SPEA-V-202

Contemporary Economic Issues in Public Affairs

Tax Policy 2

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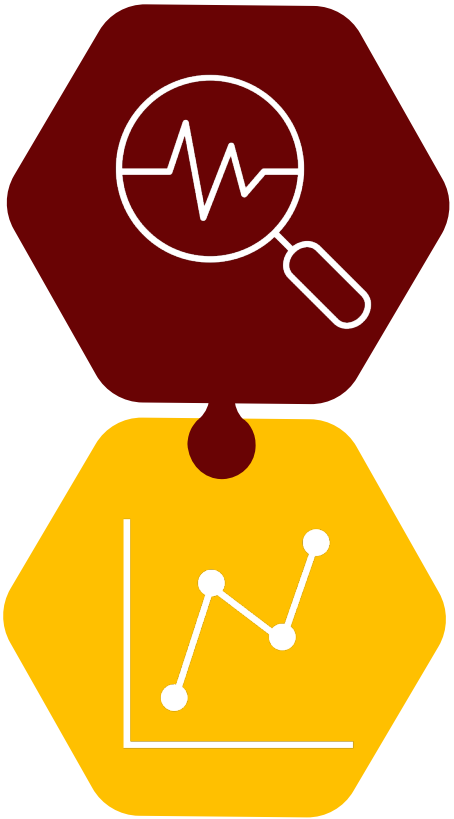
Outline for Today



Behavioral Effects of Taxation

- Taxes, supply and demand.
- Tax Incidence
- DWL

Tax Incidence, DWL and elasticities

- DWL and elasticities
- Incidence and elasticities

Type of Taxes

In terms of which agent needs to pay the tax to the government, we have two types of taxes.

- **Taxes on Demand:** consumers are the ones required to pay the tax to the government.
- **Taxes on Supply:** producers are the ones required to pay the tax to the government.
- In general, a tax raises the price buyers pay and lowers the price sellers receive.

$$P_d = P_s + t$$

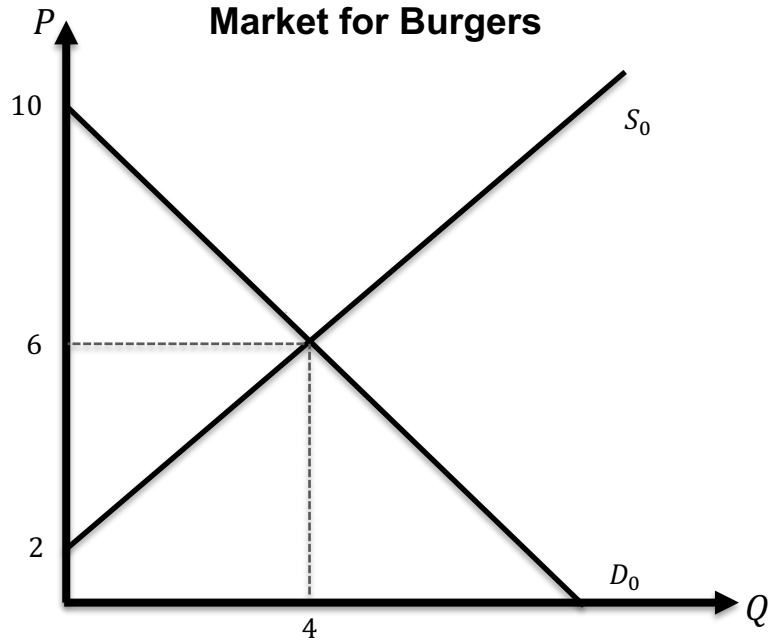
$$P_s = P_d - t$$

Taxes in the Supply and Demand Model

Recall our market for burgers. Suppose the government is considering a new sales tax on burgers.
How can we analyze the effects of this policy using our supply and demand diagram?

Steps to analyze tax policy

1. Who needs to pay the tax to the government?
2. What is the effect on the curve of the agent that pays?
3. What happens to the equilibrium?



Taxes in the Supply and Demand Model

Recall the market for burgers. Suppose the government imposes a **sales tax on consumers equivalent to $2 for each burger purchased**. How does this look in our supply and demand diagram?

Before $Q_d(P) = 10 - P$

For each burger purchased by the consumer, the government will take $2 from the price at which is bought.

