# Assignment 3 Answers

Due: November 15th at 6pm

December 5, 2022

1. (25 points) A proposal to establish a minimum corporate income tax on corporations earning over a particular amount is a key component of the Inflation Reduction Act. Assume this 15% tax is implemented and the corporation is modeled as an individual. The graph below shows an income-leisure decision for the firm if it pays 0% tax, where one can think of the hours worked being the hours worked by all employees to generate that amount of income. The dashed line that cuts across the entire graph shows the income threshold at which the tax takes effect. Point A is the firm's optimal decision under a 0% tax rate.
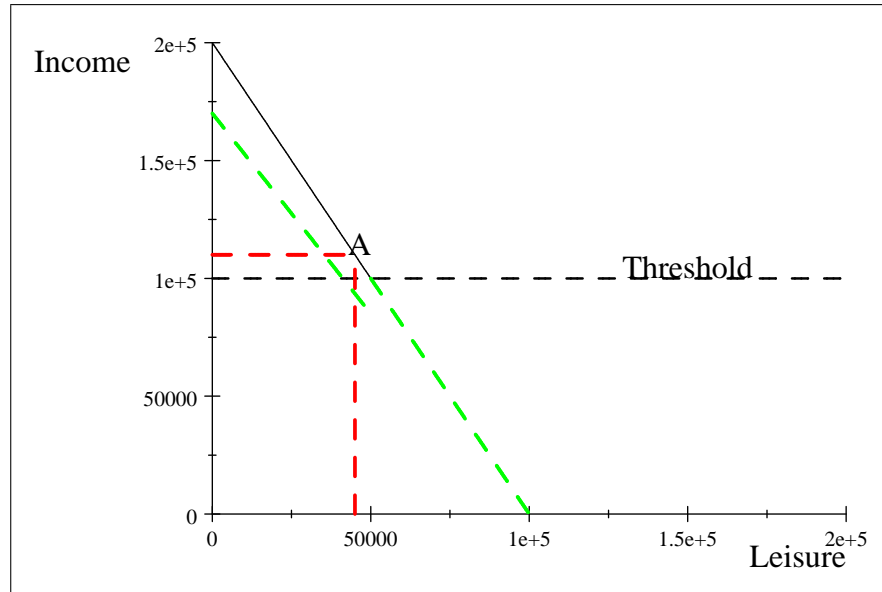
  a Assume that the 15% tax is implemented on incomes over the threshold. Illustrate the new budget constraint on the graph.

Answer:

The green dashed line, which is discontinuous, is the new budget constraint. Note that it starts at $170,000$ in income and has a slightly different slope than the original budget constraint because the tax is on income, which is comprised of both the intercept and slope term in the equation (in other words, the tax effects the intercept and the slope). When income is less than $100,000$, the budget constraint is the original budget constraint. The corporation has the same after-tax income ($100,000$) at both 50,000 leisure hours and ˜41,200 leisure hours under this new budget constraint.

  b Assuming the firm has standard indifference curves, given the budget constraint you have drawn, explain why the corporation might cut worker hours (i.e. increase their leisure time).
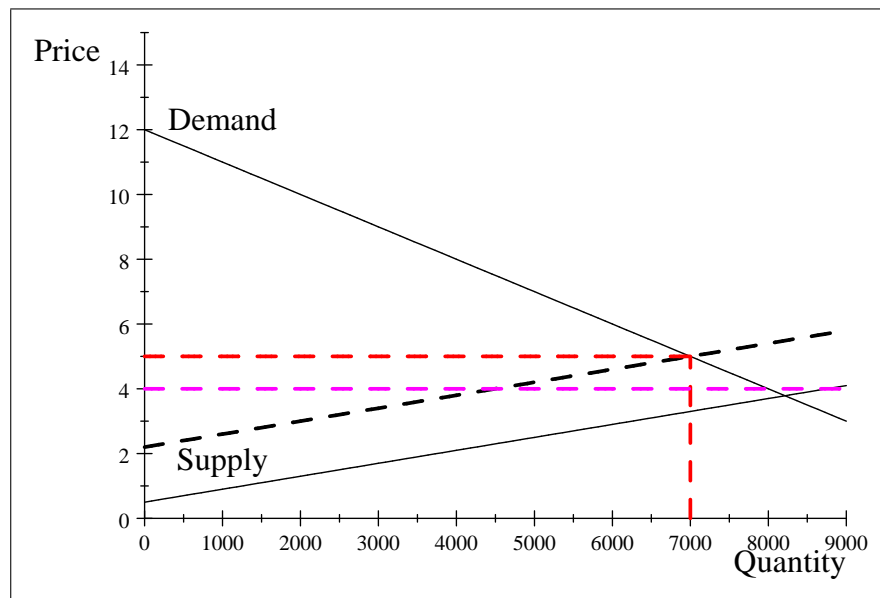
Answer:

