Price Theory I Fall 2018

Problem Set 4, Question 2 Solutions

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Takeaways and General Points: This question draws heavily from Chapter 15 of *"Law's Order: What Economics Has to Do with Law and Why It Matters"* by David Friedman (son of Milton Friedman). The relevant chapter is available on his web site. There are two main takeaways from this question:

1. Consider all costs and benefits when formulating a problem. It may not be immediately obvious, for instance, that criminals get benefits from committing crimes, and these benefits should be taken into account.
2. Take time to think about the shape of the relevant cost curves. This problem is more straightforward if one assumes a convex cost of punishment. But describing the shape of these curves is essential.

(a) Monetary Fines

Each crime induces three transfers: (1) a gain to the criminal G; (2) a loss to the victim DV[1]; (3) a cost to the law enforcement apparatus for enforcement. Remembering (3) is crucial. A society must spend resources to find, prosecute, convict, and punish crimes. If everyone were perfectly law-abiding, there would be no need for such spending. But since some crimes occur, we must fund police, courts, and prisons rather than schools and roads (for example). As crime increases, we want to deter more crimes and hence must spend more resources on deterrence. Denote by $C(\cdot)$ the cost function for crime deterrence. Assume that $C(\cdot)$ is convex.

Now let us make precise what we mean by 'deterrence.' Each crime has an associated probably of detection A and punishment P, making expected punishment $A \times P$. Break out the cost function into subcomponents for detection and punishment: $C_1(P)$

[1] "Damage to victim" $\equiv DV$.

and $C_2(A)$. Assume that each component is increasing and convex:

$$C_1'(P) > 0; \quad C_1''(P) > 0$$
$$C_2'(A) > 0; \quad C_2''(A) > 0$$

Then we can formulate society's problem similarly to that of the firm: the goal is to minimize costs so as to achieve a given level of deterrence:

$$\min_{P,A} [C_1(P) + C_2(A)]$$
$$s.t. \quad A \times P = D$$

Where D is the desired level of deterrence. This is just like a firm minimizing costs subject to producing a given amount of output. The solution to this problem produces a *cost curve for deterrence* $C(D)$, showing the lowest-cost way to achieve each level of deterrence.

What crimes would we like to prevent? Those which impose a cost which is greater than the cost of preventing them, e.g.:

$$(Prevent) \Leftrightarrow [\text{Net Cost}] > [\text{Cost of preventing}]$$

The LHS above is $DV - G$ (damage to victim less gain to criminal). The RHS is $C(D)$ (the sum of $C_1(P)$ and $C_2(A)$). For the marginal offense, $G = D = E[Pu]$, where $E[Pu]$ is expected punishment (equivalently, the level of deterrence). Criminals who gain less than D for a crime won't commit it (because they expect their punishment to be greater than their cost), while those who gain more than D will. Therefore, for the marginal offense, [Net Cost] $= DV - D$.

Now the optimal punishment will deter the marginal crime. Thus it will satisfy:

$$C'(D) = DV - D^* \quad \Rightarrow \quad D^* = DV - C'(D) \tag{1}$$

Why is this the optimal amount of deterrence? If we choose $D < D^*$, then the damage to the vicim will be greater than the cost of preventing this additional crime. If we choose $D > D^*$, then the cost to society of enforcing the marginal crime exceeds the net damange of the marginal crime. Therefore optimal deterrence D^* is such that the cost of deterring the marginal crime just equals its net cost.

Two things are important to note:

1. Not all crimes are deterred. All 'efficient' crimes (those with $G > DV$) still occur, and some non-efficient ones also occur, because the cost of deterrence is too high for them.
2. If the marginal cost $C'(D)$ is high (e.g. if the supply of crimes is inelastic), then the optimal punishment is less than DV. If the marginal cost $C'(D)$ is *negative* (e.g. the supply of crimes is very elastic), then the optimal punishment is greater than DV.

(b) Judgement-proof Criminals

So far we have considered punishment $D \equiv A \times P$ as being in purely dollar terms. But suppose that people have different amounts of wealth, and some cannot pay D^* for the crime they have committed. Then a pure monetary fine will be insufficient to achieve the optimal level of deterrence: it will *under*-deter, since all criminals with wealth $W < D^*$ will face deterrence level W and therefore commit more crimes than we would like.

We must therefore broaden our choice set of punishments. In particular, we might consider jail time as a punishment. The optimal punishment still satisfies

$$D^* = DV - C'(D)$$

But now D^* might be an equivalent amount of *incapactitation time* (e.g. jail time). What is equivalent amount? There are three things to consider: (1) the amount might differ by individual, since the opportunity cost of time is higher for richer people; (2) incapacitation reduces future enforcement costs, since it saves the cost of catching, trying, and punishing criminals for crimes they might have committed while they were in fact in jail; (3) jail imposes a negative net cost on society.

Let me elaborate first on (3). If a criminal pays a fine, this is a simple transfer: he loses and the government gains. But if a criminal is jailed, he loses (the NPV of his sentence length) and the government must pay to jail him. This extra cost of jail increases the cost of deterrence $C(D)$. Its effect on the *marginal cost* $C'(D)$ is unclear.

The second point (2) suggests that *there is a benefit to jail time* over and above its monetary cost. This benefit decreases the net cost of the crime.

Thus less strict jail sentences are necessary, both because jail has an additional benefit and because it is more expensive than fines. Denoting by J the net present value of jail time in terms of foregone earnings, we have: $J < D$ Finally, note that as we increase the fine D, the number of people who can pay it falls, and we have to jail more (which is more expensive).

