

Supply, Demand, and Efficiency

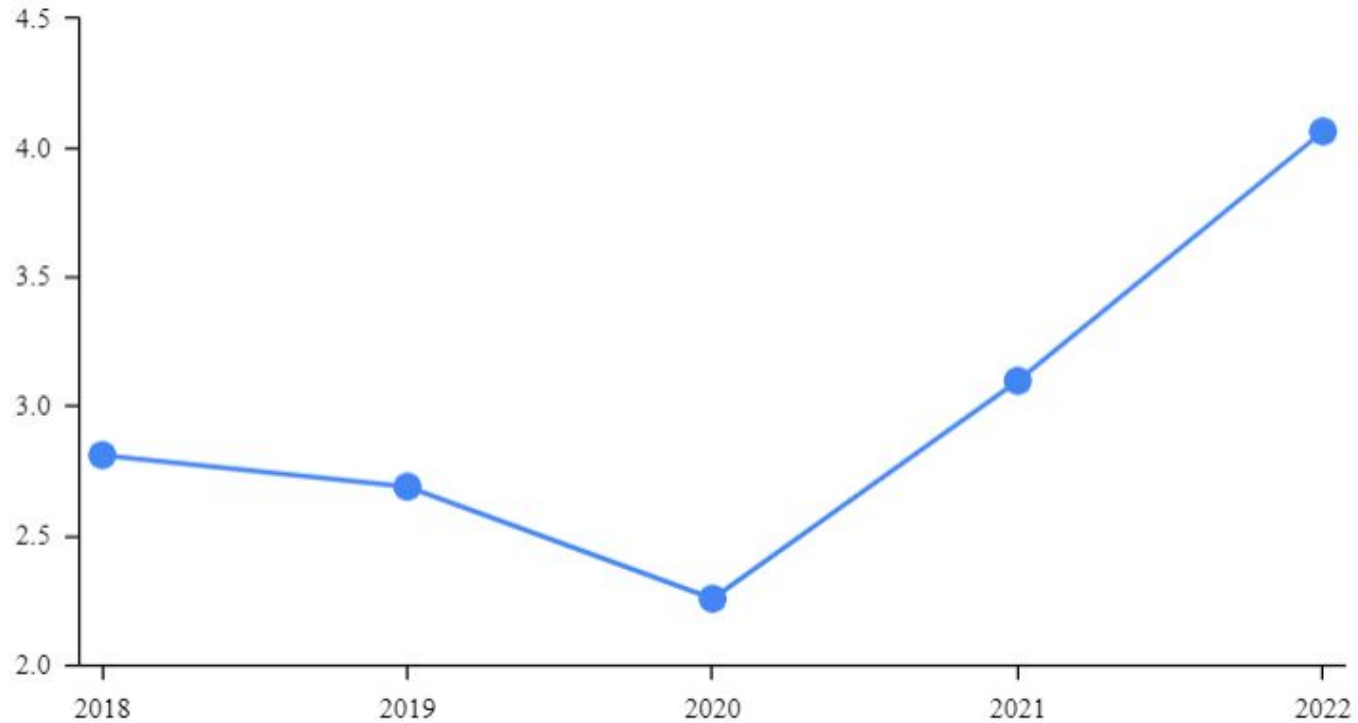
Fall 2023
Econ 2316, Northeastern University
Prof. Josh Abel

P&R: chapter 2 (especially 2.1-2.5 and 2.7)
Emerson: chapters 10 and 11

Supply and Demand Application: Gas Prices

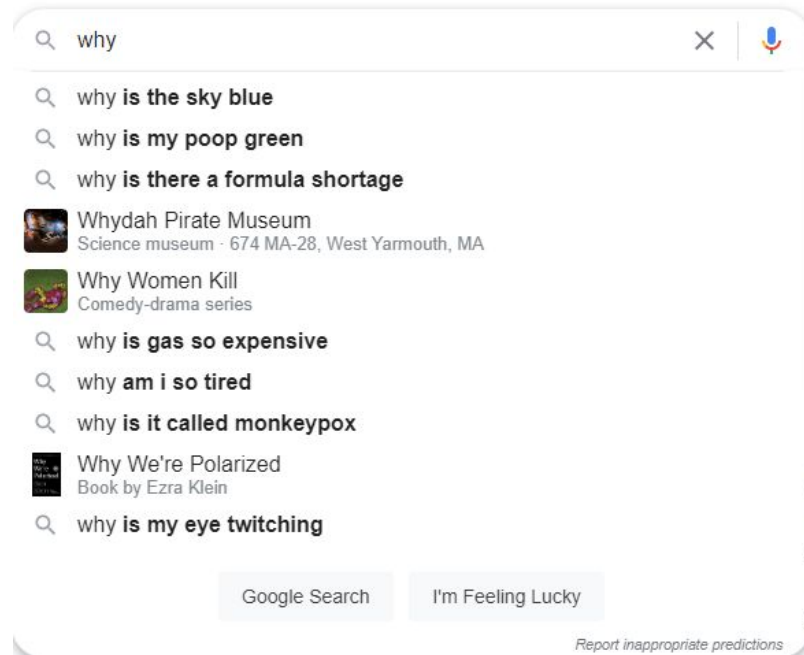
Retail gas prices

Retail Gas Prices (All Grades, Dollars per Gallon)

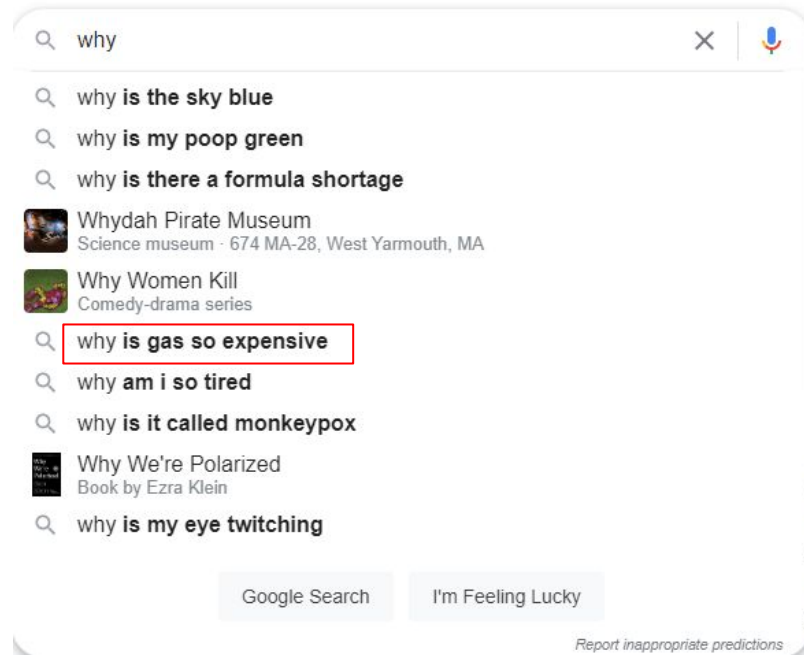


Source: U.S. Energy Information Administration

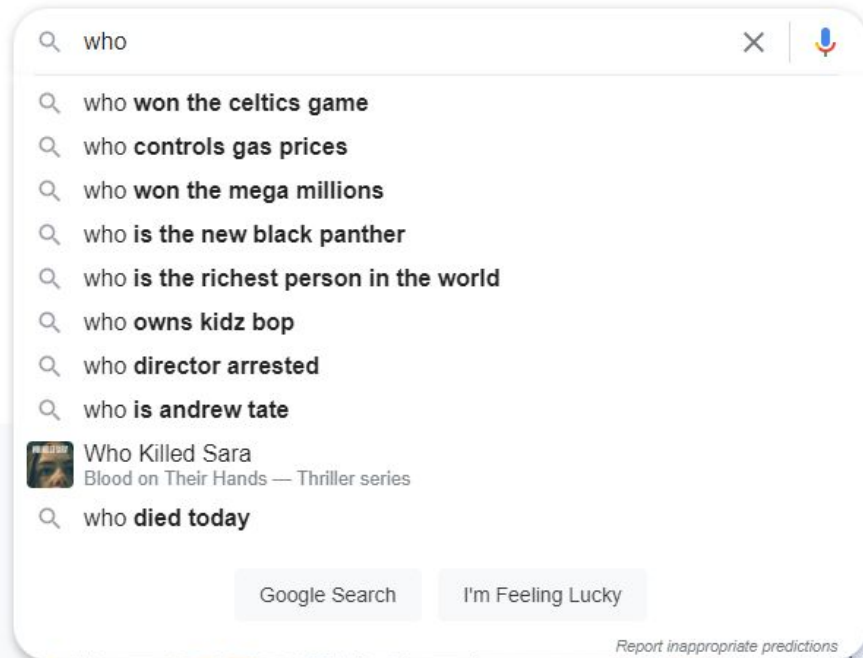
Gas prices matter a lot to a lot of people



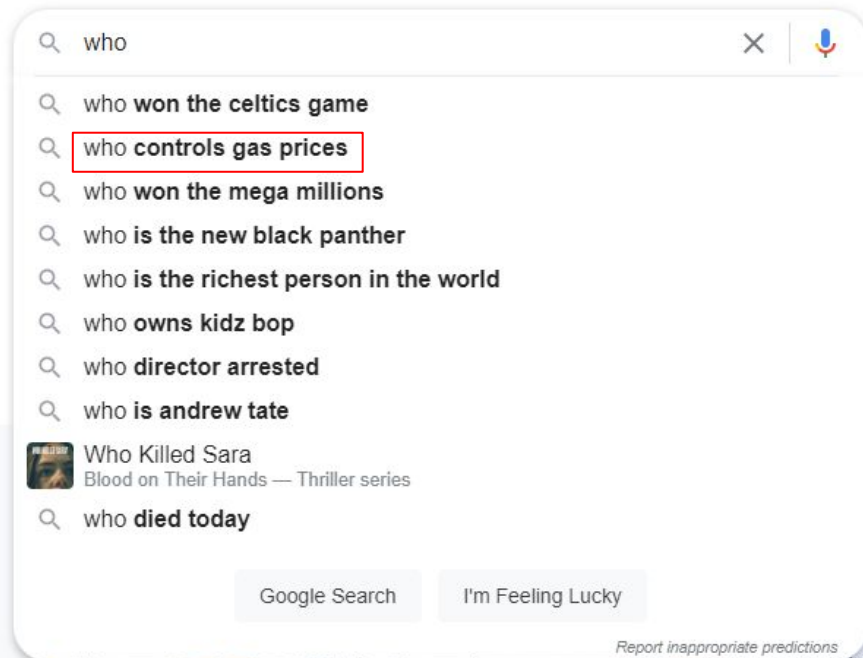
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r/AskReddit · Posted by u/ThisRedditorCares 5 months ago



[Serious] Who is to blame for the rising gas prices? America's president or Russia's president?

Serious Replies Only

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Big Oil, seeing and taking advantage of an opportunity. That's it, that's oil.



17



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BasalTripod9684 · 5 mo. ago

Neither, America is a free market economy. Biden couldn't interfere with prices if he wanted too. And Russia relies on selling its gas to keep its economy afloat.

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evilabed24 · 5 mo. ago

Personally think it's society at large's fault for not moving towards Electric vehicles

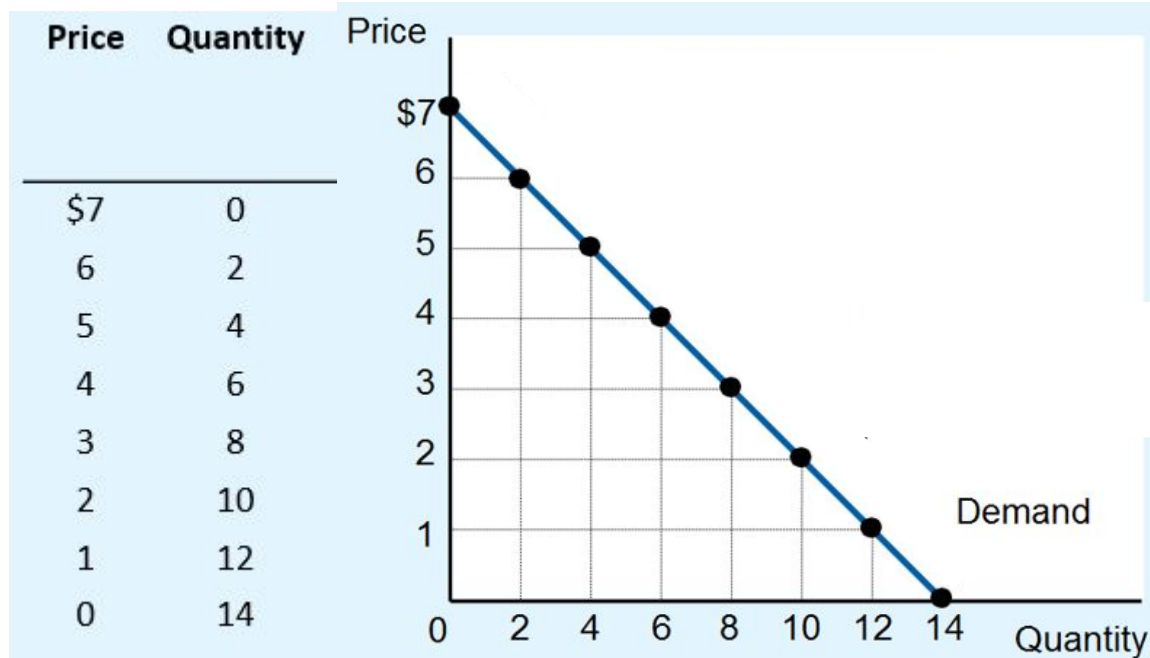
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Demand

- Demand for a good (e.g. quantity of gallons of gas) has many determinants:
 - Preferences
 - Do consumers have a lot of places to drive to?
 - Consumer income
 - Do consumers have a lot of money to spend?
 - Prices of related goods
 - Are there large highway tolls? How accessible is public transit?
 - Number of consumers in the market
 - *Price*
 - *What does it cost to obtain 1 gallon of gas?*

Demand Curve

- The Demand Curve is a visualization of demand
 - **Quantity** demanded as a function of **Price**
 - All other determinants are in the background



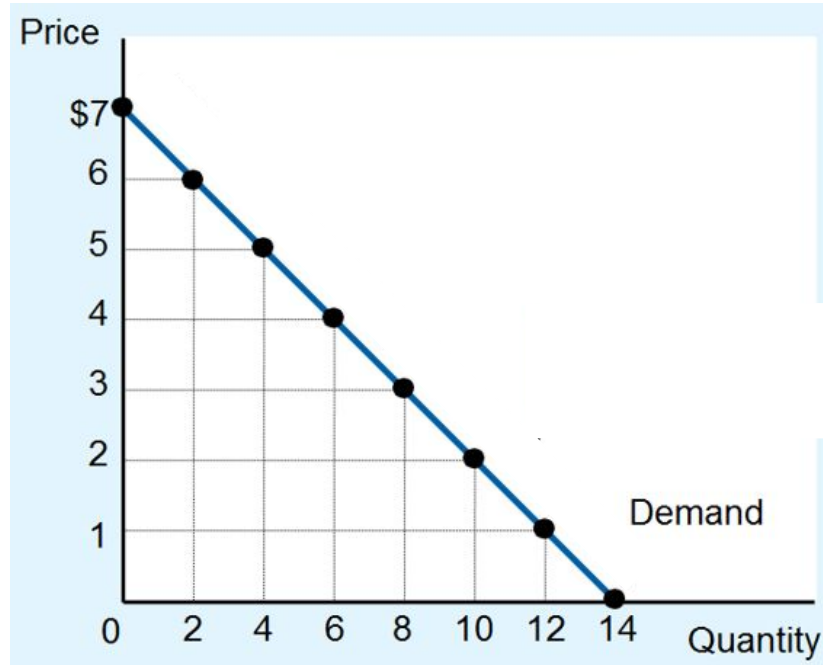
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- A change in price moves us along the Demand Curve



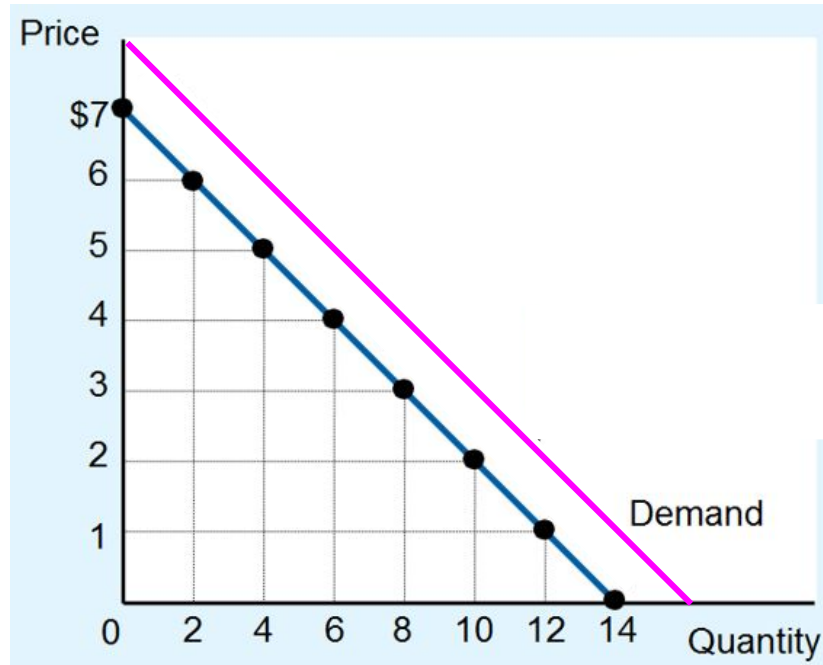
Shifts of the Demand Curve

- Changes in non-Price determinants of Demand (e.g. income rises) shift the Demand Curve



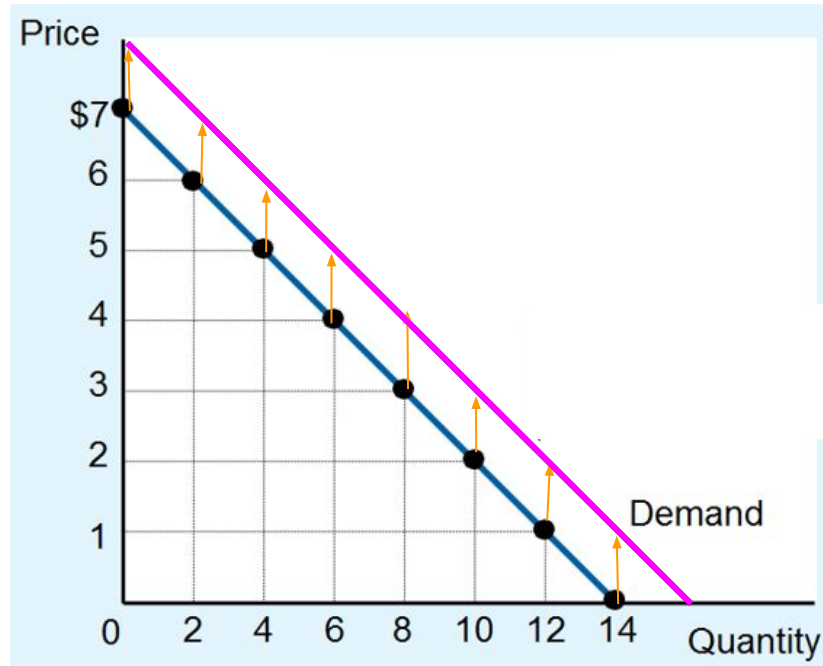
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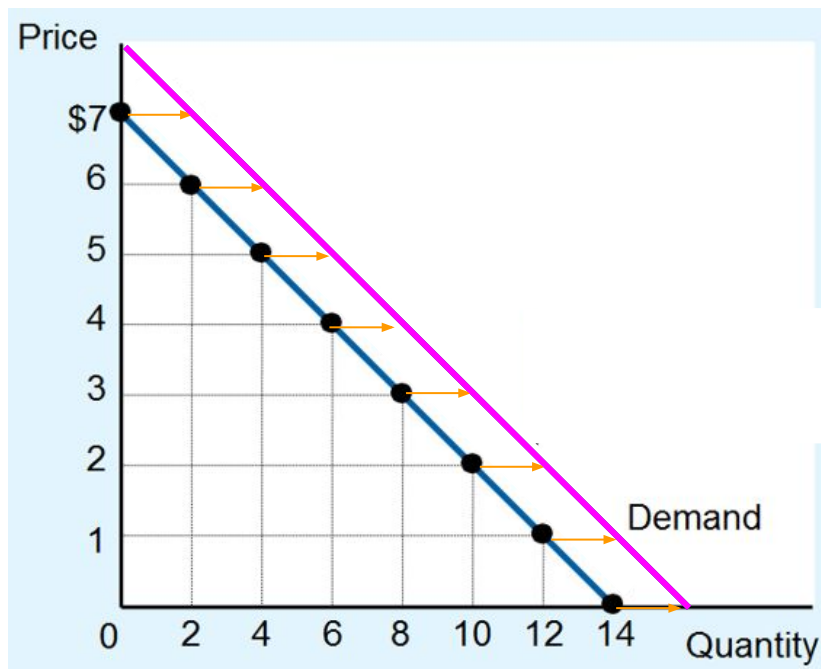
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- Changes in non-Price determinants of Demand (e.g. income rises) shift the Demand Curve
 - “I am richer, so I’m willing to pay more for a gallon of gasoline.”



