Externalities: There's No Use Crying Over Spillovers

Lesson Author

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Standards and Benchmarks (see page 18)

Lesson Description

This active lesson emphasizes the four major externalities found when production and consumption affect individuals outside of an immediate producer and consumer. After learning basic vocabulary associated with the concepts, students will demonstrate their understanding of the causes and consequences of each type of externality. Finally, students will practice how to draw and label graphs of the four types of externalities and identify any type of government intervention necessary to reduce deadweight loss in a transaction.

Grade level

9-12, College

Concepts

Deadweight loss

Externality

Marginal external benefits and costs

Marginal private benefits and costs

Marginal social benefits and costs

Pigouvian subsidy and tax

Spillover

Objectives

Students will be able to

- describe the conditions that cause an externality,
- identify government policies used to reduce the deadweight loss of an externality, and
- draw and accurately label the four types of externalities in graphs.

Compelling Question

How are parties other than a specific producer and consumer affected by the exchange of goods and services?

Time Required

50-60 minutes

Materials

- PowerPoint slide deck
- Handout 1, one copy for classroom display
- Handout 2, one copy cut into strips for classroom use
- Handout 3, one copy for each student
- Handout 3 Answer Key, one copy for the teacher

Procedure

1. Ask students if they've ever been annoyed at a library where two people are carrying on a conversation. (*Answers will vary.*) Have them consider the relationship of all three parties in this situation: The person talking and the person listening are engaged in and activity in which they're both actively participating. As a bystander, you are affected by this conversation, even though you are not participating.

2. Tell students the conversation you are listening to is having a **spillover** effect. That is, parties other than the ones directly involved are impacted. This is known as an **externality**.

3. Tell students externalities can be positive or negative. If the conversation is fascinating, you might want to listen in more intently as your curiosity is raised. Or, you might be distracted from your book by their talking and annoyed you can't focus on what you'd like.

4. Review with students that a market that matches producers with consumers can be graphed using the standard supply and demand model. Display slide 2, "Supply & Demand Graph." Explain that in a state of equilibrium, the supply and demand curves intersect at a particular price level and quantity produced.

5. In addition to illustrating supply and demand, with which students should be quite familiar, these curves have other attributes. Display slide 3, "Marginal Benefits & Costs." Explain that the demand curve is a measure of the additional benefit consumers receive from consuming additional units of a good or service; thus, demand represents the **marginal private benefit** because consumers

make decisions based on their private benefits (satisfaction or utility). Conversely, the supply curve represents the additional cost incurred by producers to produce additional units of a good or service; thus, supply represents the **marginal private cost** because producers make decisions based on private costs of production. (*Show students the first animation illustrating that Demand = Marginal Private Benefit [MPB] and Supply = Marginal Private Cost [MPC].*)

6. At market equilibrium, the marginal costs and benefits for both producers and consumers are equal. Explain that when there are no externalities, there are no external costs or benefits; that is, third parties do not incur additional costs or gain additional benefits from the production or consumption of a good or service. In that way, the demand curve is equivalent to the marginal private benefit and the **marginal social benefit**, and the supply curve is equivalent to the marginal private cost and the **marginal social cost**. (*Show students the second animation on slide 3 illustrating Marginal Social Benefit [MSB] and Marginal Social Cost [MSC].*) This equality between private and social benefits and private and social costs ensures that the market outcome is socially optimal or allocatively efficient; that is, resources are allocated to maximize total economic surplus after accounting for the private and social impacts of production and consumption.

7. If private production or private consumption of a good or service has an impact on society, in which third parties other than the direct producers or consumers of the good are affected, then there are externalities in the market and we should consider the social perspective. Thus, the marginal social cost includes all costs imposed on society (private production costs + external costs), and the marginal social benefit includes all benefits received by society (private benefits + external benefits).

8. Ask students if market equilibrium is always socially optimal. (*Answers will vary.*) Follow up by explaining that in some situations, society may want less of a good or service produced or consumed at market equilibrium due to negative spillover effects. Conversely, society may want more of a good or service produced or consumed at market equilibrium due to positive spillover effects.

