Economics 390

Fall 2019

Homework #2 With Answers

Due on Thursday, November 14, 2019

Homework is due at the beginning of lecture. The professor reserves the right to not accept homework if it is late. The expectation is that the homework will be done in a professional manner: it should be stapled, it should be neat, well organized, and complete. You cannot receive full credit if you omit questions and do not follow the provided instructions. There is no need to submit the questions: you need to simply submit your answers. You will not be able to get full credit for the homework if you do not show your work in an organized, easy-to-follow manner. Make sure your name is clearly and legibly written on the homework. Illegible answers will not get full credit.

1. Consider the market for gasoline in the country of Xerbia. The market for gasoline in this country is currently described by the following demand and supply equations:

Demand: Q = 50,000 – 5000P

Supply: Q = 20,000P

where P is the price per gallon of gasoline and Q is gallons of gasoline. Although the good citizens of Xerbia are aware that consuming gasoline creates externality costs on their society the current gasoline market does not incorporate any of these externalities.

a. Describe at least four possible externality costs associated with the consumption of gasoline.

b. Given the externality costs you delineated in (a), where do you think the marginal social cost of gasoline curve is relative to the given supply curve? That is, are the two curves the same, is the marginal social cost of gasoline curve to the right of the market supply curve, or is the marginal social cost of gasoline curve to the left of the market supply curve?

c. Given the above information, what is the current market equilibrium quantity and price?

d. Suppose that the government analyzes the externality costs in this market and concludes that the market should ideally result in 20,000 gallons of gasoline being consumed if all the externalities associated with gasoline consumption were internalized in the market. Assuming the externality costs are per unit of usage of gasoline and are constant, what is the externality cost per gallon of gasoline consumed?

e. Suppose the government elects to impose a tax to internalize the externality. How big an excise tax would the government need to impose in order to address the externality that you measured in (d)?

Answer:

a. The answers will vary here, but here is at least a starting list of things you might have thought of: congestion costs, the over construction of highways and the resultant allocation of resources to highway construction rather than some other use, air pollution, particulate pollution, costs associated with health issues of those with respiratory illnesses, cost of military expenditures to secure low price gasoline, road rage, externality costs of accidents, etc.

b. The marginal social cost of gasoline includes many costs that are currently not included in the market supply curve. This implies that the marginal social cost of gasoline curve will be located to the left of the market supply curve.

c. To find the current equilibrium price and equilibrium quantity use the given demand and supply curves: thus, 50,000 – 5000P = 20,000P or P = $2 per gallon of gasoline. Q = 50,000 – 5000(2) = 40,000 gallons of gasoline.

d. If the market should ideally result in the consumption of 20,000 gallons of gasoline, we can use this information to compute the externality cost per gallon of gasoline. Using the supply equation, we find that producers are willing to supply 20,000 gallons of gasoline for a price of $1 per gallon. Using the demand equation, we find that demanders are willing to demand 20,000 gallons of gasoline for a price of $6 per gallon. The externality cost per gallon of gasoline is therefore $5 per gallon.

e. If the government imposed an excise tax of $5 per gallon of gasoline this would cause the market supply curve to shift to the left by the amount of the externality cost per gallon of gasoline. The market with this tax would then provide the socially optimal amount of the good: 20,000 gallons of gasoline sold for a price of $6 per gallon.

2. Paul and Jonette are the only residents in their community. They are currently trying to decide how many streetlights should be installed in their community. Paul and Jonette both recognize that streetlights once they are installed are non-rival: that is, once the streetlight is installed and lit, everyone can enjoy consuming the benefits of the streetlight without affecting the level of consumption benefits available to other individuals in the community. They also recognize that streetlights are non-exclusive: that is, streetlights are apt to be under demanded as each individual in the community realizes that even if they do not pay for the streetlight they will still be able to enjoy consuming the benefits from the streetlight once it is installed and lit. Paul and Jonette have both decided to not free ride and take advantage of the non-exclusivity of the streetlight: they each are willing to fully reveal their willingness to pay for streetlights. Paul and Jonette’s demands for streetlights are given in the equations below where Q is the quantity of streetlights and P is the amount per streetlight, they are willing to pay.

Paul’s Demand for Streetlights: P = 10 – (1/2) Q

Jonette’s Demand for Streetlights: P = 10 – Q

You also know that the MC of providing an additional streetlight is $4 per streetlight. Assume that this MC curve reflects the marginal social cost of providing streetlights.

a. In a diagram with the graphs vertically “stacked” on top of one another draw three graphs: in the top graph draw Jonette’s demand curve, in the middle graph draw Paul’s demand curve, and in the bottom graph draw the market demand curve for streetlights. Remember that these streetlights are public goods: this implies that you will need to vertically sum the individual demand curves to get the market demand curve. That is, select a quantity and ask how much Paul and Jonette will each pay to install this amount of streetlights-remember that the streetlights are non-rival so the critical thing here is that each of these individuals will contribute together for the purchase of this quantity of streetlights since they can both consume the benefits from this level of streetlights simultaneously.

b. In your graph draw in the MC curve for streetlights.

c. Mark the socially optimum amount of streetlights on your graph. Then determine how much Paul will pay per streetlight and how much Jonette will pay per streetlight.

