Microeconomics

Lecture 2

Quantity Taxes

- **A quantity tax levied at a rate of $$t$ is a tax of $$t$ paid on each unit traded.**
- **If the tax is levied on sellers then it is an excise tax.**
- **If the tax is levied on buyers then it is a sales tax.**

Quantity Taxes

- **A tax rate *t* makes the price paid by buyers, p_b, higher by *t* from the price received by sellers, p_s,**

$$p_b = p_s + t.$$

Quantity Taxes

- **Even with a tax the market must clear.**
- **I.e. quantity demanded by buyers at price p_b must equal quantity supplied by sellers at price p_s,**

$$D(p_b) = S(p_s).$$

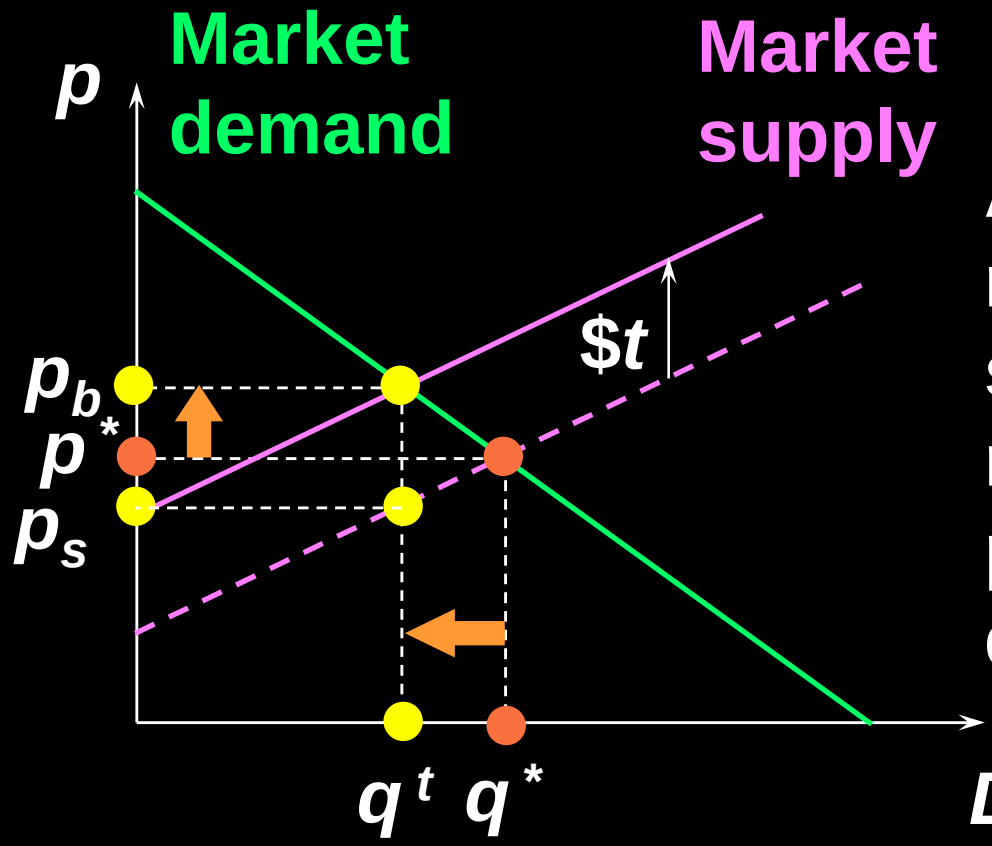
Quantity Taxes

$p_b = p_s + t$ and $D(p_b) = S(p_s)$ describe the market's equilibrium.

Notice these conditions apply no matter if the tax is levied on sellers or on buyers.

Hence, **a sales tax rate $\$t$ has the same effect as an excise tax rate $\$t$.**

Quantity Taxes & Market Equilibrium

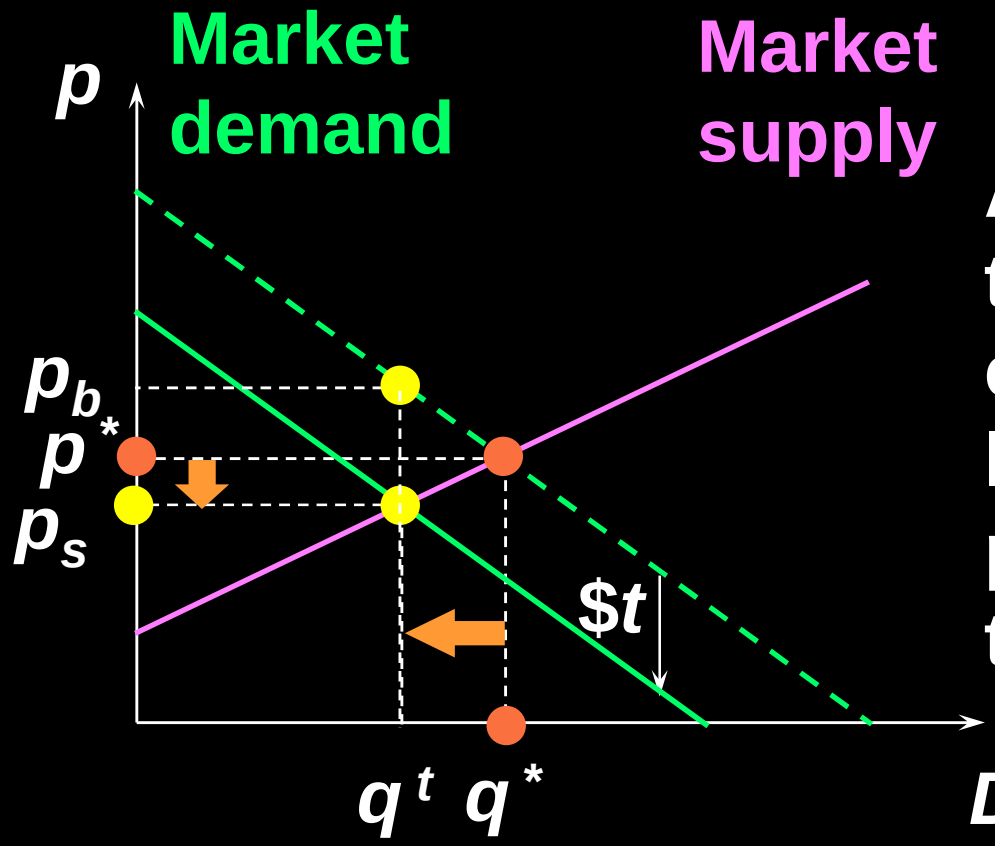


An excise tax raises the market supply curve by $$t$, raises the buyers' price and lowers the quantity traded.

***D*(*p*), *S*(*p*)**

And sellers receive only $p_s = p_b - t$.

Quantity Taxes & Market Equilibrium

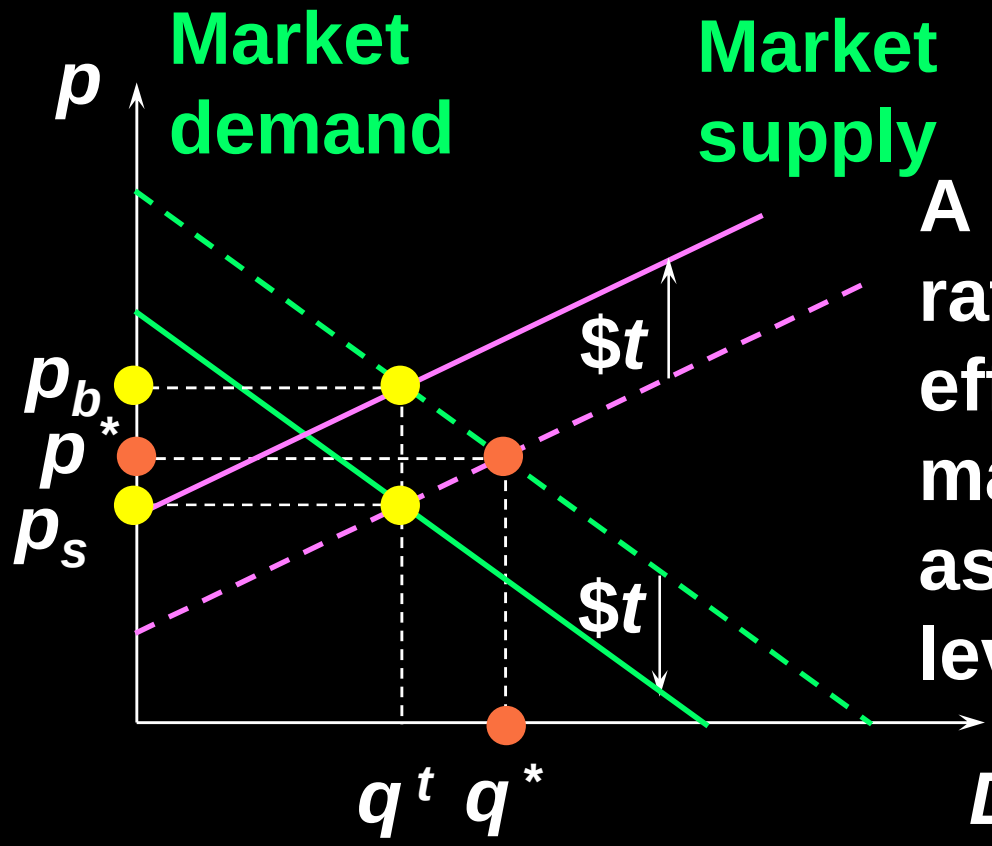


An sales tax lowers the market demand curve by $$t$, lowers the sellers' price and reduces the quantity traded.

