed both quantities and prices to change.

The terms base year (BY) and current year (CY) are often used instead of year 1 and year 2. This yields a more general definition of real GDP.

$$\text{Real GDP}_{CY} = Q_{CY} \times P_{BY} \text{ for all goods and services produced}$$

Notice that the *real GDP in the base year* multiplies base year quantities with base year prices, which means that nominal GDP and real GDP are equal in the base year. The figure below shows the growth in real and nominal GDP in the US since 1947. Notice that in the base year, 2009, the nominal and real GDP are equal. This is because both nominal and real GDP are calculated using 2009 prices.

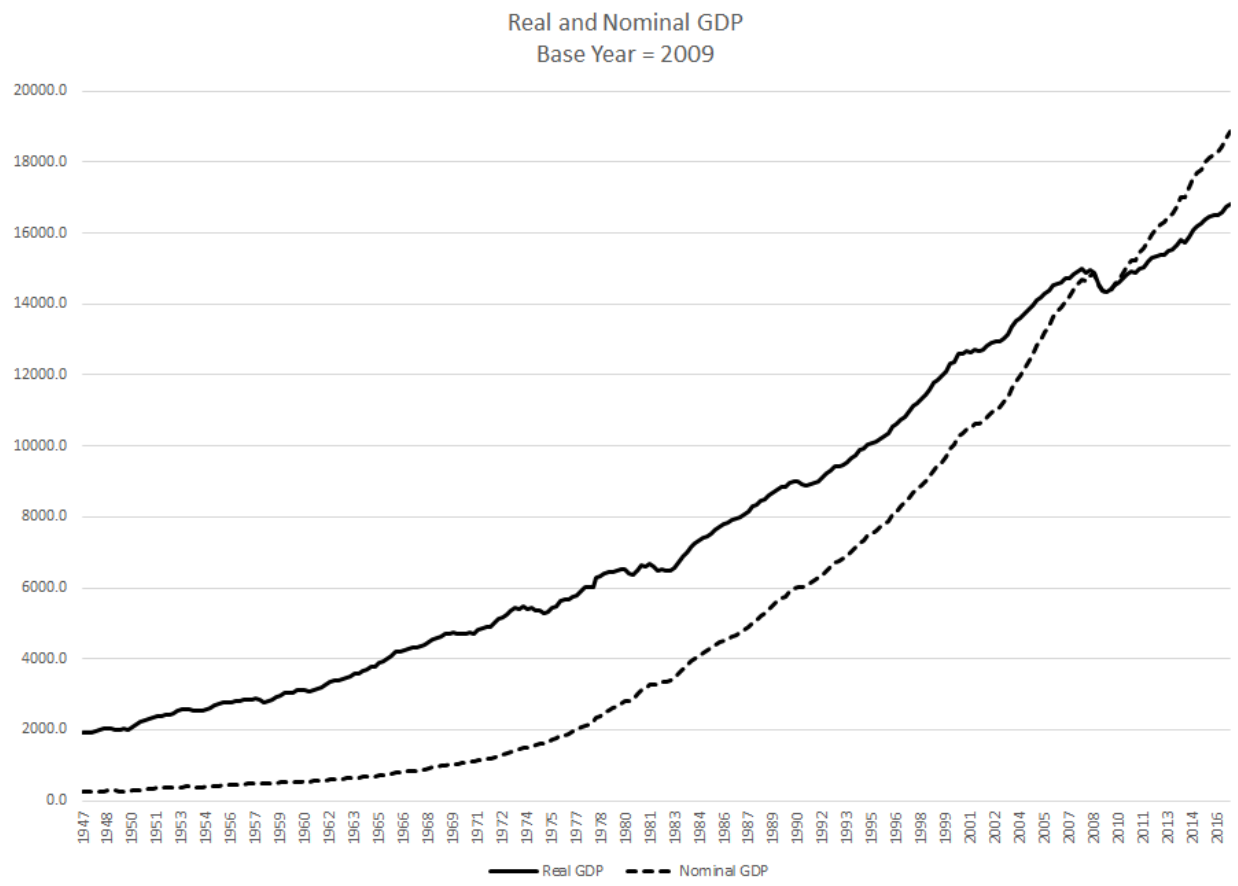


Figure 3.1.05

When we examine changes in the real GDP, we know that the real GDP changes are driven by varying levels of production. The real GDP in the fourth quarter of 2016 (using 2009 prices) was 16.8 trillion dollars. In the first quarter of 2009, the real (and nominal) GDP was 14.4 trillion dollars. We can calculate the percentage growth in the real GDP between 2009 and 2016 by figuring out the percentage change in real GDP over the two years.

$$\% \text{ Change in Real GDP}_{2009 \text{ to } 2016} = [(\text{Real GDP}_{2016} - \text{Real GDP}_{2009})/\text{Real GDP}_{2009}] \times 100$$

$$\% \text{ Change in Real GDP}_{2009 \text{ to } 2016} = [(16.8 - 14.4)/14.4] \times 100 = 16.7\%$$

Since 2009, the real GDP has grown over 16.7%. This corresponds with a recovery from the Great Recession, which we will talk about extensively in later chapters.

The percentage change equation can apply to any variable. Try using the formula to figure out the growth rate in nominal GDP between 2009 and 2016.

3.12: Growth Rate in GDP

In 2009, nominal GDP was 14.4 trillion. In 2016, nominal GDP increased to 18.9. What is the growth rate in nominal GDP between 2009 and 2016.

A

1.31%

B

4.5%

C

31.25%

D

131%

In order to answer this question, we can apply our formula for growth rate from above that looked at how real GDP grew from 2009 to 2016.

% Change in Nom. $GDP_{2009 \text{ to } 2016}$ = [(Nom. GDP_{2016} - Nom. GDP_{2009})/Nom. GDP_{2009}] × 100

% Change in Nom. $GDP_{2009 \text{ to } 2016}$ = [(18.9 - 14.4)/14.4] × 100 = 31.25%

Between 2009 and 2016, the nominal GDP grew by 31.25%. Over that same time period, real GDP, or the increase in GDP holding prices constant, grew by 16.7%. This means that if prices had not changed between 2009 and 2016, the GDP would have increased by 16.7%. Instead, because prices and quantity both increased, nominal GDP grew by 31.25%.

The calculation of the growth rate in real versus nominal GDP should have you thinking about how we can use real and nominal GDP to gain insight about how much prices changed, compared to quantity. In order to determine the fraction of nominal GDP growth caused by price changes, we examine the nominal-to-real GDP ratio. The nominal-to-real GDP ratio is called the **GDP Deflator**.

$\text{GDP Deflator}_{CY} = (\text{Nominal GDP}_{CY}/\text{Real GDP}_{CY}) \times 100 = (Q_{CY} \times P_{CY}/Q_{CY} \times P_{BY}) \times 100$

$\text{GDP Deflator}_{2016} = (\text{Nominal GDP}_{2016}/\text{Real GDP}_{2016}) \times 100 = (Q_{2016} \times P_{2016}/Q_{2016} \times P_{2009}) \times 100$

$\text{GDP Deflator}_{2016} = (18.9/16.8) \times 100 = 112.5$

The GDP deflator divides the nominal GDP by the Real GDP, which essentially gives us the difference in prices between the base year and current year, reported as a percentage.

3.13: GDP Deflator

Good	Quantity_{Yr1}	Price_{Yr1}	Quantity_{Yr2}	Price_{Yr2}
Food	1000	2	1500	3
Housing	200	10	300	15
Clothing	500	5	1000	10

What is the GDP Deflator in University Town in Year 2?

A

100

B

111

C

154

D

173

Before question 3.13, we calculated the nominal and real GDP in year 2, which were $19000 and $11000, respectively. The GDP Deflator in year 2 is then (19000/11000) x 100 = 172.73. If the question was re-worded to ask what the GDP Deflator in year 1 (base year) is, you would answer 100, since GDP Deflator = (6500/6500) × 100 = 100. This means that between year 1 and year 2, the prices in the economy increased by 72.73%, which happens to be the difference between GDP Deflators in year 1 and year 2.

But before we start thinking about the differences in GDP Deflator as being equivalent to price changes from year-to-year, imagine that in year 3, the GDP Deflator is 195. This means that the prices between year 1 and year 3 increased by 95%. However, the growth in prices between year 2 and year 3 is not the difference between the value of the GDP Deflators.

In order to convert the GDP Deflator values into a change in prices, we need to look at the percentage change in the GDP Deflator over time (similar to GDP growth), not just the difference in the GDP Deflator from year-to-year.