Now, suppose that the MC of providing a streetlight increases and is now $8 per streetlight.

d. Given this new MC of providing a streetlight, what is the socially optimum amount of streetlights? How much will Paul pay per streetlight and how much will Jonette pay per streetlight?

Answer:

a. and b.



c. The socially optimum amount of streetlights is where the market demand curve intersects the MC curve. This occurs in the third graph at (Q, P) = (12, $4) so the optimal amount of streetlights for this community is 12 streetlights. The cost per streetlight is $4 and Paul will pay all of this. From Jonette’s perspective she is not willing to pay for so many streetlights: her demand for streetlights occurs for quantities less than or equal to 10 streetlights.

d. If the MC of streetlights increases to $8 this shifts the MC curve upward in the graphs. The optimal amount of streetlights will be where this new MC curve intersects the market demand curve. This will occur at a quantity of 8 streetlights. Paul will pay $6 per streetlight to get this quantity and Jonette will pay $2 per streetlight to get this quantity: together they will contribute $8 per streetlight.

To find this quantity you will need to know the equation for the market demand curve segment where the new MC intersects the demand curve. The equation for the market demand curve segment we are interested in is P = 20 – (3/2) Q. Set this demand curve equal to the MC curve to find the socially optimal amount of the good. Thus, 8 = 20 – (3/2) Q or Q = 8. Then use this quantity in Paul’s demand curve to find the amount he is willing to pay per streetlight when eight streetlights are provided. Use this quantity in Jonette’s demand curve to find the amount she is willing to pay per streetlight when eight streetlights are provided. Make sure that the sum of the amounts these two individuals are willing to pay is equal to the MC of providing a streetlight: if they are not equal, then you have made an error and you need to go back and revise your work.

3. Suppose you are given the following graph of a monopoly.



a. Given this graph, write an equation for this monopolist’s marginal revenue curve (MR).

b. If this monopolist is a single price monopolist, what price and output will this monopolist produce? What will be the monopolist’s profits at this price and output combination? Show how you found your answers.

c. If this monopolist is instead regulated to produce the socially optimal amount of the good, what price and output will the monopolist produce? What will the regulatory authority need to do in order to get the monopolist to produce at this price and output level? Explain your answer fully.

d. If this monopolist is instead regulated to produce at an output level where the firm breaks even, what price and output will the monopolist produce? Is there a deadweight loss associated with this level of production? Explain your answer verbally and then provide a mathematical calculation of this area of deadweight loss.

Answer:

a. From the graph it is relatively easy to write the monopolist’s demand curve: P = 100 – (1/1000) Q. Once we have the demand curve, then we can write the monopolist’s MR by recalling that MR for the monopolist will have the same y-intercept as the demand curve and twice the slope: thus, MR = 100 – (1/500) Q.

b. If the monopolist is a single price monopolist it will produce that quantity where MR = MC and then charge the price associated with this quantity and the demand curve. So, looking at the graph we can find MR (see (a)): MR = 100 – (1/500) Q but we cannot write an equation for MC. But we know from the graph that MR = MC when MC is $40 per unit. So, we can set MC = MR and substitute 40 for MC: thus, 40 = 100 – (1/500) Q or Q = 30,000. Then using this quantity and the demand curve we can find the price this monopolist will charge: P = 100- (1/1000) (30,000) = $70 per unit. The monopolist will produce 30,000 units and charge a price of $70 per unit if the monopolist is a single price monopolist that is not regulated.

To find the monopolist’s profits we need to recall that profits = TR – TC. TR = P\*Q = ($70 per unit) (30,000 units) = $2,100,000. TC we need to find by looking at the graph and finding the ATC for 30,000 units and then recalling that TC = ATC\*Q. So, TC = ($60 per unit) (30,000 units) = $1,800,000. Profits are therefore equal to $300,000.

c. If the monopolist is regulated to produce the socially optimal amount of the good, the monopolist will produce that amount of good where P = MC: from the graph we can see that P = MC where the MC curve intersects the demand curve. This occurs at a quantity of 85,000 units (quite a bit more than that single price monopolist was going to produce!). To find the regulated price we will need to go back to the demand curve and substitute Q = 85,000 into it since we do not have an equation for the MC curve: thus, P = 100 – (1/1000)(85,000) = $15 per unit (quite a bit lower than the price the single price monopolist was going to charge!). However, this regulated monopolist will be unwilling to produce at this price and quantity combination without a subsidy since at the price and output, the firm earns negative economic profit. From the graph it is impossible to measure the size of the subsidy needed, but we could write an expression for the size of the subsidy as: Subsidy = (ATC of producing Qoptimal – MC of producing Qoptimal)(Qoptimal). See if you can find this area on the above graph.

d. If the monopolist is regulated to breakeven, the monopolist will produce that amount of good where P = ATC: from the graph we can see that P = ATC where the ATC curve intersects the demand curve. This occurs at a quantity of 60,000 units and a price of $40 per unit. There is a deadweight loss associated with producing this level of output since P is greater than MC when the firm produces 60,000 units. The DWL measures the total surplus that is given up in a market: this time this surplus is given up because of regulatory intervention that restricts the level of output from being the socially optimal amount of output (if the monopoly was a single price monopolist the DWL would be even greater-look at the graph and see if you can locate this area). We can approximate the DWL as follows: DWL = (1/2) ($40 per unit - $15 per unit) (85,000 units – 60,000 units) = $312,500. We know that the DWL will be less than this amount since the actual area of the DWL is a smaller area than the one we are able to calculate.