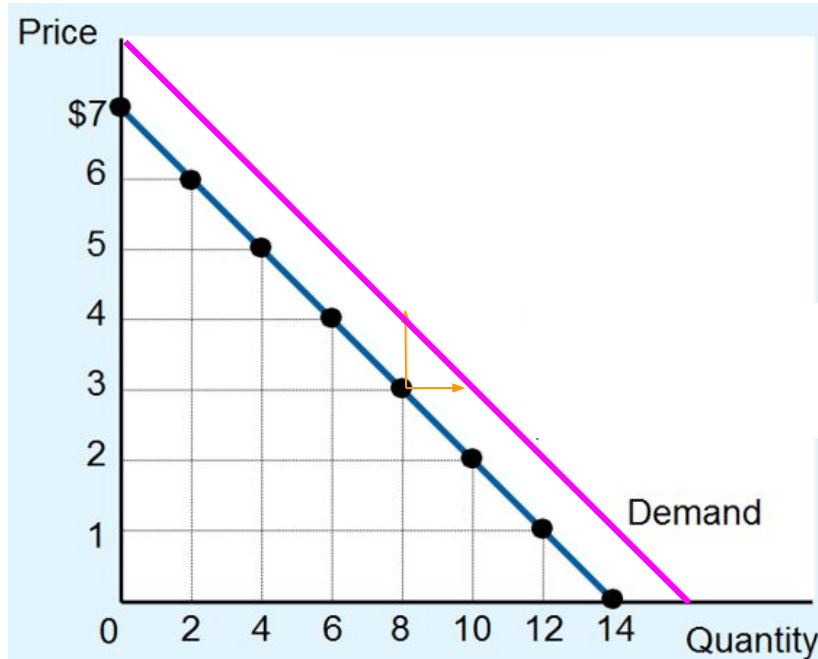
Shifts of the Demand Curve

- Changes in non-Price determinants of Demand (e.g. income rises) shift the Demand Curve
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 - “I am richer, so I’m willing to buy more gasoline at any given price.”



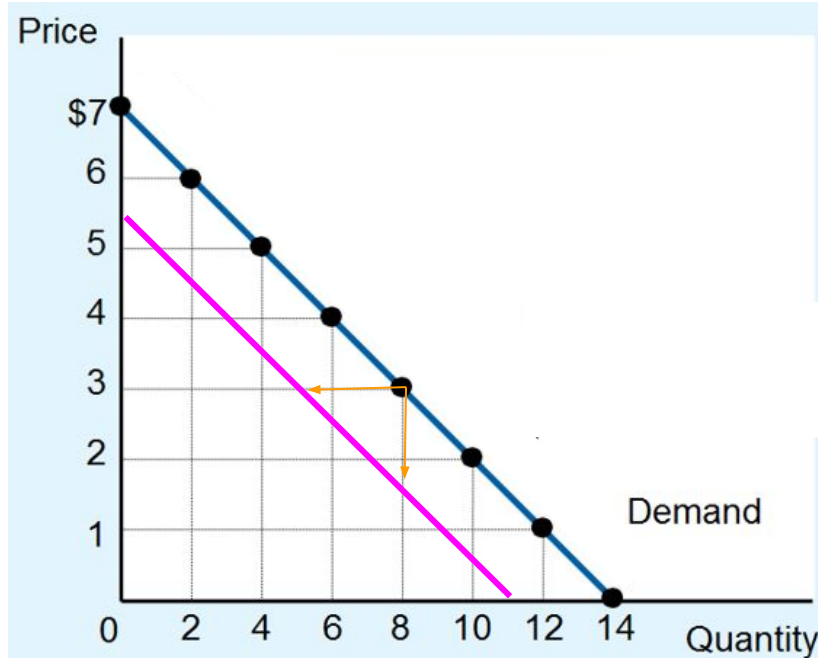
Complements and Substitutes

- An increase in public transit prices shifts the Demand Curve for cars up/right
 - Public transit is a Substitute for cars, and therefore gas



Complements and Substitutes

- An increase in public transit prices shifts the Demand Curve for cars up/right
 - Public transit is a Substitute for cars, and therefore gas
- An increase in car prices shifts the Demand Curve for gas down/left
 - Cars are a Complement for gas

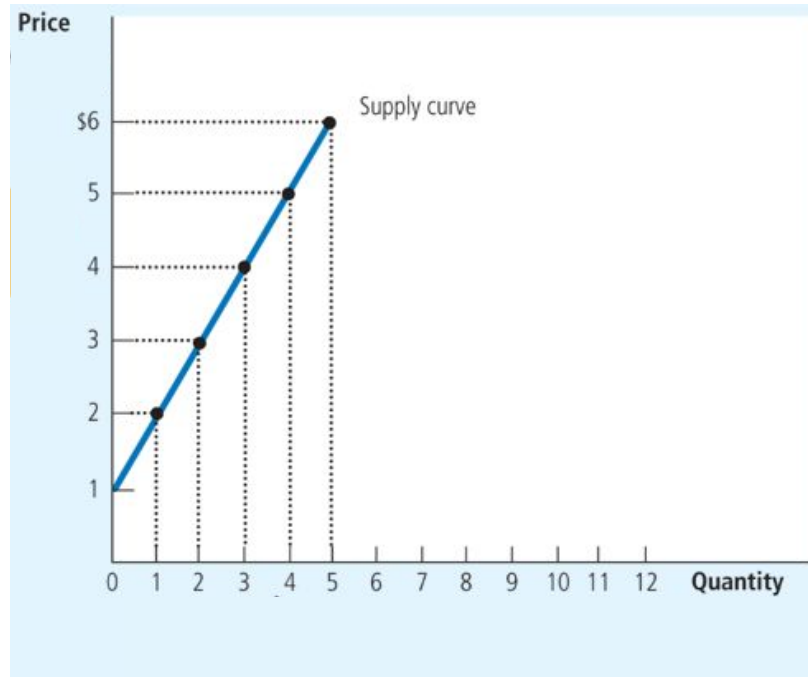


Supply

- Supply of a good (e.g. quantity of gallons of gas) has many determinants:
 - Costs
 - What is the price of crude oil (an input)?
 - What must be paid to transport gas from the refinery to the gas station?
 - Number of producers in the market
 - *Price*
 - *How much can 1 gallon of gas be sold for?*

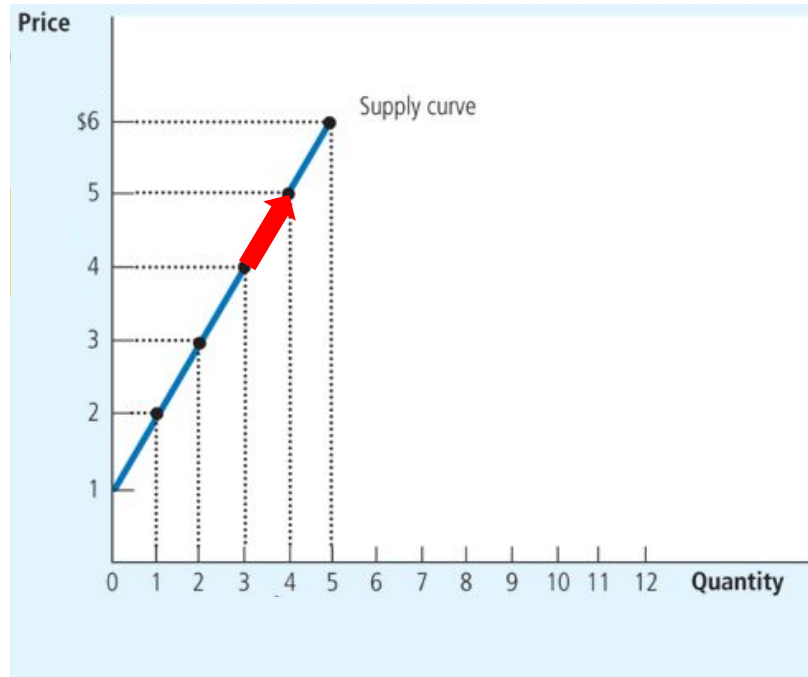
Supply Curve

- The Supply Curve is a visualization of supply
 - ***Quantity*** supplied as a function of ***Price***
 - All other determinants are in the background



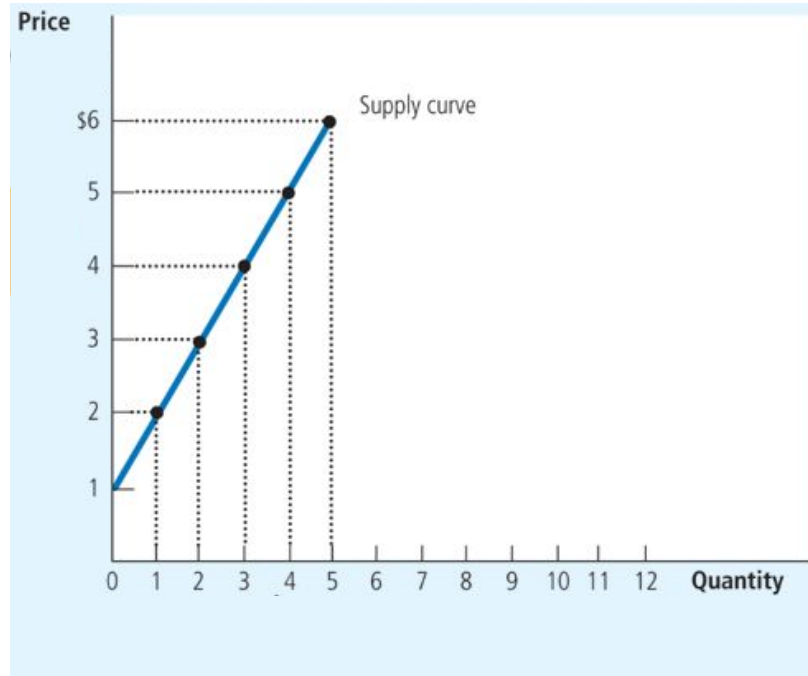
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- A change in Price moves us along the Supply Curve



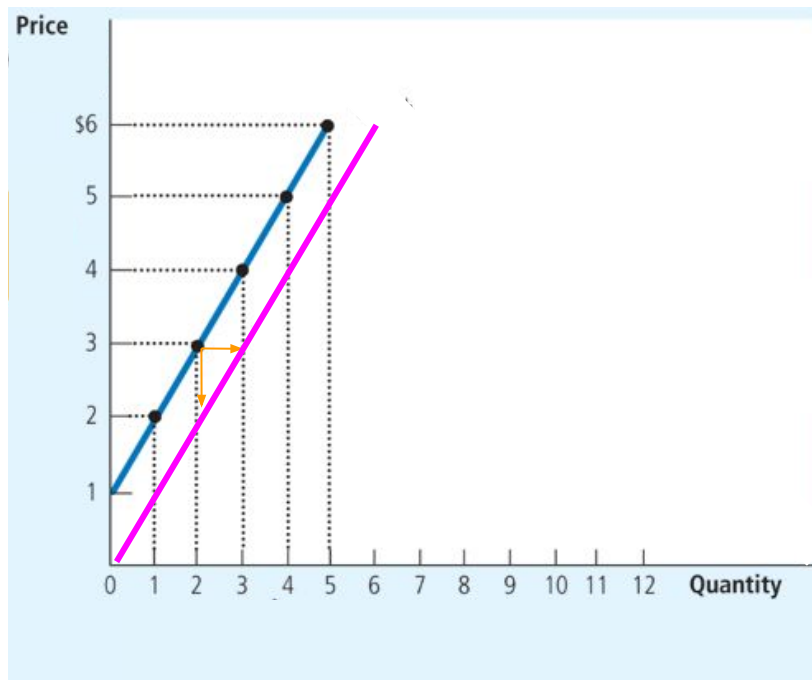
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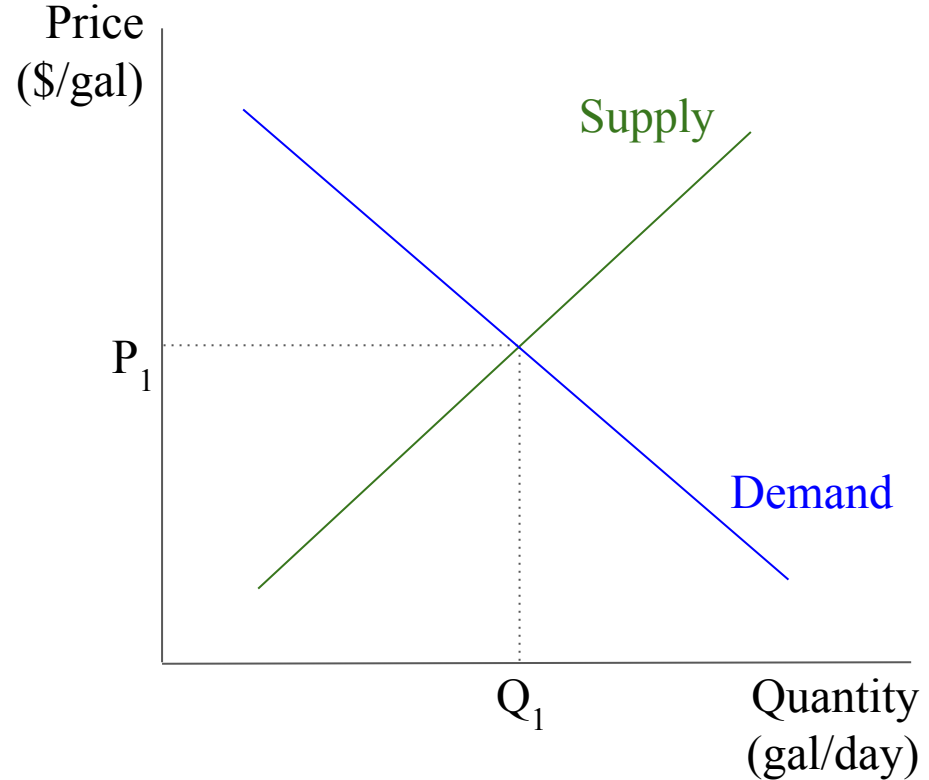
Shifts of the Supply Curve

- Changes in non-Price determinants of Supply (e.g. cost decreases) shift the Supply Curve
 - “My costs went down, so I can accept a lower price when I sell gas.”
 - “My costs went down, so I can sell more gas at any given price.”



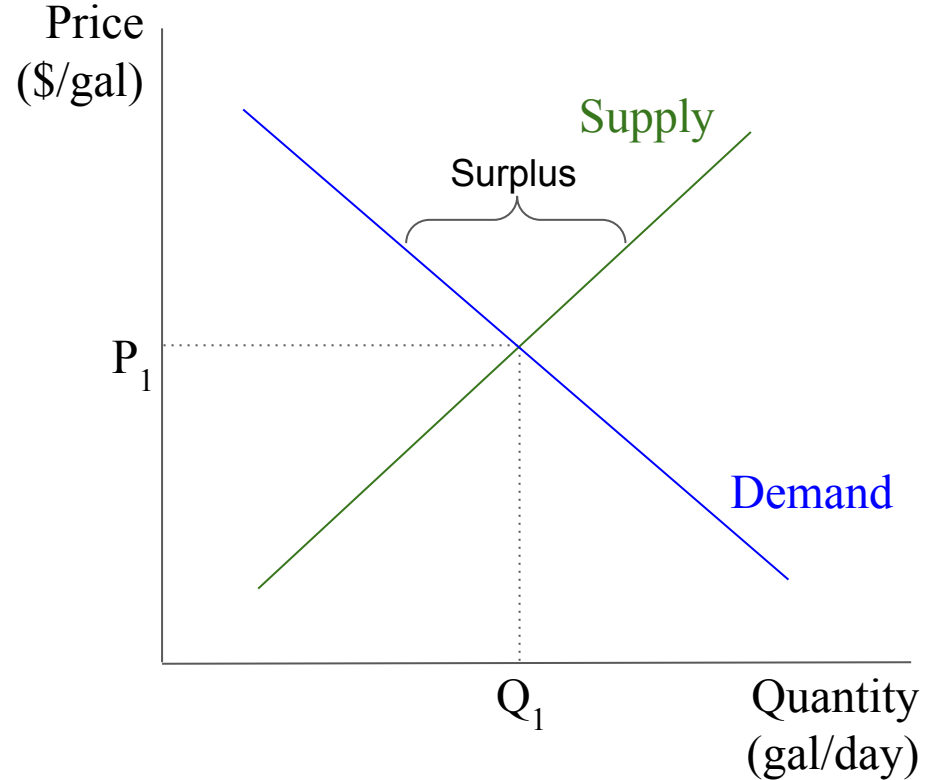
Equilibrium

- On a given day, market price and quantity are found at the intersection of that day's supply and demand curves
- P_1 is the only price that clears the market



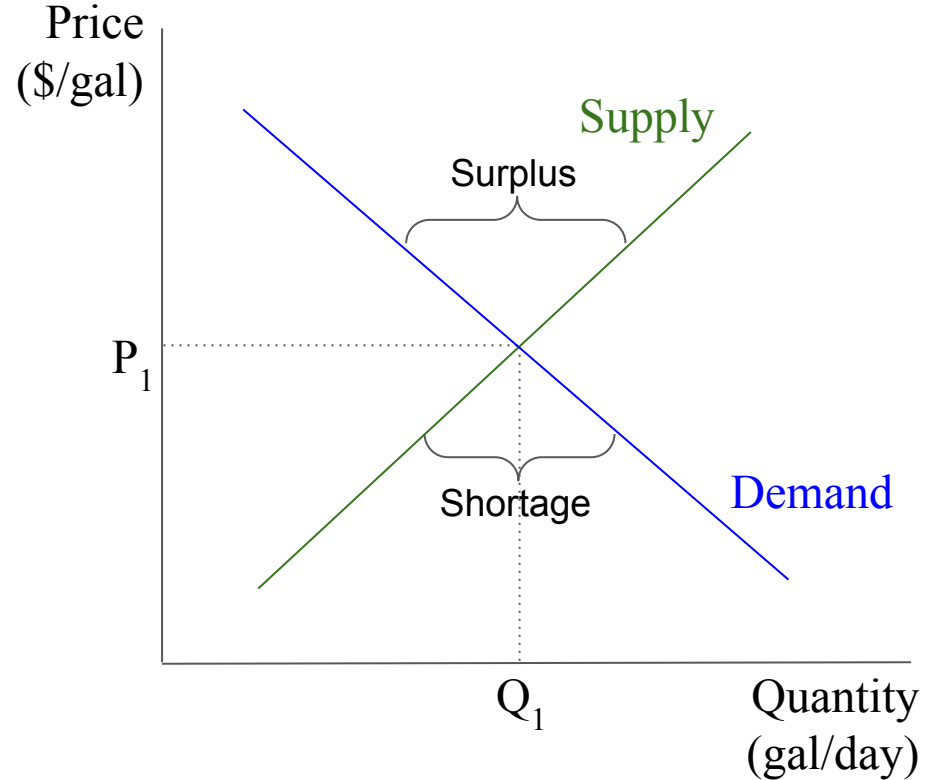
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 - $P > P_1$: too much supply; producers will have to cut prices to sell surplus



