Price Theory I Fall 2018

Problem Set 2, Question 2 Solutions

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October 19, 2018

Takeaways and General Points: There are two important takeaways from this problem: (1) demand generates markets. Simply 'prohibiting' something does not prevent it from happening: it just shifts demand between markets; (2) if the law of one price doesn't hold, think carefully about why not. Is this really the same market?

(a) Licit and Illicit

For the purposes of this question, let's assume that licit and illicit cigarettes are exactly the same. The only difference is that the licit ones are legal (and there are no other quality differences). So this seems to be a violation of the law of one price. How can this be?

Despite being the same physically, these are not actually the same cigarettes. That is, there are actually *two* demand curves: that for legal cigarettes and that for illegal cigarettes. There are two reasons they could differ:

1. They differ on the **demand side:** The government imposes some penalty k with some probability p if you get caught with illegal cigarettes. Thus there isn't really 'one price.'
2. They differ on the **supply side:** Legal and illegal cigarettes could be the same from a consumer's point of view, but there may be an upward-sloping supply for the delivery of illegal cigarettes.

Changes in the expected punishment cost $p \times k$ will push marginal individuals out of the untaxed market into the taxed market. Alternatively, increases in the tax will push marginal individuals out of the taxed market into the untaxed market.

From a supply-side perspective, the cigarette market consists of two parts: (1) the taxed sector, which is in fully elastic supply; (2) the untaxed sector, with an upward-sloping supply curve.

(b) Size of market

False. As mentioned, there are two markets in the current regime: (1) taxed, legal cigarettes; (2) illicit, fined/enforced cigarettes (going with the first item in the list in **(a)**). Under full prohibition, there would be only one choice: illicit cigarettes which are subject to enforcement.

So moving from the current regime to prohibition would push many of the legal smokers into the illegal market. Note that these smokers had a choice between the legal and illegal markets before, and chose the legal market. Therefore prohibition would raise the effective price of cigarettes for them. How would quantities respond? Note that *demand is inelastic*. Therefore quantities would respond *less* than prices, so most smoking would continue.

(c) Health costs

For the tax to be socially beneficial, we need some sort of externality. What could be the source of this externality? One possibility is for people to be uninformed about the health costs of smoking (while the government knows the cost). This seems somewhat unrealistic. Alternatively, it is sometimes argued that health expenditure is subsidized and thus smoking has a fiscal externality. This is problematic since subsidized health expenditure is often subsidized for altruistic or utilitatrian reasons beyond individual health. Absent any externality, the tax just imposes a wedge between the price paid by smokers and the price received by retailers. (Remember that health costs alone are not an externality, because people consider them when choosing whether to smoke or not)

What about the welfare of criminals? Here criminals are those who sell cigarettes in the untaxed market. Remember that the supply curve in this market is upward-sloping, so there will be some producer surplus. Thus pushing individuals into the untaxed market increases overall welfare if we include this surplus in our calculations. But the loss to the individuals who move into the untaxed market *must* be greater than the gain the criminals, because they previously chose to shop in the taxed market. Therefore taking the welfare of criminals into account does not change our conclusion.

Finally, consider the form of punishment. Thus far we have focused on fines (e.g. the punishment k is monetary). But some criminals may not be able to pay a fine that is too large. For these criminals, the government must impose prison time or other nonmonetary punishments. Prison is needed to support fines of a large enough magnitude.

Note that demand for smoking is inelastic. In that case, penalties must be harsh to reduce smoking. Therefore those who choose to subvert such penalties must use many resources to do so - resources which could have gone to productive use elsewhere. This

additional effect makes it particularly unlikely that bans on cigarettes are socially beneficial.

Figure Figure 1 (reproduced from the textbook) shows an inelastic CES demand curve. Reducing consumption from q_c to $\hat{q}$ entails an increase in consumer expenditure on cigarettes from $2E$ to $4E$ (where E is the area of one rectangle in the figure). This increase in expenditures implies that twice as many resources are diverted toward the cigarette market and away from other activities.

