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Amnesties and Co-operation

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Abstract

One of the costs of anticipated amnesties is current and future non-compliance with the law. Relatively to a no-amnesty situation, efficient enforcement policies may therefore differ when an amnesty is offered. To study this question, a model is built in which individuals impose a cost on society when they commit a crime. When a criminal participates in an amnesty, or (to a lesser extent) when he is caught, some fraction of the social cost is recovered, reflecting co-operation with the authorities. The analysis characterizes efficient anticipated amnesties. It is shown that the efficient level of enforcement may be smaller in the case of an anticipated amnesty than in a no-amnesty situation. The reason is that despite the increase in the initial number of criminals generated by the amnesty, many criminals eventually participate in it. If participants in the amnesty are very co-operative, then a large proportion of the social cost is recovered making the initial increase in the number of criminals less costly. The optimal level of the reduced sanction imposed on those who participate in the amnesty is also characterized.

1. Introduction

Amnesties are not frequent although they seem to have become more prevalent recently. In the United States, they have been given for tax evasion,[1] unreturned library books,[2] parking tickets, draft evasion,[3] and illegal immigration. In June 1996, following the Dunblane tragedy, a firearm amnesty was offered in England, Scotland, and Wales. In France, it is now a tradition for newly elected *Président de la République* to give an amnesty for minor violations to the law.[4] There is also the case of South Korea that gave an amnesty to illegal immigrants in 1992, and of Canada in which there is a policy of granting immunity to tax evaders who voluntarily pay their delinquent taxes, an implicit amnesty (Andreoni, 1990). Finally, one has to note that amnesties for tax evasion have now been used in at least 21 countries other than Canada and the U.S.[5]

Studying amnesties is important because our knowledge of this practice is far from com-plete and because another round of amnesties is likely to take place. Indeed, it is reasonable to think that the conditions that made it optimal to offer amnesties in the late 1980s and early 1990s could be met again and again in the future. The benefits and costs of amnesties have been described by Leonard and Zeckhauser (1987). Among the benefits of an amnesty, they mention the reduction in guilt of the criminals, and the smoothing of a transition to a regime of a stricter enforcement.[6] As to the costs, they list the increased feelings by honest citizens that the law is unfair, and the encouragement to future non-compliance as future amnesties are expected to occur.[7] This last point is probably the most important concern of opponents to the use of amnesties. Because amnesties were so popular in the later 1980s and early 1990s, people may anticipate that a new round of amnesties will soon take place and modify their behavior accordingly.[8] Yet, an increase in non-compliance does not *per se* mean that an amnesty is not efficient (Andreoni, 1990).

Because non-compliance is expected to rise, one might think that it would be efficient to increase enforcement after an amnesty has been offered. Indeed, Alm, McKee, and Beck (1990), using experimental methods, found that the average level of compliance falls after an amnesty has taken place. However, they also obtained that if enforcement is increased after an amnesty, then the level of compliance may increase. Malik and Schwab (1991) studied the desirability of amnesties when the probability that an amnesty will be offered and the level of enforcement are chosen optimally. In their paper, the authority can only select one level of enforcement, and this level will be implemented whether an amnesty actually takes place or not. In the current analysis, the probability that an amnesty will take place is either zero or one, and we allow the authority to select the optimal level of enforcement in each case.

Examining the characteristics of the crimes for which amnesties are most commonly used, one can note two things. The first one is that the authority, by declaring an amnesty, is able to recover a portion of the social cost of crimes. For example, by declaring an amnesty, some authorities have been able to recover evaded taxes or potentially harmful illegally owned guns. We will show that this feature is an important determinant of the efficiency of an amnesty. We will also show that it affects the efficient level of enforcement. Secondly, for most amnesties, the reduced sanction imposed on participants is usually zero. This paper establishes the conditions under which it is efficient for the authority to set the reduced sanction at zero. Note that in this paper, we will focus on amnesties offered to criminals which have not been caught.[9] Possible examples of such amnesties are tax evasion, firearm possession, or illegal immigration.