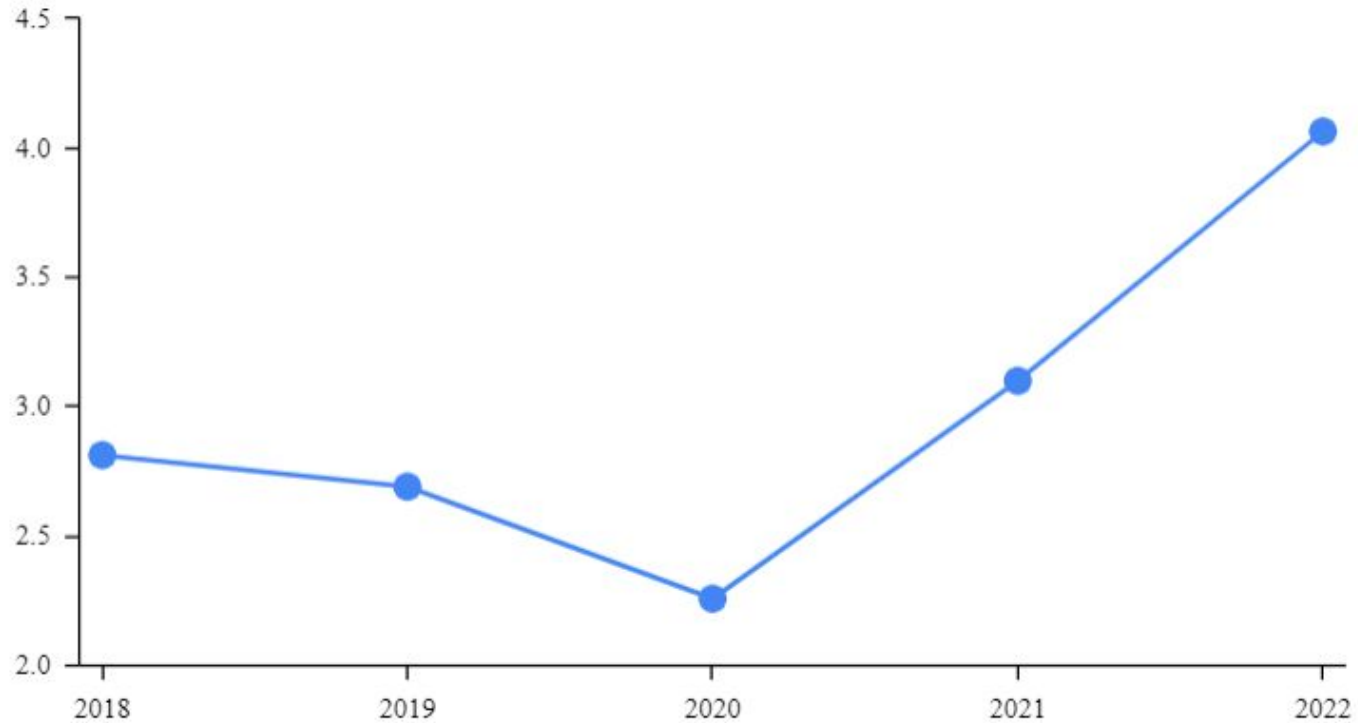
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- P_1 is the only price that clears the market
 - $P > P_1$: too much supply; producers will have to cut prices to sell surplus
 - $P < P_1$: too much demand; consumers will bid up prices to get scarce gas



Retail Gas Prices

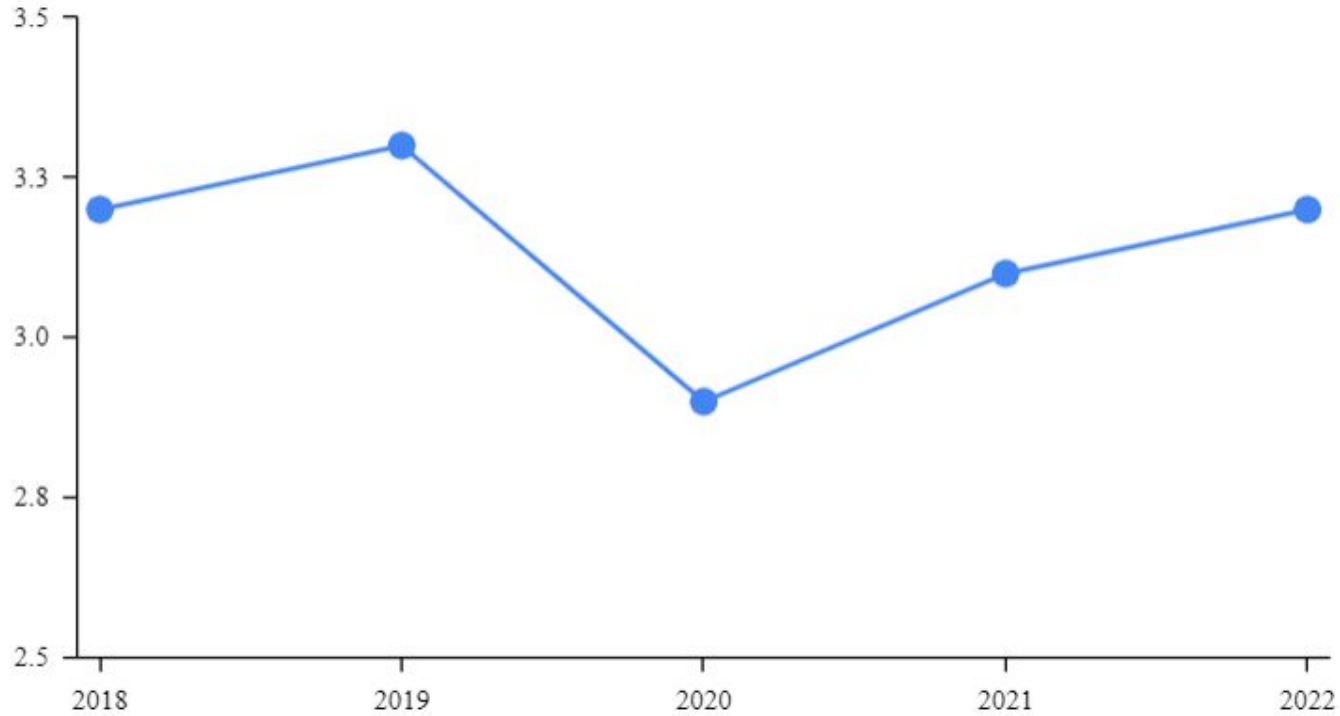
Retail Gas Prices (All Grades, Dollars per Gallon)



Source: U.S. Energy Information Administration

Car Travel

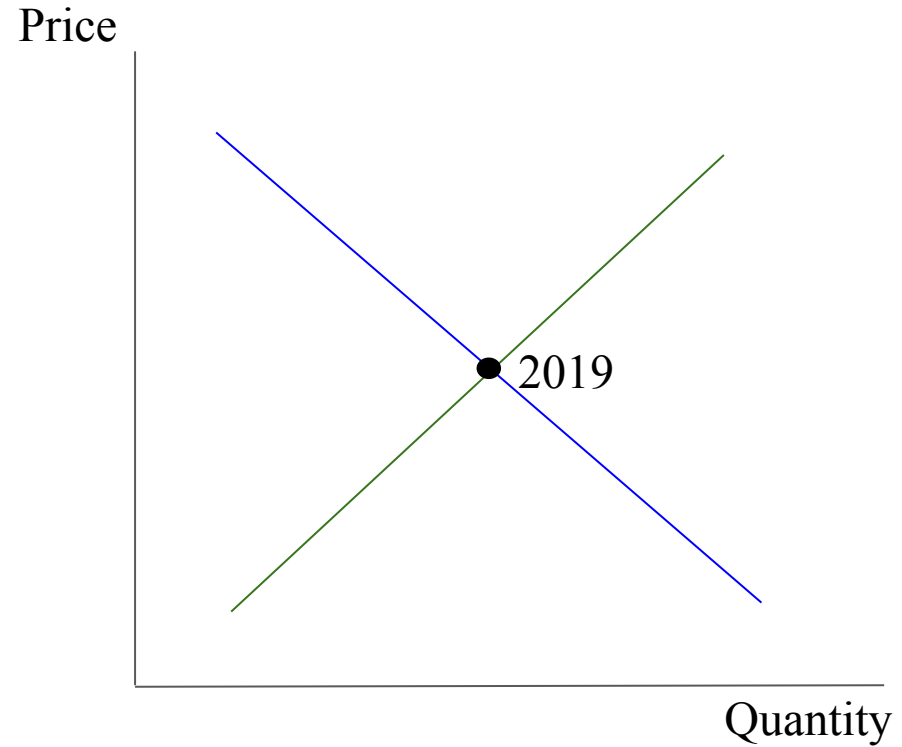
Miles driven per day (millions)



Source: U.S. Federal Highway Administration

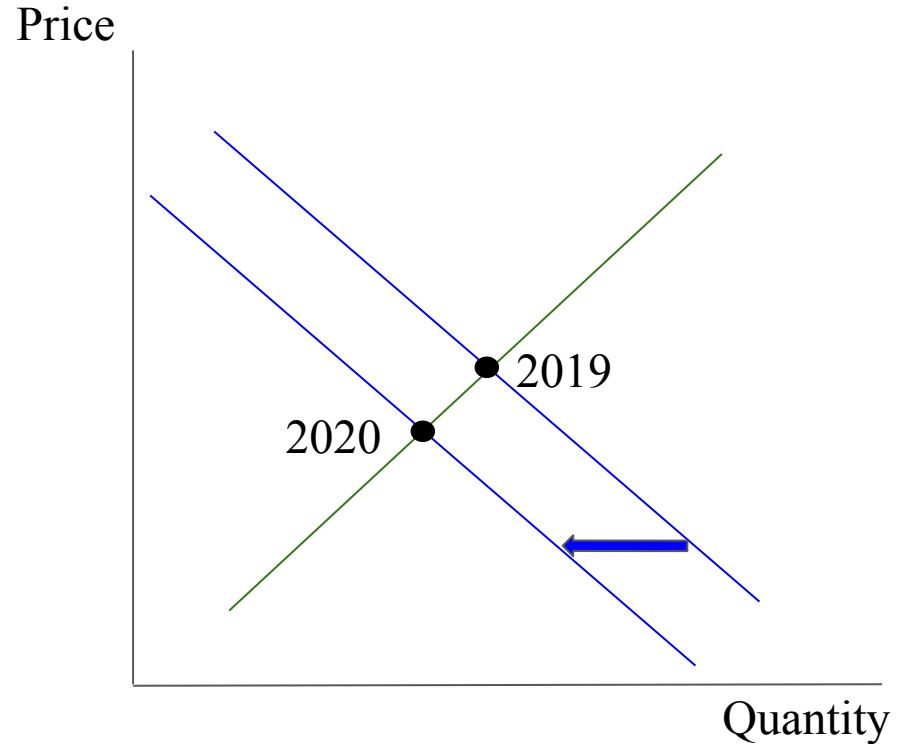
2019

- Let's start with a baseline year of 2019



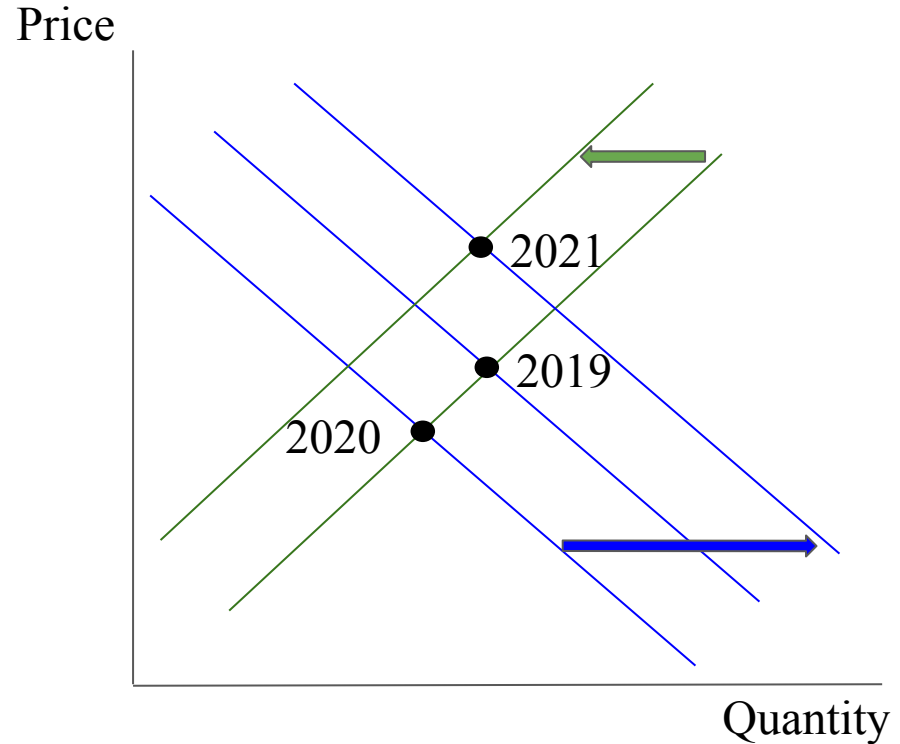
2020

- Compared to 2019, 2020 saw lower prices and less usage.
- This was driven by the drastic reduction in activity caused by the pandemic
- When price and quantity move in the same direction, that is the classic sign of a demand shock.



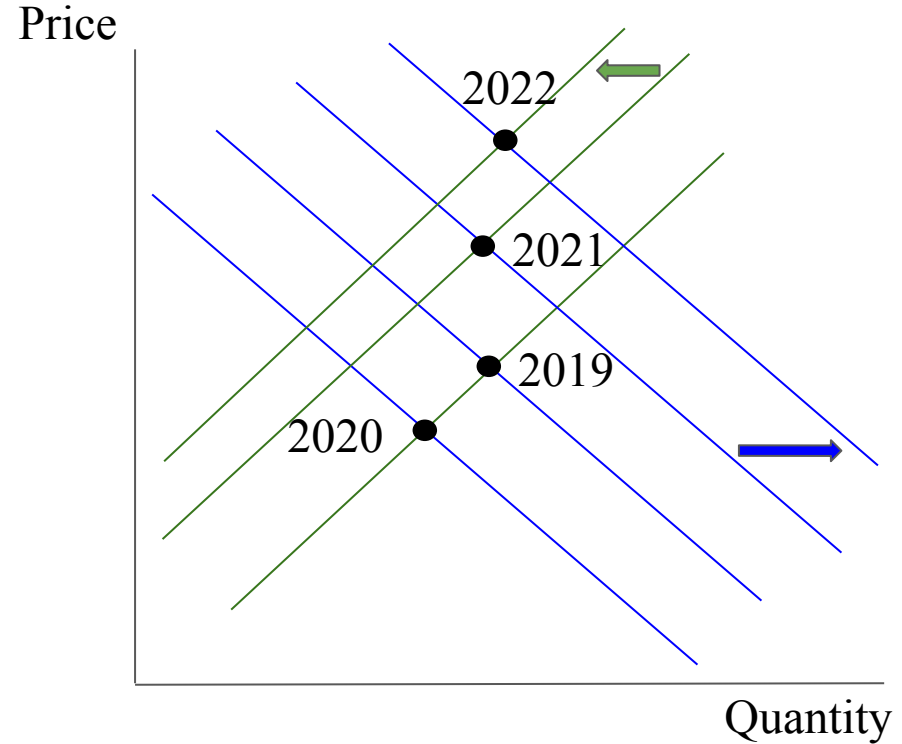
2021

- In 2021, usage returned close to 2019, but prices were notably higher.
- Such a pattern requires shifts in both the demand and supply curves.
- Demand shifted out due to vaccinations and optimism about a return to normal
- And supply shifted in due to labor shortages and supply chain problems



2022

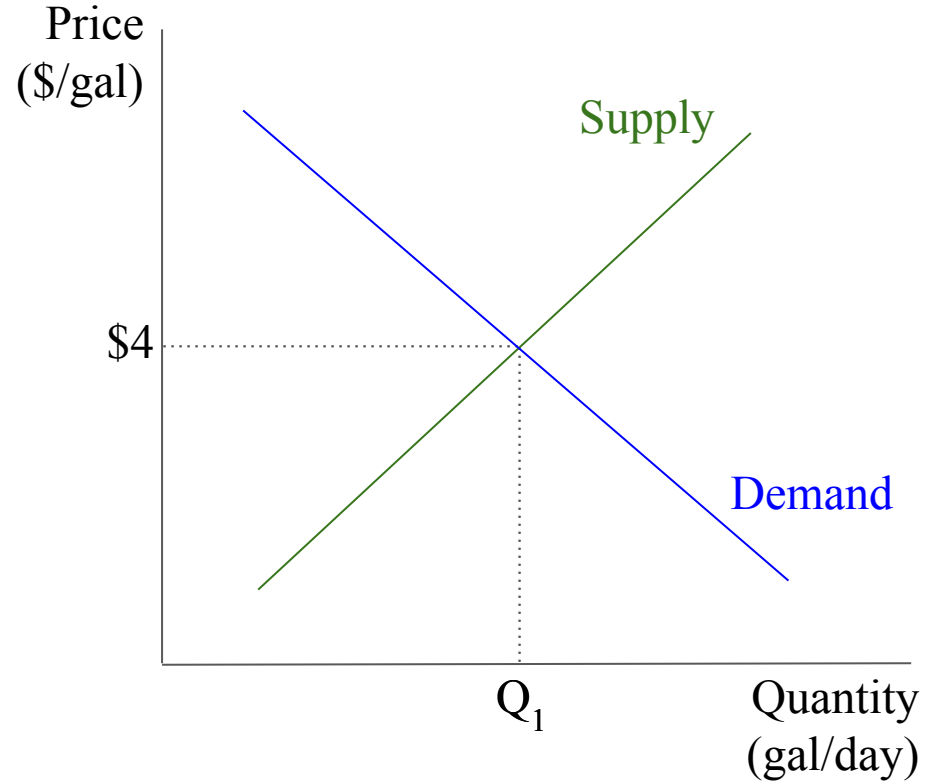
- War in Ukraine (supply) and continued post-Omicron normalization push price higher and higher.



Potential policy remedies

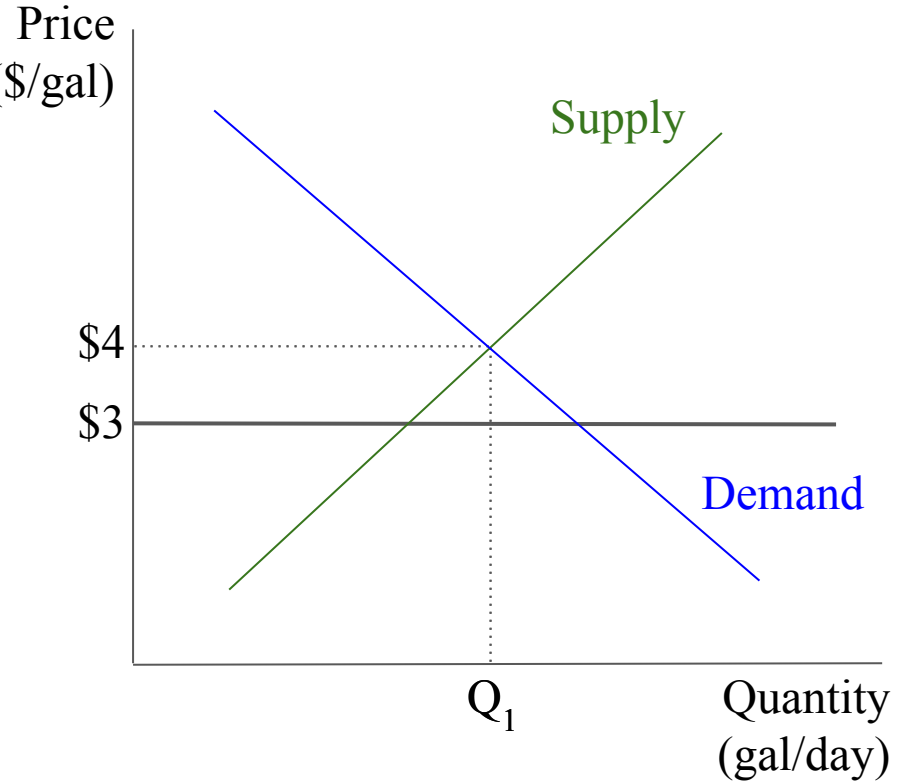
1. Price ceiling
2. Gas tax holiday

1. Price ceiling



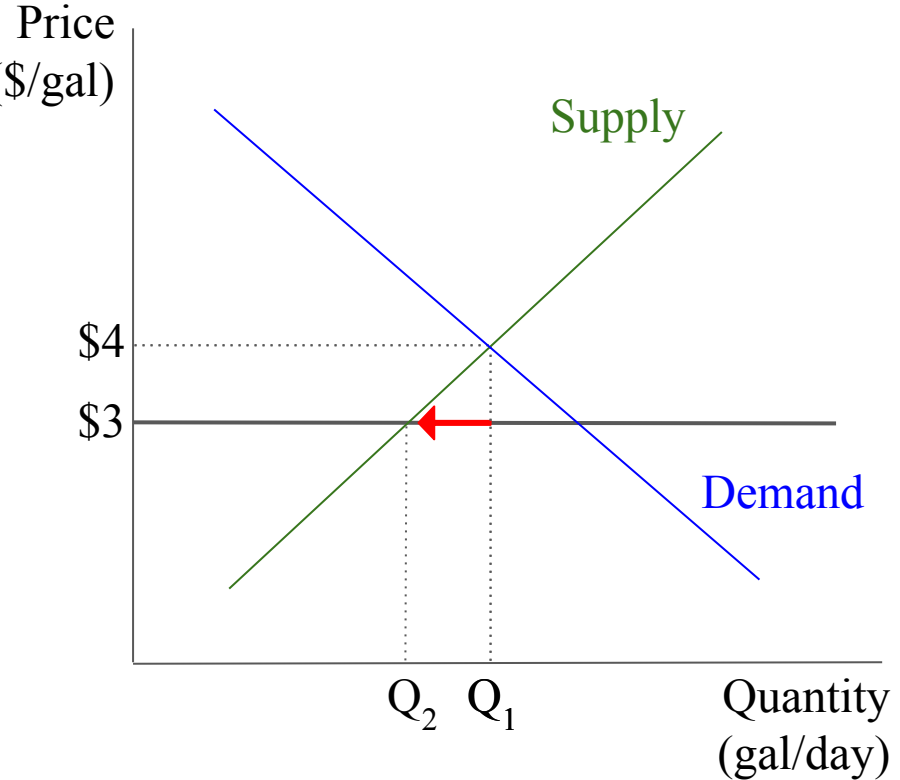
1. Price ceiling

- Could outlaw the sale of gas above \$3
- Economists are usually very skeptical of this



