Gwinnett School of Math, Science, and Technology

Macroeconomics Yearlong Notes

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Infinite **Possibilities**

GWINNETT SCHOOL OF MATHEMATICS, SCIENCE, AND TECHNOLOGY

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1 Types of Goods (01/08)

1.1 Characteristics of the Four Types of Goods

- **Rivalrous** goods are those that can only be consumed by one person at a time.
- **Non-rivalrous** goods are those that can be consumed by multiple people at the same time.
- **Excludable** goods are those that can be restricted to certain people.
- **Non-excludable** goods are those that cannot be restricted to certain people.
- If a public good is overcrowded enough, it can become a common resource

1.2 The Four Types of Goods

	Non-rivalrous	Rivalrous
Non-excludable	*Public Goods*\ (e.g. Sunset, Common Knowledge)	*Common-Pool/Common Resources* (e.g. Irrigation Systems, Libraries)
Excludable	*(Toll/Club/Artificially Scarce) Goods/Natural monopolies* (e.g. Day-Care Centers, Country Clubs)	*Private Goods* (e.g. Donuts, Personal Computers)

1.3 Examples

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        Case Scenario              | Type of Good/Service
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————————————————————- | —————— A college education │ Artificially scarce A manicure or pedicure │ Private good Stone Mountain park │ Artificially scarce State park campgrounds │ Artificially scarce National defense │ Public good Peach Pass lane on I-85 │ Artificially scarce Fish in the ocean │ Common resource Street lights │ Public good Netflix/Hulu │ Artificially scarce Flu shot │ Private good Tornado safety shelter │ Public good Bottled water in a tornado safety shelter │ Common resource Hearing a tornado siren │ Public good Going to an almost empty public beach │ Public good Going to an overcrowded public beach │ Common resource St. Lawrence SeaWay │ Natural monopoly Flying on a commercial airplane │ Natural monopoly Flying a single seat private airplane │ Private good Wedding guests eating a slice of the wedding-cake │ Common resource Cake sold at a bakery │ Private good

2 Introduction to Externalities (01/09-01/10)

2.1 Overview

- An **externality** is a cost/benefit that affects a *third party* who did not choose to incur that cost/benefit.
- They are a type of **market failure** because they are *not* accounted for in the price of the good/service.
- The deadweight loss (DWL) of positive externalities will point to the right and vice-versa for negative externalities.
    - Which means the DWL triangle always points to the social optimum quantity.

2.2 Internalizing an Externality (aka *how to fix an externality*)

2.2.1 Problems with externalities

1) Private individuals won't take into account the external costs/benefits
2) Public goods and common pool resources tend to lack property rights

2.2.2 Coase Theorem (the fix!)

"We can fix externalities without the government if we..."

1) Give property rights to people
2) Minimize transaction costs

2.2.3 Examples

Methods the government can employ to internalize an externality in a free market:

- Pollution or emission limits
- "Pollution credits" for private firms to buy and sell in the market

2.3 Positive Externality in Consumption
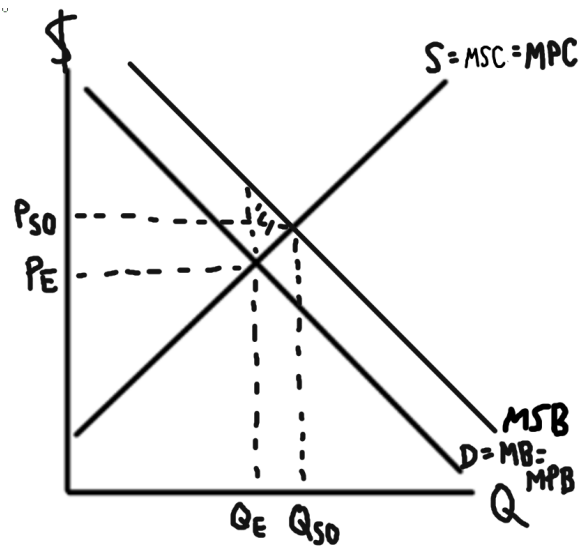
Figure 1: Positive Externality in Consumption

2.3.1 Examples

- Consumption of education
- Consumption of health care
- Advertisement can lead to an increase of demand in the free market $\therefore MPB$ goes up and moves the market toward MSB.