4. Suppose Sarah and Matthew are running for an elected position and are busy campaigning. Prior to the election the two candidates will debate several times and each candidate is considering what strategy they plan to take when their positions are questioned. One strategy is to respond with an aggressive rebuttal that defends the position that the candidate holds while a second strategy is to redirect the conversation and debate toward a new topic without addressing the issue. Both candidates have done research on the impact of these two strategies on likely voting outcomes and this is what they find. If Sarah takes the aggressive rebuttal strategy while Matthew simultaneously adheres to the same strategy, Sarah sees her votes increase by 10 votes while Matthew sees his votes increase by 8 votes. If Sarah adheres to the redirect strategy while Matthew adheres to the aggressive rebuttal strategy, Sarah sees her votes increase by 6 votes while Matthew sees his votes increase by 6 votes. If Sarah adheres to the aggressive strategy while Matthew adheres to the redirect strategy, Sarah sees her votes increase by 7 votes while Matthew sees his votes increase by 5 votes. If both candidates adhere to the redirect strategy, then both candidates see their votes increase by 5 votes each.

a) Given the above information fill in the following payoff matrix where each entry indicates the number of points won (a positive numeric value) or points lost (a negative numeric value).



b) Examine the payoff matrix you created in (a). Does Sarah have a dominant strategy? Explain your answer.

c) Examine the payoff matrix you created in (a). Does Matthew have a dominant strategy? Explain your answer.

d) Suppose Sarah follows her dominant strategy; can you predict what Matthew will do given the above information? Explain your answer.

e) You plan to watch Sarah and Matthew debate each other this weekend. Describe the debate you anticipate seeing. Who do you predict will win the election given this analysis?

Answers:

a)



b) Sarah's dominant strategy is to adopt an aggressive rebuttal strategy. To see this think about Sarah looking at this table as two separate columns: a column where Matthew plays "Aggressive Rebuttal" and a column where Matthew plays "Redirect to New Topic". If Matthew plays "Aggressive Rebuttal", then Sarah will win 10 votes with an aggressive rebuttal and only 6 points with a redirection to a new topic. If Matthew plays "Redirect to New Topic", then Sarah will win 7 votes with an aggressive rebuttal and only 5 votes with a redirection to a new topic. Sarah has a better outcome no matter what strategy Matthew adopts if Sarah adopts the "Aggressive Rebuttal" strategy.

c) Matthew's dominant strategy is to adopt an aggressive rebuttal strategy. To see this think about Matthew looking at this table as two separate rows: a row where Sarah plays "Aggressive Rebuttal" and a row where Sarah plays "Redirect to New Topic". If Sarah plays "Aggressive Rebuttal", then Matthew will win 8 votes with an aggressive rebuttal and only 5 votes with a redirection to a new topic. If Sarah plays "Redirect to New Topic", then Matthew will win 6 votes with an aggressive rebuttal and only 5 votes with a redirection to a new topic. Matthew has a better outcome no matter what strategy Sarah adopts if Matthew adopts the "Aggressive Rebuttal" strategy.

d) If Sarah follows her dominant strategy of “Aggressive Rebuttal” then the payoff matrix shows us that Matthew is better off when he pursues his “Aggressive Rebuttal” strategy: he’s still losing votes relative to the number of votes that Sarah is getting but his alternative scenario leaves him even further behind in vote getting.

e) At the debate you can anticipate lots of loud voices, aggressively rebuttals, and incendiary words: should make for an exciting evening although it may not be the best path to reaching consensus and negotiating the political landscape.

5. Sam, Megan, and Josie live in the same community (they are the only residents) and they are debating installing some lighthouses. Thankfully each of these individuals is willing to reveal their preferences and demand for lighthouses, but the community is still trying to decide how many lighthouses they should buy. Here is the relevant information that they have gathered:

Sam’s demand for lighthouses: Q = 10 – 2P

Megan’s demand for lighthouses: Q = 40 – 4P

Josie’s demand for lighthouses: Q = 10 – P

Marginal social cost of a lighthouse: MSC = $18

a) Given the above information draw an illustration of these three demand curves plus the market demand curve for lighthouses. In your illustration provide four different graphs that are vertically stacked with the market demand curve the bottom graph in the stack. Make sure all your graphs are clearly and completely labeled. Describe verbally how you found the market demand curve.

b) Write the equation(s) for the market demand curve and provide a range or domain for any segments of the demand curve. Show how you found these equations.

c) What is the socially optimal amount of lighthouses for this community? Explain how you found your answer. How much will Sam pay per lighthouse? How much will Megan pay per lighthouse? How much will Josie pay per lighthouse?

