

Gwinnett School of Math, Science, and Technology

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## **Macroeconomics Yearlong Notes**

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2023-2024



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# 1 Types of Goods (01/08)

## 1.1 Characteristics of the Four Types of Goods

- **Rivalrous** goods are those that can only be consumed by one person at a time.
- **Non-rivalrous** goods are those that can be consumed by multiple people at the same time.
- **Excludable** goods are those that can be restricted to certain people.
- **Non-excludable** goods are those that cannot be restricted to certain people.
- If a public good is overcrowded enough, it can become a common resource

## 1.2 The Four Types of Goods

	<b>Non-rivalrous</b>	<b>Rivalrous</b>
<b>Non-excludable</b>	<i>Public Goods</i> (e.g. Sunset, Common Knowledge)	<i>Common-Pool/Common Resources</i> (e.g. Irrigation Systems, Libraries)
<b>Excludable</b>	<i>(Toll/Club/Artificially Scarce) Goods/Natural monopolies</i> (e.g. Day-Care Centers, Country Clubs)	<i>Private Goods</i> (e.g. Donuts, Personal Computers)

## 1.3 Examples

Case Scenario	Type of Good/Service
A college education	Artificially scarce
A manicure or pedicure	Private good
Stone Mountain park	Artificially scarce
State park campgrounds	Artificially scarce
National defense	Public good
Peach Pass lane on I-85	Artificially scarce
Fish in the ocean	Common resource
Street lights	Public good
Netflix/Hulu	Artificially scarce
Flu shot	Private good
Tornado safety shelter	Public good

Case Scenario	Type of Good/Service
Bottled water in a tornado safety shelter	Common resource
Hearing a tornado siren	Public good
Going to an almost empty public beach	Public good
Going to an overcrowded public beach	Common resource
St. Lawrence SeaWay	Natural monopoly
Flying on a commercial airplane	Natural monopoly
Flying a single seat private airplane	Private good
Wedding guests eating a slice of the wedding-cake	Common resource
Cake sold at a bakery	Private good

## 2 Introduction to Externalities (01/09-01/10)

### 2.1 Overview

- An **externality** is a cost/benefit that affects a *third party* who did not choose to incur that cost/benefit.
- They are a type of **market failure** because they are *not* accounted for in the price of the good/service.
- The deadweight loss (DWL) of positive externalities will point to the right and vice-versa for negative externalities.
  - Which means the DWL triangle always points to the social optimum quantity.

### 2.2 Internalizing an Externality (aka *how to fix an externality*)

#### 2.2.1 Problems with externalities

- 1) Private individuals won't take into account the external costs/benefits
- 2) Public goods and common pool resources tend to lack property rights

#### 2.2.2 Coase Theorem (the fix!)

"We can fix externalities without the government if we..."

- 1) Give property rights to people
- 2) Minimize transaction costs

#### 2.2.3 Examples

Methods the government can employ to internalize an externality in a free market:

- Pollution or emission limits
- "Pollution credits" for private firms to buy and sell in the market

## 2.3 Positive Externality in Consumption

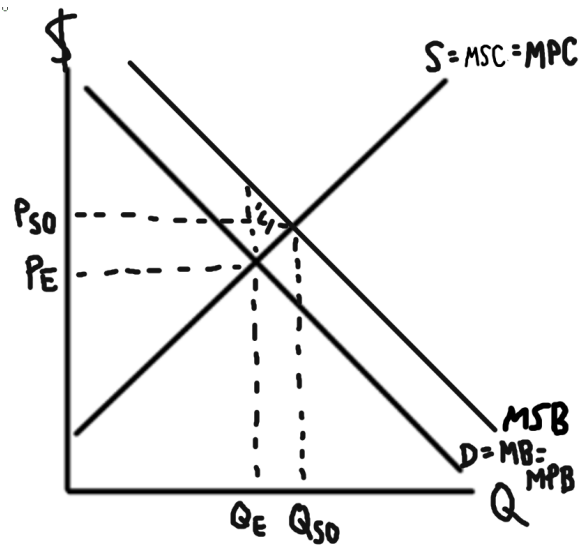


Figure 1: Positive Externality in Consumption

### 2.3.1 Examples

- Consumption of education
- Consumption of health care
- Advertisement can lead to an increase of demand in the free market  $\therefore$   $MPB$  goes up and moves the market toward  $MSB$ .

