

Intermediate Microeconomic

Spring 2025

Part four: Competitive markets

Week 6(b): Markets and efficiency (II)

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Competitive Equilibrium: Roadmap

- Compute competitive market equilibrium
- **Properties of market equilibrium**
 - **Efficiency**
 - **Equity**
- Three examples of government interventions and their welfare implications
 - Price controls
 - Minimum wages
 - Taxation

Efficiency of competitive equilibrium

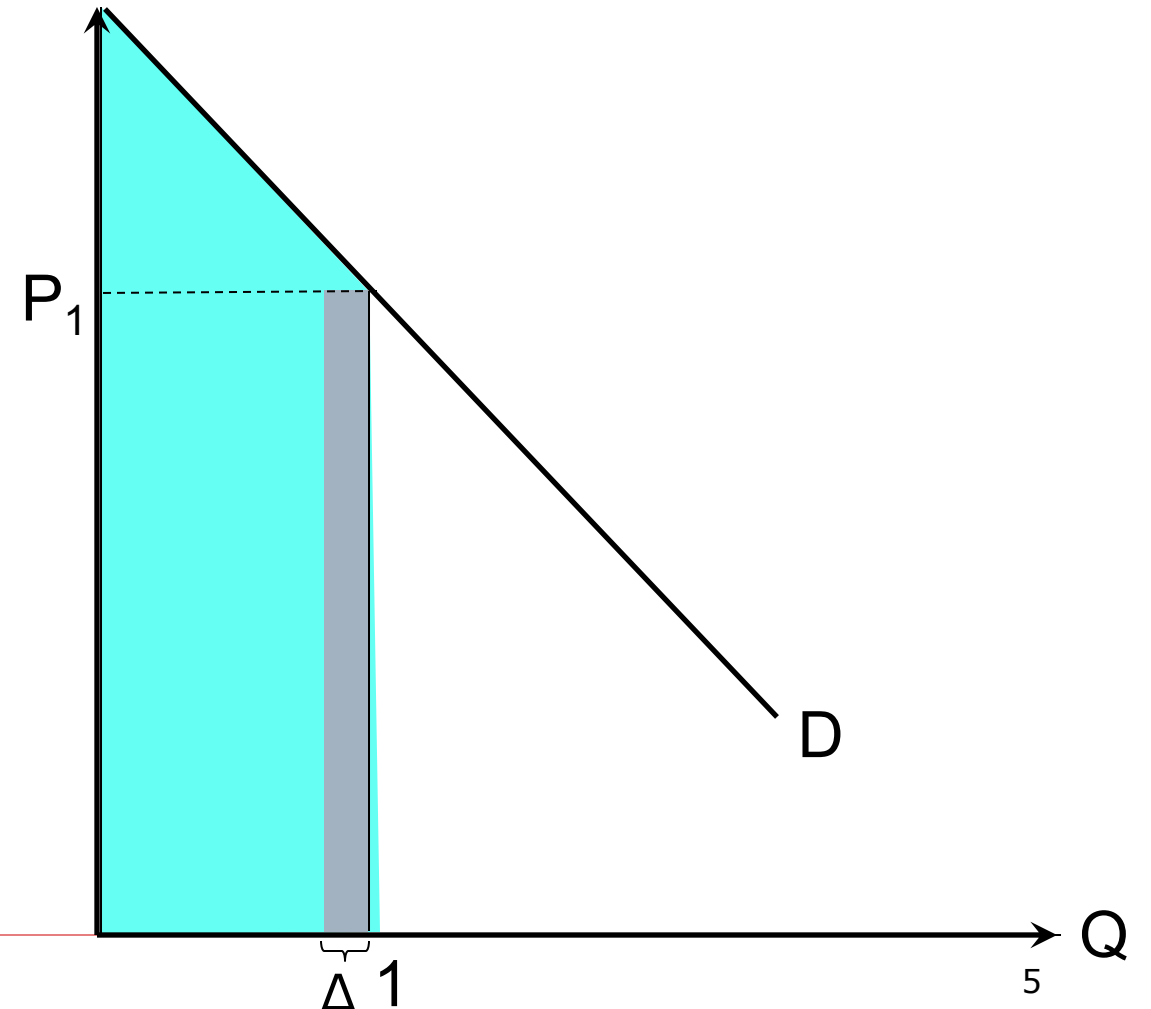
- ❑ To think about whether competitive equilibrium is “good” or “bad”, need to use two measures of how much **value** consumers and producers get from the market equilibrium
- ❑ Consumer side: **consumer surplus**
- ❑ Producer side: **producer surplus**
- ❑ Can be summarized graphically on the demand-supply chart

Willingness to pay (WTP) and consumer surplus

- At price P , a utility-maximizing consumer chooses the quantity off of his demand curve.
- That is, demand curves show how much a person is willing to buy at a given price.
- So, **a demand curve shows how much a person is “willing to pay” to consume the Q^{th} unit of output.**

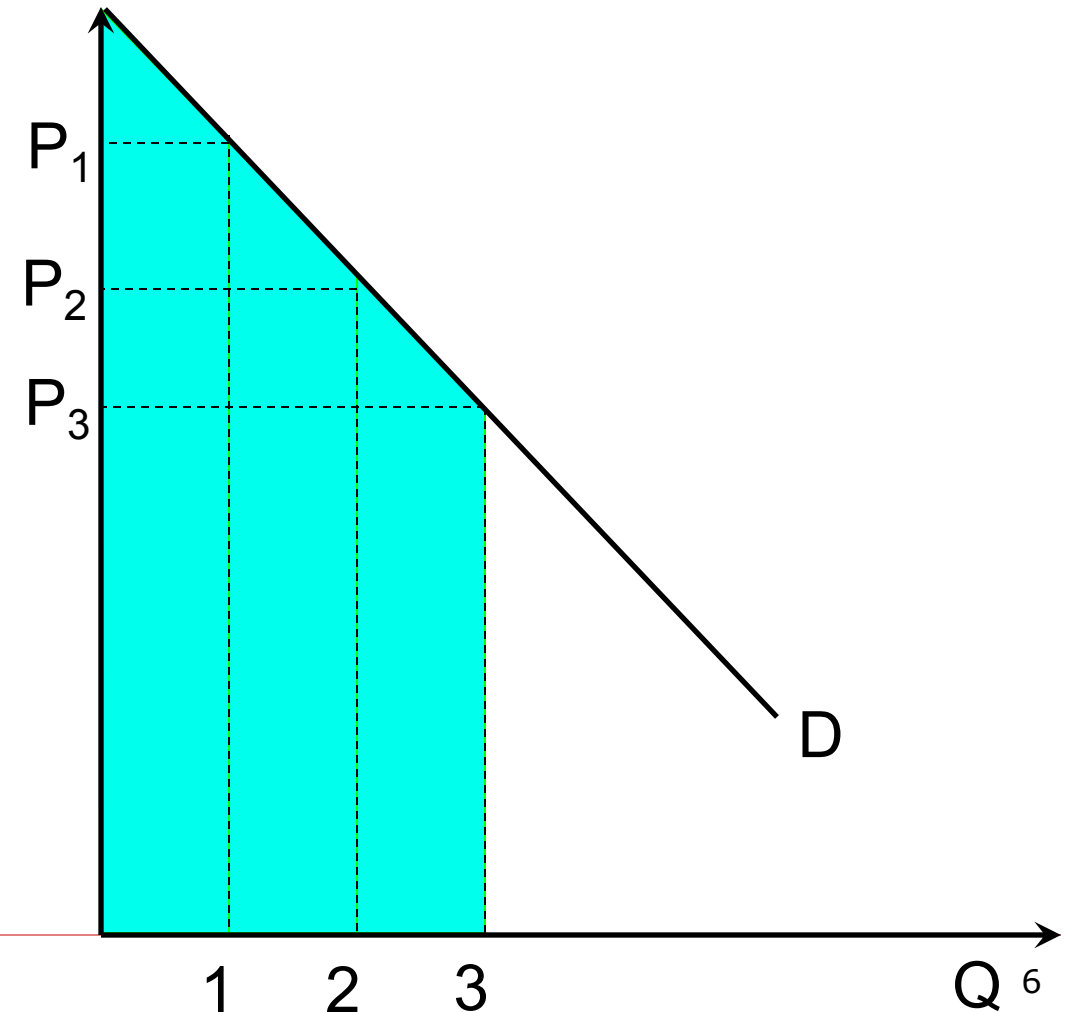
Willingness to pay for goods

- Demand curve tells you the value that the consumer places on the Q th bit of output.
- If you have $1-\Delta$ units of output, your willingness to pay (WTP) for Δ more units is approximately $P_1 * \Delta$.
- Height of the demand curve gives the *marginal* willingness to pay for a little bit more of the good.
- WTP for 1 unit of the good is the area under the demand curve between 0 and 1.



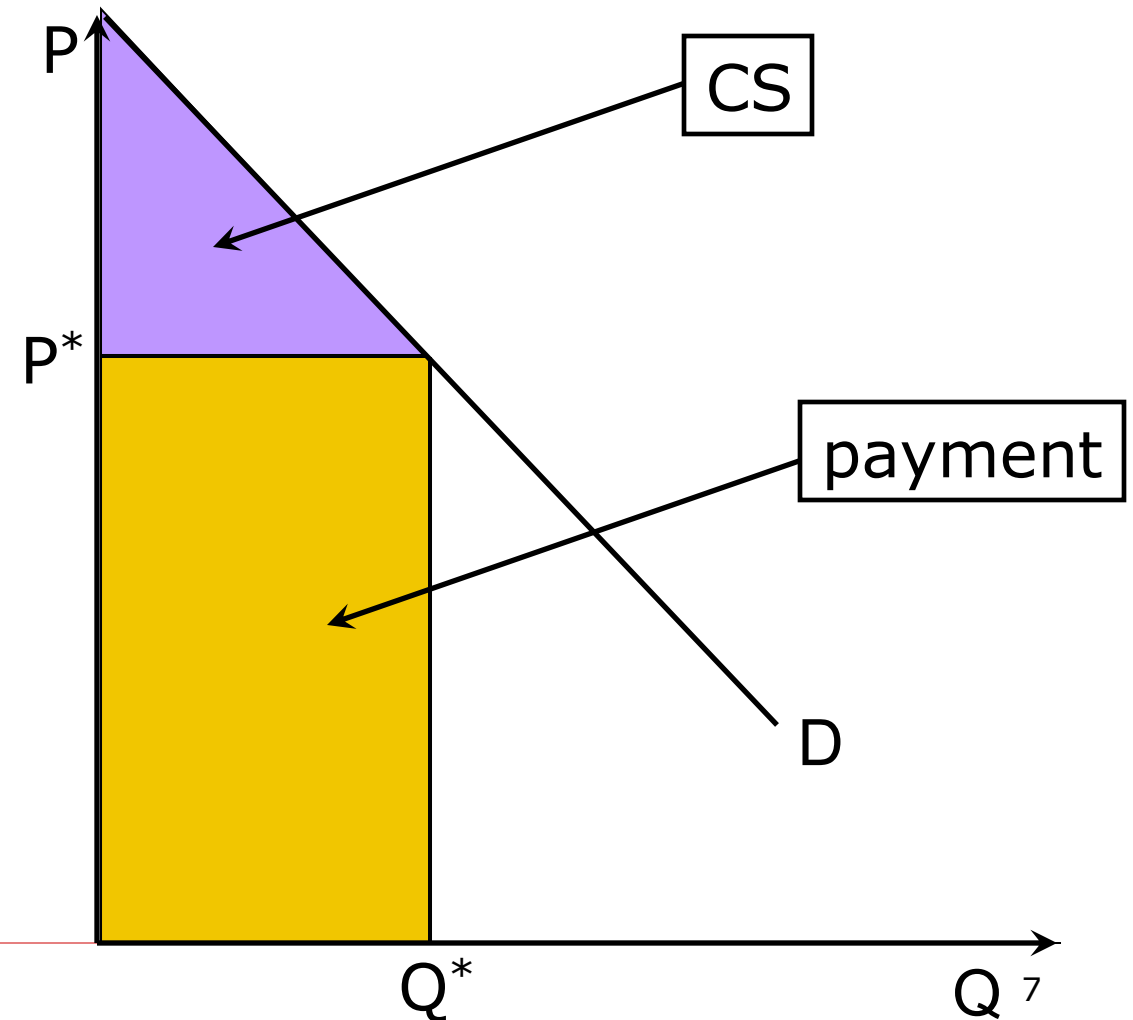
Willingness to pay for goods

- The most individual will pay for the 1st unit is:
- The most individual will pay for the 2nd unit is:
- The most individual will pay for the third unit is:
- So, **the area under the demand curve represents the total value that this consumer gets from consuming the good.**



Consumer Surplus

- ❑ To compute the net benefit, we have to subtract off what the consumer pays.
- ❑ If the market price is P^* , and the consumer buys Q^* units, the total payment is $P^* \times Q^*$ (red rectangle).
- ❑ **Total benefit** (previous slide) minus the payment is the net benefit of paying P^* per unit for Q^* unit.
- ❑ We call the net benefit **Consumer Surplus (CS)** (purple triangle).