9. By their nature, externalities create socially inefficient outcomes. To identify inefficiencies, it is best to analyze the situation by asking the following questions:
    - Who is causing the spillover—the producer or consumer?
    - Is the third party helped or hurt by this spillover?
    - Is the marginal social cost greater than or less than the marginal private cost at market equilibrium?
    - Is the marginal social benefit greater than or less than the marginal private benefit at market equilibrium?
    - Does society want producers (consumers) to produce (consume) more or less?

10. Tell students that with the above information, one can identify which of the following four externalities is causing the inefficient outcome:
    - Negative production
    - Negative consumption
    - Positive production
    - Positive consumption

11. Now explain the role that government plays in externalities. If desired, the government can assist in reducing an inefficient outcome by intervening in the market in a variety of ways (which are introduced in step 22 below).

12. Refer students to the original analogy in step 1. Discuss the following:
    - If people are generally annoyed by loud conversations in libraries and would like to see the amount of people talking reduced, what intervention could the government conceivably create to lessen the number of loud conversations? (*Answers will vary but may include new legislation with fines or penalties to reduce the behavior*.)
    - What if instead of society wanting less of something, it wanted more of a particular good or service that helps beyond the consumer's immediate benefit or private firms' current production? What actions could the government take to encourage firms to produce more and consumers to buy more? (*Answers will vary but may include awareness programs or subsidies to encourage the behavior*.)

13. Display one of the four signs from *Handout 1: Externality Types* in each corner of the classroom.

14. Distribute one slip from *Handout 2: Externality Descriptors* to each of 20 students. Have each student with a strip read it aloud and discuss with the class which externality is being described. When a consensus has been reached, have that student move to the corner of the room that matches their externality type. Each externality descriptor includes a summary of the externality, an example, and a potential government intervention.

15. After discussion and moving around the room, students with the slips should be organized in the following groups/corners:

Negative production externality	Negative consumption externality	Positive production externality	Positive consumption externality
The third party is hurt by the production of the good/service	The third party is hurt by the consumption of the good/service	The third party is helped by the production of the good/service	The third party is helped by the consumption of the good/service
The marginal private cost of producing the good/service is less than the marginal social cost (how much society incurs)	The marginal private benefit of consuming the good/service is greater than the marginal social benefit (how much society benefits)	The marginal private cost of producing the good/service is greater than the marginal social cost (how much society benefits)	The marginal private benefit of consuming the good/service is less than the marginal social benefit (how much society incurs)
Society wants LESS to be exchanged in the market $Q_S < Q_M$	Society wants LESS to be exchanged in the market $Q_S < Q_M$	Society wants MORE to be exchanged in the market $Q_S > Q_M$	Society wants MORE to be exchanged in the market $Q_S > Q_M$
Air pollution from a coal burning factory	Secondhand cigarette/cigar smoke	A beekeeper producing honey also helps pollinate local plants and trees	Herd immunity from smallpox vaccines
Cap & trade pollution permits	Taxes on cigarettes	Government subsidies to beekeepers	Public information campaigns encouraging public health safety measures

16. Discuss the following:
    - Do you think **deadweight loss (DWL)** exists in an externality? (*Students may respond that there is deadweight loss in every type of externality, as the market equilibrium is not socially optimal*.)

17. Point out that in each externality graph, deadweight loss always points to the socially optimal quantity where marginal social cost equals marginal social benefit. This is a very helpful concept to remember when drawing visuals and graphs on this topic.

18. Distribute whiteboards or large sheets of butcher paper to each of the four groups. Instruct each group to draw a graph showing their externality based on the descriptions from the slips that were previously distributed and discussed. Remind them that the graph should contain the following:
    - The *x*-axis labeled "Quantity" and the *y*-axis labeled "Price"
    - The marginal private cost, marginal social cost, marginal private benefit, and marginal social benefit curves with all four properly labeled

- The market equilibrium quantity where MPC = MPB and price includes Q_M and P_M.
- The socially optimal quantity where MSC = MSB and price includes Q_S and P_S.
- Deadweight loss shaded in and labeled
- The **marginal external cost (benefit)**: This is the vertical distance between marginal private cost and marginal social cost curves (or marginal private benefit and marginal social benefit curves).

