ECON-102: Principals of Microeconomics
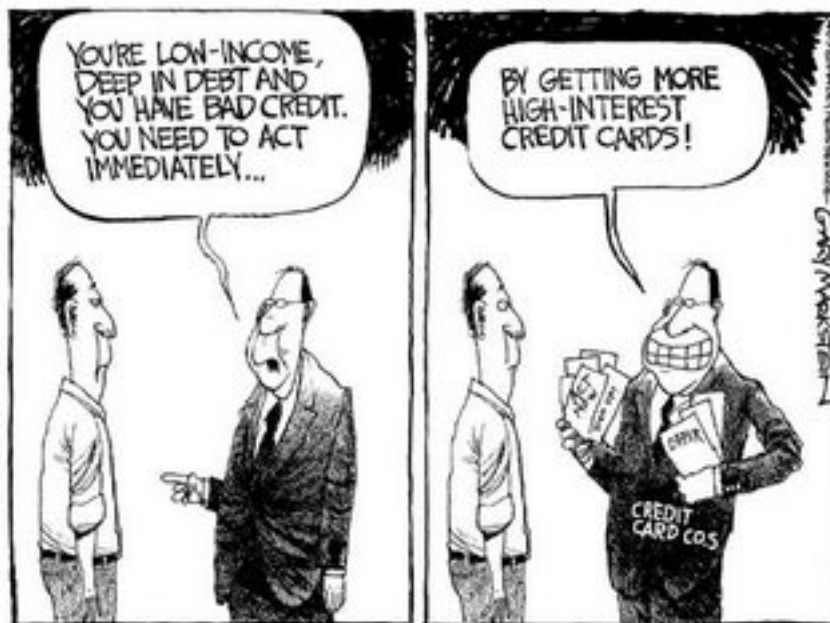
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1 Unit 1: Fundamental Concepts

1.1 Section 1: Economics

In general terms, economics is defined as the study of how we can best increase a nation's standard of living and citizens' happiness with the resources that we have available to us.

Standards of living include:

- cars

- houses

- leisure time

- access to health care

- cleaner air

1.1.1 Marginal Benefit & Marginal Cost

Marginal benefit and marginal cost can be though of as a positive cause-and-effect in a business environment, with the benefit being the effect and cost being the cause. When your marginal benefit is greater the marginal cost, the more likely a positive investment is at play. For example, you may buy an expensive car for your long commute, but it has the best MPG in the current car market and is heavily reliable (marginal benefit)–potentially outweighing the initial cost (marginal cost).

1.1.2 Difference between Macro- & Micro- economics

Macroeconomics focuses on the wider concepts that play a role on the entire economy. Components of this include:

- national unemployment rate

- inflation rate

- interest rate

- federal government budgets & fiscal policies

- economic growth

- Federal Reserve System & monetary policy

- foreign exchange rates

- balance of payments

Microeconomics deals with the smaller concepts of an economy such as:

- supply and demand of individual goods and services

- price elasticity (sensitivity) of goods and services in demand

- production

- cost functions

- business behavior and profit maximization

- income inequality & distribution

- effects of protectionism (tariffs, quotas, trade restrictions, etc.)

If macroeconomics is studying a forest, microeconomics is studying the individual trees.

1.2 Section 2: The Production Possibilities Curve

1.2.1 Production Choices

Production choices are the idea that if you have limited resources to produces various products, you want to optimize the resources at hand so that you can make the most of the available resources, not under-use, and not over-promise a production value that is not achievable.

1.2.2 Points on the Curve and Trade-Offs

In a given graph, any values that lie on the curve means that the operating cost of the products are being used as efficiently as possible. The idea is that the output cannot increase if it is limited by a constant resource and technology. Scarcity talks about the limited resources at hand–which directly correlates with the Production Possibility Curve. If a value lands on the curve, increasing the production of one good/category will be at the expense of other goods/categories. Points E, C, B, A, and D depicted in figure 1 represents the most optimized products that can be produced with resources at hand. It also shows varying priorities for both Guns and Roses productions.

Any points that fall inside the curve (to the left of the curve, i.e point G in figure 1) shows an inefficient use of resources to produce products. Some
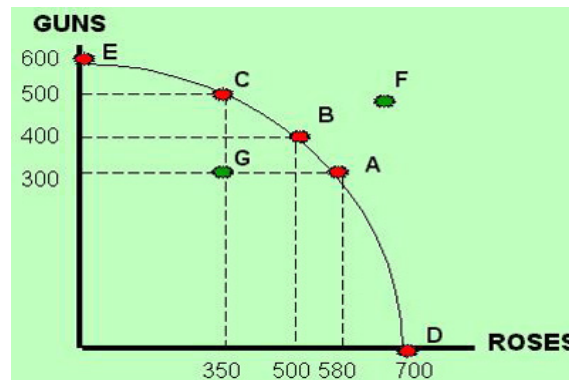
Figure 1: Example of a Possibility Curve of Guns and Roses production.

reasons for this could be using fewer than the available resources (unemployment), or using all resources but inefficiently (underemployment).

Points that fall outside the curve (to the right of the curve, i.e point G in figure 1) shows a combination that cannot be achieved with the available resources. This value does not mean point F will never be achievable– the economy may grow and F may fall on or inside the Possibility curve, but at the current analysis of the economy, it will not be possible. Increases in technology and/or resources can help contribute to the growth of the Production Probability Curve, which can help reach point F in the future.

1.3 Section 3: Economic Growth

Economic growth occurs when the economy realizes greater production levels. Essentially, when either the number of resources increase, or the way we use resources becomes more efficient, is the only time the curve can shift outwards. In short, economic growth is made possible by advances in technology and/or increase in resources.

1.3.1 Increase in Capital Goods

If a country is producing at full employment, more capital goods can be produced only inf the country produces fewer consumption goods. A few ways governments can encourage more production of capital goods can be through tax breaks for the production of capital goods, or increasing taxes on the production/sale of non-capital (consumption) goods.

