EC337: Economics of Legal Issues, Spring 2009

Problem Set #4
Due: Wednesday, April 29.

April 29, 2009

1. **(Criminal Law)** Ernie runs a crime syndicat on Sesame Street and has decided to ramp up his syndicat's activities in view of the current recession. In particular, the number of burglaries to houses on Sesame Street increased to 300 per year since the recession began. Since it was once a friendly place, Sesame Street currently has no police (and so bears no social cost K of policing). Big Bird, the mayor, is considering adding patrolmen at an annual cost of $K(p) = \$1,000,000$. The proposed increase would increase the likelihood p of convicting burglars from 0% to 25% and it is expected that the number of burglaries would fall to 100 per year. Suppose that whenever a house is burglarized and the burglar is not caught, the net expected social damages $g - h$ are $-\$10,000$ but that **no net damages are caused when the burglar is caught**. Under Sesame Street criminal law, burglars who are caught face 3 years in jail at a variable social cost c of $\$10,000$ per year. In terms of p, the annual social welfare function can be written as:

$$SWF = N(p)\left((1-p)(g-h) - pct\right) - K(p)$$

where $N(p)$ is the expected number of burglaries (i.e. 300 under the current non-policing scheme and 100 under the Big Bird's proposed policing scheme). [**Note:** While slightly different than the model we discussed in class, you should be able to explain why this expression makes sense].

(a) Calculate the social welfare under: (i) the current non-policing scheme; and (ii) Big Bird's proposed policing scheme. From a social welfare standpoint, would you recommend that Big Bird go ahead with the proposal?

Answer:

$$\begin{aligned}
\text{(i) } SWF &= 300\left((1-0)(-\$10,000) - (0)(\$10,000)(3)\right) - 0 = -\$3,000,000 \\
\text{(ii) } SWF &= 100\left((1-.25)(-\$10,000) - (.25)(\$10,000)(3)\right) - \$1,000,000 \\
&= 100\left(-\$7,500 - (\$7,500)\right) - \$1,000,000 = -\$2,500,000
\end{aligned}$$

Since $-\$2,500,000 > -\$3,000,000$, Big Bird's proposal achieves higher social welfare and should be recommended.

(b) If every criminal type obtains some benefit g with probability $(1-p)$ and faces a sanction s with probability p, derive an expression which describes which criminal type g is just indifferent between committing a burglary and following the law. As discussed in class, this the level of deterrence

$D(p, s)$ given the sanction s and the probability of conviction p. [**Note:** This is slightly different than the expression for deterrence derived in class]. Now suppose that $\alpha = 1$ (so that jail does not impose additional costs beyond the opportunity costs faced by the criminal). Calculate the level of deterrence $D(p, ct)$ achieved under: (i) the current non-policing scheme; and (ii) Big Bird's proposed policing scheme.

Answer: In order to determine the level of deterrence:

$$\begin{aligned} (1-p)g &= ps \\ \text{Isolating } g \text{ gives } g &= \frac{ps}{(1-p)} \\ \text{Thus } D(p,s) &= \frac{ps}{(1-p)} \end{aligned}$$

Applying this formula to: (i) the current non-policing scheme; and (ii) Big Bird's proposed policing scheme:

$$\begin{aligned} \text{(i) } D(p, ct) &= D(0\%, (\$10,000)(3)) = \frac{0(\$10,000)(3)}{(1-0)} = \$0 \\ \text{(ii) } D(p, ct) &= D(25\%, (\$10,000)(3)) = \frac{.25(\$10,000)(3)}{(1-.25)} = \$10,000 \end{aligned}$$

(c) Bert, who is morally opposed to lengthy incarceration, suggests that the penalty for burglary be reduced to 1 year. In order to counteract this reduction in deterrence, he suggests that the number of police patrolmen be increased even further at an additional annual cost of $\$750,000$ (**beyond the costs of Big Bird's proposal**). If the probability of catching burglars increased to 50%, would Bert's proposal be an efficient improvement over Big Bird's proposal? [**Hint:** You have enough information to answer this question. Use your answer in part (b) to calculate the level of deterrence under Bert's proposal].