19. Have groups present their graphs to the class. Display slide 4, "Negative Production Externality." Encourage groups to use their slips to describe how that explanation helps them build their graph. For example, in a negative production externality, the group may describe that since the third party is hurt by the production of this item, it is a negative production externality and society would want less of it exchanged in the market.

20. In the PowerPoint presentation mode, group members can use the normal/edit view to move graph pieces from the right side to the graph on the left. After the group has finished moving all the pieces, check their work by displaying the answer key on slide 5. Repeat for the remaining three externality groups, displaying slides 6-11.

21. Display slide 12, "Externality Examples." Ask students to identify what type of spillover is illustrated, referencing the following answer key:
    - *Example 1 is a negative production externality, as air pollution from the refining of chemicals creates a hazardous atmosphere for others living in the general vicinity*.
    - *Example 2 is a negative consumption externality, as the consumption of tobacco in an enclosed space also affects third parties with foul smelling air, cancer causing chemicals, etc*.
    - *Example 3 is a positive consumption externality. Smallpox vaccine efforts in the twentieth century not only prevented individuals who received the shot from acquiring the deadly smallpox disease, but eventually achieved herd immunity and eradication of the illness*.
    - *Example 4 is a positive production externality. The beekeeper is producing honey, but the positive spillover is that the bees can help pollinate area plants, maintaining a healthy ecosystem at no expense to other orchard owners*.

22. Remind students that when there are externalities, society wants either more or less than what is currently being exchanged in the market. Public policies may be used to reduce deadweight loss by closing the gap between private and social costs (or benefits), thereby bringing the market outcome closer to the socially optimal quantity. While continuing to display slide 12, discuss what types of government interventions may be used. Use the following as a reference:
    - Example 1— Negative production externality: Government may enforce a **Pigouvian tax**, named for British economist Arthur Pigou who theorized that a per-unit tax would force producers to "internalize" the negative cost of the externality and reduce production. This

would bring it closer to the socially optimal quantity. Other forms of government regulation may also be used.

- Example 2—Negative consumption externality: Government may create a Pigouvian tax. If this tax raises the price, consumers will have to internalize the tax and fewer will purchase and use the product, thereby reducing consumption. Public awareness campaigns may also be used to educate the public of the negative consequences of using a product, such as tobacco.
- Example 3—Positive consumption externality: Government may encourage consumption through public information campaigns. In extreme cases, legislation may also be used.
- Example 4— Positive production externality: Government may encourage production by offering a **Pigouvian subsidy** as an incentive to producers to increase production.

23. Explain that so far, we have been concerned with identifying the major components of externalities and potential government interventions. Display slide 13 and explain that this is a negative production externality, now with specific price and quantity amounts labeled on the *x*- and *y*-axes. Just like any other graph we can add numerical values and make certain calculations. Discuss the following:
    - First calculate the amount of deadweight loss by finding the area of the triangle, or half of base x height. (*$200; or ½ x [$12 – $8] x [600 – 500]; or ½ x [$4] x [100]*)
    - What is the dollar value of the marginal external cost—the vertical distance between the marginal social and private costs? (*$4*)
    - What type of government intervention could achieve the socially optimal quantity, achieve allocative efficiency, and reduce deadweight loss? (*Pigouvian tax*)
    - If the government implements a per-unit Pigouvian tax, what would be the appropriate amount to achieve the socially optimal quantity and eliminate deadweight loss? (*$4; As shown on the graph, this can increase the marginal private cost, incentivizing firms to produce less*.)

24. Remind students that not only do negative externalities create deadweight loss that can be corrected by Pigouvian taxes, but positive externalities can be encouraged with subsidies to achieve the socially optimal quantity. Display slide 14 and explain that this is a positive production externality graph with specific price and quantity amounts. Discuss the following:
    - Calculate the amount of deadweight loss. (*$750,000; or ½ x [$400 – 100] x [15,000 – 10,000]; or ½ x [$300] x [5,000]*).
    - Identify the dollar value of the marginal external cost. (*$300*)
    - What type of government intervention could achieve the socially optimal quantity and reduce deadweight loss? (*A Pigouvian per-unit subsidy*)
    - If the government implements a per-unit subsidy, what would be the appropriate amount to achieve the socially optimal quantity and eliminate deadweight loss? (*$300; As shown on the graph, this can decrease the marginal private cost, encouraging firms to produce more*.)