$\%\ \text{Change in Deflator} = \%\ \text{Change in Prices}_{\text{YrA to YrB}} = [(\text{Deflator}_{\text{YrB}} - \text{Deflator}_{\text{YrA}})/\text{Deflator}_{\text{YrA}}] \times 100$

Between year 1 and year 2, the change in price is,

$\%\ \text{Change in Prices}_{\text{Yr1 to Yr2}} = (172.73 - 100)/100 \times 100 = 72.73\%$

Another way to think of this outcome is that the *inflation rate* between year 1 and year 2 was 72.73%. If the percentage change in prices is negative, then we

would be experiencing *deflation*, which is the same thing as saying we have negative inflation.

3.14: GDP Deflator and Inflation

You calculated the GDP Deflator in year 2 to be 173 and in year 3 to be 195. What is the inflation rate between year 2 and year 3?

A

12.7%

B

22%

C

73%

D

95%

To answer the question above, we need to figure out what the percentage change in the GDP Deflator is between year 2 and year 3. This is not as simple as taking the difference between the Deflators in year 2 and 3 (which is 22). The difference in the Deflators need to be divided by the starting GDP Deflator of 173 and converted to a percentage. This means that the inflation rate between year 2 and year 3 is [(195 - 173)/173] × 100 = 12.7%.

Measuring Well-Being

As we discussed earlier, GDP or production, which is also income, can help us obtain goods and services that will make us better off. However, simply having more money on its own does not necessarily improve our well-being.

How well does more money align with being better off? Take a look at the GapMinder website. The link will take you to a graph full of bubbles that represent all the countries in the world. On the x-axis is GDP per capita and the y-axis is the life expectancy in the country. The latest year of data is 2015

and you will likely notice a positive relationship between GDP per capita and life expectancy. If you press the play button down in the bottom left corner, the relationship will be depicted over time. As you watch the relationship change over time, what do you notice about life expectancy and income per capita? Can you explain the noticeable shocks in life expectancy that occur from time-to-time?

Explore the GapMinder website and you will see that you will be able to isolate a number of different relationships. This will give you an idea of what more income represents and what it does not represent.

One variable that GapMinder does not have is the happiness of a country. Some countries have recognized that happiness is an important outcome and have made efforts to increase the happiness of citizens. Take a look at the video on Gross National Happiness to learn about a new measure of well-being:

3.2: Stable Prices and the Consumer Price Index

In the previous section on GDP, we learned that the GDP Deflator provides us information about the change in the price level over time. Specifically, the growth rate in the GDP Deflator between two years is equivalent to the percentage change in prices over the same time period.

The GDP Deflator is a natural segue into our second goal in Macroeconomics: **Stable Prices**. A country may report that measures of their well-being, such as GDP, are strong. However, a GDP that is growing fast may not be as beneficial to citizens if the price level is also growing quickly. Even if additional production is growing, quickly rising prices will make it difficult for people to maintain a high standard-of-living. At the same time, you may have

heard that government institutions target specific inflation rates or some inflation is good for the economy. All of this begs the question: what do we mean when we say a healthy economy has *stable prices*?

Ideal Level of Inflation

What is the ideal level of inflation in an economy?

Responses

Reply

Ordered by

Newest Responses

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In the discussion above, the ideal level of inflation varies considerably from person-to-person. Some may argue that having no price growth and 0% inflation is ideal. Others may argue for a higher inflation amount like 10%. Negative inflation rates (deflation) may have been mentioned as well.

Placing a specific value on the ideal level of inflation is hard to do, but there are some guidelines that we can use when assessing whether the level of inflation is too high or too low. First, think about what can happen if inflation is too high. There are a couple of reasons that a high inflation rate is problematic.

Imagine the average firm in the economy is planning for the next year. Today, they start to invest, hire and generally prepare for production over the next twelve months. The firm will take into account how they expect prices to change over the next year and what price they will sell their product for in the

future. Expecting an increase in the general level of prices will likely influence contract negotiations regarding the wages of workers.

Assume that prices are expected to rise by 2% over the next year. Firms incorporate this projection into their decision. Over the course of the year, envision what happens if the actual inflation rate turns out to be incorrect by 25%. This means that the true inflation rate could be 25% lower than the 2% expectation and prices only rise by 1.5%. If firms have committed to increasing worker wages by 2%, but the price of their product only increases by 1.5%, firms could incur a loss as a result of the discrepancy.

The opposite outcome can happen if prices rise by 2.5% when a 2% price rise was expected. In this setting, workers would face 2.5% higher prices, but wages would only rise 2%. Firms may be better off because of being able to sell goods at a higher price than expected, but workers would not be able to afford as much as they did before.

You may be thinking, "if prices increase 2.5%, but wages only increase 2%, workers will not be hurt too much by this difference." That is exactly the point of targeting a low inflation rate.

If the inflation rate was expected to be 50% instead of 2%, missing the inflation target by 25% (+/- 12.5 percentage points) is very costly to either firms or workers. In the case where the true inflation rate is 62.5%, but the expected inflation rate was 50%, workers will suffer considerably since their wages will not likely reflect the unexpected increase in prices. Conversely, when the true inflation rate is 37.5% instead of 50%, firms will generate relatively less revenue.

This example would then suggest that the lower we expect the inflation rate to be, the better. But we should not strive for the lowest inflation rate possible. Go to an extreme setting and ask what happens when the general level of prices decreases? For many expensive goods, such as a car or a home,

you will likely think, "I will wait to purchase these items because the price is going to decrease." If this happens to most goods and services in the economy, the total level of spending in the economy will decrease, causing firms to reduce production and lay off workers. Having a negative inflation rate (or deflation) will not be beneficial to an economy in the long run.

Why not target a 0% inflation rate? When estimating the inflation rate, we will see below that there is a possibility that the reported levels of inflation are over-estimated by 1-2%. Seeing a reported level of inflation of 0% may truly suggest a negative inflation rate.

This discussion is leading us to believe that a **small, predictable level of inflation** is what macroeconomists should target. This means we will be willing to have some price increases from year-to-year. The argument above suggest that small variations in the expected level of inflation are not very costly, but is there any benefit to having some inflation?

It turns out that some inflation allows for less friction in the labor market. This occurs because firms often face difficulties in decreasing the wages of workers, even though wage reductions may be necessary in order for the economy to return to equilibrium in the long-run. If prices are rising, firms can freeze wages, which decreases the real wage. The real wage is similar to the real GDP and can be thought of as the wage, holding prices constant. If the price level is not increasing, firms would need to decrease the actual wage in order to decrease the real wage. Decreasing wages is bad for worker morale and potentially problematic due to labor laws. For this reason, having small price increases mitigates problems associated with frictions in the labor market.

The General Level of Consumer Prices

In the previous chapter, we estimated changes in the level of prices by looking at the difference between nominal and real GDP. The growth rate in the GDP

Deflator is a measure of changes in prices. A major concern with using the GDP Deflator to estimate price changes is that there are a lot of goods and services in the GDP that are not relevant to the average consumer.

GDP Deflator Elements

What goods and services used to calculate the GDP are not relevant to the average consumer?

Responses

Reply

Ordered by

Newest Responses

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In calculating the GDP Deflator, we consider goods purchased by the government, firms and foreigners. The prices of most of the goods bought by these groups are not relevant to the average household. For example, a local government may respond to a decrease in the price of concrete by increasing the amount of highway construction that takes place. Few households care directly about the price of concrete. The same idea applies to a beverage company purchasing a machine that converts recycled aluminum to soda cans.

Another component of the GDP that households are not concerned about directly are the prices faced by foreigners. A family in Napa Valley may be able to get good deals on local wine, but the wineries may charge a lot to foreigners ordering their wine. The price of the wine to foreigners (and the prices foreigners face in general for exported goods) is not relevant to local consumers purchasing the wine.

Instead of using the GDP to estimate changes in the general level of prices faced by consumers, we can create a measure of price changes capturing goods and services that households and individual consumers typically face. There are goods and services that should be considered in our measure of consumer prices that are not in the GDP. What are some examples?

Missing elements of the GDP Deflator

The prices of many of goods and services are relevant to consumers and households, but are not included in the GDP. What would be an example of goods or services that fall into this category?

Responses

Reply

Ordered by

Newest Responses

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-
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Probably the most common category of goods or services that are not included in the GDP but are relevant to consumers are used goods. The price of a used good does not count towards GDP, but consumers will react to a decrease in the price of used cars, for example, by purchasing more used cars. The GDP deflator does not capture changes in the price of used goods.

In the discussion above, we briefly mentioned that the prices of exports are not directly relevant to domestic consumers. This is not the case for imports. Household will respond to a decrease in the price of imports by purchasing more goods produced by foreign firms. Prices of imports are included in the GDP Deflator calculation, but unlike the prices of exports, import prices should be considered when constructing a measure of prices that consumers face.

The calculation of the general level of prices that consumers face is called the **Consumer Price Index (CPI)**. Think of the CPI as the average price of all goods and services that a household consumes; if the household only bought big baskets that contained everything that is ever purchased, the CPI would be the price of that basket. The CPI is calculated by the Bureau of Labor Statistics (BLS) using high-level statistical analyses that you will all learn after you become Economics Majors! For now, we can construct the CPI using three general steps.