Answer: You need to determine how many crimes $N(p)$ are committed under Bert's proposal since this information is not given. Since the number of crimes is determined by the level of deterrence, $D(p, ct)$, first figure out the level of deterrence under Bert's proposal using the answer from part (b):

$$D(p, ct) = D(50\%, (\$10,000)(1)) = \frac{.5(\$10,000)(1)}{(1-.5)} = \$10,000$$

Notice that $D(50\%, (\$10,000)(1)) = D(25\%, (\$10,000)(3))$, so that Bert's proposal provides the same deterrence as Big Bird's. So, there must be 100 burglaries committed under Big Bird's proposal as well. Hence, the social welfare of Bert's proposal is:

$$\begin{aligned} SWF &= 100\left((1-.5)(-\$10,000) - (.5)(\$10,000)(1)\right) - \$1,750,000 \\ &= 100\left(-\$5,000 - (\$5,000)\right) - \$1,750,000 = -\$2,750,000 \end{aligned}$$

Notice that $-\$2,500,000 > -\$2,750,000$ so that Big Bird's proposal achieves higher social welfare.

(d) Elmo, who was carefully listening through my lectures on criminal law, has another idea. Instead

of imposing jail sentences for burglary, he proposes that Sesame Street criminal law mandate fines–since these are less costly from a social point of view. Calculate the fine f that achieves the same level of deterrence $D(p, f)$ as: (i) Big Bird's proposal; and (ii) Bert's proposal. Now suppose that a fraction β of each fine is lost or "burned off" in administrative costs. In terms of p, the annual social welfare function can be written as:

$$SWF = N(p)\left((1-p)(g-h) - p\beta f\right) - K(p)$$

Is there a value of β for which Bert's proposal (using fines instead of jail sentences) creates higher social welfare than Big Bird's proposal (using fines instead of jail sentences). [**Note:** Think about it and please make sure that the answer you obtain makes sense].

Answer: You need to determine the finses which induce the same level of deterrence as Big Bird and Bert's proposals. You can use your answers from parts (b) and (c) to help:

$$\begin{aligned}
\text{Under Big Bird's Proposal} \quad &: \quad D(25\%, (\$10,000)(3)) = \$10,000 = \frac{.25f}{(1-.25)} = D(25\%, f) \\
\text{Under Bert's Proposal} \quad &: \quad D(50\%, (\$10,000)(1)) = \$10,000 = \frac{.5f}{(1-.5)} = D(50\%, f)
\end{aligned}$$

Solving each of these two eqauations for f:

$$\begin{aligned}
\text{Under Big Bird's Proposal:} \quad & f = \$30,000 \\
\text{Under Bert's Proposal:} \quad & f = \$10,000
\end{aligned}$$

This should make sense. In each case, you found a fine that gives the same level of deterrence as the jail sentences under each proposal. Now, to calculate social welfare:

$$\begin{aligned}
\text{Under Big Bird's Proposal} \quad &: \quad SWF = 100\left((1-.25)(-\$10,000) - (.25)\beta(\$30,000)\right) - \$1,000,000 \\
\text{Under Bert's Proposal} \quad &: \quad SWF = 100\left((1-.5)(-\$10,000) - (.5)\beta(\$10,000)\right) - \$1,750,000
\end{aligned}$$

You want to find the β such that the SWF under Bert's proposal is larger than the SWF under Big Bird's proposal or:

$$\begin{aligned}
100\left((1-.5)(-\$10,000) - (.5)\beta(\$10,000)\right) - \$1,750,000 \quad &> \\
100\left((1-.25)(-\$10,000) - (.25)\beta(\$30,000)\right) - \$1,000,000 \quad &\text{ or} \\
100\left((.5-.75)(-\$10,000) - (.75-.5)\beta(\$10,000)\right) \quad &> \quad \$1,750,000 - \$1,000,000 \text{ or} \\
100(.25)(\$10,000)(1-\beta) \quad &> \quad \$750,000 \text{ or} \\
\$250,000(1-\beta) \quad &> \quad \$750,000 \text{ or} \\
(1-\beta) \quad &> \quad 3 \text{ or} \\
-2 \quad &> \quad \beta
\end{aligned}$$

Since β is, by definition, a fraction between zero and one, there is no $0 \leq \beta \leq 1$ such that the SWF

under Bert's proposal is larger than the SWF under Big Bird's proposal.