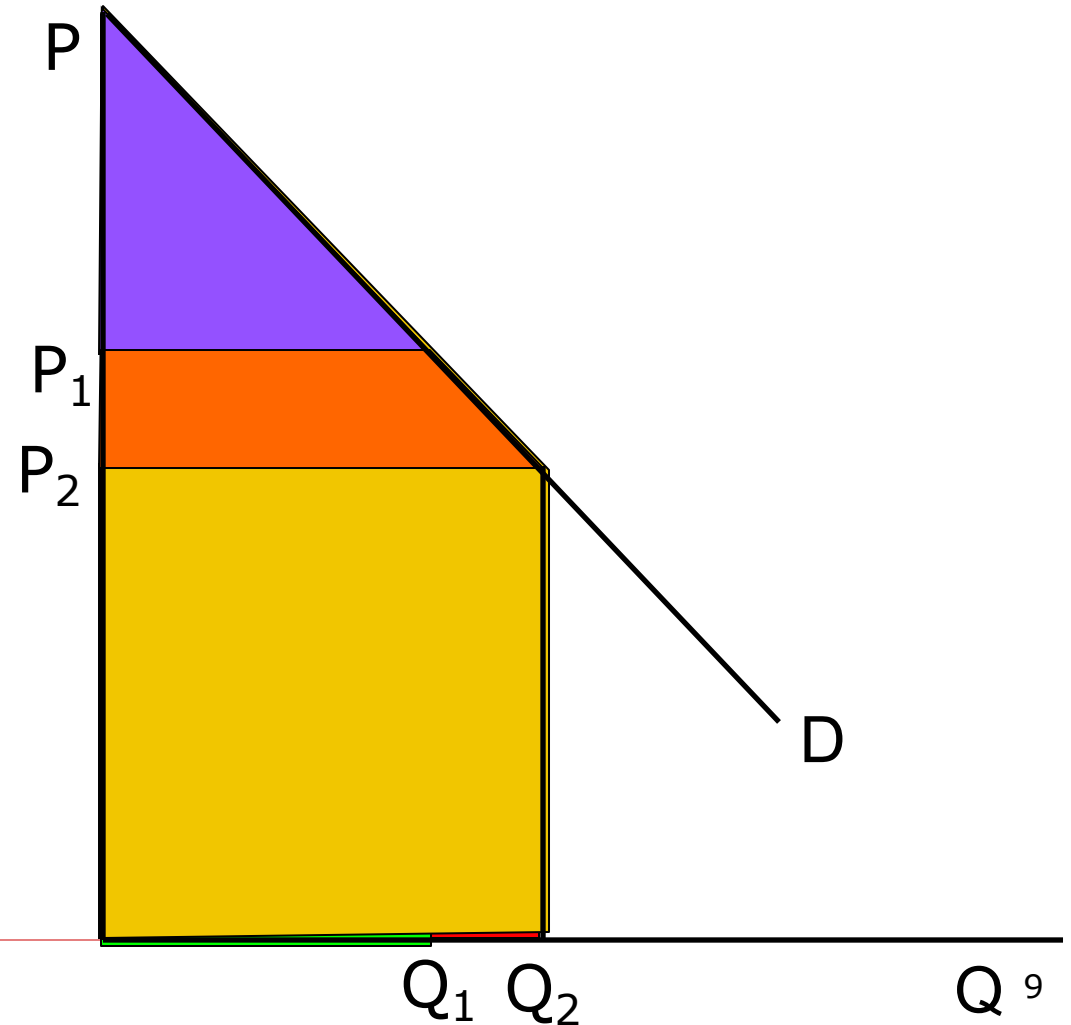


Consumer Surplus

- Consumer surplus = The extra benefit that consumers receive by being able to make market transactions at the prevailing price
- In our “standard” model (consumer pays the same P^* for every Q s/he consumes), consumer surplus = area under the demand curve, above P^* , left of Q^* .
- But, if producers use a more complicated pricing scheme (which we’ll study later), the consumer surplus may be something else.
 - We’ll worry about this in later part of the class

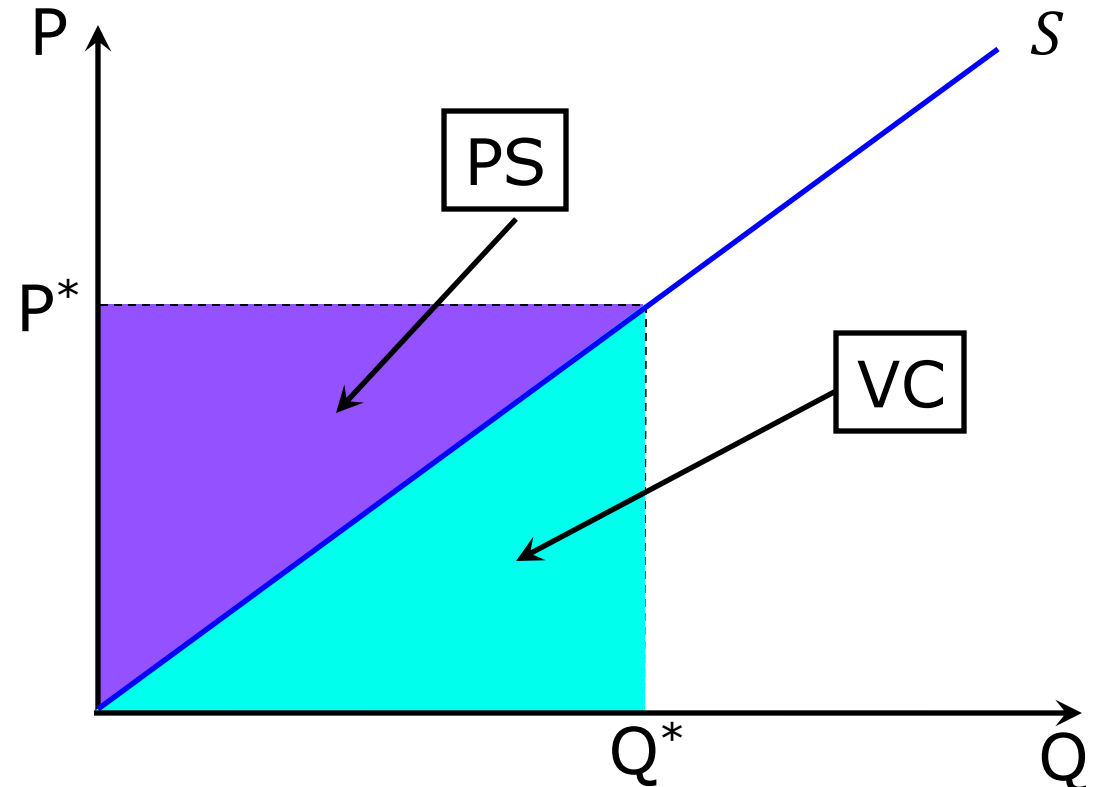
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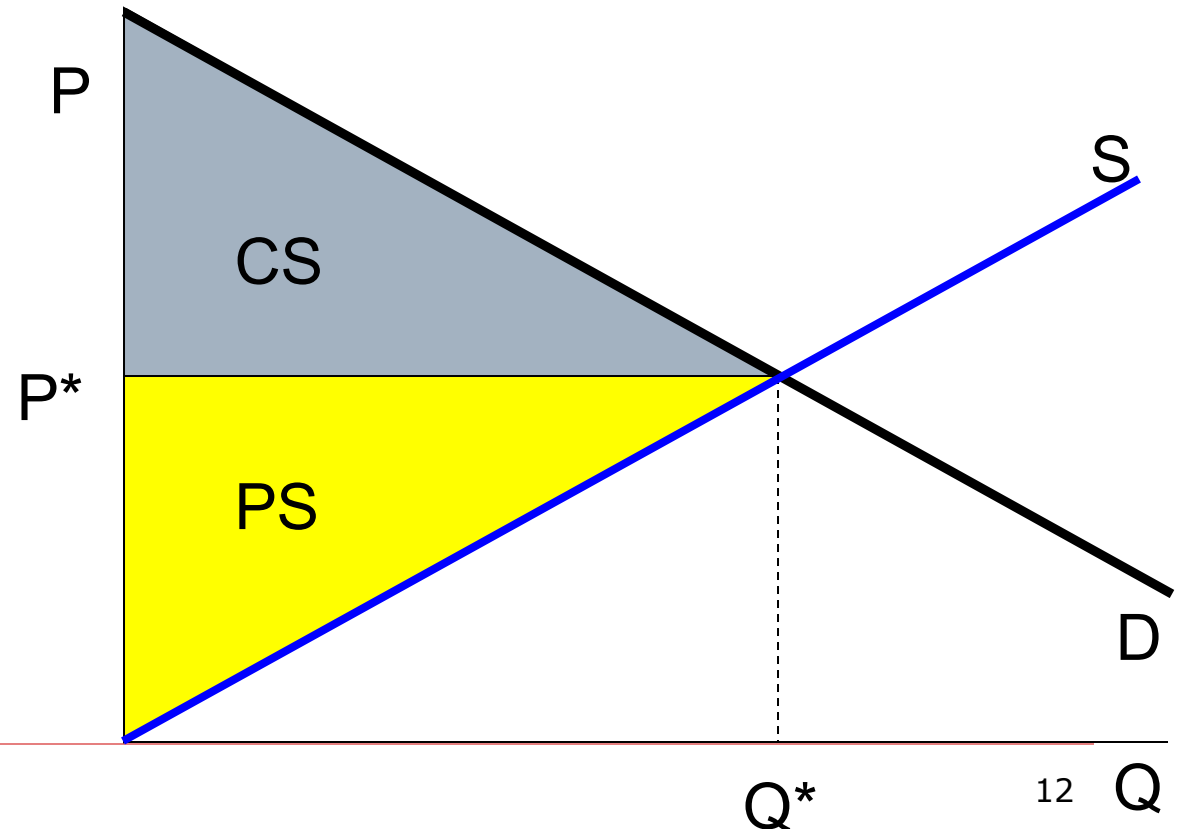
Producer Surplus

- The “height” of the supply curve equals to $MC(Q)$
 - Because supply curve satisfies $P=MC(Q)$
- So, the area under the supply curve up to the Q^{th} unit is the variable cost of producing all units up to that point.
- If the price is P^* , the firm earns revenue $P^* * Q^*$ (rectangle).
- Net value (**Producer Surplus**) is area of rectangle minus area of triangle.
 - = excess revenue over variable cost of producing Q^* units and selling them at P^* .



Total Societal Gains from Market

- The total surplus created when the market is in equilibrium (Q^*, P^*) is the sum of CS and PS.
- **Question:** Which Q maximizes total surplus?
- **Answer:** The Q at which supply and demand intersects, i.e. the market equilibrium quantity
- So, competitive equilibrium maximizes the total social gains, aka. **Competitive equilibrium outcome is "efficient"**



Efficiency of competitive equilibrium

- **“First Fundamental Theorem of Welfare Economics” (aka, First Welfare Theorem):** the competitive market equilibrium results in an efficient outcome
 - **“Efficient:”** CS+PS is maximized
 - Also known as **“Pareto Optimal”**: There is no other allocation that can make one market participant better off without making another participant worse off.

