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Public Goods Defined

According to Wikipedia, market failure is "a term used by economists to describe the condition where the allocation of goods and services by a market is not efficient." One source of market failure is related to the distribution of public goods. First defined by Paul Samuelson (1954), a public good is a good that is both non-rival and non-excludable allowing persons other than the buyer to benefit from the good. Rivalrous goods are goods that are unusable once another person has used it, such as a pair of underwear. Public goods on the other hand are nonrivalrous and thus are consumable even after some else uses it. For instance, the air one breathes is a nonrivalrous good because many consumers can use the same air. Public goods are also nonexclusionarymeaning the goods, once available, are freely available to all and noone can be prevented from using it. For example, free television signals are nonexclusionary in that anyone can enjoy these signals given that they have the technology to receive them.

Public Goods and Market Failure

Public goods lead to inefficiencies in the market due to the fact that since everyone gets to consume the good once available, there is little motivation for the consumer to buy the good. Instead, the consumer prefers to let someone else purchase the good so they can use it for free, an effect called "free ride". The inefficiency is due to noone taking the initiative to buy the good and thus the good is not accessible to anyone. To illustrate this dilemma, let's assume a neighborhood composed of three people, Ann (A), Bob (B), and Charles (C), has the problem of frequent speeders. To reduce this problem, they want to add speed bumps to the neighborhood streets. Ann's inverse demand function is $PA = 32 – Q$. Bob's and Charles' inverse demand functions are identical to Ann's. Because speed bumps are public goods, the total demand function for speed bumps is the vertical sum of Ann, Bob, and Charles' inverse demand curves. Thus, the total demand function equals:

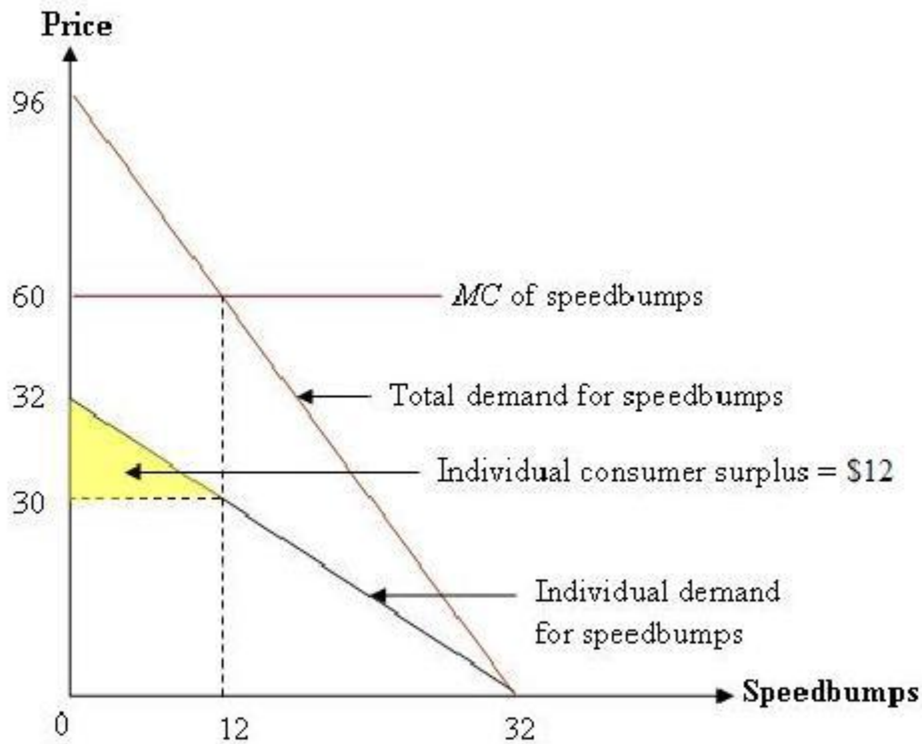
$PA = 32 – Q$
$PB = 32 – Q$
$PC = \underline{32 – Q}$
$PT = 96 – 3Q$

