Microeconomics for Public Policy I
Fall 2023

Problem Set 3

On what and how to submit

- For this and all future problem sets, questions are from the "Problems" section of the questions at the end of the chapter.

- Due before Lecture 4 to your Box folder

- Name the file "ps03_[lastname].[extension]". For example, my file would be "ps03_brooks.pdf".

- You do not need to type your submission. Any **legible** submission is ok. For example, you can write the problem set with hand-drawn graphs, take a picture, and submit the picture.

1. Suppose that market for hamburgers was in equilibrium, with a supply curve of $Q^S = 2000P - 10000$ and a demand curve of $Q^D = 20000 - 1000P$. Responding to populist citizen pressure, the government puts a price ceiling of $8 on hamburgers.

(a) In market equilibrium, before the ceiling, find

    (a) equilibrium price
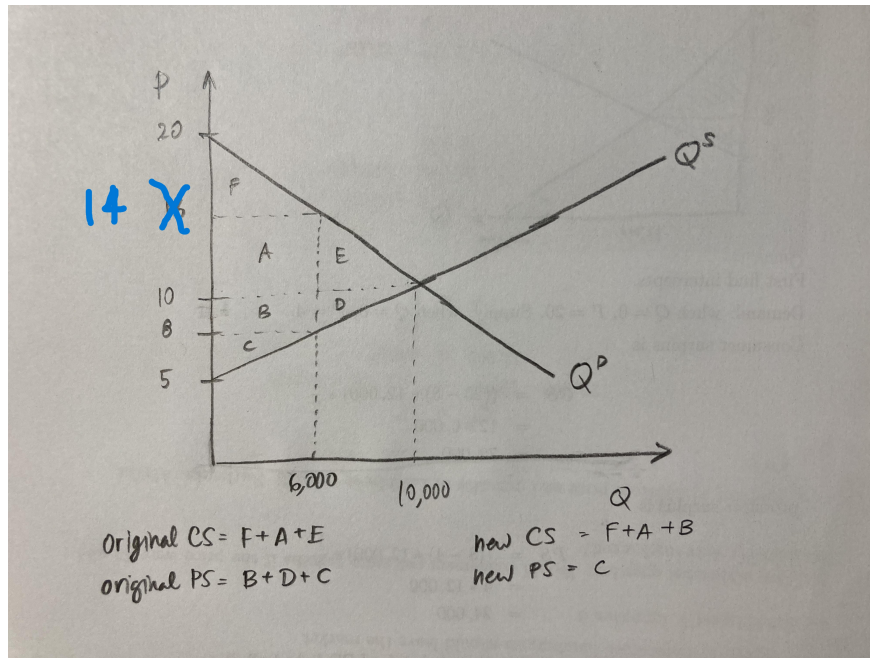
    (b) producer surplus

    (c) consumer surplus

(b) After the price ceiling, find

    (a) new quantity

    (b) producer surplus

    (c) consumer surplus

    (d) transfer

    (e) deadweight loss

    (f) deadweight loss as a share of the transfer (from either producers to consumers or vice-versa)

(c) Up until now, we assumed that all hamburgers were created equal, and it is self-evident that they are not. If there is a variety of hamburger quality, which hamburger sellers will be the most harmed by this policy?

Answers
Here is the figure I used to solve this problem:

P

20

14 ✗

F

A   E

10

B   D

8

C

5

Q^S

Q^D

6,000   10,000   Q

Original CS = F + A + E   new CS = F + A + B

original PS = B + D + C   new PS = C

(a) Market Equilibrium

    (a) equilibrium price

        Set $Q^S = Q^D$: $2000P - 10,000 = 20,000 - 1000P$.

        Solve for P: $P^* = 10$.

        Not in the question, but useful – find the equilibrium quantity. To do this, plug $P^* = 10$ into the supply or demand equation. You find $Q^{D*} = Q^{S*} = 10,000$

    (b) producer surplus

        This is the area marked $B+C+D$ on the figure. This is a triangle of width 10,000 (the equilibrium quantity). The height is the difference between the equilibrium price $(P^* = 10)$ and the price at which the supply curve hits the vertical axis.

        Note that on the vertical axis, $Q = 0$. Therefore, set Q^S in $Q^S = 2000P - 10,000$ to zero and solve for P. At $Q = 0$, $P = 5$. Therefore, the height of the triangle is $10 - 5 = 5$.

        Producer surplus is therefore $PS = (0.5)(10,000)(10 - 5) = 25,000$.

    (c) consumer surplus

        This is the area marked $F+A+E$ on the figure. This is a triangle of width 10,000 (the equilibrium quantity). The height is the difference between the equilibrium price $(P^* = 10)$ and the price at which the demand curve hits the vertical axis.

Note that on the vertical axis, $Q = 0$. Therefore, set Q^D in $Q^D = 20,000 - 1000P$ to zero and solve for P. At $Q = 0$, $P = 20$. Therefore, the height of the triangle is $20 - 10 = 5$.

Consumer surplus is therefore $CS = (0.5)(10,000)(20 - 10) = 50,000$.