After $Q_d(P) = 10 - (P + t)$

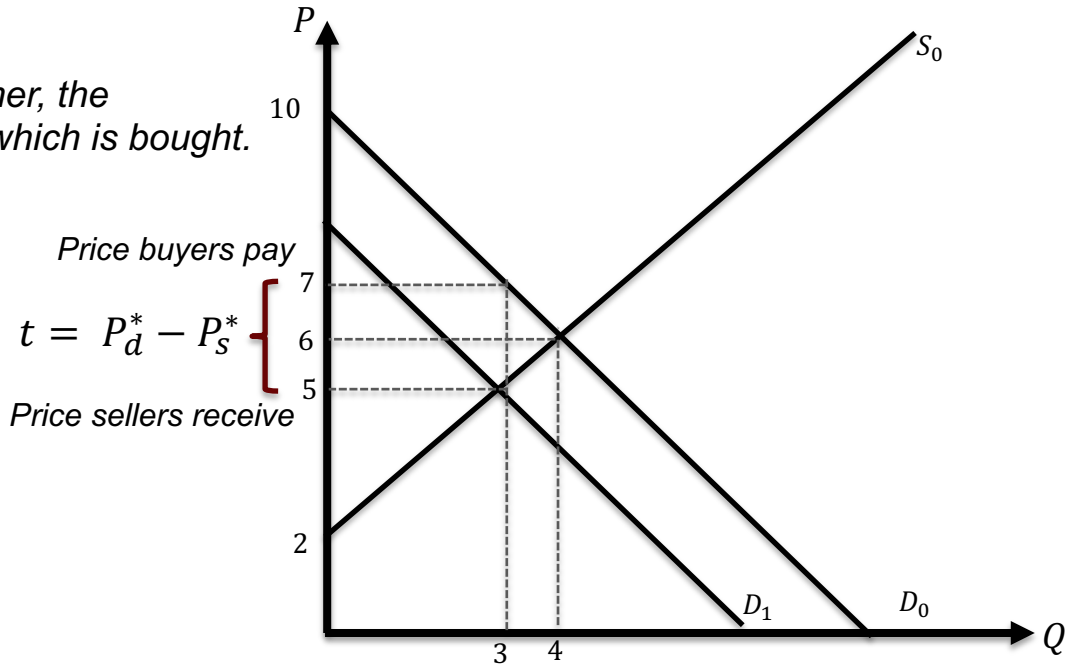
$$Q_d(P) = 8 - P$$
$$Q_s(P) = P - 2$$

$P_s^* = 5$

$Q^* = 3$

$P_d^* = P_s^* + t$

$P_d^* = 7$



Welfare Effects of Taxation: Direct Effects

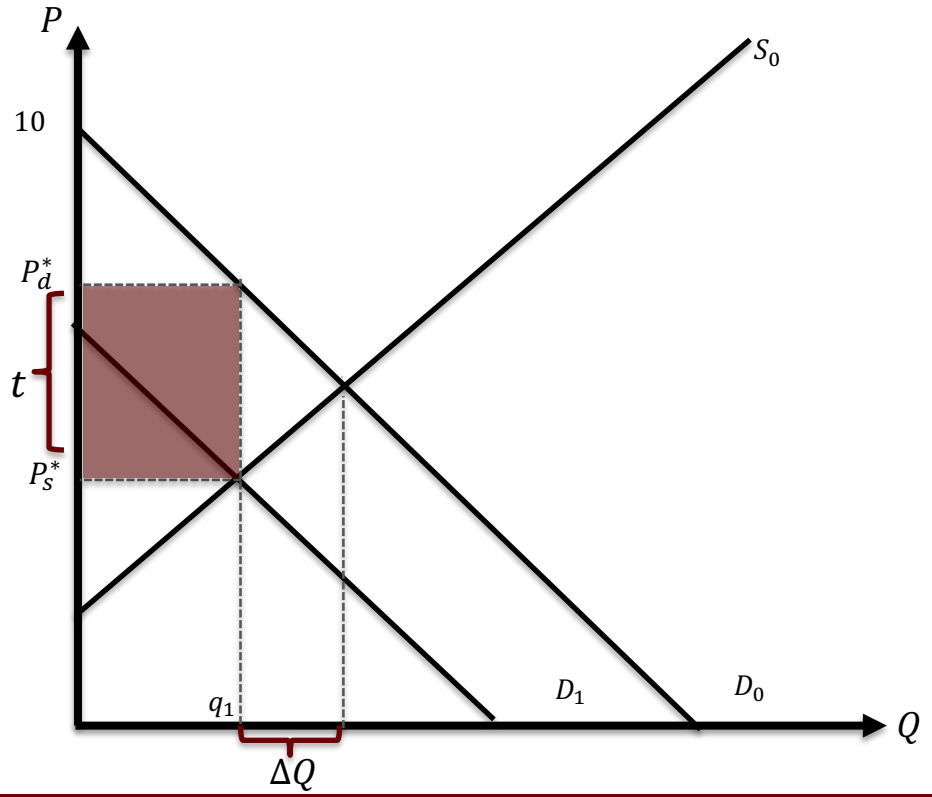
Revenue raised by the government is the direct effect of taxation on welfare.

- Government revenue is determined by the quantity consumed after the tax, and the amount of the tax.

$$Tax\ Revenue = t \times q_1$$

- In our supply and demand diagram, it is given by the square delimited by the change in prices and quantity consumed after the tax.

- Before the tax, the revenue was part of the total surplus, but now is owned by the government.

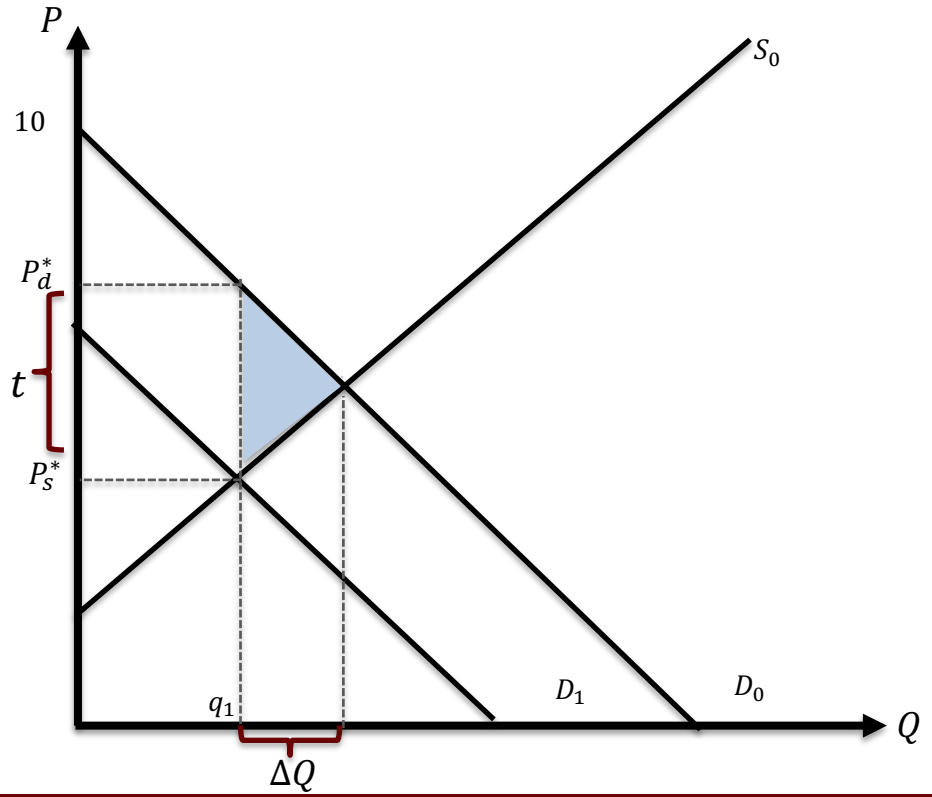


Welfare Effects of Taxation: Indirect (DWL)

With the tax, there is a welfare loss for both consumers and producers.