### 2.3.2 Spillover Effect

- The spillover effect is  $MEB = MSB - MPB$ .
- $MPB < MSB$
- $MPC = MSC$

### 2.3.3 Internalizing the Spillover Effect

- The external **benefits** can be internalized by **subsidizing** the product/service to the consumers of the good/service.
- The government intervention will move the private market to **social optimum** where  $MSB = MSC$ .

## 2.4 Negative Externality in Consumption

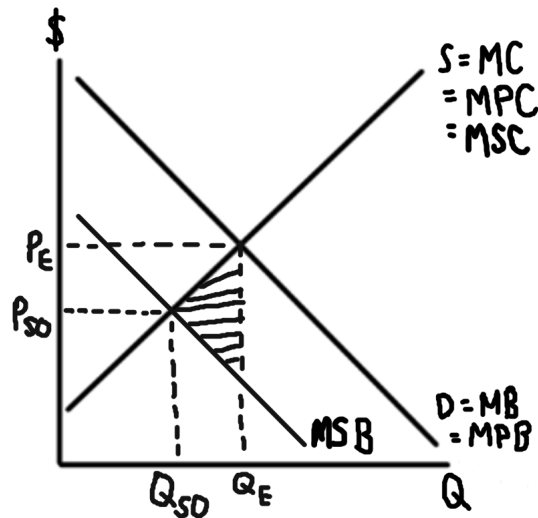


Figure 2: Negative Externality in Consumption

### 2.4.1 Examples

- Smoking in public/passive smoking
- Pollution due to fossil fuels
- Playing loud music
- Discarding garbage in public places

### 2.4.2 Spillover Effect

- The spillover effect is  $MEB = MSB - MPB$ .
- $MPB > MSB$
- $MPC = MSC$

### 2.4.3 Internalizing the Spillover Effect

- The external **benefits** can be internalized by **imposing a tax** on the product/service to the consumers of the good/service.
- The government intervention will move the private market to **social optimum** where  $MSB = MSC$ .

## 2.5 Positive Externality in Production

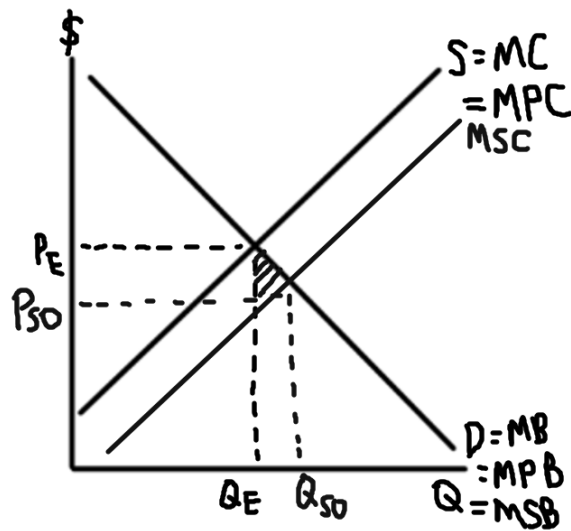


Figure 3: Positive Externality in Production

### 2.5.1 Examples

- Companies invest in training/professional development of their employees.
- Firms invest in research and development (R&D).

### 2.5.2 Spillover Effect

- The spillover effect is  $MEC = MSC - MPC$ .
- $MPB = MSB$
- $MPC > MSC$

### 2.5.3 Internalizing the Spillover Effect

- The external **costs** can be internalized by **subsidizing** the product/service to the producers of the good/service.
- The government intervention will move the private market to **social optimum** where  $MSB = MSC$ .