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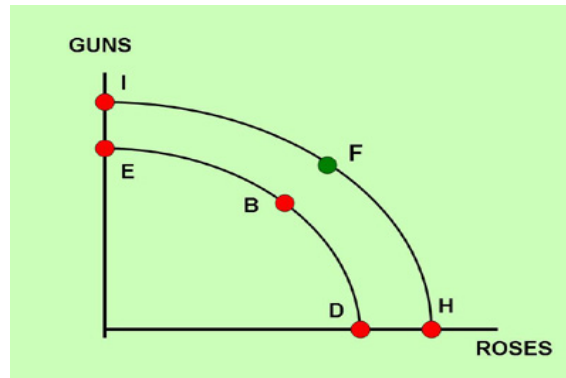
Figure 2: Example of how economic growth now reaches point F.

1.3.2 Advances in Technology

Advancements in technology that contribute to economic growth are usually due to entrepreneurs who have incentives to produce more efficiently and lower their costs. When this model is successful, this usually drives the entrepreneur to continue to improve their models to become more efficient with both the work/effort needed, and the money saved. Governments that allow entrepreneurs to keep most of their profits and tax them less has been shown to produce greater rates of technological growth. In addition to new technology, the more human technological advancements made (greater education, training, skills, etc), the higher the production probability curve also grows.

1.3.3 Economic Growth and Economic Systems

There are various factors that can lead a country to economic growth and downfalls. For example, in a capitalist country, having a government that supports just reward systems (taxes and regulations that reward work and entrepreneurship), just legal system, infrastructure, national security, and protection of individual property rights can all lead to great economic growth. Also, political incentives can also lead to economic growth. For example, India's switch to international trade in the 90's has led to greater opportunities, and the same for China in the 80's when they adopted the free market elements.

Countries that practice communistic or command economy policies have seen significantly less economic growth due to the sheer control the government has over resources and entrepreneurial entrepreneurial incentives.

In third world countries, instability with governments, corruption, civil strife, national security, and uncertainty make is extremely difficult to have

a steady, growing economy.

1.3.4 Conditions for Economic Growth

Countries with the highest per-capita earnings are characterized by all or most of the following:

1. **Strong private property rights.**

   If a country does not do its best to protect the property rights of its citizens, then the incentive to work hard in an economic state begins to dwindle. If a country allows the protection of private property to individuals, then incentive to work hard increases, since the properties (land, equipment, commodities, etc) is protected and belongs to the individual who earned it.

2. **Free markets, free international trade, and a stable price level.**

   Free markets are markets in which prices of goods and services, wages, rents, interest rates, and foreign exchange rates are determined by the interaction of private sector demand and supply.

   In order for free international trade, countries need to avoid protectionism (tariffs, quotas, etc.)

   Stable price level is achieved when there is little to no fluctuation in the country's average price level. This can be achieved by a country's monetary agency keeping its money supply restricted or constant.

3. **Essential government regulations and reasonable levels of taxation.**

   Balanced rule, regulations, and taxes must be enforced by governments in order for governments to provide essential functions. If there is too high of a tax, businesses and individuals will be less incentivized to work, while excessive regulations can lead to time consuming and expensive business operations. If there are high taxes and excessive regulations, this discourages business start-ups, make businesses fail, or businesses may move abroad to avoid high taxes/regulations.

4. **Little corruption.**

   If a governments/private groups initiates force by taking away citizen's businesses'/private property, it does not give any incentive for individuals to create/continue/maintain business with that government.

The only cause of long-term economic growth and outward shifts in the production possibility curve are *increases in resources and advances in technology*. More and better resources allow businesses to produce more efficiently and effectively, lower costs, increase real incomes and increase purchasing consumers' power. Increasing a nation's money supply or increased government spending *may* help in the short-run, but has economic disadvantages in the long-run. When wages are increased, that only means that the price of goods and services will increase. There is no profit gain for businesses, and there is no money-saved from consumers. The only thing that has changed is the *nominal* prices of wages, goods and services. The only way to increase real profits is to increase productivity. This also lowers costs and decreases prices, which allows increases in real profits and real demand.

1.4 The Circular Flow

The way how a basic economy works is that businesses offer goods, and households pay businesses for those goods. Households also offer services to the businesses, and in return, businesses pays the households for their services. Government also plays a role, since they offer neutral services to both parties (households and businesses). Since they offer services to both parties, the parties must also contribute to the government for those services (in the form of taxes).

When you bring in foreign markets into account, the same principals apply for businesses, households, and governments.

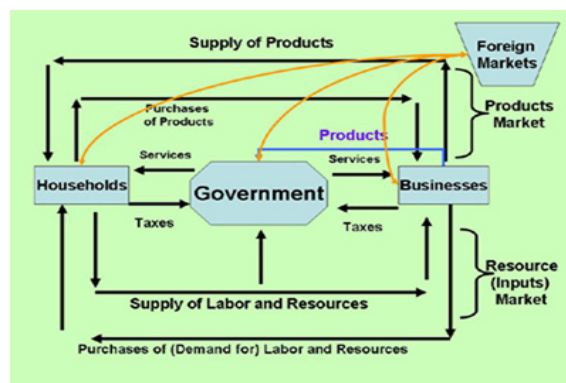Figure 3 is an illustration of the circular flow of a basic economy.

Figure 3: Graphical representation of how the circular flow works with businesses, households, governments, and foreign markets.

1.5 Economic Systems

There are three different types of economic systems:

- **Laissez-faire economy** represents a pure capitalist system (also called a price system). In this economy, the supply and demand behavior of businesses and households determine the price of goods and services and factors of production. The government plays a very limited role and only provides the most essential functions such as a legal system, protecting individuals/property rights, and providing infrastructure and certain public goods.

- **Command economy** is a communist system where a country's government determines the prices of goods and services and factors of production. The country/government controls all of the country's economic decisions.

- **Mixed economy** is a mix between a command and laissez-faire economy. The exact mix of the two is dependent on the government involvement. Most industrialized countries follow this type of economic system.

1.6 Important Concepts and Definitions

Some definitions and concepts that will be used throughout these notes.

1.6.1 Nominal and Real Values

Nominal value (nominal wages, nominal interest rates, nominal Gross Domestic Product, GDP) is the price of the actual dollar value which was recorded during the transaction. This can be the price that shows up on a contract, receipt, etc. You can think of this as the original monetary price of an invoice. Real value is the monetary value that is reflective of the current market. For example, lets say you bought a house 10 years ago for $50,000, but its current market value is $100,000. The nominal value of the house is $50,000, while the actual value is $100,000.