Answers:

a)



To find the market demand curve, we need to hold the quantity constant and then add the prices each of these individuals are willing to pay for this quantity of the good. We do this because the lighthouses are non-rival goods: that is, one person’s use of the lighthouse does not diminish another person’s ability to also consume this lighthouse. Thus, when the quantity is 10 units, Sam is willing to pay $0 per lighthouse, Megan is willing to pay $7.5 per lighthouse, and Josie is willing to pay $0 per lighthouse: this implies that the point (Q, P) = (10, 7.5) is on the market demand curve. We can repeat this process for Q = 40 and Q = 0 to get the different end points of the market demand curve.

b) The market demand curve has two linear segments, so we need two equations. For prices greater than or equal to 7.5 the market demand curve is P = 25 – (7/4) Q. For prices less than or equal to 7.5 we need to do a bit more work. First, the slope of this lower segment is equal to rise/run = (-7.5/30) = (-1/4). Then, we know that the points (Q, P) = (10, 7.5) and (40, 0) sit on this lower segment. So, use the slope-intercept form and go to work!

y = mx + b

P = (-1/4) Q + b

0 = (-1/4) (40) + b

b = 10

So, the market demand equation for the lower segment is P = 10 – (1/4) Q.

c) To find the socially optimal amount of lighthouses we need to equate the marginal social benefit curve (the market demand curve) to the marginal social cost curve. We know that MSC is given as MSC = 18. We need to use the equation for the upper segment of the market demand curve for our MSB: MSB = 25 – (7/4) Q. Thus,

18 = 25 – (7/4) Q where Q is the socially optimal quantity of lighthouses

7 = (7/4) Q

Q = 4 lighthouses = socially optimal quantity of lighthouses

Using Sam’s demand curve: Q = 10 – 2P

4 = 10 – 2P

2P = 6

P = $3 per lighthouse is the amount that Sam will pay per lighthouse.

Using Megan’s demand curve: Q = 40 – 4P

4 = 40 – 4P

4P = 36

P = $9 per lighthouse is the amount that Megan will pay per lighthouse.

Using Josie’s demand curve: Q = 10 – P

4 = 10 – P

P = $6 per lighthouse is the amount that Josie will pay per lighthouse.

Lest you be concerned about this: notice that Sam, Megan, and Josie's contribution per lighthouse sums to $18 which is the MSC of providing an additional lighthouse. So, we will be able to collect enough money to pay for the lighthouses and all three individuals will enjoy having the socially optimal amount of lighthouses in their community.

6. Consider the market for college education in the economy of Kernersville. The market demand curve for a year of college education is given by P = 50,000 – 2Q where P is the price per year of college and Q is the quantity of students attending college per year. This market demand curve expresses the marginal private benefit of going to college but does not include the social benefits derived from this education. The market supply curve for a year of college education is given by P = 2Q. This market supply curve expresses the marginal social cost of going to college. The social benefit of going to college for a year is equal to $10,000 per year per student, in addition to the private benefit that goes to the student directly.

a) Given the above description is there a negative or positive externality in this market? Explain your answer.

b) Given the above description, is this a consumption or a production externality? Explain your answer.

c) What quantity of students will attend college this year and what price will they pay given the above information? Show your work.

d) Suppose that the described externality is internalized in this market. Write the new equations we will need in order to find the socially optimal amount of college education to provide this year. Explain how you got these equations.

e) What is the socially optimal amount of college education to provide this year given the above information? What is the “right” (the one that corresponds to the socially optimal amount of the good) price for a year of college? Explain your answer.

f) What is the deadweight loss that occurs when the externality is not internalized in this market? Show your work.

Answers:

a) This is a positive externality since the economy derives extra social benefits from the education of its students.

b) This is a consumption externality. We know this because the market supply curve is the MSC of producing this good while the market demand curve is the marginal private benefit (MPB) rather than the marginal social benefit (MSB) of consuming the good.

c) We can find the market solution by equating the market supply curve to the market demand curve: thus,

2Q = 50,000 – 2Q

4Q = 50,000

Q = 12,500 college students this year will be the market outcome

P = $25,000 per college student or

P = 50,000 – 2Q = 50,000 – 2(12,500) = $25,000 per college student

d) The market supply curve does not change since this curve expresses the MSC of providing the good: Market supply curve = marginal social cost = MSC = 2Q.

The market demand curve expresses only the marginal private benefits from consuming a college education for the year. We need to add in the social benefit which is $10,000 per student per year. So, the new marginal social benefit curve (MSB) will be P = 60,000 – 2Q (the MSB curve is effectively shifting up from the MPB by $10,000 per student).

e) Using these two equations from (d) we get:

2Q = 60,000 – 2Q where Q is the socially optimal amount of the good

4Q = 60,000

Q = 15,000 college students per year is the socially optimal amount of the good

Note: the market, left alone, under produces this good since the market fails to consider the social benefits derived from the consumption of this good.

P = $30,000 or

P = 60,000 – 2Q = 60,000 – 2(15,000) = $30,000

f) DWL = (1/2) ($35,000 per student per year - $25,000 per student per year) (15,000 students per year – 12,500 students per year) = $212,500,000 = $12.5 million

7. Suppose you are the President of a small country and you have decided to provide health insurance to all the residents of your country. You plan to provide this health insurance by first assessing how much money you will need to set aside per year to cover the health costs of your citizens; second, figuring out what each person would need to contribute if everyone contributed the same amount to insure that all would get health insurance coverage; third, figuring out how big a subsidy per person would need to be paid by the government in order that all could afford the health insurance; and fourth, figuring out how much more needs to be collected from the affluent in order to cover the costs of these subsidies for the lower income individuals.