## 2.6 Negative Externality in Production

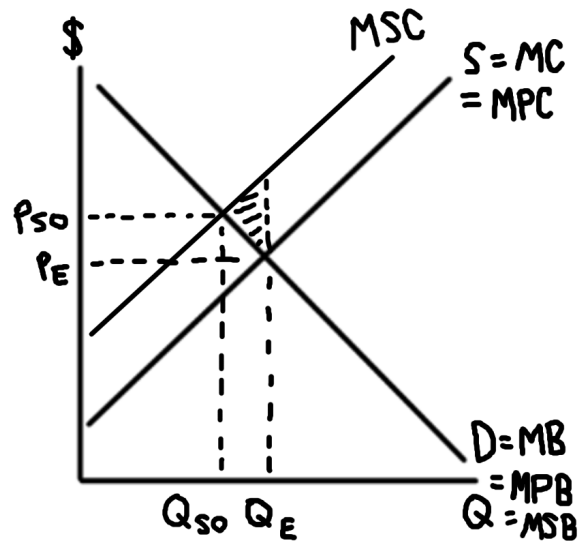


Figure 4: Negative Externality in Production

### 2.6.1 Examples

- Firms produce chemicals that cause pollution  $\therefore$  local fisherman cannot catch fish.
- Construction of roads lead to change of landscape and parks
- Coal fired power plants

### 2.6.2 Spillover Effect

- The spillover effect is  $MEC = MSC - MPC$ .
- $MPB = MSB$
- $MPC < MSC$

### 2.6.3 Internalizing the Spillover Effect

- The external **costs** can be internalized by **imposing a tax** on the product/service to the producers of the good/service.
- The government intervention will move the private market to **social optimum** where  $MSB = MSC$ .

### 3 Income Inequality (01/12)

#### 3.1 The Lorenz Curve and Gini Coefficient

- The **Lorenz Curve**  $L(x)$  is a graphical representation of the distribution of income in a country.
  - The x-axis is the cumulative percentage of the population (0%-100%).
  - The y-axis is the cumulative percentage of income (0%-100%).
  - It is always accompanied by the line  $y = x$  which represents **perfect equality**.
- The **Gini Coefficient**  $G$  is a numerical representation of the Lorenz Curve.
  - It is the ratio of the area between the Lorenz Curve and the line  $y = x$  to the area under the line  $y = x$ .
    - \*  $G = \frac{A}{A+B}$  where  $A = \int_0^1 [x - L(x)] dx$  and  $B = \int_0^1 L(x) dx$ .
  - The closer  $G$  is to 1, the more unequal the distribution of income is.

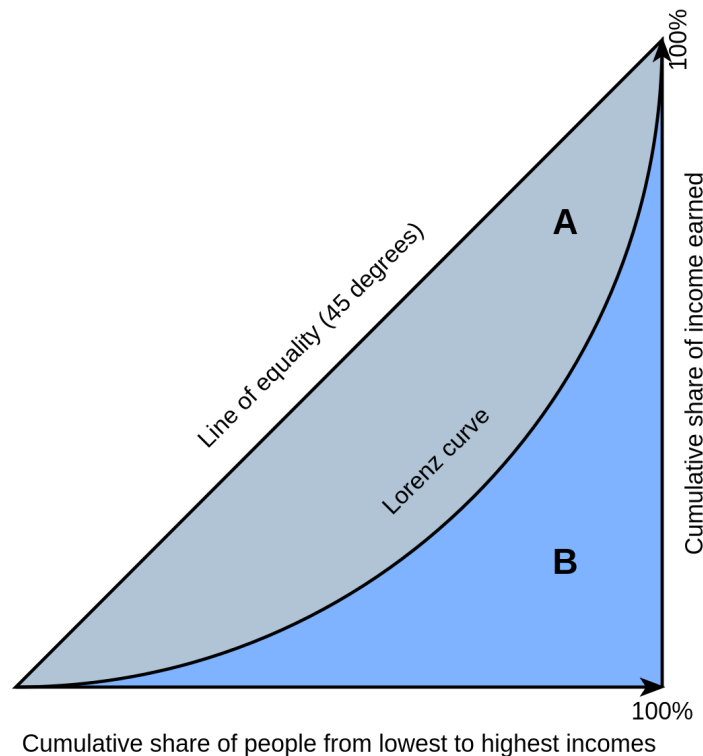


Figure 5: Visual depiction of the Lorenz Curve

As demonstrated in *Figure 6* below:

- If  $G$  is 0, then the Lorenz Curve is **also** the line  $y = x$  because the area between both curves  $A$  is 0.
- If  $G$  is 1, then the Lorenz Curve is the  $x$ -axis ( $y = 0$ ) because  $A + B$  must also equal the area under  $y = x$ , or  $\frac{1}{2}$ .