2.3.2 Spillover Effect

- The spillover effect is $MEB = MSB - MPB$.
- $MPB < MSB$
- $MPC = MSC$

2.3.3 Internalizing the Spillover Effect

- The external **benefits** can be internalized by **subsidizing** the product/service to the consumers of the good/service.
- The government intervention will move the private market to **social optimum** where $MSB = MSC$.

2.4 Negative Externality in Consumption
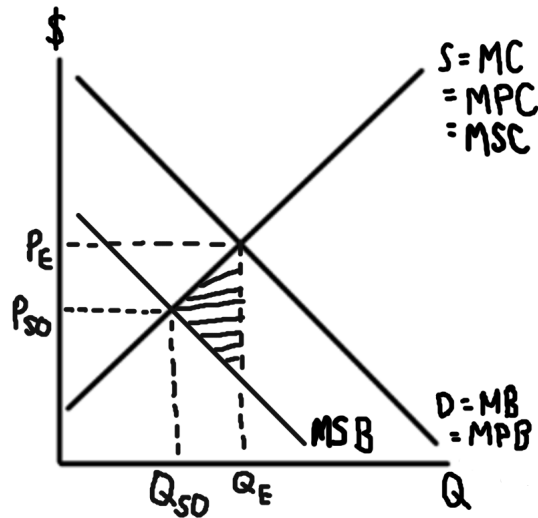
Figure 2: Negative Externality in Consumption

2.4.1 Examples

- Smoking in public/passive smoking
- Pollution due to fossil fuels
- Playing loud music
- Discarding garbage in public places

2.4.2 Spillover Effect

- The spillover effect is $MEB = MSB - MPB$.
- $MPB > MSB$
- $MPC = MSC$

2.4.3 Internalizing the Spillover Effect

- The external **benefits** can be internalized by **imposing a tax** on the product/service to the consumers of the good/service.
- The government intervention will move the private market to **social optimum** where $MSB = MSC$.

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2.5 Positive Externality in Production
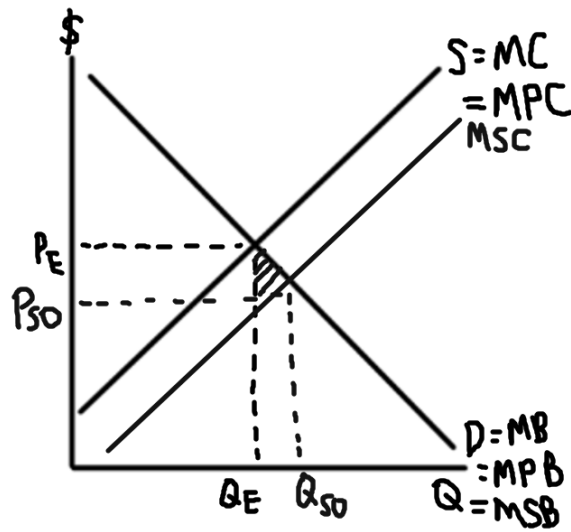
Figure 3: Positive Externality in Production

2.5.1 Examples

- Companies invest in training/professional development of their employees.
- Firms invest in research and development (R&D).

2.5.2 Spillover Effect

- The spillover effect is $MEC = MSC - MPC$.
- $MPB = MSB$
- $MPC > MSC$

2.5.3 Internalizing the Spillover Effect

- The external **costs** can be internalized by **subsidizing** the product/service to the producers of the good/service.
- The government intervention will move the private market to **social optimum** where $MSB = MSC$.

2.6 Negative Externality in Production
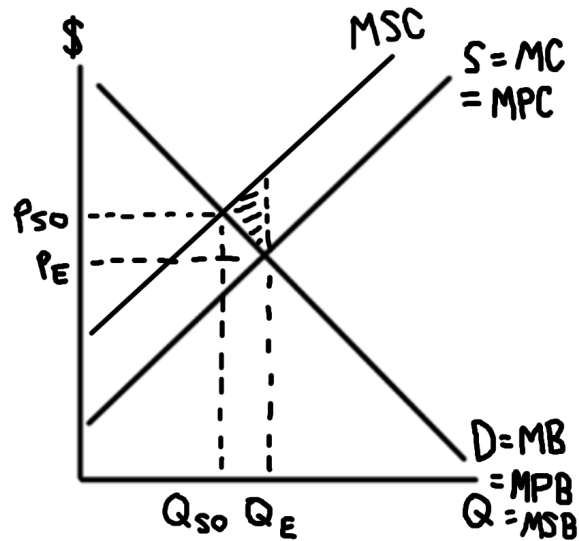
Figure 4: Negative Externality in Production