Both the individual and total demand functions are illustrated in Figure 1. As seen in the graph, the total demand curve is three times the values of the individual demand functions. Assuming the marginal cost of obtaining speed bumps is $60 per unit, the efficient quantity of speed bumps is:

$60 = 96 – 3Q$

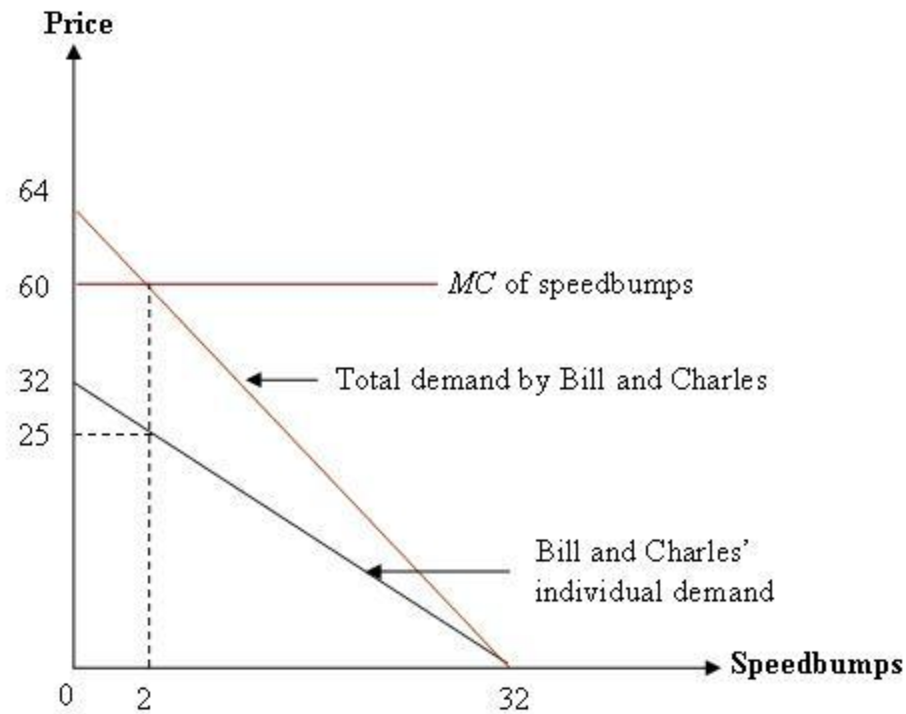
Or solved is 12 speed bumps. Note, that the marginal cost of each speed bump is greater than the each neighbors individual demand curve suggesting that noone would be willing to buy a speed bump if up to each person. Interestingly, if Ann, Bob, and Charles each place $30 into a speed bump fund they could purchase the number of efficient speed bumps and enjoy a consumer surplus of: [(32-30) * 12]/2 = $12. However, each person is better off by letting the other two neighbors purchase the speed bumps. Each neighbor is motivated to free ride, benefiting from using the speed bumps for free while the others pay for them.

Figure 1. The Demand for Speed Bumps.



It is actually beneficial for each neighbor to lie about their actual demand for speed bumps and represent the value of speed bumps to them as zero. For example, if Ann secretly wanted to use the speed bumps for free and let Bill and Charles pay for them, she could state that the speed bumps were unnecessary for her and that she didn't care about the speeders in the neighborhood, all the while hoping the others would pay for them so she could get the benefit for free. This action would change the total demand function to PT equals 64 - 2*Q*, the sum of Bill and Charles' inverse demand functions. This change would make the efficient quantity 2 (See Figure 2a). By misrepresenting her deman for speed bumps, Ann would now enjoy a consumer surplus of: (25*2) + [(32-25)*2)/2] equals $57 (See Figure 3). If she had told the truth, her consumer surplus would have been only $12. Therefore, Ann is better off deceiving Bill and Charles into buying the speed bumps. This same tactic also applies to Bill and Charles.

