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Abstract

Agents may commit a crime twice. The act is inefficient so that the agents are to be deterred. Even if an agent is law abiding, she may still commit the act accidentally. The agents are wealth constrained. The government seeks to minimize the probability of apprehension. If the benefit from the crime is small, the optimal sanction scheme is decreasing in the number of offenses. In contrast, if the benefit is large, sanctions are increasing in the number of offenses. Increasing sanctions do not make the criminal track less attractive; they make being being honest more attractive.
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1. Introduction

Most legal systems punish repeat offenders more severely for the same offense than non-repeat offenders. Second-time offenders, for example, receive more severe punishment than first-time offenders. Penalty escalation characterizes traditional crimes such as theft and murder, but also violations of environmental and labor regulations, tax evasion, etc. This principle of escalating sanctions based on offense history is so widely accepted that it is embedded in many penal codes and sentencing guidelines.

For the rather well developed law and economics literature on optimal law enforcement escalating sanction schemes are a puzzle.[1] This literature looks for an efficiency-based rationale for such a practice. Does a sanction scheme that maximizes welfare (defined as the sum of individuals' benefits minus the harm caused by their acts minus enforcement costs) indeed have the property of sanctions increasing with offense history? So far the results have been mixed. At the very best the literature, which we describe at the end of this introduction, has shown that under rather special circumstances escalating penalty schemes may be optimal.

The purpose of this paper is to provide a new explanation for increasing sanctions. We consider agents who choose whether or not to become criminals. If they choose the criminal track, they commit the act twice. The criminal market thus has a barrier to exit. An agent may join a criminal organization engaging in smuggling; to evade taxes a person may accept an illicit job; a firm may install a pollution abatement device that is not sufficient; a trucking company may accept a just-in-time shipment it can only handle ignoring speed limits.

If the agents opt to be law abiding, they may still commit the act by mistake in each period. A traveller may unknowingly not declare merchandize at the customs; a taxpayer may want to give a true account of her earnings, yet she may by mistake forget a source of income in her declaration; a firm may accidentally pollute the environment; a driver may miss a speed limit on the highway.

The act is inefficient; the agents are thus to be deterred. The agents are wealth constrained so that increasing the fine for the first offense means a

[1] See, e.g., Garoupa (1997) or Polinsky and Shavell (2000) for surveys of this literature.

reduction in the possible sanction for the second offense and vice versa. The government seeks to minimize the probability of apprehension.

We find that when the benefit from the offense is high, sanctions that increase with offense history are optimal; when the benefit is low, decreasing sanctions minimize enforcement costs. When the benefit from the act is high in relation to the agents' wealth, a high probability of apprehension is necessary to deter. With a high probability of apprehension, raising the sanction for the second offense at the expense of sanction for the first offense makes being honest very attractive: the probability of committing the act unintentionally twice is low. The government uses escalating sanctions not to make being a criminal less attractive but to make being honest more attractive.

When the benefit from the act is low, a low probability of apprehension is sufficient to deter. With a low probability of apprehension, raising the sanction for the first offense at the expense of the fine for the second offense makes being a criminal less attractive: the probability of being apprehended once is higher than being apprehended twice. The government uses decreasing sanctions to make the criminal carrier less attractive.

The idea to take into account the fact that people commit crimes by mistakes has been used by several authors to explain escalating penalties. For example, Stigler (1970, pp. 528-29) argues "that the first-time offender may have committed the offense almost accidentally and (given any punishment) with negligible probability of repetition, so heavy punishments (which have substantial costs to the state) are unnecessary." Similarly, Rubinstein (1979) and Chu, Hu, and Huang (2000) explicitly consider the cost of erroneously convicting innocent offenders. In all these papers the optimality of escalating penalties is driven by the cost of punishing unintentional offenses. We do not consider such a cost. In our set-up all offenses, intentional and unintentional, give rise to the same benefits and harms and are fined with the same amount. Escalating sanctions may be optimal because they make obeying the law more attractive.[2]

Let us now discuss the related literature in some more detail. In Rubinstein (1979) even if an agent abides by the law, she may commit the

[2]See Dana (2001) for a critical discussion of unintentional acts. In contrast, Posner (1986, p. 207) argues that for any crime that involves an element of negligence or strict liability there is a risk of accidental violation of the criminal law.

act accidentally. The government wishes to punish deliberate offenses but not accidental ones. Rubinstein shows that in the infinitely repeated game an equilibrium exists where the government does not punish agents with a "reasonable" criminal record and the agents refrain from deliberate offenses.