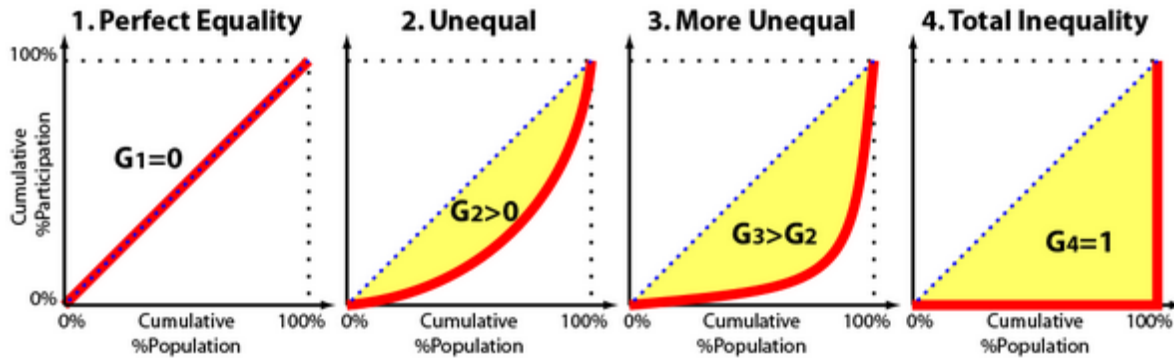


Figure 6: Varying Gini Coefficients and their corresponding Lorenz Curves

### 3.2 Deriving Simpler Expressions for the Gini Coefficient

Since we know that  $A + B = \int_0^1 x \, dx = \frac{x^2}{2} \Big|_0^1 = \frac{1}{2}$ , we can derive “easier” expressions to calculate the Gini Coefficient  $G$ .

#### 3.2.1 Deriving $G = 2A$

$$G = \frac{A}{A + B} \quad \text{(Initial Gini Coefficient formula)}$$

$$\frac{1}{G} = \frac{A + B}{A} \quad \text{(Reciprocate)}$$

$$\frac{A}{G} = A + B \quad \text{(Multiply by A)}$$

$$\frac{A}{G} - A = B \quad \text{(Subtract A)}$$

Now we can substitute  $B$  into the original area formula:

$$\begin{aligned}
 A + B &= \frac{1}{2} && \text{(Area under } y = x \text{)} \\
 A + \left( \frac{A}{G} - A \right) &= \frac{1}{2} && \text{(Substitute } B \text{)} \\
 \frac{A}{G} &= \frac{1}{2} && \text{(Simplify)} \\
 \frac{A}{\frac{1}{2}} &= G && \text{(Simplify)} \\
 2A &= G && \text{(Multiply by 2)}
 \end{aligned}$$

### 3.2.2 Deriving $G = 1 - 2B$

Since we've already expressed  $B$  in terms of  $A$ , we just need to get  $A$  in terms of  $B$ .

$$\begin{aligned}
 G &= 2A && \text{(Previous derivation)} \\
 \frac{G}{2} &= A && \text{(Divide by 2)} \\
 \frac{G}{2} &= \frac{1}{2} - B && \text{(Substitute } A \text{ using the expression } A = \frac{1}{2} - B \text{)} \\
 G &= 1 - 2B && \text{(Multiply by 2)}
 \end{aligned}$$

Therefore, two **alternate expressions** for the Gini Coefficient are:

$$G = 2A \quad (1)$$

$$G = 1 - 2B \quad (2)$$