Efficiency of competitive equilibrium

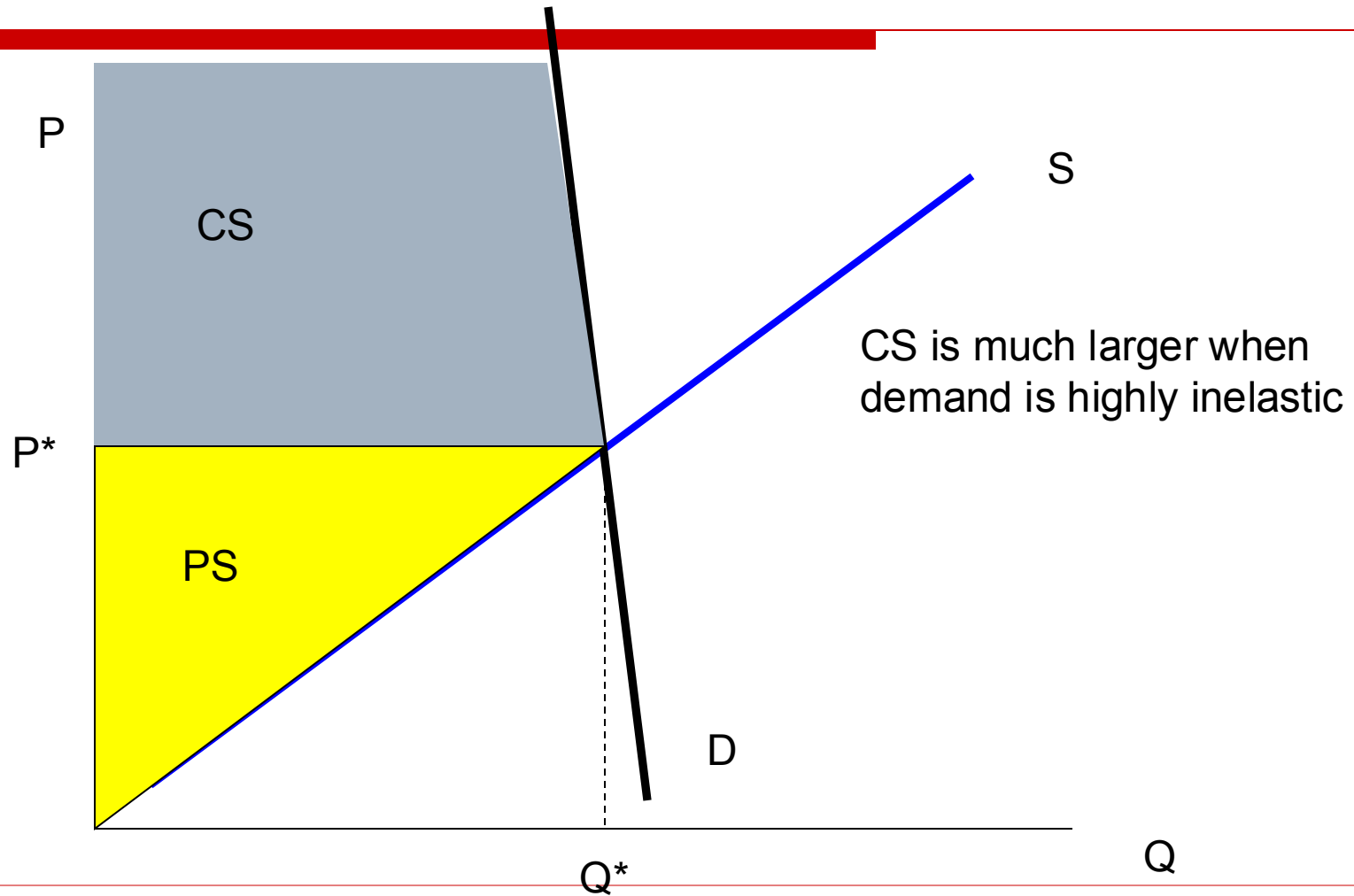
- **“First Fundamental Theorem of Welfare Economics” (aka, First Welfare Theorem):** the competitive market equilibrium results in an efficient outcome
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- First Welfare Theorem is one of the most powerful results in microeconomics: free interaction between self-interested market participants can result in efficient economic outcome
 - Market is “decentralized”: No need for the government to know demand and supply curve
 - Can generalize to N consumer, K-commodity economy settings
 - This is essentially what people means when they talk about Adam Smith’s “Invisible Hand”

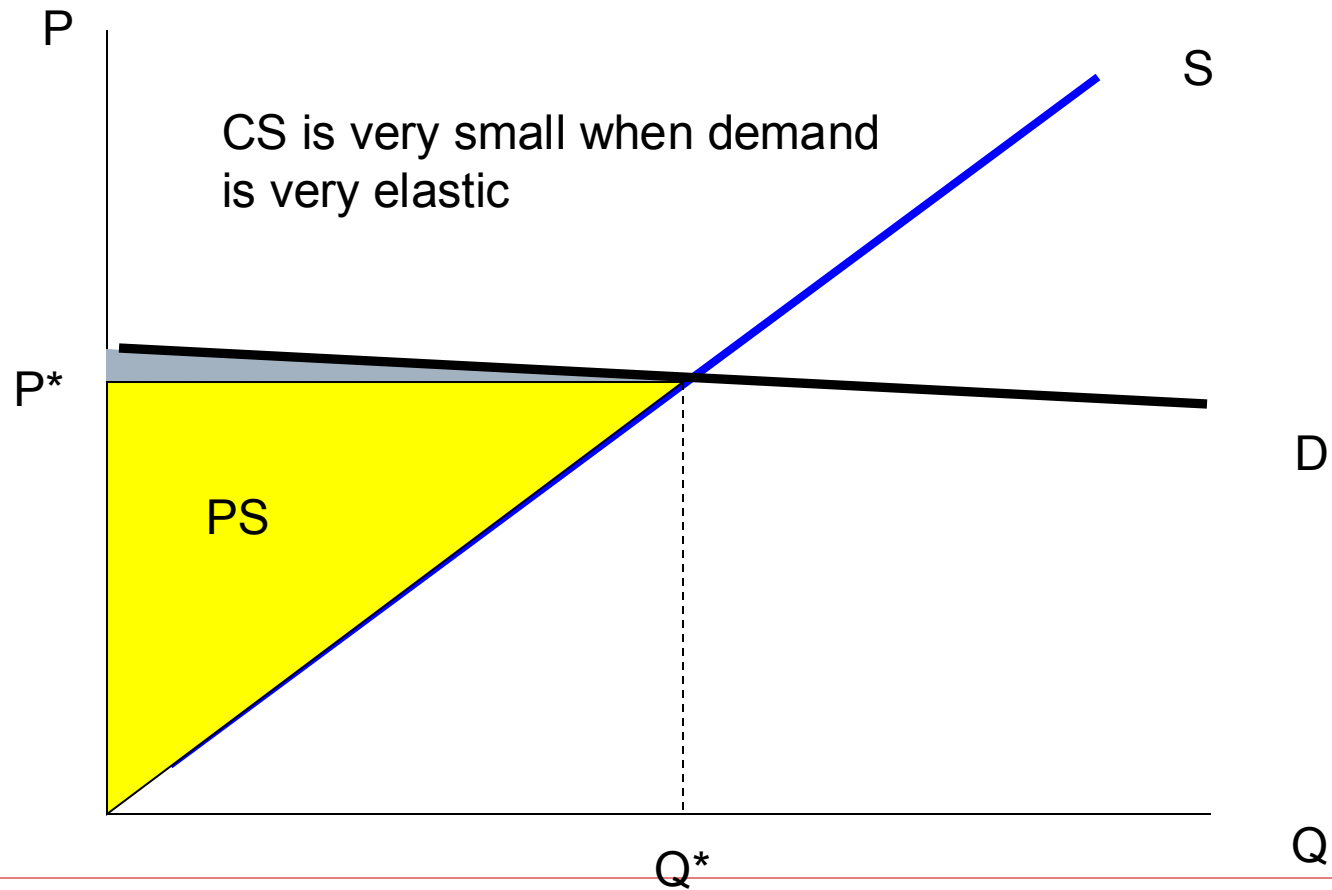
Equity of competitive equilibrium

- Pareto Optimal: There is no other allocation that can make one participant better off without making another participant worse off.
 - Example: dropping \$5 on the ground and distributing the rest among you would *not* result in a Pareto Optimal distribution of the \$100.
- Note, though, that Pareto Optimality says nothing about “equity”
 - Example: giving \$100 to one person and \$0 to everyone else is Pareto Optimal!
- Just because the market equilibrium is Pareto Optimal (i.e. maximizes the sum of CS and PS), that doesn’t say anything about the **distribution** of surplus between producers and consumers