Rubinstein (1980) considers a setup where an agent can commit two crimes. A high penalty for the second crime is exogenously given. The sanction for the first crime may be lower than the sanction for the second crime. Rubinstein shows that for any set of parameters there exists a utility function such that deterrence is higher if the sanction for the first crime is lower than the sanction for the second crime. Rubinstein does not allow for the second sanction to be lower than the first one.

Landsberger and Meilijson (1982) develop a dynamic model with repeat offenses. Their concern is how prior offenses should affect the probability of detection rather than the level of punishments.

In Polinsky and Rubinfeld (1991) agents receive an acceptable as well as an illicit gain from the criminal activity. The government cannot observe the illicit gains. Repeat offenses are, however, a signal of a high illicit gain. For certain parameter values of the model it may be optimal to punish repeat offenders more severely.

In Burnovski and Safra (1994) agents decide ex ante on the optimal number of crimes. They show that if the probability of detection is sufficiently small, reducing the sanction on subsequent crimes while increasing the penalty on previous crimes reduces the overall criminal activity. This result is similar to our result when the benefit and the probability of apprehension are low. We also derive the optimal sanction scheme when the probability of apprehension is high. Moreover, we derive the policy that minimizes enforcement costs.

In Polinsky and Shavell (1998) agents live for two periods and can commit a crime twice. The government observes the agent's age and her criminal record. They show that the following policy may be optimal: Young first-time offenders and old second-time offenders are penalized with the maximum sanction. Old first-time offenders may be treated leniently. Accordingly, this result does not say that repeat offenders are punished more severely; old first-time offenders may be punished less severely than old repeat- and young first-time offenders.

Chu, Hu, and Huang (2000) consider like Rubinstein (1979) a legal system that may convict innocent offenders. The government takes the possibility of erroneous conviction as a social cost into account. The optimal penalty scheme punishes repeat offenders (slightly) more than first-time offenders. Reducing the penalty for first-time and increasing it slightly for repeat offenders has no effect on deterrence. The cost of erroneous convictions is, however, reduced because the probability of repeated erroneous conviction is lower than for first-time mistakes.

Dana (2001) argues that contrary to the assumptions in the literature, probabilities of detection increase for repeat offenders. As a result, the optimal deterrence model dictates declining, rather than escalating, penalties for repeat offenders. Taking the salience and optimism biases from behavioral economics into account makes the case for declining penalties even stronger.

Baik and Kim (2001) extend Polinsky and Rubinfeld (1991) by introducing the possibility of social learning of illicit gains between the two periods. If social learning is more important than the inherent characteristics in inducing offenses, it may be optimal to punish first-time offenders as severely as repeat offenders.

Emons (2003) considers a similar set-up as we do here. There, however, agents do not commit the act accidentally. Agents can choose more strategies than they can in this paper; in particular, they can pick history-dependent strategies. There we show that it is optimal to punish first-time offenders as harshly as possible while the second offense is not punished at all.

Emons (2004) asks the question whether the decreasing sanction scheme of Emons (2003) is subgame-perfect. Does a rent-seeking government stick to the decreasing sanction scheme once a crime has occurred? If the benefit and/or the harm from the crime are not too large, this is indeed the case; otherwise, equal sanctions for both crimes are optimal.

In the next section we describe the model and derive our basic result. Section 3 concludes.

