LESSON PLAN

Public Goods & Asteroid Defense

Using the example of asteroid defense to teach public goods, and a fun classroom activity to cover the difference between private, public, club, and common goods.

Grade level: 9 - 12

Relevant standards:
CEE National Standards: 16 - Role of Government and Market Failure
AP Microeconomics Standards: Unit IV - Market Failure and Role of Government

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Learning goals for the students

- Understand the characteristics of public goods.
  - Be able to explain why asteroid defense is unlikely to be provided by the private sector.
  - Be able to explain why markets on their own cannot allocate public goods well and why that is a problem.
- Understand the principles of rivalry & non-rivalry, as well as excludability & non-excludability as it relates to the types of goods.
  - Be able to identify examples of goods and services that are rival/non-rival as well as excludable/non-excludable.
- Understand the different types of goods, including private goods, club goods, common goods, and public goods.

Concepts:
- Public Good, Club Good, Common Good, Private Good, Rival vs. Non-Rival, Excludable vs. Non-Excludable, Free Rider problem, Tragedy of the Commons

Lesson Structure & Overview

*Set up based on 75-minute class, but adaptable to other structures.*

**Pre-class:**
(1) Create knowledge gap in the minds of students
(2) Introduce and assign MRU Video and Planet Money podcast and assign resource to go along with the podcast.

**In-class:**
(3) Warmup, Direct Instruction, “Finding Home” activity, debrief
(4) Revisit and review questions assigned the previous class period.

**After-class:**
(1) Use media to setup another real-world problem they must use the concepts they’ve learned to solve.
  
  Further reference materials are provided to support students who are confused.
  (2) For those students who have caught the “econ bug” and are wanting to learn more, additional materials are provided along with an extra credit question.
**Pre-class**

1. **Create a knowledge gap in the minds of the students to drive curiosity:**
   a. Present students with facts and images about asteroids from the [Asteroid Day](#) campaign.
      i. Background knowledge of interest:
         1. Asteroid Day is held each year on the anniversary of the largest impact in recent history, the 1908 Tunguska event in Siberia. A relatively small asteroid, about 40 meters across or the size of a modest office building, devastated an unpopulated area about the size of a major metropolitan city.
         2. More than 1 million asteroids have the potential to impact Earth and through all the available telescopes worldwide, we have discovered only about one percent.
         3. At the current rate of discovery of 20 meter Near Earth Objects (NEOs) and larger at about 1000/year, it will take more than 1,000 years to find one million NEOs that potentially threaten Earth!
         4. “Asteroid 2018 GE3” could be several times bigger than the meteor that exploded over Chelyabinsk, Russia, five years ago, creating a shockwave that blew out thousands of windows in the city of Chelyabinsk, causing hundreds of minor injuries.
         5. It came within about half of the distance between us and the moon, or 119,000 miles (192,000 kilometers) from the surface of the planet.
         6. A couple of times a week, on average, an asteroid will come closer than the distance to the moon, but most of those are hunks about the size of a bus or maybe a house.

2. **Provide resources for students to watch/listen to the night before class:**
   a. [Marginal Revolution University- Public Goods & Asteroid Defense](#) (2.5 mins)
   b. [Planet Money Podcast- How to Stop an Asteroid](#) (13 mins)

3. **Provide an introduction to the economic concepts related to this topic**
a. Have students complete a discussion questions activity to foster engagement with the topic & prepare for class activities to be submitted and reviewed for credit.

**Planet Money Ep. 645: How to Stop an Asteroid discussion questions activity:**

Complete the following questions to submit as reflection / bring to class as notes (30 possible points).

1. In this scenario of providing asteroid defense, how would you categorize the good that is desired (asteroid defense): Is it rival/nonrival? Is it excludable/nonexcludable – explain your thinking using specifics from the podcast. (5 points)

2. Given these characteristics, why is it unlikely that the private market would provide this type of good? (5 points)

3. Ed Lu, the CEO of the B612 Foundation, says that the technology is available to make the earth safe from potential asteroid strikes. What is the problem? (5 points)

4. Why is it that humanity is more willing to spend money on a movie about saving the earth from asteroids rather than paying for actual asteroid defense? (5 points)

5. What is the traditional method of paying for the provision of public goods? What are some other examples of public goods? (5 points)

6. Why is a public good like asteroid defense even more difficult to provide than many other public goods? (5 points)

7. Use your imagination…. What are some other potential solutions to this provision issue?

**In Class**

(1) Warmup (5 min)

a. What are some differences between a Snickers bar and an F-18 hornet?

What are some differences between a Snuggie and a fireworks show?

i. This question is deliberately a strange one and expect some interesting and funny answers from students (Ex: you can eat one and not the other…. One explodes and the other doesn’t). The question is ultimately getting at the principles of rivalry and excludability.
1. Reference that a man has indeed consumed an airplane (see Michel Lotito).

ii. **Excludability**: The benefits that flow from a snickers bar are excludable; that is, only the person who pays for the snickers bar will benefit from it. That is not the case with the F-18 hornet, as the national defense it will provide will benefit both taxpayers and free-riders.

iii. **Rivalry**: The Snuggie is rival, while the fireworks show is non-rival. One person’s usage of the Snuggie diminishes another person’s ability to use that Snuggie, while one person’s viewing of a fireworks show does not diminish another’s ability to view the fireworks show.

(2) **Direct instruction (25 min):**

a. Review the threat that asteroids represent to earth, as well as the Asteroid Day campaign.

   i. Emphasize the facts from the Asteroid Day campaign as well as anecdotes about the most recent asteroid strikes that have hit Russia.

b. Introduce the term “public good”, focusing on the characteristics of non-excludability and non-rivalry.

   i. Clarify that public goods are not necessarily provided by the public sector.