2.6.1 Examples

- Firms produce chemicals that cause pollution ∴ local fisherman cannot catch fish.
- Construction of roads lead to change of landscape and parks
- Coal fired power plants

2.6.2 Spillover Effect

- The spillover effect is $MEC = MSC - MPC$.
- $MPB = MSB$
- $MPC < MSC$

2.6.3 Internalizing the Spillover Effect

- The external **costs** can be internalized by **imposing a tax** on the product/service to the producers of the good/service.
- The government intervention will move the private market to **social optimum** where $MSB = MSC$.

3 Income Inequality (01/12)

3.1 The Lorenz Curve and Gini Coefficient

- The **Lorenz Curve** $L(x)$ is a graphical representation of the distribution of income in a country.

  - The x-axis is the cumulative percentage of the population (0%-100%).
  - The y-axis is the cumulative percentage of income (0%-100%).
  - It is always accompanied by the line $y = x$ which represents **perfect equality**.

- The **Gini Coefficient** G is a numerical representation of the Lorenz Curve.

  - It is the ratio of the area between the Lorenz Curve and the line $y = x$ to the area under the line $y = x$.
    * $G = \frac{A}{A+B}$ where $A = \int_0^1 [x - L(x)]\ dx$ and $B = \int_0^1 L(x)\ dx$.
  - The closer G is to 1, the more unequal the distribution of income is.
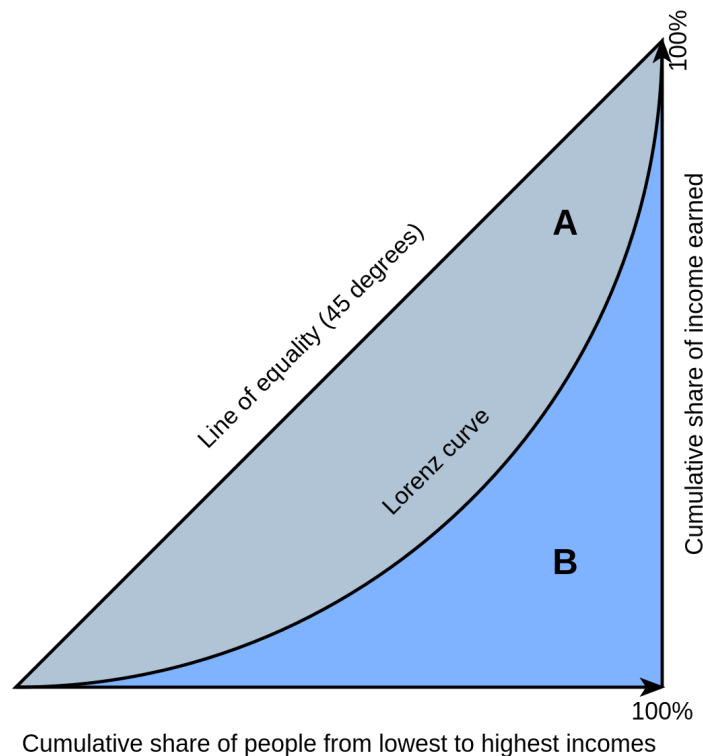
Figure 5: Visual depiction of the Lorenz Curve

As demonstrated in *Figure 6* below:

- If *G* is 0, then the Lorenz Curve is **also** the line *y* = *x* because the area between both curves *A* is 0.
- If *G* is 1, then the Lorenz Curve is the x-axis (*y* = 0) because *A* + *B* must also equal the area under *y* = *x*, or $\frac{1}{2}$.
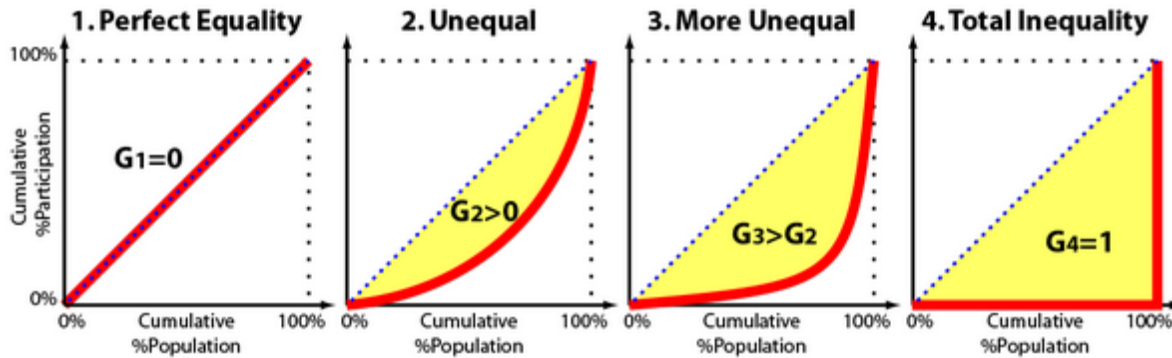
Figure 6: Varying Gini Coefficients and their corresponding Lorenz Curves

