

Notes for ECON 25100 - Microeconomics

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These are lecture notes for spring 2024 ECON 25100 at Purdue as taught by Professor Abigail Banan. Modify, use, and distribute as you please.

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Course Introduction

This course offers a comprehensive exploration of the principles that govern individual economic decision-making and the interactions within markets.

Introduction to Economic Principles

This section will briefly define several important terms, topics, and principles relevant to the rest of this class.

Economics is the study of allocation of scarce resources to meet the unlimited human wants.

- Microeconomics: decision-making by individual economic agents such as firms and consumers.
- Macroeconomics: aggregate performance of the entire economic system.
- Empirical economics: facts to present a description of economic activity.
- Economic theory: relies upon principles to analyze behavior of economic agents.

Economy has slowly transitioned from mainly theoretical to mainly empirical.

Assumptions are made consistently, to more rigorously create a methodology to analyze the world without overly complicating things.

Model building is the creation of abstractions from reality.

Occam's razor: The best model is that which describes reality and is the simplest.

"Ceteris Paribus": All other things equal. (changing only certain parameters and leaving everything else the same)

The lack of assumptions would make things either too simple or too complicated to viably describe reality.

Economics provides a method to make a rational choice.

Rigorous models are made to predict human behavior through either inductive logic, or deductive logic.

There are two kinds of economics:

- Positive Economics: concerned with reality.
- Normative economics: concerned with what should be. (If a statement has "should" it's probably normative).

The economic problem involves the allocation of resources among competing wants.

This exists due to scarcity.

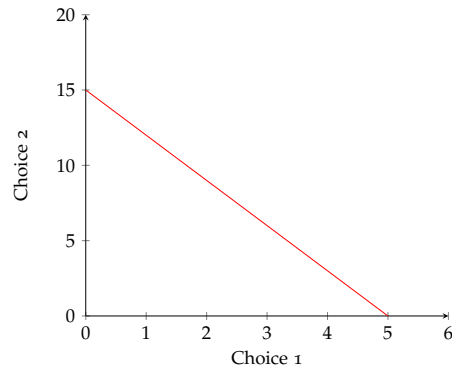
Scarcity exists because of unlimited human wants and limited resources.

Economic Resources:

- Land - space, natural resources.
- Capital - physical assets like factories or tractors.
- Labor - skills, abilities, knowledge, etc.
- Entrepreneurial talent - the economic agent who creates the enterprise.
- Technology - a manner in which resources are combined to produce commodities (methods of making processes more efficient).

Core Principles of Economics:

- **Cost-Benefit Principle:** cost and benefits are the incentives. Do something if the benefits outweigh the costs. (Convert everything to money, and then calculate).
The cost-benefit principle is directly related to the willingness to pay, which is precisely, the conversion of benefits to money.
If the benefit is greater than the cost, one has achieved an economic surplus. This principle aims to maximize the economic surplus. It also relates to framing effects, which is when a decision is affected by the method in which the situation or object is framed.
- **Opportunity Cost Principle:** The allocation of resources implies decisions and choices. For every choice we make, there are other choices we do not, and the next best alternative has a cost, which is known as the opportunity cost.
This principle focuses on the trade-offs of particular options. The opportunity cost is not the sum of all lost options, only the next best one.
All choices involve trade-offs due to scarcity. The usage of resources on one choice limits the amount available for other choices.
Note: a sunk cost is a cost that cannot be recouped, and should be ignored. They should not be included into the current decision.
As a subtopic of Opportunity Cost Principle is the Production Possibilities Frontier, which analyzes the different set of attainable gains based on different allocations. Under the assumption that the costs and benefits are constant, the graph will look something like this:



Any allocation of time below the PPF is an inefficient use of resources.

Points above it are unreachable unless new productivity increase methods are found.

- **Marginal Principle:** Decisions about quantities are best made incrementally. Instead of analyzing how many, one should analyze whether smaller increases are viable and reasonable.

Marginal Benefit: Benefit on an extra unit.

Marginal Cost: Cost of an extra unit.

While the marginal benefit of an additional unit exceeds its costs, it should be acquired.

Anything that asks how many can be analyzed marginally.

Economic surplus is maximized when the marginal cost equals the marginal benefit.