***D*(*p*), *S*(*p*)**

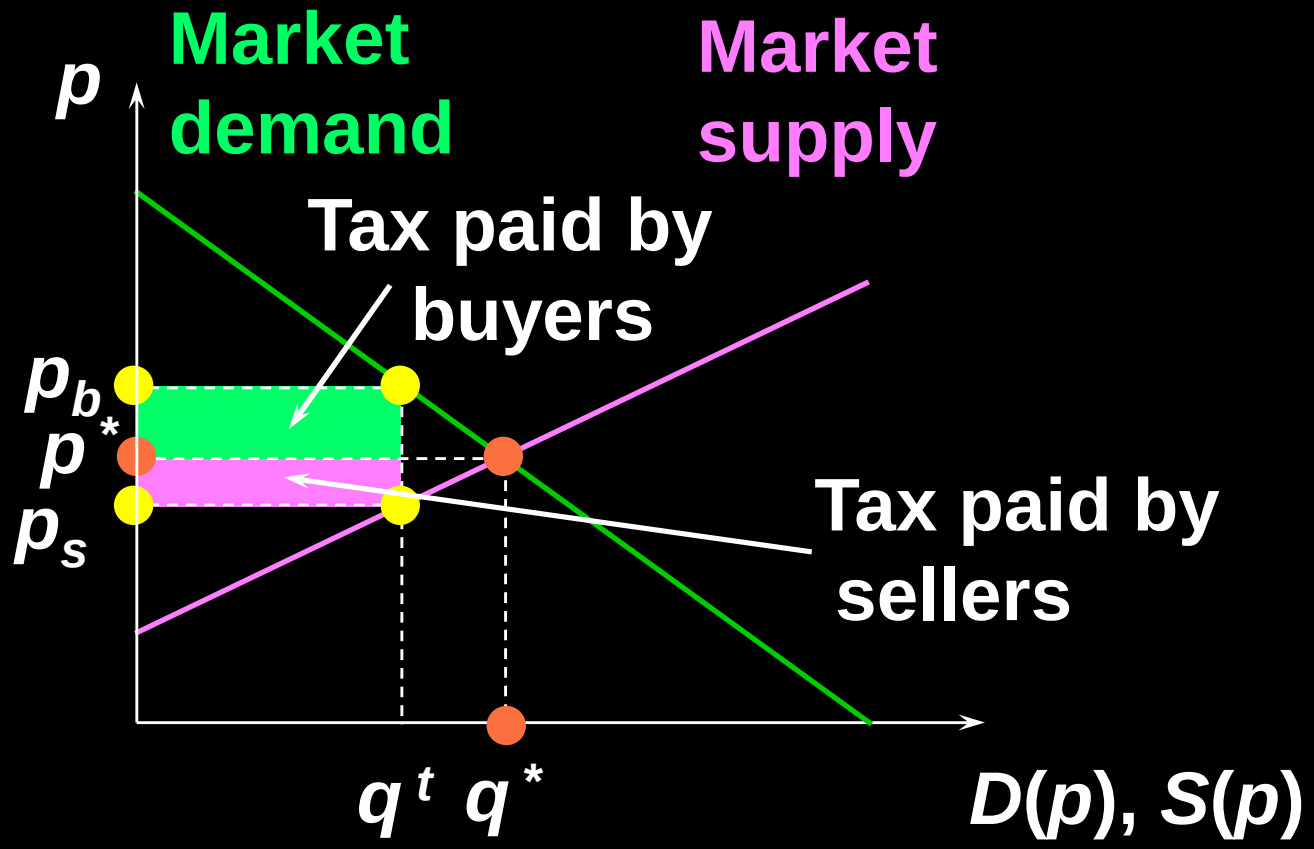
And buyers pay $p_b = p_s + t$.

Quantity Taxes & Market Equilibrium



A sales tax levied at rate $$t$ has the same effects on the market's equilibrium as does an excise tax levied at rate $$t$.

Quantity Taxes & Market Equilibrium



Quantity Taxes & Market Equilibrium

- **E.g. suppose the market demand and supply curves are linear,**

$$D(p_b) = a - bp_b,$$

$$S(p_s) = c + dp_s.$$

Quantity Taxes & Market Equilibrium

$D(p_b) = a - bp_b$ and $S(p_s) = c + dp_s$.

With the tax, the market equilibrium satisfies

$p_b = p_s + t$ and $D(p_b) = S(p_s)$ so

$p_b = p_s + t$ and $a - bp_b = c + dp_s$.

Substituting for p_b gives

$$a - b(p_s + t) = c + dp_s \Rightarrow p_s = \frac{a - c - bt}{b + d}.$$

Quantity Taxes & Market Equilibrium

$$p_s = \frac{a - c - bt}{b + d}$$ **and** $p_b = p_s + t$ **give**

$$p_b = \frac{a - c + dt}{b + d}$$

The quantity traded at equilibrium is

$$q^t = D(p_b) = S(p_s)$$

$$= a + bp_b = \frac{ad + bc - bdt}{b + d}.$$

As t increases, p_s and q^t falls, p_b rises

Quantity Taxes & Market Equilibrium

The total tax paid (by buyers and sellers combined) is

$$T = tq^t = t\frac{ad + bc - bdt}{b + d}.$$

The tax paid per unit by the buyer is

$$p_b - p^* = \frac{a - c + dt}{b + d} - \frac{a - c}{b + d} = \frac{dt}{b + d}.$$

The tax paid per unit by the seller is

$$p^* - p_s = \frac{a - c}{b + d} - \frac{a - c - bt}{b + d} = \frac{bt}{b + d}.$$

Tax Incidence and Own-Price Elasticities

- **The tax incidence of a buyer and a seller indicates what is the unit tax paid by the buyer relative to the unit tax paid by the seller, $(p_b - p^*)/(p^* - p_s)$.**

Tax Incidence and Own-Price Elasticities

- **In case of linear demand and supply curves the tax incidence is:**

$$\frac{p_b - p^*}{p^* - p_s} = \frac{dt/(b+d)}{bt/(b+d)} = \frac{d}{b}.$$

- **I.e. the part of tax paid by the buyer is higher, the larger the slope of the supply curve, *d*, and the smaller the slope of the demand curve, *b*.**

Tax Incidence and Own-Price Elasticities

By the definition of the (arc) own-price elasticity of demand:

$$\varepsilon_D = \frac{\frac{\Delta q}{q^*}}{\frac{\Delta p}{p^*}} = \frac{q^t - q^*}{q^*}\frac{p^*}{p_b - p^*}$$

$$\Rightarrow \quad p_b - p^* = \frac{\left(q^t - q^*\right)\times p^*}{\varepsilon_D \times q^*}.$$

Tax Incidence and Own-Price Elasticities

By the definition of the (arc) own-price elasticity of supply:

$$\varepsilon_S = \frac{\frac{\Delta q}{q^*}}{\frac{\Delta p}{p^*}} = \frac{q^t - q^*}{q^*}\frac{p^*}{p_s - p^*}$$

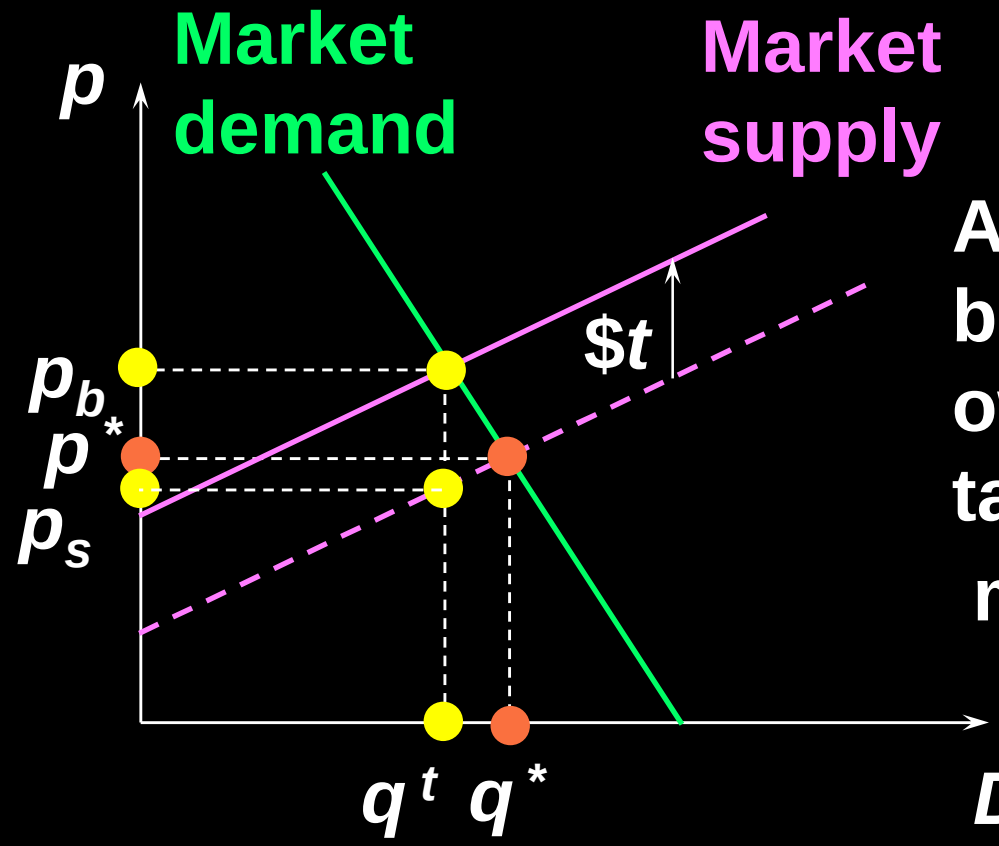
$$\Rightarrow \quad p_s - p^* = \frac{\left(q^t - q^*\right)\times p^*}{\varepsilon_S \times q^*}.$$

Tax Incidence and Own-Price Elasticities

Tax incidence is $\frac{p_b - p^*}{p^* - p_s} = -\frac{\varepsilon_S}{\varepsilon_D}$.