Prior to the imposition of the tax, the firm was allowing about 45,000 leisure hours and earning about $110,000 in income. Under the tax, if they use that amount of leisure time the firm will have an after-tax income of $93,500. The firm could do better by reducing worker hours or increasing worker leisure time to 50,000 hours because then the firm would have an income of $100,000. Because of the discontinuity in the budget constraint the firm can generate more after-tax income by having fewer worker hours, which generates less overall income but keeps the firm from surpassing the income threshold and allows the firm to avoid the tax.

c Assume now that there are many firms that face an identical income-leisure tradeoff budget constraint. Firms have different preferences, so prior to the imposition of the tax, firms make income-leisure decisions that lead to incomes that look like they are uniformly distributed over the income range to an observer. Using your post-tax budget constraint from part **a**, after the implementation of the tax, would we still expect to see a uniform distribution of firm incomes? Explain why or why not, and if you do not expect to see a uniform distribution of firm incomes explain how the empirical distribution of incomes might change.

Answer:

Because of the discontinuity in the budget constraint, we would no longer expect to see firms with income levels uniformly distributed throughout the range of incomes. Instead, we would expect to see firms lumped or bunched at the discontinuity on the lower portion of the original indifference curve (where the representative firm is in part **a**). There will still be firms that are making a high income that are on the new portion of the budget constraint, and there may be some firms which, for various reasons, are between the two discontinuities, but the key is that some bunching should occur. This bunching could alter the empirical technique one might use to analyze the data.[1]

2. (25 points) Consider the following graph, which shows the market for gasoline. The original equilibrium price is $3.80 and equilibrium quantity is 8200. The inverse demand function is $P = -0.001Q + 12$; the demand function is $Q = 12,000 - 1000P$.

a Calculate the price elasticity of demand at the equilibrium price and quantity. Is demand elastic or inelastic at the equilibrium price and quantity?

Answer:

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[1]We had a speaker, Ben Lockwood, who presented on this topic earlier in the semester.

We can calculate price elasticity of demand by taking the slope from the demand function (which is -1000) and multiplying it by $\frac{P}{Q}$. We have:

$$
\begin{aligned}
PED &= \left| -1000 * \frac{3.8}{8200} \right| \\
PED &= \frac{19}{41} \\
PED &\approx 0.463
\end{aligned}
$$

So demand is inelastic.

b Suppose that a major international event occurs and the supply of gasoline is restricted. Show a general supply shift on the graph that reflects this restriction and identify the new equilibrium price and quantity on the graph.

Answer:

Supply should decrease, as shown by the dashed black line. The equilibrium is identified on the graph by the dashed red lines. The equilibrium price and quantity given the shift I have made are $5 and 7000 gallons.

c The federal tax on gasoline is 18.3 cents per gallon. Suppose there is a policy proposal to eliminate the federal tax on gasoline (a gas tax holiday) for a period of three months (suppose it begins on October 1st and ends on December 31st). Assume the announcement of the gas tax holiday is made on September 1st so that there is a month between announcement and implementation.

    i In words, describe the effect that this proposal would have on the supply and/or demand curves for gasoline.

Answer:

Theoretically, if a tax is removed, the supply of the good should increase and demand should remain the same. The equilibrium price should decrease and quantity increase.

    ii Looking week by week, and including the month before and the month after the gas tax holiday, how would we expect behavior of consumers to change over that time period and at what points in time might we expect behavior of consumers to change the most? Explain, assuming that there are no other unexpected shocks that affect the gasoline market during this time period.

Answer:

There will likely not be much change in behavior during the first 3 weeks after the announcement is made but before the gas tax holiday takes effect. The week before the gas tax holiday takes effect we might see consumers make fewer purchases as they run their tanks lower in order to take advantage of the savings from the gas tax holiday the following week. We would likely see increased purchases the first week of the gas tax holiday, both from those consumers who held off purchasing the week before and also from consumers purchasing more because the price is a little lower. Purchases would likely fall the second week of the gas tax holiday, but be greater than purchases prior to the gas tax holiday because of the lower price. From week 2 of the first month of the gas tax holiday until the next to last week of the gas tax holiday we should expect fairly stable volume of purchases. In the next to last week of the gas tax holiday we may see an increase in the number of purchases as consumers top off their tanks before the end of the gas tax holiday. The first week after the gas tax holiday ends we would likely see a reduction in purchases, both due to the now higher price because the gas tax is reinstated and also because consumers have topped off their tanks the prior week. Weeks 2-4 after the gas tax is reinstated should see purchases about the same as the first 3 weeks before the gas tax holiday went into effect.