Figure 2a and b. Free Riding



Correction of Market Inefficiency Created by Public Goods

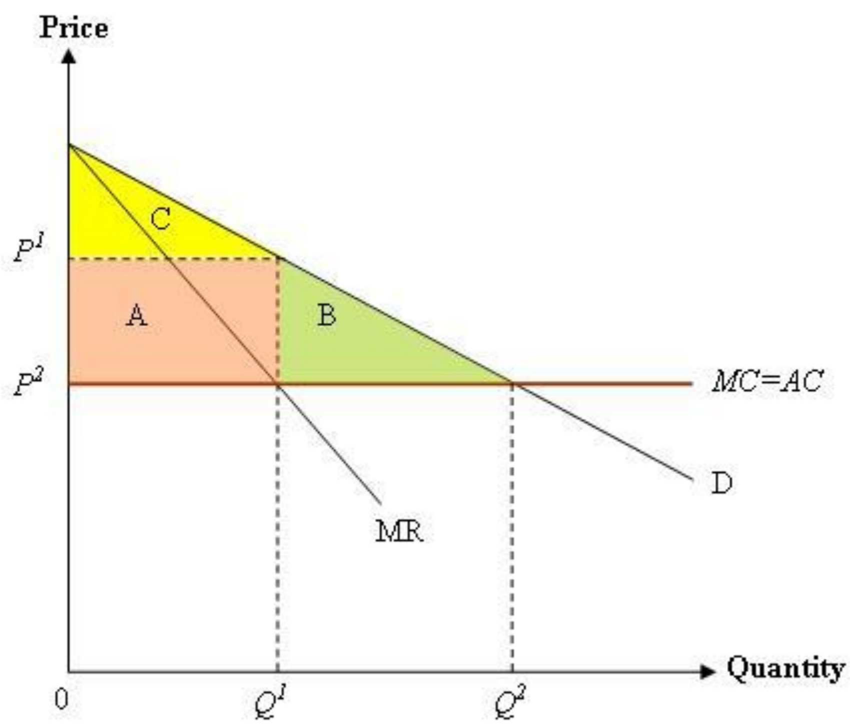
Several solutions have been proposed to help eleviate the free-rider problem created by public goods. Three main solutions are: 1) changing the nature of the good, 2) social pressure, and 3) Government controls. In some instances, it is possible to change the good ina way to make it exclusionary. For example, cable television is a substitute for broadcast television. Thus, the nature of the good has changed, making it no longer a public good. Another option to overcome the free rider problem is through the use of social pressure. For example, if an area has a crime problem, an increase in the number of law enforcement officers may be needed to reduce crime. The community may establish a fund to help pay for the law officers salaries and while all are not required to pay into the fund, the consequence of doing so would be social unacceptance. Thus, the money paid into the fund is, in actuality, a way to gain social acceptance. The free rider problem is reduced because what the payment purchases has changed from law enforcement to social acceptance. Lastly, government corrects the problem created by public goods through the tax system. This system forces citizens to share the cost of the good. The problem with this approach is that many people will over report the their desired quantity because they see their contribution to the total amount of government funds to be extremely small and thus will treat their personal cost as zero. For example, if Ann were to report the amount she desired given that she believed her personal cost was zero, she would request 32 speed bumps, more than double the efficient amount of 12.

Rent Seeking

Governmental policies are sometimes used to improve resource allocation and overcome inefficiencies in the marketplace. However, these policies usually end up benefiting one group at the expense of another. Thus, effected parties lobby to influence these policies through a process called rent seeking (Krueger, 1974; Tullock, 1967). For example, as seen in Figure 3, assume that the local power company has a monopoly within a specific region and is operating at a price of *P1* and produces an output level of *Q1.* This price/quantity combination allows the power company to earn a profit delineated by the orange shaded area A. Power consumers within this region would like their local representative through new regulations to decrease the price to *P2*, resulting in a quantity of *Q2*. This price reduction would reduce the monopoly's profits to zero, while consumers would gain a consumer surplus of areas A, B, and C. The monopoly, knowing it would loose its profits (area A), is willing to spend up to the amount of area A in lobbying to prevent these regulations. Consumers are also willing to lobby the representative and would be willing to spend up to the amount of areas A + B to get new regulations passed.

