LECTURE 10
EXTERNALITIES
February 20, 2020

I. OVERVIEW
   A. Market failures
   B. Definition of an externality

II. NEGATIVE EXTERNALITIES (EXAMPLE: GASOLINE)
   A. Definition
   B. New names for old concepts
   C. Social marginal cost
   D. The private outcome versus the socially optimal outcome
   E. Welfare analysis of a negative externality
   F. Other examples of negative externalities

III. POSITIVE EXTERNALITIES (EXAMPLE: VACCINES)
   A. Definition
   B. Social marginal benefit
   C. The private outcome versus the socially optimal outcome
   D. Welfare analysis of a positive externality
   E. Other examples of positive externalities

IV. REMEDIES FOR EXTERNALITIES
   A. Private solutions
   B. Government regulation
   C. Taxes and subsidies
LECTURE 10
Externalities

February 20, 2020
Announcements

• **Room Assignments for the Midterm:**
  
  • Sections moving to 105 Stanley:
    101 and 103 (Todd Messer)
    109 and 110 (Pedro Pires)
    115 and 116 (Priscila de Oliveira)

  • Everyone else should come to the usual room (155 Dwinelle).

  • Students with DSP accommodations should hear from Todd Messer about arrangements. If you haven’t, please contact him (messertodd@berkeley.edu).
Announcements

• Review Session:
  • Friday, February 21, 6 – 8 p.m. in 155 Dwinelle.
I. **Overview**
Market Failure

• When markets do not work well; there is some defect.

• First example was monopoly—a profound lack of competition.
Externality

• An effect related to the production or consumption of a good that falls on people who are not the producers or consumers.
II. Negative Externalities
Atmospheric CO$_2$ Concentration

Source: National Oceanic and Atmospheric Administration.
U.S. Carbon Dioxide Emissions, By Source

- **Electricity**: 37%
- **Transportation**: 31%
- **Industry**: 15%
- **Residential & Commercial**: 10%
- **Other (Non-Fossil Fuel Combustion)**: 6%

*Source: Environmental Protection Agency.*
Negative Externality

• The effects on those outside the market are bad.
• There is an external cost.
• Negative externalities can result from either the consumption or the production of a good (or both).
Market for Gasoline

\[ P \]

\[ Q \]

\[ S_{1,MC_{1}} \]

\[ D_{1,MB_{1}} \]

\[ P_{1} \]

\[ Q_{1} \]
Some Terminology

• “Private” refers to the people participating in the market (the buyers and sellers).

• “Social” includes effects on people both in the market and outside the market.
Review of Welfare Analysis

 PMC is the private marginal cost; PMB is the private marginal benefit.
Total Private Surplus

• Sum of consumer surplus and producer surplus.

• It is the area between the PMB and PMC, up to the level produced and consumed.
More Terminology

• **External Marginal Cost:** The additional cost to people outside the market when one more unit is produced and consumed.

• **Social Marginal Cost:** Private marginal cost plus external marginal cost.
Negative Externality (Market for Gasoline)
Total Social Surplus

• Total private surplus plus external benefits minus external costs.

• It includes the welfare of both people in the market and outside the market.
Welfare Analysis of a Negative Externality

Total Private Surplus: \(a+b+c\)

External Costs: \(-(b+c+d)\)

Total Social Surplus: \(a-d\)

Deadweight Loss: \(d\)

Q₁: \(\frac{Q₁}{a+b+c}\)

Q*: \(\frac{Q^*}{a+b}\)
Deadweight Loss

• The total social surplus is largest at the quantity where SMB=SMC.

• Why is this the case?

• Any shortfall from the largest total social surplus is the deadweight loss.
Some Points about the Welfare Analysis of a Negative Externality

- The total social surplus includes the people in the market.
- The total social surplus typically isn’t maximized at very low levels of production and consumption.
- When there is no externality, SMB and PMB are the same, and SMC and PMC are the same.
  - The market produces where PMB=PMC, which is the same as where SMB=SMC.
Other Examples of Negative Externalities?

- Second-hand smoke from cigarettes.
- Texting or drinking and driving.
- Pesticide runoff from farms.
- Noise related to a construction project.
Whenever There Is a Negative Externality:

• The SMC curve lies above the PMC curve.

• The people in the market will choose to produce where PMC=PMB (or supply is equal to demand).

• But society would be better off if the market produced and consumed *less* (where SMC=SMB).
III. Positive Externalities
Positive Externality

• The effects on those outside the market are good.
• There is an external benefit.
• Positive externalities can result from either the consumption or the production of a good (or both).
More Terminology

- **External Marginal Benefit**: The additional benefit to people outside the market when one more unit is produced and consumed.

- **Social Marginal Benefit**: Private marginal benefit plus external marginal benefit.
Positive Externality (Market for Vaccines)
Welfare Analysis of a Positive Externality

Total Private Surplus: \( a \)  
External Benefits: \( b \)  
Total Social Surplus: \( a+b \)  
Deadweight Loss: \( c \)  

\[ \begin{array}{c|c|c} 
& Q_1 & Q^* \\
\hline
Total Private Surplus & \( a \) & \( a-d \) \\
External Benefits & \( b \) & \( b+c+d \) \\
Total Social Surplus & \( a+b \) & \( a+b+c \) \\
Deadweight Loss & \( c \) & \\
\end{array} \]
Other Examples of Positive Externalities?

• Technology spillovers.

• Education.

• Planting flowers in your yard.
Whenever There Is a Positive Externality:

• The SMB curve lies above the PMB curve.

• The people in the market will choose to produce where PMC=PMB (or supply is equal to demand).

• But society would be better off if the market produced and consumed *more* (where SMC=SMB).
IV. REMEDIES FOR EXTERNALITIES
Remedies for Externalities

• **Private Solutions:**
  - Negotiation and compensation.
  - Social sanctions.

• **Government Regulation**

• **Taxes and Subsidies**
Remedy for a Negative Externality (Tax)

D_1, PMB_1, SMB_1

Q

P

SMC_1, S_2

S_1, PMC_1

Q^*

Q_1

Q_2

External MC, Tax

D_1, PMB_1, SMB_1
Remedy for a Positive Externality (Subsidy)

Diagram showing demand and supply curves with external marginal benefit and the effect of a subsidy.