

Midterm I Suggested Solutions

Introductory Economics, Amherst College

March 2021

Instructions

This exam is open book and open notes. There are 57 points in total. You have 24 hours to complete the exam. Answers must be turned in on moodle by the end of the day on Friday, March 19 (at 3 PM EST, Amherst time).

Please write clearly, only legible answers will be graded. You need to label each question and the work for a given question should be easy to find in your solutions. Disorganized solutions will lose points. **You must explain all non-trivial steps you take to solve each problem.** At the same time, please be concise.

You cannot consult another person to assist you with the exam. Note this means you cannot share notes or receive suggestions from a person about what would be helpful resources/problems/videos to look at to answer a question. You can, however, use any publicly available resources as long as you provide proper attribution.

Acknowledgment (all the points)

Please list all resources that you used to complete the exam. Note you do not need to cite anything that is posted to moodle or directly distributed as part of the class. Also, note whether or not you received advice from anyone on how to answer questions on the exam - **you cannot work with anyone else**, the point of this part is to acknowledge that you did not work with anyone else.

Question 1 [13 pts.]

Henion Bakery produces cupcakes. Henion's supply curve is

$$q_s(p) = \begin{cases} 3(p - 2) & \text{if } p > 2 \\ 0 & \text{else} \end{cases}.$$

Suppose that the market price of a cupcake is always \$5/cupcake for the entire problem.

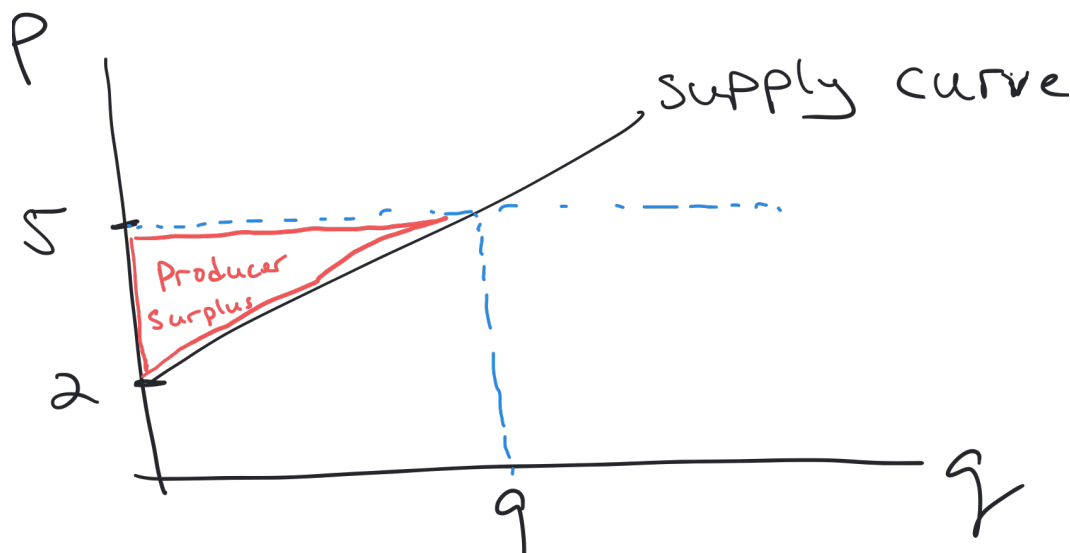
1. [4 pts.] How many cupcakes does Henion want to build? What is their producer surplus?
2. [4 pts.] What is Henion's marginal cost of baking its 6th cupcake. Explain.

If Henion buys a stand mixer, it will lower the marginal cost of producing a cupcakes by 50%.

3. [5 pts.] What is the most amount of money would Henion be willing to pay to buy the stand mixer? Explain.

Answers.

- 1.



The producer surplus is found by noting three things: (1) the quantity the producer builds, which is 9 (plug 5 in for p in the supply curve), (2) the amount the producer gets paid (5 per unit), and (3) their production costs as described by the supply curve. Those three things trace out the red outlined region above which is PS. That triangle has area 13.5.

