An Introduction to Economics

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Pigouvian Policies

- Agents failing to consider externalities $\Rightarrow$ Inefficient outcomes

- Want agents to internalize their externalities

- Idea: Change their incentives on the margin to align with social objectives.

Pigouvian Policies

- Goal: Market outcome achieves the efficient quantity.

- Solution: Impose taxes or subsidize so that the market clears at the efficient quantity

- Particulars: For a negative externality, impose a tax equal to the marginal externality. For positive externalities, provide a subsidy equal to the marginal externality.

Suppose that supply and demand for tobacco products is given:

$$P = 60 - 2Q_d$$
$$P = \frac{5}{6}Q_s$$

Price is in U.S. dollars per pack, and quantities are in millions of packs. Suppose that consumption of cigarettes generates a constant negative marginal externality of $3 per pack.

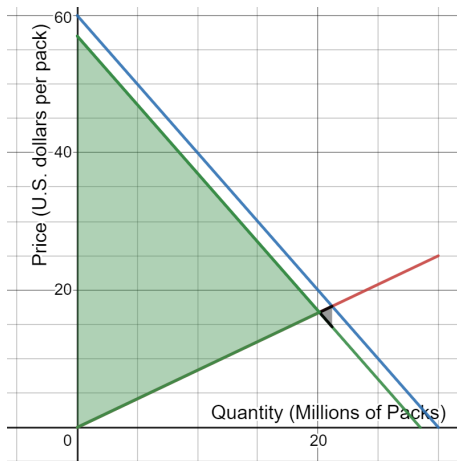# Pigouvian Taxes: Example (2)

Figure 1: Marginal private benefit (blue), marginal social benefit (green curve), marginal social cost (red), deadweight loss (gray), total social surplus (green shaded)
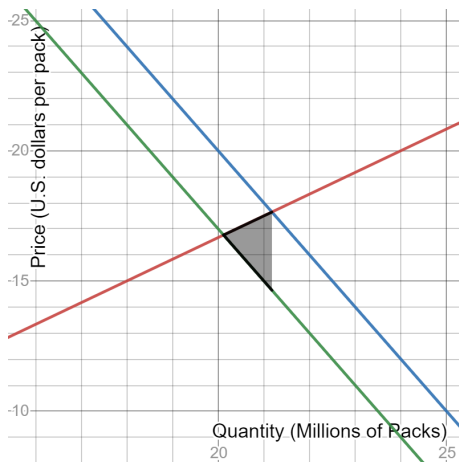
Zooming In

Figure 2: Marginal private benefit (blue), marginal social benefit (green), marginal social cost (red), deadweight loss (gray)

Pigouvian Taxes: Example (3)

Impose a tax of \$3 per pack on consumers so that market prices reflect marginal social benefit.

With the tax, the relationship between market price and quantity becomes:

$$P_{market} = 60 - 3 - 2Q_d = 57 - 2Q_d$$

Now, the marginal private benefit is equal to the marginal social benefit for each quantity, because consumers incur the additional costs of their negative externalities.
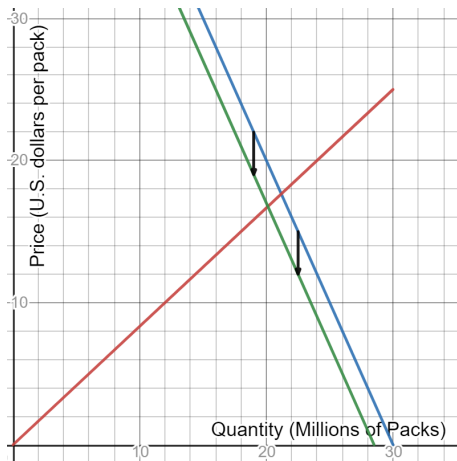
Figure 3: Marginal private benefit move to marginal social benefit.

Tax Revenue

- How much revenue was raised by the taxes in the previous example?

- Tax Revenue = Tax · Quantity

- Here: Quantity at the new equilibrium is $\frac{342}{17}$

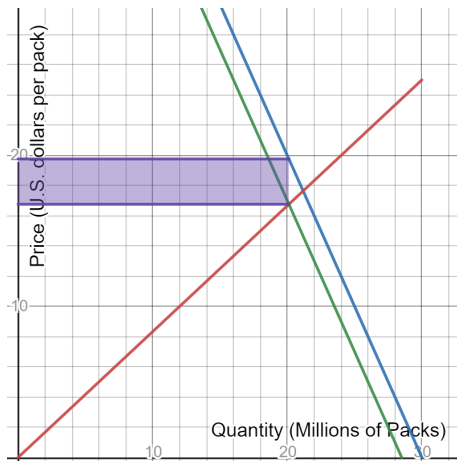- Total revenue is then: $3 \cdot \frac{342}{17} = \frac{1026}{17}$

Figure 4: Tax Revenue: Purple

Society Benefits, but Individuals?

- Even though we're at the socially optimal level, private benefits are reduced
- The agents in the market are losing out due to the tax
- Private benefits are lost, but social surplus is higher than before.
- The **social surplus** from these, now forgone, transactions was actually negative.
- For these transactions, the negative externality was larger than the difference between marginal private benefit and marginal social cost.
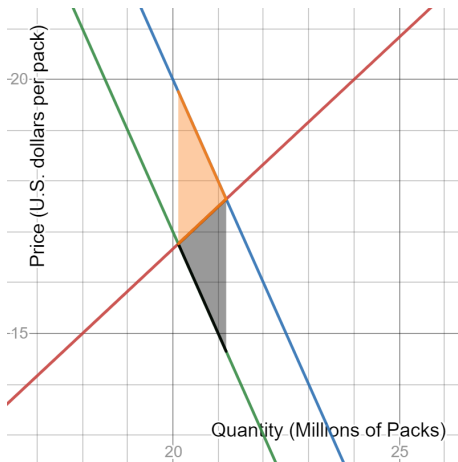
Figure 5: Private loss as a result of the tax (yellow), deadweight loss at the **original** equilibrium (gray)

- Important: These transactions, while providing private benefits, did not benefit society

- The marginal negative externality of 3 was higher than the marginal total surplus generated by the transactions.