3.2 Deriving Simpler Expressions for the Gini Coefficient

Since we know that $A + B = \int_0^1 x \, dx = \left.\frac{x^2}{2}\right|_0^1 = \frac{1}{2}$, we can derive "easier" expressions to calculate the Gini Coefficient *G*.

3.2.1 Deriving *G* = 2*A*

$$G = \frac{A}{A + B} \qquad \text{(Initial Gini Coefficient formula)}$$

$$\frac{1}{G} = \frac{A + B}{A} \qquad \text{(Reciprocate)}$$

$$\frac{A}{G} = A + B \qquad \text{(Multiply by } A\text{)}$$

$$\frac{A}{G} - A = B \qquad \text{(Subtract } A\text{)}$$

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Now we can substitute B into the original area formula:

$$A + B = \frac{1}{2} \qquad \text{(Area under } y = x\text{)}$$

$$A + \left(\frac{A}{G} - A\right) = \frac{1}{2} \qquad \text{(Substitute } B\text{)}$$

$$\frac{A}{G} = \frac{1}{2} \qquad \text{(Simplify)}$$

$$\frac{A}{\frac{1}{2}} = G \qquad \text{(Simplify)}$$

$$2A = G \qquad \text{(Multiply by 2)}$$

3.2.2 Deriving $G = 1 - 2B$

Since we've already expressed B in terms of A, we just need to get A in terms of B.

$$G = 2A \qquad \text{(Previous derivation)}$$

$$\frac{G}{2} = A \qquad \text{(Divide by 2)}$$

$$\frac{G}{2} = \frac{1}{2} - B \qquad \text{(Substitute } A \text{ using the expression } A = \tfrac{1}{2} - B\text{)}$$

$$G = 1 - 2B \qquad \text{(Multiply by 2)}$$

Therefore, two **alternate expressions** for the Gini Coefficient are:

$$G = 2A \qquad\qquad (1)$$

$$G = 1 - 2B \qquad\qquad (2)$$

3.3 Negative Externalities: Public vs. Private Resolution and More on the Coase Theorem (01/16)

3.3.1 Conditions

Recall that the **Coase Theorem** states market failures will always be resolved by the free market. Here are all the conditions for Coase Theorem to hold true:

- Both sides are rational and willing to negotiate to maximize their own utility.
- Low to no transaction costs
- Private property rights are well-defined
- Perfect information is available to both sides and they have the same leverage

3.3.2 Miscellaneous Market Failures

There are a couple of other market failures that the government should try to combat, based on the types of markets we learned about *in previous units*:

- **Monopoly**: A single firm controls the entire market.
  - This will cause the firm to produce *less* than the social optimum and still charge a *greater price*.
- **Monopsony**: A single firm controls the entire labor market.
  - This will cause the firm to hire *less* than optimum and for a *lower wage*.

4 Intro to Macronomic Indicators (01/22-01/23)

GDP stands for Gross Domestic Product. These three words are important to understand:

- Gross: Not just profits - *total* value
- Domestic: Made WITHIN the borders of the US
- Products: Goods and services which have been produced

Formal definition of GDP: **GDP** is: the sum of the market value of all final goods and services produced within the United States in a given time period (usually a year).

Concept	Is	Is NOT
Sum	TOTAL	Single industry or market
Value	Based on the market price of the goods and services	subjective
Final	new and complete goods and services; ready for use	intermediate goods/services; used goods
G&S	ONLY a good or service	FINANCIAL ASSETS (Stock/Bonds/ETFs/Crypto)
Produced	MADE	transfer payments or foreign aid
Domestically	WITHIN US borders	US citizens abroad
Time	This year (NEW production)	OLD G&S, Goodwill

4.1 Calculating GDP

GDP is known as tam easure of *national income accounting*. What are the two accounting techniques used in measuring GDP?

