Crime and Punishment: An Economic Approach

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1 The Basic Analysis

1.1 The Cost of Crime

- Public and private expenditures are significantly understated, since expenditures by many public agencies in the course of enforcing particular piece of legislation and private precautions against crime are not included

- Due to large growth of tax and other legislation, tax evasion and other kinds of white-collar crime have presumably grow more rapidly than felonies

- Indirect evidence of growth in crime is the large increase in the amount of currency circulation since 1929. Despite spread of credit cards and cheques, amount of currency used increases since using currency has no record of transactions

1.2 The Model

The amount of harm would tend to increase with activity level, as in the relation

$$
\begin{aligned}
H &= H(O) \\
\frac{dH}{dO} &> 0 \\
H_i" &> 0 \\
H &= \text{Harm from crime} \\
O &= \text{Crime activity level}
\end{aligned}
$$

The social value gain to offenders, G also tend to increase with number of offenses

$$
\begin{aligned}
G &= G(O) \\
G' &> 0 \\
G" &< 0
\end{aligned}
$$

The net cost or damage to the society by crime, D can be written as

$$
\begin{aligned}
D(O) &= H(O) - G(O) \\
D" &= H" - G" > 0
\end{aligned}
\tag{1}
$$

It follows from (1) that

$$D'(O) > O \quad \forall O > O_a \quad if \ D'(O_a) \geq 0$$

- The cost of murder measured by the lost of earnings of victims excludes the value society placed on life itself

- The cost of gambling excludes the utility to those gambling and the "external" utility of some clergy and others

- The cost of "transfers" like burglars and embezzlement exclude social attitudes towards forced wealth redistribution and also the effects on capital accumulation of the possibility of theft

1.3   The Cost of Apprehension and Conviction

The output of police and various court activity can be summarized as $A = f(m, r, c)$ where f is the production summarizing the "state of arts". The cost of the activity, A can be summarized by the

$$\begin{aligned} C &= C(A) \\ C'(A) &> 0 \end{aligned} \tag{2}$$

One approximation to an empirical measure of "activity" is the number of offenses clear by conviction. It can be written as

$$\begin{aligned} A &= pO \tag{3} \\ p &= \text{Probability that an offense is cleared by conviction} \end{aligned}$$

By (2) and (3), one has

$$\begin{aligned} C_p &= C'O > 0 \\ C_o &= C'p > 0 \end{aligned}$$

An increase in either the probability of conviction and number of offenses would increase total cost. If marginal cost of increased activity is rising, further implications would be that

$$\begin{aligned} C_{pp} &= C"O^2 > 0 \\ C_{OO} &= C"p^2 > 0 \\ C_{pO} &= C_{Op} = C"pO + C' > 0 \end{aligned}$$

A more sophisticated approach to (3) is that

$$A = h(p, O, a)$$

The variable a stands for the arrests and other determinants of activity and there is no presumption that the elasticity of h w.r.t. p equals that w.r.t. O. Substitution yields the cost function $C = C(p, O, a)$

1.4   The Supply of Offenses

- Person commits an offense if the expected utility to him exceeds the utility he could get by using his time and other resources at other activities

The number of offense can be represented as

$$O = O(p, f, u)$$
$$\frac{dO}{dp} < 0$$
$$\frac{dO}{df} < 0$$

$$O = \text{Average market offense}$$
$$p = \text{Probability of getting convicted per offense}$$
$$f = \text{Punishment per offense}$$
$$u = \text{Portmanteau variable representing all other influences}$$

- Since only convicted offenders are punished, in effect there is "price discrimination" and uncertainty; if convicted, he pays f per convicted offense, while otherwise he does not

- The change in some component u can be anticipated. For instance, a rise in the income available in legal activities or an increase in law-abiding due, say, to "education" would reduce the incentive to enter illegal activities, and thus number of offenses. Or a shift in the form of punishment from fine to imprisonment would reduce number of offenses since crime generally cannot be committed while in prison

- An increase in p compensated by an equal percentage reduction in f would not change the expected income from an offense, but could change the expected utility, because the amount of risk would change. If individual is risk preferrers, increase in p (compensated by decrease in f) would reduce the expected utility of crime, and thus number of offenses; if the individual is risk averse, increase in f would have a greater effect; if the individual is risk neutral, increase in p and f have the same effect.