2. The Model

Consider a set of individuals who live for two periods. In each period the agents can engage in an illegal activity, such as speeding, polluting the environment, or evading taxes. If an agent commits the act in either period, she receives a monetary benefit $b > 0$. Yet the act causes a monetary harm $h > 0$ to society. The harm h is sufficiently higher than the benefit b so that the act is not socially desirable. The individuals are to be deterred from the activity.[3]

To do so the government chooses sanctions. The government cannot tell whether an agent is in the first or second period of her life. The government only observes whether the crime is the first or the second one. Accordingly, the government uses fines $s_1, s_2 \geq 0$ where s_1 applies to first-time and s_2 to second-time observed offenders. Moreover, the government chooses a probability of apprehension p. This probability is the same for first- and second-time offenses.[4] To save on notation we take p as a measure of the enforcement cost. Since apprehension is costly, the government wishes to minimize p.

Individuals are risk neutral and maximize expected income. They have initial wealth $W > 0$. Think of W as the value of the privately owned house or assets with a long maturity. The agents hold on to their wealth over both periods unless government interferes with sanctions. Any additional income they receive in both periods, be it through legal or illegal activities, is consumed immediately. Accordingly, all the government can confiscate is W. If the fine exceeds the agent's wealth, she goes bankrupt and the government seizes the remaining assets. This implies that the fines s_1 and s_2 have to satisfy the "budget constraint" $s_1 + s_2 \leq W$.[5]

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[3] We will give the exact condition as to the size of the harm later on. We assume that the benefits and the harms are the same for both crimes. If, say, the benefit of the second crime were much higher than the benefit of the first one, this might provide a rationale for escalating penalties.

[4] We thus rule out the case where agents with a criminal record are more closely monitored than agents without a record. See Landsberger and Meilijson (1982) for an analysis of optimal detection probabilities.

[5] This assumption distinguishes our approach from Polinsky and Shavell (1998) who work with a maximum per period sanction s_m. Accordingly, they may set $s_1 = s_2 = s_m$, which is typically the optimal enforcement scheme. In their framework s_m is like a per

To save on notation let the interest rate be zero. An agent can choose between the following two strategies:

- She can choose to be law abiding. This means that she does not commit the act deliberately in both periods. She may, however, commit the act accidentally. More specifically, in each period she may commit the act by mistake with probability $\alpha \in (0,1)$. If she commits the act accidentally, she receives the benefit b and has to pay the sanctions if apprehended. We call this strategy (0,0) which gives rise to utility

  $$U(0,0) = W + 2(1-\alpha)\alpha(b - ps_1) + \alpha^2[2b - ps_1 - p((1-p)s_1 + ps_2)] =$$

  $$W + 2\alpha(b - ps_1) + \alpha^2 p^2(s_1 - s_2).$$

  With probability $(1-\alpha)^2$ the agent does not commit the act at all. With probability $\alpha(1-\alpha)$ she commits the act in period 1 and not in 2 (or in period 2 and not in 1). In either case she receives the benefit b; with probability p she is apprehended and fined s_1. With probability α^2 she commits the act twice. With probability p the agent has a criminal record in the second period and thus is fined s_2; with probability $(1-p)$ she has no record and pays s_1 if apprehended. This is the strategy we wish to implement.

- The agent can choose to be a criminal. Then she commits the act deliberately in both periods which we denote by $(1,1)$. Being a criminal generates utility

  $$U(1,1) = W + b - ps_1 + b - p((1-p)s_1 + ps_2).$$

  For both acts she receives the benefit b. With probability p she is apprehended for the first crime and fined s_1. The second crime is detected with probability p. With probability p the agent has a criminal record in the second period and thus is fined s_2; with probability $(1-p)$ she has no record and pays s_1 if apprehended.

period income which cannot be transferred into the next period. Burnovski and Safra (1994) use the same budget constraint as we do.

Before we start deriving the optimal sanctions, we have to ensure that the government indeed wants complete deterrence. Without any deterrence welfare amounts to $2(b-h)$. Everybody commits the crime twice and there are no enforcement costs. If the government completely deters with the maximum enforcement cost of 1 (recall that we take the probability of apprehension p as a measure of the enforcement cost), welfare is $2\alpha(1-\alpha)(b-h)+2\alpha^2(b-h)-1$. Accordingly, if $1 < 2(h-b)(1-(1-\alpha)\alpha-\alpha^2)$ the government wants complete deterrence at any cost.