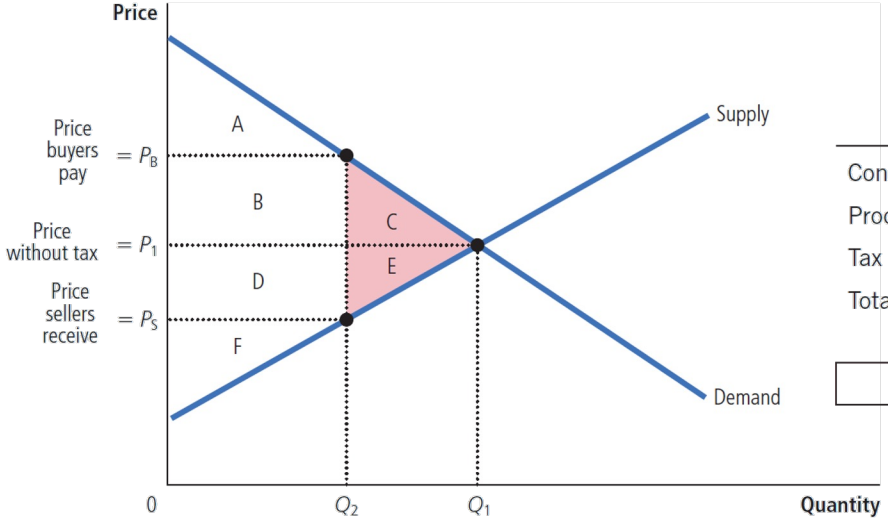
- The tax shifts the demand curve to the left (i.e. WTP decreased overall).
- Relative to the original equilibrium, there is a welfare loss (deadweight loss).
- How can we calculate it? As always. It is given by the area of a triangle. Let ΔQ be the change in the consumed quantity due to the tax.

$$DWL = \frac{1}{2} \times \Delta Q \times t$$



Welfare Effects of Taxation

Both consumers and producers have welfare losses from the tax, but the government raises revenue to provide other goods and service in the economy.



	Without Tax	With Tax	Change
Consumer Surplus	A + B + C	A	− (B + C)
Producer Surplus	D + E + F	F	− (D + E)
Tax Revenue	None	B + D	+ (B + D)
Total Surplus	A + B + C + D + E + F	A + B + D + F	− (C + E)

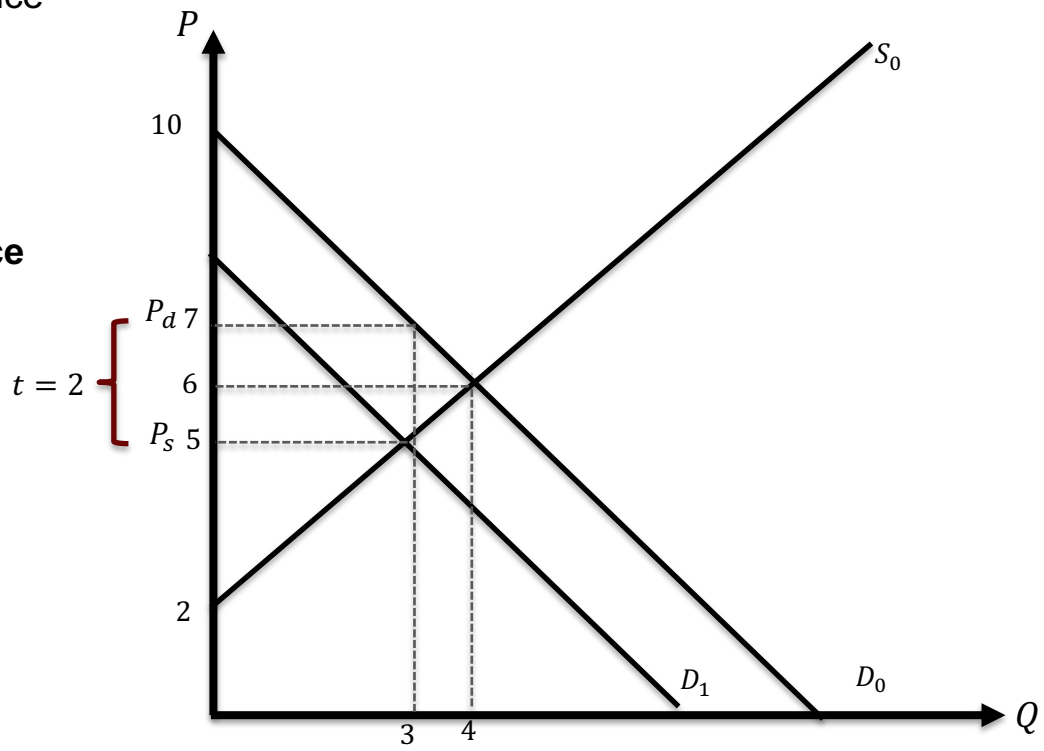
The area C + E shows the fall in total surplus and is the deadweight loss of the tax.

Source: Figure 3, Mankiw Ch 8.

Tax Incidence

Despite the tax is imposed on consumers, the price received by suppliers changed relative to the original equilibrium.

- This highlights an important fact.
- **Statutory incidence ≠ Economic incidence**
- Statutory incidence: burden of taxation determined by who pays the tax to the government.
- Economic incidence: burden of taxation in terms of consumer and producer surplus.
  - Accounts for behavioral responses of taxation and welfare effects.



Tax Incidence

Question: does it matter whether the tax is levied on consumers or producers?

- Suppose the government is evaluating the implementation of a new sales on tax.
- It needs to choose who bears the statutory incidence of the tax.
- In other words, who is going to pay the actual tax to the government. Could be either consumers or producers.
- What do you think? Who should the government pick and why?
- Recall the first example of a specific tax of $2 imposed on consumers of burgers.
- Let's analyze what happens when that same tax is levied to producers.

Tax Incidence: Taxes on the Demand Curve.

Setting: sales tax on consumers equivalent to $2 for each burger purchased.

Before $Q_d(P) = 10 - P$

For each burger purchased by the consumer, the government will take $2 from the price at which is bought.