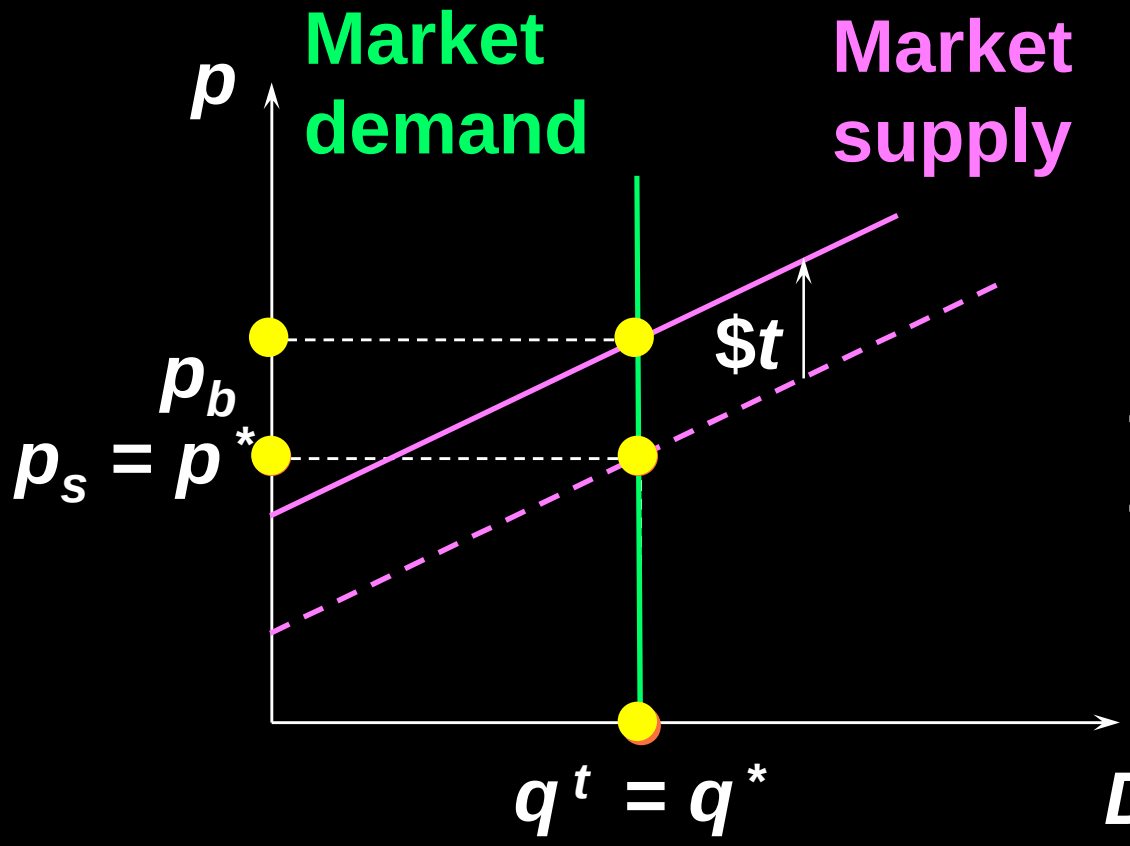
The fraction of a $*t* quantity tax paid by buyers (sellers) rises as supply becomes more (less) own-price elastic or as demand becomes less (more) own-price elastic.

Tax Incidence and Own-Price Elasticities



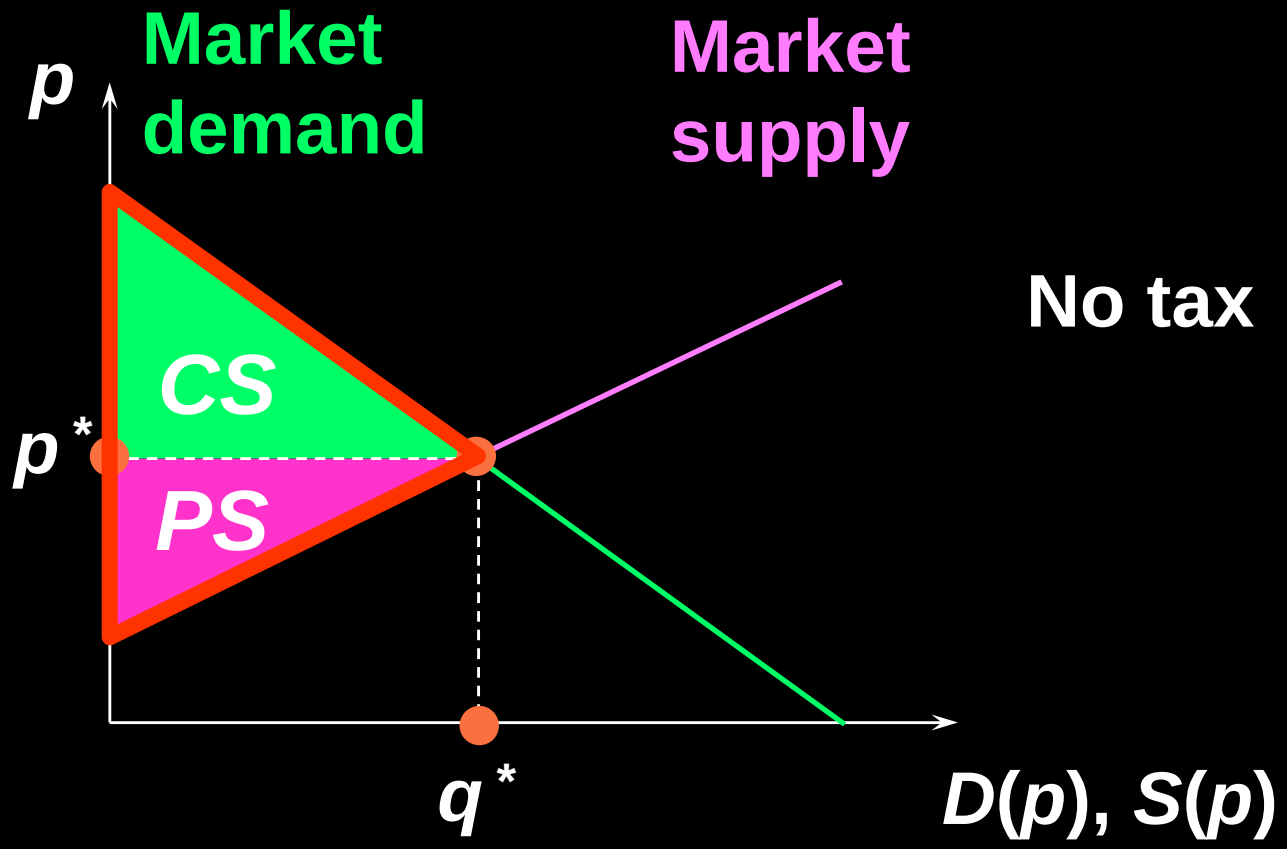
As market demand becomes less own-price elastic, tax incidence shifts more to the buyers.

Tax Incidence and Own-Price Elasticities

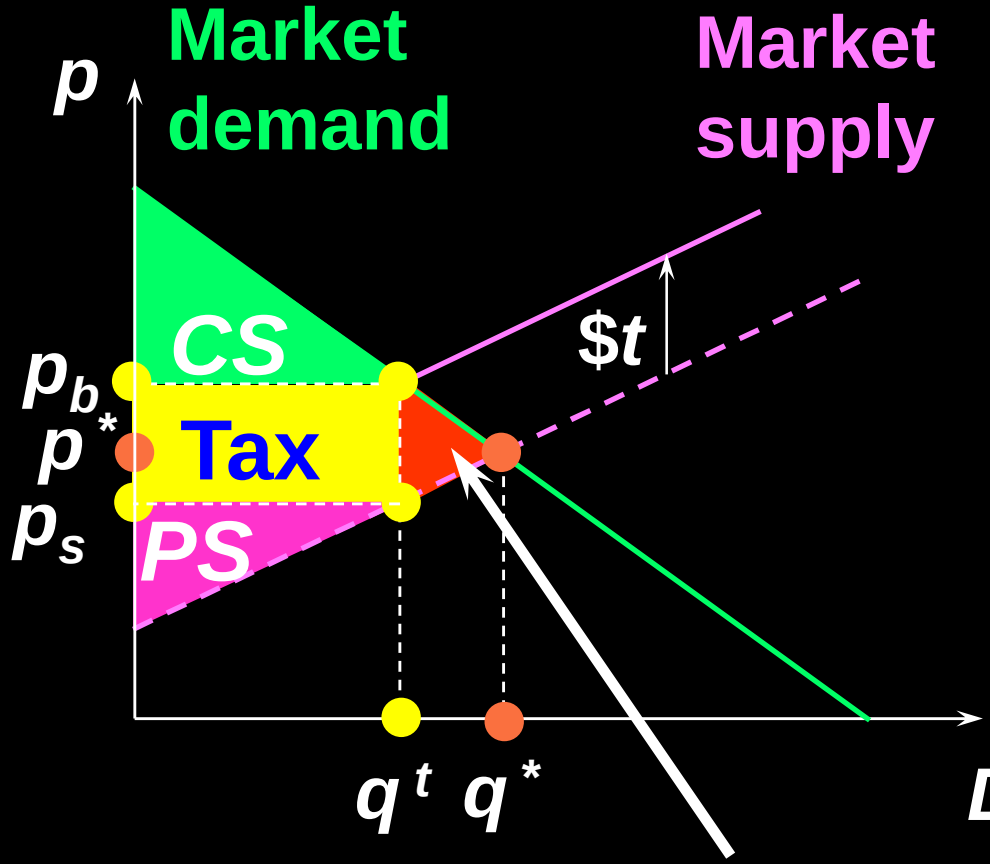


In the limiting case of a fixed demand, $\varepsilon_D = 0$, buyers pay the entire tax, even though it is levied on the sellers.