Step 1: Create a Basket of Goods and Services

3.15: Goods in the CPI Basket

Show Responses

No correct answers: No correct answer has been set for this question

What is the most important good or service you purchase? In other words, what product cost is most relevant to you.

The first step in creating the CPI is figuring out what goods and services should be included in the representative household basket. In other words, think about all the things that households buy. Yes, everything! This basket would include obvious purchases like food, housing and clothing. But we also want to make sure we include non-necessities like smartphones (yes, you can live without one), entertainment, education and transportation.

Less common purchases should also be added to the basket. The cost of an eye doctor visit, lawn mowers and watches must be in the representative basket. We will discuss the specifics of the basket in step 2.

Step 2: Assign Weights to the Goods and Services in the Basket

After gathering together all the goods and services consumers purchase, it is not surprising that some goods and services are more important than others, regardless of what the price of the good or service is. The CPI weighs the

goods and services based on how important they are to a consumer. According to the BLS, a good or service's weight in the CPI is "the share of total consumer spending that it represents." Click on the link and you will see all the categories that the BLS uses to create the CPI basket, along with the weights applied to each category.

When calculating weights, the most expensive goods and services *do not* have the most weight. Instead, the goods and services that take up the biggest portion of a household budget are weighted the most.

Steeping some tea...

The BLS surveys tens of thousands of households every year in order to calculate the weights for all goods and services in the CPI basket. In the question above, you were asked to order the goods and services from the highest to lowest weight in the CPI basket. The "correct answer" is based on the reported weights by the BLS. However, your basket may differ from the average household.

One possible similarity between your answer and the BLS is that housing is given the most weight in the CPI basket. In the average household, approximately 42.6% of their spending goes towards housing (including rent, utilities, maintenance, etc.). After housing, the next largest category is more difficult to pin down. Transportation is 15.3% of the CPI basket, while Food and Beverages are 14.6% of the CPI basket.

The CPI breaks the general groups into very detailed categories. For example, you may be a student that survives the day by constantly consuming fancy coffee drinks. If you purchase 3 expensive Mochas per day, you probably consider *coffee* to be a relatively big part of your budget (up to 5%? 10%). For the average household, only 0.17% of their budget is spent on coffee. Remember that some people do not drink coffee, so when Starbucks introduces an exciting new drink, non-coffee drinkers do not care if the drink is free or $100 per cup. The CPI weight is showing what the average household budgets for various goods, not necessarily ones unique household.

Step 3: Create a Weighted Basket Cost

In creating the CPI we are looking for one number that represents the average cost of all goods and services purchased by consumers. Changes in the price of this representative basket depends on how much a good or service is weighted. For example, if the price of Lasik eye surgery falls from $2000 an eye to $1000 an eye at the same time the average rent for an apartment rises from $1000 to $1500, it does not make sense for the CPI to decrease. Only a few households will benefit from a decrease in the price of Lasik, whereas every apartment renter will spend $500 more per month on housing.

In order to create the CPI so that price changes of commonly bought goods and services are more important than less common goods and services, we will create a weighted basket cost. This means that we will multiply the weight of each good in the CPI by the price of the good.

Let's simplify our analysis and only put three general goods and services in our basket: housing, food and transportation. The weights of the goods and services are 50% for housing, 25% for food and 25% for transportation. In the table below, the three purchases along with their weight and average price in 2016 are shown.

How much is the cost of a weighted basket? In other words, how much does the average good bought by a household cost? We can find this by linking the weight of each good to the price.

$$\text{Weighted Basket Cost}_{2016} = \text{Weight}^{H} \times \text{Price}_{2016}{}^{H} + \text{Weight}^{F} \times \text{Price}_{2016}{}^{F} + \text{Weight}^{T} \times \text{Price}_{2016}{}^{T}$$

$$\text{Weighted Basket Cost}_{2016} = 0.50 \times 100 + 0.25 \times 20 + 0.25 \times 10 = 50 + 5 + 2.50 = 57.50$$

In 2016, the average price of a good/service in the representative household's basket was $57.50. To figure out how much prices increase over a year, look at the next table showing the prices of the three goods in 2017.

Without doing any calculations, we can see that prices of housing and food increased between 2016 and 2017, while transportation prices stayed constant at $10. Given that housing is twice the weight of transportation and the price of housing increased by 20%, the price of the average good/service will feel more expensive.

Using the weighted basket cost equation above, calculate the weighted basket cost in 2017.

3.17: Weighted Basket Cost

Show Correct Answer

Show Responses

Using the table of weights and prices above that consists of housing, food and transportation, calculate the weighted basket cost in 2017.

A

$57.50

B

$70.00

C

$115.75

D

$150.25

To figure out the weighted basket cost in 2017, multiply the weight of each good by the price in 2017 and add up the values.

Weighted Basket Cost$_{2017}$ = 0.50 × 120 + 0.25 × 30 + 0.25 × 10 = 60 + 7.50 + 2.50 = $70.00

Calculating the CPI

The weighted basket costs are used to calculate the CPI. The CPI "standardizes" the average cost of the basket to be 100 in the base year. This is done by defining a year as a base year and dividing the current year basket cost by the base year basket cost.

$CPI_{\text{Current Year}}$ = (Weighted Basket $\text{Cost}_{\text{Current Year}}$ /Weighted Basket $\text{Cost}_{\text{Base Year}}$) × 100

Imagine that the base year in the example above is 2016. This means that the CPI values in 2016 and 2017 are:

CPI_{2016} = (Basket $\text{Cost}_{CY=2016}$ /Weighted Basket $\text{Cost}_{BY=2016}$) × 100 = (57.50/57.50) × 100 = 100

CPI_{2017} =(Basket $\text{Cost}_{CY=2017}$ /Weighted Basket $\text{Cost}_{BY=2016}$) × 100 = (70.00/57.50) × 100 = 121.7

Notice that in the base year (2016), the CPI is 100. Even though the base year basket cost was $57.50, the CPI sets the base year basket cost at 100. Standardizing the base year basket cost at 100 makes our interpretation of the CPI straightforward. We are able to say that in 2016, our base year, the

average price of goods and services was $100. In 2017, the average price increased to $121.7.

Similar to the GDP Deflator, we can calculate the inflation rate as the growth rate of our price measure. When working with the CPI, the inflation rate is:

$$\text{Inflation Rate}_{Yr1 \text{ to } Yr2} = [(CPI_{Yr2} - CPI_{Yr1})/CPI_{Yr1}] \times 100$$

$$\text{Inflation Rate}_{2016 \text{ to } 2017} = [(121.7 - 100)/100] \times 100 = 21.7\%$$

The CPI basket cost of 100 in 2016 increased by 21.7% to 121.7 in 2017. It is important to remember that the inflation rate is not the difference in CPI values, but instead the percentage growth in the CPI values between two years. What will the inflation rate be in 2018 if the CPI is 130?

3.18: CPI and Inflation

Show Correct Answer

Show Responses

In 2017, the CPI was 121.7. In 2018, the CPI is 130. What is the inflation rate between 2017 and 2018?

A

6.8%

B

8.3%

C

21.7%

D

30%

We can present the question above in a different way: in 2017, the average price of goods and services was $121.70. In 2018, the average price increased to $130. What is the percentage growth in the average price of goods and services between 2017 and 2018?

Using our growth rate equation above,

$$\text{Inflation}_{2017 \text{ to } 2018} = [(CPI_{2018} - CPI_{2017})/CPI_{2017}] \times 100 = [(130 - 121.7)/121.7] \times 100$$

$$\text{Inflation}_{2017 \text{ to } 2018} = 8.3/121.7 \times 100 = 6.8\%$$

The average price of a good/service increased by 6.8% between 2017 and 2018, which increased the average price from 121.70 to 130.

The CPI over Time

Now that we know what the CPI is, analyzing the CPI will make a lot more sense. The figure below shows how the CPI has grown since 1947. The base year is defined as 1983. This means that the average cost of a good in 1983 is standardized and made equal to 100.