After $Q_d(P) = 10 - (P + t)$

$$Q_d(P) = 8 - P$$
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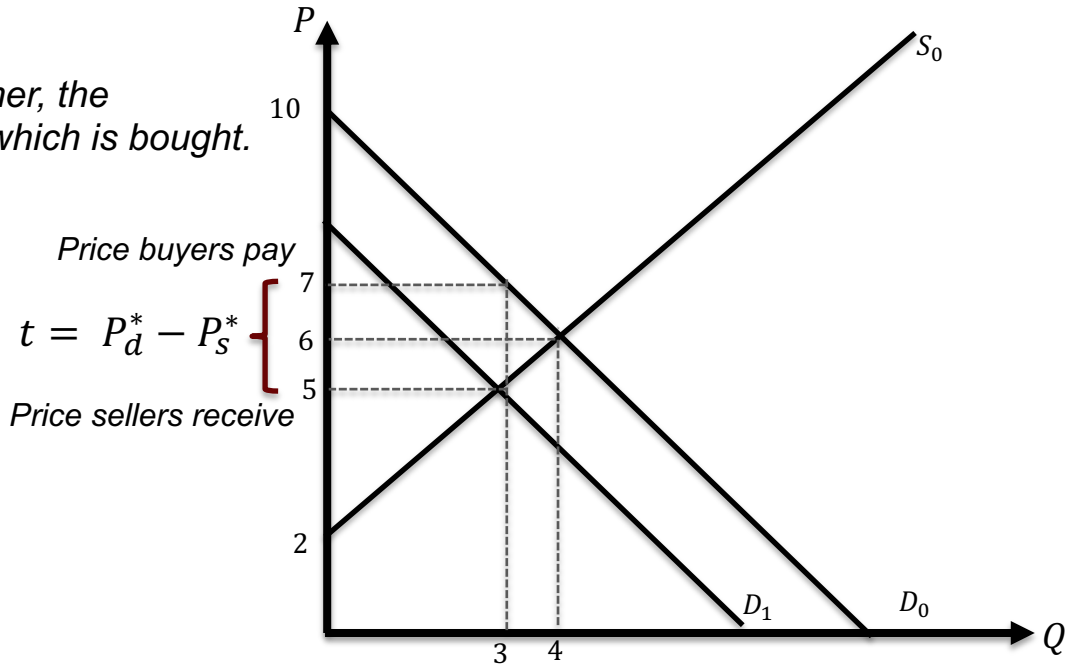


Tax Incidence: Taxes on the Supply Curve.

Setting: tax on producers equivalent to $2 for each burger sold.

Before $Q_s(P) = P - 2$

For each burger sold by the supplier, the government will take $2 from the price at which is sold.

After $Q_s(P) = (P - t) - 2$

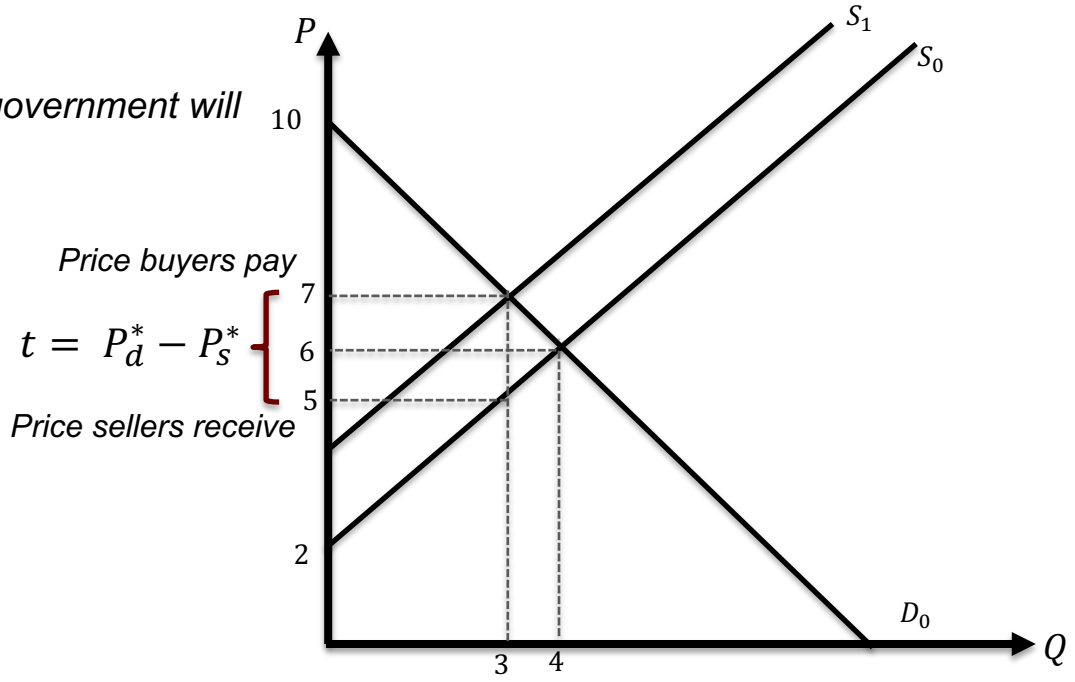
$$Q_s(P) = P - 4$$
$$Q_d(P) = 10 - P$$

$P_d^* = 7$

$Q^* = 3$

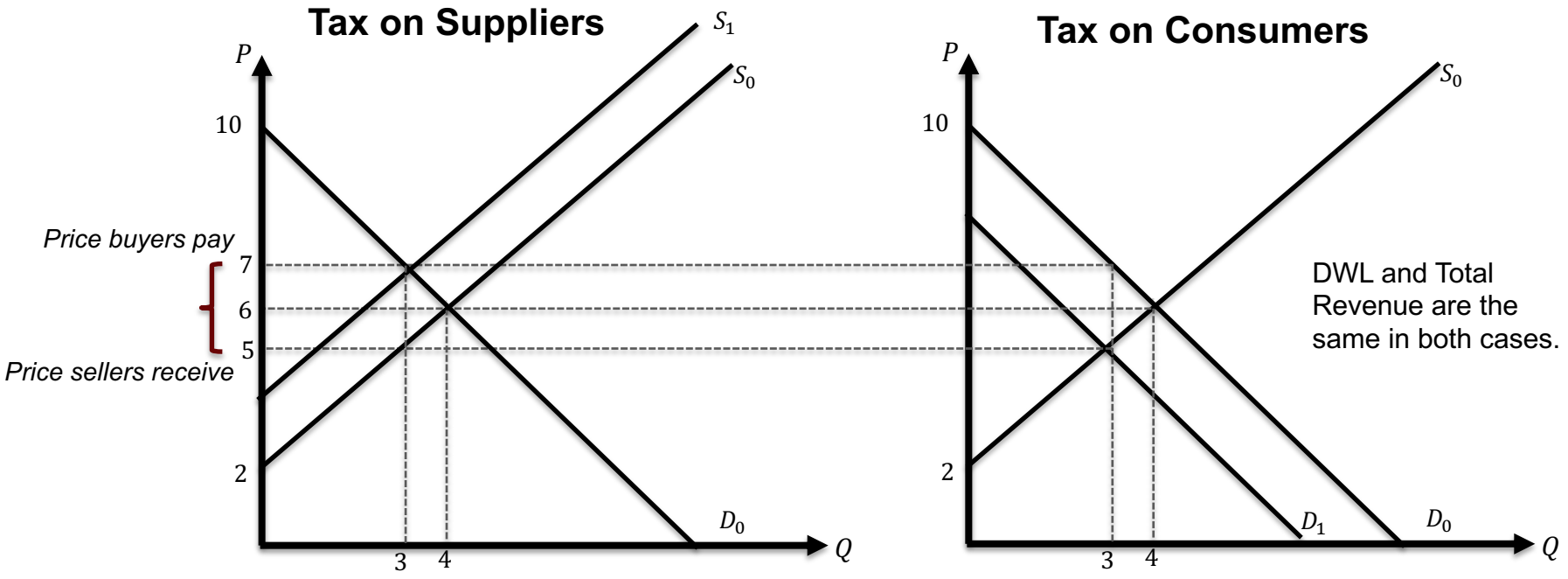
$P_d^* = P_s^* + t$

$P_s^* = 5$



Tax Incidence

Important Remark: In terms of the economic outcome**, it does not matter on who the tax is levied.**



Some useful math around the effect of taxes on welfare.