Deadweight Loss and Own-Price Elasticities



Deadweight Loss and Own-Price Elasticities

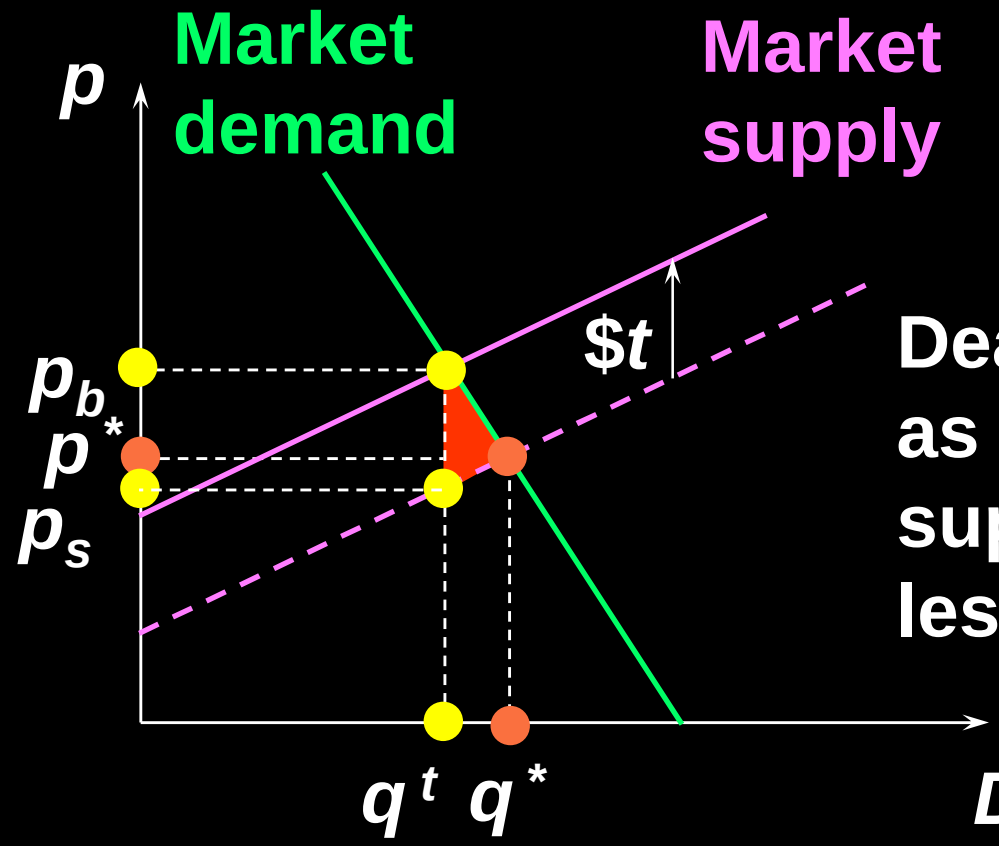


The tax reduces both *CS* and *PS*, transfers surplus to government, and lowers total surplus.

Deadweight loss

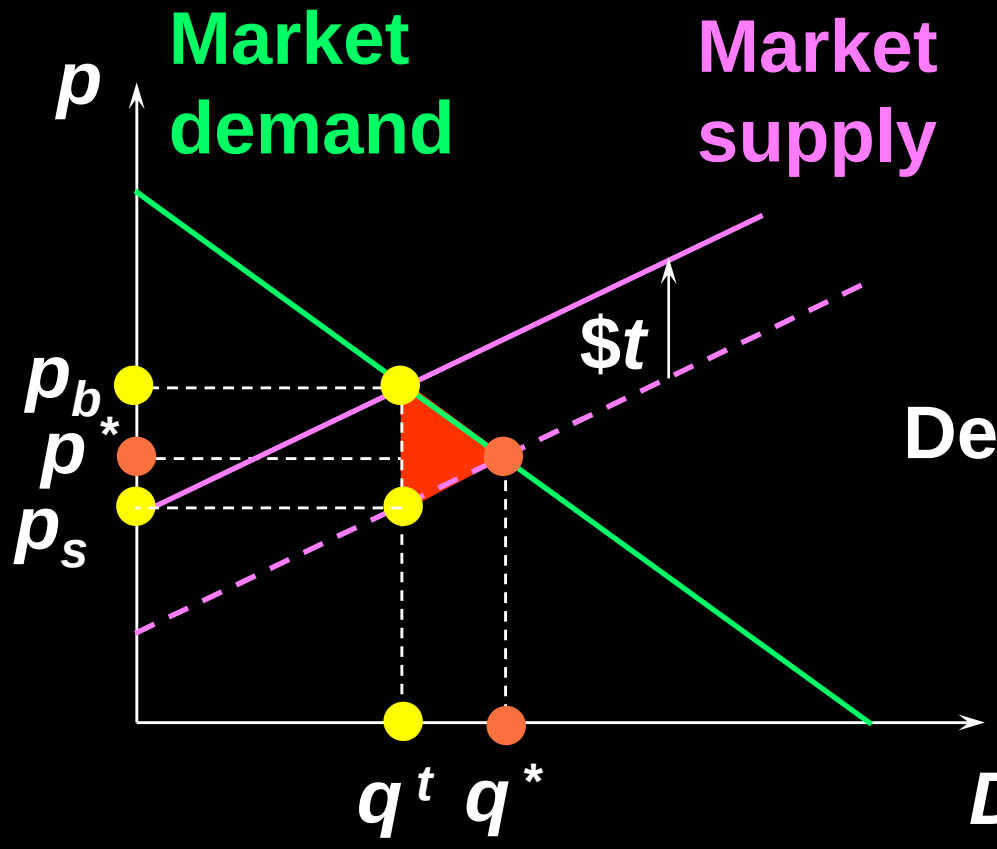
(it is the inefficiency of the government intervension)

Deadweight Loss and Own-Price Elasticities



Deadweight loss falls as market demand or supply becomes less own-price elastic.

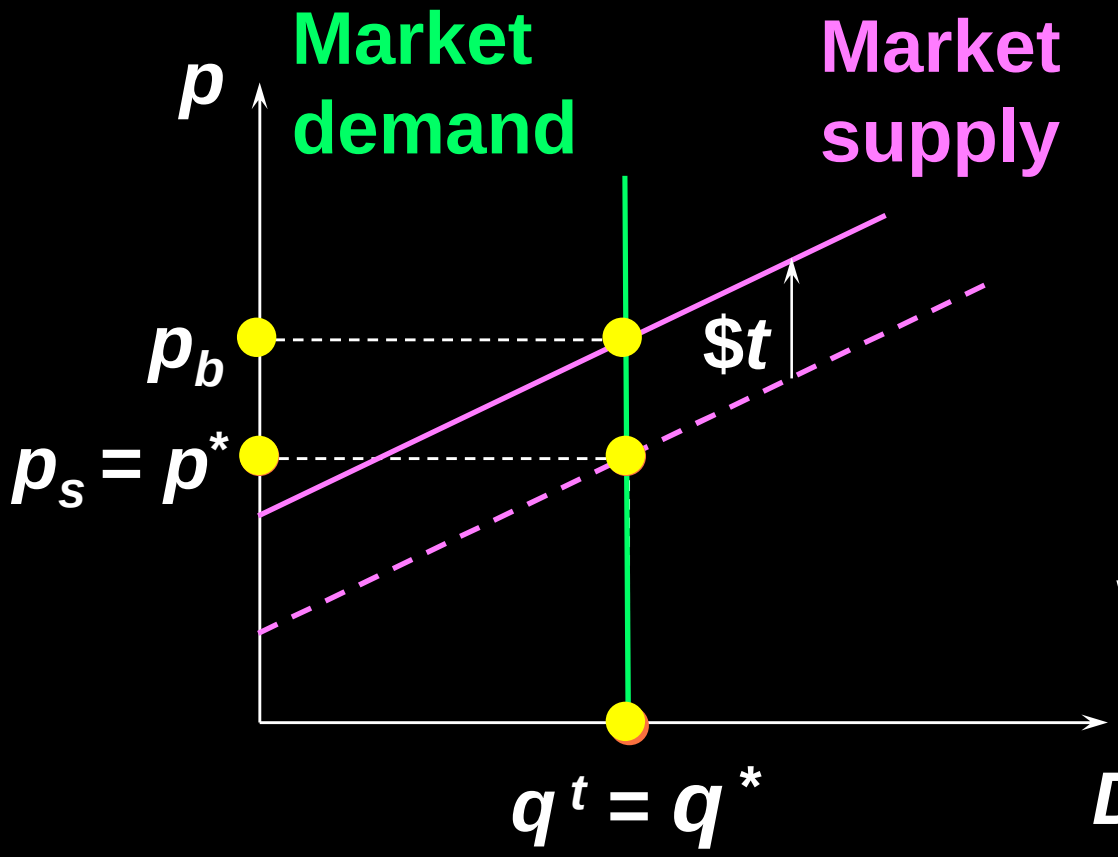
Deadweight Loss and Own-Price Elasticities



Deadweight loss rise

Deadweight loss give a good estimate of the efficiency cost of government policies

Deadweight Loss and Own-Price Elasticities



In the limiting case of a fixed demand, $\varepsilon_D = 0$, the tax causes no dead-weight loss.

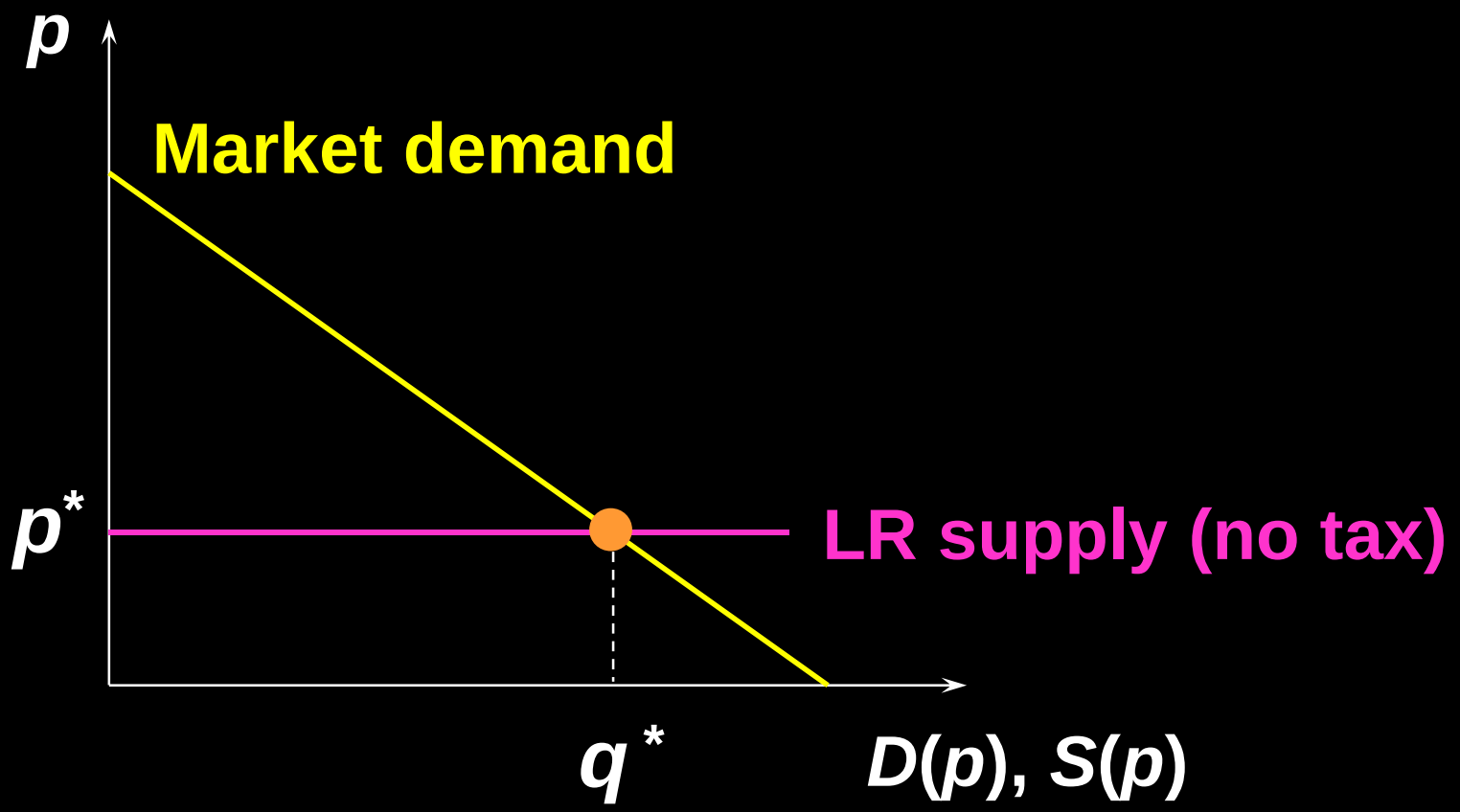
Deadweight Loss and Own-Price Elasticities