The main objective of this paper is to study the impact of there being an amnesty on the efficient level of enforcement. For this purpose, we build a model in which the individuals contemplate committing a crime that pays off some private gain but also imposes some cost to society. To deter criminal activities, the authority invests resources in enforcement and sanction the criminals that are caught. We suppose that when a criminal is caught, a fraction γ of the social cost of crime is recovered. For example, evaded taxes may be recovered when a tax evader is identified.[10] Note however that it is likely that the authority will not be able to recover the totality of the social cost. For example, a tax evader may not reveal the exact amount of his concealed income, even after having been identified. Amnesties are then introduced. We are interested in amnesties that are desirable (in the sense that they reduce total cost) and fully anticipated. Intuitively, the case of a fully anticipated amnesty is a good benchmark because it is the worse in terms of non-compliance. Amnesties consist in a criminal confessing to his crime in exchange of a reduced sanction. An important feature of our model is that when an individual participates in an amnesty, he *co-operates* with the authorities and so, a larger fraction, say β, of the social cost of crime is recovered than when a criminal is caught ($\beta \geq \gamma$).[11] There are several examples of co-operation in the real world:[12] payment of delinquent taxes or return of illegally owned firearms, etc. We then characterize the efficient level of enforcement under two regimes: no-amnesty and anticipated amnesty. We suppose that the authority minimizes the sum of the cost of enforcement and of the net social cost of crime.[13] We then compare the level of enforcement in the two regimes. It turns out that this comparison is generally ambiguous, but that clear cut analytical results can be obtained for the case where the distribution of gain from crime is uniform. We also present numerical results for the more general model.

This paper is organized as follows. In the next section, we present the basic model. In Section 3, amnesties are introduced and the private sector behavior characterized for given levels of enforcement. The fourth section addresses the issue of efficient policies in the two regimes. The conclusion follows.

2. The Model

Consider the following simple economy. All the individuals in the economy earn the same exogenous income y, are risk neutral, and have the same utility function $U(y) = y$. All of them also have the opportunity to commit a crime. The gain from committing the crime is denoted g and varies across individuals. It is distributed according to a continuous distribution function with density $f(g)$ and cumulative $F(g)$ over support $[g^\ell, g^h]$. The gain g of an individual is private information. The authority cannot observe each agent's gain, but knows the distribution of gain in society. When an agent commits a crime, he imposes a cost Z to society. We suppose that for all crime, the social cost is larger than the private gain, i.e. $Z > g^h$. Therefore, all crimes are undesirable.

In order to deter crime, the authority invests in enforcement α and imposes a sanction S on any criminal who is caught. Investing α implies enforcement cost $C(\alpha)$, where $C' > 0$ and $C'' > 0$, and translates into a probability of detection α.[14] The sanction S is costless for the authority. For the remainder of the analysis, the sanction is assumed fixed and exogenous. When the authority detects a criminal, the criminal's gain g is dissipated,[15] and he is administered the sanction S. For that particular criminal, society recovers a portion $\gamma \in [0, 1]$ of the social cost Z (i.e. γZ is recovered).

It is assumed that once an individual has committed a crime, he suffers a shock θ. Instead of enjoying his private gain g, he gets θg. We assume that θ is random: with probability q, $\theta = \lambda < 1$, while with probability $(1 - q)$, $\theta = 1$. A shock $\theta = \lambda$ corresponds to an *ex post* decrease in the value of the gain g. For future use, we denote the expected shock by $\bar{\theta} = q\lambda + (1 - q)$. Note that such a shock is necessary for the amnesty to have an impact. Indeed, if an individual was willing to commit a crime when the sanction was large, then this individual will certainly want to remain a criminal when an amnesty is offered and the sanction is reduced (i.e. the cost of being a criminal is decreased), unless something happens on the side of benefits. In the literature, the occurrence of such shocks is a standard assumption. For example, Andreoni (1990) and Malik and Schwab (1991) introduce a utility shock. In our analysis, the shock could also be interpreted as a utility one, reflecting guilt or regret.[16] An alternative interpretation is that the shock could reflect varying market conditions. For example, the demand for stolen goods could have decreased or their supply increased, these phenomena leading to a decrease in the market price.