Closure

25. Discuss the following main points of externalities:

    - What are spillover effects of either the production or consumption of a good or service called? (*Externalities*)
    - What are the four main types of externalities? (*Negative production, negative consumption, positive production, and positive consumption*)
    - What is the best way to identify what type of externality exists in a market? (*Ask which party is causing the spillover [producer/consumer] and then determine if a third party is helped or hurt by the exchange.*)
    - What is the dollar value of the externality? What is the marginal external cost or the marginal external benefit? (*The dollar value is always equal to the vertical distance between the social or private benefit.*)
    - When graphing externalities, what does deadweight loss always point toward? (*The socially optimal quantity*)
    - What is a Pigouvian tax? (*A per-unit tax on either the producer or consumer of a good/service to correct a negative externality by increasing the price of the good/service to reduce its use*)

Assessment

26. Distribute a copy of *Handout 3: Externalities Graphing Practice* to each student. Instruct students to identify each type of externality described and then draw a graph showing that spillover. Students are to also identify one example of a government intervention that may bring about a more socially optimal quantity in a market. Review students' work with the *Handout 3: Externalities Graphing Practice—Answer Key*.

Handout 1: Externality Types (page 1 of 4)

NEGATIVE PRODUCTION EXTERNALITY

Handout 1: Externality Types (page 2 of 4)

NEGATIVE CONSUMPTION EXTERNALITY

Handout 1: Externality Types (page 3 of 4)

POSITIVE PRODUCTION EXTERNALITY

Handout 1: Externality Types (page 4 of 4)

POSITIVE CONSUMPTION EXTERNALITY

Handout 2: Externality Descriptors (page 1 of 3)

The third party is helped by the production of the good/service

The third party is hurt by the production of the good/service

The third party is helped by the consumption of the good/service

The third party is hurt by the consumption of the good/service

The marginal private cost of producing the good/service is less than the marginal social cost (how much society incurs)

The marginal private benefit of consuming the good/service is greater than the marginal social benefit (how much society benefits)

The marginal private benefit of consuming the good/service is less than the marginal social benefit (how much society benefits)

Handout 2: Externality Descriptors (page 2 of 3)

The marginal private cost of producing the good/service is greater than the marginal social cost (how much society incurs)

Society wants producers to produce more

Society wants consumers to consume more

Society wants producers to produce less

Society wants consumers to consume less

Secondhand cigarette/cigar smoke

Herd immunity from Smallpox vaccines

Handout 2: Externality Descriptors (page 3 of 3)

Air pollution from a coal burning factory

A beekeeper producing honey
also helps pollinate local plants and trees

Cap & trade pollution permits

Excise per-unit taxes on tobacco

Government subsidies to beekeepers

Public information campaigns
encouraging public health safety measures

Handout 3: Externalities Graphing Practice

Name: _____

Beach Ken plays guitar late into the night, waking Allan up on a regular basis.

Type of externality: _____

Draw a graph of the spillover effect and label the following: MPC (Supply), MPB (Demand), Q_M, P_M, MSC, MSB, Q_S, P_S, and DWL.

Identify one intervention that would achieve the socially optimal quantity and reduce DWL (i.e., allocative efficiency) to produce at Q_S:

_____

_____

Barbie fixes up her dreamhouse with new landscaping, increasing property values in the surrounding Malibu area.

Type of externality: _____

Draw a graph of the spillover effect and label the following: MPC (Supply), MPB (Demand), Q_M, P_M, MSC, MSB, Q_S, P_S, and DWL.

Identify one intervention that would achieve the socially optimal quantity and reduce DWL (i.e., allocative efficiency) to produce at Q_S:

_____

_____

Ken's Mojo Dojo Casa House remodeling project and new guitar factory creates heavy air pollution, causing breathing difficulties for area residents.

Type of externality: _____

Draw a graph of the spillover effect and label the following: MPC (Supply), MPB (Demand), Q_M, P_M, MSC, MSB, Q_S, P_S, and DWL.

