ECON 110, Prof. Hogendorn

Problem Set 3 Answers

1. *Juvenor_a.*

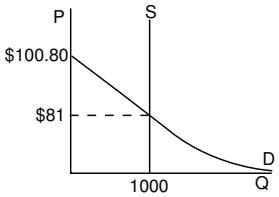
   (a) Amherst Guy (AG) added the inverse demand curves, which means he added a price plus a price. This makes no sense. The right way to do it is to add the quantities as a function of price:

$$\begin{aligned} q^{men} &= 5000 - 50p \\ q^{women} &= 4000p^{-1} \\ q^{market} &= 5000 - 50p + 4000p^{-1} \end{aligned}$$

   (b) AG set supply in terms of quantity equal to demand in terms of price. Now that we have demand in terms of quantity from (a), we can find the correct equilibrium price:

$$\begin{aligned} s(p) &= q(p) \\ 1000 &= 5000 - 50p + 4000p^{-1} \\ 0 &= 4000 - 50p + 4000p^{-1} \\ 0 &= 4000p - 50p^2 + 4000 \\ p &= 81 \end{aligned}$$

   (c) AG's graph was wrong for two reasons. Less important, it was based on his incorrect demand curve. More important, we know that supply is perfectly inelastic, but he drew it as elastic. The correct graph is:



(d) AG found CS by taking the entire area under the demand curve, but only the area under demand and above the price is surplus to the consumer. It's typically easier to integrate with respect to price to find this area:

$$\int_{81}^{100.8} 5000 - 50p + 4000p^{-1}dp$$

(Note that this demand curve does have a choke price of 100.8.)

2. *Accord_a.*

(a)

$$\begin{aligned} \epsilon &= \frac{dq}{dp}\frac{p}{q} \\ -4.5 &= \frac{dq}{dp}\frac{21180}{24000} \\ -5.1 &= \frac{dq}{dp} \end{aligned}$$

If we approximate using linear demand $q = a - bp$,

$$\begin{aligned} b &= 5.1 \\ a - b21180 &= 24000 \\ a &= 132,000 \end{aligned}$$

(b) Since the Accord is just one particular type of car, there are many close substitutes available to consumers. Then even a small percentage change in the price of the Accord will

cause a large percentage demand response from consumers. In general, the more broadly one defines a "good," the lower the price elasticity. E.g. Accords have a higher elasticity than mid-size cars, which in turn have higher elasticity than all cars, which in turn have higher elasticity than all vehicles.

The Tesla Roadster, however, is a unique vehicle with no close substitutes. It is also an expensive vehicle that is probably purchased by individuals for whom price is less of an issue. For these reasons, its demand elasticity is probably lower, at least for small changes in price.

(c) Consumer surplus is the area under the demand curve and above the price. The simple answer to this question that there are two issues: (i) the price of the EX-L V-6 is higher, which reduces consumer surplus, and (ii) the demand curve for the EX-L V-6 is shifted up because of the value in the additional features, which increases consumer surplus. Thus, the answer depends on whether the features shift the demand curve by more or less than the price increase.

One can go further and argue that the EX-L V-6 is a bit more along the lines of the Tesla Roadster (alas, only a bit). In that case, it may have lower demand elasticity, which would imply a steeper demand curve and perhaps more area under the curve for consumer surplus. This is all conjectural, but it is plausible.

(d) Price elasticity of supply is

$$\begin{aligned} \epsilon_s &= \frac{ds}{dp}\frac{p}{s} \\ &= 0.19\frac{21180}{24000} = 0.17 \end{aligned}$$

3. *Dollar-sales-tax_a.*

   (a) Setting demand equal to supply gives us:

   $$40 - 3\text{p} = 2\text{p} \Rightarrow 40 = 5\text{p} \Rightarrow \text{p} = 8 \quad \text{Q} = 16$$

   The choke price is 0=40-3p, or p=13.3. The supply curve runs through the origin. Then consumer and producer surplus are:

   $$\text{CS} = \frac{1}{2}(13.3 - 8)16 = 42.7 \qquad \text{PS} = \frac{1}{2}(8 - 0)16 = 64$$

   (b) Assuming the sales tax is collected from the suppliers, the tax effectively shifts the supply curve to S(p-1)=2(p-1)=-2+2p. The new equilibrium is

   $$40 - 3\text{p} = -2 + 2\text{p} \Rightarrow 42 = 5\text{p} \Rightarrow \text{p} = 8.4 \quad \text{Q} = 14.8$$

   The choke price is unchanged, and the PS is the area between the net price of 7.4 and the true supply curve:

   $$\text{CS} = \frac{1}{2}(13.3 - 8.4)14.8 = 36.3 \qquad \text{PS} = \frac{1}{2}(7.4 - 0)14.8 = 54.8$$

   The tax revenue is 1×14.8=14.8. The difference between the total surplus of 42.7+64=106.7 before the tax and 36.3 + 54.8 + 14.8 = 105.9 with the tax is the deadweight loss, equal to 0.8.

4. *UAW_a.* Of course this answer pertains to the version of the problem where the supply and demand curves really are 45-degree lines and cross at the point (30,30).

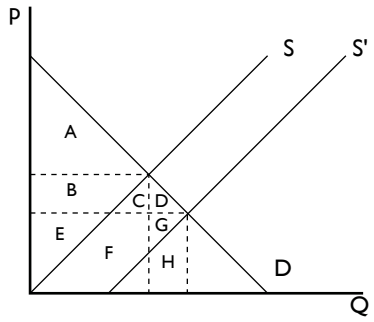
   (a) For $S(p)$ it's super easy -- the equation for a line through the origin with slope 1 is just $S(p) = p$. For demand, we know that the form of the equation is $Q(p) = a - bp$. Parameter b just give the slope, which we know is -1. So we just need to make sure it goes through the point (30,30), which requires $a = 60$. Thus, $Q(p) = 60 - p$.

(b) The supply curve goes through the origin, so $\varepsilon_S = 1$. The equilibrium point is half-way along the demand curve, so $\varepsilon = -1$. (You could of course just calculate using the formula. I took off one point if you missed the shortcuts.)

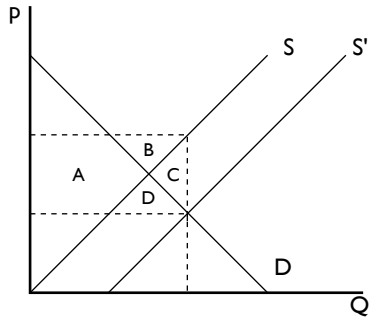
(c) Total spending, equal to total revenue, is just price times quantity: $30 \times 30 = 900$.

The rectangle of total spending is exactly cut in half by the supply curve. The top half is producer surplus of 450, the bottom half is total variable costs of 450.

(d) CS increases by B+C+D. PS increases by F+G−B. Total variable costs decrease by C+F−H. Note that there is in fact some increase in TVC (area H) indicating that the concessions could lead to some new jobs even if they still decrease overall union pay.



(e) The government has to spend area A+B+C+D in subsidy. Area C is deadweight loss.



(f) The union concessions really do reduce firm costs. Thus, the new equilibrium is efficient -- more cars are produced at a lower price due to the lower costs.

The subsidy, on the other hand, does not change costs. The market is now distorted, since the price does not equal the costs of the marginal car.

If you want to delve a little deeper here, it's possible that the union initially (a) *distorted* labor costs upward by monopolizing the labor market or (b) *corrected* a downward distortion of wages caused by employers' market power in the labor market. If you make either of these arguments, the deadweight loss conclusion about the concessions changes.