- The widespread generalization that offenders are more deterred by the probability of conviction than punishment when convicted imply that offenders are risk preferrers

- In equilibrium, real income of persons in risky activities are, at the margin, relative high or low as persons are generally risk avoiders or prefferers respectively

- Social loss from illegal activities is usually minimized by selecting p and f in regions where risk is preferred i.e. regions where "crime does not pay"

1.5 Punishments

- The cost of different punishments to an offender can be made comparable by converting into their monetary equivalent. For instance, the cost of imprisonment is the discounted sum of earnings forgone and the value placed in consumption and freedom. Hence, the cost of prison for an offender who can earn more outside is generally greater. Also, cost to each offender would be greater the longer the prison sentence, since both forgone earnings and forgone consumption are positively related to the length of sentences

- Punishments affect not only offenders but also other members of the society. Fines paid by offenders are received as revenue by others. At the same time, other members are hurt since imprisonment requires expenditure on guards, foods and etc.

- Total social cost of punishments is the cost to offenders plus the cost or minus the gain to others

The social costs can be written in terms of offender's cost as

$$f' = bf$$

where f' is the social cost and b is the coefficient that transforms f into f'.

- $b \approx 0$ for fines, while $b > 1$ for torture, probation, and imprisonment

2 Optimality Condition

- An increase in p increases the social cost of offenses through its effect on the cost of combating offense, C as does an increase in f if $b > 0$ through the effect on the cost of punishments, bf. Hence, optimal p and f is not 1 and infinity respectively

The social loss from offenses, L is defined as follow

$$L = D(O) + C(p, O) + bpfO$$
$$O = O(p, f)$$

The aim would be to select values of b and f that minimize L. The term $bpfO$ is the total social loss from punishments, since bf is the loss per offense punished and pO is the number of offenses punished. Combining the FOC's, we have

$$D' + C' = -bpf(1 - \frac{1}{\epsilon_f}) \tag{4}$$

$$D' + C' + C_p \frac{1}{O_p} = -bpf(1 - \frac{1}{\epsilon_p}) \tag{5}$$

$$\epsilon_f = -\frac{f}{O}O_f$$

$$\epsilon_p = -\frac{p}{O}O_p$$

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The term on the left side of (4) and (5) gives the marginal cost of increasing the number of offenses, O: in equation (4) through a reduction in f and in (5) through reduction in p. Since $C' > O$ and O is assumed to be in a region where $D' > 0$, the marginal cost of increasing O through f must be positive. A reduction of p partly reduces the cost of combating offenses, and, therefore the marginal cost of increasing O must be less when p rather than f is reduced; the former can even be negative if C_p is sufficiently large. Average revenue, $-bpf$ is necessarily negative, but marginal revenue, give by RHS of (4) and (5) is not necessary negative and would be positive if the elasticities ϵ_p and ϵ_f were less than unity. Since the loss is minimized when marginal revenue equals marginal cost, the optimal value of ϵ_f must be less than unity, and that of ϵ_p could only exceed unity if C_p were sufficiently large.

Since the MC of changing O through change in p is less than that of changing O through f, the equilibrium marginal revenue from p must also be less than that of f. But (4) and (5) indicate that marginal revenue from p can be less iff $\epsilon_p > \epsilon_f$. This is precisely the condition indicating offenders have the preference for risk and thus that crime does not pay.

- The loss of offenses is minimized if p and f are selected from those regions where offenders, on balance, risk preferrers.

- If the supply of depended only on pf-offenders are risk neutral- a reduction in p compensated by an equal percentage increase in f would leave $pf, O, D(O)$, and $bpfO$ unchanged but would reduce loss since the cost of apprehension and conviction would be lowered by reduction in p

- If offenders were risk avoiders, the loss would be minimized by setting p arbitrary close to 0 and raising f sufficiently high so that the producet pf would induce optimal number of offenses

- Convicted criminal are punished in many countries rather severely, because an increased probability of conviction obviously absorbs public and private resources in the form of more policeman, judges and juries

- Judges and juries may be unwilling to convict offenders if punishments are set very high

3 Shifts in the Behavioral Relations

An increase in the marginal damage from a given number of offenses, D', increases the marginal cost of changing offenses by a change in either p or f. The

optimal number of offenses would necessarily decrease, because the optimal values of p and f would increase. In this case, optimal p and f move in the same direction.

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- Optimal probability of apprehension and conviction and the punishment when conviction would be greater for more serious offense

Since an increase in marginal cost of apprehension, C' has identical effects as an increase in D', it must reduce the number of offenses. On the other hand, increase in C_p has no direct effect on the MC of changing offenses with f and reduces the cost of charging offenses by p. Hence, optimal p would decrease and only partially compensated with an increase f, so that the optimal number of offenses go up. Accordingly, an increase in both C' and C_p must increase the optimal f but can increase or decrease the optimal p and number of offenses depending on the importance of C' and C_p.