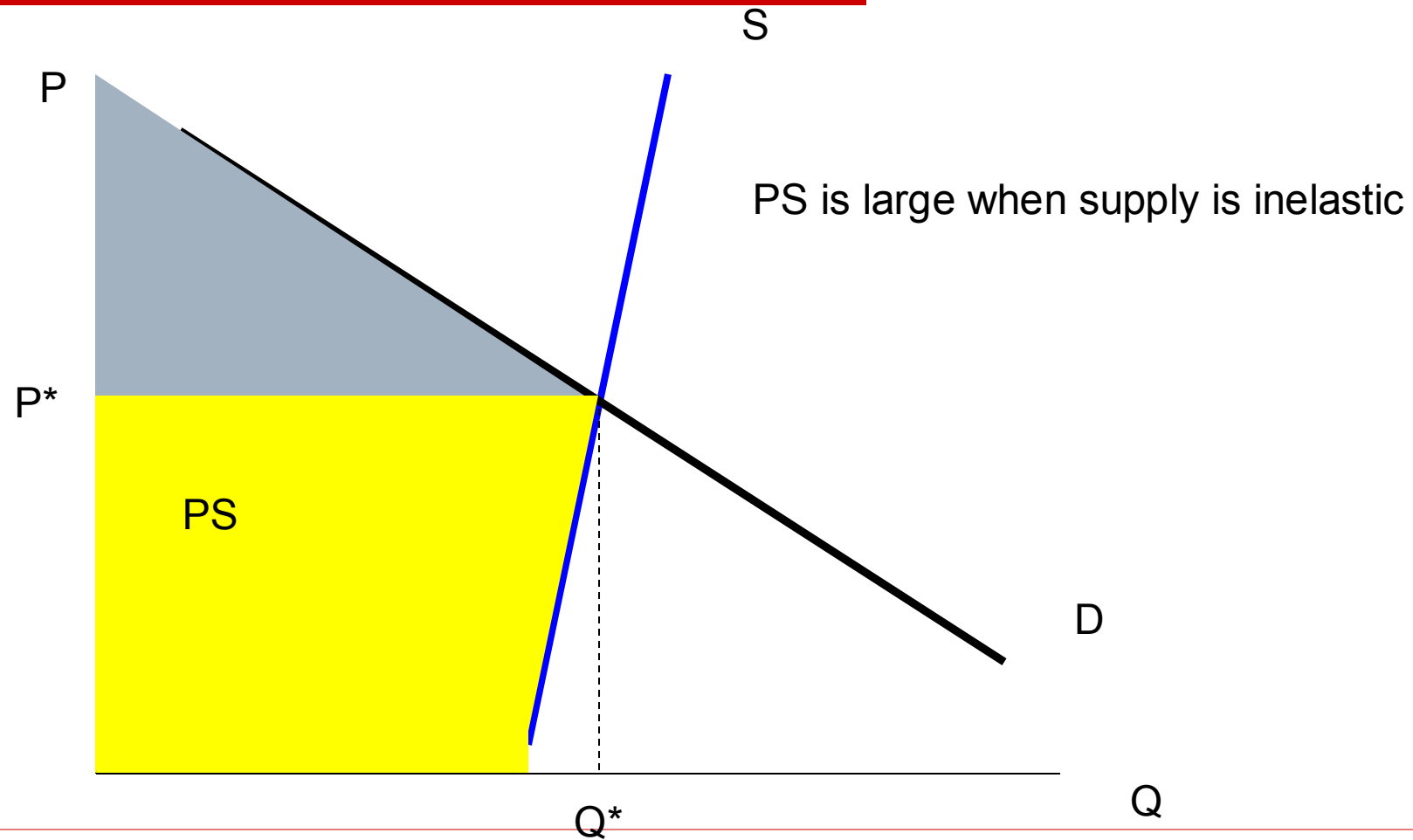
Elasticities and CS



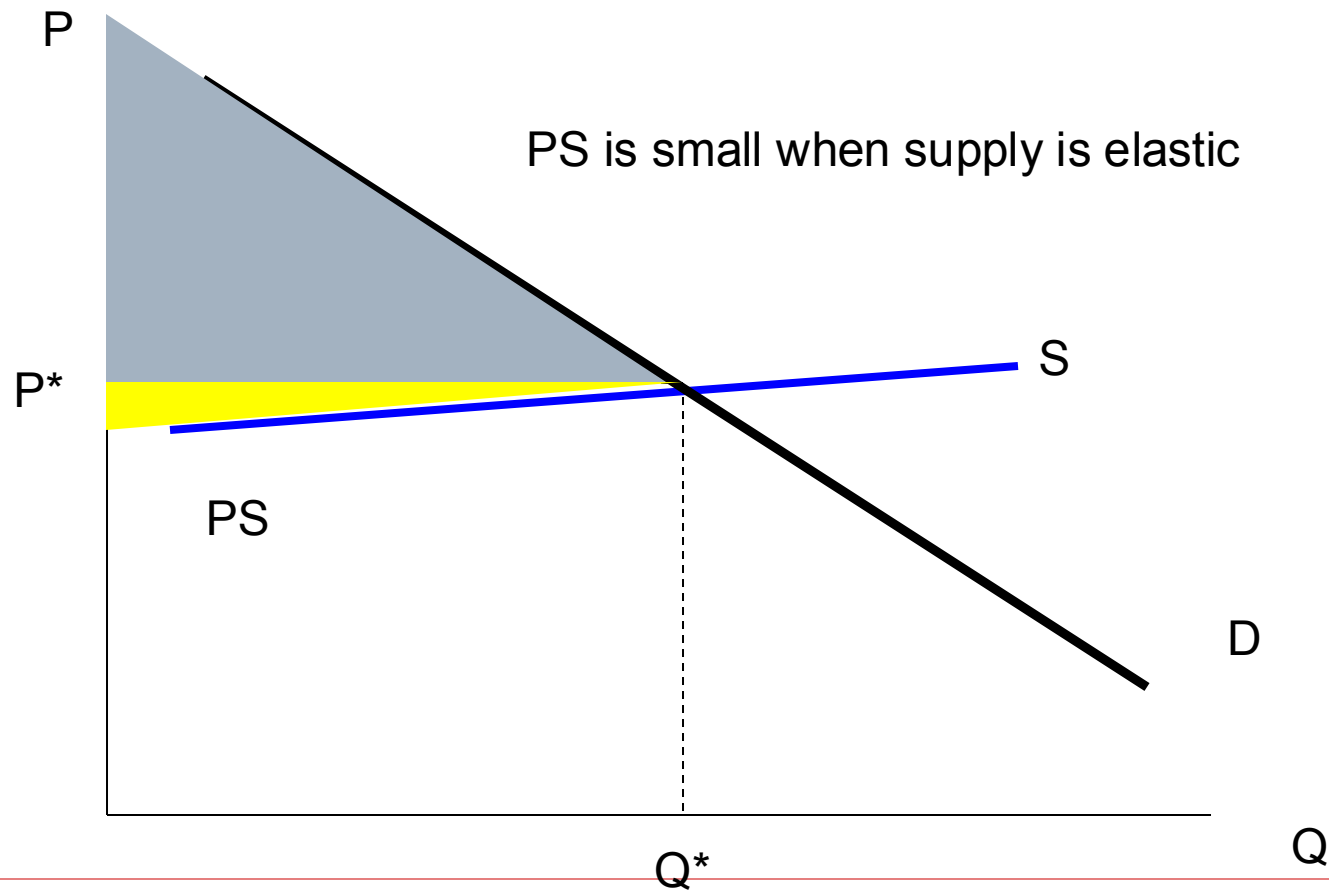
Elasticities and CS



Elasticities and PS



Elasticities and PS



Equity of competitive equilibrium

- Although competitive market results in efficient market outcome, the equity property of a competitive equilibrium is much less certain
- But as a society (or as a government), we also care about equity
 - We probably don't want markets make some people very rich and some people very poor
- For the remainder of the lecture, we'll study several ways one can depart from a purely competitive markets in order to "improve" the distribution of wealth.
 - One thing we will see, though, is that departing from competitive markets frequently means moving to an allocation that is not Pareto Optimal.

Competitive Equilibrium: Roadmap

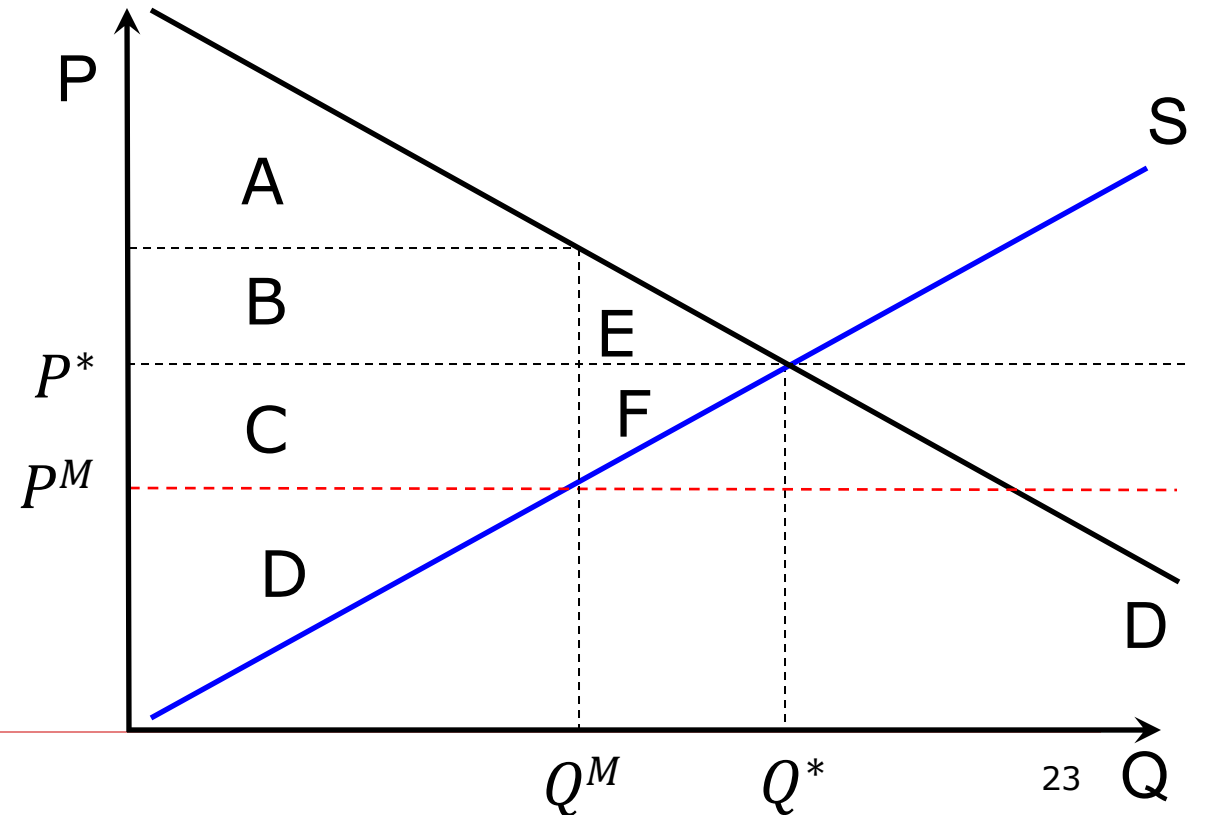
- Compute competitive market equilibrium
- Properties of market equilibrium
 - Efficiency
 - Equity
- **Three examples of government interventions and their welfare implications**
 - **Price controls**
 - **Minimum wages**
 - **Taxation**

Government intervention

- Discuss three types of frequently used governments interventions in markets:
 - Price controls
 - Minimum wages
 - Taxation
- We'll now examine the effect some of these interventions have on market equilibrium and market efficiency.
- Note: In all following slides, I will use (P^*, Q^*) to denote competitive market equilibrium price and quantity

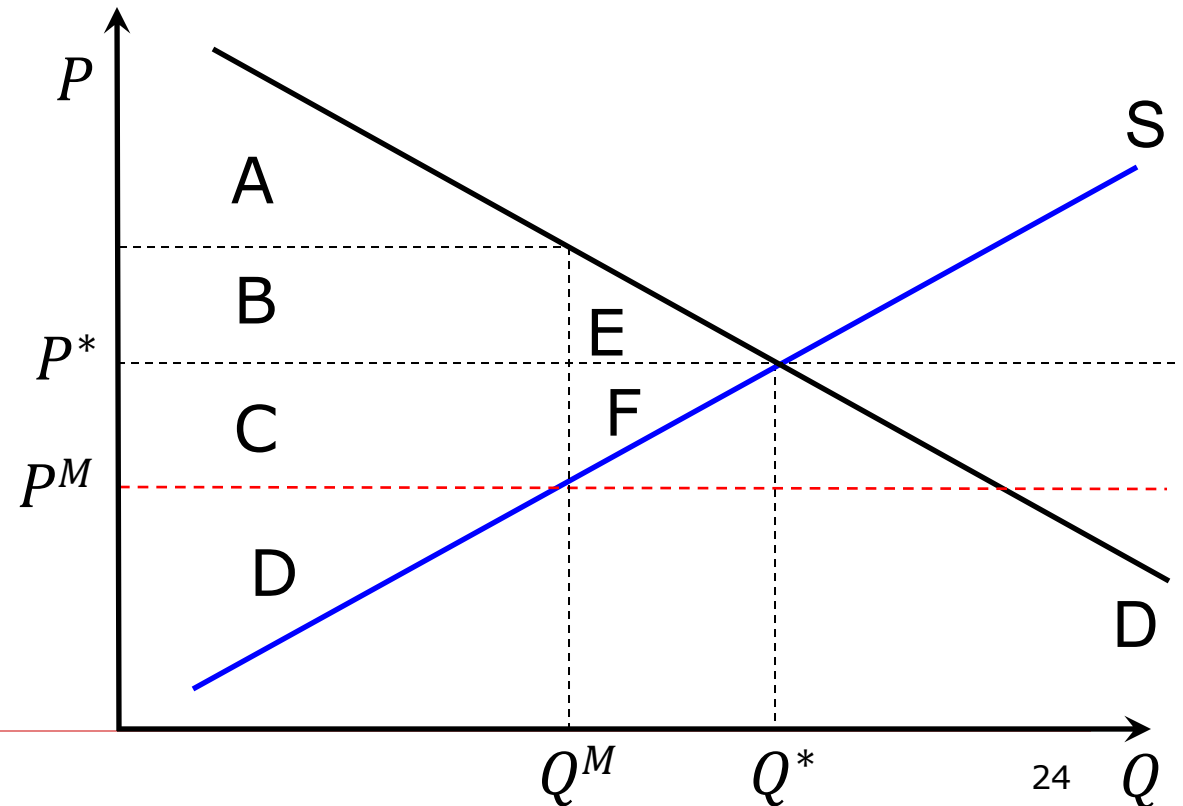
1. Price Controls

- Regulators impose a maximum price P^M on the market. Quantity drops to Q^M .
- Consumers
 - CS Before: $A + B + E$
 - CS After: $A + B + C$
 - $\Delta CS = C - E$
 - Some consumers no longer get the good ($-E$).
 - Those that still do, get it more cheaply (C).



Price Controls

- Producers:
 - PS Before: $C + D + F$
 - PS After: D
 - $\Delta PS = -C - F$
 - Some units are no longer produced and sold ($-F$).
 - Those that are still sold get a lower price ($-C$).

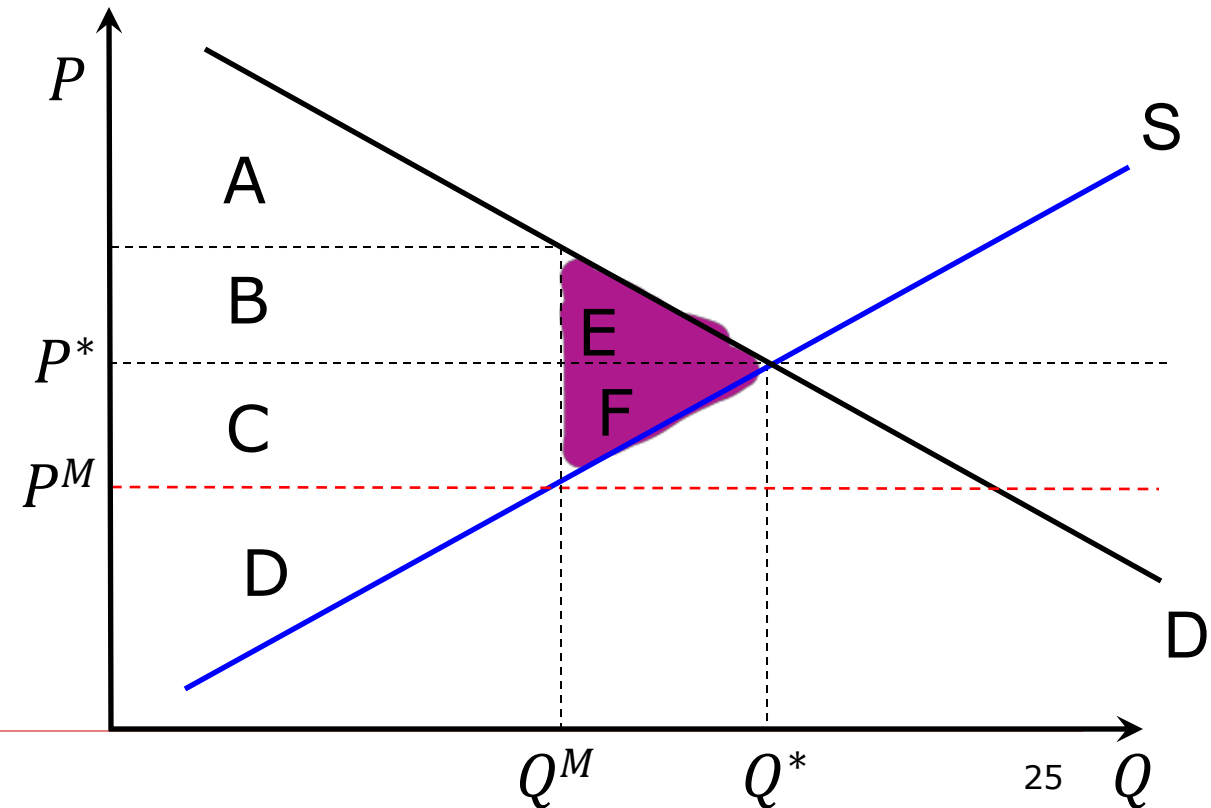


“Deadweight Loss”

Total Surplus:

■ $\Delta TS = -E - F$

- Economists call $E + F$ the “deadweight loss” of the policy = reduction in overall efficiency.