- **Interdependence Principle:** Your best choice depends on your other choices, the choices others make, development of markets, expectations of the future. When these factors change, the best choice might change as well.

Because you have limited resources, all the choices you make, affect others.

The choices made by other economic actors shape the choices available to you.

Changes in price and opportunities in one market affect your ability to make choices in others.

There is also a dependence through time, as choices you make now will have an effect on what you can do in the future.

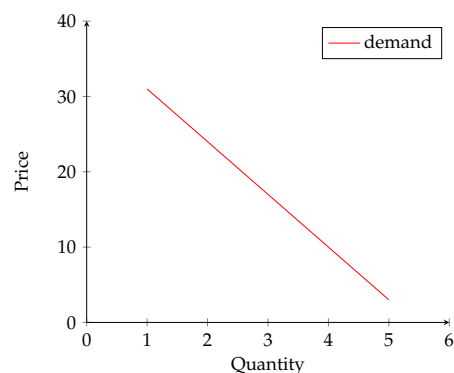
Demand & Supply

Demand

A demand curve is a function that shows the quantity demanded at different prices.

Quantity demanded is what buyers want to buy and are able to buy at the given price.

Demand refers to the entire curve, while quantity demanded is a point on the curve.



The Demand Schedule and Curve are the tabular and graphical representations of the supply and demand curve.

The Law of Demand states that a demand curve will have a negative slope.

Utility: the happiness from the consumption of goods.

Marginal Utility: the change in utility derived from the consumption of one more unit of the good.

The demand curves show the marginal benefit. Thus, the demand curve is also the marginal benefits curve.

Diminishing Marginal Utility: the utility derived from consuming one more good is less than the one before. This ends up in a lower willingness to pay for the additional unit.

IMPORTANT: Keep buying until price = marginal benefit.

A demand function is typically written as $Q_d = f(P)$, but we prefer to plot the inverse demand function $P = f^{-1}(Q_d)$.

The Market Demand shows the aggregate of all individual demand curves, which we were discussing prior to this. The change in price causes movement along the demand curve, as the change is endogenous (from inside the system).

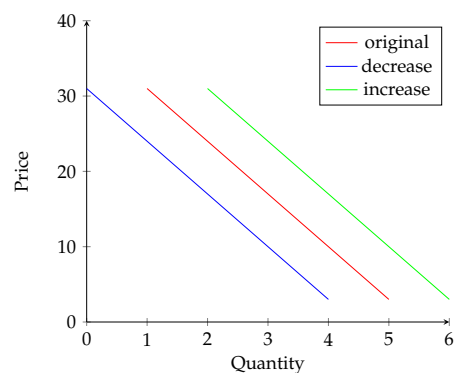
So, if the price increases, the quantity demanded will decrease.

However, the exogenous changes, caused the curve to shift:

- Population
- Expectations
- Seasons
- Tastes (fashion)
- Income:

- Normal Goods: good for which demand increases alongside increase of income.
- Inferior Goods: good for which demand decreases with income increases.
- Prices of related goods:
 - Substitutes-in-consumption: if two things can be replaced, the decrease in the price leads to the increase of the other.
 - Complements-in-consumption: if two things are used together, the increase in the price of one leads to a decrease in the demand of the other.

When external factors change, that is, not the price, the demand shifts as well.

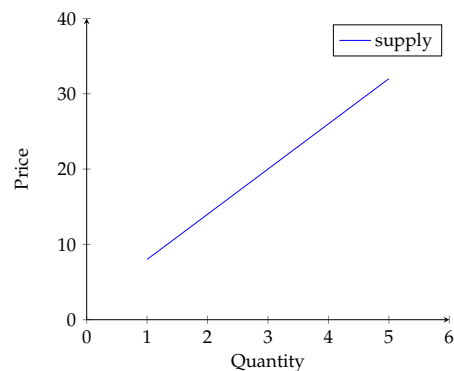


So, price changes quantity demanded, everything else shifts the demand, either positively or negatively.

Supply

The supply curve is a function that shows the quantity supplied at different prices. Quantity supplied is the amount that suppliers are willing and able to supply at a price.

NOTE: supply is the curve, quantity supplied is a point.



The supply curve, unlike the demand curve has a positive slope.

More price means more supply.

The marginal cost for selling one more unit is the focus of this curve.