- **Deadweight loss due to a quantity tax rises as either market demand or market supply becomes more own-price elastic.**
- **If either $\varepsilon_D = 0$ or $\varepsilon_S = 0$ then the deadweight loss is zero.**

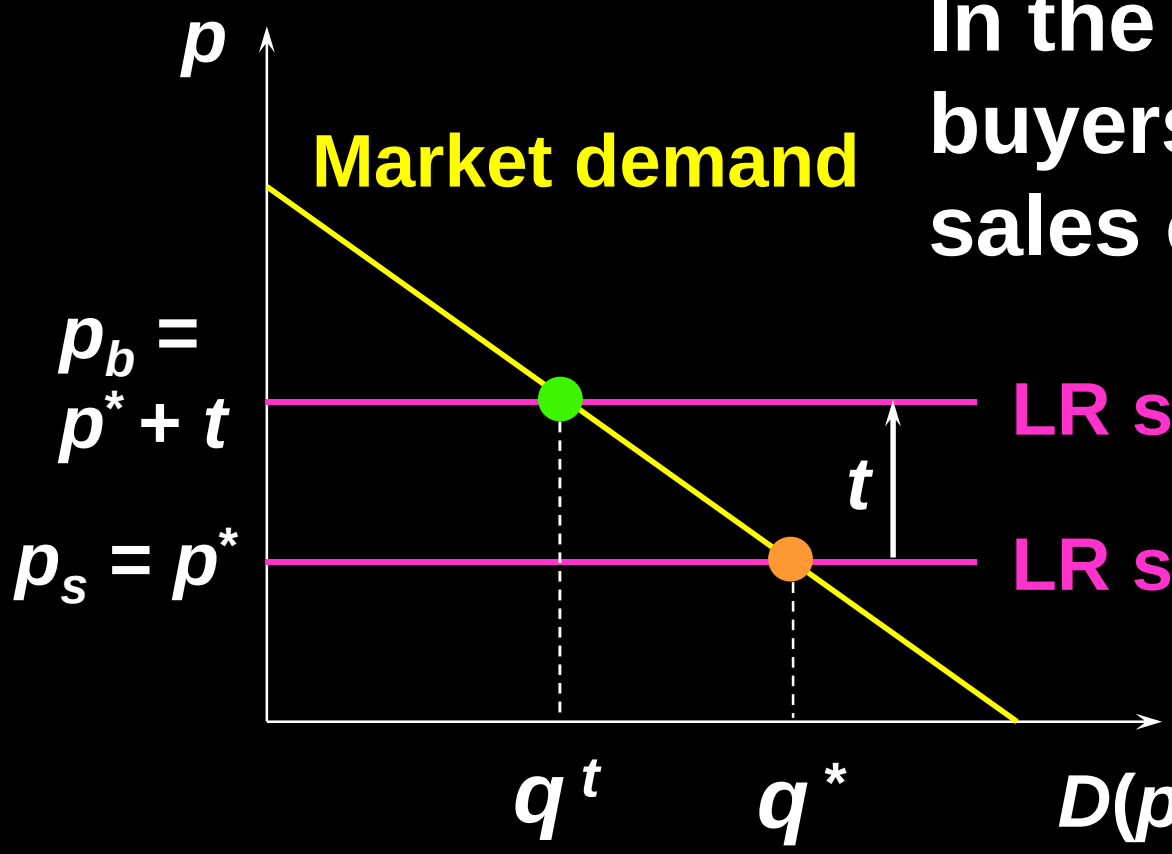
Long-Run Implications for Taxation

- In a short-run equilibrium, the burden of a sales or an excise tax is typically shared by both buyers and sellers, tax incidence of the tax depending upon the own-price elasticities of demand and supply.
- Q: Is this true in a long-run market equilibrium?

Long-Run Implications for Taxation



Long-Run Implications for Taxation

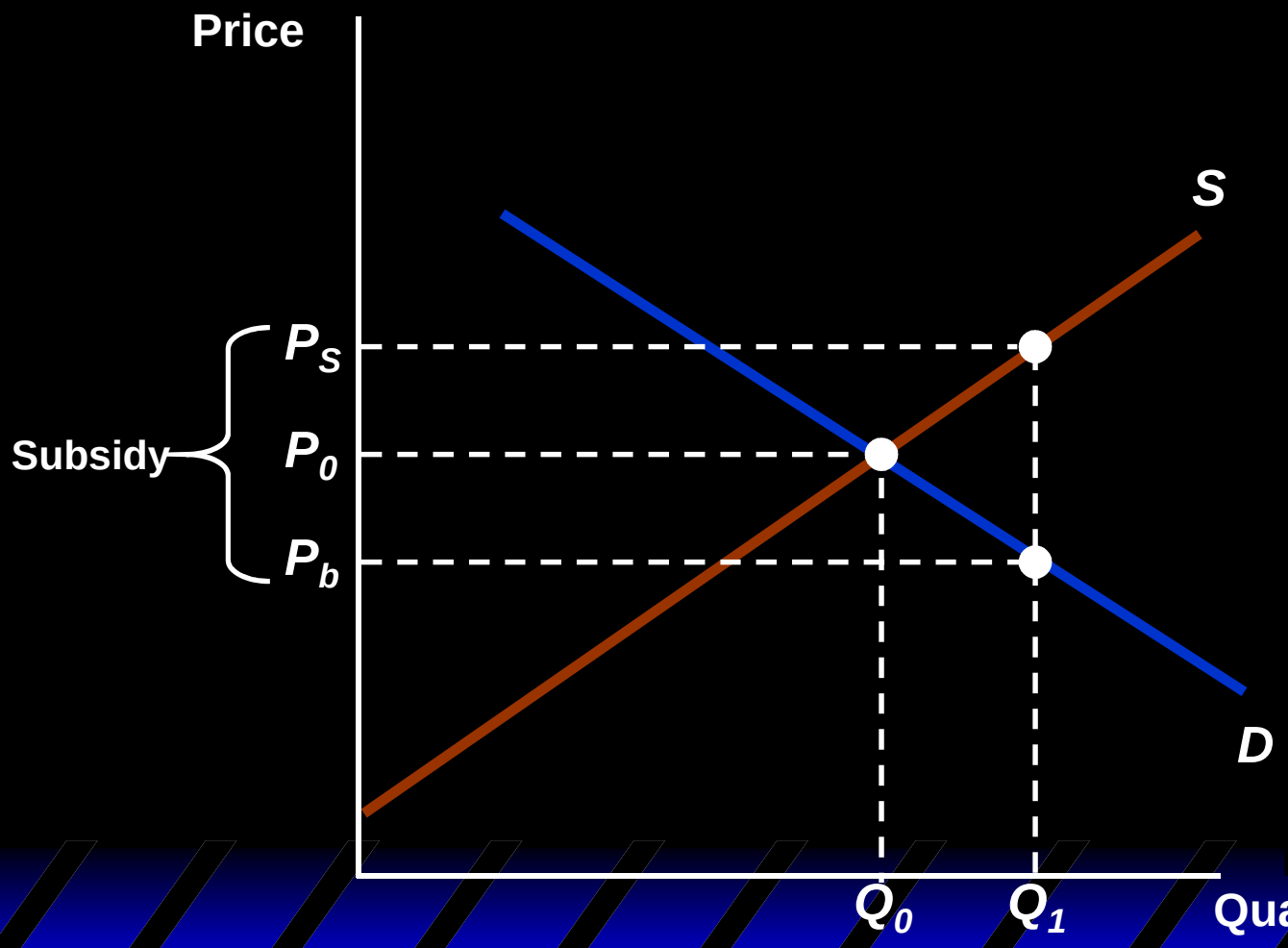


In the long-run the buyers pay all of a sales or an excise tax.