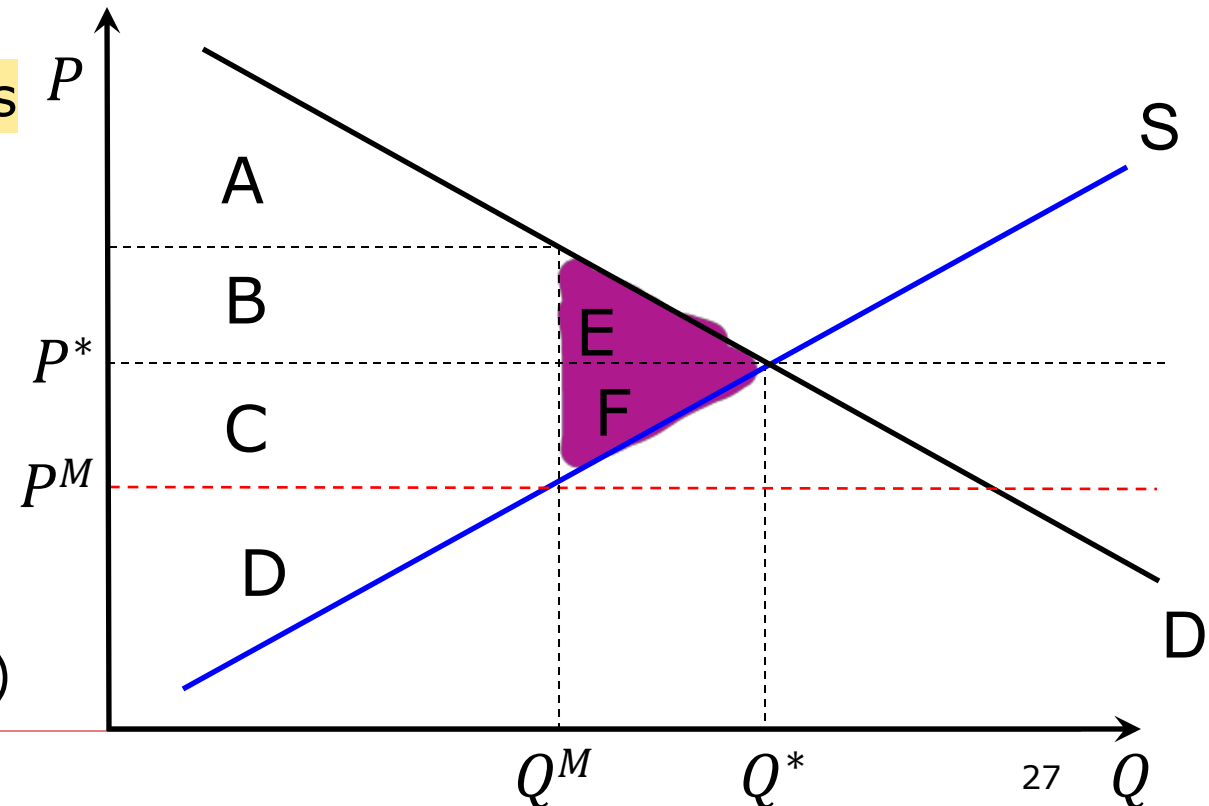


Cause of deadweight loss

- Deadweight loss is created because $Q^M < Q^*$.
 - Price control creates a distortion of quantity away from the competitive level
 - This “distortion” of the quantity exchanged leads to the DWL.
 - It is NOT because price is higher/not equal to the optimal price.

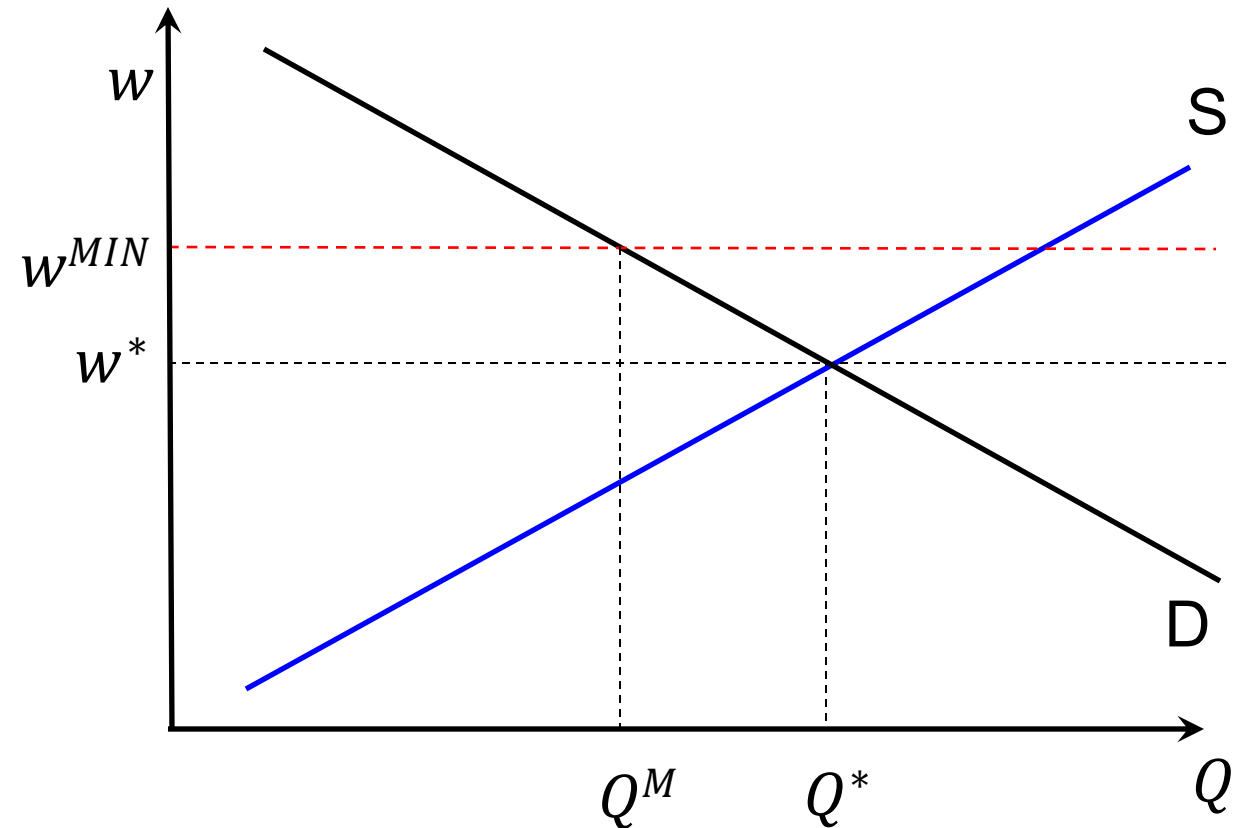
“Deadweight Loss”

- ❑ “In theory”, when there is a DWL, you can enact policies that make everyone better off.
- ❑ Example: no price control, but producers pay consumers a C .
 - ❑ Both consumers and producers would prefer this.
- ❑ In practice, very difficult to do
 - ❑ Requires the government to know shape of demand and supply curves
 - ❑ (Recall how difficult it was just to estimate Uber users’ demand curve!)



2. Minimum wage

- S is the supply of labor, D is the demand for labor.
- The price is the wage rate, w .
- A minimum price $w^{MIN} > w^*$ is imposed on this market.
- Quantity is reduced from Q to Q^M .
- What happens to CS, PS, TS?



Minimum wage

□ Before Minimum Wage:

■ $CS =$

■ $PS =$

□ After Minimum Wage:

■ $CS =$

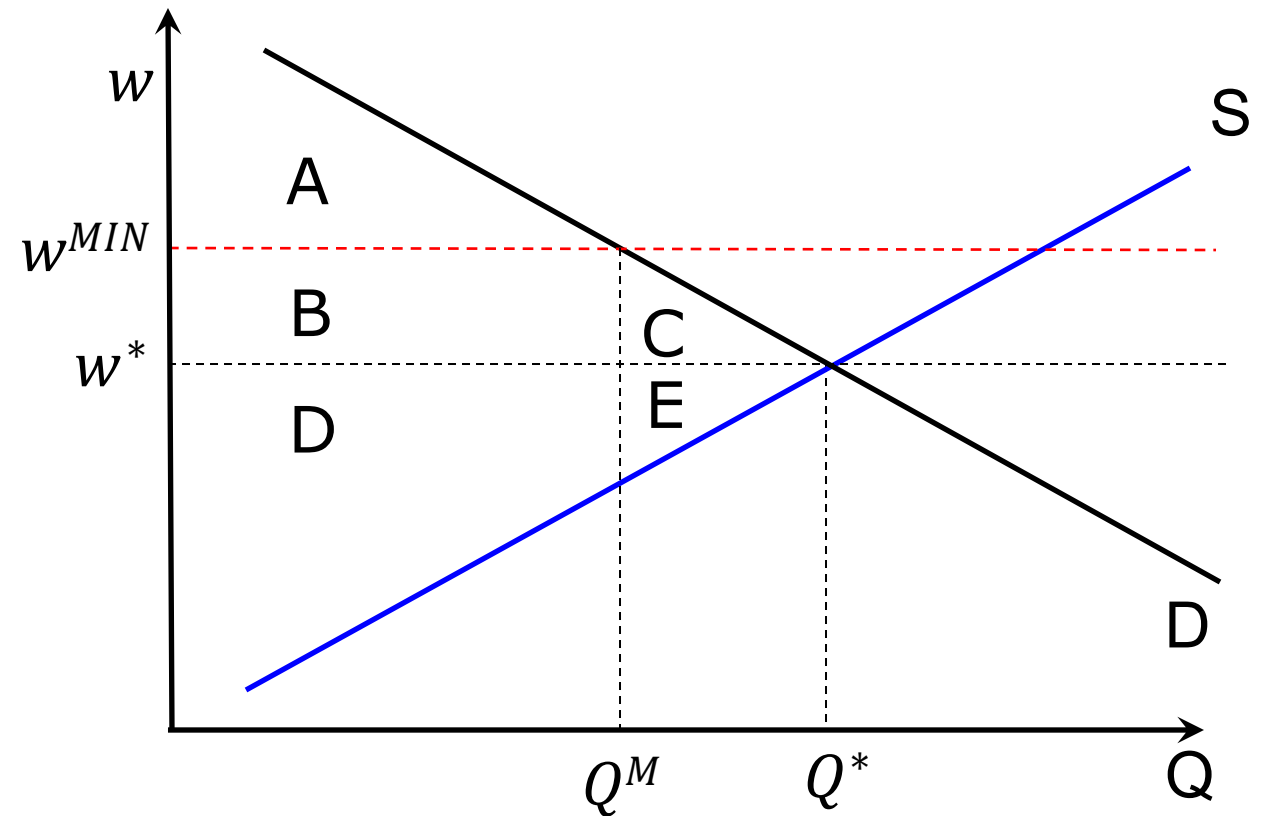
■ $PS =$

□ Change:

■ $\Delta CS =$

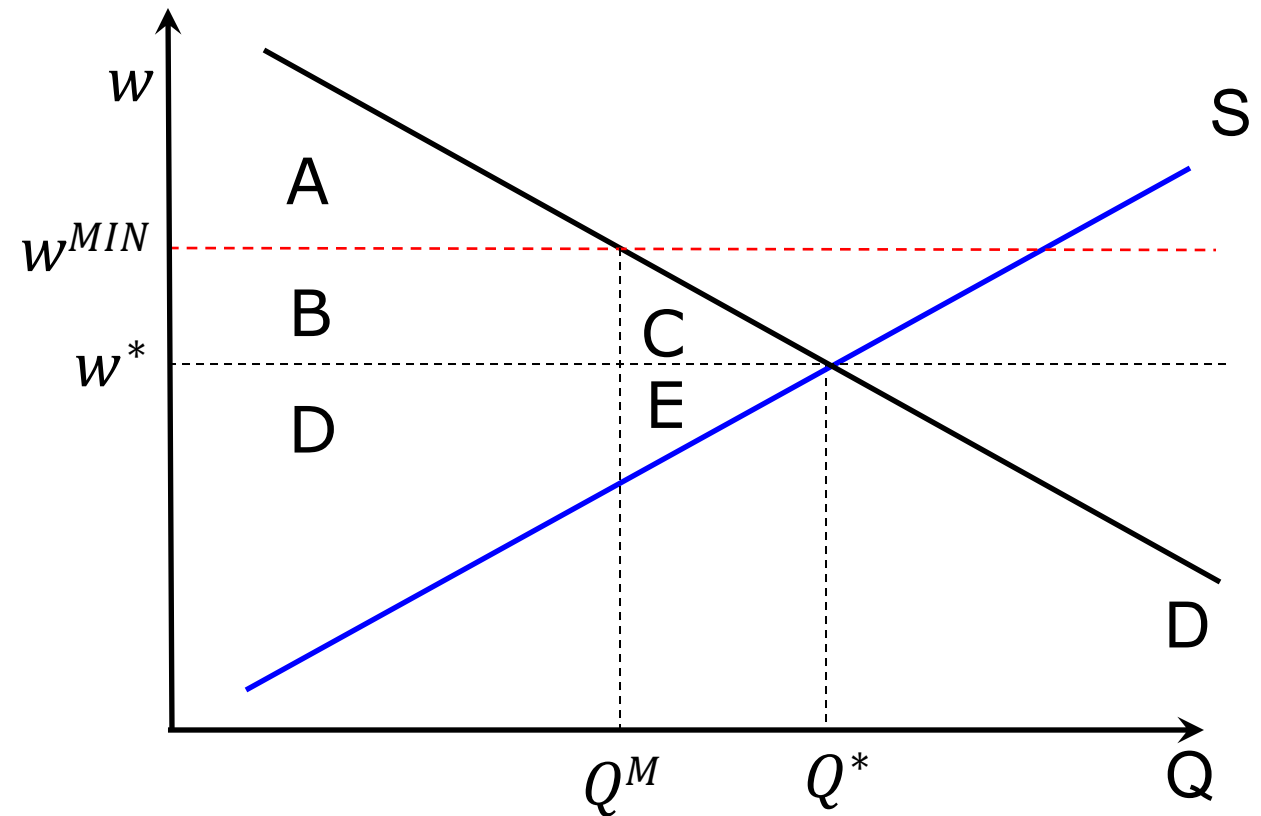
■ $\Delta PS =$

■ $DWL =$



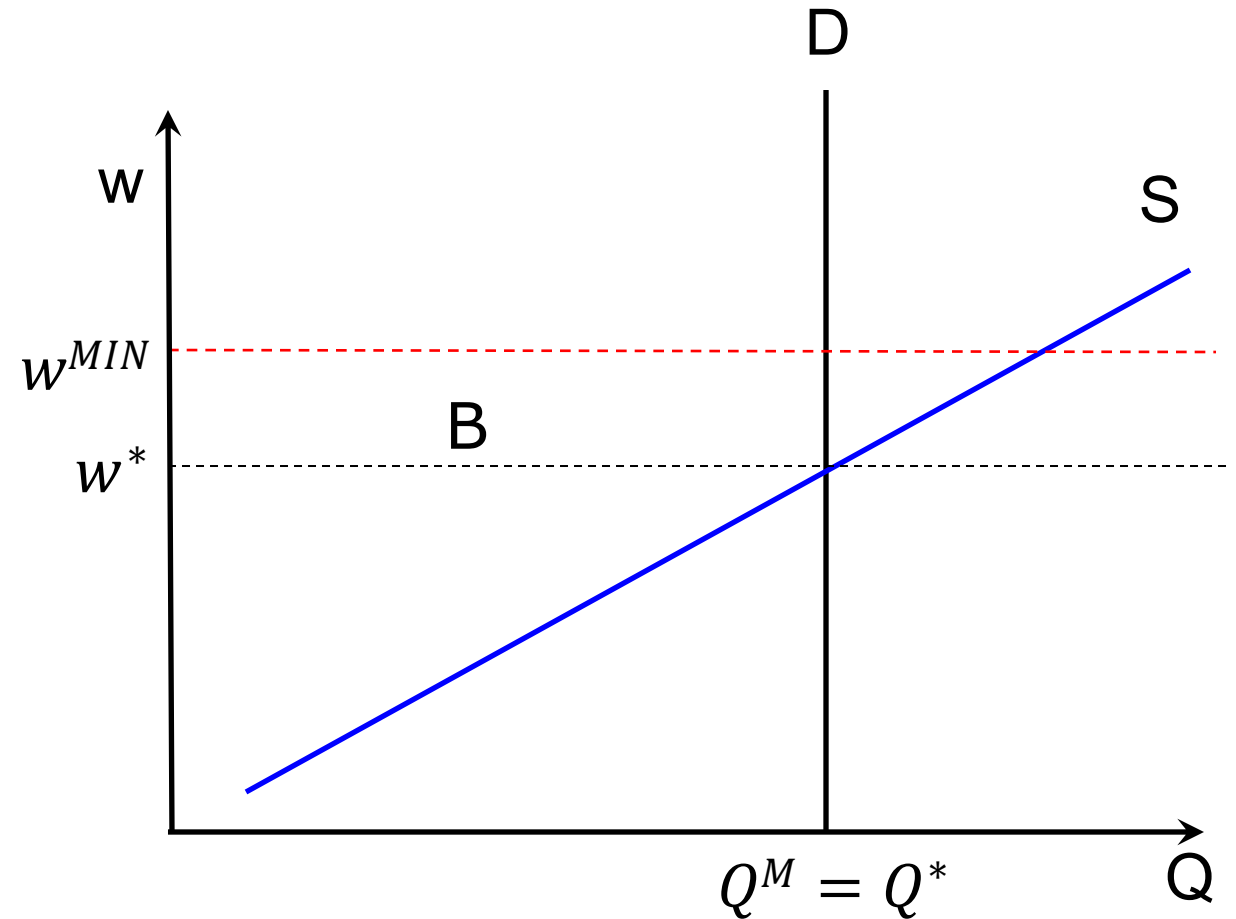
Minimum wage

- Minimum wage has two effects on workers:
 - Some people lose their jobs.
 - Those who are still employed make more money.
- The DWL comes from the first effect, and its magnitude depends on the elasticity of demand.

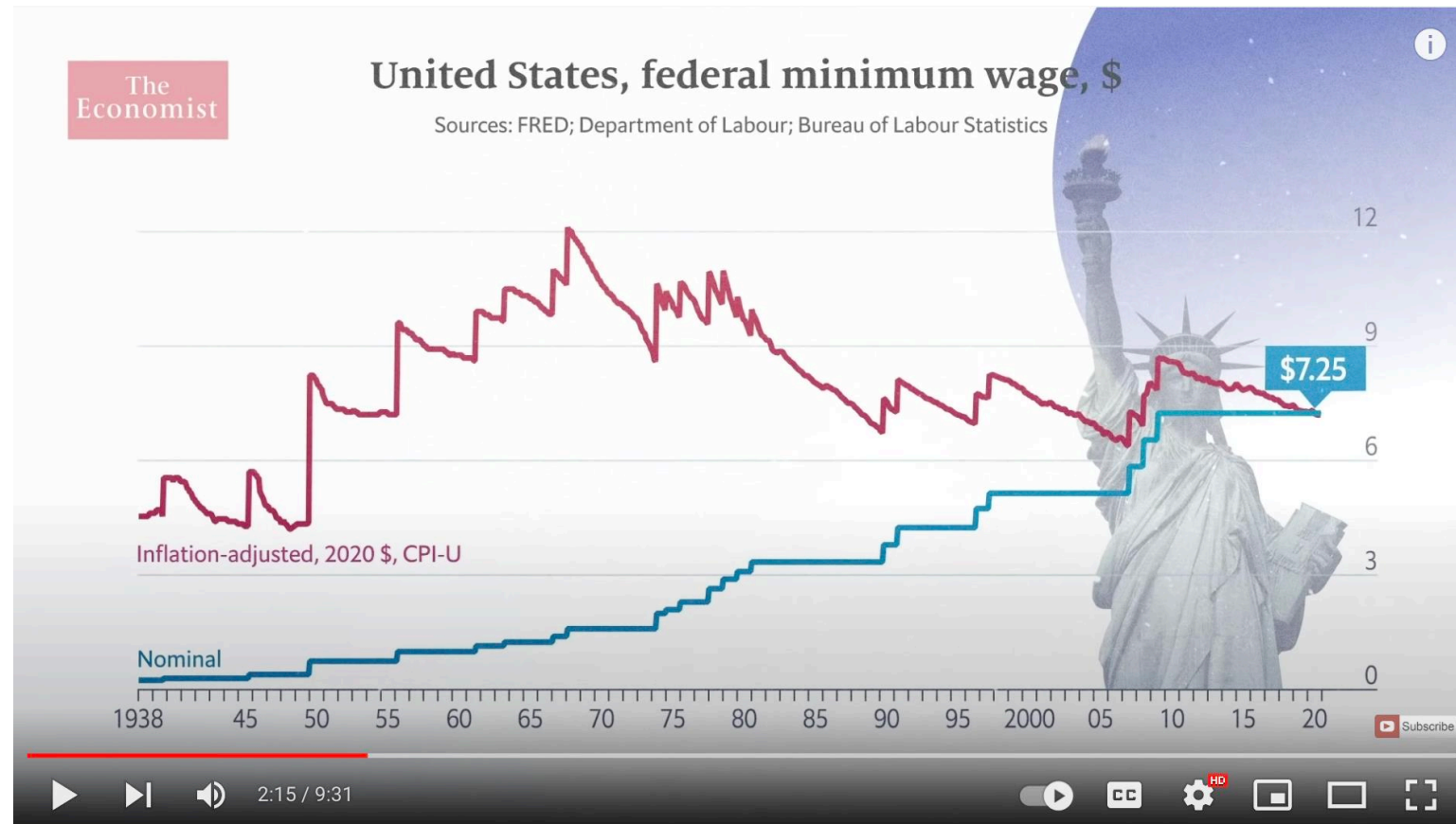


Minimum wage

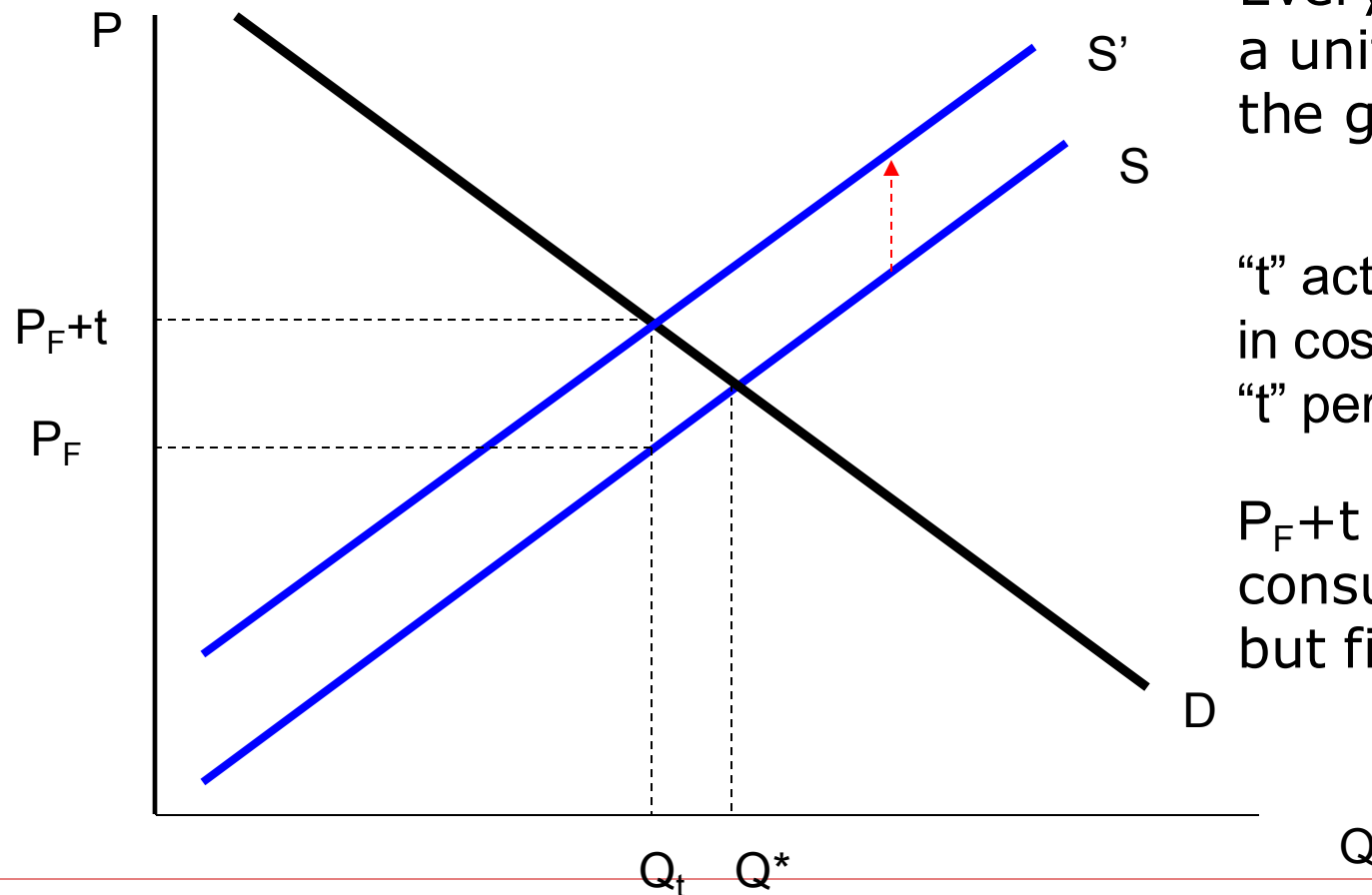
- *If demand for labor is perfectly inelastic, then the wage rises and there is no reduction in employment!*