The opportunity cost from producing the additional good minus the additional production costs.

Variable costs are costs that vary with quantity, while fixed remain constant.

NOTE: the supply curve is also your marginal cost curve.

Marginal product is the increase in output from an additional labor unit.

It diminishes with each additional labor unit. It can occur when some of your inputs are fixed.

Marginal costs of production rise, which causes the positive slope of the supply curve.

More input costs lead to rising marginal costs, as the production requirements increase.

The marginal benefit is the gain from the additional unit.

As price increases, producers will be more willing to produce more.

Once again, continue producing until $MC = MB$, or until price and marginal costs are equal.

The supply function is $Q_s = f(P)$, but the plot is the inverse, $P = f^{-1}(Q)$.

Individual Supply shows a firm's willingness to produce and sell at different prices. Market supply is the sum of all individual price curves.

The market one is in influences the decisions made. The supply depends on the market price. This class will start by analyzing a perfectly competitive market, in which everyone sells the exact same product, and there are many suppliers and buyers.

This does not usually exist in real life, which would cause sellers to not be price-takers.

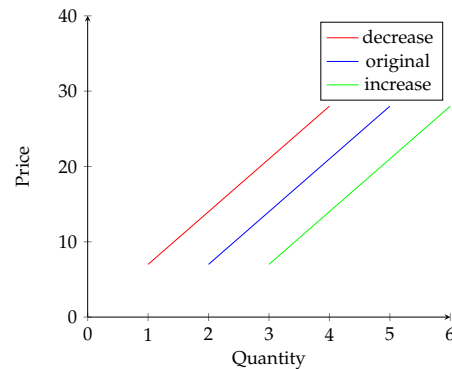
A change in price causes movement along the supply curve, changing quantity supplied.

Supply curves are shifted by

- Input Prices
- Productivity and Technology
- Prices of related items:
 - Substitutes-in-production: Alternate use of resources, goods that can be made with the same resources.
 - Complements-in-production: Goods made together, like byproducts, or scrap usage.

- Expectation of the future
- Type and number of sellers

A supply shift looks like the following:



Markets and Equilibrium

Markets are organized by what is produced, who produces it, how they are produced, and who gets the product. There are two kinds of economies:

- Planned economies: These decisions are made by a central power
- Market economies: Each person makes their own decisions

A market is what connects buyer and sellers through goods or services.

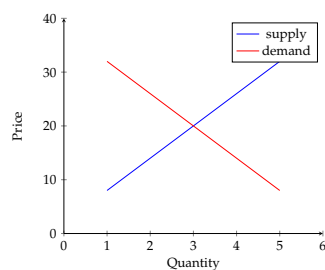
They can be places or websites. There are several types, such as monopolies, oligopolies, etc.

Equilibrium is the point at which the market ceases to change. It is when quantity supplied and quantity demanded are equal. This defines equilibrium quantity as the quantity demanded in equilibrium and the equilibrium price as the price of a product at equilibrium.

Every seller finds a buyer, and every buyer finds a seller. The balance created by this allows there to be no changes.

There is no shortage or surplus, which are $Q. \text{demanded} > Q. \text{supplied}$ and the opposite respectively.

This looks like the following when represented graphically:



The system of equations to solve is:

$$Q_d = -a_1P + c_1$$

$$Q_s = a_2P - c_2$$

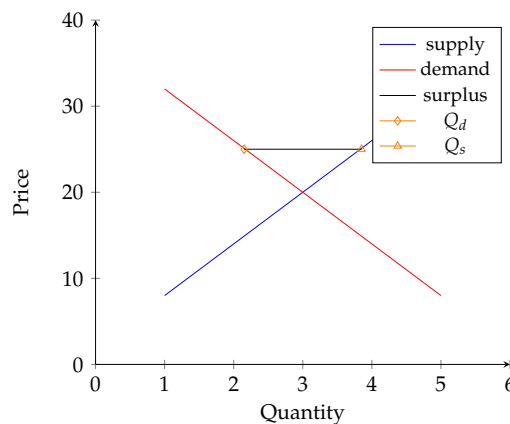
$$Q_s = Q_d$$

Where the searched for, and relevant variables are P and Q (not Q_s and Q_d separately, as they are equal).