While one would think that consumers would push to get these regulations passed, the problem becomes that *individual* consumers would gain much less than the total of all consumers. In addition, new regulations may be considered a public good, one that everyone benefits from, and thus each consumer may desire to "free ride", hoping others will spend enough to pass the regulations while they spend nothing. The outcome is that consumers spend much less in lobbying than does the power company, as the regulations are not a public good to them. The final outcome is that in many cases, the power company can suppress the legal regulations that would harm their profits.

Figure 3. Motivation to Involve in Rent-Seeking Behavior



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Questions:

1). Public goods are both __and___ .

A. rivalrous, exclusionary
B. non-rivalrous, exclusionary
C. rivalrous, non-exclusionary
D. non-rivalrous, non-exclusionary
E. none of the above

2). Which tactics may be used to decrease the free-rider problem?

A. Change the nature of the good
B. Government controls
C. Social pressure
D. All of the above
E. None of the above

For questions 3-5, please use the following information:
You are the manager of Dark Industries. Lately, your 15 employees have been unhappy with the amount of lighting in the parking lot and have been asking for security lights. Each of your employees has an inverse demand function of $P = 15 - Q$ for security lights, where Q is the number of lights. The marginal cost for placing these lights in the parking lot is $25 per unit.

3). What is the socially efficient quantity of security lights?

A. 10
B. 13
C. 21
D. 3
E. 12

4). What price would each employee have to pay per light to obtain the efficient quantity?

A. $20
B. $25
C. $30
D. $40
E. $45

5). How many lights are likely to be installed?

A. 13
B. 10
C. 9
D. 2
E. 0

6). You are the president of the aforementioned power company that faces an inverse demand curve of P equals 12 – *Q* and has a cost function of *C(Q) equals* 2*Q*. Consumers within your region are pushing their legislators to pass a regulation that would force your prices to level *P2.* What is your profit level and how much would you be willing to spend on lobbying efforts to dissuade the legislators from passing the regulation?

A. $20, $10
B. $25, $25
C. $10, $12
D. $2, $7
E. $0, $0

Answers:

1). Answer: D. Public goods are both non-rivalrous and non-exclusionay in that they can be used by many consumers after one person has used it and are freely available to all.

2). Answer: D. All of the solutions may be useful in regulating the free-rider problem.

3). Answer: B. The total demand for security lights is:

$P = 225 - 15Q$

By equating total demand with the marginal cost of installing security lights gives the efficient quantity of security lights:

$25 = 225 - 15Q$

Thus, the efficient quantity Q equals 13 lights.

4). Answer: C. If each employee paid their marginal valuation of another light, which is

P equals 15 – 13 = $2

So, the 15 employees together would pay $30 for each light.

5). Answer: E. No lights are likely to be installed because of the free rider problem unless you, the manager, collects $26 from each employee to buy the 13 lights.

6). Answer: B

If the regulation is passed, your company's price will be fixed at a marginal cost of $3 and you will earn $0 profits. If the regulation does not pass, your company will continue to earn its current profit level by charging its current price at its current output level. You current output is determined by the point where MR = MC:

$12 - 2Q = 2$

Solving for Q gives the power company an output of $Q1$ of 5 units. Your current price is obtained by using the computed $Q1$ into the demand function to obtain:

$P1$ equals 12 – (5) = 7

Therefore, as the manager of the power company, you could loose up to $P1Q1 - C(Q1)$ = $25 if the regulation passes, thus you are willing to spend up to that amount on lobbying efforts to prevent the regulation.