Identify one intervention that would achieve the socially optimal quantity and reduce DWL (i.e., allocative efficiency) to produce at Q_S:

_____

_____

Barbie goes back to school and with her degree gets a better job conducting groundbreaking research to benefit girls everywhere.

Type of externality: _____

Draw a graph of the spillover effect and label the following: MPC (Supply), MPB (Demand), Q_M, P_M, MSC, MSB, Q_S, P_S, and DWL.

Identify one intervention that would achieve the socially optimal quantity and reduce DWL (i.e., allocative efficiency) to produce at Q_S:

_____

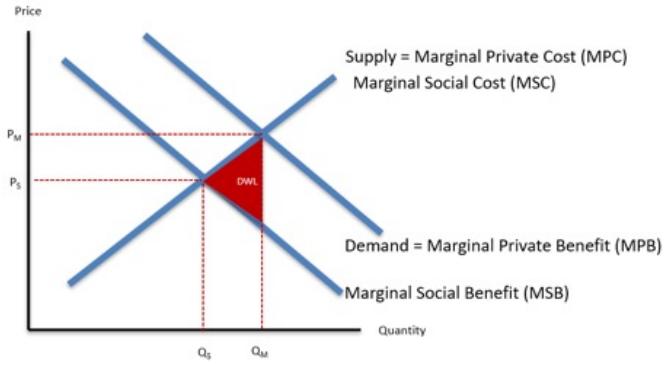
_____

Handout 3: Externalities Graphing Practice—Answer Key

Beach Ken plays guitar late into the night, waking Allan up on a regular basis.

Type of externality: _____*Negative consumption*_____

Draw a graph of the spillover effect and label the following: MPC (Supply), MPB (Demand), Q_M, P_M, MSC, MSB, Q_S, P_S, and DWL.



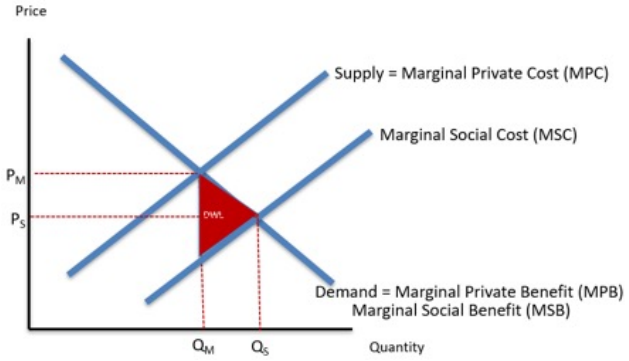
Identify one intervention that would achieve the socially optimal quantity and reduce DWL (i.e., allocative efficiency) to produce at Q_S:

Answers will vary but may include noise ordinance, legislation, or public awareness campaigns.

Barbie fixes up her dreamhouse with new landscaping, increasing property values in the surrounding Malibu area.

Type of externality: _____*Positive production*_____

Draw a graph of the spillover effect and label the following: MPC (Supply), MPB (Demand), Q_M, P_M, MSC, MSB, Q_S, P_S, and DWL.



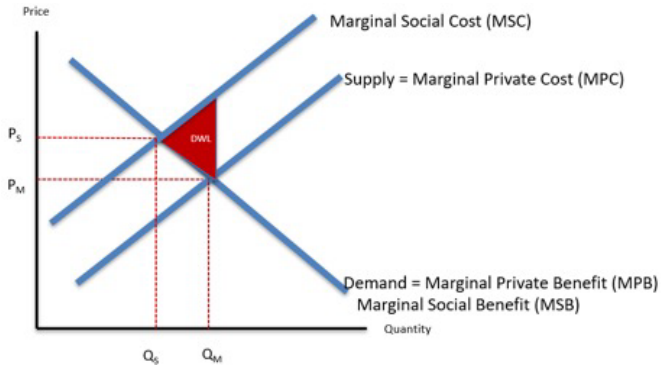
Identify one intervention that would achieve the socially optimal quantity and reduce DWL (i.e., allocative efficiency) to produce at Q_S:

Pigouvian subsidy

Ken's Mojo Dojo Casa House remodeling project and new guitar factory creates heavy air pollution, causing breathing difficulties for area residents.