Luckily you do have some information:

* The population of your country is 20 people; this population is constant over time.
* 5% of your population in any given year will have significant healthcare costs of $100,000 per person; 40% of your population in any given year will have some healthcare costs of $20,000 per person; and 55% of your population in any given year will have low healthcare costs of $2000 per person. No one in the population knows with certainty whether they will have significant healthcare costs, some health care costs, or low healthcare costs each year.
* You also have the following information about everyone in your country:

|  |  |
| --- | --- |
| Individual | Income Available to be spent on health insurance (this is related to total gross income of the individual) |
| Joe | $8,000 |
| Amber | $8,000 |
| Jose | $8,000 |
| Mary | $9,000 |
| Sue | $10,000 |
| Mabel | $10,000 |
| Maria | $12,000 |
| Clyde | $12,000 |
| Lee | $12,000 |
| Zhihao | $13,000 |
| Jaeho | $13,000 |
| Josephine | $13,000 |
| Sylvester | $14,000 |
| Yoshi | $14,000 |
| Moshi | $16,000 |
| Gwen | $18,000 |
| Owen | $20,000 |
| Abigail | $20,000 |
| Samantha | $30,000 |
| Cletus | $30,000 |

a. Given the above information calculate the amount of money you will need to collect in order to cover this year’s health care costs in your country. Use the following table to help you calculate these costs.

|  |  |  |  |
| --- | --- | --- | --- |
| % of population with health issue | Number of people with particular health issue | Cost per person of this particular health issue | Total cost for this health issue |
| 5% of population have significant health costs |  |  |  |
| 40% of population have some health costs |  |  |  |
| 55% of population have low health costs |  |  |  |
| TOTAL COST OF COVERING ALL HEALTH ISSUES | ----- | ----- |  |

Answer:

|  |  |  |  |
| --- | --- | --- | --- |
| % of population with health issue | Number of people with particular health issue | Cost per person of this particular health issue | Total cost for this health issue |
| 5% of population have significant health costs | 1 | $100,000 per person | $100,000 |
| 40% of population have some health costs | 8 | $20,000 per person | $160,000 |
| 55% of population have low health costs | 11 | $2000 per person | $22,000 |
| TOTAL COST OF COVERING ALL HEALTH ISSUES | ----- | ----- | $282,000 |

b. If everyone in the country is required to pay an equal amount for health insurance and the President wishes to collect enough funds to cover all health costs for the year, what payment will each individual be required to make?

Answer:

Since you need to collect $282,000 per year and there are 20 people in your country, you will need to collect $282,000/20 people are $14,100 per person.

c. Now that you have calculated the amount of money per person (the healthcare insurance premium) you will need to collect to cover the costs of the year’s health care, take the time to calculate how much additional money you will need to collect from the affluent in order to subsidize the lower income individuals when they go to purchase their health insurance. You will find it helpful to use the following table. Note: lest you think that this is an all-together dumb plan (against the Affordable Care Act) recall that in the U.S. our policy has been to provide healthcare even if you do not have insurance-and this healthcare cost does get past on to someone who has to pay in the form of a combination of higher taxes and higher medical costs.

|  |  |  |
| --- | --- | --- |
| Individual | Income Available to be spent on health insurance (this is related to total gross income of the individual) | Amount of subsidy required for the individual to be able to afford the healthcare insurance premium for the year |
| Joe | $8,000 |  |
| Amber | $8,000 |  |
| Jose | $8,000 |  |
| Mary | $9,000 |  |
| Sue | $10,000 |  |
| Mabel | $10,000 |  |
| Maria | $12,000 |  |
| Clyde | $12,000 |  |
| Lee | $12,000 |  |
| Zhihao | $13,000 |  |
| Jaeho | $13,000 |  |
| Josephine | $13,000 |  |
| Sylvester | $14,000 |  |
| Yoshi | $14,000 |  |
| Moshi | $16,000 |  |
| Gwen | $18,000 |  |
| Owen | $20,000 |  |
| Abigail | $20,000 |  |
| Samantha | $30,000 |  |
| Cletus | $30,000 |  |
|  | TOTAL ADDITIONAL AMOUNT OF MONEY THAT MUST BE COLLECTED TO COVER SUBSIDY TO LOWER INCOME INDIVIDUALS |  |

Answer:

|  |  |  |
| --- | --- | --- |
| Individual | Income Available to be spent on health insurance (this is related to total gross income of the individual) | Amount of subsidy required for the individual to be able to afford the healthcare insurance premium for the year |
| Joe | $8,000 | $6100 |
| Amber | $8,000 | $6100 |
| Jose | $8,000 | $6100 |
| Mary | $9,000 | $5100 |
| Sue | $10,000 | $4100 |
| Mabel | $10,000 | $4100 |
| Maria | $12,000 | $2100 |
| Clyde | $12,000 | $2100 |
| Lee | $12,000 | $2100 |
| Zhihao | $13,000 | $1100 |
| Jaeho | $13,000 | $1100 |
| Josephine | $13,000 | $1100 |
| Sylvester | $14,000 | $100 |
| Yoshi | $14,000 | $100 |
| Moshi | $16,000 | $0 |
| Gwen | $18,000 | $0 |
| Owen | $20,000 | $0 |
| Abigail | $20,000 | $0 |
| Samantha | $30,000 | $0 |
| Cletus | $30,000 | $0 |
|  | TOTAL ADDITIONAL AMOUNT OF MONEY THAT MUST BE COLLECTED TO COVER SUBSIDY TO LOWER INCOME INDIVIDUALS | $41,400 |