I have broken this down into a 20-week table, assuming four weeks per each of the five months. I am using Q^* as the equilibrium quantity before any effect of the gas tax holiday:

Period	Week(s)	Effect on Quantity
Pre-announcement	1-3	Q^*
Pre-announcement	4	$Q^H : Q^H > Q^*$
Gas tax holiday	1	$Q^L : Q^H > Q^L > Q^*$
Gas tax holiday	2-11	$Q^M : Q^H > Q^M > Q^L$
Gas tax holiday	12	$Q^H : Q^H > Q^*$
Post-holiday	1	$Q^L : Q^H > Q^L > Q^*$
Post-holiday	2-4	Q^*

d An alternative policy proposal calls for a price ceiling to be imposed. Using the equilibrium price and quantity from the supply curve you drew in part **a** as a reference, illustrate a binding price ceiling on the graph. What short run and long run effects could occur due to the imposition of the price ceiling? Consider the effects on both the seller and the buyer.

Answer:

The dashed magenta line is a price ceiling at $4. The obvious short run effect is that there will be a shortage of the good as consumers demand more of the good at $4 than suppliers are willing to supply. That shortage likely means gas stations out of gas so consumers have to search more for stations with gas and that waiting times will increase in lines; both of those increase the time cost for consumers in the short run. Long run effects for suppliers could be a shift away from investing in gasoline production as the price is capped. Long run effects for buyers could be a shift away from gasoline powered vehicles – while the price of gasoline is being kept below the equilibrium price, consumers may not like the uncertainty of whether there will be gas at the pump and shift towards other methods of transportation; on the other hand it's possible that gasoline powered vehicle purchases increase because consumers prefer the time cost to the higher monetary cost of other options.

3. (25 points) Consider three individuals who would benefit from a public good. If the public good is supplied, each individual would receive the equivalent of $1,500 of utility from the public good. It costs $1,995 to supply the public good, but each individual only has $1,000 that could be contributed towards the supply of the public good.

a Can any individual supply the public good on their own? Explain.

Answer:

Each individual only has $1,000 that could be contributed so no individual can supply the public good independently. If they could supply it for $1,000 or less they would because they receive $1,500 worth of benefit

b Is it possible that the public good can be provided by only two individuals contributing? Explain.

Answer:

Yes, two individuals can supply the public good because it costs $1,995 to supply and two individuals have a combined $2,000 that they could contribute.

c Describe the free-rider problem in public goods and whether it is present in this problem. If it is present, how can an individual benefit by free-riding in this scenario?

Answer:

The free-rider problem occurs because individuals who do not pay for the public good can still consume the public good. It is present in this problem. As we see in part b, only two individuals need to contribute to supply the public good (and they might do so because the benefits exceed the costs), so the third individual could free ride on the contributions of the other two and receive the benefit of the public good without paying.

d Rather than relying on private contributions, a tax system could be enacted to provide the public good. If each individual was taxed $665 with the funds being used to supply the public good, would the individuals vote in favor of the tax proposal? Assume the individuals are only concerned with whether the benefits they receive from the public good outweigh the cost in taxes.

Answer:

Each individual has $1,000 that could be contributed and they each receive $1,500 worth of benefit. They only have to contribute $665 so they receive $1,500 − $665 = $835 in benefit from the public good. As they benefit more from the public good than their contribution, they should vote in favor of the tax proposal.

e Does this tax system seem equitable given what you know about the individuals' benefit from their public good and their ability to pay?

Answer:

As all individuals receive the same benefit from the public good (see part **d**), have the same ability to pay, and pay the same amount, this taxation system seems equitable.

f In this example there is a very small society (three people) who all have similar abilities to pay and receive the same benefit from the good. Suppose there are now 30,000 individuals. With 30,000 people, it is less likely that every individual values the public good the same and that every individual has the same ability to pay. Explain why a taxation plan that charges everyone $\frac{1}{30,000}$ of the total cost of the public good might not be supported by the individuals in this society and whether or not the plan is equitable.