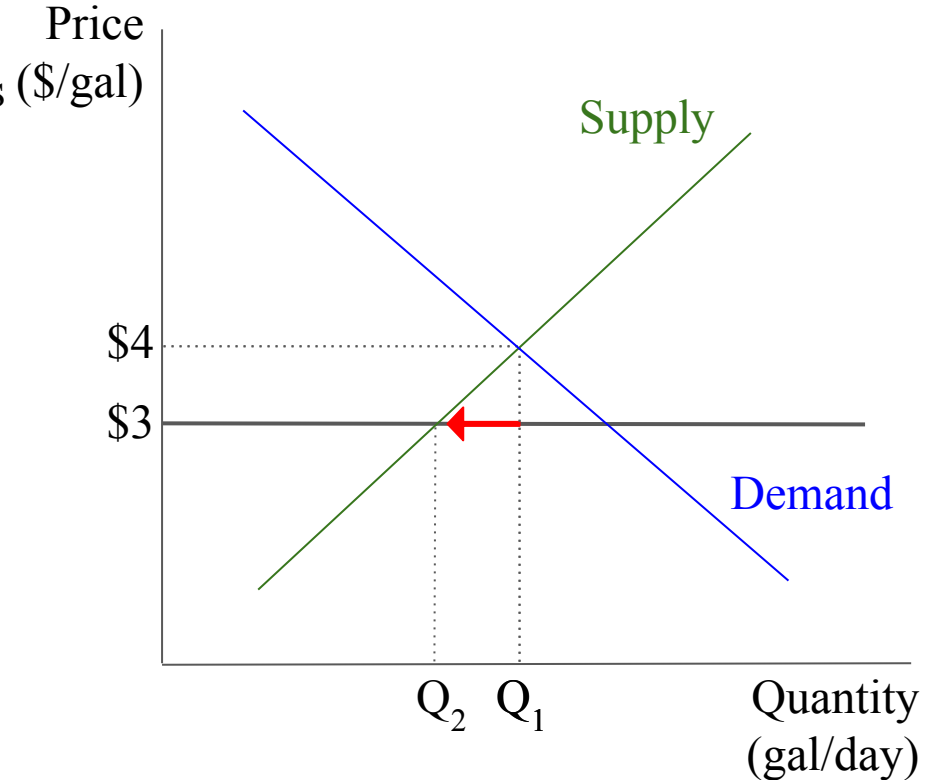
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- Consumers will find that there's less gas to buy than there was before



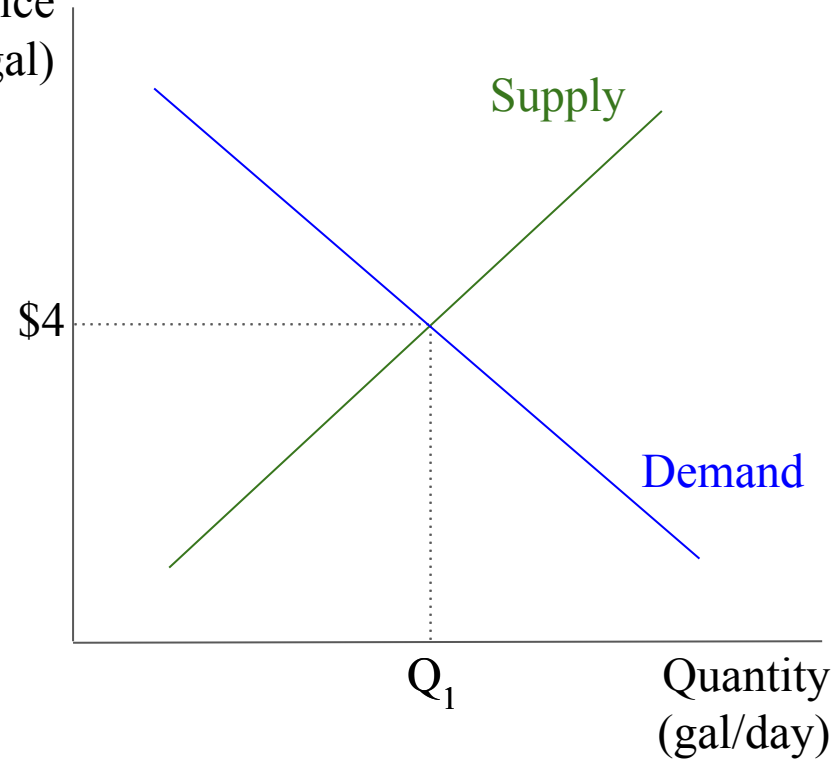
1. Price ceiling

- Could outlaw the sale of gas above \$3
- Economists are usually very skeptical of this
- Consumers will find that there's less gas to buy than there was before
 - Those who can't get it will be mad
 - Those who get it may be happy
 - Cheap gas!
 - Or maybe they had to wait in really long lines – depends on allocation mechanism
 - Part of the “price” was their time



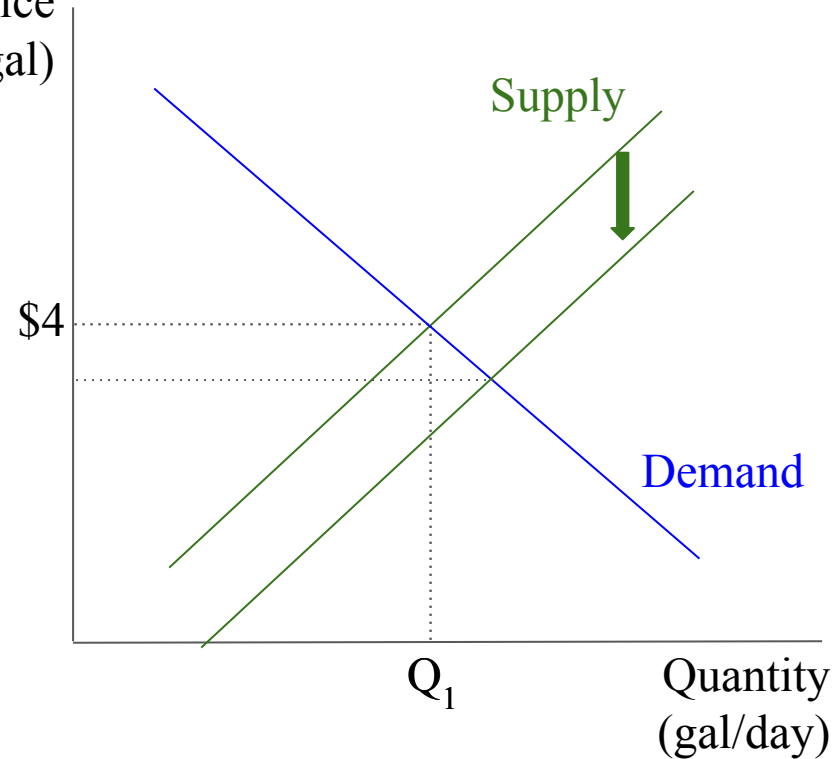
2. Gas tax holiday

- Federal and state governments tax gasoline. Price
 - E.g. Federal tax is ~\$0.18/gallon; MA is (\$/gal) ~\$0.27.
- Tax revenue is typically spent on highway/infrastructure maintenance.
- People including President Joe Biden advocated a temporary removal of gas taxes to lower prices



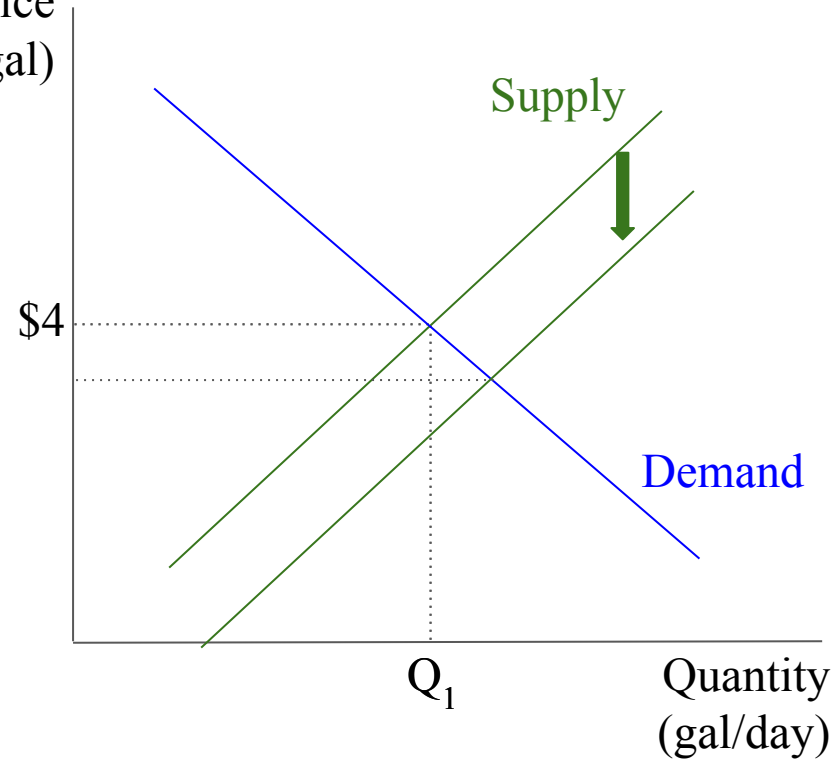
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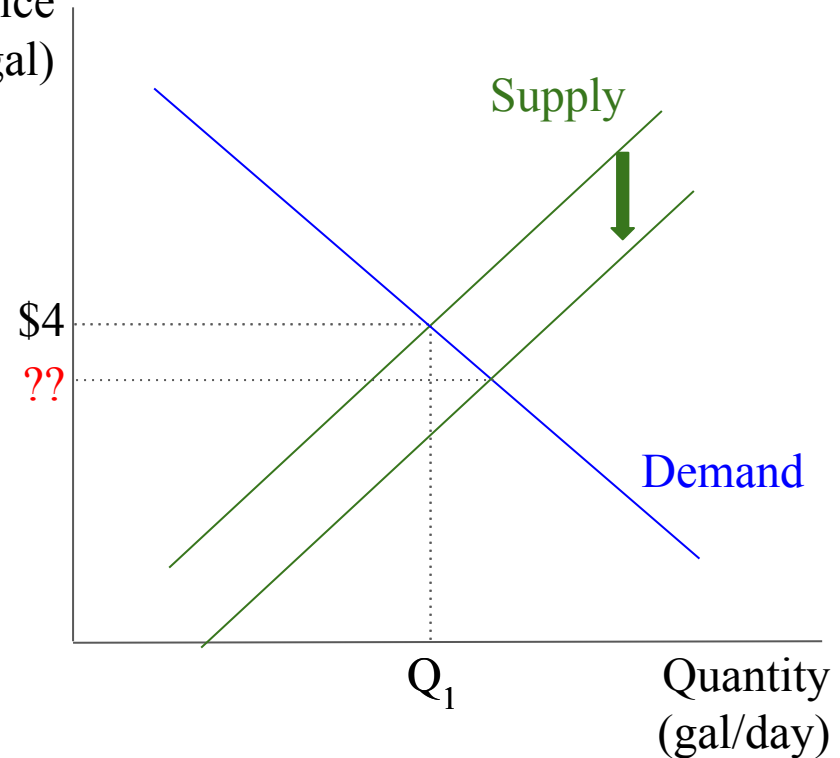
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- Tax revenue is typically spent on highway/infrastructure maintenance.
- People including President Joe Biden advocated a temporary removal of gas taxes to lower prices
- Lowering the cost of supply by $\$0.18$ will lower the price consumers pay
 - But by how much? This depends on elasticities.



Elasticities

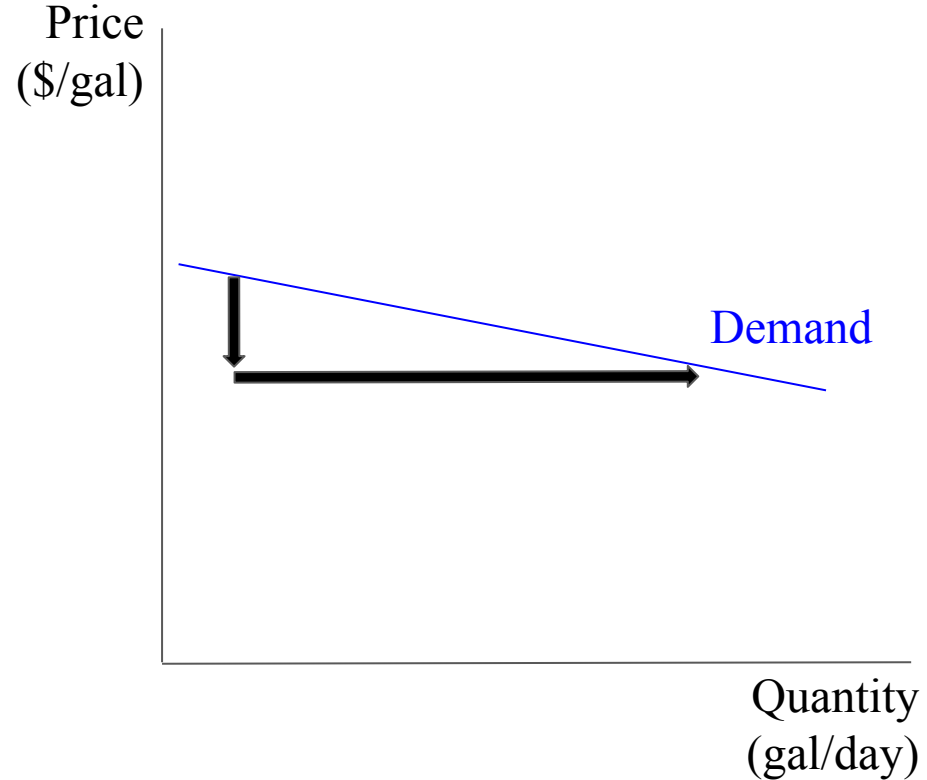
- An elasticity describes how responsive a quantity is to a change in price (or sometimes, income).

Price
(\$/gal)

Quantity
(gal/day)

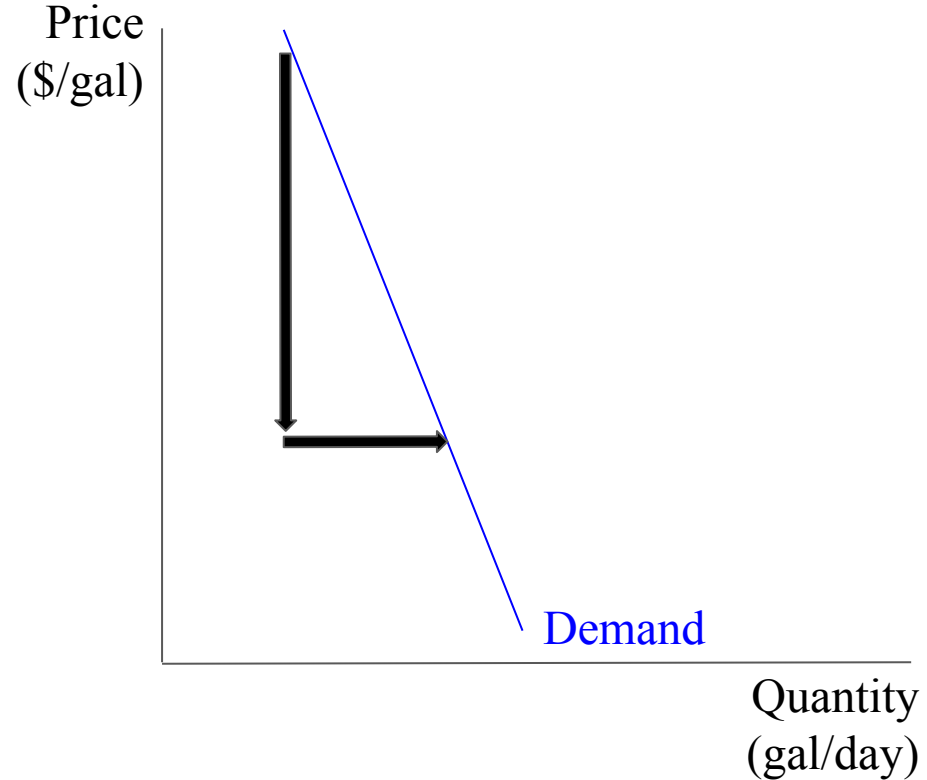
Elasticities

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- A flatter demand curve is more elastic
 - Small change in price leads to large change in quantity



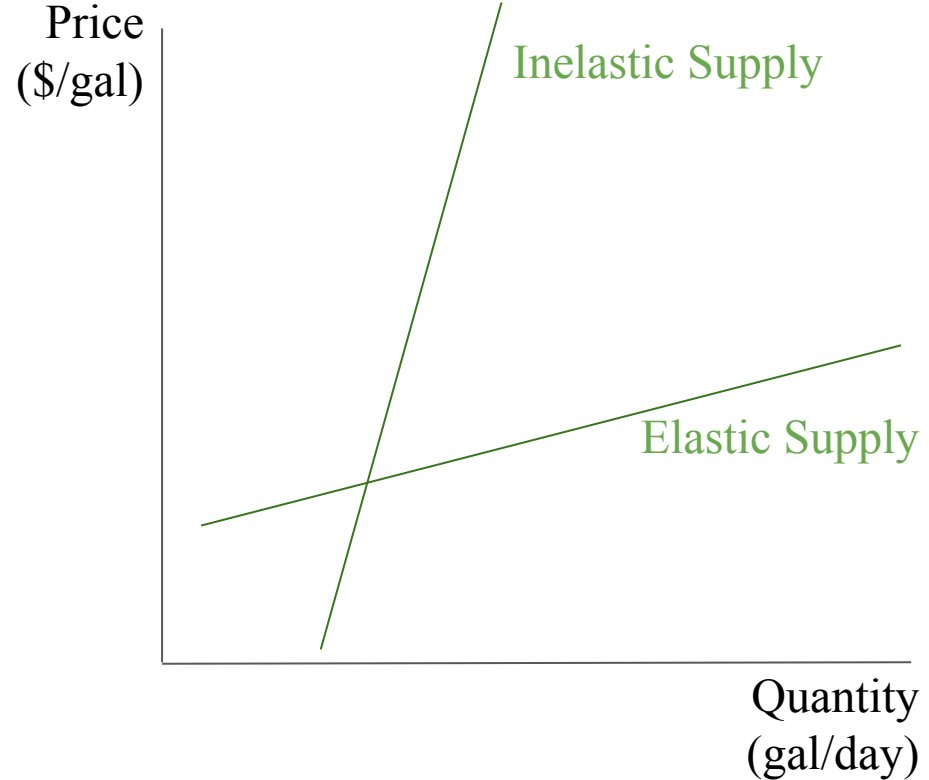
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- A steeper demand curve is more inelastic
 - Large change in price leads to small change in quantity

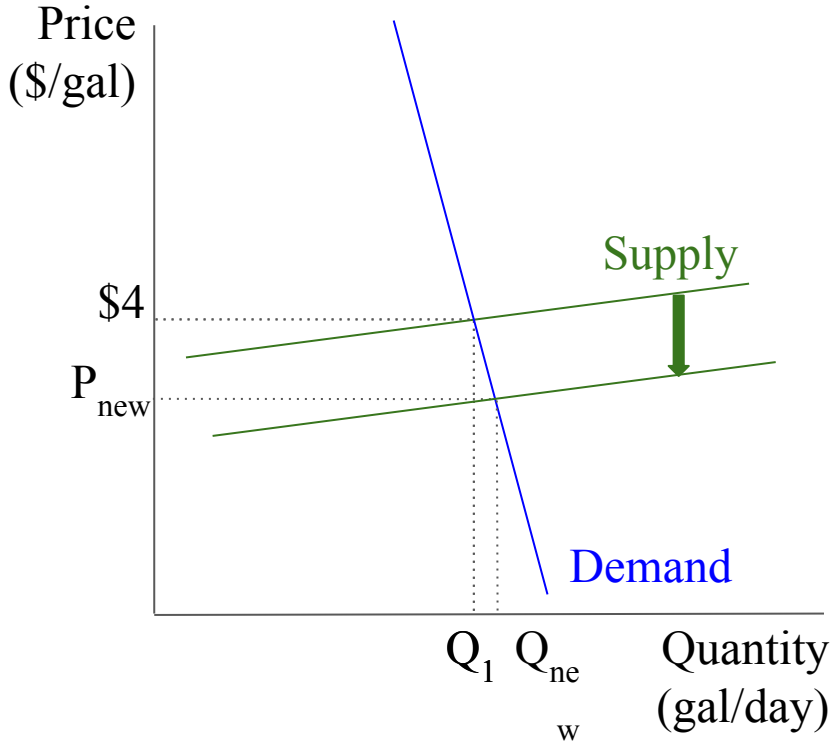


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 - Large change in price leads to small change in quantity
- Same term apply to supply curves