The utility of an individual that chooses not to commit a crime (stay honest) is simply his income: $U^H = y$. The utility of an individual who commits a crime is given by:

$$\begin{aligned} E[U^C] &= (1-\alpha)[y + q\lambda g + (1-q)g] + \alpha[y - S] \\ &= y + (1-\alpha)\bar{\theta}g - \alpha S \end{aligned} \tag{1}$$

Of course, an individual chooses to commit a crime only if he is better off doing so, i.e. if $E[U^C] \geq U^H$. Given α, the individual which will be just indifferent between committing and not committing a crime has a potential private gain $\hat{g}(\alpha)$ given by:

$$\hat{g}(\alpha) = \frac{\alpha S}{(1-\alpha)\bar{\theta}} \tag{2}$$

Since U^H is fixed and $E[U^C]$ is increasing in g, all individuals with $g \geq \hat{g}(\alpha)$ will commit a crime while the others will not. Note that $\hat{g}(\alpha)$ is increasing in α (and S) so that an increase in either of these variables will induce a reduction in the number of crimes committed. Also note that $\hat{g}(\alpha)$ is decreasing in $\bar{\theta}$.

3. Amnesties

In this section, we introduce amnesties. For now, we take the level of enforcement α and the reduced sanction s as given. The choice of α and s will be endogenized in next section. As mentioned earlier, we concentrate on the case where amnesties are anticipated.

Suppose the following sequence of events:

(1) The authority announces its enforcement policy, α, and that it will eventually offer an amnesty with reduced sanction s.

(2) Given the announced policy, the individuals decide whether to commit a crime or not.

(3) The individuals that have committed a crime are affected by a shock θ.

(4) The authority declares the (anticipated) amnesty. The amnesty consists of the following:

   (a) An individual who participates in the amnesty confesses that he has committed a crime, his gain g is dissipated, and a reduced sanction s is imposed on him;

   (b) Society recovers a fraction β of the social cost Z, where $1 \geq \beta \geq \gamma \geq 0$;

(4) The individuals that have committed a crime decide whether to participate in the amnesty or not.

(5) Detection takes place, individuals that are still criminals *post*-amnesty are caught or not, and payoffs are awarded.

Note that this sequence of events implicitly assumes that the authority can commit to its announced policy (in stage (1)), even though it might be optimal to revise the chosen policy *ex post*. The analysis will focus on the Subgame Perfect Equilibrium of this game between the authority and potential criminals, taking as given that the authority can commit.[17] Of course, when making its policy choices in stage (1), the authority fully understands the behavior of the private sector in later stages of the game.

We now analyze the criminals' decision to participate in the amnesty. A criminal that decides to participate in the amnesty has utility $U^A = y - s$. On the other hand, if he remains a criminal and draws $\theta = 1$, he gets $y + (1-\alpha)g - \alpha S$, and so he is better off not participating in this case.[18] However, if an individual draws $\theta = \lambda$, he gets $y + (1-\alpha)\lambda g - \alpha S$, and he may choose to participate in the amnesty. For a policy (α, s), a criminal that has drawn $\theta = \lambda$ will be indifferent between participating in the amnesty or not if he is of type $\tilde{g}(\alpha, s)$, which is given by:

$$\tilde{g}(\alpha, s) = \frac{\alpha S - s}{(1-\alpha)\lambda} \tag{3}$$

Note that $\tilde{g}(\alpha, s)$ is increasing in α but decreasing in s. Since U^A is fixed and U^C is increasing in g, we can infer that all the criminals drawing $\theta = \lambda$ will participate in the amnesty if they are of type $g < \tilde{g}(\alpha, s)$, while they will remain criminals otherwise.