The Effects of Subsidy

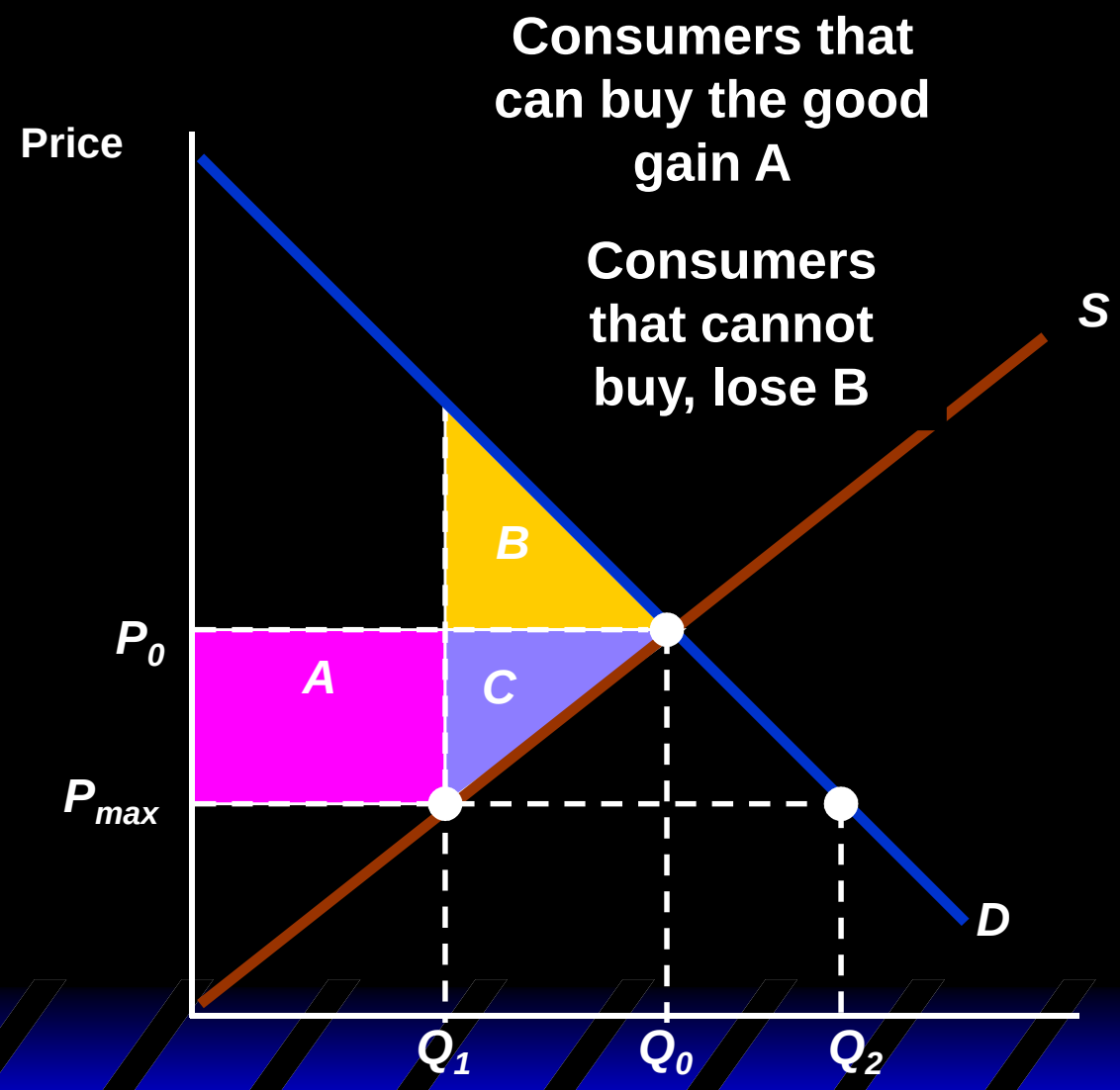
- A subsidy can be analyzed in much the same way as a tax
  - Payment reducing the buyer's price below the seller's price
- It can be treated as a negative tax
- Quantity increases
- The benefit of the subsidy accrues mostly to buyers if E_D / E_S is small

Effects of a Subsidy



Like a tax, the benefit of a subsidy is split between buyers and sellers, depending upon the elasticities of supply and demand.

Price Control and Surplus Changes



Consumers that can buy the good gain A

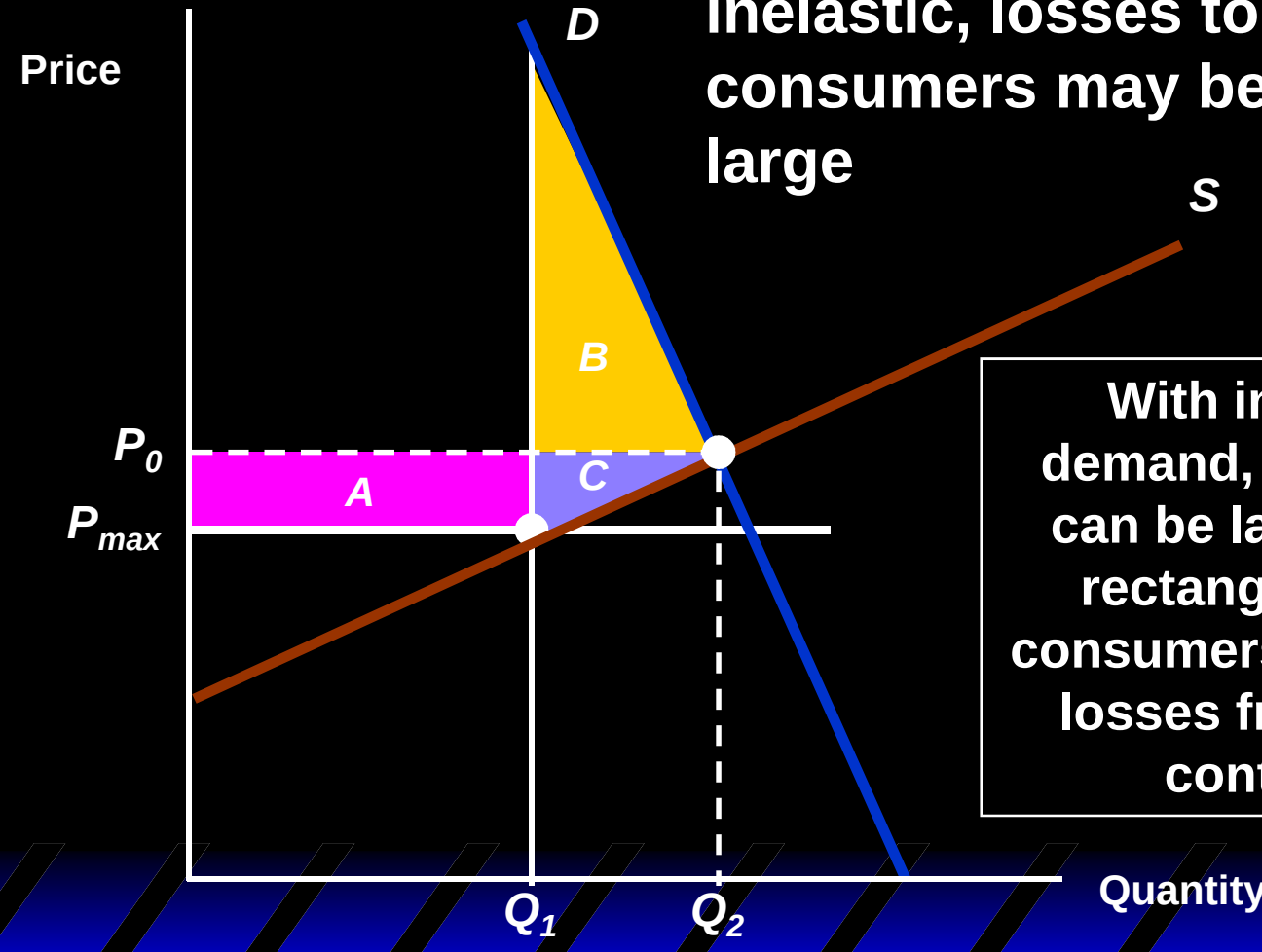
Consumers that cannot buy, lose B

The loss to producers is the sum of rectangle *A* and triangle *C*

Triangles B and C are losses to society – dead weight loss

Price Controls With Inelastic Demand

If demand is sufficiently inelastic, losses to consumers may be fairly large



With inelastic demand, triangle *B* can be larger than rectangle *A* and consumers suffer net losses from price controls.

Minimum Prices

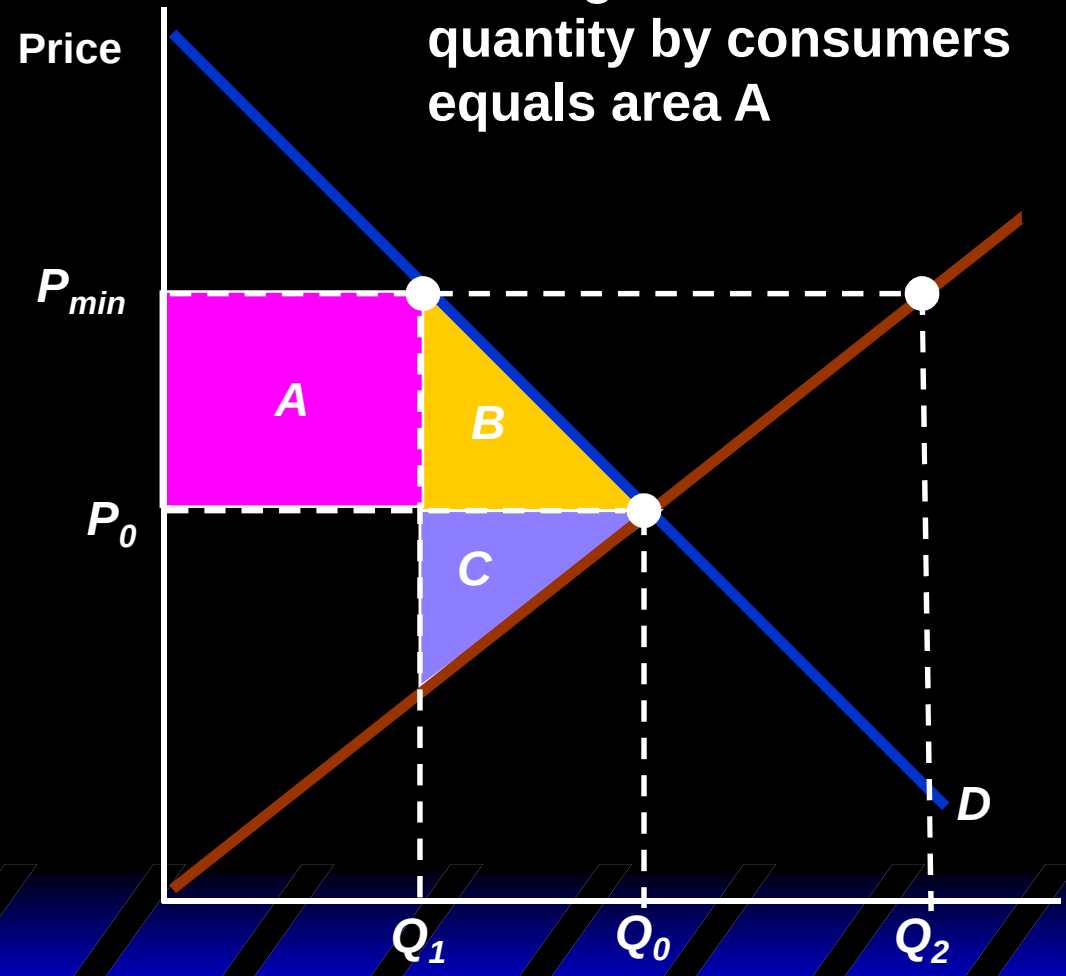
- When price is set above the market clearing price:
  - Quantity demanded falls
  - Suppliers may, however, choose to increase quantity supplied in face of higher prices
  - This causes additional producer losses equal to the total cost of production above quantity demanded

Minimum Prices

The deadweight loss given by triangles *B* and *C* results.