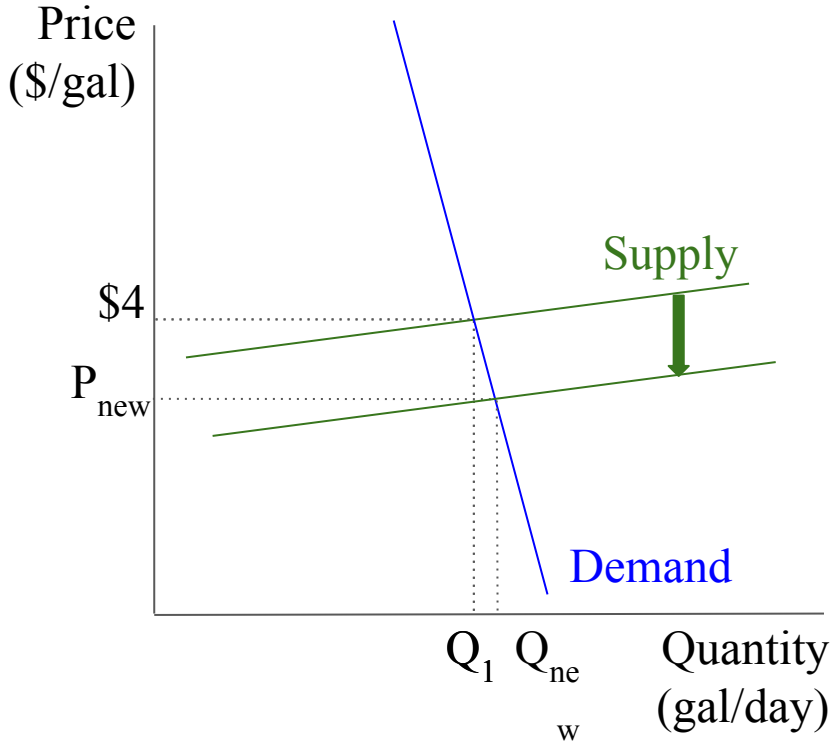


Effect of gas tax holiday on price depends on elasticities

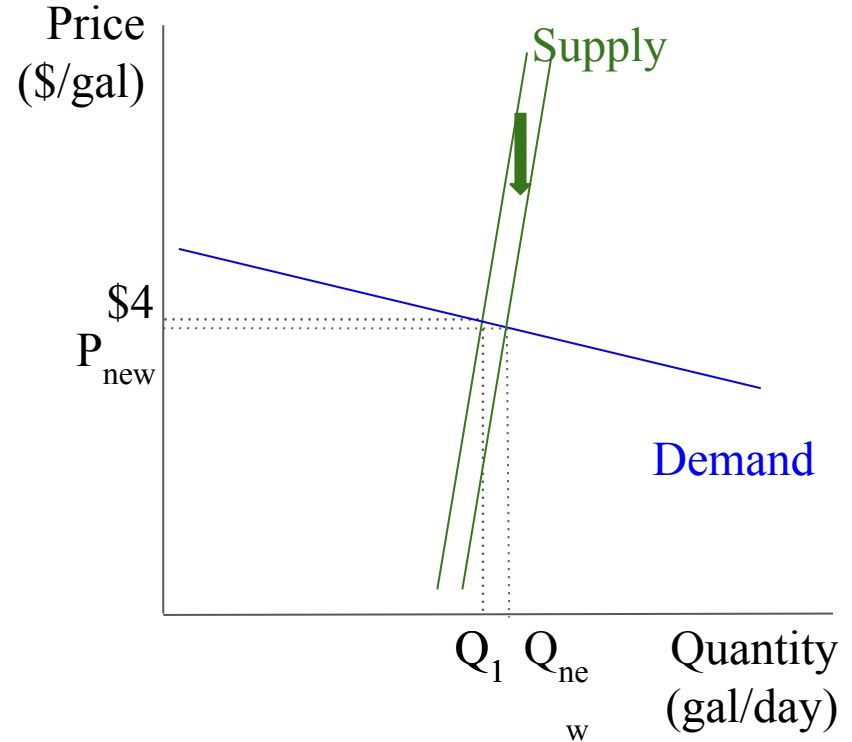


Suppliers have to lower the price a lot to get consumers to buy the cheaper gas they can produce. Price falls a lot.

Effect of gas tax holiday on price depends on elasticities



Suppliers have to lower the price a lot to get consumers to buy the cheaper gas they can produce. Price falls a lot.



Even a small change in price increases demand to meet the new supply. Price falls very little.

Elasticities of supply and demand for gasoline

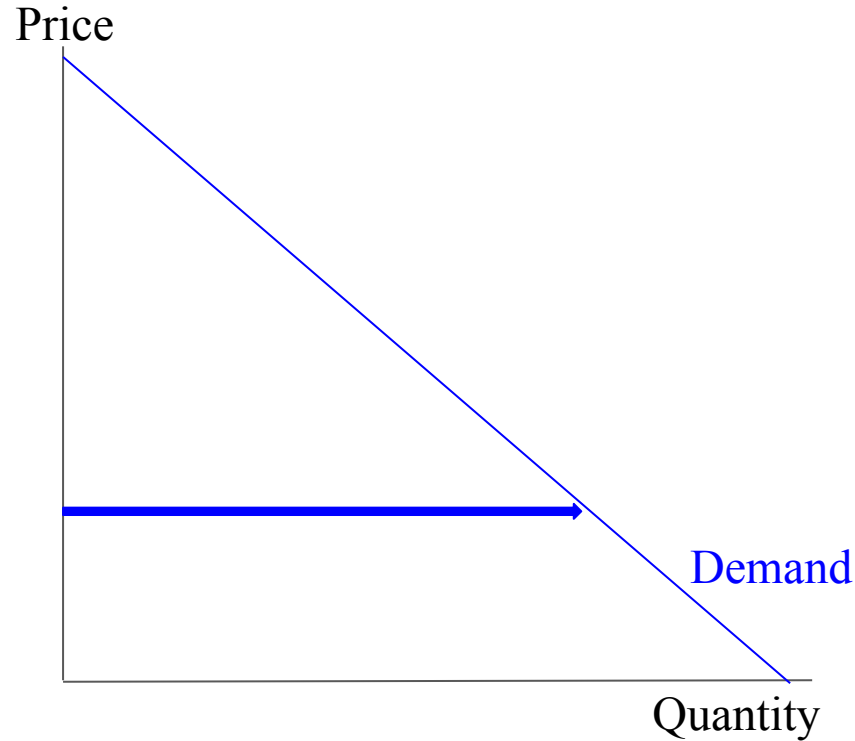
- Elasticity of demand for gasoline was typically thought to be very low: ~ -0.02
 - So a 10% increase in gas prices lowers demand by just 0.2%
- More recent work with more modern econometric approaches have it much higher: ~ -0.4
 - So a 10% increase in gas prices lowers demand by 4%
- Supply elasticity is less well-studied, but a recent approach puts it at ~ 0.7
 - So a 10% increase in gas prices increases supply by 7%
 - Should be cautious: given current labor shortage and supply chain issues, may be harder to increase supply these days, i.e. elasticity of supply could be a lot lower than 0.7.

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 - So a 10% increase in gas prices increases supply by 7%
 - Should be cautious: given current labor shortage and supply chain issues, may be harder to increase supply these days, i.e. elasticity of supply could be a lot lower than 0.7.
- *Since demand is likely less elastic than supply, it is likely that most of the savings from a gas tax holiday would go to consumers.*

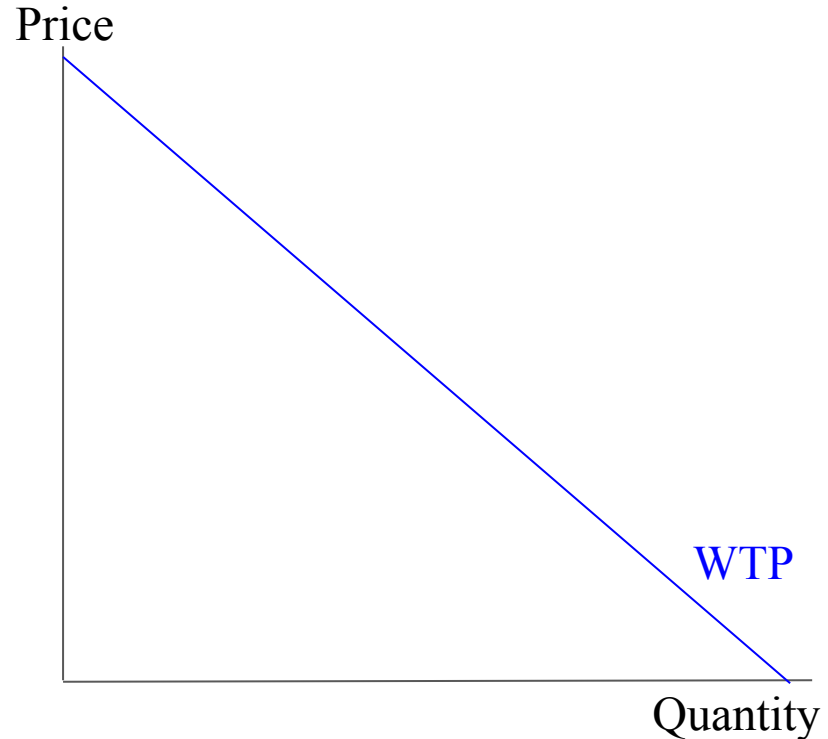
Willingness-to-Pay

- Demand Curve shows Q^D for any given P
 - (Horizontal)



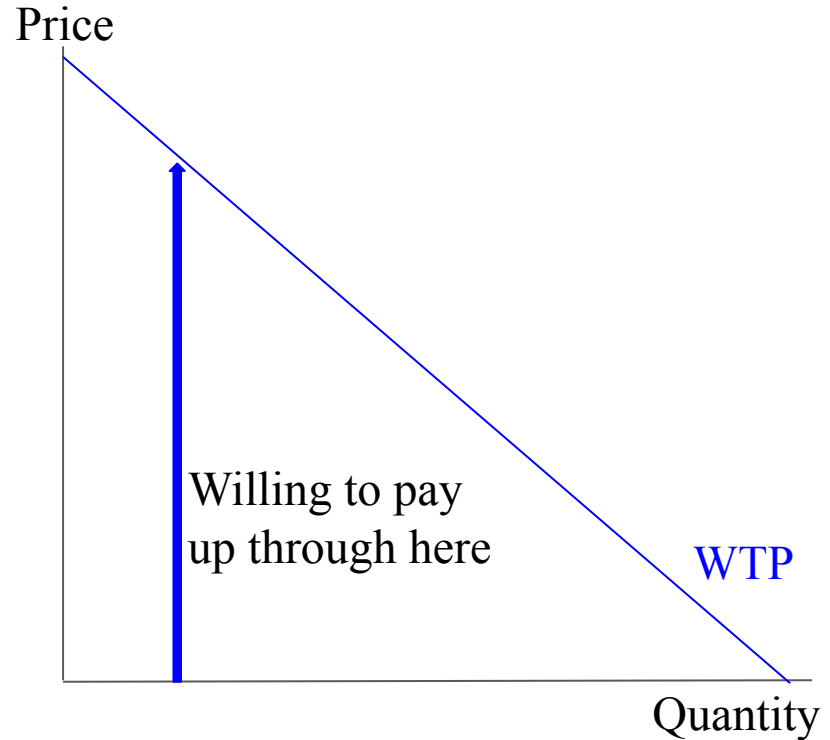
Willingness-to-Pay

- Demand Curve shows Q^D for any given P
 - (Horizontal)
- Suppose consumers are Rational
 - They spend money as wisely as they can
- Demand Curve shows Willingness-to-Pay
 - Maximum they would spend for the good
 - Shows how the good is *valued*
 - (Vertical)



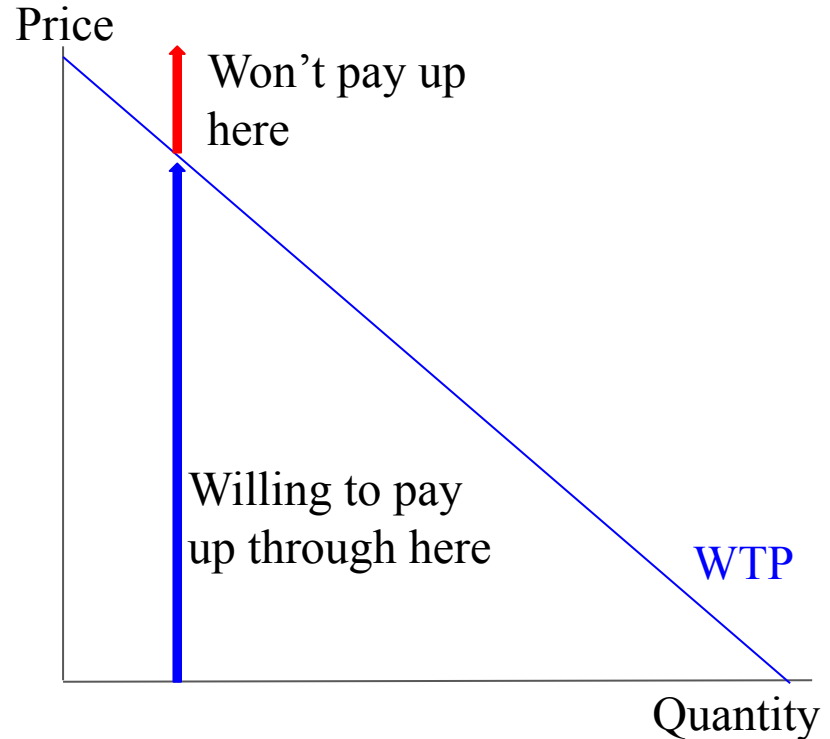
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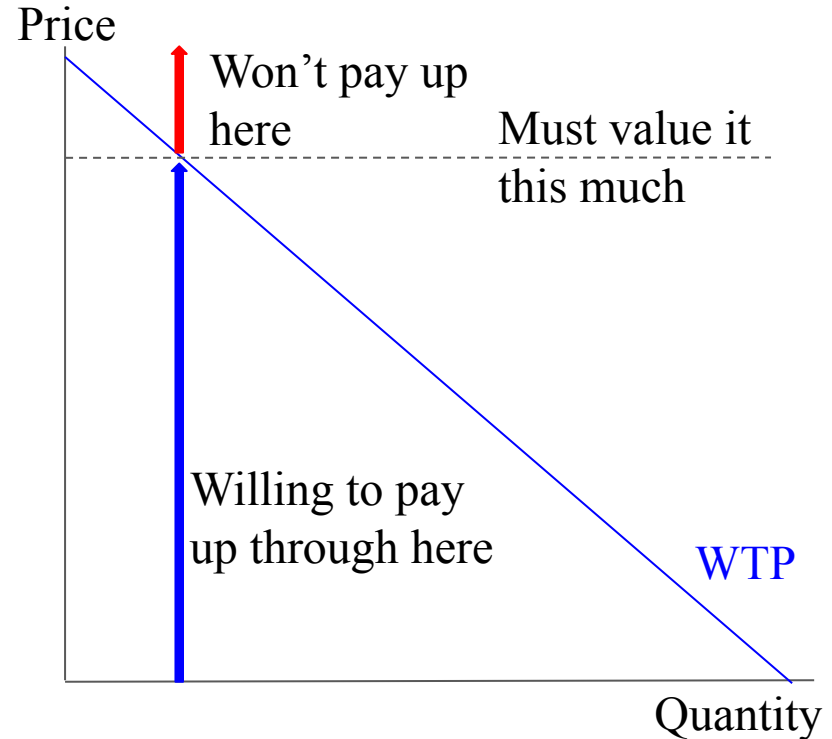
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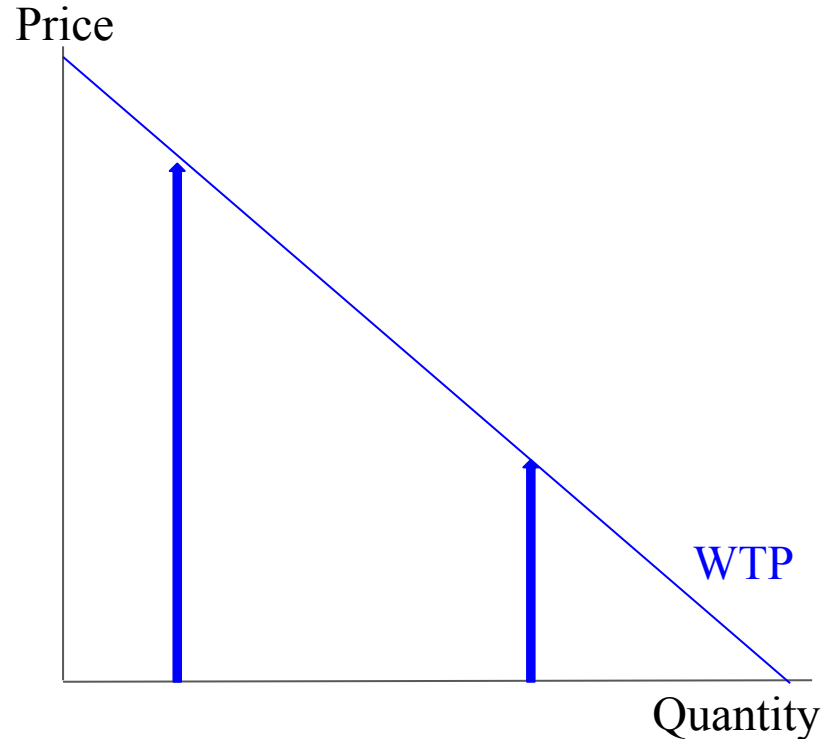
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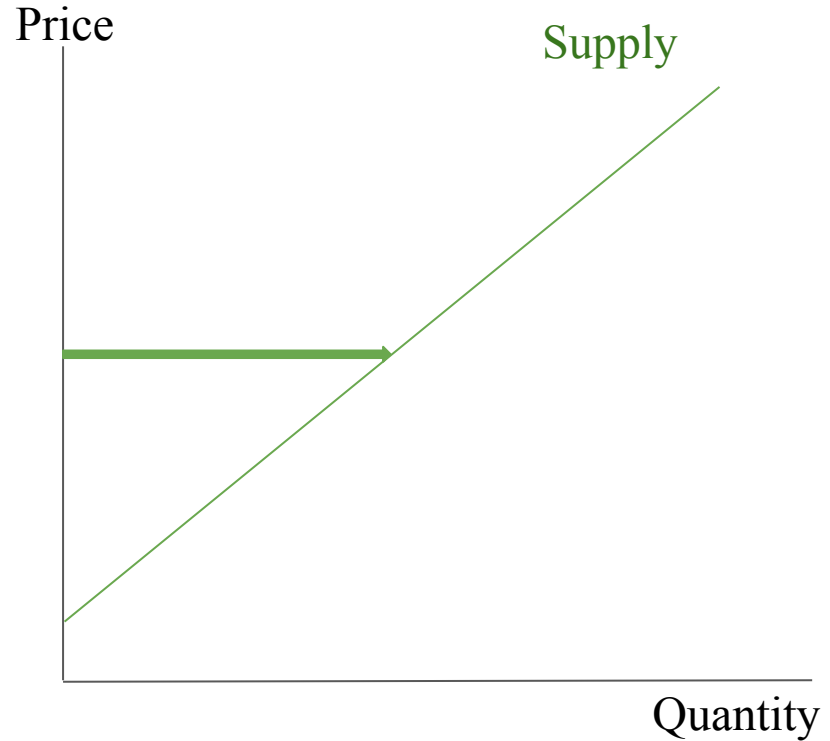
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 - Maximum they would spend for the good
 - Shows how the good is *valued*
 - (Vertical)
- Downward-sloping Demand:
 - First units consumed are more valuable
 - Diminishing Marginal Value
 - Value of each unit is less than the one before