- Although an improvement in technology and reform may or may not increase the optimal p and reduce number of offenses but it does reduce the optimal f and thus the need to rely on severe punishmens for those convicted. This explains why secular improvement in police technology and reform goes hand in hand with decline severity of punishments.

The income of a firm would usually be larger if it could be separate, at little cost, its total market into sub markets that have substantially different elasticities of demand: higher prices would be charge in sub markets having lower elasticities. Similarly, if total market offenses could be separated into subs markets, the results imply that if $b > 0$ the total loss would be reduced by charging lower prices- lower $p's$ and $f's$ - in less elastic sub markets.

- Unpremeditated murderers are supposed to act impulsively, and therefore, to be relatively unresponsive to size of punishments; likewise, the insane or young are probably less affected by increase in the probability of conviction or the punishment when convicted. Hence, the relatively smaller prison terms and greater use of probation are used for such groups

An increase in b increases the marginal revenue from changing the number of offenses by changing p or f and thereby, increases the optimal number of offenses, reduces the optimal value of f, and increase the optimal value p.

- Optimal f would be smaller and optimal p would be larger for punishment such as imprisonment relative to fines

4 Fines

4.1 Optimality Conditions

If $b = 0$, say, because punishment was by fine, and the cost of apprehending convicting offenders were also zero, the two optimality condition in (4) and (5) would reduce to

$$
\begin{aligned}
D'(O) &= 0 \\
G'(O) &= H'(O)
\end{aligned}
$$

The monetary value of penalties would equal to marginal harm caused by offenses.

- If marginal harm always exceed marginal gain, then the optimum level of crime is 0.

If cost of apprehension and convictions were not zero, then the optimality condition would have incorporate the marginal cost as well as marginal damages and would become, if probability of conviction is assumed to be 1

$$
D'(O) + C'(O, 1) = 0 \tag{6}
$$

Equation (6) would hold if the fine equaled the sum of marginal harm and marginal cost

$$
f = H'(O) + C'(O, 1)
$$

- Offenders have to compensate for the cost of catching them as well as for the farm they directly do

4.2 The case for fines

This subsection argues that fine should be used whenever feasible

- Probation and institutionalization used up social resources, and fines do not, since the latter are basically just transfer of payments, while the former use resources in form of prison fatalities and offender's own time

- It is hard to determine the marginal gains and marginal harms of crimes, thus making it hard to determine the level of fine

- Optimal fines at the margin fully compensate victims and restore the status quo ex ante, so that victims are no worse off than if offenses were not committed. Not only do other punishments fail to compensate, but also require "victims" to spend additional resources in carrying out punishment. Hence, there is additional punishment towards "ex-convicts"(people who went to jail) since they did not pay the debt to the society but there is no additional punishments for "ex-finees"

- Fines can be considered the price of an offense but so do any other form of offense; for example, the price of stealing a car is six month jail. The only difference is the measurement units. So, fines are not immoral

- Optimal fines should depend directly on social loss inflicted by the crime and not directly on offenders' income, race and etc

- Monetary value of a given fine is the same for all offenders but not the "value" of a given sentence prison sentence or probation period is not; the latter is generally positively related to an offender's income

- Rich offenders are more likely to choose to pay fine instead of going to jail since cost of staying in prison is higher for them. On the other hand, poorer offenders have an incentive to choose jail over paying fine. This implication is that the probability of conviction would be systematically related to earnings of offenders: negatively for offenses punishable by imprisonment and positively for those punishable by fines

- In certain cases where the harm exceeds the resource of offenders, other forms of punishment are required. Hence, crime like murder which is so heinous that no amount of money can compensate for are punished by lifetime imprisonment or capital punishment

- Since fines are preferable, it also suggests the need for a flexible system of installment fines to enable offenders to pay fine more readily and thus avoid other punishments.

- If some offenders could pay a fine for a given offense and others could not, the former should be punished solely by fine while the latter partly by other methods

- If a rich man purchases and a poor man steals one, the former is congratulate while the latter is put in jail. Yet the rich man purchases is "equivalent" to a "theft" subsequently compensated by a "fine" equal to the price of car, while the poor man, in effect, goes to prison because he can't afford to pay for this "fine"

- Optimal prison term is unfair only when the monetary equivalent of prison term is higher than optimal fine

4.3 Compensation and Criminal Law

If punishments were by fine, minimizing the social loss form offenses would be equivalent to compensating "victims" fully, and deterrence or vengeance could only be partially pursued. If the case of fines were accepted, and optimal fines become the norm, the approach towards criminal law would change. Hence, a criminal action would not be defined fundamentally by the nature of the action, but the inability to pay for the harm he caused.