1.6.2 Positive and Normative Economic Statements

Positive economic statements are facts, or statements which can be proven. Positive statements does not have to be a true statement; the statement can be proven false. It just needs to be provable. Examples of positive economic statements are:

- The federal government experienced a budget surplus this past year (this is a false positive statement, but, by definition, a positive economic statement).

- When the value of the dollar falls, Japanese products imported into the United States become more expensive (this is a true positive statement).

- Legalizing drugs will reduce the drug profits that illegal drug dealers make (this is a true positive statement).

- The United States does not have a federally mandated minimum wage (this is a false positive statement).

A normative economic statement cannot be proven; they are opinions or value judgements. Examples of normative economic statements are:

- The government should raise taxes and lower government spending to reduce the budget deficit.

- We need to try to lower the value of the dollar in order to discourage the imports of Japanese goods into this country.

- Our government should legalize the use of drugs in this country.

- The federal minimum wage should be at least $15.00.

1.6.3 Ceteris Paribus

Latin for "if no other things in the economy change". When college tuition rises, student enrollment will decrease, ceteris paribus. But if the parents' real income increased as well, then student enrollment may increase, despite the tuition increase. Therefore, the ceteris paribus condition is violated.

1.6.4 Fallacy of Composition

If you say what is good for one thing is *necessarily* good for the entire group, then you are subject to fallacy of composition. If a college has a shortage of parking spots, your intuition is to tell students to arrive early. But if every student comes early, there will still be a parking shortage issue.

1.6.5 Broken Window Fallacy

The idea that destruction stimulates the economy, therefore destruction creates employment. This is not true. If you break a window, and hire a glazier to fix it at the cost of $500, the you have provided employment to the glazier. However, if you did not break the window, you would have kept the $500, and afterwards you could buy a watch (which also increases employment). If you break the window, you are gaining the employment of the glazier, but losing the employment of the tailor. If you don't break the window, you will 1) keep the window, 2) keep the $500. 3) employ the tailor. Keeping the window is an important factor, since it was already working, therefore there was no need to mindlessly destroy it in order to hire a glazier. In general, destruction is not a good thing microeconomicailly.

1.6.6 Fallacy of Cause and Effect

Basic idea of cause and effect; just because one action is immediately followed by another action, does not mean action a caused action b to occur.

1.7 Economics and Critical Thinking

When looking at economic statements, scenarios, and analyses, you have to pay attention and think about these six guidelines:

1. **Question the source.**
   Study the background of the person making the statement to determine biases.
2. **Question the assumptions.**
   Make sure you are not drawing conclusions too fast before thinking of other factors that might come into play.
3. **Question how the variables are defined.**
   The defining of variables is extremely important. If you are vague with the variables in your assumption, then you will have poor results, or the results you did not intend on happening. You can also be fooled by others' poor variable definitions, potentially swaying you and causing a sort of false-results. Garbage-in, garbage-out.
4. **Question the validity of the statement.**
   Make sure the statements concluded do not fall into the fallacies, like the fallacy of cause and effect, and fallacy of composition (broken window fallacy).
5. **Question the statistics.**

Statistics can be meddled with, especially when you are vague with defining variables in your initial question.

6. **Think like an economist.**
Think practical in the sense of the real world and economics. Yes, maybe one solution passes the above five checks, but is it reasonable in the real world (outside of the math and conditions)?

2 Unit 2: Supply and Demand

2.1 The Law of Demand

The law of demand states that buyers of a good will purchase more of the good if its price is lower, and vice versa. This assumes that no other economic changes take place. This law assumes ceteris paribus–no other changes take place.

2.1.1 Substitution and Income Effects

The substitution effect states that as the price of a product decreases, it becomes cheaper than competing products (assuming the competing product does not decrease in price). Consumers will substitute the cheaper product for the more expensive product.

The income effect states that as the price of a product decreases, buyers will have more income available to purchase more products, and vice versa. The buyer will more likely buy more of the product that became cheaper, since they have more expense to use on said product.

2.2 The Demand Curve

When graphing a demand curve, we look at two variables, product (P) and the quantity (Q) of the product purchased during a certain time period. The demand curve always slopes downwards. Figure 4 the demand curve.

Market demand is the total demand for a product by all customers. Total demand is the sum of all *individual* buyers' demand.

A demand schedule and a corresponding demand curve represents the buyer's *willingness* and *ability* to purchase the product. For demand to exist, a buyer must *desire* and be *able* to afford it.

Usually, a buyer's willingness to purchase a product depends on the value the buyer expects to receive from purchasing the product. This is called the **utility**.
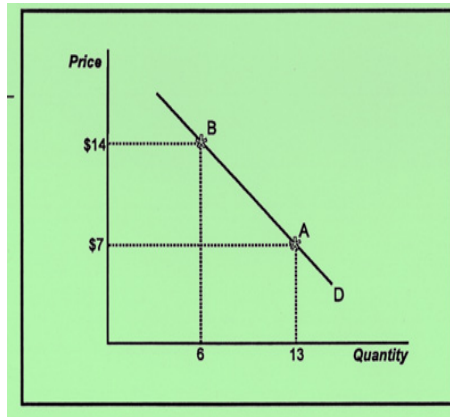
Figure 4: Graph of demand curve.

When a buyer purchases additional products, this is called the **marginal utility**. Typically, a buyer's marginal utility decreases as the person consumes more of a product.

util is the imaginary measure of satisfaction. Since satisfaction differs for different people and products, there is no real measurement. It is used for comparison purposes. Utils is the measurement of utility.

Usually, more valuable items come with more utility (lets say, a car). If you do not own a car, the first car you get will have high utility. But if you wanted to buy a second car, the second car does not have nearly as high of a utility as the first car did. This is called the **law of diminishing marginal utility**.

In other words, the more of a product you have, the less satisfaction you receive from buying additional products. This does not apply for every product. Beer, for example, usually does not follow this law (since the more you drink, the more you will typically want).

2.3 The Law of Supply

2.3.1 Price and Quantity Changes

When ceteris paribus, product suppliers offer more of a product at a higher than at lower prices. If a product price is high, then the supplier can make a greater profit by selling more (assuming the price of production is constant and there is a demand for the good).