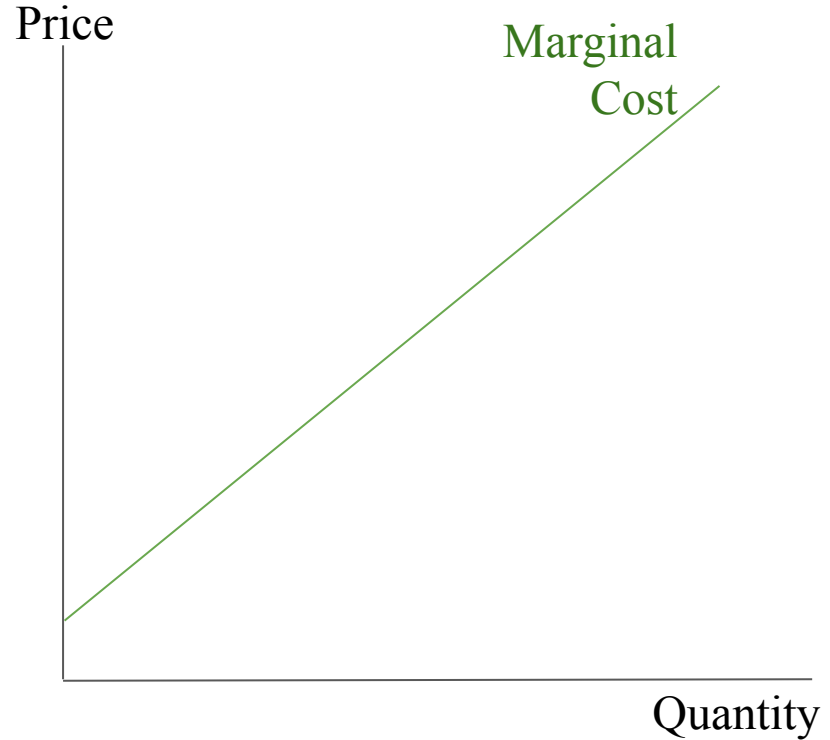
Marginal Cost

- Supply Curve shows Q^S for any given P
 - (Horizontal)



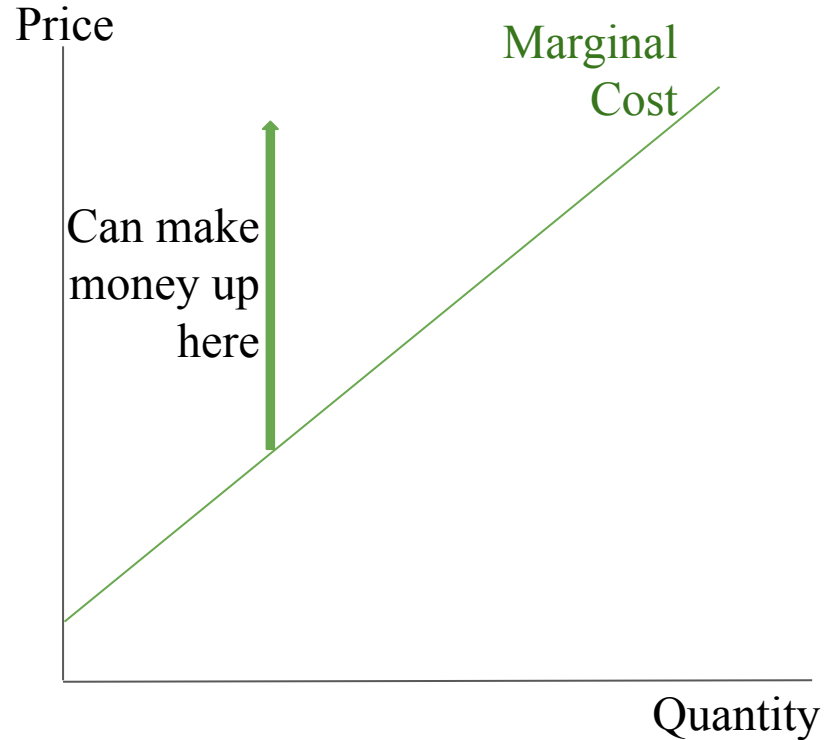
Marginal Cost

- Supply Curve shows Q^S for any given P
 - (Horizontal)
- Supply Curve shows Marginal Cost
 - Cost of producing each unit
 - (Vertical)



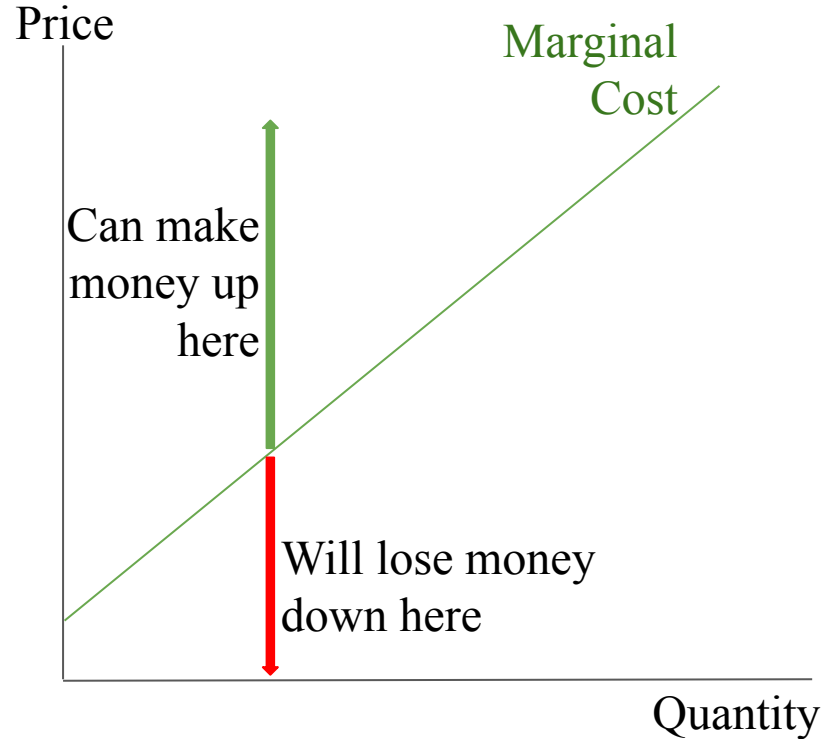
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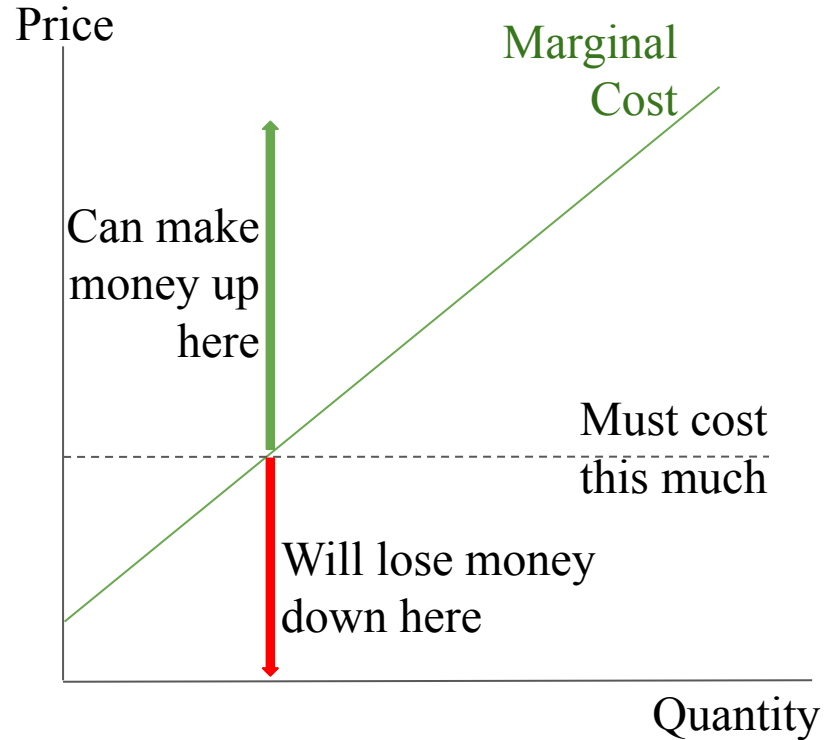
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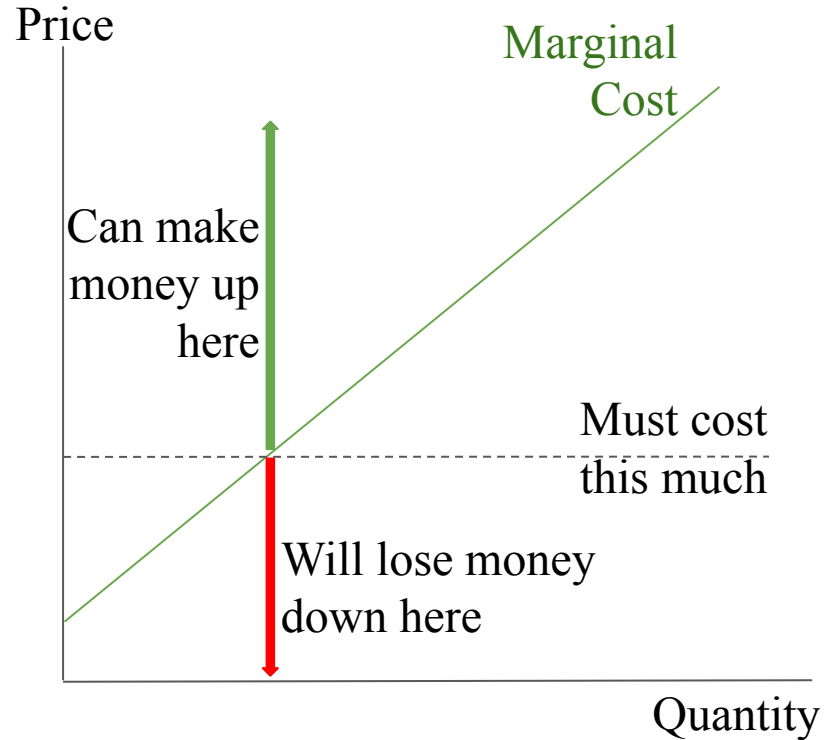
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 - (Horizontal)
- Supply Curve shows Marginal Cost
 - Cost of producing each unit
 - (Vertical)



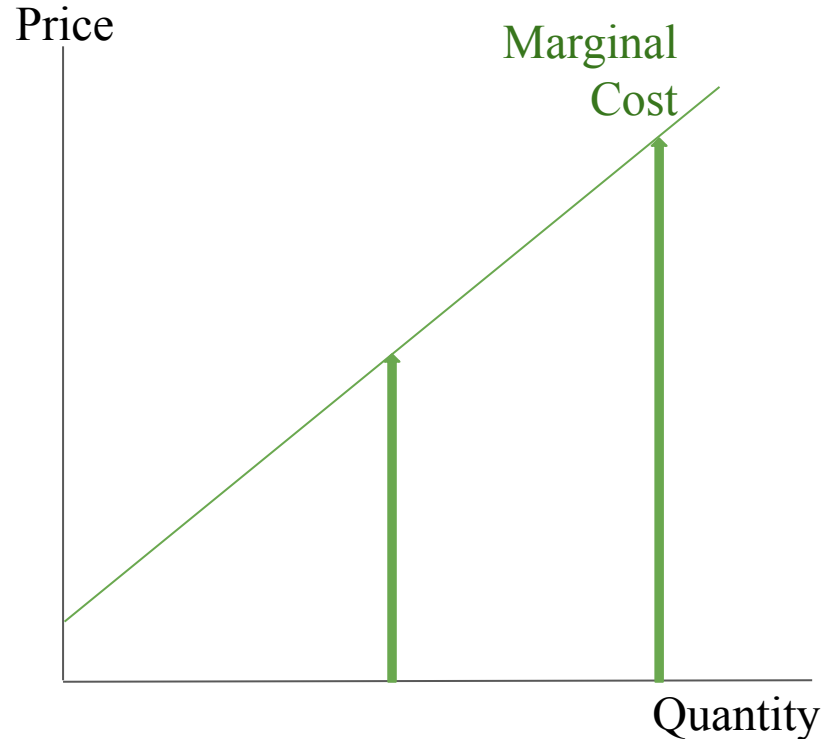
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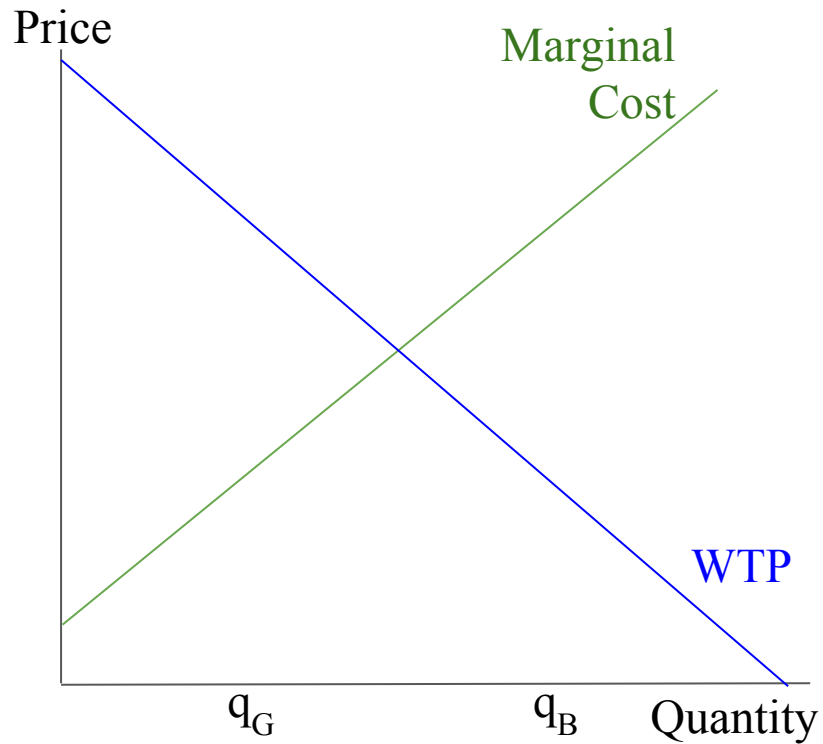


Marginal Cost

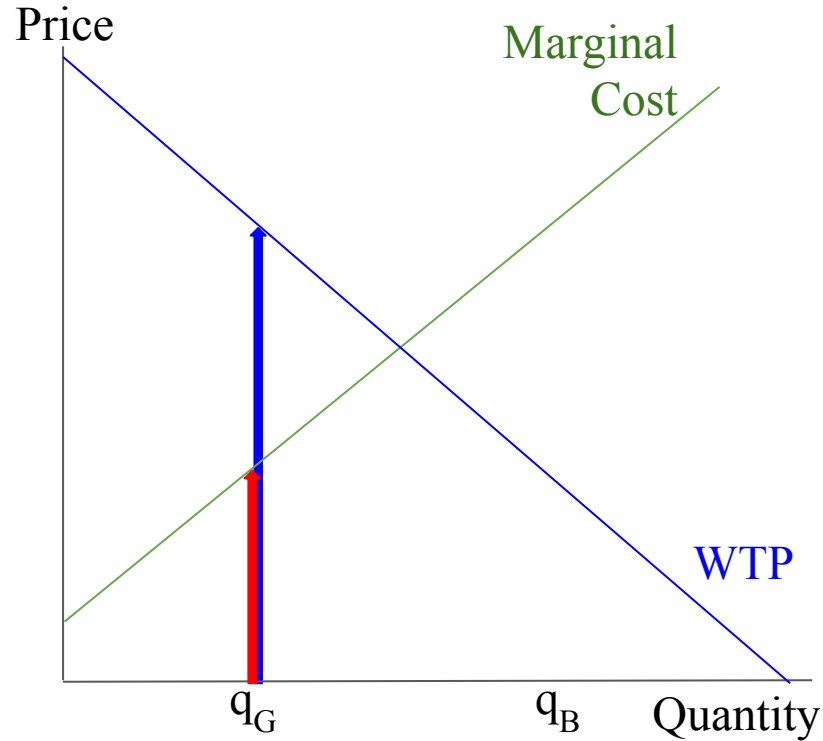
- Supply Curve shows Q^S for any given P
 - (Horizontal)
- Supply Curve shows Marginal Cost
 - Cost of producing each unit
 - (Vertical)
 - In a few weeks, we'll show that this is not always the case...
- Upward-sloping Supply:
 - First units produced are cheapest
 - Increasing Marginal Cost
 - Most efficient producers enter market first