Tax Incidence

- Natural Question: Which side of the market is harmed more by the tax in terms of private benefits?

- Consumer incidence (burden): Difference between new total price paid and the old market price

- Producer incidence (burden): Difference between old market price and the new amount received per transaction.

Returning to the example (2)

- In our previous example new total price for consumers is: new market price + tax
- New amount received per transaction for producers is simply the new market price.
- Old market price: $\frac{300}{17}$
- New market price: $\frac{285}{17}$
- Consumer incidence: $(\frac{285}{17} + 3) - \frac{300}{17} = \frac{36}{17}$
- Producer incidence: $\frac{300}{17} - \frac{285}{17} = \frac{15}{17}$
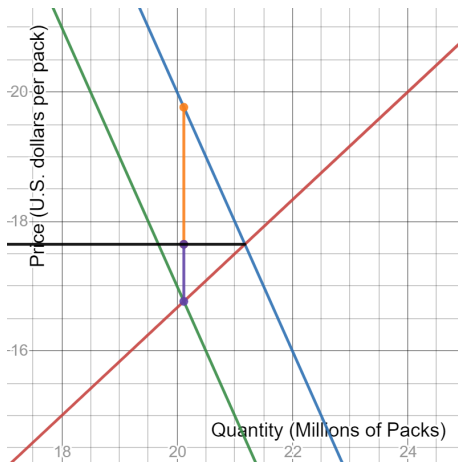- Notice: $\frac{36}{17} + \frac{15}{17} = 3$

Figure 6: Consumer incidence (yellow), producer incidence (purple), old market price (black)

Incidence and Elasticity

- Let's compute elasticities at the old market equilibrium:

- Price elasticity of demand: $-\frac{1}{2} \cdot \frac{300}{360} = -\frac{5}{12}$

- Price elasticity of supply: $\frac{6}{5} \cdot \frac{300}{360} = 1$

- Idea: Incidence tied to the relative elasticities of supply and demand at the equilibrium

- See whiteboard

- The **more inelastic** side of the market bears the majority of the tax incidence.
- The incidence of the tax **does not** depend on which side of the market is being taxed.
- In the case of one side being perfectly inelastic, this side bears all of the incidence of the tax.

What about without externalities?

- Taxes and subsidies can be useful for achieving optimal quantities of goods which generate externalities.

- What happens when we use taxes and subsidies in markets without externalities?

Taxes without externalities: Example

Suppose that you are given the following supply and demand curves:

$$P = 15 - \frac{3Q_d}{2}$$

$$P = 4 + \frac{3Q_s}{10}$$

Suppose that there are no externalities in the market.

- This means that marginal social benefit is given by the demand curve, and marginal social cost by the supply curve.
- Suppose that we impose a tax of $5 on consumers. What is the result?
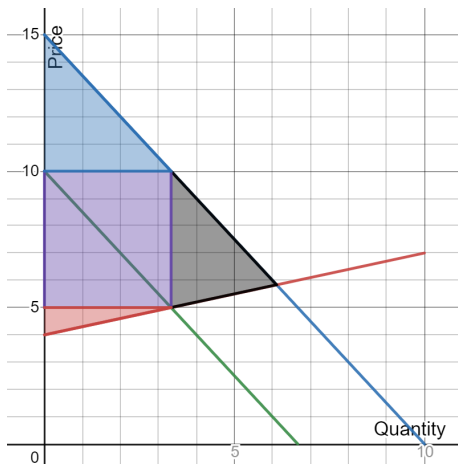- What would happen if we impose the same tax, but on the suppliers?

Figure 7: Deadweight loss (gray), revenue (purple), consumer surplus (blue) and producer surplus (red)

Incidence in Example

- Original market price: $\frac{35}{6}$

- New market price: 5

- Consumer incidence: $(5 + 5) - \frac{35}{6} = \frac{25}{6}$

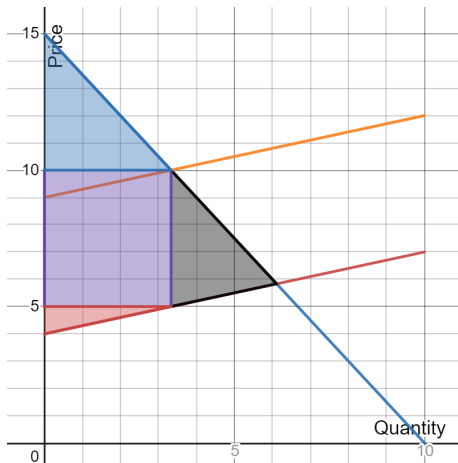- Producer incidence: $\frac{35}{6} - 5 = \frac{5}{6}$

Figure 8: Deadweight loss (gray) after the tax

Incidence once more

- We see that deadweight loss is the same!

- Incidence is also the same.

- Consumer incidence: $10 - \frac{35}{6} = \frac{25}{6}$

- Producer incidence: $\frac{35}{6} - (10 - 5) = \frac{5}{6}$

Lessons: Recapped

- Taxes useful for handling externalities and generating revenue

- The side of the market which is relatively more inelastic bears a greater tax burden

- Taxation in markets without externalities can result in deadweight loss

- The incidence and deadweight loss is independent of the side of the market which is taxed directly