Consider now the decision to become a criminal made in stage (1). Although the choice of participating in the amnesty is really made after θ has been revealed, individuals anticipate their future decisions and can therefore be viewed as choosing between three possibilities given a level of enforcement α and sanction s.

The first possibility for the individual is, as before, to choose not to commit a crime and, in that case, his utility is simply $U^H = y$. Secondly, he can choose to commit a crime and to never participate in the amnesty, thereby obtaining expected utility $E[U^C] = y + (1-\alpha)\bar{\theta}g - \alpha S$. Finally, an individual can choose to commit a crime and to participate in the amnesty if he draws $\theta = \lambda$. In that case, his expected utility is given by $E[U^A] = y + (1-\alpha)(1-q)g - \alpha(1-q)S - qs$. Note that U^H is constant while $E[U^C]$ and $E[U^A]$ are both increasing in g.

We already know that $E[U^C] \geq (<) U^H$ if $g \geq (<) \hat{g}(\alpha)$. It can also be seen that $E[U^C] \geq (<) E[U^A]$ if $g \geq (<) \tilde{g}(\alpha, s)$. From these two facts, we can infer that an individual with $g \geq \tilde{g}(\alpha, s)$ will always choose to commit the crime and to never participate in the amnesty.

We also have to compare the utility of not committing a crime with that of committing one and participating in the amnesty when $\theta = \lambda$. Let $\breve{g}(\alpha, s)$ denote the type of an individual who is indifferent between these two alternatives; it is given by:

$$\breve{g}(\alpha, s) = \frac{\alpha S + (q/(1-q))s}{1-\alpha} \tag{4}$$

Note that $\breve{g}(\alpha, s)$ is increasing in α and s.

For an amnesty to have an impact, it has to be the case that (α, s) are set so that $\tilde{g}(\alpha, s) > \hat{g}(\alpha)$. It is possible to obtain that for amnesties that have an impact:[19]

$$\breve{g}(\alpha, s) < \hat{g}(\alpha) < \tilde{g}(\alpha, s) \tag{5}$$

Hence, it is possible to conclude the following. All the individuals with $g < \breve{g}(\alpha, s)$ do not commit a crime while all those with $g \geq \breve{g}(\alpha, s)$ do so. Once the amnesty is declared, the criminals that have drawn $\theta = \lambda$ and that are of type $g < \tilde{g}(\alpha, s)$ participate in it. Those that have drawn $\theta = 1$ and those that have drawn $\theta = \lambda$ but are of type $g \geq \tilde{g}(\alpha, s)$ do not participate in the amnesty. Since $\hat{g}(\alpha) > \breve{g}(\alpha, s)$, more crimes are committed when there is an amnesty than when there is not (for an identical level of enforcement).

4. Efficient Policies

We now turn to the endogenization of the level of enforcement and of the reduced sanction for the participants in the amnesty. Generally, an authority can use two instruments to deter crime: the level of enforcement and that of the sanction. When an authority declares an amnesty, it can also use the level of the reduced sanction for those who participate in the amnesty, s. As mentioned earlier, we suppose that the sanction S for criminals that are caught is fixed and exogenous. In the current model, there are no *good crimes* (since $Z > g^h$) and so, the efficient sanctions are maximal (à la Becker, 1968). We assume that for reasons lying outside the model, they have been set at some non-maximal level and therefore, that all crimes have not been deterred. If we were to make the sanction S endogenous, we would need to introduce justifications for them being less than maximal; this would complicate the analysis and would take us away from our objective of studying enforcement and amnesties.[20] However, the situation is different for the sanction s imposed on the participants to the amnesty. This sanction should not be used for deterrence purposes; this job is better done by the sanction S imposed on the criminals that are caught. The problem with setting s large is that it has an impact on participation in the amnesty. Indeed, if the reduced sanction s is very large ($s > S$) and if $g^\ell \geq 0$ and $\lambda \geq 0$, then no criminal will participate in the amnesty.