- Case for outlawing constraints of trade: If compensation were stressed, the main purpose of legal proceedings would be to levy fines equal to the harm inflicted on society by constraints of trade. There is no point of imprisonment or dissolution of companies. If the optimal fines were levied, firm would automatically cease any constraints to trade, because the gain to them would be less than the harm they cause and thus less than fines expected

- If valid, compensating fines would discourage all constraints of trade. If not valid, such fines would permit the socially desirable constraints to continue, and at the same time, would compensate society for the harm done

4.4 Private Expenditures against Crime

- Whereas most punishments result in a net loss to society as a whole, they often produce a gain for actual victims. For instance, punishment by fines given to actual victims is just a transfer payment for society but it is clear gain to victims; similarly, punishment by imprisonment is a net loss to society but is a negligible loss to victims, since they usually pay a negligible part of imprisonment costs.

5 Some Applications

5.1 Optimal Benefits

- A system of cash prizes would have many advantages over patent system similar to the advantages of fines have over other punishments. A patent system requires cost of hiring of lawyers to establish the patents, cost of maintain the patent and less extensive use of an invention than otherwise occur since monopoly power is created. On the other hand, in the cash prizes system, inventors are compensated for social value of their invention and there is no other costs to it. However, it is hard to measure the social value of the invention.

5.2 The Effectiveness of Public Policy

- An important determinant of cost of crime is the time between commission and detection of an offense. For the earlier an offense is detected, the earlier the police can be brought in and more likely the victim is able to identify the offender. This suggest effectiveness is greater for robbery than for a related feloney like burglary.

5.3 A Theory of Collusion

- The gain to firms from colluding is positively related to the elasticity of their marginal costs curves and inversely related to the elasticity of their collective demand curve

- If cost of collusion is zero, the optimal solution would obviously to eliminate all of them and engage pure monopoly pricing

- The first costs of collusion is discovering violation and "apprehending violators". This cost is greater the greater the desired probability of detection and the number of violations. The latter is related to the number of firms in an industry, which partly explains why monopoly power is related to concentration.

- The second cost to collusion to punishing violators. The most efficient punishment is where fines are levied against violator and collected by the collusion. However, if fine and legal recourse is ruled out, methods like predatory-pricing and violence hurt both violators and the collusions

- Optimal prices would be closer to competitive position the more elastic the demand curves were, the greater the number of buyers and sellers, the less transferable punishments were, and the more hostile to collusion government were

- In US where collusion is banned, illegal industries is better at colluding since force and illegal methods could be used against violators. In Germany where collusions are legalized, those in legal industries is better at colluding since they can prosecute violators legally.

6 T/F/U Questions

1. Capital punishments should be replaced with imprisonment for life. **ANS**: Uncertain. The social cost of punishments would likely to increase since imprisonment for life increases the need for prison facilities. On the hand, the probability of conviction may actually increase. This is because jury and judges are more likely to convict someone when the punishment is less severe. If the people who commit crime is risk preferrers, an increase in probability of getting convicted decreases the expected utility of commiting crime more than the increase the severity of punishment. This implies that reduction in the severity of punishment(from capital punishments to imprisonment for life) together with an increase in the probability of getting punished may actually lowers the expected utility of comitting crime. Hence, deterrence for crime may actually increase, and there is social welfare gain from this increase.

2. Rich people would pay a higher fine in exchange for shorter prison sentence. **ANS:** True. The cost of time staying in jail is higher for people

with high income. Hence, they have a willing to pay a higher fine for shorter prison sentence.

3. Athletes should be given the freedom to use performance enhancing drugs since the athletes who choose use the drugs has a higher benefit than cost of using them. **ANS:** False. Rewards of athletes are related to victories in sporting events. Hence, if using performance enhancing drugs does improve athletes' probability victory, than the athlete is basically using the drug because the reward exceeds the health cost of drugs. However, the problem arises when many athletes use drugs; the overall outcome is essentially zero sum in the sense that the performance of these athletes has improved without having much effect on who wins the game; this is essentially a rent-seeking behavior which has a social costs. In addition, usage of drugs by leading athletes may encourage the usage of drugs by teenagers who wish to become successful athletes. These teenagers may lack the maturity to do the cost-benefit analysis of drug usage and thus, imposing a cost on their health without much gain.

4. Collective punishments is efficient. **ANS:** Uncertain. Collective punishment is effective when someone other than the actual perpetrator of a wrongful act may have more information that he could, if motivated, use to prevent the act that the government has. However, collective punishment often times punish innocent members of a group. This cost of punishing innocent members of the group may exceed the benefit of collective punishment, making collective punishment inefficient.