(b) After price ceiling

    (a) new quantity

    At a price of 8, consumers would like to purchase more than 10,000 units (see this on your figure, where $P = 8$ on the demand curve. However, producers would like to produce fewer units than 10,000 (see this on the figure, where $P = 8$ on the supply curve. Because producers won't make all the units consumers would like to buy at a price of 8, the market supply is determined by the producers.

    Find the quantity produced by plugging $P = 8$ into the supply curve and you find $Q = 6,000$.

    (b) producer surplus

    Producer surplus is now (or still) the area below the price and above the supply curve. Because the price has declined, producer surplus is now only area C.

    This is a triangle of width 6,000 and a height that is the difference between the price ceiling and the price at which the supply surve hits the vertical axis: $8 - 5$. Therefore $PS = (0.5)(6000)(8 - 5) = 9,000$

    (c) consumer surplus

    Consumer surplus is now (or still) the area above the price and below the demand curve. Because the price has declined, consumer surplus is now rectangles $A + B$, plus triangle F.

    The missing information here is the height of triangle F. However, we know that the price at which the bottom of F is is the same price at which $Q = 6000$ on the demand curve. Plugging $Q = 6000$ into the demand curve, gives $6000 = 20,000 - 1000P$. This implies $P = 14$.

    Therefore $CS = (14 - 8)(6,000) + (0.5)(6,000)(20 - 14) = 36,000 + 18,000 = 54,000$.

    (d) transfer

    This is the portion of surplus that moves from one party to another. In this problem, producers initially had B, and then it moved to consumers.

    The transfer is therefore a rectangle 6,000 units wide and (10-8) units tall: $T = (10 - 8)(6,000) = 12,000$.

(e) deadweight loss

Deadweight loss is the amount of the surplus that disappears after the policy. Here that amount is the areas $E+D$. This is a triangle of width $10,000-6,000 = 4,000$, and height $14 - 8 = 6$.

$$DWL = (0.5)(4,000)(14 - 8) = 12,000$$

(f) deadweight loss as a share of the transfer

This is how much the DWL divided by the transfer: $= 12,000/12,000 = 1$.

(c) which hamburgers are the most harmed?

Hamburgers that are expensive to produce – those that cannot make and market for under \$8 per burger – are the most harmed. This may inefficient producers, and it may also be higher quality producers.

2. GLS Chapter 3, Question 3

And one additional question: Would consumers get more surplus if the price were \$6 and the quantity were unchanged?

a Find the equilibrium price and quantity of LED light bulbs in Fairbanks, Alaska.

Price:

$$
\begin{aligned}
Q^D &= Q^S \\
20,000 - 1000P &= -12,000 + 3000P \\
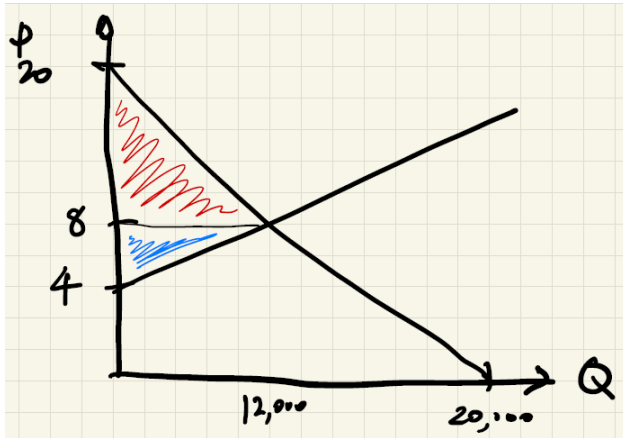32,000 &= 4000P \\
32 &= 4P \\
P &= 8
\end{aligned}
$$

Quantity:

$$
\begin{aligned}
Q^D &= 20,000 - 1000P \\
&= 20,000 - 1000(8) \\
&= 12,000
\end{aligned}
$$

Check:

$$
\begin{aligned}
Q^S &= -12,000 + 3000P \\
&= -12,000 + 3000(8) \\
&= -12,000 + 24000 \\
&= 12,000
\end{aligned}
$$

b Calculate consumer and producer surplus at the equilibrium price.

First find intercepts.

Demand: when $Q = 0$, $P = 20$. Supply: when $Q = 0$, $P = 4$.

Consumer surplus is

$$
\begin{aligned}
CS &= ((20 - 8) * 12,000) * \frac{1}{2} \\
&= 12 * 6,000 \\
&= 72,000
\end{aligned}
$$

producer surplus is

$$
\begin{aligned}
PS &= ((8 - 4) * 12,000) * \frac{1}{2} \\
&= 4 * 12,000 \\
&= 24,000
\end{aligned}
$$

c What is the total surplus created in the market for LED light bulbs?

total surplus is $= CS + PS = 72,000 + 24,000 = 96,000$

d (my addition) Would consumers get more surplus if the price were $6 and the quantity were unchanged?

yes! producers would lose and consumers would gain.

3. Price regulations

Find a specific example of a price ceiling or floor – not one from class or from the text-book. Roughly, what was the impact of this regulation on quantity supplied and quantity demanded?

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We accept any logically argued answer here.