2.3.2 Income and Substitution Effects

Income effect is when a business is able to sell a product for a higher price
and still sell approximately the same amount.

The substitute effect is when a supplier notices the market price of prod-
uct A increasing, ceteris paribus, producing product B will be less attractive
to the supplier. The supplier will want to produce more of product A since
they can make a better profit out of it compared to producing product B.

2.4 The Supply Curve

The supply curves has an upwards slope. At higher prices, firms are willing
and able to sell more than at lower prices. There is a direct relationship
between price and quantity supplied. Figure 5 shows the supply curve.
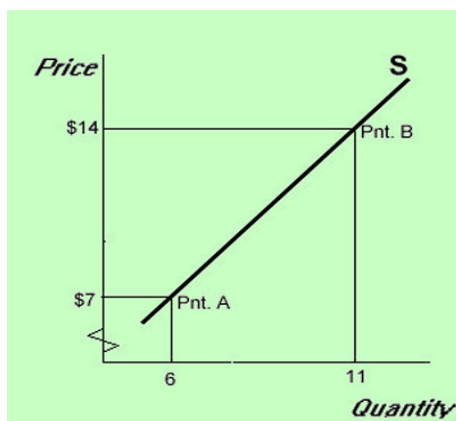
Figure 5: Graph of supply curve.

The same principals of the demand curve applies to the supply curve.

2.5 Equilibrium Price and Quantity

2.5.1 Market Price and Quantity

When you put the supply and demand curve together, you will obtain a
graph with an intersecting point. This intersecting point is the equilibrium
of what suppliers want to price their product quantities at, and what buyers
are willing to buy quantity at certain prices. If a seller wants to sell their
product for an extremely high price, buyers will only buy small quantities
when sellers actually want to sell a lot more. To compromise, they will lower
the price. Vice versa with buyers. Figure 6 an example of the equilibrium
graph.

Figure 6: Graph of how supply and demand curves combined will create an equilibrium.

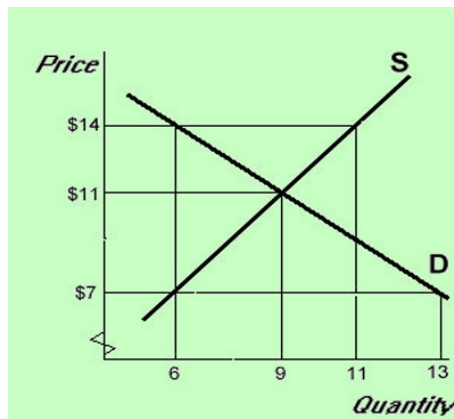An example of lower-limits (price floor) to the supply-demand equilibrium is rent control. Rent control is placed below the equilibrium, so that more people can afford housing, but doing so, landlords are less incentivized to create those living spaces since they will not be making profits.

An example of upper-limits (price ceiling) is minimum wage. Minimum wage is set above the equilibrium. This means that there is more incentive for workers to want to get a job (because they will be paid more), but companies will not want to pay this since they will lose profits. There will be less demand for companies to hire vs the high supply of willing workers.

2.6   Demand Determinants

Demand curve can shift from left to right, and they are determined by these factors;

1. **A change in buyers' real income or wealth.**

   Usually, a normal product increases if the buyers experiences an increase in real incomes or wealth. However, when this happens, some products may experience a decrease in demand. For example, someone who could only afford pasta can now afford steak. Steak will become the normal product as the buyer will no longer purchase pasta as much as steak since they experienced the increase of real income/wealth.

2. **Buyers' tastes and preferences.**

   Self explanatory, the more popular an item is, the more buyers will want it. Also, this will leave unpopular items to be sold less, therefore

lose value.

3. **The prices of related products or services.**

   A buyer always purchases product A. All of a sudden, product B is cheaper than product A. The buyer will instead start to purchase product B since it is cheaper, lowering the demand for product A, and increasing the demand for product B.

4. **Buyers' expectations of the product's future price or availability, or their future income or wealth.**

   If buyers assume increased incomes, or product value (they believe there will be a shortage of toilet paper, more expensive gas prices, etc.), the demand will rise in the short-term (stock up on toilet paper, fill up the gas tanks). This will also increase the costs of those items since the demand also rises (in the short-term).

5. **The number of buyers (population).**

   The more of a population, the more the demand will be. If there is a rise of newborn babies, there will be higher demand for baby products.

2.7   Change in Demand on Equilibrium Price and Quantity

When the demand curve shifts to the right, demands increases. The market price increases, and so does the equilibrium quantity (in the short-run).

When the demand curve shifts to the left, equilibrium price and quantity decreases (in the short-run).

2.8   Supply Determinants

Supply curve can shift from left to right, and they are determined by these factors:

1. **Advance in technology.**

   Advancements in technology will lower the cost of producing it, which increases profit. Also creates incentive to increase supply.

2. **Change in the price of an input used to make the product.**

   When price of input (labor, raw materials, machinery, land) decreases, business makes more profit per product and is willing and able to increase the supply of the product (and vice versa).

3. **Change in taxes, subsidies, or regulations.**

   Taxing or more regulations on manufacturing of a product lowers the supply, because cost of producing supply increases. A subsidy (government grant) to a business or individual can increase the supply.

4. **Number of suppliers.**

   When there are more competitors of a product, there will be more demand (and vice versa). Sometimes, government agencies can limit the amount of suppliers (licenses, permits, diplomas, etc) which safeguards the consumers to ensure they receive quality, but also limits the amount of suppliers.

2.9 Change in Supply on Equilibrium Price and Quantity

An increase in supply will show the line going rightward (or downward), while a decrease in supply will show the line going leftward (or upward).

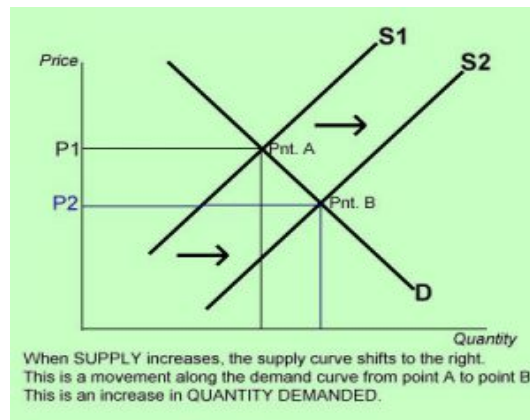Figure 7 shows an example of what this looks like.