Recall the definition of DWL and the elasticity of demand.

$$DWL = \frac{1}{2} \times \Delta Q \times t \qquad \epsilon_d = \frac{\Delta Q}{\Delta P} \times \frac{p_0}{q_0}$$

1. Note that for the cases of taxes: $\Delta P = t$

2. Plug on the formula of elasticity of demand $\epsilon_d = \frac{\Delta Q}{t} \times \frac{p_0}{q_0}$

3. Rearrange in terms of Q $\Delta Q = \epsilon_d \times t \times \frac{q_0}{p_0}$

4. Substitute in the formula of DWL: $DWL = \frac{1}{2} \times \left(\epsilon_d \times t \times \frac{q_0}{p_0}\right) \times t$

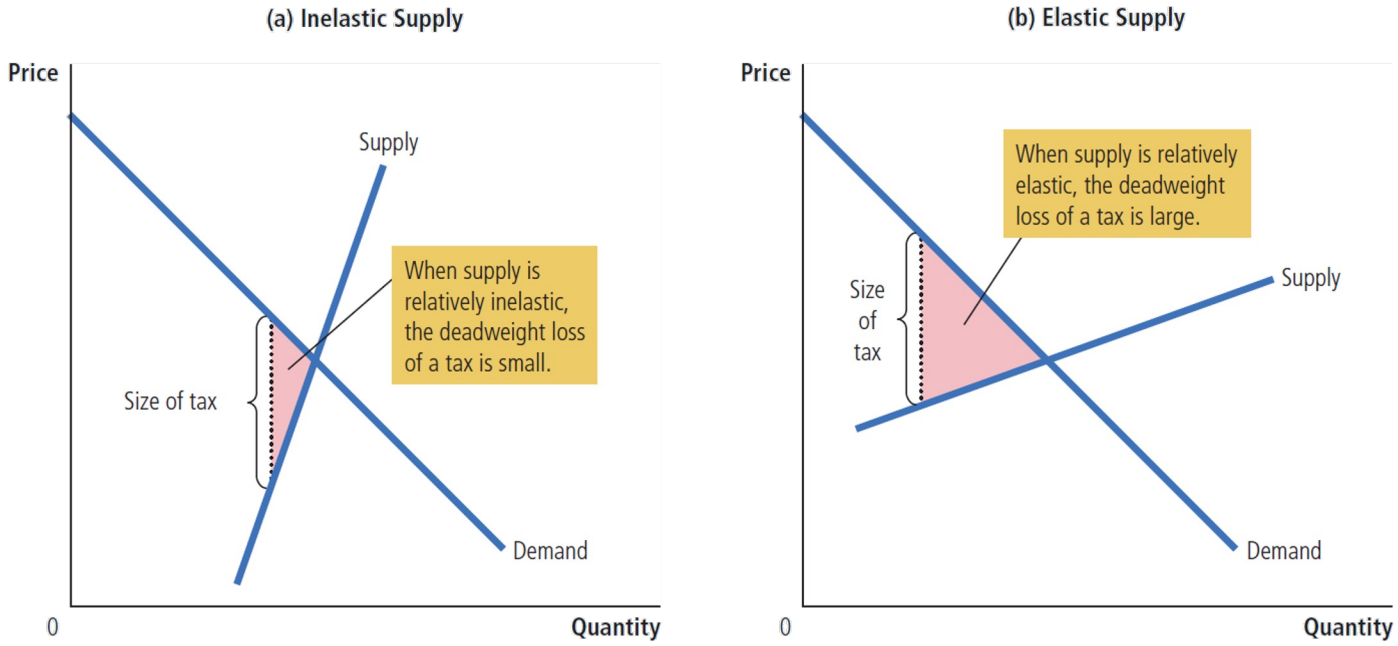
$$DWL = \frac{1}{2} \times \epsilon_d \times p_0 q_0 \times \left(\frac{t}{p_0}\right)^2$$

Key insights: DWL

- Increases quadratically with the size of the tax.
- Increases with the elasticity of demand.

Taxes, DWL and Elasticity of Supply

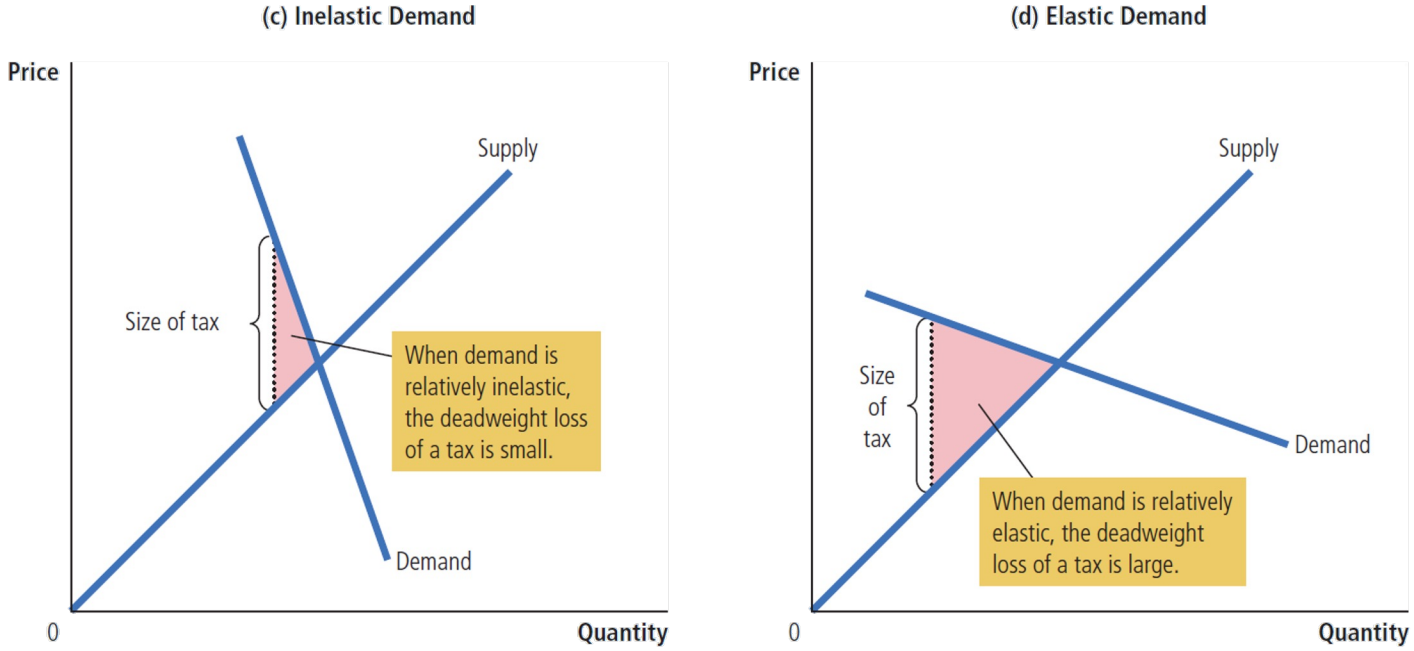
What happens to the DWL when the supply becomes more elastic?