- **Expenditure Approach**: Measures GDP by adding up all the spending on final goods and services produced in the nation during the year.

  - $GDP = C + I + G + (X - M)$; C=Consumption, I=Investment, G=Government Spending, X=Exports, M=Imports

- **Income Approach**: Measures GDP by adding up all the income earned by the factors of production (land, labor, capital, entrepreneurship) during the year.

  - $GDP = W + I + R + P$; W=Wages, I=Interest, R=Rents, P=Profits

- Therefore, $GDP = C + I + G + (X - M) = W + I + R + P$

4.2 Circular Flow Model and Leakages
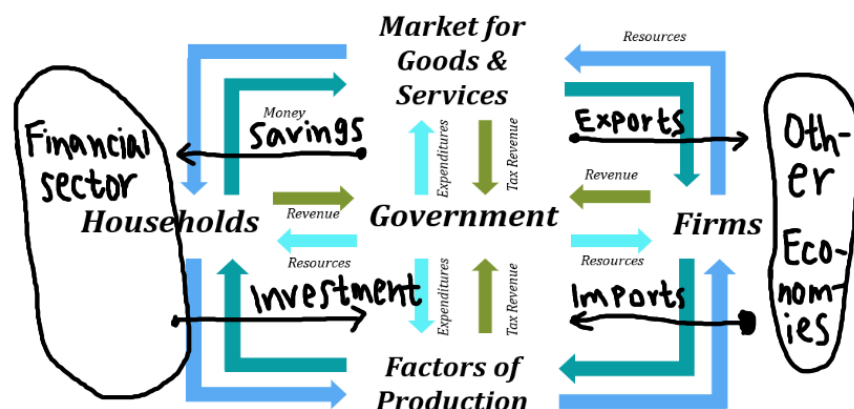
Figure 7: Circular Flow Model

- **Leakages** are the non-consumption uses of income, such as savings, taxes, and imports.
- Your piggy bank and transfer payments are leakages.

4.3 Gross National Product

- **GNP** is the sum of the value of all final goods and services prodced by Americans anywhere in the world during a time period.

4.4 Examples of Factors that Affect GDP

4.4.1 Which of these is Counted in GDP?

- A monthly check received by an economics student who has been granted a government scholarship.
- A farmer's purchase of a new tractor ☑
- A plumber's purchase of a two-year-old used truck ×
- Cashing a U.S. government bond ×
- The services of a mechanic in fixing the radiator in his own car
- A Social Security check from the government to a retired store clerk
- An increase in business inventories ☑
- The government's purchase of a new submarine for the Navy ☑
- A barber's income from cutting hair ☑

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- Income received from the sale of Nike Stock ×

4.4.2 Which of these is counted in GDP and part of consumption?

- You Spend $7 at the movies ✓
- A family pays a contractor $200k for a house he built them this year ×
- A family pays $75k for a house built three years ago ×
- An accountant pays a tailor $175 to sew a suit for her ✓
- The government increases its defense expenditures by $1 billion ×
- The government makes a $300 Social Security payment to a retired person ×
- You buy General Motors Corp. stock for $1k in the stock market ×
- At the end of the year, a flour-milling firm finds that its inventories of grain and flour are $10k above the amounts of its inventories at the beginning of the year ×
- A homemaker works hard caring for her spouse and two children ×
- Ford Motor Co. buys new auto-making robots ×
- You pay $300 a month to rent an apartment ✓
- Apple Computers builds a new factory in the US ×
- RJ Reynolds Co. buys control of Nabisco ×
- You buy a new Toyota that was made in Japan. ×
- You pay tuition to attend college. ✓

4.4.3 Which of these is Counted in GDP and part of investment?

- A family pays a contractor $200k for a house he built them this year ✓
- A family pays $75k for a house built three years ago ×
- The government increases its defense expenditures by $1 billion ×
- The government makes a $300 Social Security payment to a retired person ×
- You buy General Motors Corp. stock for $1k in the stock market ×
- At the end of the year, a flour-milling firm finds that its inventories of grain and flour are $10k above the amounts of its inventories at the beginning of the year ✓
- A homemaker works hard caring for her spouse and two children ×
- Ford Motor Co. buys new auto-making robots ✓ ×
- Apple Computers builds a new factory in the US ✓
- RJ Reynolds Co. buys control of Nabisco ×
- You buy a new Toyota that was made in Japan. ×