Let us now derive sanctions that give the agents proper incentives not to become criminals. The agent is law abiding if $U(1,1) \leq U(0,0)$. Straightforward computations confirm that the agent does not become a criminal, if

$$s_2 \geq \frac{2b}{p^2(1+\alpha)} - s_1 \left[\frac{2}{p(1+\alpha)} - 1\right]. \tag{1}$$

Accordingly, with all sanction schemes (s_1, s_2) satisfying (1) the agent has proper incentives and becomes no criminal. For example, the equal sanction scheme $s_1 = s_2 = b/p$ induces no crimes. So do the two corner solutions $(\hat{s}_1, 0) = (2b/(2p - p^2(1+\alpha)), 0)$ and $(0, \hat{s}_2) = (0, 2b/(p^2(1+\alpha)))$. Note that $(\hat{s}_1, 0)$ is decreasing and $(0, \hat{s}_2)$ is increasing in the number of offenses. Due to the linearity of our problem the two corner solutions $(\hat{s}_1, 0)$ and $(0, \hat{s}_2)$ are of particular interest.

In a preliminary step let us check when, for given p and α, $\hat{s}_1 \geq \hat{s}_2$. Once we know this, minimizing enforcement costs while deterring individuals is straightforward. Here we have

$$\hat{s}_1 = \frac{2b}{2p - p^2(1+\alpha)} \geq \hat{s}_2 = \frac{2b}{p^2(1+\alpha)} \Leftrightarrow p \geq \frac{1}{1+\alpha}$$

insert **Figure 1** around here

Accordingly, for all combinations (α, p) in the shaded are of Figure 1 the sanction $\hat{s}_2$ which deters all by itself is lower than the corresponding sanction $\hat{s}_1$. To put it differently, in the shaded area $\hat{s}_2$ provides better deterrence than $\hat{s}_1$. The intuition is as follows: Suppose we increase s_2 by one at the expense of s_1. This exercise raises $U(0,0)$ by $2\alpha(p - \alpha p^2)$ and $U(1,1)$ by $2(p - p^2)$. If $p \geq 1/(1+\alpha)$, the utility of obeying the law increases by more than the utility of being a criminal. If p is sufficiently high, the utility of a criminal increases by little because being apprehended for the second act is almost as likely as for the first act. The law abiding agent gains more from this exercise because for her the probability of committing the act twice is lower than committing the act only once. Only when $\alpha = 0$, the law abiding agent does not gain. Then we are in the scenario of Emons (2003); in this case it is optimal to work with $\hat{s}_1$ only to make strategy (1,1) as unattractive as possible.

Let us next tackle the task of minimizing the enforcement costs, as given by p, while providing incentives not to commit any crime.[6] Obviously, Becker's (1968) maximum fine result applies here, meaning that in order to minimize p the government will use the agent's entire wealth for sanctions.[7] Combined with our preliminary result this implies that we will set either $s_1 = W$ or $s_2 = W$ depending on which sanction provides better deterrence. This is a function of the probability of apprehension p which, in turn, depends on the benefit from the crime b: given the maximum fine W, p has to go up if b increases to maintain deterrence. Therefore, all we have to do is to compute the benefit b giving rise to the critical probability of apprehension $p = 1/(1+\alpha)$ when we optimally set $\hat{s}_2 = W$ (or alternatively $\hat{s}_1 = W$).[8] This yields $b = W/(2(1+\alpha))$. Accordingly, we have the following

Proposition:

i) If $b < W/(2(1+\alpha))$, the optimal sanctions are $s_1^* = W$ and $s_2^* = 0$ and $p^* = 1/(1+\alpha) - \sqrt{1/(1+\alpha)^2 - 2b/W(1+\alpha)}$;

ii) if $b = W/(2(1+\alpha))$, the optimal sanctions are $s_1^* \in [0, W]$ and $s_2^* = W - s_1^*$ and $p^* = 1/(1+\alpha)$;

iii) if $b \in (W/(2(1+\alpha)), W(1+\alpha)/2]$, the optimal sanctions are $s_1^* = 0$ and $s_2^* = W$ and $p^* = \sqrt{2b/W(1+\alpha)}$;

iv) if $b > W(1+\alpha)/2$, deterrence is not possible.