Figure 7: Plot of supply shift.

2.10 The Effect of Change in Both Demand and Supply on Equilibrium Price and Quantity

When talking about short and long term changes, short term is in a time span of several months, while long term is over a year or longer. *Equilibrium price* represents the market price (price you find at the grocery store). When

talking about the *equilibrium* quantity, it represents the quantity or amount of a certain product being bought and sold in a store.

A simple way to know when supply and demand affect price and quantity increases/decreases is by memorizing the four conditions:

When **demand** *increases* $\Longrightarrow$ **Price** *increases* and **quantity** *increases*

When **demand** *decreases* $\Longrightarrow$ **Price** *decreases* and **quantity** *decreases*

When **supply** *increases* $\Longrightarrow$ **Price** *decreases* and **quantity** *increases*

When **supply** *decreases* $\Longrightarrow$ **Price** *increases* and **quantity** *decreases*

2.11 Demand vs Quantity Demanded and Supply vs Quantity Supplied

2.11.1 The Difference between Demand and Quantity Demand

If the market price of a product decreases, then the *quantity demand* increases, and vice versa. For example, when the price of strawberries decreases (while in season), more customers will purchase strawberries. Figure 8 how the quantity demand has changed by a movement *along* the demand curve.
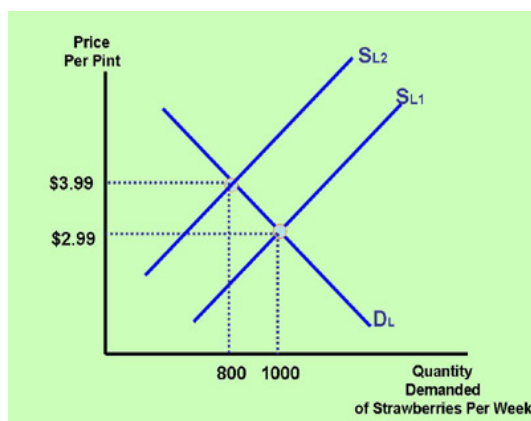
Figure 8: Change in quantity demand.

When one or more of the five demand determinants (see section 2.6) changes, then *demand* changes. For example, when buyers' income increase, the *demand* (not the quantity demanded) for a normal product increases. Or when the price of a substitute product decreases, then the demand for the product in question decreases. Or when the number of buyers increases, the demand increases, and the price of the product increases. An increase

in demand is shown by a *rightward shift* in the demand curve. See Figure 9 as a reference. In the graph, demand increases as D1 shifts to D2. *Quantity supplied* also increases as the equilibrium points shift along the supply curve from point A to point B.
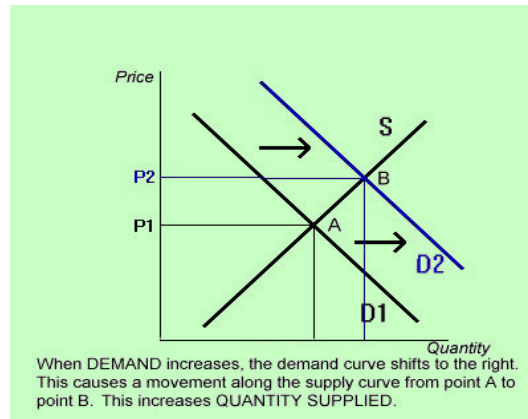
Figure 9: Graph depicts the change of demand going rightwards.

2.11.2 The Difference between Supply and Quantity Supplied

If the market price of a product increases, then the *quantity supplied* increases, and vice versa. For example, when housing prices increase, more people will want to sell their house. See Figure 10 below as a reference of how quantity supplied affects supply.

Figure 10: The graph depicts the number of goods increasing as price increases as well.

When one or more of the four supply determinants (See 2.8) changes, then *supply* changes. For example, when technology advances, or the cost of production decreases, *supply* increases. See Figure 11 below as a reference.

Figure 11: As supply increases from as S1 shifts to S2, quantity increases as the equilibrium points shift along the demand curve from point A to point B.
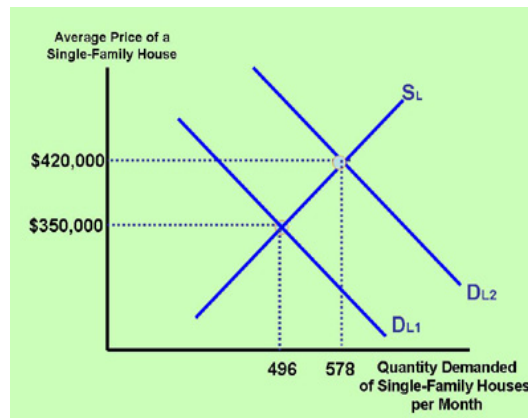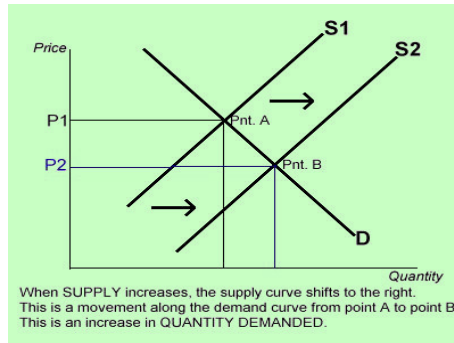
2.12 Consumer Surplus and Producer Surplus

Producer surplus happens when the price changed by businesses is higher than the equilibrium (businesses are producing more than what consumers are buying). Consumer surplus happens when businesses charge at the equilibrium price, but consumers are willing to pay above the equilibrium price since they value the item a lot.

2.12.1 Consumer Surplus

The difference between how much consumers value a product and how much they actually pay for it at the equilibrium price is called *consumer surplus*. Figure 12 below shows the area which consumer surplus lies.