d. Suppose the cost of the healthcare insurance subsidy is divided among those who have more income available for health insurance than the amount of required premium. Start by divvying up the healthcare insurance premium so that no one supports the subsidy beyond the level of income they have available for health insurance; and then divide any remaining subsidy needed evenly among those individuals who still have funds available (you will need to think carefully here). Show how you found your answer. Also fill in the following table to consolidate your work in this problem. Remember that each individual cannot spend more than the amount of their income they have available for health insurance: this implies that you may have to do some thinking about the amount of subsidy that is being paid by lower income individuals.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Individual | Income Available to be spent on health insurance (this is related to total gross income of the individual) | Amount of subsidy required for the individual to be able to afford the healthcare insurance premium for the year | Healthcare Insurance Premium (what the individual paid for their healthcare insurance) | Additional charge per person to cover healthcare subsidy costs | Total Payment per person for Healthcare Insurance (includes premium plus subsidy) |
| Joe | $8,000 |  |  |  |  |
| Amber | $8,000 |  |  |  |  |
| Jose | $8,000 |  |  |  |  |
| Mary | $9,000 |  |  |  |  |
| Sue | $10,000 |  |  |  |  |
| Mabel | $10,000 |  |  |  |  |
| Maria | $12,000 |  |  |  |  |
| Clyde | $12,000 |  |  |  |  |
| Lee | $12,000 |  |  |  |  |
| Zhihao | $13,000 |  |  |  |  |
| Jaeho | $13,000 |  |  |  |  |
| Josephine | $13,000 |  |  |  |  |
| Sylvester | $14,000 |  |  |  |  |
| Yoshi | $14,000 |  |  |  |  |
| Moshi | $16,000 |  |  |  |  |
| Gwen | $18,000 |  |  |  |  |
| Owen | $20,000 |  |  |  |  |
| Abigail | $20,000 |  |  |  |  |
| Samantha | $30,000 |  |  |  |  |
| Cletus | $30,000 |  |  |  |  |
| COLUMN TOTALS | --- |  |  |  |  |

Answer:

Our earlier work indicated that the healthcare insurance premium is $14,100 per person. Now, we also need to collect $41,400 to cover the cost of the subsidy for lower income individuals. There are 6 people (Moshi, Gwen, Owen, Abigail, Samantha, and Cletus) who can fully fund their health insurance plus contribute a bit toward a subsidy support for those individuals who do not have enough income available to pay the full amount of their health insurance premium. So, we start the process of getting the needed $41,400 from these six individuals: Moshi can only contribute $1900 since that is the difference between the income he has available for health insurance and the $14,100 he must pay for his own insurance; A similar calculation for Gwen finds that she can contribute $3900; Owen and Abigail can each contribute $5900. At this point these four individuals can provide $17,600 of the needed subsidy; so, this implies that Samantha and Cletus must provide a total of $23,800 in order for the amount to equal the required subsidy of $41,400. Dividing $23,800 by 2 we get that Samantha and Cletus will need to contribute an additional $11,900 to help provide this subsidy. From this exercise I hope that you see that there is a redistribution of income that occurs with this program: poorer people cannot afford the health insurance and they are given a subsidy so that they be insured. (Do remember that prior to ACA, our default was to provide healthcare to those without insurance and then pass on this cost to insured people who paid higher prices.)

Here is the completed table: notice that if you sum the last column you do get $282,000, which is the total amount of dollars that must be collected in order to provide healthcare to everyone in this country for the year.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Individual | Income Available to be spent on health insurance (this is related to total gross income of the individual) | Amount of subsidy required for the individual to be able to afford the healthcare insurance premium for the year | Healthcare Insurance Premium (what the individual paid for their healthcare insurance) | Additional charge per person to cover healthcare subsidy costs | Total Payment per person for Healthcare Insurance (includes payment plus additional charge) |
| Joe | $8,000 | $6100 | $14,100 | $0 | $8,000 |
| Amber | $8,000 | $6100 | $14,100 | $0 | $8,000 |
| Jose | $8,000 | $6100 | $14,100 | $0 | $8,000 |
| Mary | $9,000 | $5100 | $14,100 | $0 | $9,000 |
| Sue | $10,000 | $4100 | $14,100 | $0 | $10,000 |
| Mabel | $10,000 | $4100 | $14,100 | $0 | $10,000 |
| Maria | $12,000 | $2100 | $14,100 | $0 | $12,000 |
| Clyde | $12,000 | $2100 | $14,100 | $0 | $12,000 |
| Lee | $12,000 | $2100 | $14,100 | $0 | $12,000 |
| Zhihao | $13,000 | $1100 | $14,100 | $0 | $13,000 |
| Jaeho | $13,000 | $1100 | $14,100 | $0 | $13,000 |
| Josephine | $13,000 | $1100 | $14,100 | $0 | $13,000 |
| Sylvester | $14,000 | $100 | $14,100 | $0 | $14,000 |
| Yoshi | $14,000 | $100 | $14,100 | $0 | $14,000 |
| Moshi | $16,000 | $0 | $14,100 | $1900 | $16,000 |
| Gwen | $18,000 | $0 | $14,100 | $3900 | $18,000 |
| Owen | $20,000 | $0 | $14,100 | $5900 | $20,000 |
| Abigail | $20,000 | $0 | $14,100 | $5900 | $20,000 |
| Samantha | $30,000 | $0 | $14,100 | $11,900 | $26,000 |
| Cletus | $30,000 | $0 | $14,100 | $11,900 | $26,000 |
| COLUMN TOTALS | --- | $41,400 | $282,000 | $41,400 | $282,000 |

e. To further complicate this issue let’s imagine that people in this group actually know more about their healthcare situation than does the President. The following table tells us what they privately know about their healthcare situation for the coming year (assume that this information is completely accurate).