We thus find that when b is small the optimal sanction scheme sets $s_1^* = W$ and $s_2^* = 0$. First time offenders are punished with the maxi-

[6] Since in our setup the harm of the crime exceeds its benefit, maximizing social welfare boils down to minimizing enforcement costs.

[7] If $s_1 + s_2 < W$, sanctions can be raised and p lowered so as to keep deterrence constant.

[8] Stated differently, we minimize p subject to (1) and $s_1 + s_2 = W$. Plugging the budget constraint into (1) and differentiating the equality yields $dp/ds_1 = 2p(1-p(1+\alpha))/(4b(1+\alpha) + 2s_1$ with $dp/ds_1 \geq (<)\ 0$ if $p \geq (<)\ 1/(1+\alpha)$.

mal possible sanction while second time offenders are not punished at all. When $b = W/(2(1+\alpha))$ and thus $p^* = 1/(1+\alpha)$ any combination of sanctions is optimal. The government can, for example, choose equal sanctions $s_1^* = s_2^* = W/2$. When b is large optimal sanctions are increasing in the number of offenses; more specifically, the first offense comes for free and second one is punished with the maximum penalty W.

We may summarize as follows. When the benefit from the act is high in relation to the agents' wealth, a high probability of apprehension is necessary to deter. With a high probability of apprehension raising s_2 at the expense of s_1 makes being honest attractive because the probability of committing the act twice accidentally is low. The government uses increasing sanctions not to make being a criminal less attractive but to make being honest more attractive.

When the benefit from the act is low, a low probability of apprehension is sufficient to deter. With a low probability of apprehension raising s_1 at the expense of s_2 makes being a criminal less attractive because the probability of being apprehended once is higher than being apprehended twice. The government uses decreasing sanctions to make being a criminal less attractive.

What happens if α increases while b remains constant? The critical level $W/(2(1+\alpha))$ goes down, making it more likely that b exceeds the critical level. As errors become more common, escalating sanctions are more likely to be optimal. Further note that p^* goes down with α. If α goes up, so does $U(0,0)$ while $U(1,1)$ remains unchanged. Since being honest becomes more attractive, a lower probability of apprehension is sufficient to deter.[9]

Our results may also be interpreted somewhat differently. Suppose the government wants a high probability of apprehension p not to minimize enforcement costs but for, say, reasons of justice or due to political pressure. Then our result implies that for given high p deterrence is higher with escalating penalties. Next suppose the government decides to monitor first time offenders more closely so that the probability of detecting the second crime is higher than p. Then our result that increasing penalties may provide better deterrence than decreasing sanctions still holds qualitatively. Accordingly, escalating sanctions may be consistent with a higher probability of detection

[9]If we increase the number of crimes, our result that escalating sanctions are optimal for high p still holds qualitatively.

in the second period.

At this point it is important to stress that our results only hold because our agents simply choose between obeying the law and becoming a criminal which, in turn, means committing the act twice. If we allow for more strategies such as committing the act only in period one and then stop, or only in period two, or in period in one and in period two only if not apprehended in period one etc., the picture is less clear-cut.[10] Nevertheless, on can easily think of situations where the choice is as simple as in our model, e.g., an youngster contemplates joining a gang, a firm decides whether or not to install a necessary pollution abatement device, a firm thinks about hiring illegal immigrants etc.

3. Conclusions

The purpose of this paper is to give a rational for escalating penalties. When the benefit from the crime and thus the probability apprehension is low, cost minimizing deterrence is decreasing; when the benefit and the probability of apprehension are high, sanctions are increasing in the number of offenses. Escalating penalties make both, the criminal and the law abiding agent better off. Yet, with a high probability of apprehension the law abiding agent gains relatively more from moving to increasing sanctions. Accordingly, escalating penalties are used not to make the criminal career less attractive but to make being honest more attractive.

An interesting topic for future research is to check whether penal codes and sentencing guidelines indeed recommend the use of escalating sanctions based on offense history when the benefit of crime and the probability of apprehension are high.