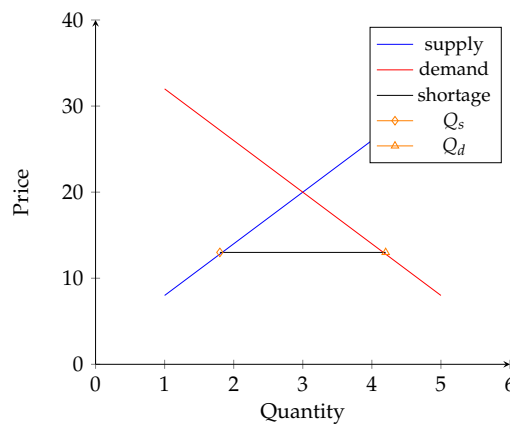
If the market is not in equilibrium, that is, it is in disequilibrium, which are marked by:

- Queuing: People trying to get stuff and not succeeding.
- Bundling of extras: promotions, 2 for 1, etc.
- Secondary Markets: people buying and reselling.

If market price $>$ equilibrium price, surplus will occur, and thus market forces will force the price to reach equilibrium. Surplus is $Q_s(P_H) - Q_d(P_H)$ with P_H being the high price.



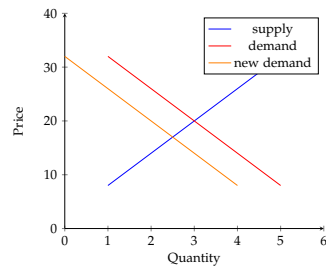
The shortage in a market is calculated by $Q_d - Q_s$ at a low price P_L . Which looks like this:



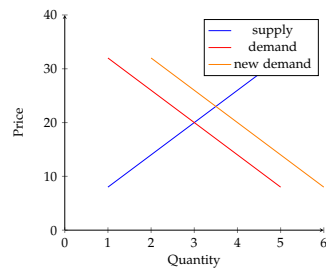
New Equilibrium

Equilibrium can vary with:

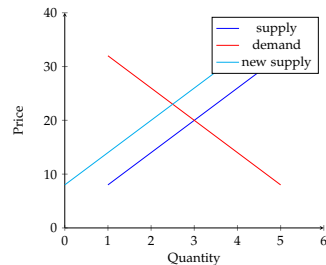
- Shifts in demand: if one of the demand shifters occurs, the demand curve will shift. This will cause the equilibrium to shift as well.
 - Decrease in demand: decrease in equilibrium price and a decrease in equilibrium quantity.



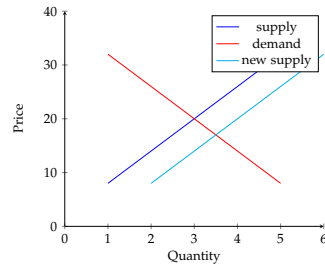
- Increase in demand: increase in equilibrium price and quantity.



- Shift in Supply: occurs when one of the supply shifters occurs. Once again, the market moves to a new equilibrium.
 - Decrease in Supply: increase in equilibrium price and decrease in quantity.

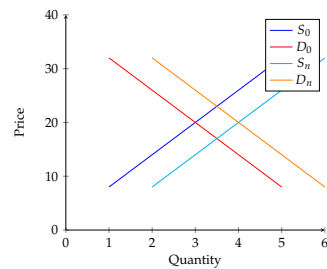


- Increase in Supply: decrease in equilibrium price and increase in quantity.

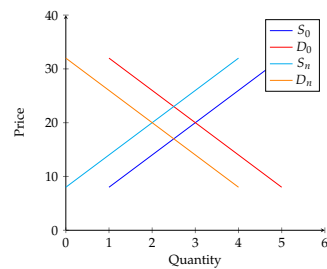


It is however, also possible for both demand and supply to shift. This may result in an ambiguous shift of equilibrium price and equilibrium quantity.