2.12.2 Producer Surplus

Producer surplus is similar to consumer surplus, but it measures the benefits of a trade for producers. *Producer surplus* is the difference between the minimum price at which producers would have been willing to produce the product and how much they are actually receiving at equilibrium. Figure 13 below shows the area which producer surplus lies.
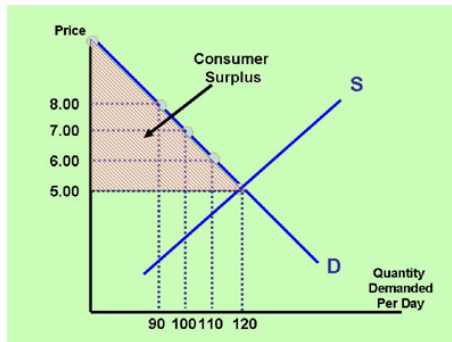
Figure 12: Red area indicates where consumer surplus lies.
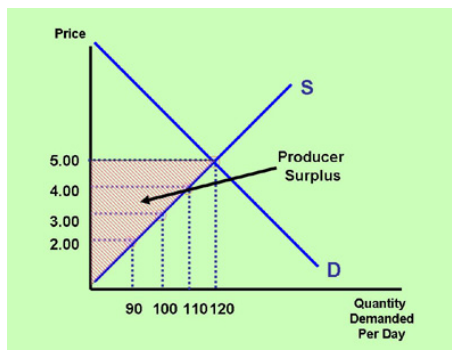
Figure 13: Red area indicates where producer surplus lies.

3 Unit 3: Elasticity

Elasticity is how much the price of a good fluctuates depending on decrease in demand. If the price of a product increases and the amount demanded decreases by a lot, then the product is *elastic*. If it decreases by a little, or not at all, then the product is *inelastic*.

3.1 Demand Curves and Elasticity

3.1.1 Price Elasticity of Demand

Price elasticity of demand measures the responsiveness of buyers to a price change. In other words, it measures the relationship between the percentage change in the amount of purchased and the percentage change in the price.

3.1.2 Derivation of a Demand Curve

The type of data that economist use to estimate the shape and location of a product's demand curve are:

1. **Historical Data**

   Price and quantity data show how consumers have responded to past changes in the price and quantity demand of the product. Price and quantity demand changes must be looked at in isolation of other variables. **It is important to estimate the price and quantity demand changes assuming other variables remain constant (ceteris paribus).**

2. **Surveys**

   If you ask customers their input on how they would respond to a future change in the price of the product, you may not get accurate data, but it will allow economist to estimate the location and slope of a demand curve. When you know the location and slope of a product's demand curve, you can determine its *price elasticity of demand.*

3.1.3 Formula for Price Elasticity of Demand

The law of demand states that as the price of a product decreases, quantity demand increases, and vice-versa. Elasticity measures **how much** less people buy of that product when the prices rises, and vice-versa. Price elasticity of demand is determine by looking at the ratio of:

e = The percentage change in quantity demand divided by the percentage change in the price of the product.

or

$$e = \frac{\text{\% change in Q}}{\text{\% change in P}}$$

where:

1. **The % change in Q** $= \frac{\text{change in quantity demanded}}{\text{average of the two quantities in demand}}$
2. **The % change in P** $= \frac{\text{change in price}}{\text{average of the two prices}}$

The formula above is called the "arc" formula. It is the most accurate and most commonly used in economics.

3.2 Elasticity and the Slope of the Demand Curve

3.2.1 Demand Curves and Elasticity

Elasticity affects the slope of a product's demand curve. A greater slope, the steeper the demand curve is and a less-elastic product. Figure 14 below is a visualization of what each line means in terms of elasticity.
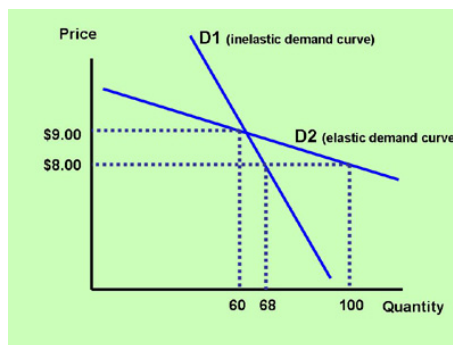

Figure 14: In line D1, you can see when the cost goes down from $9 to $8, the demand only slightly increases (from 60 to 68), while the line D2–when the cost goes down from $9 to $8, the demand increases a lot more (from 60 to 100). These are the effects of slope and elasticity.

3.2.2 Perfect Elasticity and Perfect Inelasticity

Perfect elasticity is when a product can only be set at one price. If the price change then the quantity demand changes to zero.

Perfect inelasticity is when a product can only be bought at one quantity size, no matter the price of the product.

Figure 15 below is a graph of both perfect elasticity and perfect inelasticity.

3.3 Determinants of Price Elasticity of Demand

3.3.1 Elasticity Determinants

Some products are elastic (buyers are price sensitive), and some products are inelastic (buyers are not price sensitive). For some products (cars vs salt), price elasticity of demand can make a huge impact for the buyer (10% increase in a car's value has more impact than 10% increase in the value of salt.)

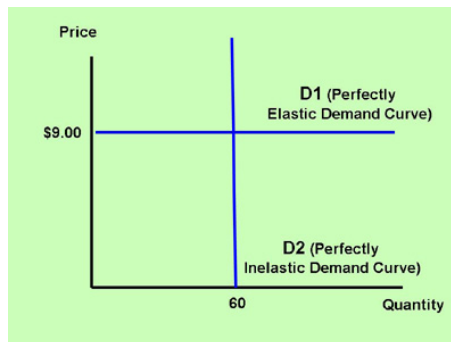There are three determinants of price elasticity of demand:

Figure 15: Example of both perfect elasticity and inelasticity

1. **The availability of close substitutes**

   If there are a lot of close substitutes available, then people will react strongly to price increases. Price elasticity of demand is high.

2. **The importance of the product's cost in one's budget**

   If a product is inexpensive to a consumer's budget, then increases in price will not matter that much. Mostly everyone has a budget for salt, so a 10% increase will not impact the consumer as much. But if the consumer wants to purchase a car (clearly, a car is not on a consumer's usual budget), a 10% will matter a lot more.

3. **The period of time under consideration**

   Price elasticity of demand is greater the longer it takes for a product to increase its price. This gives consumers more time to adjust to increasing prices whereas if it is an immediate jump in price, it will cause more issues for consumers.