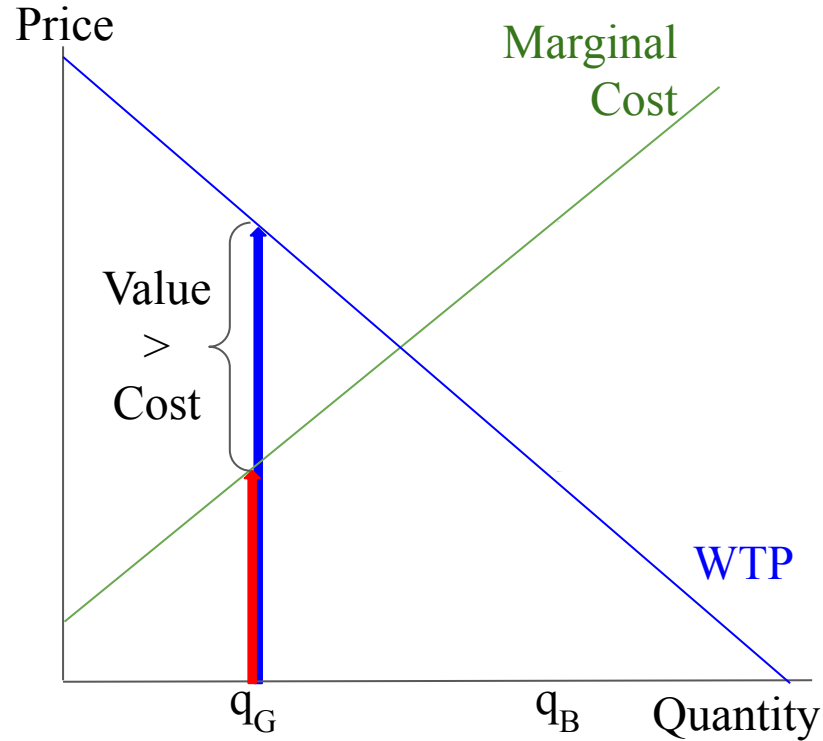
Gains from Trade, Visualized



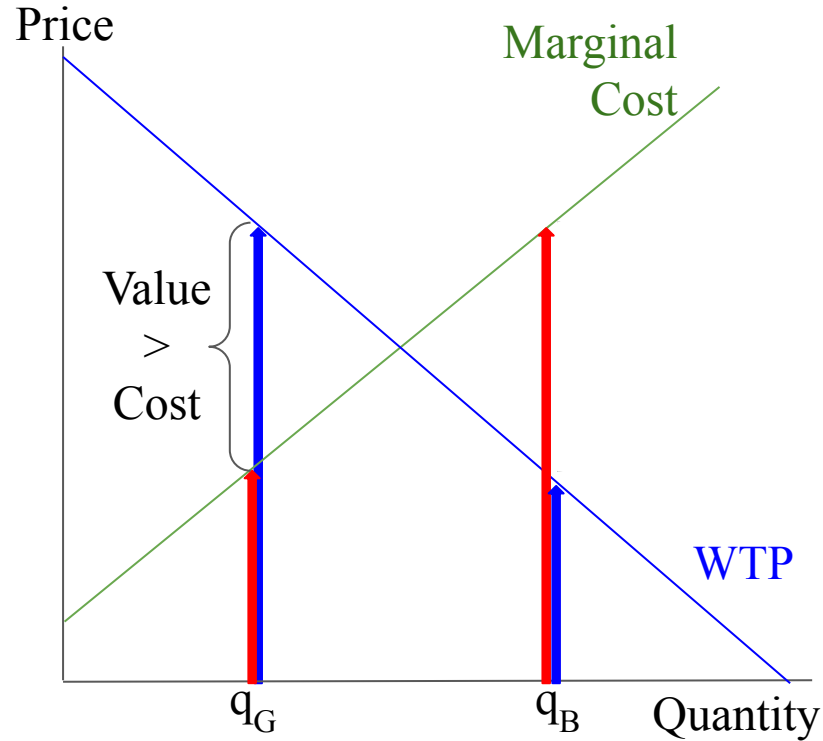
Gains from Trade, Visualized



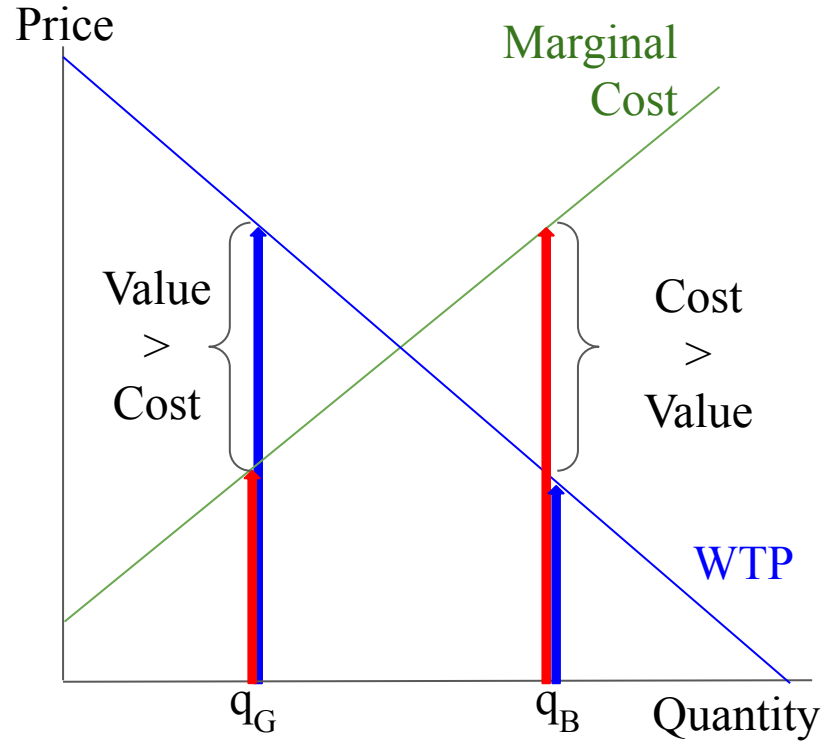
Gains from Trade, Visualized



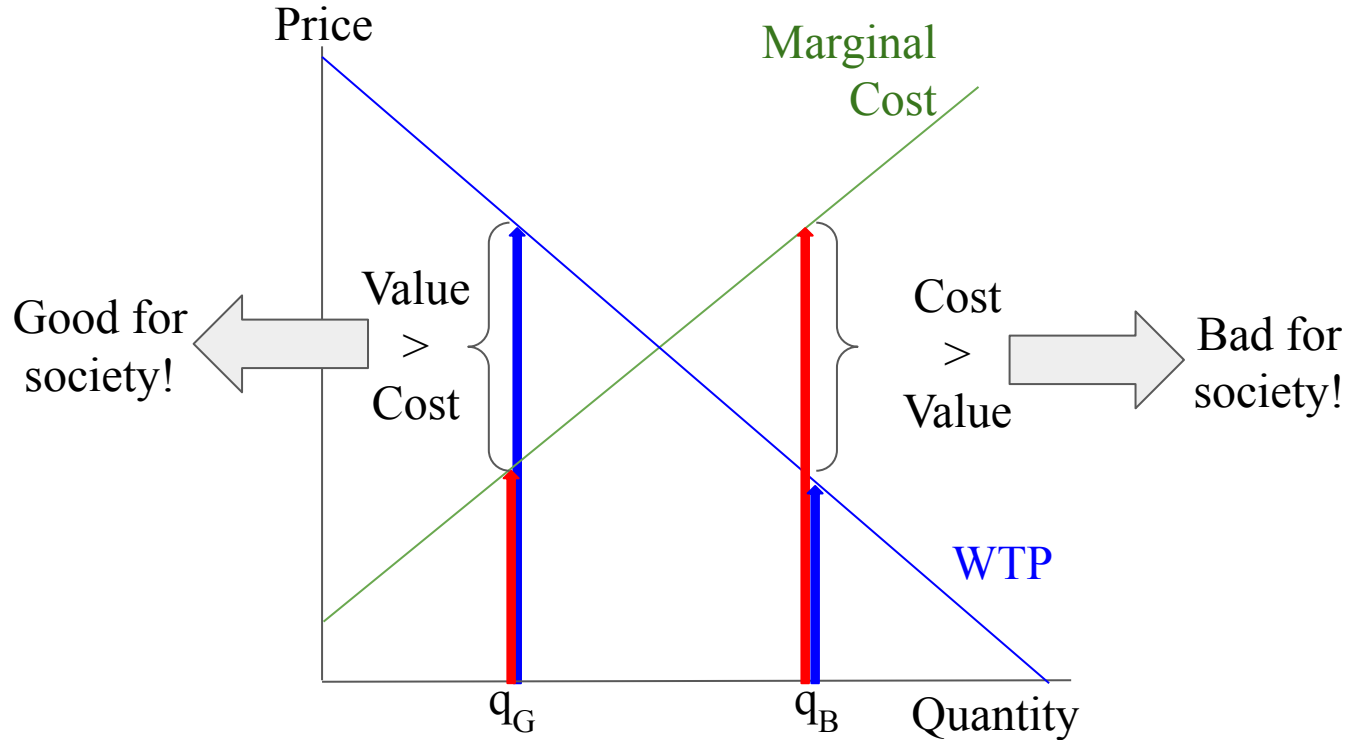
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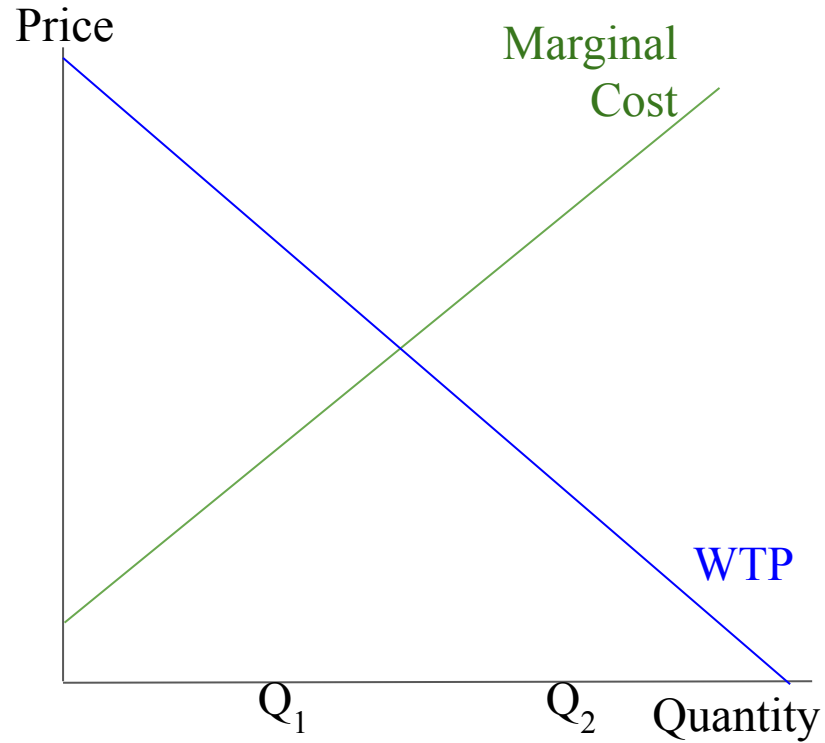
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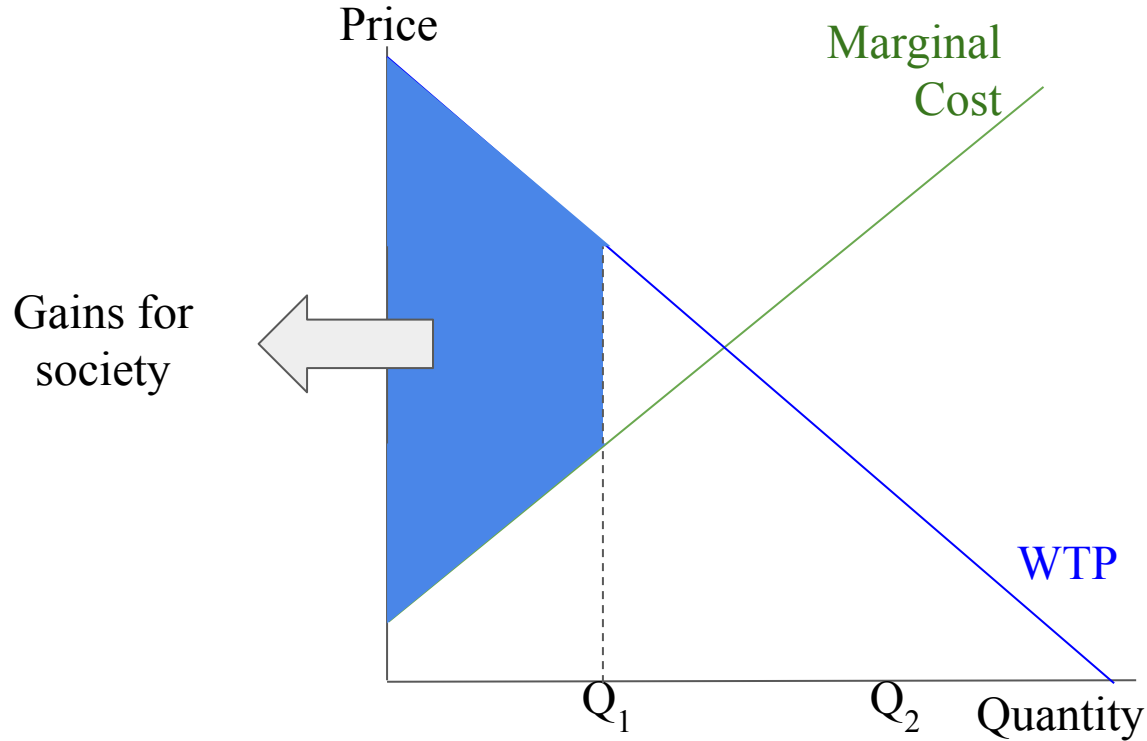
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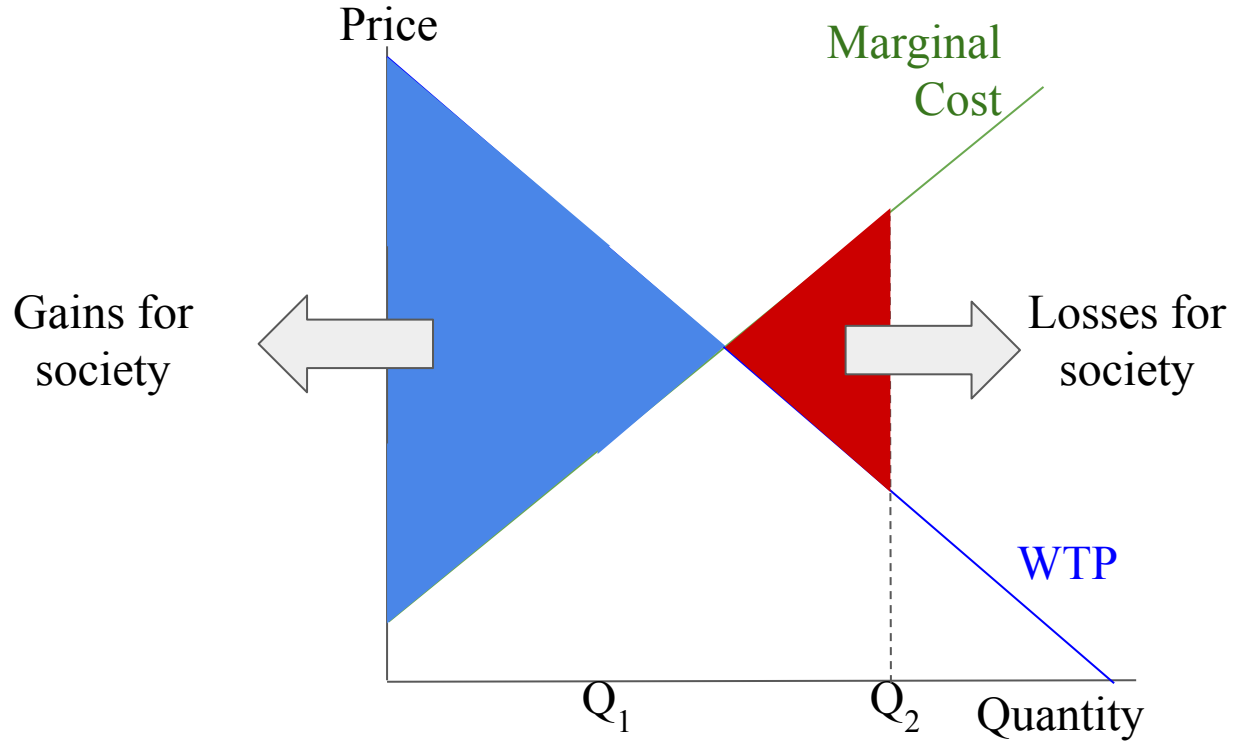
Social Surplus



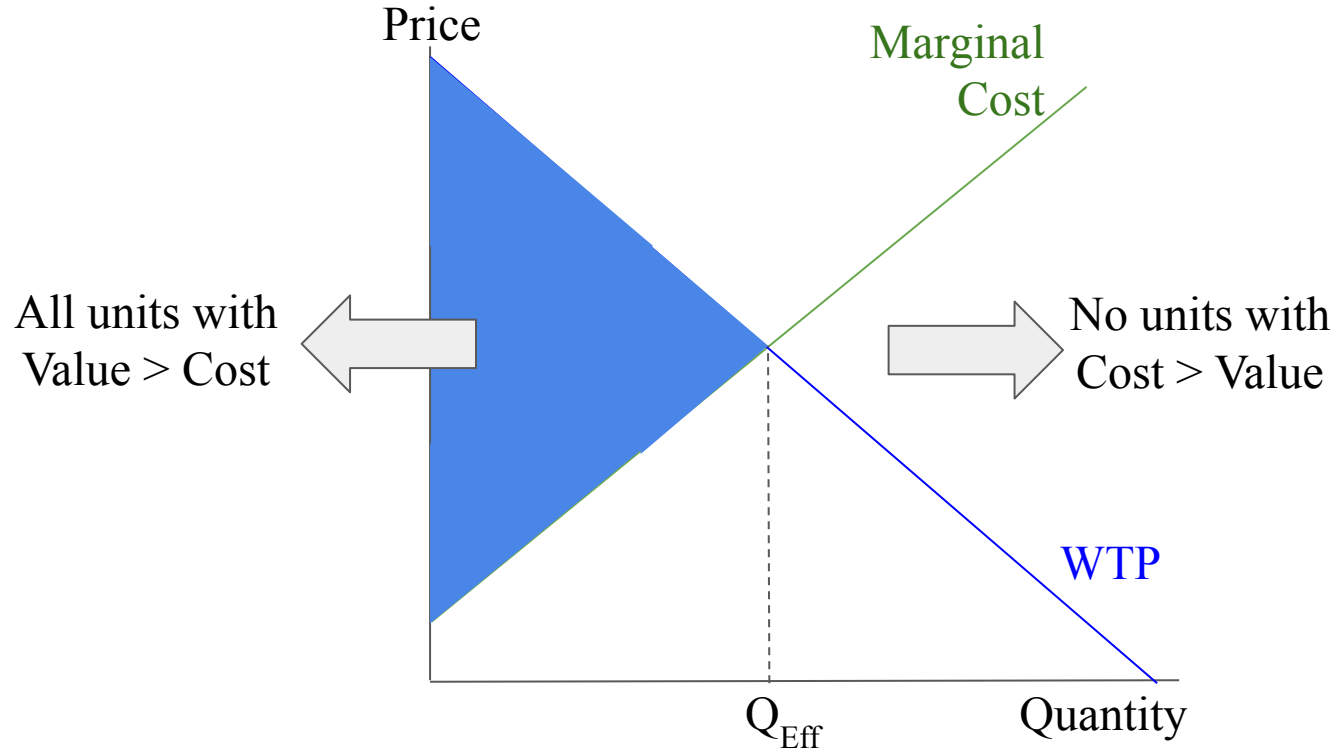
Social Surplus



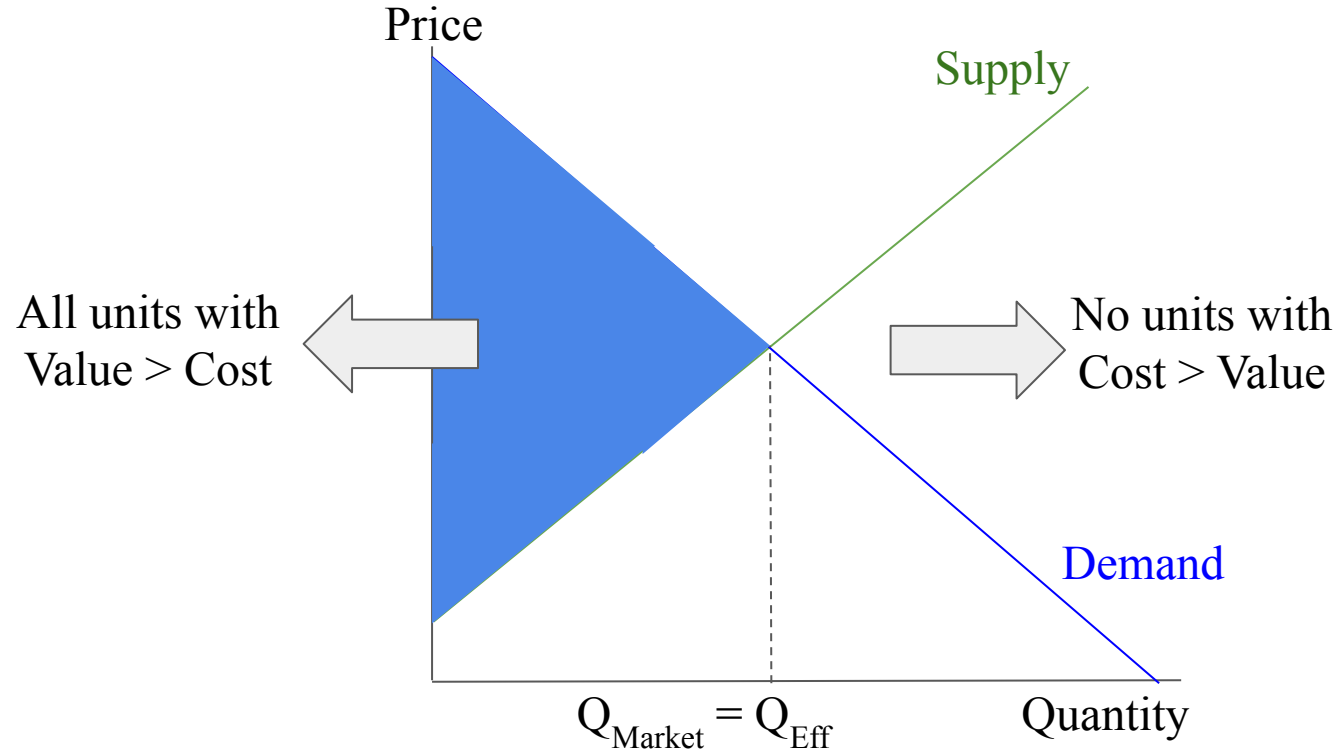
Social Surplus



Efficiency

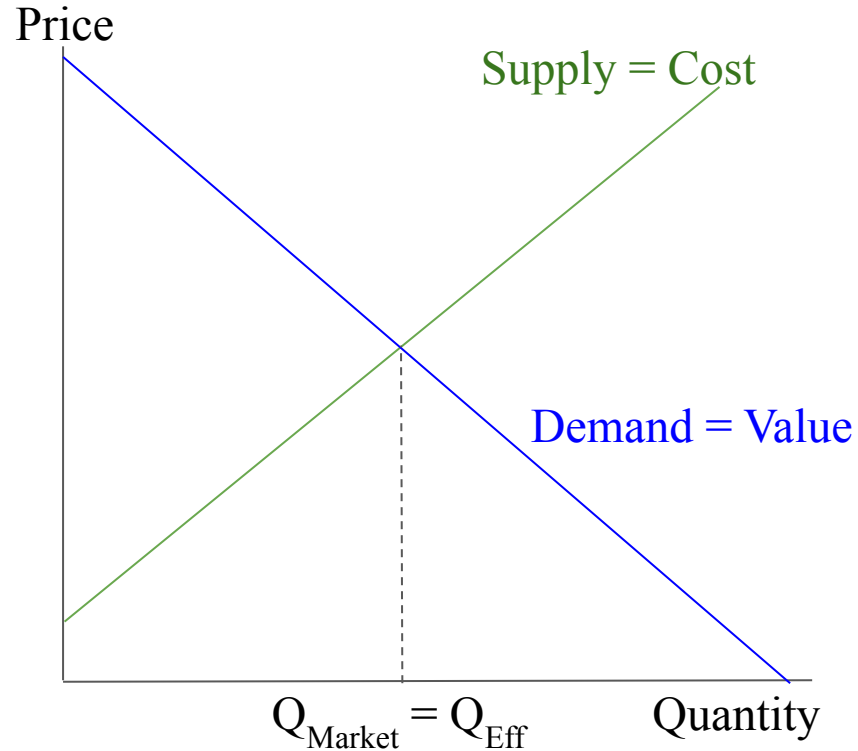


The Market is Efficient



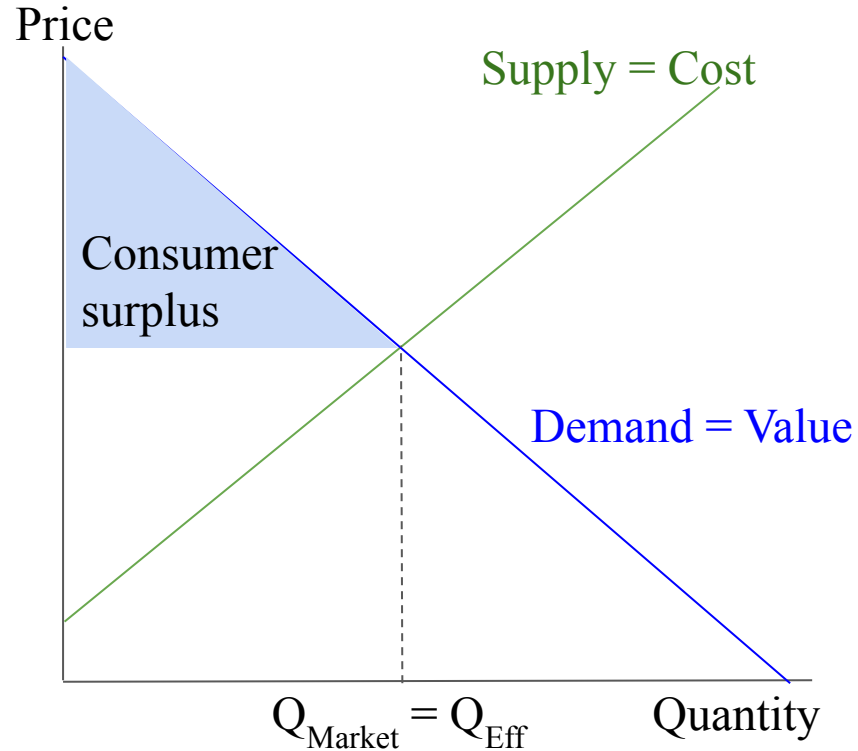
“The Invisible Hand”