Increased price leading to decreased quantity by consumers equals area A

Consumers priced out of the market lose area B

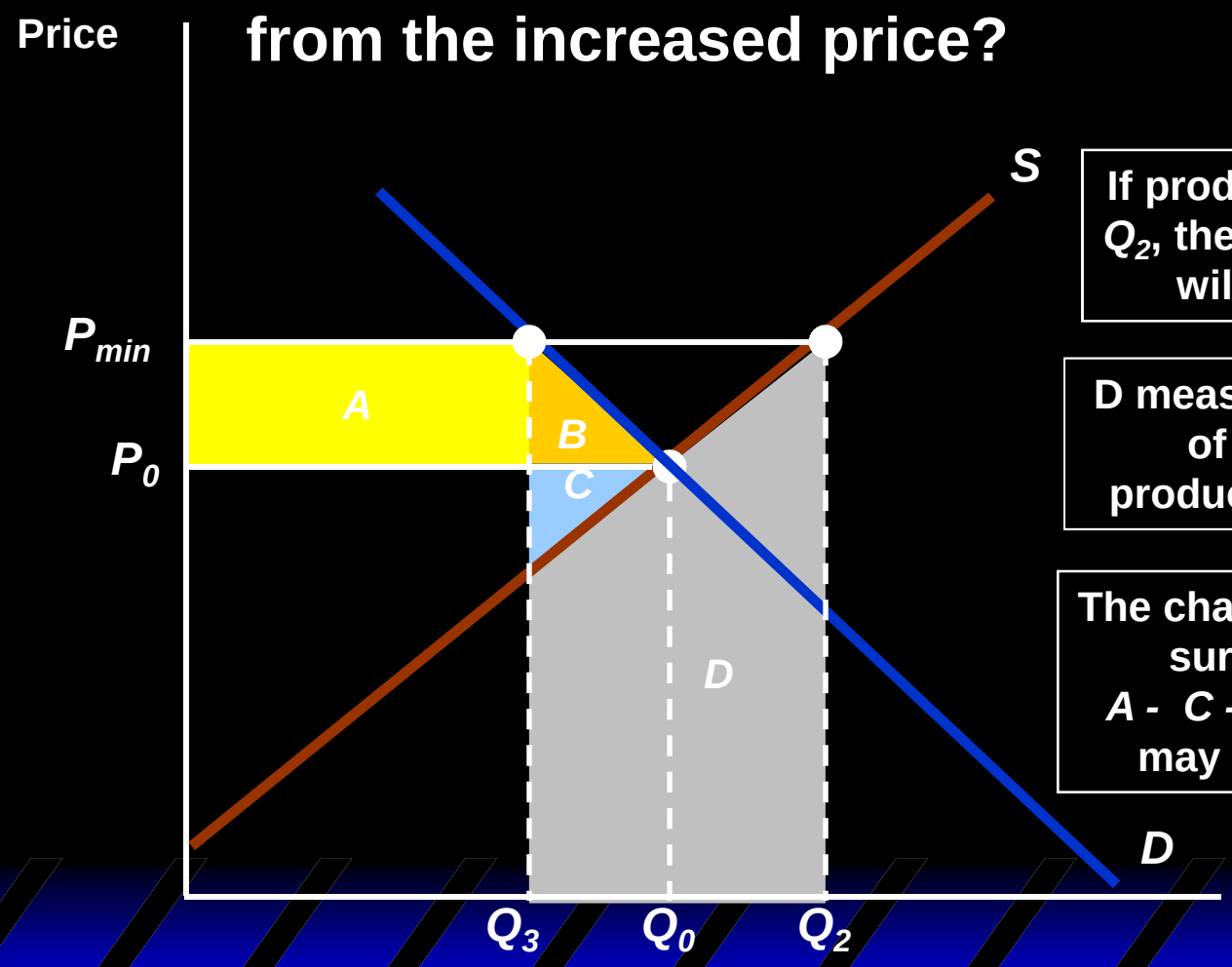


PS increases from increased price for units sold equal to A

Losses for producers from drop in sales equal to C

Minimum Prices

What if producers expand production to Q2 from the increased price?



If producers produce Q_2, the amount $Q_2 - Q_3$ will go unsold.

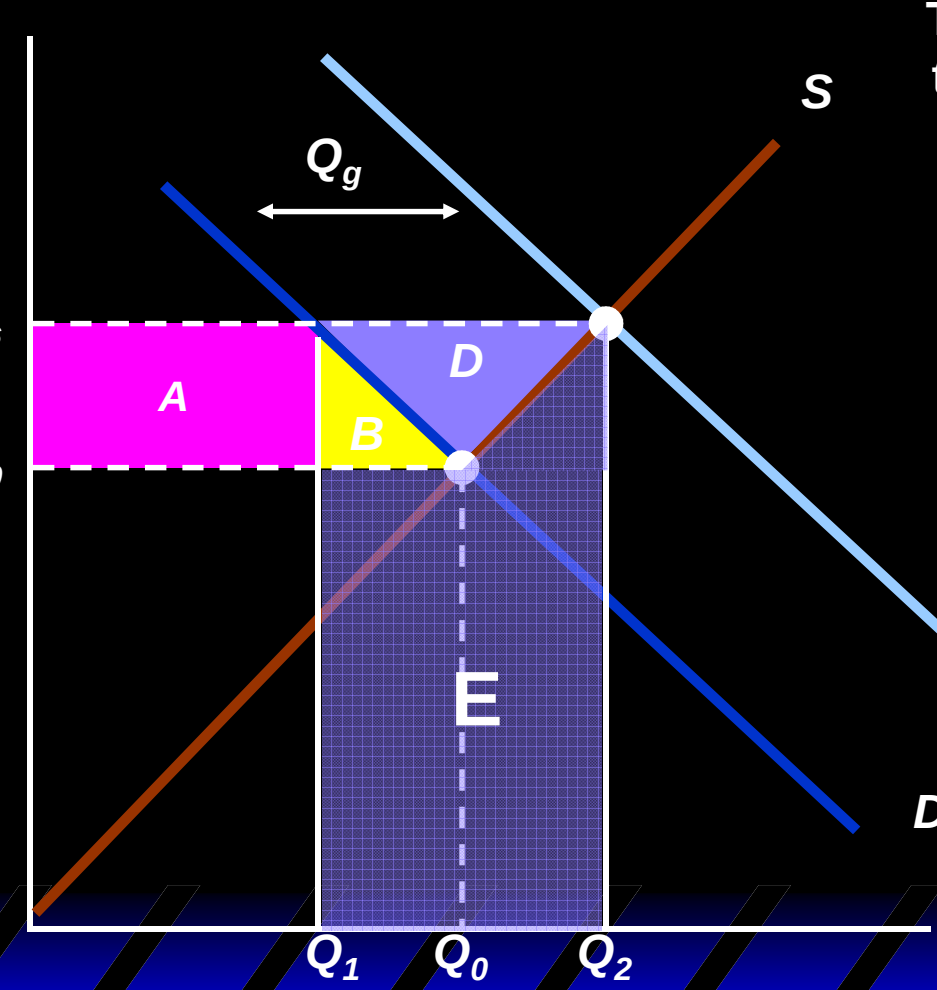
D measures total cost of increased production not sold.

The change in producer surplus will be *A - C - D.* Producers may be worse off.

Price Supports

- Much of agricultural policy is based on a system of price supports
  - Prices set by government above free-market level and maintained by governmental purchases of excess supply
- Government can also increase prices through restricting production, directly or through incentives to producers