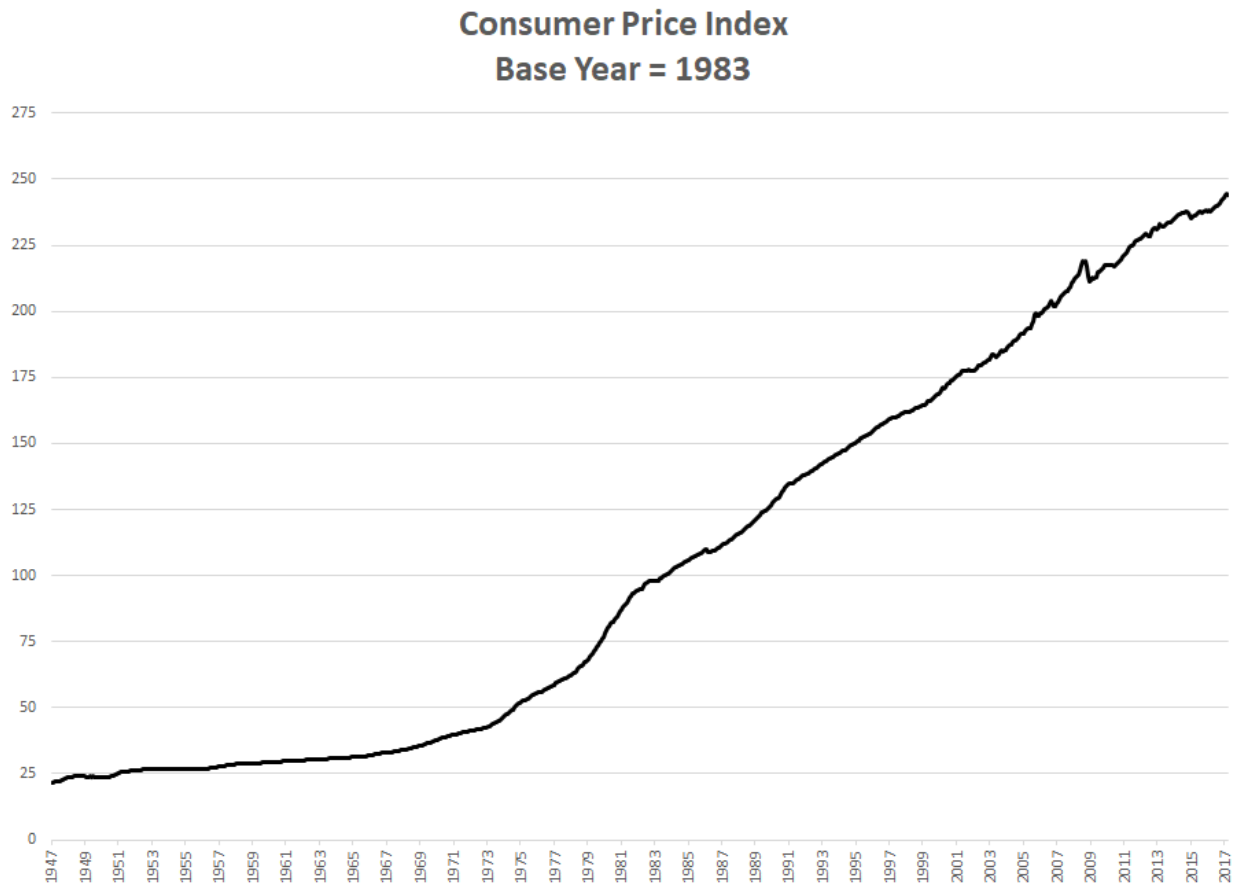

Figure 3.2.01

At the start of 2017, the CPI was 243. This means that a representative basket of goods and services that was $100 in 1983 has increased to $243. Moving backwards in time, at the end of 1950, the CPI was 25. Between 1950 and 1983, prices faced by the average household increased 400%. From 1983 to 2017, prices increased almost 250%. Between 1950 and 2017, the average basket of goods and services increased by almost 1000%. This is found by using our growth rate in the CPI equation above.

Comparing the CPI to the GDP Deflator

You probably noticed some similarities between the calculations of the CPI and GDP Deflator. That is because calculating the statistics are done in a very similar way. In the case of the GDP Deflator is found by comparing the nominal GDP (allowing prices and quantity to change) to the real GDP (holding prices constant as quantity changes). The CPI compares current year basket costs (allowing prices to change, but quantity is held constant) to base year basket costs (prices and quantity are constant).

While it is nice that these two statistics are related, it is also easy to get the calculation of the statistics confused. Take a look at the following table and use it as a guide when faced with questions about the GDP Deflator or the CPI.

This table shows how the calculation of the GDP Deflator and CPI differ. Notice that in the GDP Deflator calculation, the quantity used in deriving the deflator comes from the current year. The CPI uses the base year weights to derive the statistic. Both statistics yield a ratio of current year prices to base year prices, but they are weighted by different "years". Keep years in order and you will keep the statistics in order.

3.2: Stable Prices and the Consumer Price Index

In the previous section on GDP, we learned that the GDP Deflator provides us information about the change in the price level over time. Specifically, the growth rate in the GDP Deflator between two years is equivalent to the percentage change in prices over the same time period.

The GDP Deflator is a natural segue into our second goal in Macroeconomics: **Stable Prices**. A country may report that measures of their well-being, such as GDP, are strong. However, a GDP that is growing fast may not be as beneficial to citizens if the price level is also growing quickly. Even if additional production is growing, quickly rising prices will make it difficult for people to maintain a high standard-of-living. At the same time, you may have heard that government institutions target specific inflation rates or some inflation is good for the economy. All of this begs the question: what do we mean when we say a healthy economy has *stable prices*?

Ideal Level of Inflation

What is the ideal level of inflation in an economy?

In the discussion above, the ideal level of inflation varies considerably from person-to-person. Some may argue that having no price growth and 0% inflation is ideal. Others may argue for a higher inflation amount like 10%. Negative inflation rates (deflation) may have been mentioned as well.

Placing a specific value on the ideal level of inflation is hard to do, but there are some guidelines that we can use when assessing whether the level of inflation is too high or too low. First, think about what can happen if inflation is too high. There are a couple of reasons that a high inflation rate is problematic.

Imagine the average firm in the economy is planning for the next year. Today, they start to invest, hire and generally prepare for production over the next twelve months. The firm will take into account how they expect prices to change over the next year and what price they will sell their product for in the future. Expecting an increase in the general level of prices will likely influence contract negotiations regarding the wages of workers.

Assume that prices are expected to rise by 2% over the next year. Firms incorporate this projection into their decision. Over the course of the year, envision what happens if the actual inflation rate turns out to be incorrect by 25%. This means that the true inflation rate could be 25% lower than the 2% expectation and prices only rise by 1.5%. If firms have committed to increasing worker wages by 2%, but the price of their product only increases by 1.5%, firms could incur a loss as a result of the discrepancy.

The opposite outcome can happen if prices rise by 2.5% when a 2% price rise was expected. In this setting, workers would face 2.5% higher prices, but wages would only rise 2%. Firms may be better off because of being able to sell goods at a higher price than expected, but workers would not be able to afford as much as they did before.

You may be thinking, "if prices increase 2.5%, but wages only increase 2%, workers will not be hurt too much by this difference." That is exactly the point of targeting a low inflation rate.

If the inflation rate was expected to be 50% instead of 2%, missing the inflation target by 25% (+/- 12.5 percentage points) is very costly to either firms or workers. In the case where the true inflation rate is 62.5%, but the expected inflation rate was 50%, workers will suffer considerably since their wages will not likely reflect the unexpected increase in prices. Conversely, when the true inflation rate is 37.5% instead of 50%, firms will generate relatively less revenue.

This example would then suggest that the lower we expect the inflation rate to be, the better. But we should not strive for the lowest inflation rate possible. Go to an extreme setting and ask what happens when the general level of prices decreases? For many expensive goods, such as a car or a home, you will likely think, "I will wait to purchase these items because the price is going to decrease." If this happens to most goods and services in the economy, the total level of spending in the economy will decrease, causing firms to reduce production and lay off workers. Having a negative inflation rate (or deflation) will not be beneficial to an economy in the long run.

Why not target a 0% inflation rate? When estimating the inflation rate, we will see below that there is a possibility that the reported levels of inflation are over-estimated by 1-2%. Seeing a reported level of inflation of 0% may truly suggest a negative inflation rate.

This discussion is leading us to believe that a **small, predictable level of inflation** is what macroeconomists should target. This means we will be willing to have some price increases from year-to-year. The argument above suggest that small variations in the expected level of inflation are not very costly, but is there any benefit to having some inflation?

It turns out that some inflation allows for less friction in the labor market. This occurs because firms often face difficulties in decreasing the wages of workers, even though wage reductions may be necessary in order for the economy to return to equilibrium in the long-run. If prices are rising, firms can freeze wages, which decreases the real wage. The real wage is similar to the real GDP and can be thought of as the wage, holding prices constant. If the price level is not increasing, firms would need to decrease the actual wage in order to decrease the real wage. Decreasing wages is bad for worker morale and potentially problematic due to labor laws. For this reason, having small price increases mitigates problems associated with frictions in the labor market.

The General Level of Consumer Prices

In the previous chapter, we estimated changes in the level of prices by looking at the difference between nominal and real GDP. The growth rate in the GDP Deflator is a measure of changes in prices. A major concern with using the GDP Deflator to estimate price changes is that there are a lot of goods and services in the GDP that are not relevant to the average consumer.

GDP Deflator Elements

What goods and services used to calculate the GDP are not relevant to the average consumer?