   For example, if the price of gas increases immediately, car owners may not decrease the mileage they drive in the first week, but after a couple of years, they may buy a more fuel-efficient car, move closer to school/work, etc.

3.3.2 Elasticity and the Effect of a Tax Change on the Price of the Product

How much equilibrium price of a product will increase with taxes depends on the product's elasticity. The demand curve slope can help determine the price of the products after a new tax is imposed. Figure 16 below are two graphs to show the difference in prices with different slopes.
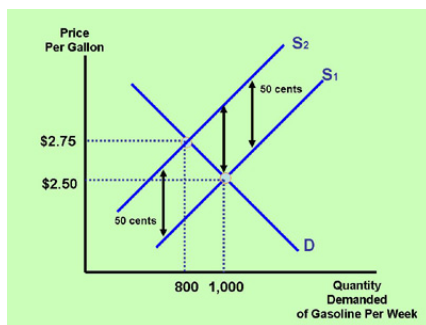
(a) With higher elasticity, you will get lower price change (less steep slope).
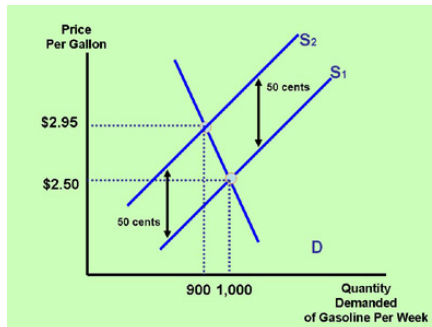
(b) With lower elasticity, you will get a higher price change (steeper slope).

Figure 16: Side-by-side comparison visualizing a 50¢ tax increase with two different elasticity slopes.

In general, for less-elastic products (steeper demand curves), the burden of the tax is mostly on the consumer. For more-elastic products, the burden of the tax is mostly on the suppliers.

3.4   Elasticity and Total Revenue

3.4.1   Definition of Elastic, Inelastic, and Unit Elastic Demand

By definition:

A product is elastic when its elasticity is greater than 1.

> When a product is elastic and its price changes, the percentage change in quantity demanded is greater than the percentage change in the price.
>
> As an example, if buyers purchase 20% fewer products as a result of a 10% price increase, then the product is elastic.

A product is inelastic when its elasticity is less than 1.

> The numerator (percentage change in quantity demanded) of the elasticity formula is less than the denominator (percentage change in price).
>
> As an example, if buyers purchase 6% fewer products as a result of a 15% increase, then the product is inelastic.

A product is unit elastic when its elasticity is equal to 1.

> If a product's price rises by 8% and its quantity demanded decreases by 8%, then the product is unit elastic.

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3.4.2 Elasticity and Revenue

A businesses total revenue is equal to the number of products it sells times the price of the product, therefore:

Total Revenue = Price times Quantity

or

$$TR = P \times Q$$

If a product is *elastic*, the percentage change in the quantity demanded change is greater than the percentage change in the price. Therefore, for an elastic product, if the price increases, the percentage change in the quantity demanded decreases by a greater amount, and the firm's revenue will decrease, and vice-versa.

if a product is *inelastic*, the percentage change in the quantity demanded change is smaller than the percentage change in the price. Therefore, for an inelastic product, if the price increases, the percentage change in the quantity demanded decreases by a smaller amount, and the firm's revenue will increase, and vice-versa.

In summary:

When a product is elastic and its price falls, total revenue increases.

When a product is elastic and its price rises, total revenue decreases.

When a product is inelastic and its price rises, total revenue increases.

When a product is inelastic and its price falls, total revenue decreases.

When a product is unit elastic and its price changes, total revenue remains constant.

3.5 Income Elasticity of Demand, Cross Price Elasticity of Demand, and Price Elasticity of Supply

3.5.1 Income Elasticity of Demand

Income elasticity of Demand measures the percentage change in a buyer's purchase of a product as a result of a percentage change in their income. Income elasticity is:

$$e_i = \frac{\textbf{percentage change in demand}}{\textbf{percentage change in income}}$$

or

$$e_i = \frac{\text{(change in demand / average demand)}}{\text{(change in income / average income)}}$$

If the income elasticity demand is *positive*, that means the buyer is purchasing a normal good with their increased income. If the income elasticity *demand* is negative, that means the buyer is purchasing an inferior good, therefore the buyer can afford more expensive goods if they decide to purchase fewer of the inferior goods (the numbers we used to calculate the income elasticity).

3.5.2 Cross Price Elasticity of Demand

Cross price elasticity of demand can measure the price change of one product's affect on the demand for another substitute product (i.e apples and oranges).

The formula for the cross price elasticity of demand for product A relative to a price change in product B is:

$$e_{cp} = \frac{\text{percentage change in the demand for product A}}{\text{percentage change in the price os subsituute prodcut B}}$$

or

$$e_{cp} = \frac{\text{(change in the quantities of product A / average of the quantites of product A)}}{\text{(change in price of product B / average of product B prices)}}$$

3.5.3 Price Elasticity of Supply

Price elasticity of supply measures the percentage change in the quantity supplied by produces divided by the percentage change in the price of the product.

4 Unit 4: Business Production Behavior

4.1 Factors of Production

There are three factors of production (inputs):

1. **Land.**

   Land includes land and other natural, non-man-made materials, such as raw materials, energy sources, and trees. The payment for the use of land is called "rent" in economics.

2. **Labor.**

   Labor includes all forms of human productive effort, from blue collar (manual labor) to white collar (office and management work) to entrepreneurial activities (organizing resources, coming up with ideas, taking risks) to professional athletes and celebrities. Rewards for non-entrepreneurial labor are called wages, salaries, bonuses, or commissions. Entrepreneurs earn "profits".

3. **Capital Goods.**

   Capital goods represent the man-made machines, equipment, buildings, and other tools used to produce products. When the term "capital" is used by itself, we refer money used to finance the purchase of capital goods. When businesses borrow money to purchase goods, they pay "interest" to the lenders.

4.1.1 Factor Prices

Factor prices are the payments for land, labor, and capital goods. They include:

1. **Wages:** Payments and rewards for (the price of) non-entrepreneurial labor.

2. **Rent:** Payment and reward for the use of land.

3. **Interest:** Payment and reward for capital (money) used to purchase capital goods.