      1. For example, if the government started producing jeans and distributing jeans at no monetary cost to the consumer, the jeans would not fit the characteristics of a public good. While the jeans would indeed be non-excludable, they would still exhibit rivalry.

   ii. Clarify that some public goods are provided by the private sector.

      1. A search engine like Google fits the characteristics of a public good (provided one has internet access).

iii. Example: asteroid protection.

   1. A good like asteroid protection has some unusual properties that challenge market provision because it is **Non-Excludable**.

      a. Ex: If you pay for a pair of jeans, you get the exclusive use of them. If you don’t pay for them, you are excluded from using the jeans.

   2. Asteroid protection is different in that it is **non-excludable**. In other words, non-payers cannot be easily excluded from using the
good. If you don’t contribute to asteroid protection, this does not prevent you from accessing the service once it is provided.

c. Introduce the “Free Rider” problem in relation to asteroid protection.

  i. Ask students: Will your individual payment make a difference as to whether asteroid protection is provided? Think of the incentives.

    1. No. Either enough other people pay, so you are protected.

       a. Or, enough other people don’t pay, and you’re not protected.

    2. Either way, your individual payment doesn’t determine protection or not.

  ii. Explain: Faced with this scenario, many people will choose to buy the jeans and free-ride off of others when it comes to the asteroid protection.

    1. The Free-Rider Problem is an issue when it comes to the provision of public goods. In a market economy, private firms supply goods and services because the profit motive. In doing so, they satisfy human wants and desires, and make a profit in the process. When it comes to public goods, the profit motive is not as strong, as firms cannot make everyone who utilizes the good/service pay for it, as these goods/services are non-excludable.

  iii. Explain: This type of good provides an argument for taxation and government provision.

    1. But how do we decide which public goods to provide, how to provide them, and in what quantity?

       a. In the private market, the price system and the interaction between buyers and sellers brings goods into existence, but what is the mechanism to determine the correct quantity and price for public goods?

    2. In the private market, entrepreneurs are trying to discover new ways to supply innovative private goods at lower costs.

       a. In the political process, it’s much less clear who the entrepreneurs are and if they have the incentives to supply public goods at a low cost.

  d. Introduce club goods, common goods, and private goods.
   1. Excludable: Non-payers can be excluded from using the good/service.
   2. Non-Rival: Your usage of the good/service does not reduce someone else’s ability to use the good/service.
      a. Examples: Hulu, Netflix, Home Wi-Fi, Gym/Fitness Center.

   1. Non-Excludable: Non-payers cannot be excluded from using the good/service.
   2. Rival: Your usage of the good/service reduce someone else’s ability to use or benefit from the good/service.
      b. Emphasize the incentives that lead to overconsumption of these goods, resulting in the “Tragedy of the Commons.”
         i. Ex: Chicken and Tuna are both delicious and are frequently consumed... but why aren’t chicken in danger of extinction? Think of the incentives.

   1. Excludable: Non-payers can be excluded from using the good/service.
   2. Rival: Your usage of the good/service reduce someone else’s ability to use or benefit from the good/service.
      a. Examples: Pair of jeans, Ford truck, haircut, massage, Butterfinger candy bar.
      b. These goods/services are provided by the private sector as there is a high profit motive in doing so.

(3) Activity “Finding Home” (25 min)

Class Activity: Use the materials and instructions in the Finding Home activity.
Discussion questions after the activity:

- Which goods gave you the most trouble categorizing?
- Address “hybrid” examples. That is, a city street can be non-rival if it is not very congested, but at some point, it can be considered rival, in that the addition of your car to the street causes the street to become so congested that other drivers can no longer benefit as they would like to from the street.

4) Review & discuss homework questions (15 min)
   a. Review the connection of the homework to public goods concepts.
   b. Clarify points related to the content learned today and discuss the homework questions, collecting them for credit.

5) Homework setup (5 min)
   a. Explain homework assignment to students, including the Planet Money Podcast & discussion questions, along with watching the Vox YouTube video.
   b. Have students complete a discussion questions activity to foster engagement with the topic & review concepts learned in class to be submitted and reviewed for credit.
      i. Planet Money: Free Parking (16 min) (some explicit language).
      ii. Vox: The High Cost of Free Parking High Cost of Free Parking (6 min).

After Class

1) Provide resources for students to watch/listen to for homework after class:
   a. Planet Money: Free Parking (16 min) (some explicit language)
   b. Vox: The High Cost of Free Parking High Cost of Free Parking (6 min)

Planet Money Ep. 630 Free Parking discussion questions activity:

Complete the following questions to submit as reflection / bring to class as notes (50 possible points).

1. What was Eric Meyer’s goals/aspirations in developing the Haystack app? (5 points)
2. Why did he become hated for the app? (5 points)
3. How would you categorize the good that is desired (city street parking): Is it rival/nonrival? Is it excludable/nonexcludable – explain your thinking using specifics from the podcast. (5 points)
4. What daily experience did Eric Meyer go through that made him develop the Haystack app? What budget item did some of his neighbors include in their monthly expenses? (5 points)

5. What was Eric’s genius idea to solve this problem? (5 points)

6. How did most people initially react to Eric’s idea? What angry responses did he get? (5 points)

7. What is the “tragedy of the commons”? How does it relate to city parking? (5 points)

8. What does Donald Shoup, author of The High Cost of Free Parking, say a solution is for the tragedy of the commons regarding city parking? (5 points)

9. How did opening Haystack go for Eric Meyer in Boston? (5 points)

10. What is your opinion of creating a market for public parking spaces, as Eric Meyer did? Explain your viewpoint. (5 points)
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