In calculating the GDP Deflator, we consider goods purchased by the government, firms and foreigners. The prices of most of the goods bought by these groups are not relevant to the average household. For example, a local government may respond to a decrease in the price of concrete by increasing the amount of highway construction that takes place. Few households care directly about the price of concrete. The same idea applies to a beverage company purchasing a machine that converts recycled aluminum to soda cans.

Another component of the GDP that households are not concerned about directly are the prices faced by foreigners. A family in Napa Valley may be able to get good deals on local wine, but the wineries may charge a lot to foreigners ordering their wine. The price of the wine to foreigners (and the prices foreigners face in general for exported goods) is not relevant to local consumers purchasing the wine.

Instead of using the GDP to estimate changes in the general level of prices faced by consumers, we can create a measure of price changes capturing goods and services that households and individual consumers typically face. There are goods and services that should be considered in our measure of consumer prices that are not in the GDP. What are some examples?

Missing elements of the GDP Deflator

The prices of many of goods and services are relevant to consumers and households, but are not included in the GDP. What would be an example of goods or services that fall into this category?

Probably the most common category of goods or services that are not included in the GDP but are relevant to consumers are used goods. The price of a used good does not count towards GDP, but consumers will react to a decrease in the price of used cars, for example, by purchasing more used cars. The GDP deflator does not capture changes in the price of used goods.

In the discussion above, we briefly mentioned that the prices of exports are not directly relevant to domestic consumers. This is not the case for imports. Household will respond to a decrease in the price of imports by purchasing more goods produced by foreign firms. Prices of imports are included in the GDP Deflator calculation, but unlike the prices of exports, import prices should be considered when constructing a measure of prices that consumers face.

The calculation of the general level of prices that consumers face is called the **Consumer Price Index (CPI)**. Think of the CPI as the average price of all goods and services that a household consumes; if the household only bought big baskets that contained everything that is ever purchased, the CPI would be the price of that basket. The CPI is calculated by the Bureau of Labor Statistics (BLS) using high-level statistical analyses that you will all learn after you become Economics Majors! For now, we can construct the CPI using three general steps.

Step 1: Create a Basket of Goods and Services

3.15: Goods in the CPI Basket

What is the most important good or service you purchase? In other words, what product cost is most relevant to you.

The first step in creating the CPI is figuring out what goods and services should be included in the representative household basket. In other words, think about all the things that households buy. Yes, everything! This basket

would include obvious purchases like food, housing and clothing. But we also want to make sure we include non-necessities like smartphones (yes, you can live without one), entertainment, education and transportation.

Less common purchases should also be added to the basket. The cost of an eye doctor visit, lawn mowers and watches must be in the representative basket. We will discuss the specifics of the basket in step 2.

Step 2: Assign Weights to the Goods and Services in the Basket

After gathering together all the goods and services consumers purchase, it is not surprising that some goods and services are more important than others, regardless of what the price of the good or service is. The CPI weighs the goods and services based on how important they are to a consumer. According to the BLS, a good or service's weight in the CPI is "the share of total consumer spending that it represents." Click on the link and you will see all the categories that the BLS uses to create the CPI basket, along with the weights applied to each category.

When calculating weights, the most expensive goods and services *do not* have the most weight. Instead, the goods and services that take up the biggest portion of a household budget are weighted the most.

3.16: Weights of Goods and Services in the CPI

Think about how much of a households budget the following goods and services are weighted in the CPI. Put the goods and services in order of highest to lowest CPI weight.

A

Education

B

Food and Beverages

C

Housing

D

Transportation (public and private forms of transportation)

E

Clothing

F

Medical Care (all forms)

The BLS surveys tens of thousands of households every year in order to calculate the weights for all goods and services in the CPI basket. In the question above, you were asked to order the goods and services from the highest to lowest weight in the CPI basket. The "correct answer" is based on the reported weights by the BLS. However, your basket may differ from the average household.

One possible similarity between your answer and the BLS is that housing is given the most weight in the CPI basket. In the average household, approximately 42.6% of their spending goes towards housing (including rent, utilities, maintenance, etc.). After housing, the next largest category is more difficult to pin down. Transportation is 15.3% of the CPI basket, while Food and Beverages are 14.6% of the CPI basket.

The CPI breaks the general groups into very detailed categories. For example, you may be a student that survives the day by constantly consuming fancy coffee drinks. If you purchase 3 expensive Mochas per day, you probably consider *coffee* to be a relatively big part of your budget (up to 5%? 10%). For the average household, only 0.17% of their budget is spent on coffee. Remember that some people do not drink coffee, so when Starbucks introduces an exciting new drink, non-coffee drinkers do not care if the drink is free or $100 per cup. The CPI weight is showing what the average household budgets for various goods, not necessarily ones unique household.

Step 3: Create a Weighted Basket Cost

In creating the CPI we are looking for one number that represents the average cost of all goods and services purchased by consumers. Changes in the price of this representative basket depends on how much a good or service is weighted. For example, if the price of Lasik eye surgery falls from $2000 an eye to $1000 an eye at the same time the average rent for an apartment rises from $1000 to $1500, it does not make sense for the CPI to decrease. Only a few households will benefit from a decrease in the price of Lasik, whereas every apartment renter will spend $500 more per month on housing.

In order to create the CPI so that price changes of commonly bought goods and services are more important than less common goods and services, we will create a weighted basket cost. This means that we will multiply the weight of each good in the CPI by the price of the good.

Let's simplify our analysis and only put three general goods and services in our basket: housing, food and transportation. The weights of the goods and services are 50% for housing, 25% for food and 25% for transportation. In the table below, the three purchases along with their weight and average price in 2016 are shown.

How much is the cost of a weighted basket? In other words, how much does the average good bought by a household cost? We can find this by linking the weight of each good to the price.

$$\text{Weighted Basket Cost}_{2016} = \text{Weight}^{H} \times \text{Price}_{2016}^{H} + \text{Weight}^{F} \times \text{Price}_{2016}^{F} + \text{Weight}^{T} \times \text{Price}_{2016}^{T}$$

$$\text{Weighted Basket Cost}_{2016} = 0.50 \times 100 + 0.25 \times 20 + 0.25 \times 10 = 50 + 5 + 2.50 = 57.50$$

In 2016, the average price of a good/service in the representative household's basket was $57.50. To figure out how much prices increase over a year, look at the next table showing the prices of the three goods in 2017.

Without doing any calculations, we can see that prices of housing and food increased between 2016 and 2017, while transportation prices stayed constant at $10. Given that housing is twice the weight of transportation and the price of housing increased by 20%, the price of the average good/service will feel more expensive.

Using the weighted basket cost equation above, calculate the weighted basket cost in 2017.

3.17: Weighted Basket Cost

Using the table of weights and prices above that consists of housing, food and transportation, calculate the weighted basket cost in 2017.

A

$57.50

B

$70.00

C

$115.75

D

$150.25

To figure out the weighted basket cost in 2017, multiply the weight of each good by the price in 2017 and add up the values.

Weighted Basket $\text{Cost}_{2017} = 0.50 \times 120 + 0.25 \times 30 + 0.25 \times 10 = 60 + 7.50 + 2.50 =$ $70.00

Calculating the CPI

The weighted basket costs are used to calculate the CPI. The CPI "standardizes" the average cost of the basket to be 100 in the base year. This is done by defining a year as a base year and dividing the current year basket cost by the base year basket cost.

$$CPI_{\text{Current Year}} = (\text{Weighted Basket Cost}_{\text{Current Year}} / \text{Weighted Basket Cost}_{\text{Base Year}}) \times 100$$

Imagine that the base year in the example above is 2016. This means that the CPI values in 2016 and 2017 are:

$$CPI_{2016} = (\text{Basket Cost}_{CY=2016} / \text{Weighted Basket Cost}_{BY=2016}) \times 100 = (57.50/57.50) \times 100 = 100$$

$$CPI_{2017} = (\text{Basket Cost}_{CY=2017} / \text{Weighted Basket Cost}_{BY=2016}) \times 100 = (70.00/57.50) \times 100 = 121.7$$

Notice that in the base year (2016), the CPI is 100. Even though the base year basket cost was $57.50, the CPI sets the base year basket cost at 100. Standardizing the base year basket cost at 100 makes our interpretation of the CPI straightforward. We are able to say that in 2016, our base year, the average price of goods and services was $100. In 2017, the average price increased to $121.7.

Similar to the GDP Deflator, we can calculate the inflation rate as the growth rate of our price measure. When working with the CPI, the inflation rate is:

$$\text{Inflation Rate}_{Yr1 \text{ to } Yr2} = [(CPI_{Yr2} - CPI_{Yr1})/CPI_{Yr1}] \times 100$$

$$\text{Inflation Rate}_{2016 \text{ to } 2017} = [(121.7 - 100)/100] \times 100 = 21.7\%$$

The CPI basket cost of 100 in 2016 increased by 21.7% to 121.7 in 2017. It is important to remember that the inflation rate is not the difference in CPI

values, but instead the percentage growth in the CPI values between two years. What will the inflation rate be in 2018 if the CPI is 130?