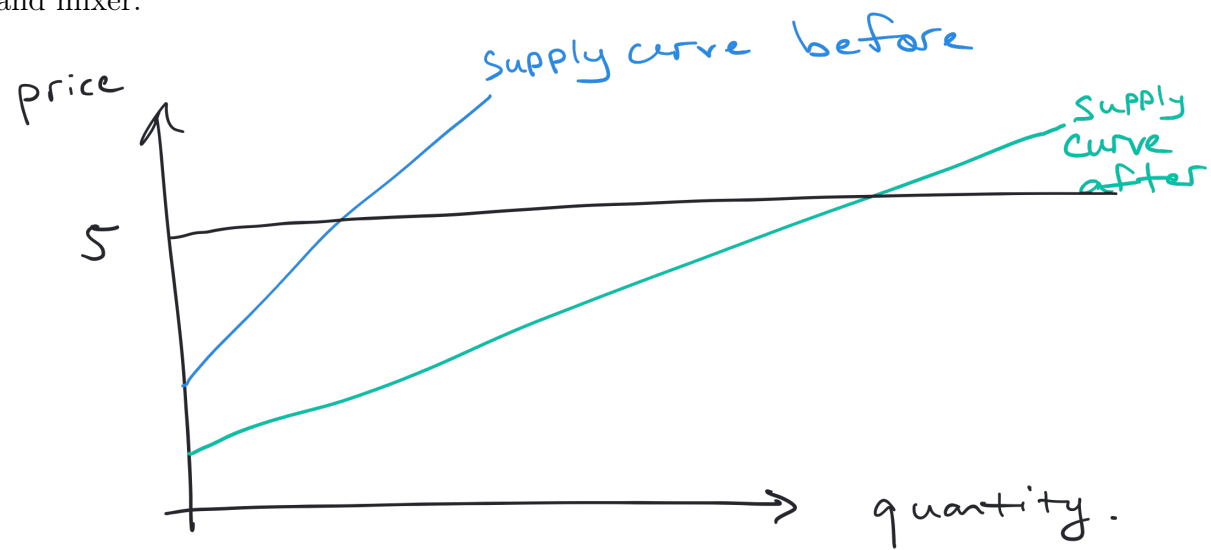
2. When the price is above 4 per unit, then Henion builds at least 6 cupcakes. When the price is below 4 per unit, Henion builds no more than 6 cupcakes. Thus, we know the marginal cost of the 6th cupcake is 4, because the marginal benefit (the price) of building the cupcake exceeds the marginal cost of building the cupcake if and only if marginal benefit is above 4 per unit.

3. Buying the stand mixer lowers the marginal cost of cupcake production by 50%. We want to think about how much the stand mixer increases the producer surplus. The difference in the producer surplus from before/after we get the stand mixer will tell me how much value the producer gets from acquiring the stand mixer, and hence their willingness to pay for the mixer.

Recall that the marginal cost exactly equals the height of our supply curve. Thus, we can find the new supply curve by carefully redrawing the marginal cost curve to be half of the height that it previously was. In addition, we know that the quantity that we want to supply with this new supply curve is the quantity for which our marginal cost is now 5. That is the quantity where the marginal cost used to be 10 (because marginal cost has been halved). Or in other words, how much did we previously want to supply when the price per unit was 10? That is the quantity (24) we now produce if we get the stand mixer.

Seeing on the diagram below, the producer surplus thus increases in area to a triangle that has size 48. Thus, we would pay 34.5 (the difference between new and old ps) for the

stand mixer.



Question 2 [12 pts.]

