LECTURE 12
EXTERNALITIES
March 1, 2016

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 12
Externalities

March 1, 2016
Announcements

• Problem Set 3:
  • Due one week from today (Tuesday, March 8th).
  • Same ground rules apply.
  • There will be a problem set work session this Friday, 4-6 p.m. in Evans 648.
Announcements (continued)

• Midterms are graded and ready to hand back:
  • Median: 68
  • Standard deviation: 13
  • Midterms are graded on an absolute scale; final grades are curved to fit a reasonable (and flexible) distribution.
I. Overview
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 $\text{CO}_2$ Concentration

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

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

Diagram showing the market for gasoline with supply curve $S_1, MC_1$ and demand curve $D_1, MB_1$. The equilibrium price is $P_1$ and the equilibrium quantity is $Q_1$. 
Some Terminology

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

• “Social” includes effects on people both in the market and outside the market.
PMC is the private marginal cost; PMB is the private marginal benefit.
Total Private Surplus

- Sum of consumer surplus and producer surplus (and government revenue, if relevant).

- It is the area between the PMB and PMC, up to the level produced and consumed (when there is not government revenue).
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: $d$

$Q_1$ and $Q^*$ are given by:

- $Q_1 = a + b$
- $Q^* = a$
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).
- The optimal consumption and production of a good with a negative externality is almost never zero.
Other Examples of Negative Externalities?

• Second-hand smoke from cigarettes.
• Texting or drinking and driving.
• Noise related to a construction project.
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)

The diagram illustrates the market for vaccines with positive externality. The demand and supply curves are labeled as $D_1, PMB_1$ and $S_1, PMC_1, SMC_1$ respectively. The equilibrium quantity is denoted as $Q_1$, and the socially optimal quantity is $Q^*$. The external marginal benefit (MB) is indicated by the difference between $Q^*$ and $Q_1$.
Welfare Analysis of a Positive Externality

<table>
<thead>
<tr>
<th></th>
<th>$Q_1$</th>
<th>$Q^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Private Surplus</td>
<td>$a$</td>
<td>$a-d$</td>
</tr>
<tr>
<td>External Benefits</td>
<td>$b$</td>
<td>$b+c+d$</td>
</tr>
<tr>
<td>Total Social Surplus</td>
<td>$a+b$</td>
<td>$a+b+c$</td>
</tr>
<tr>
<td>Deadweight Loss</td>
<td>$c$</td>
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</table>
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).
Other Examples of Positive Externalities?

- Technology spillovers.
- Education.
- Planting flowers in your yard.
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)
Remedy for a Positive Externality (Subsidy)

\[ Q^* \]

\[ Q \]

\[ S_1, PMC_1, SMC_1 \]

\[ SMB_1, PMB_2 \]

\[ D_1, PMB_1 \]

\[ Q_1 \]

\[ Q^* \]

\[ Q_2 \]