3.18: CPI and Inflation

In 2017, the CPI was 121.7. In 2018, the CPI is 130. What is the inflation rate between 2017 and 2018?

A

6.8%

B

8.3%

C

21.7%

D

30%

We can present the question above in a different way: in 2017, the average price of goods and services was $121.70. In 2018, the average price increased to $130. What is the percentage growth in the average price of goods and services between 2017 and 2018?

Using our growth rate equation above,

$$\text{Inflation}_{2017 \text{ to } 2018} = [(\text{CPI}_{2018} - \text{CPI}_{2017})/\text{CPI}_{2017}] \times 100 = [(130 - 121.7)/121.7] \times 100$$

$$\text{Inflation}_{2017 \text{ to } 2018} = 8.3/121.7 \times 100 = 6.8\%$$

The average price of a good/service increased by 6.8% between 2017 and 2018, which increased the average price from 121.70 to 130.

The CPI over Time

Now that we know what the CPI is, analyzing the CPI will make a lot more sense. The figure below shows how the CPI has grown since 1947. The base

year is defined as 1983. This means that the average cost of a good in 1983 is standardized and made equal to 100.

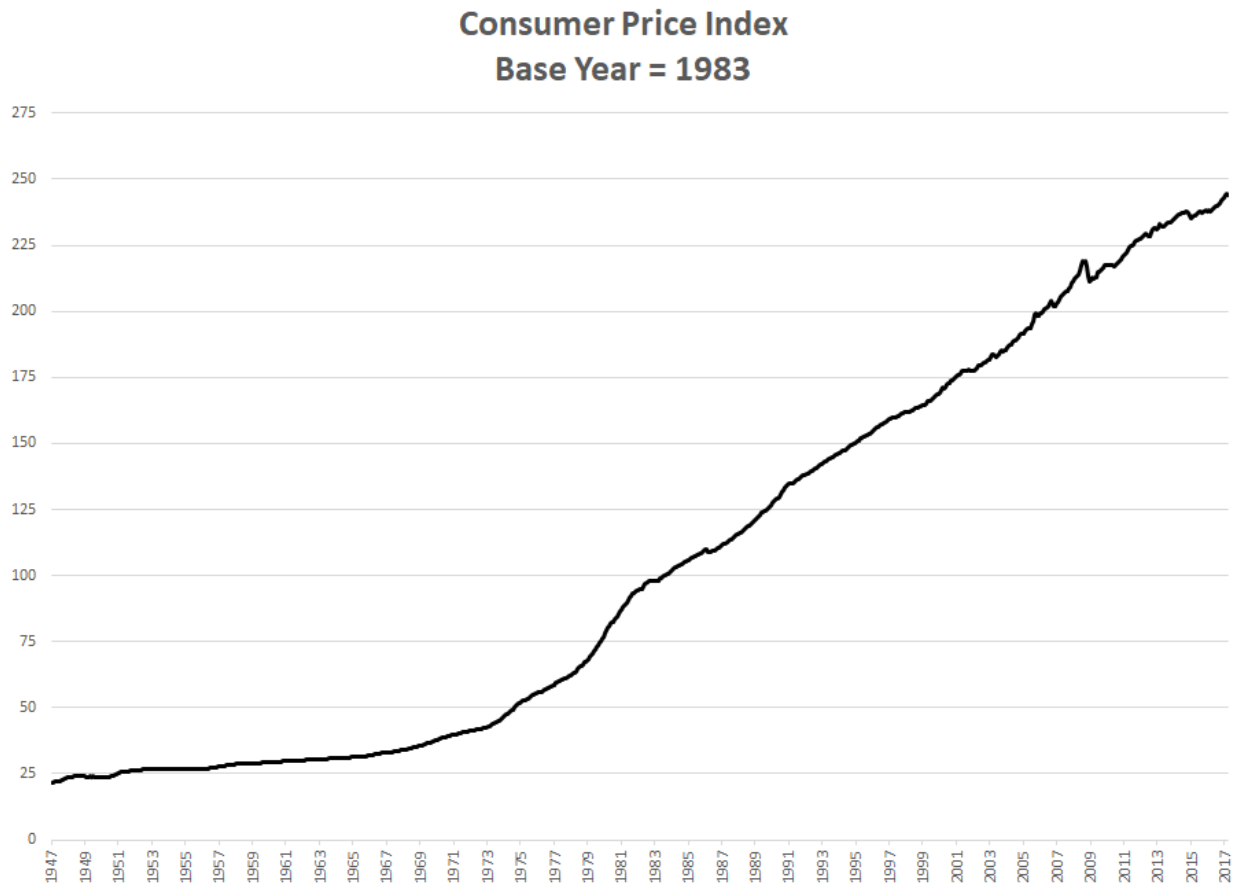

Figure 3.2.01

At the start of 2017, the CPI was 243. This means that a representative basket of goods and services that was $100 in 1983 has increased to $243. Moving backwards in time, at the end of 1950, the CPI was 25. Between 1950 and 1983, prices faced by the average household increased 400%. From 1983 to 2017, prices increased almost 250%. Between 1950 and 2017, the average basket of goods and services increased by almost 1000%. This is found by using our growth rate in the CPI equation above.

Comparing the CPI to the GDP Deflator

You probably noticed some similarities between the calculations of the CPI and GDP Deflator. That is because calculating the statistics are done in a very similar way. In the case of the GDP Deflator is found by comparing the nominal GDP (allowing prices and quantity to change) to the real GDP (holding prices constant as quantity changes). The CPI compares current year basket costs (allowing prices to change, but quantity is held constant) to base year basket costs (prices and quantity are constant).

While it is nice that these two statistics are related, it is also easy to get the calculation of the statistics confused. Take a look at the following table and use it as a guide when faced with questions about the GDP Deflator or the CPI.

This table shows how the calculation of the GDP Deflator and CPI differ. Notice that in the GDP Deflator calculation, the quantity used in deriving the deflator comes from the current year. The CPI uses the base year weights to derive the statistic. Both statistics yield a ratio of current year prices to base year prices, but they are weighted by different "years". Keep years in order and you will keep the statistics in order.

Chapter 3.3: Full Employment and the Unemployment Rate

The previous sections of this chapter talked about our first two goals of macroeconomics, a high standard-of-living and stable prices. Discussing these two goals introduced us to a number of new statistics that are commonly

used by both the media and academics when discussing the health of an economy, including, GDP, GDP deflator, CPI and inflation rates.

Now imagine that the economy has a high and growing GDP, prices are stable, but there is also a lot of unemployment. In other words, there are many workers in the economy that do not benefit from the GDP and only have a limited benefit from the stable price level. In order for the economy to be considered healthy, we must satisfy our third goal of having **full employment**. This section will discuss how to define unemployment and what we mean by full employment.

Types of Unemployment

Reasons for unemployment

What are some reasons that people become unemployed?

There are a number of reasons that people become unemployed. Some typical responses to the answers above are education, drugs, motivation and skills. Because there are many different ways for people to become unemployed, we will put the causes of unemployment into four categories. The categories will provide important insights about which types of unemployment are naturally occurring and which types represent changes in the economy as a whole. By categorizing unemployment, our third goal of full employment will become clearly defined.

Frictional Unemployment: A reason that some individuals are unemployed is because getting a job takes time. In most cases, potential workers apply for a job opening, firms go over dozens, hundreds, maybe thousands of applications and identify the best potential matches. Those potential matches are then interviewed and references are often called. When someone gets a job offer, the terms and conditions of the job are typically negotiated. The process of getting a job may only take a week or two, but can take many months in other cases.

In academia, the semester or quarter system makes the job search process particularly time consuming. Your professor probably applied for his or her current job in September or October, interviewed for the job in January, had a follow-up on-campus interview in February, received a job offer in March, signed paperwork to officially accept the offer in April or May and began working in August!

Unemployment that is caused by the time-lag (or friction) involved in workers moving from one job to another or starting a new job is called *frictional unemployment.* This type of unemployment is not representative of larger economic patterns. It may be frustrating to wait for references to be called and background checks to be completed before starting work, but firms are making sure they are hiring the best worker for the job (and following labor laws). At the same time, workers are applying to the best jobs they can find.

A feature of frictional unemployment that is important for our overall goal of full employment is that it is voluntary. Workers are not taking the first available job. New college graduates without jobs are often defined as frictionally unemployed when they do not typically apply for low-paying jobs and wait for better jobs to become available. Because frictional unemployment does not represent broader macroeconomic trends, macroeconomists do not worry about frictional unemployment when evaluating the health of the economy.

