Assignment 3 Solutions

Suppose the elasticity of supply of cigarettes is 10.

1) Find estimates of the elasticity of demand for cigarettes, the current tax rate on cigarettes, average price, and annual quantity sold in Florida. Provide your sources.

Answer

One of the things that will come up if you do a google search for something like "cigarette sales by state" is:

https://www.tobaccofreekids.org/research/factsheets/pdf/0099.pdf

From this, in Florida in 2015, approximately 834M packs were sold, the tax was $1.34 per pack, and the price including the tax was $5.90.

You could have used something different, as long as it had estimates of the relevant information. You might well have found something more current.

A google scholar search turns up many papers on the elasticity of demand for cigarettes. A good one is: List, John A. and Craig A. Galleta, "Cigarette demand: a meta-analysis of elasticities," *Health Economics*, 12: 821–835 (2003). DOI:10.1002/hec.765. This paper summarizes results from hundreds of papers, reporting an average long run elasticity estimate of -0.44.

2) How high would the price, including the tax, need to be to cut consumption to half its current level?

Answer

$-0.44 = -50\%/\%\Delta p$
$\%\Delta p = 50\%/0.44 = 113.64\%$. Price would have to increase to around 12.60. (2.1364×5.90).

3) How high would the tax have to be to push the after tax price that high?

Answer: Draw the picture and study it carefully before doing anything else!

The present supply embodies a tax of $1.34, the tax inclusive price is $5.90, and 834 (million) packs are purchased. From that we infer sellers receive 4.56 per pack after the tax. From (b), we need the supply curve with the new tax to cut demand at 417 units, where the tax inclusive price is $12.60.

What we do not yet know is the supply price corresponding to 417 units, labeled $p_{s,c}$ in the figure. We can work from the definition of supply elasticity, though: $10 = -50\%/\%\Delta p$, so $\%\Delta p = -5\%$. Thus, the supply price must fall to 4.33, making the tax 8.27.
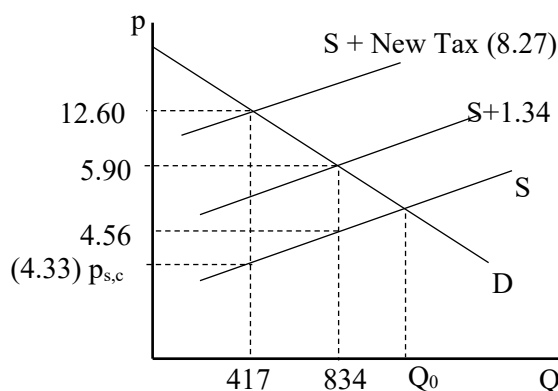
4) Estimate the consumer and producer burden of the current cigarette tax.

The thing to notice is that we still do not know what the equilibrium price would be with no tax, labeled p_0 in the figure. Finding this is the reverse of the process from the example worked in class. We are given the after tax supply and demand prices (from what is given in the problem and our work above), and we have to find the pretax price. Work from the elasticities to get two equations in two unknowns:

$$-0.44 = \frac{\Delta Q}{Q_0}\left(\frac{p_0}{5.90 - p_0}\right) \text{ and}$$

$$10 = \frac{\Delta Q}{Q_0}\left(\frac{p_0}{4.56 - p_0}\right).$$ If we divide the first equation by the second and solve, we get:

$$-0.044 = \frac{4.56 - p_0}{5.90 - p_0}$$
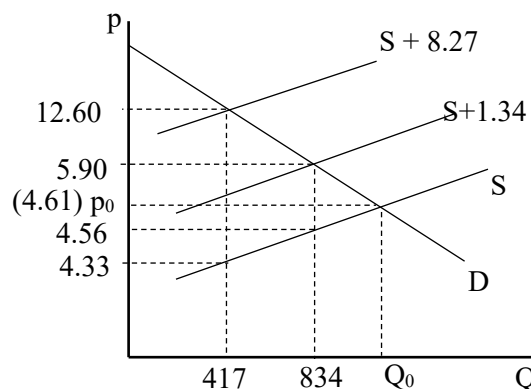
$$5.90 - p_0 = 22.73(p_0 - 4.56).$$

$$23.73 p_0 = 109.54$$

$$p_0 = 4.61$$

Most of the tax burden falls on consumers because demand is inelastic and supply is very inelastic. At the two different taxes, the tax burdens are:

Tax = 1.34: CB=(5.90-4.61)834=1,076M, PB=(4.61-4.56)834=41.7M

Tax = 8.27: CB=(12.60-4.61)417=3,332M, PB=(4.61-4.33)417=117M

5) How sensitive is your answers to modest errors in estimates of the elasticities of demand and supply?

Answer: To provide a really in depth answer, you should read over the literature to get an idea of the range of estimates, and then see how much your answers changed if you instead used estimates from the high and low end of the range. Note that with 3 estimates of each elasticity, that means doing the calculation for 9 sets of elasticities.

While you should do something like that for your project, it is beyond what I really expect here. For this purpose, you need only note that the drop in quantity it limited by the low elasticity of demand. If demand were more elastic, you would get a larger decline in quantity for a given tax, a larger deadweight loss, and a lower consumer burden. But, since supply is so elastic, the producer burden would remain relatively small. It would take a very large decline in the supply elasticity for the producer burden to become large relative to the consumer burden.

6) Do you think the tax creates a DWL or improves efficiency? Why?

Answer: Without a lot more information, it is hard to tell. If the market is working perfectly, it would create a deadweight loss. However, there are two ways in which the market does not work. First, the product is addictive, distorting. Second, there are major spillover costs—for example public costs of smoking related health care. So, the supply curve underestimates the cost of cigarettes. Therefore, a tax of appropriate size would actually improve efficiency. Whether this tax brings things closer to efficiency or not depends on lots of information we don't readily have at hand. The data from tobacco free kids cited above suggests external costs are indeed even higher than this. That, however, is just that group's figure, and more careful study would be needed to proceed.