Digression: History and debate on minimum wage



3. Taxation: Suppose government imposes a per unit tax "t" on production

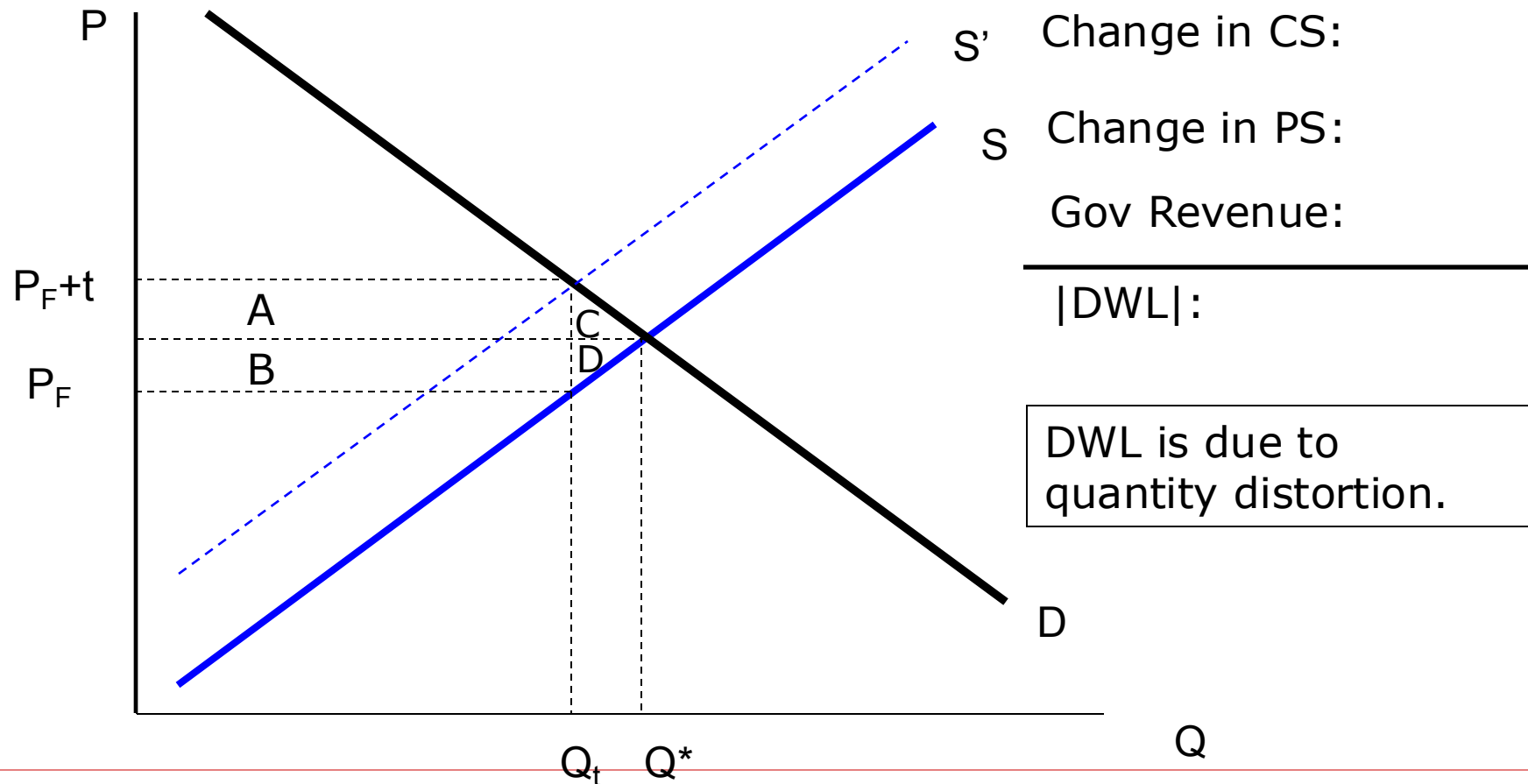


Every time the firm sells a unit, it must send \$ t to the government.

" t " acts like a per unit increase in costs – an increase in MC of " t " per unit shifts supply up

$P_F + t$ is price paid by consumers, but firm only gets to keep P_F

Suppose government imposes a per unit tax "t" on production



Deadweight loss of taxation

- ❑ Taxing an economic activity generally results in less of that activity.
- ❑ Combined loss of CS and PS generally exceeds revenue raised because of the quantity distortion.
- ❑ This is referred to as the “excess burden” of taxation
 - The cost of raising \$1 of government revenue is more than \$1, because of the deadweight loss
- ❑ **But, if government revenue is put to “good use,” benefit of government services provided with revenue may outweigh this excess burden.**
 - E.g., use gasoline tax revenue to build more roads, which helps reduce congestion and air pollution

Practice example

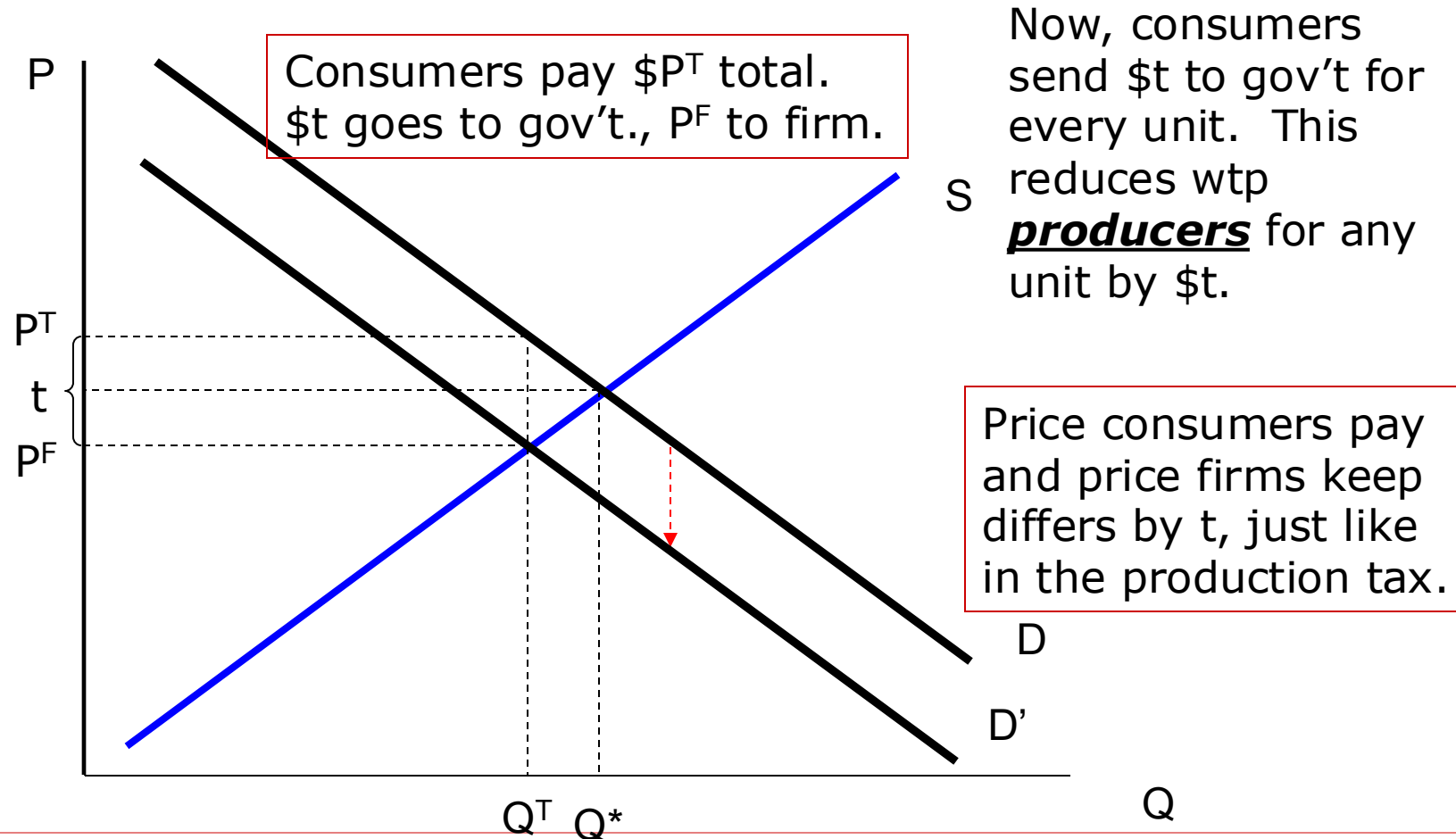
$$Q_D = 90 - 2P; Q_S = P$$

- What is the competitive market equilibrium?
- What is the new equilibrium if the government imposes a tax $t = 3$?
- What is the tax revenue raised, and deadweight loss?

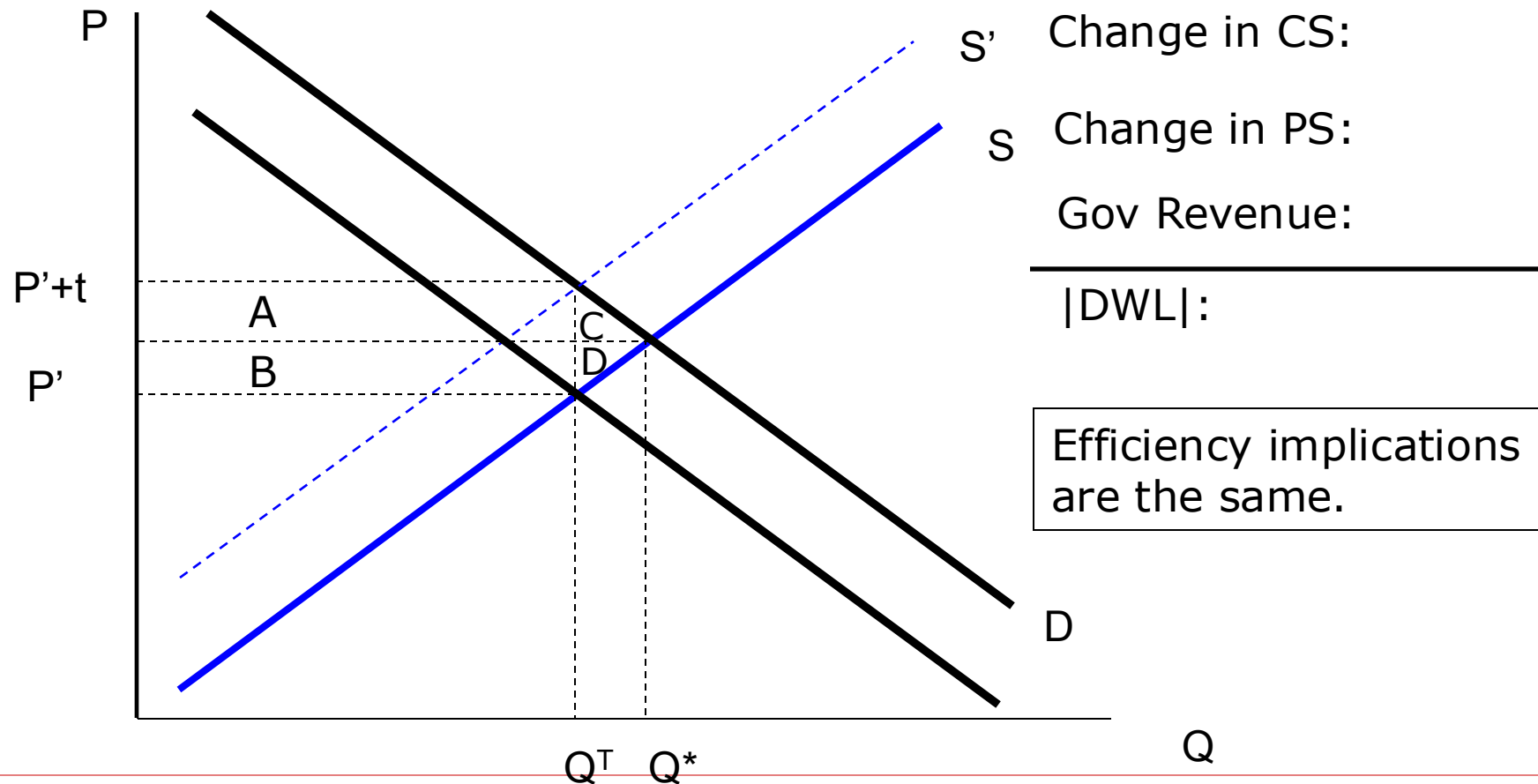
Does it matter who(m) we tax?