3.19: Frictional Unemployment and Recession

Imagine the economy enters a recession, meaning that new jobs become harder to find. What will likely happen to frictional unemployment?

A

It will increase.

B

It will decrease.

C

It will not change.

D

There is not enough information to answer the question.

This question is brief, but illustrates what frictional unemployment is trying to capture. Frictional unemployment represents individuals in-between jobs and the time involved in getting a new job. When there is a recession, workers are likely worried about keeping their current job as opposed to quitting their job and looking for another one. Overall unemployment may increase during a recession, but frictional unemployment will decrease since workers are unlikely to believe a better job is available for them.

Seasonal Unemployment: Of all the categories of unemployment, seasonal unemployment is the easiest to define. Any worker that loses their job as the result of a predictable seasonal pattern is considered seasonally unemployed. Many jobs are seasonal because of environmental changes. This includes ski instructors, lawn care workers and farmers. If a ski instructor finishes the ski season in April and begins searching for a temporary summer job in May, that instructor is considered seasonally unemployed.

Not all seasonal unemployment examples are caused by environmental factors. Tax accountants may have a lot of work in January through April when taxes are due, but struggle to find a stable source of income during the "off-season". Workers in the retail industry are in high demand during the holiday months of November and December, but become less needed after the holidays in January.

These predictable job losses may be an inconvenience for the workers, but macroeconomists do not evaluate the health of the economy by examining seasonal unemployment. In fact, economists at the Bureau of Labor Statistics report both seasonally adjusted and unadjusted unemployment rates in order to show the seasonally driven changes in the unemployment rate.

Structural Unemployment: The first two categories of unemployment occur naturally and are not reflective of the health of the labor market or the economy in general. Structural unemployment is our third category of unemployment and provide insights into the economy. However, the presence of structural unemployment is rarely indicative of an unhealthy economy.

Structural unemployment occurs when there is a mismatch between worker skills and employer needs. This can happen when the production process used by employers changes as a result of new technology. New technology may lead to a reduction in jobs in one sector, but it can simultaneously create jobs in other sectors.

Think about the production of cars prior to the assembly line in 1913. Before 1913, each Ford car took around 12 worker-hours to construct. The assembly line cut the amount of labor needed to construct a car in half. If the amount of car production remained constant after the assembly line, Ford could have reduced its workforce by half and produced the same number of cars. However, the increase in the availability of cars increased jobs in other industries such as tires and road construction. The improvement in labor market outcomes in these industries eventually led to an increase in the demand for cars as workers received more income.

Fast forward to the 1980s to see another example of structural unemployment. A family wants to go to dinner at a new, popular restaurant and needs to make reservations. They look through the most recent phone book that was put on their doorstep, but the restaurant is too new and not in the phone book (the restaurant will be in the next edition). In order to get the phone number for the new restaurant, the family calls the operator and either gets the phone number or is directly connected to the restaurant.

Today, if we want to make reservations at a restaurant, the process is very different than it was 30 years ago. You might go to opentable.com and never

talk to someone on the phone. If you do need a phone number, it may come up as you are typing the name of a restaurant into Google. If you end up seeing search results, the reviews of the restaurant that you come across may cause you to change your mind.

What jobs were relevant to making a reservation back in the 1980s? The operator at the phone company, the producers and deliverers of the phone book and whoever answered the phone at the restaurant all played a potentially large role in making a reservation. Today, that phone operator is not as necessary. Neither are workers associated with the phone book. Those jobs have been replaced by computer programmers working for wireless carriers and restaurant reservation websites.

Imagine that a lot of phone operators in the 1980s eventually lost their job in the 1990s as the demand for operators decreased. Those workers would have a difficult time getting a new job as a programmer for an online restaurant reservation company since the skills needed for programming are not the same as working as an operator. Even if the operators did have the necessary skills, the number of jobs available from the online company may be less than the number of jobs lost.

The unemployment caused by the changing structure of the economy is called *structural unemployment*. Unlike seasonal or frictional unemployment, structural unemployment may last a long time. Those operators may be out of a job for longer than a few months if their skills no longer match what employers are looking for in general. Similar to the seasonal and frictional unemployment, structural unemployment is naturally occurring in economies that are progressing and growing technologically. For that reason, structural unemployment is not considered an indicator of an unhealthy economy by macroeconomists.

Link for Discussion: Automation and Unemployment

Structural Unemployment and Automation

Quickly search for the term: automation and unemployment. You will see dozens of articles talking about the role that robots play on the labor market. Do you think that automation and robots are good for the economy or not?

Today, structural unemployment is often discussed in conjunction with automation. Everyday, firms and households are looking for ways to do routine activities more efficiently. You may have noticed a little vacuum wandering around someone's home recently. In the future, self-driving cars could make taxi drivers obsolete. The new technology is exciting and helpful, but is programming all of our activities through a robot going to lead to excessive job loss or cause more jobs in new areas, similar to the assembly line in the 1910s?

Cyclical Unemployment: A theme among the previous three categories of unemployment is that the presence of frictional, seasonal or structural unemployment does not suggest that the economy is doing poorly. That is not the case with cyclical unemployment. Cyclical unemployment occurs when individuals lose their job because of changes in production. In 2008, the big three car manufacturers located in Detroit (General Motors, Ford and Chrysler) had all been experiencing reductions in sales. Consequently, workers were laid off. The workers that lost jobs were not replaced by machines (structural), did not get their job back during the holiday season (seasonal) and were not waiting around for the right job to come along (frictional). They were *cyclically unemployed* since their job loss was due to overall changes in production.

Cyclical unemployment is the category of unemployment that macroeconomists care about. The other categories are naturally occurring and to some extent, represent a well functioning labor market. Cyclical unemployment represents lost production. If there was more production, firms would be able to find unemployed workers willing to work. As production increases, cyclical unemployment falls.

3.20: Cyclical Unemployment

Which of the following scenarios is an example of cyclical unemployment?

A

Real estate agents become unemployed because new housing developments are cancelled.

B

Garmin lays off workers because people are using Google Maps instead of GPS when driving around.

C

A river raft guide searches for a job in October after the first freeze ends the rafting season.

D

A new worker for Apple would have started, but a new background check law has increased the time between the final interview and a job offer.

In the question above, examples of each of our four categories of unemployment are seen. Answer (A) is an example of cyclical unemployment. A housing development being cancelled suggests a developer decided against building a new neighborhood, likely due to the fact that the developer was probably not going to make money on the development. Assuming a real estate company was going to benefit from selling the new homes, cancelling the project would mean that production decreases and the resulting unemployment is considered cyclical.

Answer (B) is an example of structural unemployment since Garmin jobs are being lost, but workers are potentially needed at Google. Seasonal unemployment is seen in answer (C) and an example of frictional unemployment is found in answer (D). Notice how the last three answers are not indicative of a reduction in production and are considered naturally occurring types of unemployment.

Defining Full Employment

In the discussion above we talked about three naturally occurring types of unemployment: frictional, seasonal and structural. Macroeconomists often

place these three categories into one single category called *natural unemployment*. In order for an economy to be at full employment, only natural unemployment can exist. This means that when cyclical unemployment is 0% we are achieving our goal of full employment.

3.21: Determining Cyclical Unemployment

Imagine that an economy has an unemployment rate of 6.7%. The natural rate of unemployment (frictional + structural + seasonal unemployment) is 5.0%. What is the cyclical unemployment rate?

A

1.7%

B

5.0%

C

6.7%

D

11.7%

In the question above, the economy would be at full employment if the overall unemployment rate was equal to the natural rate of unemployment of 5.0%. Any unemployment above the natural rate of unemployment is considered cyclical unemployment. That means that there is 1.7% cyclical unemployment (A) in addition to the natural unemployment rate of 5.0%, making the overall unemployment rate 6.7%.

Because cyclical unemployment exists, the economy has workers that are without jobs due to a lack of production. As production rises, cyclical unemployment will decrease, but the natural rate of unemployment will remain the same. Once the unemployment rate reaches the natural rate of 5.0% in this economy, the economy will be at full employment.

It is possible for the cyclical unemployment rate to be less than 0%. The unemployment rate in March 2017 was 4.5%, while the natural rate of

unemployment was 4.7%. This means that the cyclical rate of unemployment is -0.2%. Practically, firms are having difficulty finding suitable workers when cyclical unemployment is negative. In order to attract qualified workers, wages, and eventually prices, will have to increase. A negative cyclical unemployment rate does not align with our goal of price stability.

Calculating the Unemployment Rate

So far, we have discussed the types of unemployment that exist, along with what our goal of full employment means. However, we have not learned how the unemployment rate is calculated and what the reported unemployment rate is telling us. The Bureau of Labor Statistics (BLS) is the agency responsible for gathering and deciphering labor market data. In order to calculate the unemployment rate, the BLS uses information from the Current Population Survey, which is administered every month to a random sample of 60,000 households in the United States.

