
(a) Market demand: \( q(p) = 400q_i(p) = 40,000 - 100p \). Market supply: \( s(p) = 100s_i(p) = 400(p - 5) \).

\[
40,000 - 100p = 400(p - 5) \\
42,000 = 500p \\
p = 84 \\
q(84) = 31,600
\]

(b) This is a sales tax, so it is paid by producers and thus shifts the supply curve to \( s(p - t) \) in the diagram. The new equilibrium price and quantity is found as follows:

\[
40,000 - 100p = 400(p - t - 5) \\
42,000 = 500p - 400t \\
p(t) = 84 + \frac{4}{5}t \\
q(p(t)) = 31,600 - 80t
\]
(c) The government’s revenue function is \( R(t) = tq(p(t)) = 31,600t - 80t^2 \).

We can maximize this function by taking the derivative and setting equal to 0:

\[
\frac{dR(t)}{dt} = 31,600 - 160t = 0 \Rightarrow t^* = 197.5
\]

(d) First, using the formulas from (b) we can find that \( p(197.5) = 242 \) and \( q(p(197.5)) = 15,800 \). Then in the graph, we have the following:

\[
\Delta CS = -B - C - D = -(242 - 84)(15,800) - \frac{1}{2}(242 - 84)(31,600 - 15,800) = -3,744,600.
\]

\[
\Delta PS = -E - F = -(84 - 44.5)(15,800) - \frac{1}{2}(84 - 44.5)(31,600 - 15,800) = -936,150
\]

\[
DWL = D + F = \frac{1}{2}(242 - 44.5)(31,600 - 15,800) = 1,560,250
\]

(e) This is a very tricky question! There is actually a negative externality in consumption of fatburgers. That means that the social benefit is less than the demand curve. But we don’t actually know anything about the shape of the \( q_{soc} \) curve, perhaps it is some nonlinear curve like in the diagram below. All that we know is that at the \( q = 15,800 \) point, the negative externality is exactly equal to the sales tax.

Without the tax, there would be a deadweight loss of area \( H \).
There would be too much consumption, and the costs \( s(p) \) would exceed the benefits \( q_{soc} \).
The sales tax corrects for the externality perfectly at the \( q = 15,800 \) point. It is not a true Pigouvian tax in the sense that if there were any shifts in the supply curve, it would no longer be optimal. But the supposed deadweight loss of \( D + F \) that we found in part (d) turns out not to be a deadweight loss at all. Instead, it turns out that it was private consumer and and producer surplus that was exactly offset by the negative health externality.

2. SiliconValley\_a.

(a)

(b) Free market: External benefits = \( A + C \), Deadweight loss = \( B + D \)

Social optimum: External benefits = \( A + B + C + D \)

(c) It could provide a subsidy so that the price of web servers fell to \( p_s \) in the graph. This would increase quantity demanded to \( q_s \) and correct for the externality.


(a)

\[
PV = \frac{100000}{1.10} + \frac{300000}{1.10^2} + \frac{500000}{1.10^3} + \frac{700000}{1.10^4} + \frac{1000000}{1.10^5} = 1813531
\]

The present value of the earnings per share is thus $0.18. Paying $1 per share is too much unless there will be extremely spectacular growth after 2013. A price of $0.18 per share would be the fair value assuming that earnings beyond 2013 are not counted.