- In this example, we taxed production.
 - Firms paid tax.
- Would it matter if we taxed consumers instead?
- How does this affect the outcome?
- How to think about a consumption tax:
 - Demand: height of demand curve gives wtp for Q^{th} unit.
 - This is total wtp. Consumer doesn't care if producer or government gets the money.
 - So, if t must go to the government, consumer is willing to pay t less to producers.
 - It is "as if" the willingness to pay (inverse demand) curve has shifted down by t .

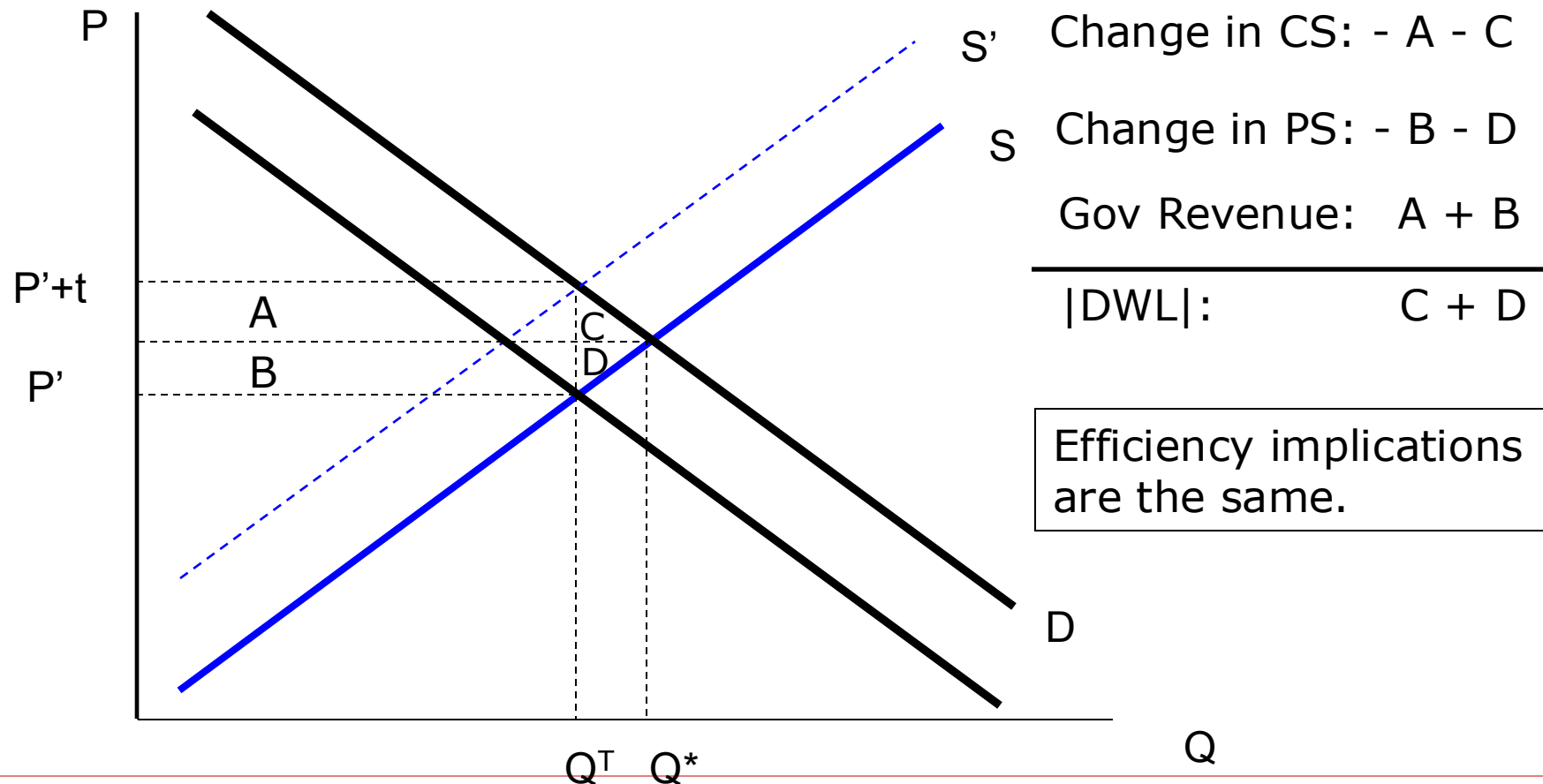
Per unit tax "t" on consumption



Per unit tax on consumption.



Per unit tax on consumption.



Why doesn't it matter?

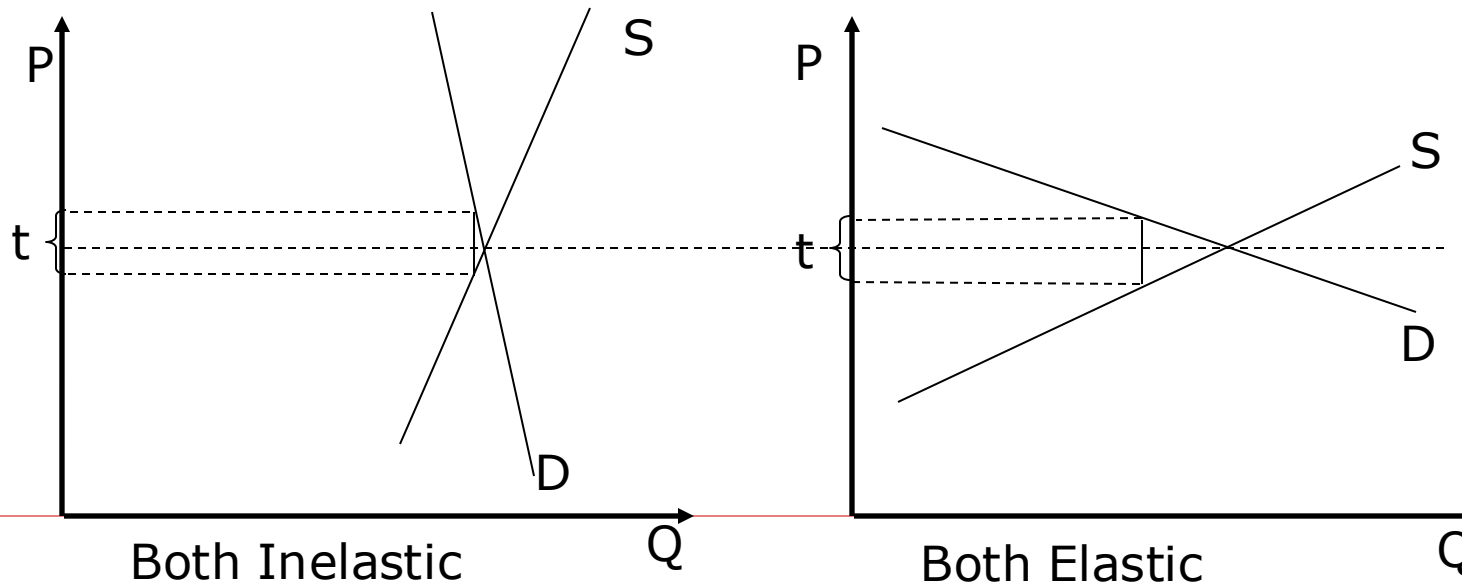
- The reason why it doesn't matter whether consumers or firms pay the tax is that the equilibrium conditions do not change.
- If we tax the consumer, the equilibrium solves:
 - $P_F + t = P_C$.
 - $S(P_F) = D(P_C) = D(P_F + t)$.
- If we tax the producer, the equilibrium solves:
 - $P_F = P_C - t$.
 - $S(P_F) = S(P_C - t) = D(P_C)$.
- These two set of equations determine the same equilibrium, regardless of who pays the tax.

Taxes and elasticity

- While the legal incidence of a tax (who pays the tax) doesn't matter, the **size of the distortion** and **which side of the market is more affected** depends on the elasticities of demand and supply.

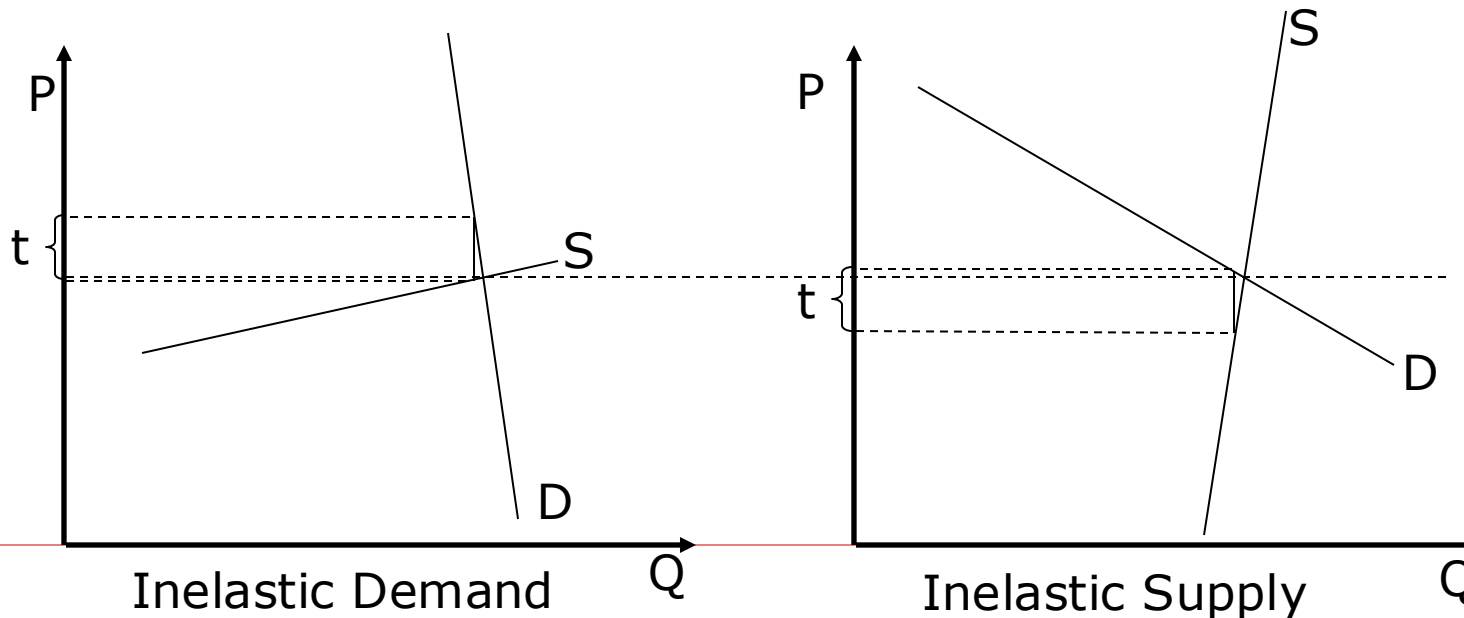
Taxes and elasticity

- Magnitude of deadweight loss: Deadweight loss from taxing inelastic goods **tends to be smaller** than from taxing elastic goods.



Taxes and elasticity

- Relative burden: The side of the market that is relative inelastic tends to have a larger price change, and therefore bears more of the tax burden.



Key takeaways

- A competitive market equilibrium outcome is quite desirable
 - It's decentralized: Every market participant solves her/his own maximization problem; no need for government to know a lot about consumers and firms
 - It's efficient (First Welfare Theorem): If people can trade freely, the market outcome is Pareto Optimal

- For these reasons, competitive equilibrium often serves as the “baseline” of microeconomics.
 - Not that economists believe all markets are competitive, all participants are rational and maximizing utility / profit, etc. But it's a nice and simple (perhaps simplest!) “baseline” situation where we know market would work

- A big part of microeconomics is to study how real-world situations deviate from this baseline, and what's the implications for social welfare. We will have several classes devote to this (**“Market failures”**)

Key takeaways

- ❑ Competitive equilibrium says nothing about equity. Markets sometimes make some people rich and some people poor. One can depart from markets in order to “improve” the distribution of wealth.
- ❑ While redistribution may be desirable, departing from markets frequently means moving to an allocation that is not Pareto Optimal.
- ❑ In practice, a lot of the debate is: is the efficiency loss worth it?
- ❑ Frequently it is better to let markets and market prices allocate goods to individuals, and redistribute through the tax system than to distort prices.
 - Lower efficiency loss.
 - Easier to implement.