From the survey they first determine the size of the civilian, non-institutional population in the United States. The BLS only wants to consider individuals who have the ability to work in their calculation of unemployment. Persons under 16 years of age, hospitalized or in prison are not considered part of the civilian population and excluded from the unemployment calculations. Military personnel are also excluded. This is because it has been difficult historically to define where members of the Armed Forces are actually working. Adding military personnel to the unemployment calculation alters the unemployment rate by less than 0.1%.

After the size of the civilian population is calculated, the CPS then determines whether an individual is employed, unemployed or not in the labor force.

In order to be considered *employed* by the BLS, in the past week, someone either: (1) worked for pay as an employee or owner, (2) worked 15 or more

unpaid hours in a family-operated business or (3) had a job, but did not work due to illness, weather, vacation, childcare or labor disputes.

Notice that there is no minimum number of hours that need to be worked in order to be counted as an employed worker. A worker that only has one hour of work is counted the same as a worker with twenty hours of work.

In order to be considered *unemployed* a potential worker must: (1) have had no employment in the past week and (2) "made specific efforts, such as contacting employers, to find employment" sometime in the past four weeks.

Each individual from the civilian population is identified as employed, unemployed or not in the labor force. The *labor force* is defined as someone who is actively engaged in the labor market, which is equal to the number of employed plus the number of unemployed individuals.

$$Labor\ Force = Employed + Unemployed$$

The BLS calculates the labor force participation rate as the proportion of the civilian, non-institutional population that is in the labor force, expressed as a percentage.

$$Labor\ Force\ Participation = [Labor\ Force/Civilian\ Population] \times 100$$

When calculating the unemployment rate, the BLS only considers workers in the labor force. The unemployment rate captures the proportion of the labor force that is unemployed and is often expressed as a percentage.

$$Unemployment\ Rate = [Unemployed\ Workers/Labor\ Force] \times 100$$

Lets go over a couple questions to make sure you have the labor market concepts solidified.

3.22: Labor Market Participation

Imagine you have an economy with a population of 1,500. There are 500 individuals who are under 16, institutionalized or in the military. Of the remaining 1000, 700 are working and 50 are not working, but actively searching for work. What is the size of the labor force in this economy?

A

50

B

700

C

750

D

1,000

In our hypothetical economy, there are 1,000 individuals who could potentially work. However, only 700 are working and 50 are not working, but actively searching for a job. Together, these 750 potential workers make up the labor force in this economy.

To calculated the labor force participation rate, we figure out the fraction of the 1000 potential workers in the labor force: [750/1000] x 100 = 75%.

3.23: Calculating the unemployment rate

Imagine you have an economy with a population of 1,500. There are 500 individuals who are under 16, institutionalized or in the military. Of the remaining 1000, 700 are working and 50 are not working, but actively searching for work. What is the unemployment rate in this economy, according to the BLS?

A

5%

B

6.7%

C

25%

D

50%

In order to calculate the unemployment rate in the same way as the BLS, we need to determine what fraction of the labor force is without a job and actively searching for work (within the last 4 weeks). In the question above, there are 50 individuals not working, but actively searching for work. Prior to the question, we learned that the labor force includes 750 individuals. This means that the unemployment rate can be calculated as:

$$\textit{Unemployment Rate} = [50/750] \times 100 = 6.7\%$$

Improving the Unemployment Rate Measure

Although there are many reasons that potential workers are unemployed, we want our unemployment measure to accurately represent the labor market in an area. There are two noticeable concerns with the basic BLS unemployment rate we just calculated.

Involuntary Part Time Workers

First, a worker is considered employed whether they work one hour a week or 80 hours a week. Imagine an economy where there are workers that only work 20 hours per week, even though they would like to work 40 hours per week. Workers with a part-time job that want to work more hours are considered *involuntary part time workers.* Involuntary part time workers are considered employed by the BLS, but the workers are not able to work as much as they want as a result of general economic conditions.

Let's incorporate involuntary part time workers into our unemployment calculations. For simplicity, lets assume that every involuntary part time worker wants to work 40 hours per week, but only works 20 hours per week on average. If we add the amount of work that two involuntary part time workers want, it would add up to 40 hours. Each involuntary part time worker is then equivalent to half (0.5) of an unemployed worker.

After we identify the involuntary part time workers, we can incorporate them into our unemployment group by multiplying the number of involuntary part time workers by 0.5. Note that we are only reclassifying what it means for someone to be unemployed, but the total number of individuals in the labor force is unchanged. Therefore, if we want to consider involuntary part time workers in our unemployment rate, we divide our unemployed workers plus half of the involuntary part time workers by the labor force.

Unemployment Rate Including Involuntary Part Time Workers = [(Unemployed + 0.5× Involuntary Part Time Workers)/Labor Force]× 100

3.24: Involuntary Part Time Workers

Imagine you have an economy with a population of 1,500. There are 500 individuals who are under 16, institutionalized or in the military. Of the remaining 1000, 700 are working and 50 are not working, but actively searching for work. You learn that of the working individuals, 100 are involuntary part time workers that are considered "half unemployed". What is the unemployment rate in this economy after considering the involuntary part time workers?

A

5%

B

6.7%

C

13.3%

D

16.7%

Let's describe the situation in question 3.24. There are 100 individuals who are considered employed by the BLS, but they would all like to work more. Assuming these 100 individuals want to work twice as much as they do, they are equivalent 50 unemployed individuals. Now the number of unemployed workers increases from 50 to 100. The labor force is unchanged at 750. This means that the unemployment rate considering the involuntary part time workers is

Unemployment Rate Including Involuntary Part Time Workers =
[(50+ 0.5× 100)/750]× 100 = 13.3%

In the simple economy in questions 3.23 and 3.24, the involuntary part time workers double the unemployment rate. In the United States, the effect is not as large, but it is significant. In January 2017, 5.8 million employed workers were defined as "part time for economic reasons". Defining the workers as "half unemployed" increased the unemployment rate in the US by 1.8% (from 4.8% to 6.6%). The additional unemployment from involuntary part time workers would be categorized as cyclical unemployment since additional production would lead to more hours for existing workers.

Marginally Attached and Discouraged Workers

A second concern with the basic BLS unemployment calculation is that individuals who want a job, but are not actively searching are not considered part of the labor force. There are potential workers that do not have a job, would like a job, filled out dozens of applications a few months ago, but have not applied to a job in the past four weeks. These individuals were part of the labor force in the month following filling out job applications, but now are not in the labor force. As long as a worker has applied for a job within the last 12 months, the BLS defines these individuals as *marginally attached workers*.

If the worker also does not believe filling out any application would be worthwhile, the worker is defined as a *discouraged worker*. The BLS reports the number of marginally attached and discouraged worker separately, but for our calculations, we will combine them into a single group called discouraged workers.

Just like we did for involuntary part time workers, let's figure out how to incorporate the discouraged workers into our unemployment calculation. Discouraged workers are not part of the labor force, but they were in the labor force a few months ago and their feelings about obtaining a job have not

changed. If we know the number of discouraged workers, we can move them out of the "not in the labor force category" and into the unemployed category. This increases the size of the unemployed group and the labor force, since the labor force includes unemployed workers.

$$\textit{Unemployment Rate Including Discouraged Workers} = [(\textit{Unemployed} + \textit{Discouraged})/(\textit{Labor Force} + \text{Discouraged})] \times \textit{100}$$

3.25: Discouraged Workers

Imagine you have an economy with a population of 1,500. There are 500 individuals who are under 16, institutionalized or in the military. Of the remaining 1000, 700 are working and 50 are not working, but actively searching for work. You learn that of the individuals not in the labor force, 100 are discouraged workers. What is the unemployment rate in this economy after considering the discouraged workers?

A

6.7%

B

8.5%

C

12.5%

D

17.6%

In our example above, there are 100 workers who are not considered part of the labor force that would like a job, but are not actively searching. These workers can be added to our unemployment calculation by increasing the size of the unemployed group by 100. Because the discouraged workers were originally out of the labor force, the labor force also increases by 100.

$$\textit{Unemployment Rate Including Discouraged Workers} = [(\textit{50} + \textit{100})/(\textit{750} + 100)] \times \textit{100} = \textit{17.6\%}$$

In January 2017, the BLS estimated that 1.75 million individuals were marginally attached workers. After these workers are added to both the

unemployed category and labor force, the unemployment rate increases from 4.8% to 5.9%.

Wrapping Up

Chapter 3 defined the three goals that will shape our policy recommendations moving forward. Whenever we are examining a particular policy in the economy, we will be asking ourselves, how does this improve our standard-of-living, what will happen to prices and are we moving closer to full employment. By having these goals define a healthy economy, we can assess the consequences of a policy in a more unbiased way than if we relied on our feelings about policy.

With the definition of these important macroeconomic concepts defined, we will move onto finding equilibrium in the macroeconomy in chapter 4.