4.4.4 Which of these is Counted in GDP and part of government spending?

- A family pays $75k for a house built three years ago ×

- The government increases its defense expenditures by $1 billion ☑
- The government makes a $300 Social Security payment to a retired person ×
- You buy General Motors Corp. stock for $1k in the stock market ×
- A homemaker works hard caring for her spouse and two children ×
- RJ Reynolds Co. buys control of Nabisco ×
- You buy a new Toyota that was made in Japan. ×

4.4.5 Which of these is Counted in GDP and part of net export/import?

- A family pays $75k for a house built three years ago ×
- The government makes a $300 Social Security payment to a retired person ×
- You buy General Motors Corp. stock for $1k in the stock market ×
- A homemaker works hard caring for her spouse and two children ×
- RJ Reynolds Co. buys control of Nabisco ×
- You buy a new Toyota that was made in Japan. ☑

4.4.6 We count only the final price of a good or service in GDP. Why?

We don't count intermediate and used goods/services because then we would be **double-counting**; also, the good/service in question might have not been made in the time period analyzed if it wasn't final.

4.4.7 A purely financial transaction will not be counted in GDP. Why?

Because a purely financial transaction doesn't involve consumption, investment, government spending, exports, or imports.

4.4.8 When a home-owner does home-improvement work, the labor is not counted in GDP. Why?

They're not paying themself or making any profits off of their work to contribute to the income approach for calculating GDP.

4.5 Calculating GDP Examples

4.5.1 Example 1

Suppose that personal income is $500 billion, personal taxes are $100 billion, and depreciation is $50 billion. Disposable income is equal to which of the following?

DI = PT – PT = 100 – 50 = $50 billion

4.5.2 My Practice

Suppose that personal income is $100 billion, personal taxes are $50 billion, and depreciation is $25 billion. Disposable income is equal to which of the following?

4.5.3 Example 2

Wages	$50 Billion
Rent	$20 Billion
Private Investment Spending	$10 Billion
Exports	$30 Billion
Interest Payments	$40 Billion
HH Profit	$80 Billion

What is the GDP? *GDP = W + R + I + X + P* = 50 + 20 + 10 + 30 + 80 = $190 billion

4.5.4 My Practice

Wages	$90 Billion
Rent	$40 Billion
Private Investment Spending	$10 Billion
Corporate Taxes	$50 Billion
Interest Payments	$100 Billion
HH Profit	$90 Billion

What is the GDP? *GDP = W + R + I + X + P* = 90 + 40 + 10 + 0 + 90 = $230 billion

4.5.5 Example 3

Consumption Spending	$50 Billion
Individual Income Taxes	$20 Billion
Private Investment Spending	$10 Billion
Corporate Taxes	$20 Billion
Exports	$30 Billion
Imports	$40 Billion
Government Purchases	$80 Billion

What is the GDP?

4.5.6 My Practice

Consumption Spending	$70 Billion
State Income Taxes	$10 Billion
Private Investment Spending	$50 Billion
Corporate Taxes	$80 Billion
Net Exports	-$40 Billion
Government Purchases	$50 Billion

What is the GDP?

Using the prior table and the expenditure approach, what percent of GDP is comprised of consumption, investment, and government spending?

How is this possible?

If a firm experiences depreciation of factor resources, which component of GDP is negatively affected?

4.5.7 Example 4

Aggregate Data	Value (Billions)
Consumption Spending	10
Employee Compensation	7
Government Spending	60
Interest Payments	10

Net Exports	-50
Profits	5
Rents	5
Savings	10

Calculate GDP using both approaches.

Do both approaches yield equal GDP values? Why or why not?

4.5.8 My Practice

Aggregate Data	Value (Billions)
Consumption Spending	190
Employee Compensation	200
Government Spending	100
Interest Payments	100
Investment Spending	90
Net Exports	60
Profits	50
Rents	50
Savings	50

Calculate GDP using both approaches.

Do both approaches yield equal GDP values? Why or why not?

4.5.9 Example 5

A country consists of 2 firms. Firm A's total revenue is $200 million. The cost of their inputs is $50 million. Firm B's total revenue is $100 million. The cost of their inputs is $10 million. What is the total value added in this economy?