(c) Delay between commission and enforcement

If there is a delay between a crime and its enforcement, this lets criminals commit other crimes. Above, I outlined a framework for efficient deterrence: balancing the benefit (reducing offenses) against the cost (imposing punishments on those not deterred). Note that the benefit depends on the slope of the demand curve for crime. In turn, the optimal punishment depends on the relation between the level of demand and the slope of demand.

To deter other crimes between commission and enforcement, we need to consider how the slopes of the demand curves change when other crimes are available. Consider two crimes: stealing lambs and stealing sheep. Let D_L be the demand curve for lamb theft, and D_{LS} the demand curve for lamb *and* sheep theft. The figures below depict two possible scenarios. In the figure on the left, the slope and value of D change by the same factor when we move from D_{LS} to D_L. Then eliminating S increases the benefit from deterring L since thieves no longer need to be deterred from stealing S (that is, the demand curve D_L is more elastic). Conversely, in the figure on the right, the slope increases *less* than the value moving from D_{LS} to D_L. Now eliminating S increases the number of thieves who must be punished for stealing L by *more* than it increases the number who will be deterred by an increase in punishment F (these figures are from Friedman & Sjostrom 1993).

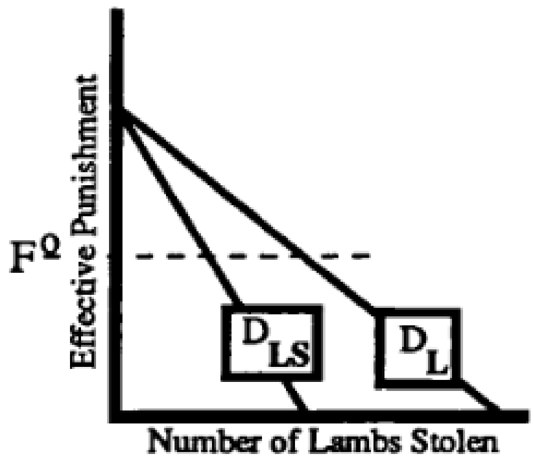

Figure 1: Slope and value change same

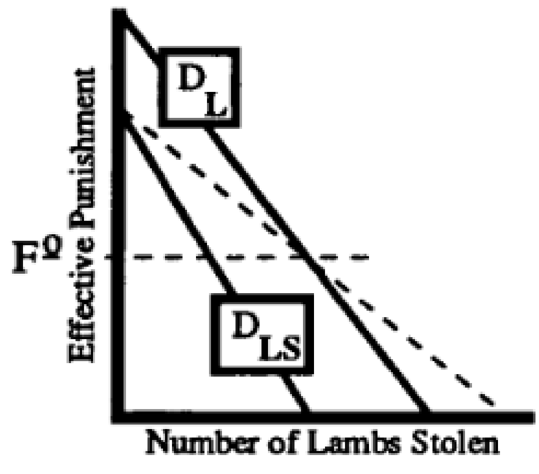

Figure 2: Slope increases less than value

What does this have to do with a delay between commission and apprehension? This delay enables other crimes to be committed, and so forces the legal system to impose even harsher punishments to prevent these other crimes in the interim period. The answers to **(a)** and **(b)** may change depending on how the *slope* of the crime demand curve changes with the addition of other possible crimes.

(d) Rich and Poor

The naive approach to this question is as follows: 'It makes no difference whether an offender is rich or poor. A crime is a crime, with the same cost $(DV + C(D))$. Therefore rich and poor should expect the same punishment.' This is not wholly correct. Consider a \$100 fine for speeding. For a very rich person, this is trivial. For a poor person, it is very expensive. More generally, it might take different amounts of punishment to deter rich or poor individuals. There are several things to consider here:

1. A given amount of jail time is more costly (in terms of foregone earnings) for the rich than the poor. In other words, punishment costs fall with income.

This in turn implies higher efficient levels of punishment as incomes rise.

2. The distribution of gains from crime might be distributed heterogeneously across income levels (e.g. poor people might gain more from crime than rich people).
3. Punishing with jail time also *provides public information about the crime*. This affects the *reputation* of the criminal. This is particularly damaging in white-collar professions such as accountants. This effectively decreases the cost of deterrence, and therefore increases the optimal level of punishment.

In sum, the rich should not have the same punishment as the poor. The punishment may be greater or smaller for a given crime, depending on the shapes of the supply and cost curve for that crime and how they change with income.

(e) Optimality

As we saw, the optimal punishment satisfies:

$$D^* = DV - C'(D)$$

That is, it balances the reduction in harm against the increase in cost. If the expected punishment is equal to the difference between the victim's loss and criminal's gain, we would have:

$$D_2 = DV - G$$

Which is only equal to D^* if $C'(D) = G$. In general, setting D equal to $DV - G$ *overdeters* crime because it ignores enforcement costs.

(f) Criminal Activity of Others

The details here can get quite complicated, depending on how you set this up. The basic idea is that the demand curve for crime is now not just linear, but could also depend on *other people's decisions to commit crime*. In other words, we previously had $D(Cr) = D(P)$, where Cr is crime and P is (effective) punishment. Now we have $D(Cr) = D(P, Cr_{Oth.})$, where $Cr_{Oth.}$ represents other people's decisions to commit crimes. Thus, $D(Cr)$ may now be nonmonotonic in P. See the section on network effects from class.