Consider a small society with only two people, a gardener and a chef. They produce two goods, raw food f and prepared meals m . Their productivity is described in the following table

Time needed to make one unit	Raw food f	Prepared meals m
Gardener	1 minute	9 minutes
Chef	5 minutes	1 minute

Suppose that each person works for six hour per day. Furthermore, assume that each person desires to consume equal amounts of raw food and prepared meals.¹

1. [4 pts.] Suppose that the two people cannot trade. How many many units of raw food and prepared meals would the gardener produce? What about the chef?
 2. [4 pts.] Draw the joint production possibility frontier of the society on a well-labeled graph.
 3. [4 pts.] Describe a trade between the two people which would illustrate the concept of gains from trade.
1. They want to consume equal numbers of units of the two outputs. The Gardener can make a single pair of output (one unit of f and one unit of m) in ten minutes. They have 360 minutes to produce. Thus, they can produce 36 pairs of the two goods.
- The Chef similarly has 360 minutes to produce and she is able to produce a single pair of output in six minutes. Thus, she would produce 60 pairs of the two goods.

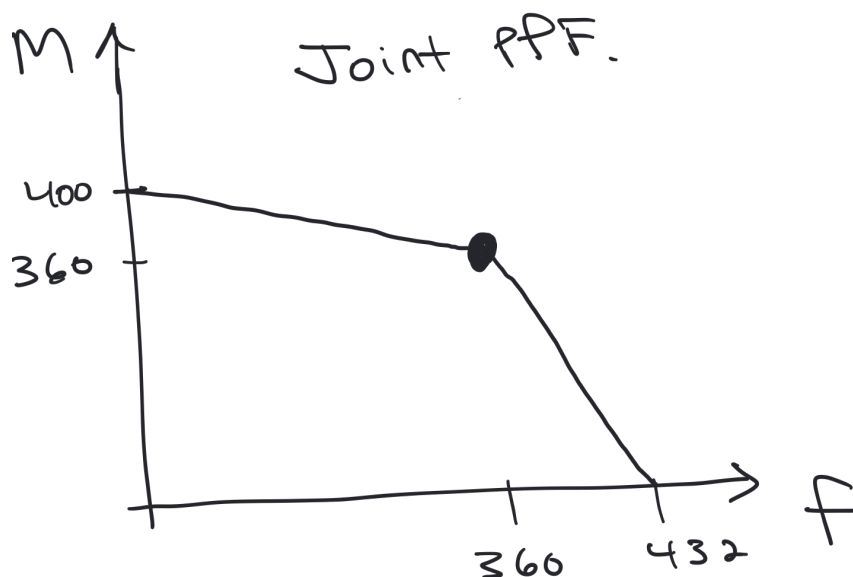
2. First note that the Gardener's opportunity cost of building one more unit of raw food f is that they must devote one more minute to raw food production, and thus, we sacrifice the $\frac{1}{9}$ of a unit of prepared meals m that we could have built using that one minute.

By the same logic, we compute the chef's opportunity cost of building one more unit of raw food is that they sacrifice 5 prepared meals.

We use this information to construct the joint PPF for the two people. One point on the PPF is the point where everyone makes prepared meals. In this case, we make 400 units of prepared meals (360 from the chef, who can make one per minute; and 40 from the Gardener, who makes meals at $\frac{1}{9}$ the speed of the chef). If we wanted to make a small amount of raw food though, we would start by first asking the Gardener to make the raw food because she has the lowest opportunity cost of producing a unit of raw food (i.e. she has the comparative advantage in raw food production). Thus, we use the Gardener's opportunity cost of building one more unit of raw food to find the slope of our PPF graph. As we ride down along the PPF, we increase production of raw food and decrease production of prepared meals at a rate that corresponds to the Gardener's OC of building another unit of raw food. This continues

¹Imagine it like this. The raw food are the ingredients that come from a farm (potatoes), and the prepared meal is the process of taking the raw food and turning it into an edible meal (like when you buy potatoes and then use them to make french fries).

until the Gardener spends all of her time making raw food. At this point we make 360 units of prepared meals and 360 units of raw food. If we want to further increase raw food production, we now increase the opportunity cost. To further increase raw food production, the chef must devote time to making raw food, and the chef's OC of making a unit of raw food is 5 unit of prepared meals. That is why the slope gets steeper at this point.



3. Recall that both want to consume an equal amount of the two goods. Suppose that the Chef only make prepared meals and the Gardener only makes raw food. They each make 360 units of the their respective good. Then, each trades 180 units of their good for the other. They both end with 180 units of each good. That is a lot better than the 36 or 60 that each consumed prior to trade.