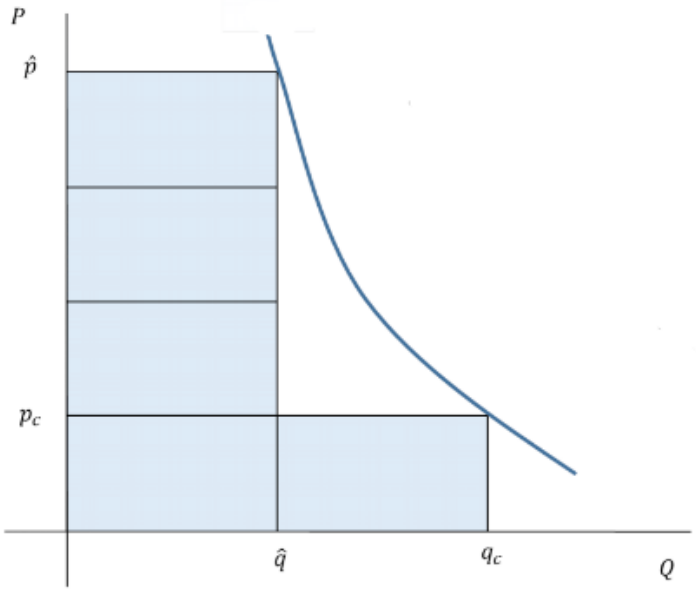

Figure 1: Inelastic Demand

(d) Minors and Cigarettes

Assuming that minors demand cigarettes, they will get them (so long as their willingness to pay is high enough). Retailers will sell cigarettes to minors so long as their profit from doing so exceeds the expected punishment:

$$\pi \geq pk$$

Where I use the assumption that the prohibition on sales to minors has the same penalties as illicit sales. Assuming constant marginal cost c and no price discrimination, we can re-write this as:

$$\pi = (p - c) \cdot q \geq pk$$

Thus, retailers will sell cigarettes directly to minors so long as ϵ^D_{Minors} is inelastic enough and the level of minor demand is high enough. Of course, they will charge minors the tax just like any other customer.

Alternatively, minors could buy cigarettes on the black market. But, recognizing that minors' outside option is paying the tax at retailers, black-market sellers will also charge minors the tax. Therefore, minors *also buy taxed cigarettes*.

(e) Legalizing Sales to Minors

It would be socially beneficial to legalize sales to minors. Minors then get much lower-priced cigarettes, since retailers will now sell cigarettes so long as:

$$(p - c) \cdot q \geq 0$$

Eliminating the punishment pk is akin to eliminating a tax: it removes a distortive deadweight loss in the cigarette market. Minors may suffer more adverse health consequences, but they already know about and have internalized these.

Moreover, productive resources from elsewhere are diverted to subverting the ban on minors smoking. Because minors' demand for cigarettes is inelastic, many such resources must be used to significantly reduce childhood smoking. Therefore, legalizing sales to minors frees up these resources to be put to better uses elsewhere.

(f) Preventing Sales to Minors

If kids got cigarettes from adults who bought them legitimately, that would *not* strengthen the case for prohibiting cigarettes for adults. If we did prohibit adult cigarette sales, we would just drive adults *and* kids to buy illegal cigarettes. To prevent kids from getting cigarettes, we should increase the tax. This will shift adults into the illegal market, and will increase the price to both adults and kids.

Alternatively, suppose minors were stealing cigarettes from adults and retailers. Increasing the tax on cigarettes increases the market value of each pack of cigarettes, which means that owners of cigarettes (retailers or adults) will take more care to prevent theft.

In short, theft is an equilibrium outcome. It cannot be entirely stopped by legal prohibitions.

(g) Innovation and Smoking

Uncertain. We have $\epsilon^D_{Licit} = -1/2$. But again, there are really *two markets*. Demand curves could be quite different in the two markets. Since we don't know the total elasticity, we can't quantify the precise impact on cigarette sales.