- If consumers are rational, demand curve represents their value of the good
- If firms maximize profits and market is competitive, supply shows marginal cost
- Efficient outcome:
 - Produce all units with Value > Cost
 - Produce no units with Value < Cost
- So market outcome is efficient!
 - (Only) units valued above cost sell



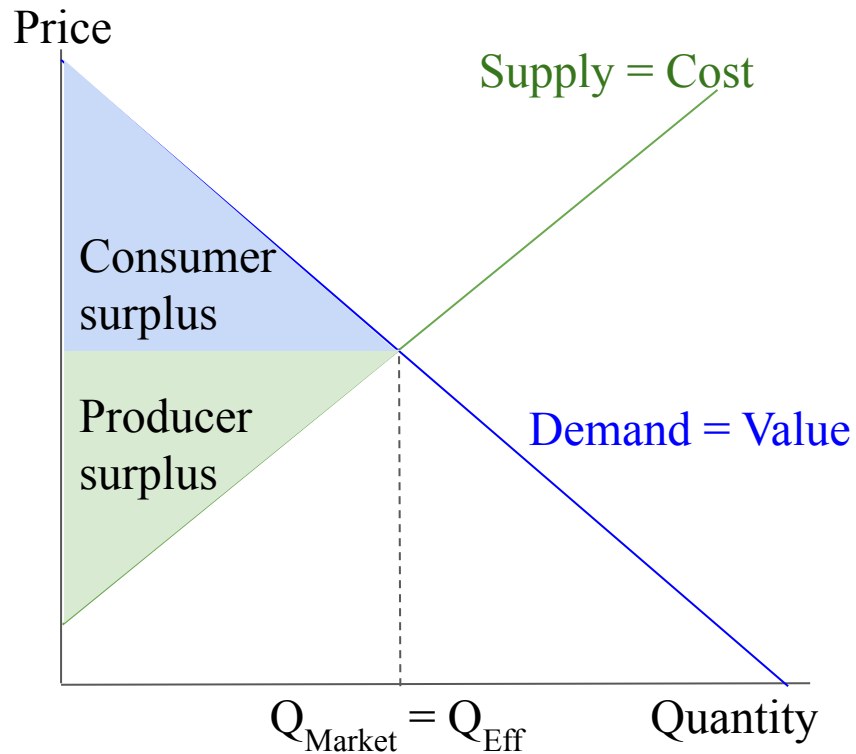
Consumer Surplus

- If consumers are rational, demand curve represents their value of the good
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- Consumer surplus: value above price



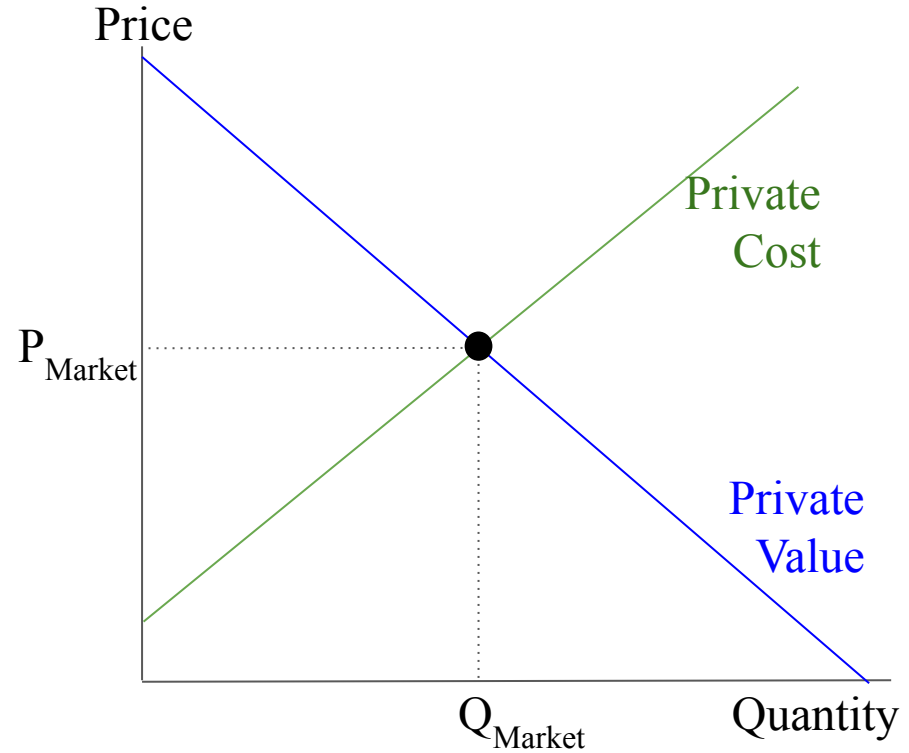
Producer Surplus

- If consumers are rational, demand curve represents their value of the good
- If firms maximize profits and market is competitive, supply shows marginal cost
- Efficient outcome:
 - Produce all units with Value > Cost
 - Produce no units with Value < Cost
- So market outcome is efficient!
 - (Only) units valued above cost sell
- Consumer surplus: value above price
- Producer surplus: price above cost



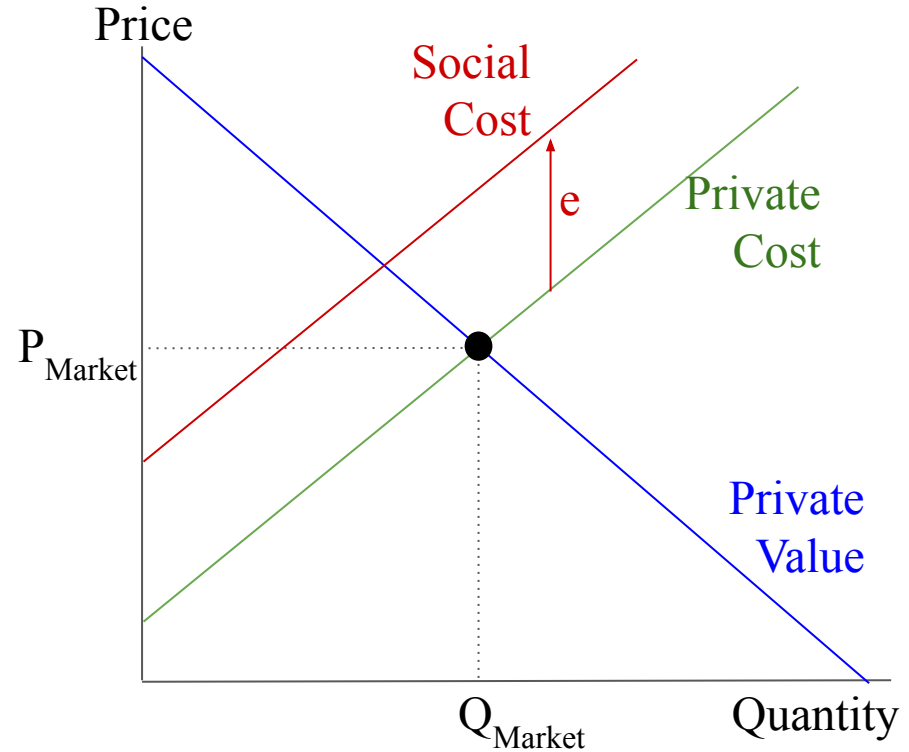
Externalities

- Supply and Demand embody values, costs
 - But they are *private* values and costs



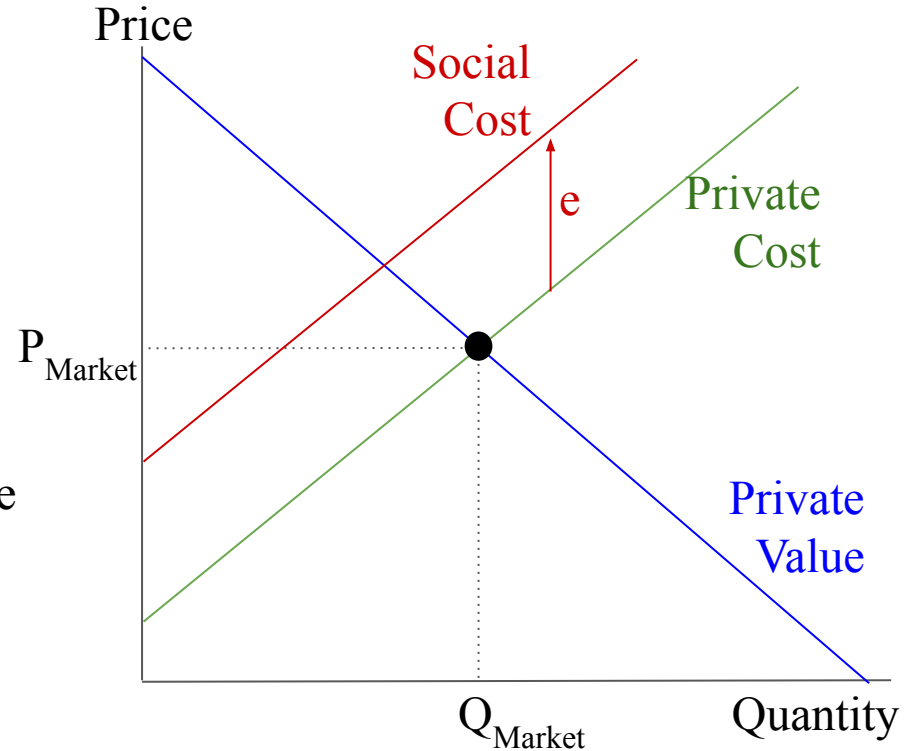
Externalities

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 - But they are *private* values and costs
- Gas has additional pollution costs to society
 - A negative externality
- How does the externality affect P and Q?



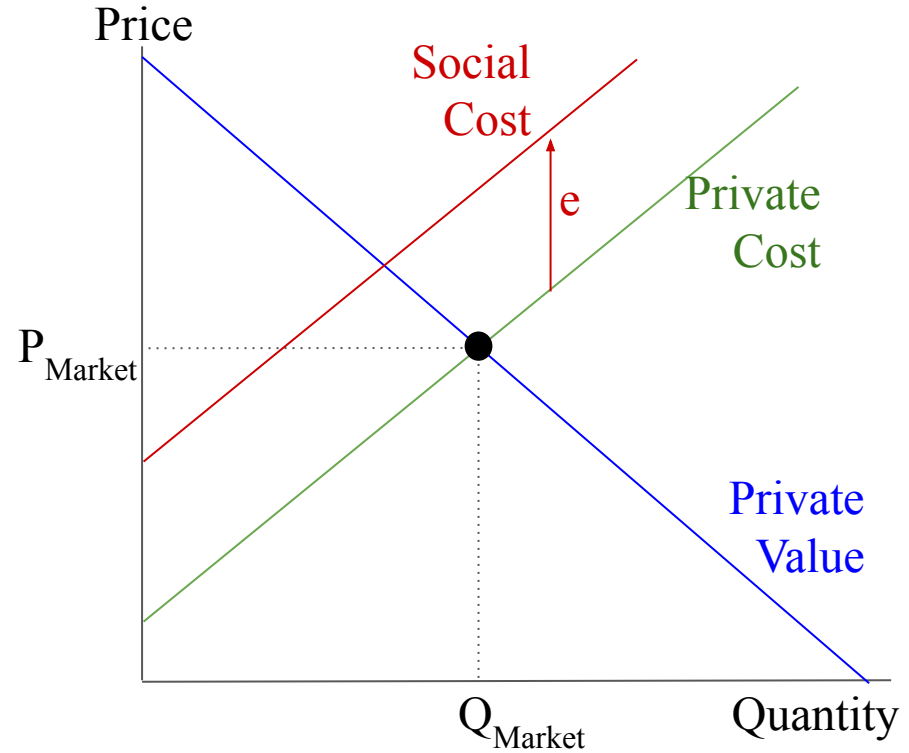
Externalities

- Supply and Demand embody values, costs
 - But they are *private* values and costs
- Gas has additional pollution costs to society
 - A negative externality
- How does the externality affect P and Q?
 - It doesn't – that's the whole point!
 - Market outcome is determined by private actors based on private incentives



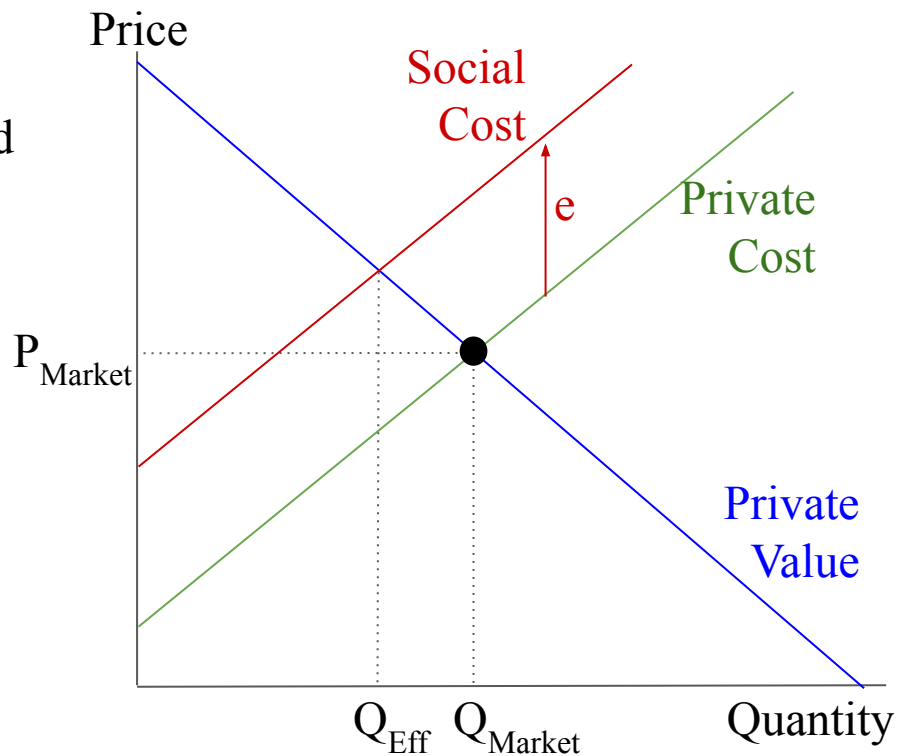
Externalities and Efficiency

- What is the efficient level of Q here?



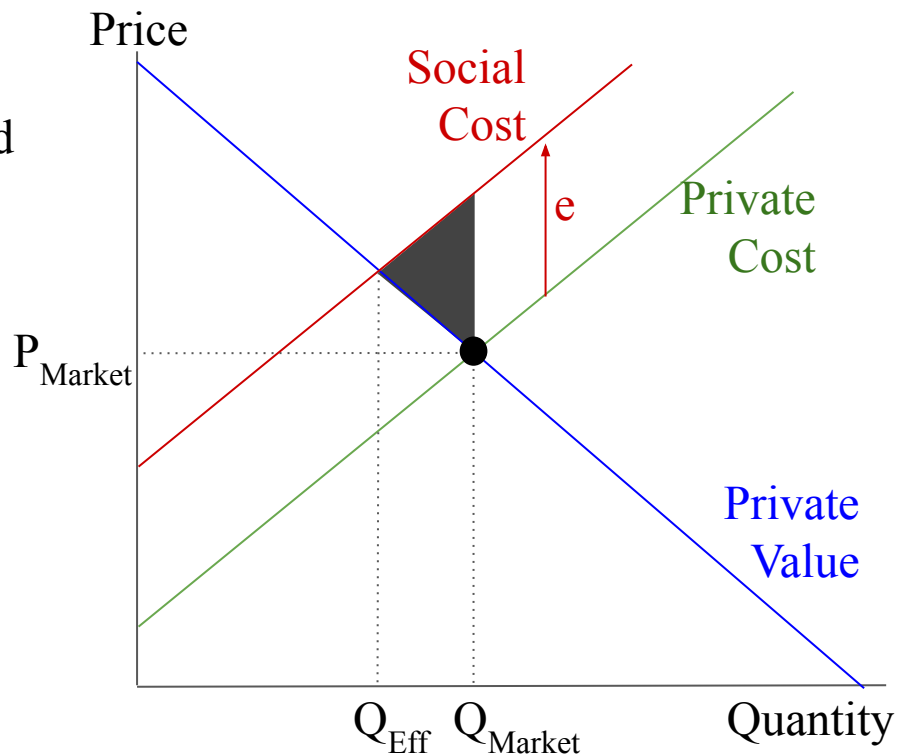
Externalities and Efficiency

- What is the efficient level of Q here?
- It is below the market quantity
 - Market ignores part of the social cost and therefore overproduces



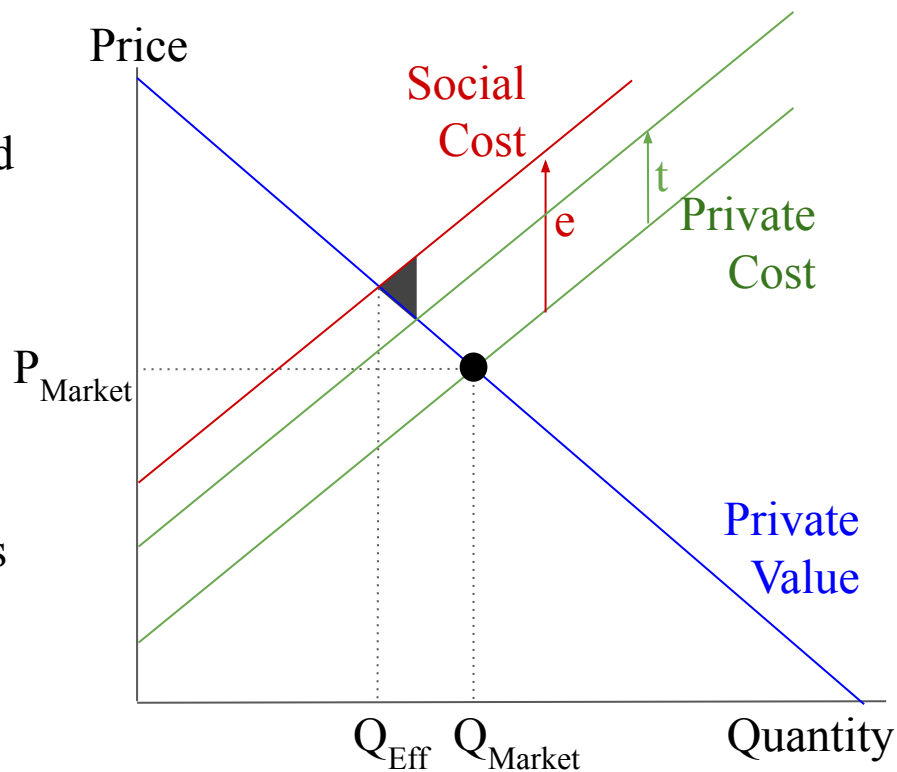
Externalities and Efficiency

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- Creates deadweight loss (DWL)
 - Units with private value just above cost
 - Small surplus is outweighed by external social costs



Externalities and Efficiency

- What is the efficient level of Q here?
- It is below the market quantity
 - Market ignores part of the social cost and therefore overproduces
- Creates deadweight loss (DWL)
 - Units with private value just above cost
 - Small surplus is outweighed by external social costs
- A gas tax increases the private cost and brings it closer to the social cost
 - Deadweight loss is reduced – society is better off!
- You will consider a positive externality on Problem Set 1



Policy is hard

- The goal of lowering the gas tax was to lower pain at the pump, but there are many effects!
 - Gas tax holiday will forfeit useful revenue
 - Gas prices affect the mix of cars that are produced
 - “Cross-price elasticity”
 - Gas usage has major environmental consequences
- *Gas tax holiday probably would deliver short-term benefits to consumers*
 - *But many markets will respond as a result*
 - *And it may conflict with other policy goals*
 - *All should be considered when considering policy options*