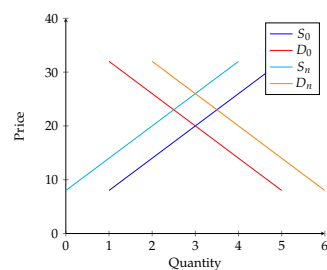
- Demand \uparrow , Supply \uparrow — equilibrium price: (?), but equilibrium quantity: (\uparrow)



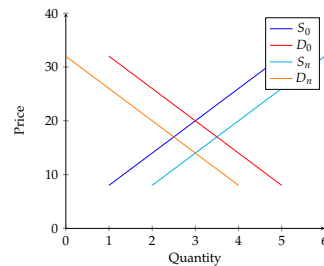
- Demand \downarrow , Supply \downarrow — equilibrium price: (?), but equilibrium quantity: (\downarrow)



- Demand \uparrow , Supply \downarrow — equilibrium price: (\uparrow), but equilibrium quantity: (?)



- Demand ↓, Supply ↑ — equilibrium price: (↓), but equilibrium quantity: (?)



Supply and demand can be used to predict and diagnose market outcomes.

All the previous analysis in this section leads to the following overall rules:

1. If price and quantity move in same direction, demand has shifted, but we don't know what has happened to the supply.
2. If price and quantity move in opposite directions, supply has shifted, but we don't know what has happened to the demand.

Elasticity

Elasticity is a measure of the responsiveness to the changes in other variables.

$$E_{x,y} = \frac{\% \Delta x}{\% \Delta y}$$

What is important about this are the sign and magnitude. It is positive if when y increases, x increases as well. The relationship is negative if when y increases, x decreases.

$|E_{x,y} > 1| \implies x$ is highly responsive to y , or the relationship is elastic

$|E_{x,y} < 1| \implies x$ is slightly responsive to y , or inelastic

$|E_{x,y} = 1| \implies x$ is proportionally responsive to y , or unitary elastic

- Price elasticity of demand: A measure of how responsive buyers are to price changes.

$$|\text{Price Elasticity of Demand}| = \frac{|\% \text{ change in quantity demanded}|}{|\% \text{ change in prices}|}$$

The negative value would mean nothing, as it is already predefined, and so, only the magnitude (or absolute value) is relevant.

There are a few other methods:

$$|E_D| = \left| \frac{100 * \frac{Q_2 - Q_1}{Q_1}}{100 * \frac{P_2 - P_1}{P_1}} \right|$$

which ignores direction, which is problematic, so you could use the midpoint formula method:

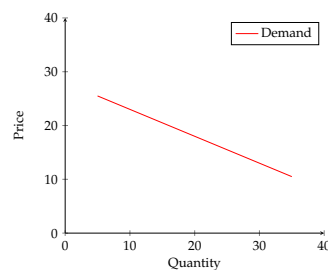
$$|E_D| = \left| \frac{100 * \frac{Q_2 - Q_1}{(Q_2 + Q_1)/2}}{100 * \frac{P_2 - P_1}{(P_2 + P_1)/2}} \right| = \left| \frac{Q_2 - Q_1}{(Q_2 + Q_1)} \frac{(P_2 + P_1)}{P_2 - P_1} \right|$$

Which is also referred to as "Arc Elasticity of Demand".

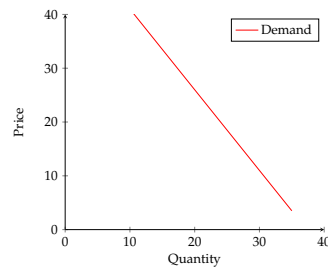
Perfectly Elastic demand has $E_D = \infty$. That is, you can change price as much as you want, and the demand will not change.

Perfectly Inelastic demand has $E_D = 0$ which means the demand will shoot to 0 for any price change.

An elastic curve would look like the following:



While an inelastic curve would look more like the following:

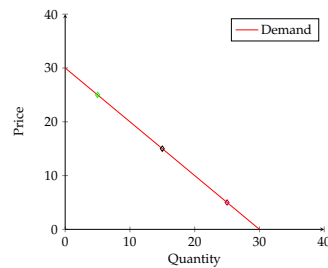


Different factors, such as

- Availability of substitutes
- Duration of purchase horizon, that is how much time there is to purchase the product
- Expenditure share of consumer budget, that is proportion of total income that the purchase will consume
- Necessity or Luxury?
- Products with lower search costs, that is how easy it is to come across the product
- Addiction

can affect the elasticity of demand.

The elasticity varies along the demand curve. At a higher price, the elasticity is higher, as the formula indicates.