4.5.10 My Practice

Kingdom of Burbonia	Firm A	Firm B	Firm C
Firm's Sales	20	50	100
Cost of Intermediate Goods Purchased by Each firm	10	40	40

What is the total value added in the Kingdom of Burbonia, measured in millions of dollars?

4.5.11 Challenge Problem

Consumption is one third of total GDP. Gross Private Investment Spending and Government Spending, Combined, are equal to consumption spending. Exports are twice the number of imports. Imports are $50 million. Government spending is four times as much as investment.

What is consumption spending?

What is investment spending?

What is government spending?

What are exports?

What is GDP?

5 Advanced GDP Calculations (01/25)

5.1 NGDP vs. RGDP

5.1.1 If we want to measure the amount of production using current prices, what economic measure should we use?

Nominal GDP

5.1.2 If we want to measure the amount of production using base year prices, what economic measure should we use?

Real GDP

5.1.3 Define "REAL"

Accounting for inflation by referencing some initial level of price.

5.1.4 What does RGDP show?

The measure of true product, accounting for inflation

5.1.5 What are the formulas for types of GDP?

Nominal GDP	Real GDP
$\Sigma(Q_c \cdot P_c)$	$\Sigma(Q_c \cdot P_{c,\text{base}})$

5.1.6 Growth rate (percent change) formula:

$\frac{\text{New GDP} - \text{Old GDP}}{\text{Old GDP}} \cdot 100\%$

For the base year, the RGDP always equals the NGDP.

5.1.7 Standard of living

- We use RGDP to measure the standard of living because it accounts for inflation.
- RGDP per capita is the best measure of standard of living.

5.1.8 Inflation/Deflation

- $\frac{NGDP}{RGDP} \cdot 100\%$ is the deflator value (*DF*).
- If *DF* > 100% (*NGDP* > *RGDP*), there is inflation.
- If *DF* < 100% (*NGDP* < *RGDP*), there is deflation.
- If *DF* = 100% (*NGDP* = *RGDP*), prices are staying the same.
- Disinflation is when the rate of inflation is decreasing, but inflation is still occurring nonetheless.
- The deflator is always 100% in the base year.

5.1.9 What limitations does GDP have as an economic measure?

- It doesn't account for non-market production (e.g. stay-at-home parents)
- It doesn't account for the underground economy (e.g. drug dealers)
- It doesn't account for negative externalities (e.g. pollution)

6 Unemployment (01/29)

6.1 Questions on introductory unemployment terms

1. Who constitutes as being employed?

If they worked full or part time during the past week or is on vacation or sick leave from a regular job.

2. Who constitutes as being unemployed?

If they did not work during the preceding week but made some effort to find work in the past four weeks.

3. Who constitutes as being out of the labor force?

People who are not employed and haven't looked for a job in four weeks. Institutionalized (prison), military, and those younger than 16 as well. Discouraged workers, full time students, unpaid homemakers, and retirees are examples.

4. Who constitutes a discouraged worker? Do they cause an underestimate or over-estimate of the unemployment rate?

Workers tha thave given up looking ofr a job, now considered out of the labor force.

5. Is the entire population considered for unemployment calculations?

Only adults (16+), non-institutionalized, civilian, nonretired population.

6.2 Types of unemployment

Frictional unemployment

- Unemployment that is initiated by workers themselves, who are in between jobs.
- "You quit your job and are looking for a new one"

Structural unemployment

- When the firm doesn't need the worker anymore
- "Your skills are no longer needed"
- This could indicate a displacement of workers by technology

Cyclical unemployment

- Unemployment that is caused by a recession
- "Your skills are still needed, but the economy is not doing well"

6.3 Unemployment calculations

1. Total Population:

18+9+2+1 = 30

2. Total Adult Working-Age Population

18+9+2 = 29

3. Total Employed

18

4. Total Unemployed

9

5. Total Labor Force:

$EM + UE$ = 18 + 9 = 27

Finding the three important rates

Note: $ER + UR$ = 100%

1. Labor Force Participation Rate (LFPR):

$\frac{LF}{TAWAP} \cdot 100\% = \frac{27}{29} \cdot 100\% = 93.1\%$

2. Employment Rate (ER)

$\frac{EM}{LF} = \frac{EM}{EM+UE} \cdot 100\% = \frac{18}{27} \cdot 100\% = 66.7\%$

3. Unemployment Rate (UR)

$\frac{UE}{LF} = \frac{UE}{(EM+UE)} = \frac{9}{27} = 33.3\%$

6.4 The Flow Problem

Day 1: Country of Burbonia has 10 citizens. All citizens are of the working-age population. 3 are UE. 1 is Discouraged. 6 are EM.