Answer:

If the cost is $1,995 and it is spread over 30,000 people, very few are likely to notice because they will be paying about 6 to 7 cents each. But if the cost was scaled up so that everyone is now paying $665, people are more likely to notice. Given that some may not be able to afford to contribute that much because they have other needs and some may not want to contribute that much because the public good might not be worth that much to them, the taxation plan might not be supported by individuals. Also, with more people, it seems more likely that someone who valued the public good more than it costs that individual could act like someone who did not value the good in order to try to free ride on others who might provide the public good if the taxation plan fails.

It seems like the taxation plan is less likely to be equitable in that some people may now be paying more for the public good than the benefits it provides them.

4. (25 points) One component of the Inflation Reduction Act is to allow Medicare to negotiate some drug prices. The picture below shows the demand, marginal revenue, marginal cost, and average total cost for a particular drug. Note that the marginal cost (MC) is constant at $15. Average total cost is downward sloping and intersects the demand curve at $25; because MC is flat, average total cost will never be below MC but at very high quantities ATC gets closer to $15 and eventually the difference between MC and ATC is indistinguishable.
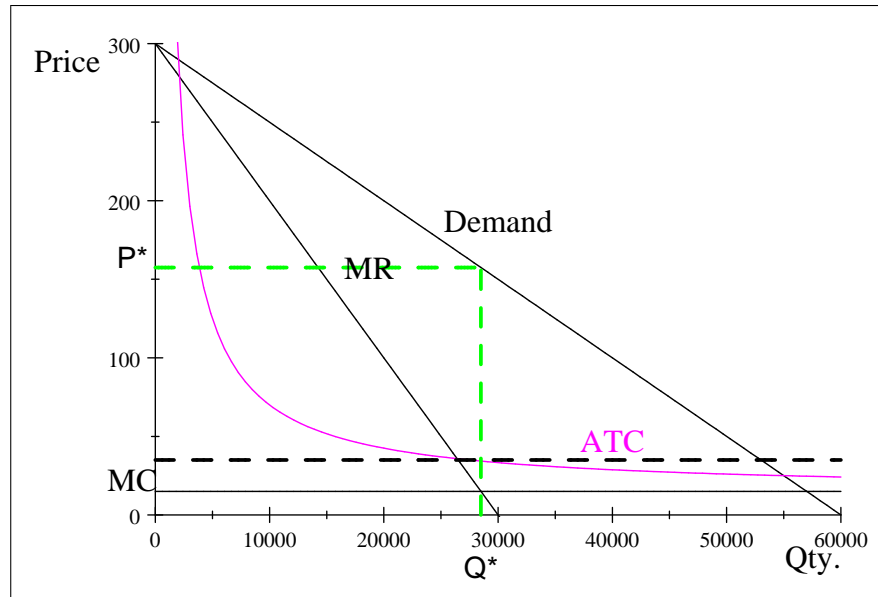
a Identify the profit-maximizing price and quantity on the graph.

Answer:

Identified on the graph by the green dotted lines and P^* and Q^*. They are $157.50 and $28,500$ based on the equations I used (which you didn't know so it's unlikely you would get those exact numbers).

b The negotiation process is more like a price ceiling being imposed with the firm facing severe financial penalties if their price exceeds the price cap. Effectively, the negotiation process imposes a price ceiling. Assume that the price cap is set at $35. In the short run, would we expect quantity to expand or contract and would there be shortages in the market? Explain, making reference to this firm's profit-maximizing behavior once the price ceiling is imposed. (It may be helpful to draw the price ceiling on the graph).

Answer:

The thick dashed black line at $35 is the price ceiling. Typically a price ceiling should decrease the quantity traded, but that may not be true in the monopoly market. The monopolist can now sell as many as consumers demand at $35 so they should sell the quantity where demand is at $35 (about $54,000$ units). Note that the price of $35 is above both ATC and MC so the monopolist is still making a profit, just not as large of a profit as before. The monopolist could have sold $54,000$ at $35 without the regulation in place and still made a profit, but chooses not to (in the unregulated market) because it could make a higher profit by charging more and selling less. That the monopolist can no longer charge more than $35 is the reason quantity expands here; at the original equilibrium quantity the monopolist is earning about zero profit with the price ceiling in place, so expanding quantity leads to higher profit.

c Now suppose that the price cap is set at $10. Does the analysis in part **b** change? Explain.

Answer:

The analysis in part **b** changes if the price cap is set at $10. The marginal cost of producing a unit is constant at $15 and a price of $10 will not cover the marginal cost of production. Without some type of assistance, this firm would stop producing so quantity would fall to zero. This example shows the danger in regulating price – set the price too low and the firm, even if it is a monopoly, may decide to stop production.