|  |  |  |
| --- | --- | --- |
| Individual | Income Available to be spent on health insurance (this is related to total gross income of the individual) | Private Information the individual has about his healthcare for this year |
| Joe | $8,000 | Low Healthcare costs |
| Amber | $8,000 | Significant Healthcare costs |
| Jose | $8,000 | Some Healthcare costs |
| Mary | $9,000 | Low Healthcare costs |
| Sue | $10,000 | Some Healthcare costs |
| Mabel | $10,000 | Low Healthcare costs |
| Maria | $12,000 | Some Healthcare costs |
| Clyde | $12,000 | Some Healthcare costs |
| Lee | $12,000 | Low Healthcare costs |
| Zhihao | $13,000 | Low Healthcare costs |
| Jaeho | $13,000 | Low Healthcare costs |
| Josephine | $13,000 | Low Healthcare costs |
| Sylvester | $14,000 | Some Healthcare costs |
| Yoshi | $14,000 | Low Healthcare costs |
| Moshi | $16,000 | Some Healthcare costs |
| Gwen | $18,000 | Low Healthcare costs |
| Owen | $20,000 | Low Healthcare costs |
| Abigail | $20,000 | Some Healthcare costs |
| Samantha | $30,000 | Low Healthcare costs |
| Cletus | $30,000 | Some Healthcare costs |

Given your answers in (b) and (d), make a prediction about whether each of these individuals will be willing to voluntarily pay into the healthcare pool. Assume that all individuals in this country consider only the financial costs to themselves of buying the healthcare insurance and their private healthcare information (that is, no one is altruistic in this community!). Use the following table to consolidate your predictions. Explain your answers.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Individual | Income Available to be spent on health insurance (this is related to total gross income of the individual) | Private Information the individual has about his healthcare for this year | Projected Total Payment per person for Healthcare Insurance (includes premium as well as any share of subsidy cost) from (d) | Projected Healthcare costs for the year | Prediction as to participation in healthcare insurance program if given option to participate or not |
| Joe | $8,000 | Low Healthcare costs |  |  |  |
| Amber | $8,000 | Significant Healthcare costs |  |  |  |
| Jose | $8,000 | Some Healthcare costs |  |  |  |
| Mary | $9,000 | Low Healthcare costs |  |  |  |
| Sue | $10,000 | Some Healthcare costs |  |  |  |
| Mabel | $10,000 | Low Healthcare costs |  |  |  |
| Maria | $12,000 | Some Healthcare costs |  |  |  |
| Clyde | $12,000 | Some Healthcare costs |  |  |  |
| Lee | $12,000 | Low Healthcare costs |  |  |  |
| Zhihao | $13,000 | Low Healthcare costs |  |  |  |
| Jaeho | $13,000 | Low Healthcare costs |  |  |  |
| Josephine | $13,000 | Low Healthcare costs |  |  |  |
| Sylvester | $14,000 | Some Healthcare costs |  |  |  |
| Yoshi | $14,000 | Low Healthcare costs |  |  |  |
| Moshi | $16,000 | Some Healthcare costs |  |  |  |
| Gwen | $18,000 | Low Healthcare costs |  |  |  |
| Owen | $20,000 | Low Healthcare costs |  |  |  |
| Abigail | $20,000 | Some Healthcare costs |  |  |  |
| Samantha | $30,000 | Low Healthcare costs |  |  |  |
| Cletus | $30,000 | Some Healthcare costs |  |  |  |

Answer:

From (d) you know the projected total payment per person for healthcare insurance (includes the amount of the premium the individual pays as well as any share of subsidy cost shouldered by the individual). You also can now project healthcare costs based on private information. When you compare these two columns there are three possibilities: the payment for coverage will be either be greater than, equal to, or less than the projected healthcare costs. So, if the payment for coverage is greater than the projected healthcare costs you will opt out of coverage and instead self-insure; if the payment for coverage is less than the projected healthcare costs you will opt in for coverage; and if the payment for coverage is equal to the projected healthcare costs, the costs to you are the same whether you join the insurance pool or opt to self-insure.