ER: 67.66%, UR: 33.33%, LFPR: 90%

Day 2: One worker loses their job to the machine, but they continue to look for employment.

- 4 UE, 1 Discouraged, 5 EM
- ER: 55.56%, UR: 44.44%, LFPR: 90%
- ER: Decreases, UR: Increases, LFPR: Stays the same

Day 3: One unemployed laborer becomes discouraged.

- 3 UE, 2 Discouraged, 5 EM
- ER: 62.5%, UR: 37.5%, LFPR: 80%
- ER: Increases, UR: Decreases, LFPR: Decreases

Day 4: One discouraged worker starts looking for a job, but there are no available positions.

- 4 UE, 1 Discouraged, 5 EM
- ER: 55.56%, UR: 44.44%, LFPR: 90%
- ER: Decreases, UR: Increases, LFPR: Increases

Day 5: Another discouraged worker finds a new job and starts working immediately.

- 4 UE, 0 Discouraged, 6 EM
- ER: 60%, UR: 40%, LFPR: 100%
- ER: Increases, UR: Decreases, LFPR: Increases

	EM → UE	EM → OoLF	UE → OoLF	UE → EM	OoLF → EM	OoLF → UE
Change in LF	NC	Dec	Dec	NC	Inc	Inc
Change in LFPR	NC	Dec	Dec	NC	Inc	Inc
Change in UER	Inc	Inc	Dec	Dec	Dec	Inc

7 CPI and Inflation Rate (01/31)

7.1 The Auction Game

7.1.1 Classroom Data

Product	Round 1 Quantity	Round 1 Price	Round 2 Quantity	Round 2 Price	Round 3 Quantity	Round 3 Price
Candy Bag	1	4	2	20	3	145

Rnd 1 Price	Round 1 Remaining Money Supply	Round 1 Additional Money Supply	Rnd 2 Price	Round 2 Remaining Money Supply	Round 2 Additional Money Supply	Rnd 3 Price	Rnd 3 Remaining Money Supply
10	90	10	20	80	20	30	70

7.1.2 Questions

1. What do the beans held by each person represent?

Money

2. What do all the beans in the room reperesent?

All of the money in the economy

3. What do you notice about the quantities across the 3 different rounds of the auction?

a

4. What do you notice about the prices across the 3 different rounds of the action?

a

5. With respect to your observations in #4, why did this happen?

a

6. Does this simulation demonstrate price stability or price instability?

a

7. Who was hurt the most across the 3 rounds? The least?

a

8. Did the quality of the goods change across the rounds of gameplay? Was this in line with the tendency of prices?

a

9. Did quantity or price appear to have the greater percentage of change across the rounds?

a

10. Does the total spending across the 3 rounds reflect the change in production or consumption? What econmic measures are used to reflect this phenomenon?

a

11. Under what conditions did increasing the money supply (beans) cause inflation? Under what conditions did increasing the money supply (beans) not cause inflation?

7.2 CPI

The **CPI** (consumer price index) is a measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services.

- The 8 major groups of the CPI

  - Food and beverages
  - Housing
  - Apparel
  - Transportation
  - Medical care
  - Recreation
  - Education and communication
  - Other goods and services

- It does not include life insurance, social security, or income taxes.
- The core CPI is the CPI minus food and energy prices.

7.3 Calculating CPI

The formula for calculating the CPI is:

$$CPI = \frac{\Sigma(P_c \cdot Q_b)}{\Sigma(P_{c,base} \cdot Q_b)} \cdot 100$$

Where P_c is the current price, $P_{c,base}$ is the base year price, and Q_b is the quantity of the good/service.

In other words, the CPI is the **ratio** of the cost of the market basket in the current year to the cost of the market basket in the base year times 100%.

7.4 Inflation Rate

The formula for calculating the inflation rate is:

$$\text{Inflation Rate} = \frac{CPI_c - CPI_b}{CPI_b} \cdot 100\%$$

7.5 Main Idea: What is the difference between the CPI and the GDP deflator?

The **CPI** inflator is for *consumers*, while the **GDP** deflator is for *producers*.