Question 3 [9 pts.]

In this question, we will study the market for toilet paper. Suppose the market for toilet paper is perfectly competitive. In addition, suppose that in January 2020 the market supply curve for toilet paper was

$$q_m^s(p) = \begin{cases} 2(p - 1) & \text{if } p > 1 \\ 0 & \text{else} \end{cases},$$

where the quantity is measured in millions of rolls. In addition, suppose that the price was \$2/roll in January 2020.

However, in March/April of 2020 there is a shock to the toilet paper market. In the absence of government intervention, this shock would have resulted in the price of toilet paper increasing to \$6/roll and an increase in quantity to 10 million rolls traded.

1. [4 pts.] Was the shock to the toilet paper a demand shock, a supply shock, or both? Explain.

Anti-price gouging law restrict the amount that firms are able to raise prices. Suppose that anti-price gouging laws make it illegal for firms to raise the price of toilet paper above \$4/roll.

2. [5 pts.] Explain why the market is not in equilibrium following the imposition of the price ceiling. In addition, explain why the price ceiling causes a deadweight loss.

1. There must be a positive demand shock. We know this because both price and quantity increased. If the demand curve did not shift, this type of change would violate the law of demand which says that as price increases, quantity demanded drops, holding all else equal. Here, price and quantity both increase; thus we are not holding all else equal on the demand side, and we know there is a demand curve shift, and the shift is out/up in order to get both a higher quantity and higher price.

The supply curve could have shifted, but we don't have enough information to say. We know that amount producers want to build when the price is \$6/roll is unchanged relative to previously.

2. The answer to this question was already on moodle. It is the answer to the reading question from ps 2.

Question 4 [23 pts.]

Let us again consider the market for barbecue sauce in the Kansas City region. Recall that this region is partially in the state of Kansas and partly in the state of Missouri. Just as on your problem set, we consider the whole region to be one unified perfectly competitive market.

The following table describes market demand and supply for barbecue sauce in the region

price per unit	Market demand	Supply from Kansas	Supply for Missouri
24	1000	70	350
26	950	120	400
28	900	200	450
30	800	300	500
32	760	400	600
34	700	480	640
36	670	550	700
38	630	580	780

1. [4 pts.] Suppose there is no government intervention in this market place. How much barbecue sauce do producers in Missouri produce? Explain.

Now suppose that the region wants to encourage growth in its barbecue sauce industry. Toward this goal, both Kansas and Missouri decide to subsidize barbecue sauce production. In particular, suppose that producers are paid \$8 for each unit of barbecue sauce that they produce (the producers in Kansas are paid by the state of Kansas, and the producers in Missouri are paid by the state of Missouri).

2. [5 pts.] What is the price consumers pay for barbecue sauce now?
3. [4 pts.] Sketch a well labeled graph of the market. Explain which region of the graph (if any) represents the deadweight loss associated with the subsidy.

Now suppose that the Kansas state government decides that it is spending too much money subsidizing barbecue sauce, and it ends its subsidy on barbecue sauce production. Missouri, however, continues to pay a \$8 unit subsidy on barbecue sauce produced in Missouri.

4. [5 pts.] How much barbecue sauce is now built in Missouri? Explain.
5. [5 pts.] Describe all sources of deadweight loss now that only Missouri subsidizes production. [You do not need to give an exact value of the total deadweight loss.]