Source: Figure 5, Mankiw Ch 8.

Taxes, DWL and Elasticity of Demand

What happens to the DWL when the demand becomes more elastic?



Source: Figure 5, Mankiw Ch 8.

Taxes, DWL and Elasticities

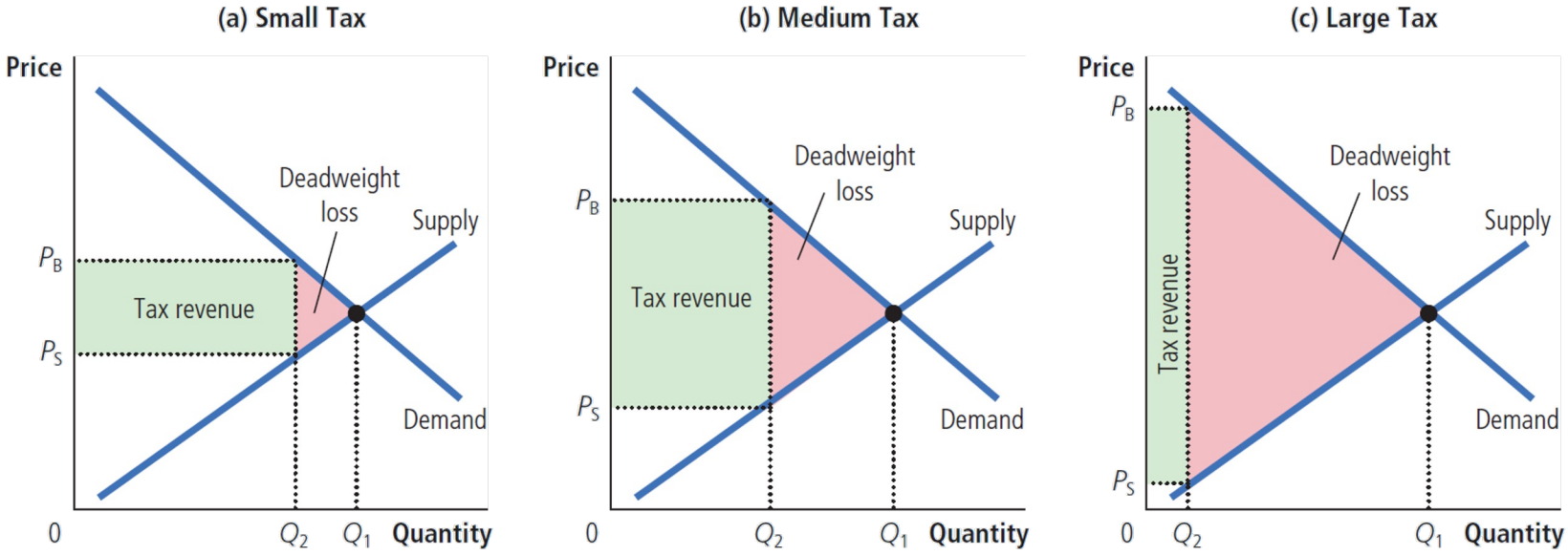
Size of the DWL: What is the relative size of the DWL depending on the elasticity of supply and demand?

Size of DWL	Supply	Demand
Elastic	Large	Large
Inelastic	Small	Small

Intuition: elastic curves mean high-responsiveness to prices. Small changes in prices lead to large adjustments in quantities.

Deadweight Loss and the size of the Tax

We have established that taxation creates deadweight losses in the economy. How does the DWL changes upon the size of the tax? **Focus on the red triangles.**



Source: Figure 6, Mankiw Ch 8.

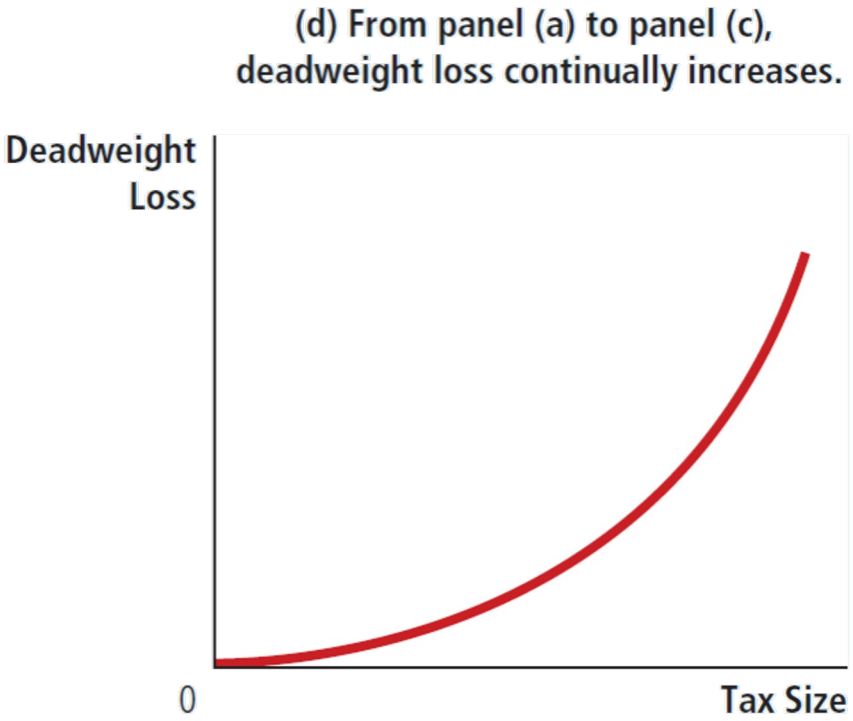
Deadweight Loss and the size of the Tax

As we can see, DWL increases with the size of the tax. In other words, **higher taxes are bad in terms of welfare.**

Is this shape familiar?

$$DWL = \frac{1}{2} \times \epsilon_d \times p_0 q_0 \times \left(\frac{t}{p}\right)^2$$

Key insight DWL: Increases quadratically with the size of the tax.



