

Problem Set 2

Due Lecture 3 in class on paper

1. GLS Chapter 3, Question 1 (in this and all future problem sets, this is the “problems” section, not the “review questions” section.)

(a) What is producer surplus at $P = 120$?

To find producer surplus at $P = 120$, we need to know Q . Given the supply curve $Q_S = 400P - 8,000$, we can calculate

$$\begin{aligned}Q_S &= 400(120) - 8000 \\ &= 48,000 - 8,000 = 40,000\end{aligned}$$

We know that producer surplus is the area above the supply curve and below the price. Where does the supply curve intersect the P-axis (or the y-axis, if you prefer to think about it this way)? The intersection is where $Q = 0$, or

$$\begin{aligned}0 &= 400P - 8,000 \\ 8000 &= 400P \\ 80 &= 4P \\ P &= 20\end{aligned}$$

So we are interested in the triangle that is 40,000 units wide and 100 ($= 120 - 20$) units tall. The area of this triangle is $PS = \frac{1}{2}(40,000)(100) = 2,000,000$.

(b) What is producer surplus at $P = 100$?

When $P = 100$, the triangle has a different width: what is Q when $P = 100$?

$$\begin{aligned}Q_S &= 400P - 8,000 \\ &= 400(100) - 8,000 = 40,000 - 8,000 = 32,000\end{aligned}$$

The height of the triangle is also shorter at 80 ($= 100 - 20$).

Therefore, producer surplus is $PS = \frac{1}{2}(32,000)(80) = 1,280,000$. Note that producer surplus is smaller than in part (a). As price declines, we expect producer surplus to decline. It is interesting to note that the price declines a little (by about 16%), but producer surplus declines a lot – by about forty percent.

2. Addendum to Question 1. Suppose that demand is $Q = 52,000 - 200P$.

(a) What is the equilibrium price and quantity?

To find equilibrium price and quantity, set supply and demand equal.

$$\begin{aligned}Q_S &= Q_D \\400P - 8000 &= 52,000 - 200P \\600P &= 60,000 \\6P &= 600 \\P &= 100\end{aligned}$$

To find equilibrium quantity, plug the equilibrium price into either the supply or demand curve.

$$\begin{aligned}Q_D &= 52,000 - 200(100) \\&= 52,000 - 20,000 = 32,000\end{aligned}$$

To check your work, you can verify that the equilibrium quantity supplied is equal to the equilibrium quantity demanded.

(b) What is producer surplus?

Producer surplus is the same as in part 1(b).

(c) What is consumer surplus?

To find consumer surplus, we need to know where the demand curve intersects the P-axis (or the y-axis, if you prefer). This is where $Q = 0$, or

$$\begin{aligned}0 &= 52,000 - 200P \\200P &= 52,000 \\2P &= 520 \\P &= 260\end{aligned}$$

This allows us to find the height of the triangle: $160 = 260 - 100$.

What is the width of the triangle? It's the equilibrium quantity, or 32,000.

Therefore, $CS = \frac{1}{2}(32,000)(160) = 2,560,000$. Note that this is larger than the producer surplus, and is so because of the shape of the demand curve (relative to the supply curve).

(d) Suppose there is a price ceiling of \$120. What is the change in producer and consumer surplus relative to the equilibrium price?

A price ceiling of \$120 – telling producers they can charge no more than \$120 per snowboard – has no effect on this market. The market price is \$100, which is below the ceiling.

(e) Suppose there is a price ceiling of \$80. What is the change in producer and consumer surplus relative to the equilibrium price?

A price ceiling of \$80 is binding. Add this ceiling to your graph. At this new price, producers would like to supply fewer snowboards. We find the specific number they would like to supply by solving

$$\begin{aligned}Q_S &= 400P - 8000 \\ &= 400(80) - 8,000 = 32,000 - 8,000 = 24,000\end{aligned}$$

At this quantity, and a price of \$80, the new producer surplus is $PS_{\text{new}} = \frac{1}{2}(24,000)(80 - 20) = (30)(24,000) = 720,000$. Producer surplus declines by $\Delta PS = PS_{\text{eqbm}} - PS_{\text{new}} = 1,280,000 - 720,000 = 560,000$.

Now solve for the new consumer surplus. For 24,000 snowboards, consumers would be willing to pay

$$\begin{aligned}Q_D &= 52,000 - 200(P) \\ 24,000 &= 52,000 - 200(P) \\ 200P &= 28,000 \\ P &= 140\end{aligned}$$

Consumers get a rectangle of width 24,000 and height of 80 to 140. They also get a triangle of height 140 to 160 and width of 24,000. In math

$$CS_{\text{new}} = (24,000)(140 - 80) + \frac{1}{2}(24,000)(260 - 140) = 2,880,000$$

The change in consumer surplus is an increase: $\Delta CS = CS_{\text{new}} - CS_{\text{eqbm}} = 2,880,000 - 2,560,000 = 320,000$.

3. Price regulations

Give an example of a price ceiling or floor – not one from class or from the textbook. Roughly, what was the impact of this regulation on quantity supplied and quantity demanded?

We accept any well-argued answer here.