Clearly if people have the right to opt in or opt out, the ability to cover the medical costs of the country collapses as the amount collected from the payments made by people who opt in will be insufficient to provide enough funds to cover the costs of healthcare. This explains why there is an Individual Mandate in the Affordable Care Act (“Obamacare”): the healthcare insurance market is a market that will clearly tend to fall apart due to the adverse selection problem. People electing to purchase insurance are adversely selected: they are a more expensive pool of individuals to insure than would be the case if the whole population was included in the insurance pool.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Individual | Income Available to be spent on health insurance (this is related to total gross income of the individual) | Private Information the individual has about his healthcare for this year | Projected Total Payment per person for Healthcare Insurance (includes premium as well as any share of subsidy cost) from (d) | Projected Healthcare costs for the year | Prediction as to participation in healthcare insurance program if given option to participate or not |
| Joe | $8,000 | Low Healthcare costs | $8,000 | $2000 | NOT Participate |
| Amber | $8,000 | Significant Healthcare costs | $8,000 | $100,000 | Participate |
| Jose | $8,000 | Some Healthcare costs | $8,000 | $20,000 | Participate |
| Mary | $9,000 | Low Healthcare costs | $9,000 | $2000 | NOT Participate |
| Sue | $10,000 | Some Healthcare costs | $10,000 | $20,000 | Participate |
| Mabel | $10,000 | Low Healthcare costs | $10,000 | $2000 | NOT Participate |
| Maria | $12,000 | Some Healthcare costs | $12,000 | $20,000 | Participate |
| Clyde | $12,000 | Some Healthcare costs | $12,000 | $20,000 | Participate |
| Lee | $12,000 | Low Healthcare costs | $12,000 | $2000 | NOT Participate |
| Zhihao | $13,000 | Low Healthcare costs | $13,000 | $2000 | NOT Participate |
| Jaeho | $13,000 | Low Healthcare costs | $13,000 | $2000 | NOT Participate |
| Josephine | $13,000 | Low Healthcare costs | $13,000 | $2000 | NOT Participate |
| Sylvester | $14,000 | Some Healthcare costs | $14,000 | $20,000 | Participate |
| Yoshi | $14,000 | Low Healthcare costs | $14,000 | $2000 | NOT Participate |
| Moshi | $16,000 | Some Healthcare costs | $16,000 | $20,000 | Participate |
| Gwen | $18,000 | Low Healthcare costs | $18,000 | $2000 | NOT Participate |
| Owen | $20,000 | Low Healthcare costs | $20,000 | $2000 | Participate |
| Abigail | $20,000 | Some Healthcare costs | $20,000 | $20,000 | Participate |
| Samantha | $30,000 | Low Healthcare costs | $26,000 | $2000 | NOT Participate |
| Cletus | $30,000 | Some Healthcare costs | $26,000 | $20,000 | NOT Participate |

f. Given your work in this problem, provide a brief explanation of why the Affordable Care Act (“Obamacare”) includes both a subsidy for low income individuals as well as an Individual Mandate that requires everyone to purchase healthcare insurance.

Answer:

The adverse selection problem exists in the market of health insurance because of asymmetric information. People know more about their health and their potential health care issues than do insurers, so even when insurance companies do their homework about how much someone will cost them to insure, they can only know so much. When only sick people or people with a higher likelihood of becoming sick buy insurance, their costs of care will be relatively high compared to a more diverse (in terms of healthcare needs) pool of people and the insurance company will need to collect relative high insurance premiums for this group. Higher premiums make insurance even less attractive for healthy people, causing even more of them to drop out of the healthcare insurance market. As this problem continues to become a bigger problem it leads to coverage becoming too expensive for almost everyone and the healthcare insurance market fails. This is what we have now in our example - a market failure for individual health insurance.

There are two types of subsidies in Obamacare. First, the affluent members are subsidizing the poor members. This transfer payment makes health insurance affordable for everyone. Second, the healthy low-cost members are subsidizing the sick high-cost members. It is another transfer payment from those who might need health care but don’t yet, to those who do need it now. For Obamacare to Work, an individual mandate is necessary. Requiring all people to either purchase plans or face a penalty is a way to broaden the risk pool and avoid the adverse selection problem.  A broader risk pool means that people become part of large, actuarially stable groups so that the average cost is affordable.

8. In class we have studied mortgages and, in particular, a fixed rate thirty-year mortgage. Let us consider that kind of loan for this set of questions.

Suppose you have signed a thirty-year fixed rate mortgage in order to buy a house. Evaluate each of the following statements about this mortgage.

i. Each month this mortgage requires that the borrower make a payment of the same dollar amount to the lending institution. The borrower if they do not pay promptly and completely then what happens?

ii. In the first years of this mortgage the borrower’s payment consists primarily of paying back the principal and in the last years of the mortgage the borrower’s payments consists primarily of paying interest on the loan to the lender.

iii. The principal balance on the loan initially decreases at a very slow rate and it is only after a number of years that the principal balance declines at an increasing rate.

iv. If a borrower borrows $300,000 at 5% interest per year for thirty years then the borrower, if they keep the loan for thirty years, will pay back (300,000)(1 + .05) = $315,000.

v. A requirement by the lender for the borrower to provide a down payment when securing a mortgage is a requirement that protects both the borrower and the lender.

Answer:

i. This is a TRUE statement. When a property is foreclosed this means that the lending institution repossesses the property. This means that the ownership of the property reverts to the lending institution and the borrower loses the property. If the lending institution sells the house for more than the amount that the borrower owes then the borrower keeps the excess; if the lending institution sells the house for less than the amount that the borrower owes then the borrower loses some portion of their downpayment. In either case the borrower’s credit rating is damaged.

ii. This statement is false: in the first years of the mortgage the payments are primarily interest payments and in the last years of the mortgage the payments are primarily principal payments.

iii. This is an accurate statement: see the example we did in class to review this concept.

iv. This is a FALSE statement. The fact that you are borrowing at 5% per year means that every year you must pay 5% interest on the amount you still owe. This is a very important concept for you to understand prior to signing any loan agreements.

v. This is a TRUE statement: if the borrower does not pay and the house is foreclosed the down payment limits the loss to the lender and it limits the loss to the borrower relative to the situation of no down payment.