Answers

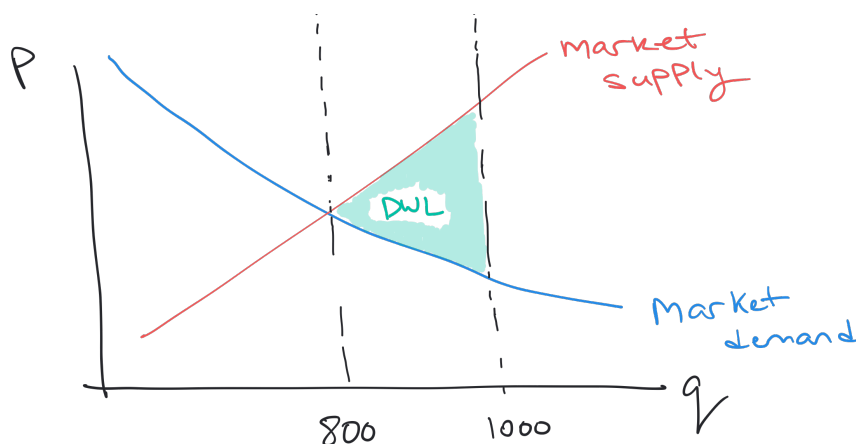
1. The price forms to set market demand equal to market supply. We know market demand, and we can get market supply by adding up the two different components of the market supply (Kansas and Missouri).

Looking to our table, we see that there are no shortages or surpluses when the price is 30. At this price market demand is 800 and that equal market supply (500 from Missouri and 300 from Kansas).

2. Now there is a subsidy. We again want to look to our table and find out when market demand will equal market supply. However, now we want to be thoughtful about the fact that producers get paid \$8 per unit more than what the consumer pays. Furthermore, we know that subsidies typically increase trade, and to do that we lower the price consumers pay (to induce more demand for that increased trade) and increase the price producers receive (to induce more supply for that increased trade).

Looking at our table, we see that when the consumers pay 24 per unit, they demand 1000 units. Similarly, when producers are paid 32 per unit (exactly \$8 more than what consumers pay) the Kansas and Missouri producers 1000 in total (400 in Kansas, 600 in Missouri).

3. The deadweight loss is the surplus lost endured because we made trades where the marginal benefit of the unit that was consumed was below the marginal cost of producing the unit. We add up the difference between marginal cost and marginal benefit for all of these units that are traded to find our DWL.



4. We again want to find when prices form to set market demand equal to market supply. However, now there is a more subtle relationship between the various prices. In particular, the price consumers pay is exactly what producers in Kansas receive, because there is no subsidy/tax there. However, producers in Missouri get paid \$8 more per unit when compared with what consumers pay. Thus, we want (1) prices where the price consumers pay, and the prices producers in Kansas get are the same, but also the price producers in Missouri get paid is \$8 more than what consumers pay; and (2) these prices set market demand equal to market supply.

We see that when consumers pay 28 per unit, producers in Kansas get paid 28 per unit, and producers in Missouri get paid 36 per unit; then market demand is 900 and market supply is 900 (700 from Missouri, where producers are paid 36 per unit; and 200 from Kansas where producers are paid 28 per unit).

5. We want to pin point the trades that causes deadweight loss here. Note that because there are no externalities, the surplus maximizing level of trade is the one we found in the first part of this problem, where 800 units are traded, and 300 were built in Kansas and 500

in Missouri.

Here, we want to understand how the outcome in part 4 deviates from this efficient outcome. We see that Missouri subsidy leads there to be (1) overconsumption (consumers get 900 units now, compared with 800 in the efficient outcome); (2) over production in Missouri (they build 700 units now, compared with 500 in the efficient outcome); and (3) under production in Kansas (they build 200 now, compared with 300 in the efficient outcome).

Why are these sources of DWL? The subsidy in general increases trade relative to the answer from part 1. Now, there are consumers with a marginal benefit of consumption that is below 30 (say 29) who consume a unit, and they get that unit from a producer who has a marginal cost that is above 30 (say 31). That trade decreases total surplus, and happens now that Missouri has the subsidy. Also note though, that there is under production in Kansas. The only way consumers will buy more sauce (relative to the part 1 answers) is if they need to pay less. So consumers pay less than 30 for each unit. Since there is no subsidy in Kansas, that means producers in Kansas get paid less than 30 to build. So there is a producer in Kansas who would supply a unit for a price below 30 (say 29) and that producer currently does not build a unit. At the same time, a producer in Missouri with marginal cost above 30 is building a unit. If that unit had instead been made in Kansas, we would have increase the total gain from trade in the market.