At the green diamond, if we were to use the midpoint formula, the elasticity would be quite high, while at the purple diamond, it would be low. The black diamond, which is the midpoint of the curve, would be unitary elastic.

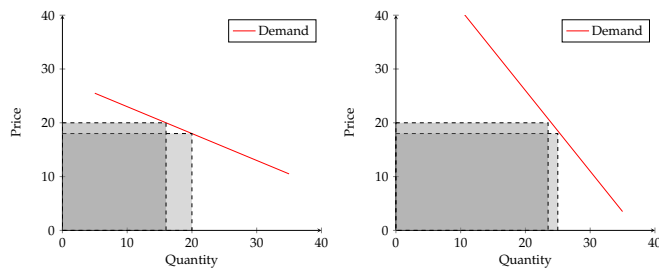
So, it would be unitary elastic at the point (Q, P) where $Q = \frac{y\text{-intercept}}{2}$ and $P = \frac{x\text{-intercept}}{2}$.

Total revenue is defined as $P * Q$.

A change in price leads to a change in quantity demanded, in the opposite direction.

The price of elasticity of demand tells us whether we should increase or decrease the price.

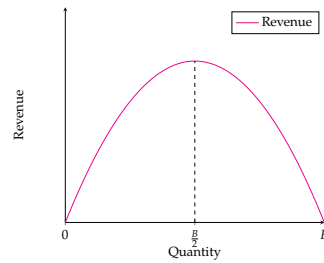
One should decrease the price if the demand is elastic. One should increase the price if the demand is elastic. This allows us to draw the following plots:



It can be seen that an increase in price in the first graph would lead to a larger decrease in quantity, causing the revenue to fall. In the other one, we can see that an increase in price would only slightly decrease the quantity demanded, which is an increase in the revenue.

Thus, we can conclude that the revenue also varies along the demand curve.

The revenue looks like this:



So, when the demand is unit elastic, the revenue is maximized.

- Cross-price elasticity: Measures how responsive the quantity demanded of one good is to the change in price of another good. It is defined by:

$$E_{CP} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price of the other good}} = \frac{\% \Delta Q_{D_B}}{\% \Delta P_A}$$

This time, there would be loss of information if we applied an absolute value.

If this value is

- < 0 : complements in consumption
- $= 0$: unrelated or independent
- > 0 : substitutes in consumption

- Income elasticity: Measures the responsiveness of demand in relation to change in income. It is defined by:

$$E_M = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}} = \frac{\% \Delta Q_D}{\% \Delta I}$$

This time as well, there would be loss of information if we applied an absolute value.

If this value is

- < 0 : inferior good
- > 0 : normal good

and if its magnitude is

- $0 < x < 1$: necessity
- > 1 : luxury

Note: this elasticity only tells us about inferior/normal or necessity/luxury, but it tells us nothing about substitute/complement.

- Price Elasticity of Supply: Measure of how responsive sellers are to price changes.

It is defined by:

$$E_{PS} = \frac{\% \text{change in quantity supplied}}{\% \text{change in price}} = \frac{\% \Delta Q_S}{\% \Delta P}$$

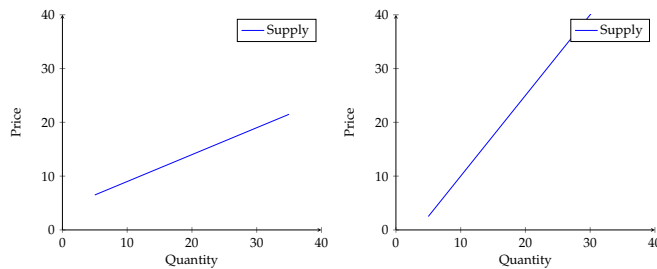
However, the midpoint formula also applies to this, which, to reiterate, was:

$$E_{PS} = \frac{\frac{Q_2 - Q_1}{Q_2 + Q_1}}{\frac{P_2 - P_1}{P_2 + P_1}}$$

Note how the absolute value is not applied in this case. This is because the supply elasticity will always be positive.

A perfectly elastic supply is horizontal, while perfectly inelastic is vertical.