4. **Profits:** Payments and rewards for entrepreneurial efforts.

4.1.2 Factor Prices in the Free Market

Without government involvement, prices of labor and land are determined by the supply and demand of the factors of products provided above. If demand for land increases (ceteris paribus), then the price of land increases, and vice-versa. If demand for a particular type of labor increases, then the price of the labor (wage) increases, and vice-versa. Figure 17 shows the supply and demand lines that are presented in a free market.
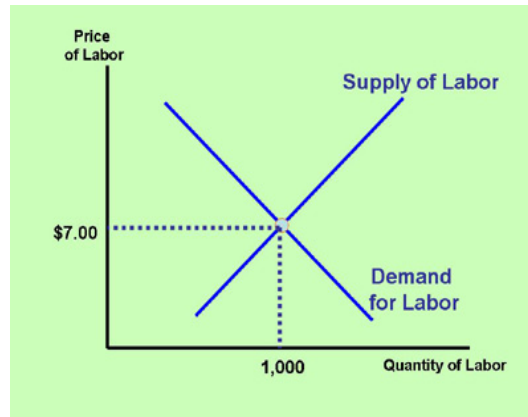
Figure 17: Increase in demand for labor is illustrated by a rightwards shift would increase the equilibrium prince, and vice-versa.

4.1.3   Government Price-Setting

Free market economies lead to the most economically efficient allocations of resources. When governments set a price above or below the free market equilibrium, then a surplus or shortage of goods will occur. In a free market, this is avoided since producers surplus at their highest levels (that consumers will buy). Typically, governments have good social intentions when setting certain prices on products; while this may help specific groups in the short-term, there will be a backfire in economic efficiency in the long-run.

Since free markets provide more incentive to produce as efficiently as possible, the profits may motivate businesses to increase productivity. With greater productivity, there are more jobs, higher real wages, better products, and a higher standard of living in the long run.

4.2   Production Functions and the Law of Diminishing Marginal Production

4.2.1   Production Function

A production function is a relationship between inputs (factors of production) and outputs (products). Illustrates how many workers and machines it might take to produce goods.

4.2.2   Short Run vs Long Run

Short run is a time period during which a business cannot vary one or more factors of production. At least one input is fixed.

long run is a time period during which the firm has the flexibility to change all inputs. They can buy bigger machines, hire more workers, expand buildings.

The length of each run is dependent on the company at hand. A software company will have a shorter length of runs vs a factors.

4.2.3   Fixed and Variable Inputs

Fixed inputs remain constant in the short run, even as production decreases/increases. Examples of fixed inputs are land, heavy machinery, buildings, and workers on long-term contracts.
Variable inputs can be varied in the short run; as in, they can increase/decrease as production increases/decreases. Examples of variable inputs are hourly and part-time labor, office supplies, energy, and raw materials.

4.2.4   Total, Average, and Marginal Production

Marginal production of labor is how much one additional worker adds to the total production.
Average production of labor is the production per worker.
Total production is how much production of a good is created.

Below in Figure 18 a table of a hypothetical car manufacturer's production schedule during a short-run period of time. We assume that the firm has fixed and variable inputs.

Number of Workers	Amount of Land in Acres	Number of Machines	Total Production of Cars	Average Production of Labor	Marginal Production of Labor
0	2	5	0	–	–
1	2	5	3	3	3
2	2	5	7	3.50	4
3	2	5	15	5	8
4	2	5	19	4.75	4
5	2	5	22	4.40	3
6	2	5	23	3.83	1

Figure 18: Example of how marginal and average production of labor affect production levels.

4.2.5 Law of Diminishing Marginal Production

The law of diminishing marginal production states that when a firm uses a variable input, such as labor, the additional productivity of workers who are hired at a later stage is less than the additional productivity of workers who were hired first.

Looking at Figure 18 above, the first three workers hired, worker 1, 2, and 3 have a production level of 3, 4, and 8 respectivly. However, looking at workers 4, 5, and 6, they have decreasing prodution levels of 4, 3, and 1. This is an example of the diminishing marginal production.

The first three workers (variable inputs) have more production because they have more resources to use from the land and machines (fixed inputs). They can become more 'specialized.'

Once the firm starts to hire workers 4, 5, and 6, those workes (variable inputs) have less access to office space, machinery, etc. (fixed inputs), therefore, they will have less production compared to the first three workers.

Since the diminishing marginal production occurs when there are fixed inputs, this means the diminishing marginal prodcution law only occurs in short runs, and are non-existent in long runs (since in long runs, every input can be changed).

In long runs, average and marginal production can decrease, but for different reasons. A company can grow too large and bureaucratic and lose efficency. When this happens,the business expereineces "decreasing returns to sales" and "diseconomies of scale."

4.2.6 Total, Marginal, and Average Production Graphs

The graphs below (Figure 19 the three different graphs for total production, marginal production, and average production.

In order to calculate the marginal production of labor value, you will have to divide the change in total production by the change in the number of workers.
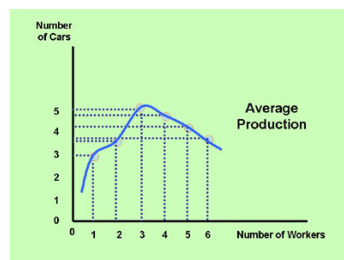
In Figure 18, to find the marginal production at a level of 3 workers, you will perform the following:

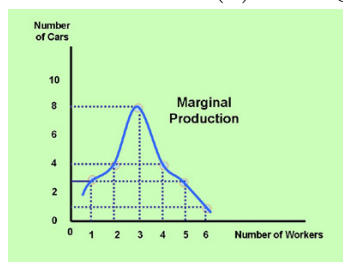Marginal Production Labor $= \frac{15-7}{3-2}$

Which equates to 8 (which is already given in the table, assuming the value was missing).
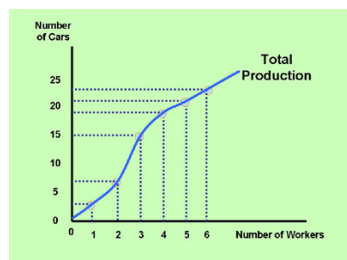
(a) Total Production

(b) Average Production

(c) Marginal Production

Figure 19: A compilation of Total, Average, and Marginal Production Graphs.