Source: Figure 6, Mankiw Ch 8.

Taxes, DWL and Elasticities

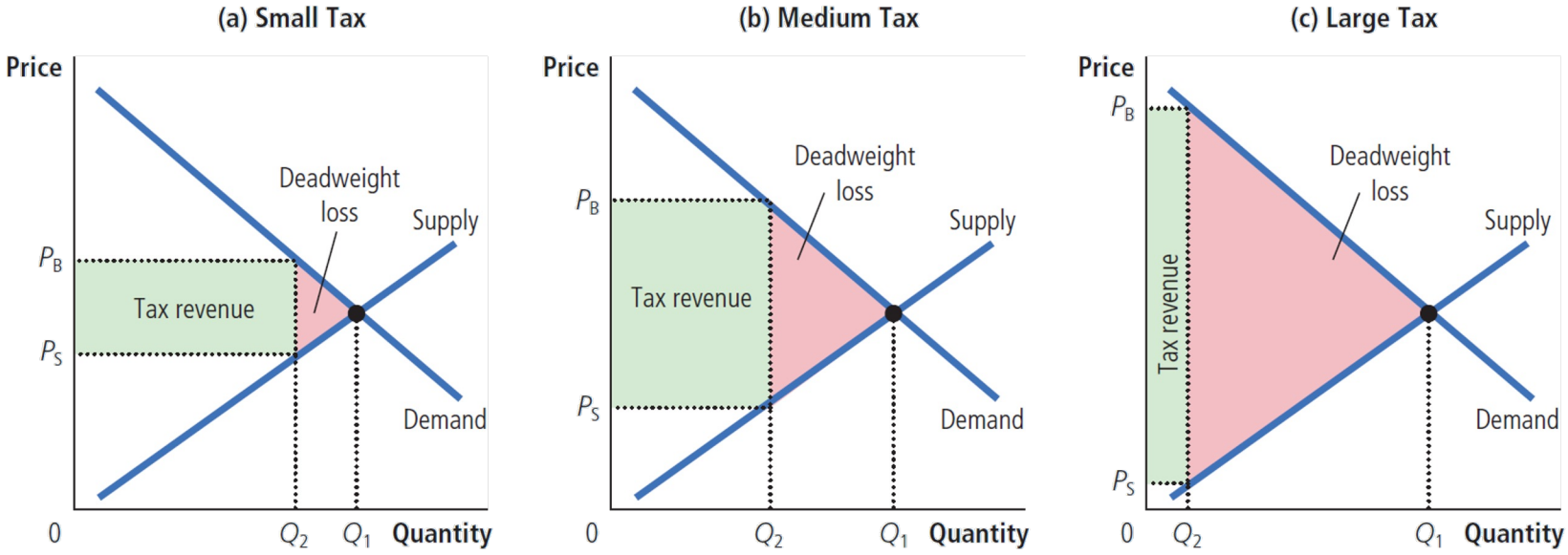
Incidence of the Burden: Who bears more of the DWL induced by the tax, depending on the elasticity of supply and demand?

DWL Incidence	Supply	Demand
Perfectly Elastic	Consumers	Producers
Perfectly Inelastic	Producers	Consumers

Intuition: elastic curves mean agents are able to adjust their behavior to new market conditions. The agent with the most inelastic curve bears more of the tax. In other words, experiences a larger decrease in its surplus.

Tax Revenue the size of the Tax

What happens to tax revenue upon a tax increase? Two competing effects:
1) $\uparrow t$ leads to higher revenue, but 2) $\uparrow t$ reduces q^*. **Focus on the green rectangles.**

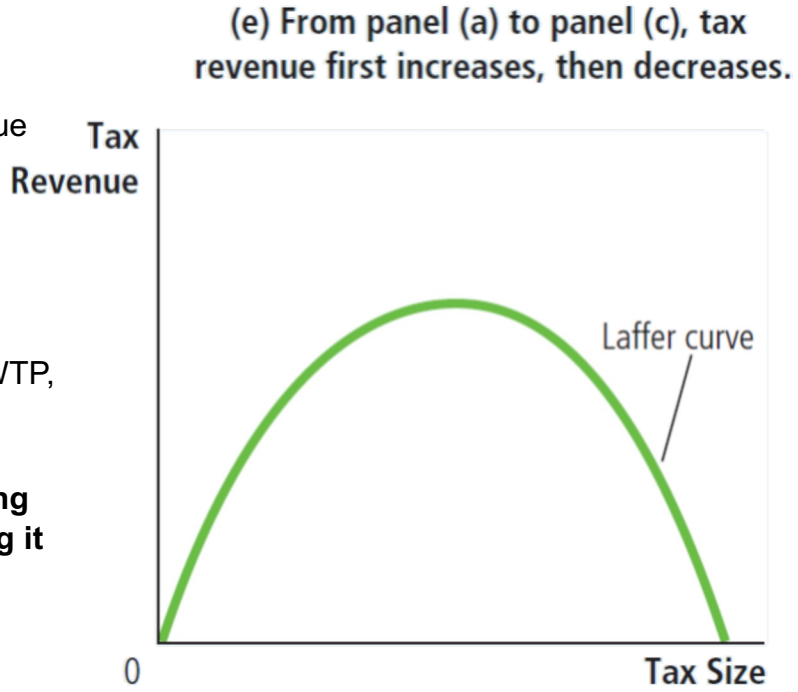


Source: Figure 6, Mankiw Ch 8.

Deadweight Loss and the size of the Tax

Laffer Curve: relates government revenue with the tax rate. Allows to explore the effects of tax policy on government revenues.

- **Think like an economist: in margins.**
- For a small tax, distortions are low (small change in q) and revenue is small.
- If the government slightly increases the tax, it could raise more revenues without dis-incentivizing consumption large enough.
- If it keeps rising the tax, each increment decreases consumer's WTP, but the increase in the tax influences positively tax revenue.
- Hence, there is a point where the **marginal benefits of increasing the tax (additional revenue) equal the marginal costs of doing it (decreasing the quantity consumed in the market).**
- Where is this point in the graph?