Price Supports



Loss in consumer surplus equal to A+B

Producer surplus increases by A+B+D

To maintain a price P_s the government buys quantity $Q_g = (Q_2\text{-}Q_1)P_S$

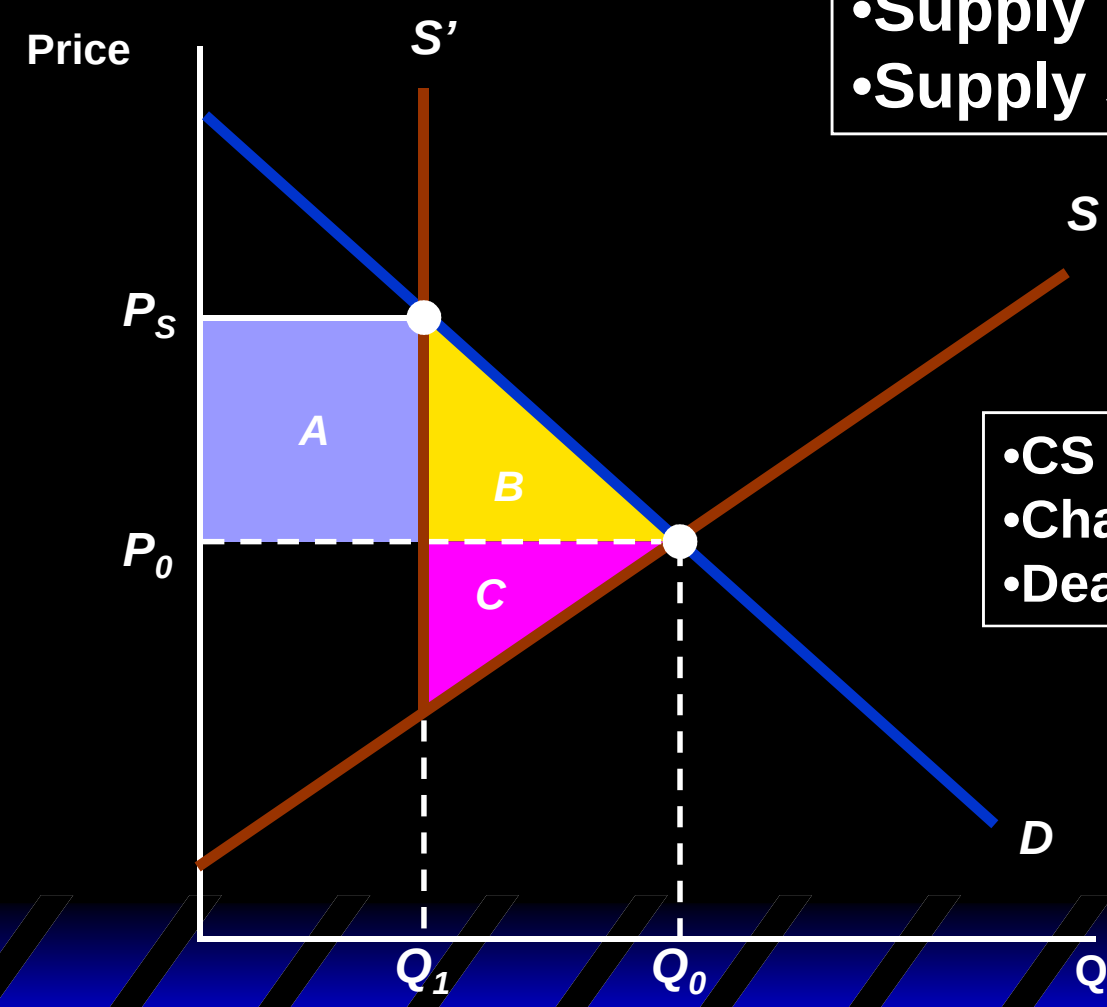
Net Loss to society is E + B.

Less costly is to simply give farmers the money

Production Quotas

- The government can also cause the price of a good to rise by reducing supply
  - Limitations of taxi license in a city
  - Limitation of required liquor licenses for restaurants

Supply Restrictions

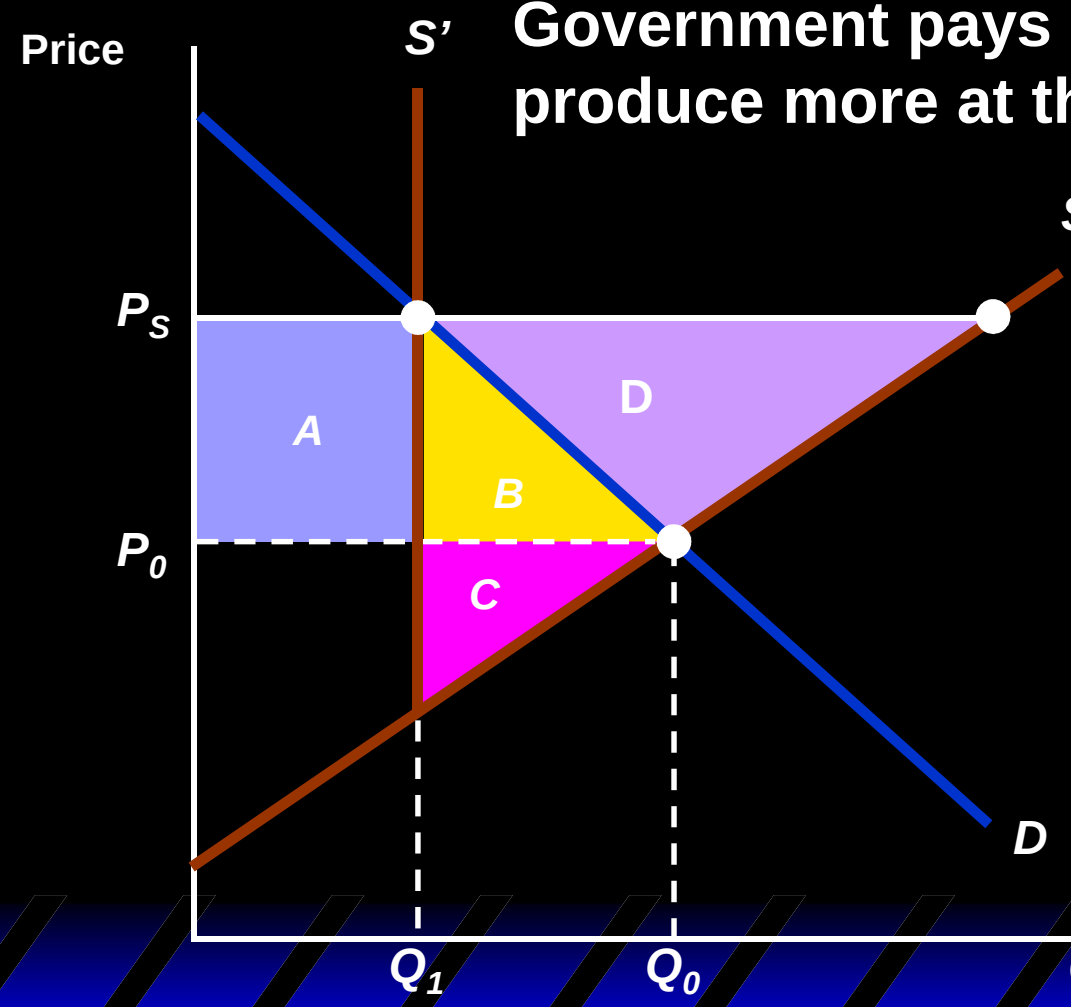


- Supply restricted to Q_1
- Supply shifts to S' & Q_1

- CS reduced by $A + B$
- Change in PS = $A - C$
- Deadweight loss = $B+C$

Supply Restrictions

Government pays farmers not to produce more at the higher price



CS reduced by *A* + *B*

Cost to government = *B* + *C* + *D*

Change in PS = *A*–*C*+*B* + *D* + *C*

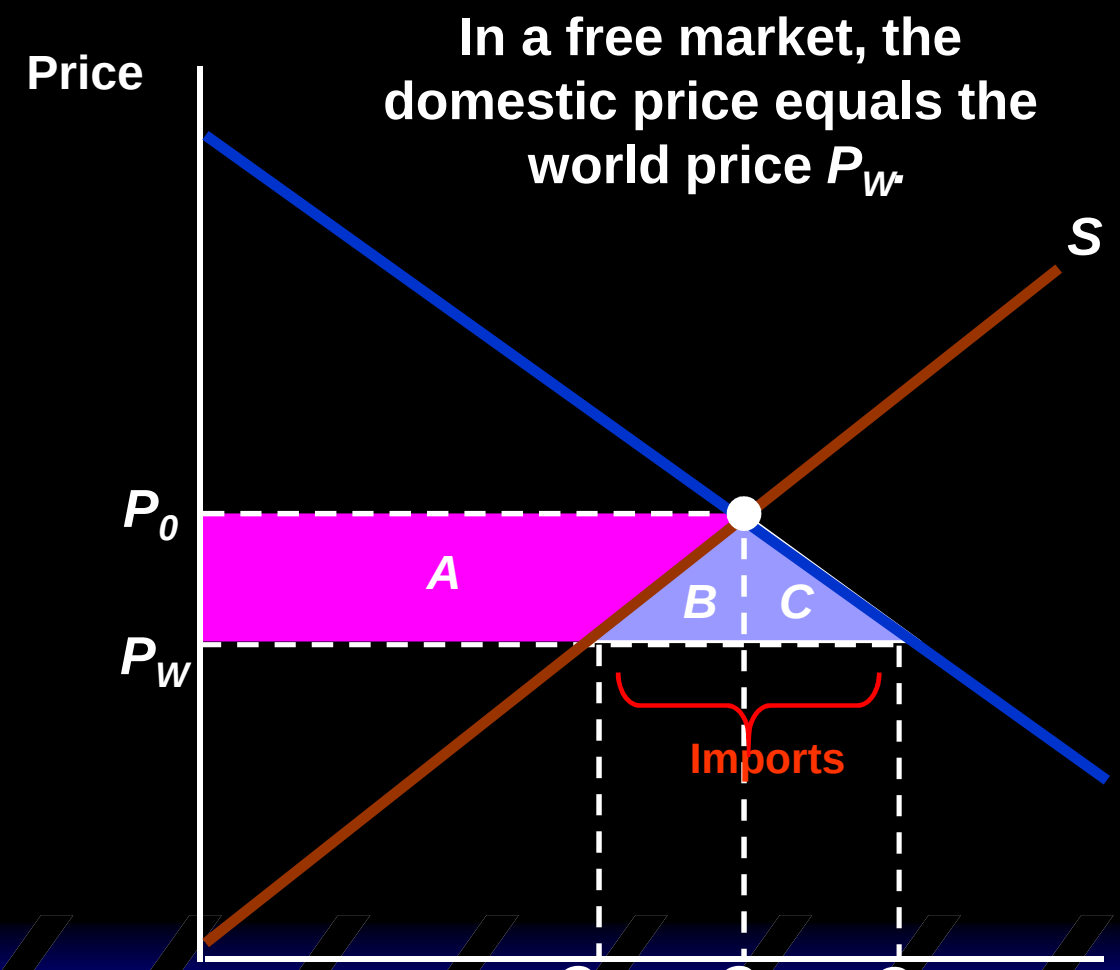
Import Quotas and Tariffs

- Many countries use import quotas and tariffs to keep the domestic price of a product above world levels
  - Import quotas: Limit on the quantity of a good that can be imported
  - Tariff: Tax on an imported good
- This allows domestic producers to enjoy higher profits
- Cost to consumers is high

Import Quotas and Tariffs

- With lower world price, domestic consumers have incentive to purchase from abroad
  - Domestic price falls to world price and imports equal difference between quantity supplied and quantity demanded
- Domestic industry might convince government to protect industry by eliminating imports
  - Quota of zero or high tariff

Import Quotas to Eliminate Imports



Quota of zero pushes domestic price to P_0 and imports go to zero.

- Loss to consumers is A+B+C
- Gain to producers is A

Dead weight loss: B +C