[10] See Emons (2003, 2004) for an analysis with all these strategies, yet without unintentional crimes.

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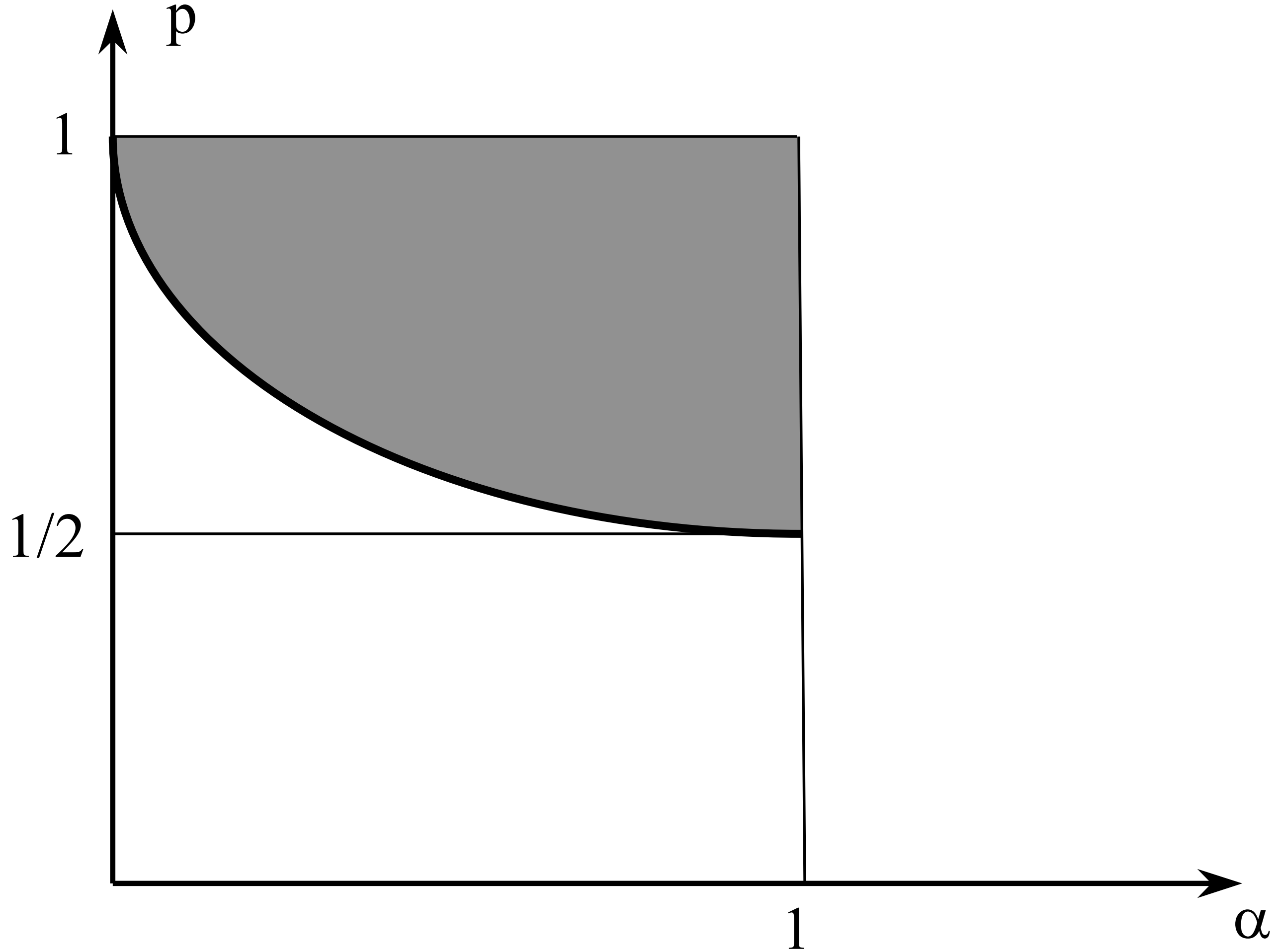

Figure 1: Increasing sanctions are optimal in the shaded area and decreasing sanctions in the non-shaded area.