Source: Figure 6, Mankiw Ch 8.

Special Case: Negative Taxes (Subsidies)

We have only talked about taxes. What about subsidies? Subsidies are when the government, instead to charging money to the agents, it pays a part of the price.

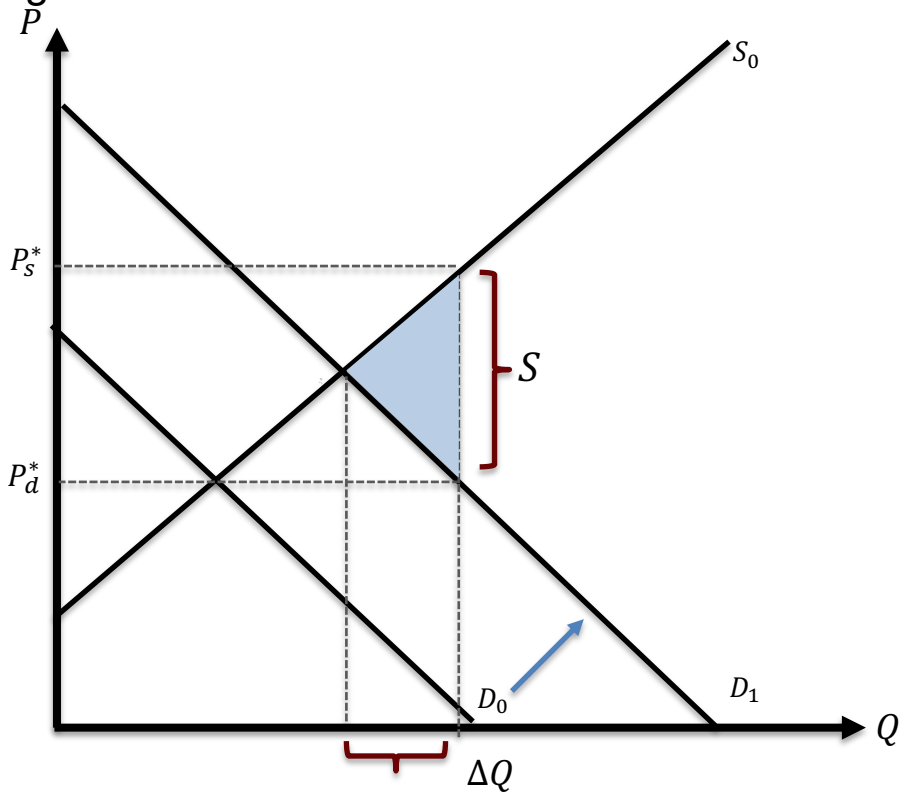
Subsidies are the counterpart of taxes. Thus, it is like doing all the analysis we have done, but with opposite effects. In the end, a subsidy is a negative tax.

- **Incidence:** lowers the price paid by buyers, and raise the price received by sellers.
  - Effects are the same, regardless who receives the subsidy.
- **Efficiency:** leads to an increase in the quantity consumed.
  - Instead of a welfare loss, we observe a welfare gain.
  - Relation with elasticities stays the same. Elastic curves lead to larger welfare gains.

Special Case: Negative Taxes (Subsidies)

Suppose we have a subsidy on the demand for burgers.

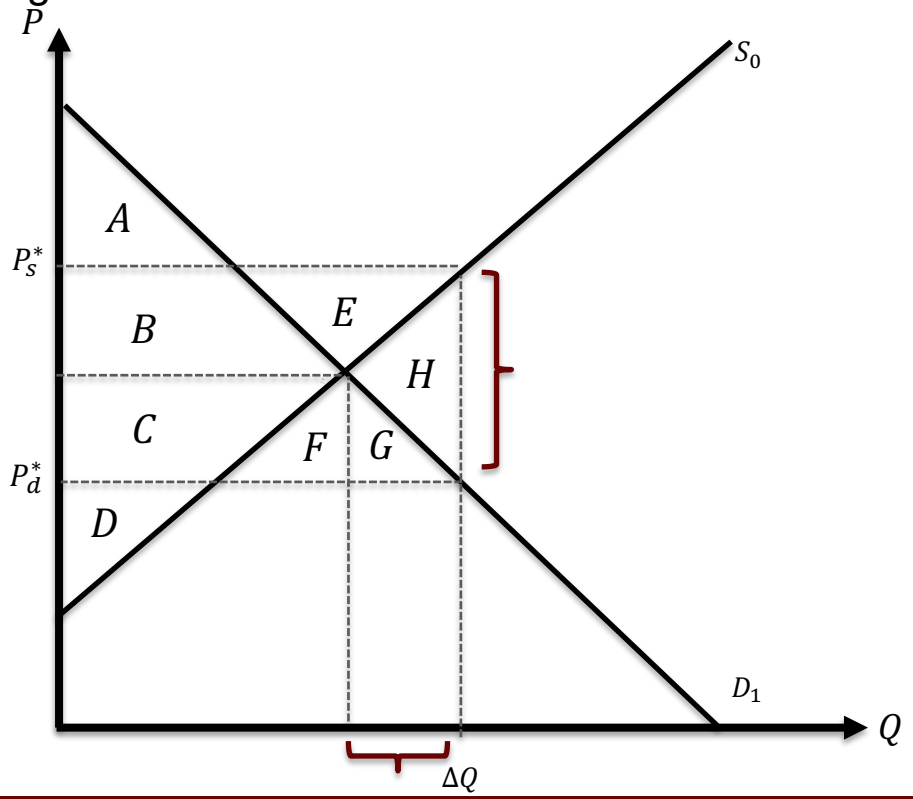
- The tax shifts the demand curve to the right (i.e. WTP increase overall).
- Prices paid by consumers stay the same, so they can consume more q.
- Prices received by suppliers increased in the magnitude of the subsidy.
- Welfare gain is determined by the area of the shaded triangle.



Special Case: Negative Taxes (Subsidies)

Suppose we have a subsidy on the demand for burgers.

	Original Eq	Subsidy
Consumer Surplus	A+B	A+B+C+F+G
Producer Surplus	C+D	B+C+D+E
Gov Revenue	0	-(B+C+E+F+G+H)
Total Surplus	A+B+C+D	A+B+C+D+H



For Next Class

- **On the Next Episode:** Externalities.
- **Readings:**. Mankiw 10.
- **Assignment 2:** Assignment 2 is due Sunday.

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