Type of externality: _____*Negative production*_____

Draw a graph of the spillover effect and label the following: MPC (Supply), MPB (Demand), Q_M, P_M, MSC, MSB, Q_S, P_S, and DWL.



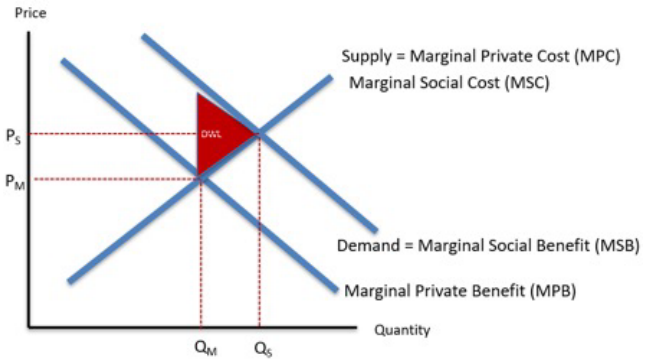
Identify one intervention that would achieve the socially optimal quantity and reduce DWL (i.e., allocative efficiency) to produce at Q_S:

Answers will vary but may include Pigouvian tax or environmental regulation legislation.

Barbie goes back to school and with her degree gets a better job conducting groundbreaking research to benefit girls everywhere.

Type of externality: _____*Positive consumption*_____

Draw a graph of the spillover effect and label the following: MPC (Supply), MPB (Demand), Q_M, P_M, MSC, MSB, Q_S, P_S, and DWL.



Identify one intervention that would achieve the socially optimal quantity and reduce DWL (i.e., allocative efficiency) to produce at Q_S:

Answers will vary but may include public awareness campaigns or government assistance to encourage higher education.

Standards and Benchmarks

AP Microeconomics Curriculum Alignment

AP Economic Skills

- Principles and Models 1B: Identify an economic concept, principle or model illustrated by an example.
- Interpretation 2A: Using economic concepts, principles, or models, explain how a specific economic outcome occurs or what action should be taken in order to achieve a specific economic outcome.
- Interpretation 2.C: Interpret a specific economic outcome using quantitative data or calculations.
- Manipulation 3.A: Determine the outcome of an economic situation using economic concepts, principles, or models.
- Manipulation 3.C: Determine the effect(s) of a change in an economic situation using quantitative data or calculations.
- Graphing and Visuals 4A: Draw an accurately labeled graph or visual to represent an economic model or market.
- Graphic and Visuals 4B: Demonstrate your understanding of a specific economic situation on an accurately labeled graph or visual.
- Graphic and Visuals 4C: Demonstrate the effect of a change in an economic situation on an accurately labeled graph or visual.

Unit Alignment

- Topic 6.2 Externalities – Learning Objective POL-3.A:a. Define externalities
- Topic 6.2 Externalities – Learning Objective POL-3.A:b. Explain (using graphs where appropriate) how in the presence of externalities, private markets do not take into consideration social costs or benefits
- Topic 6.2 Externalities – Learning Objective POL-3.B: Explain (using graphs where appropriate) how public policies address positive or negative externalities
- Topic 6.4 The Effects of Government Intervention in Different Market Structures – Learning Objective PL-4.A: a. Define government policy interventions in imperfect markets.
- Topic 6.4 The Effects of Government Intervention in Different Market Structures – Learning Objective PL-4.A: b. Explain (using graphs where appropriate) how government policies can alter market outcomes in perfectly and imperfectly competitive markets.
- Topic 6.4 The Effects of Government Intervention in Different Market Structures – Learning Objective PL-4.A: c. Calculate (using data from a graph or table as appropriate) changes in market outcomes resulting from government policies in perfectly competitive and imperfectly competitive markets.

Voluntary National Content Standards in Economics Alignment

Standard 16: Role of Government and Market Failure

- **Benchmarks: Grade 12**

    1. Markets do not allocate resources efficiently if: (1) property rights are not clearly defined or enforced; (2) externalities (spillover effects) affecting large numbers of people are associated with the production or consumption of a product; or (3) markets are not competitive.