The following are examples of elastic and inelastic demand respectively:



The factors that affect supply elasticity are the following:

- Storage ease
- Additional input availability
- The capacity to produce more
- Ease of market entry/exit
- Response time availability

Some other, less important elasticities are:

- Labor supply elasticity
- Advertising Elasticity (and cross-advertising elasticity)
- Crime elasticity

Intervening in Markets

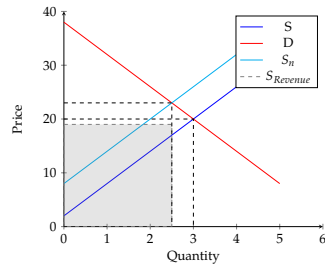
The government can influence the market through actions like taxes, regulations, subsidies, among others.

This does not, however, stop market forces, it just changes how much things benefit each of the parties in transactions.

Some taxes are:

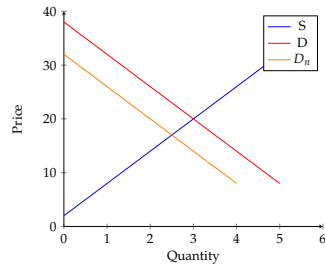
- Excise tax: tax on each unit sold, collected from supplier ← focus of the class
- Ad Valorem tax: percentage tax

A tax on sellers is seen as a rise in marginal cost of production. It causes a parallel shift of the supply curve:



It causes an increase in price and a reduction in quantity. It also reduces the amount that the seller keeps.

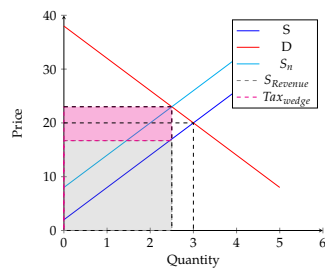
If the tax were instead on the buyer, the marginal benefit of the buyer reduces:



The posted price is what goes to the seller, and $paid - posted = tax$, which is what goes to the government.

To solve these systems, we need to get both price equations, and then add the tax to the price for whichever entity is receiving the tax.

Tax Wedge: $(Tax) \times (New \text{ Quantity in Market})$



Statutory Burden: Burden of being assigned to pay taxes

Economic Burden: Burden created by after-tax prices, on both buyer and seller

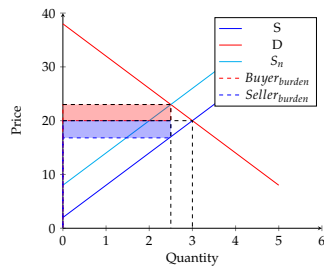
Tax incidence: Division of Economic Burden between buyer and seller

Tax incidence is independent of statutory burden. It can fall in some combination upon buyers and sellers. The policy alone is not enough to know the economic burden.

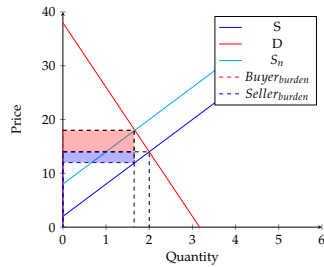
The market is what defines tax incidence, not the government. The elasticity of supply and demand curves determine who will pay more of the tax. The more inelastic the entities curve, the larger the portion of the tax borne by the entity.

So:

$$\text{Tax Revenue from Buyers} = \text{Tax Paid by buyers} \times \text{New Quantity} = (P_1 - P_0)Q_s$$



Let us look at a more extreme case:



Taxes on buyers also cause a leftward shift, however, this time it is on the demand curve.

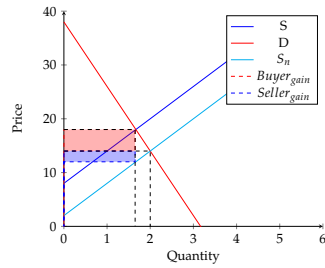
However, the burden on each entity is still the same, as the elasticity is what defines the tax incidence.

Tax Evaluation process:

- Which curve is shifting?
- Increase of decrease in taxes?
- Compare pre-tax and post-tax equilibrium
- Assess the elasticities of both supply and demand to find the tax incidence.

Subsidies

The same as taxes, but all effects go in reverse, so the curve shifts right. The curve looks like this:



Subsidies are seen as a decrease in marginal cost of production for sellers, and an increase in marginal benefit for buyers.

Once again, as seen in the graph above, the subsidy incidence is defined by the elasticity curve. The more inelastic, the more benefit.