We now formally derive the efficient policies. We first characterize the efficient level of enforcement α in the no-amnesty case. We then turn to its determination in the case of an anticipated amnesty, together with that of the reduced sanction s. We also evaluate the desirability of declaring an amnesty. We assume that the authority minimizes the sum of the cost of enforcement and of the social cost of crime.[21] This simple objective leads to interesting results and reflects the trade-off faced by many authorities. Note that we assume that the sanctions S and s do not yield revenues for the authority.

4.1. Case With No Amnesty

Consider first the determination of the efficient level of enforcement in the no-amnesty case. The problem of the authority can be written as:

$$\min_{\alpha} \Omega^N(\alpha) = \left\{ C(\alpha) + \int_{\hat{g}(\alpha)}^{g^h} [1 - \gamma\alpha] Z f(g)\, dg \right\} \tag{6}$$

where the first term represents the cost of enforcement, while the second one is the net social cost of crime, a portion γ of the gross social cost being recovered when a criminal is caught. The efficient level of α, denoted α^N, is the solution to the following rearrangement of the first order condition:[22]

$$\frac{C'(\alpha^N)}{Z} - \gamma[1 - F(\hat{g}(\alpha^N))] - \frac{[1-\gamma\alpha^N]f(\hat{g}(\alpha^N))S}{(1-\alpha^N)^2\bar{\theta}} = 0 \tag{7}$$

Equation (7) shows that the authority faces a trade-off in its choice of enforcement. The first term on the left-hand side is the marginal cost of enforcement while the last two are its marginal benefit, the second term reflecting social cost recovery (through the apprehension of criminals), and the third term capturing the deterrence effect (i.e. the reduction in the number of individuals undertaking criminal activities).

For later use, note that the value of the minimized total cost when no amnesty is declared is $\Omega^N(\alpha^N)$.

4.2. Case With an Anticipated Amnesty

As was mentioned earlier, we assume that the authority can commit to its policies and that it fully anticipates the behavior of the private sector. The problem of the authority is to choose α and s to solve:

$$\min_{\alpha,s} \Omega^A(\alpha, s) = \Bigg\{ C(\alpha) + Z\int_{\breve{g}(\alpha,s)}^{g^h} f(g)\,dg - q\beta Z \int_{\breve{g}(\alpha,s)}^{\tilde{g}(\alpha,s)} f(g)\,dg \\ -(1-q)\alpha\gamma Z \int_{\breve{g}(\alpha,s)}^{\tilde{g}(\alpha,s)} f(g)\,dg - \alpha\gamma Z \int_{\tilde{g}(\alpha,s)}^{g^h} f(g)\,dg \Bigg\}, \tag{8}$$

subject to[23]

$$s \geq 0.$$

The first term of the objective function is simply the cost of enforcement. The second term is the gross social cost of every crime that has been committed. Note that this term depends on the endogenous variables, reflecting the fact that the authority correctly anticipates the response of the private sector to its policy choices. Also note that all the individuals with $g \geq \breve{g}$ (rather than $g \geq \hat{g}$) commit a crime. The third term represents the portion (β) of the social cost that is recovered through the amnesty because the individuals co-operate with the authority. Recall that only those that have $g \in [\breve{g}, \tilde{g}]$ and that suffer a bad shock (a proportion q of all criminals) participate in the amnesty. Finally, the last two terms represent the portion (γ) of the social cost that is recovered through the apprehension of criminals. Recall that criminals are apprehended with probability α and that after the amnesty has been offered, the criminals that are left are either those that have $g > \tilde{g}$ or those that have $g \in [\breve{g}, \tilde{g}]$ and that were not affected by the bad shock (a proportion $1-q$ of all criminals).

We denote the efficient levels of the endogenous variables by (α^A, s^A). They are the solution to the following rearrangement of the first order conditions for α and s, respectively:

$$\frac{C'(\alpha^A)}{Z} - \left(S + \frac{q}{1-q}s^A\right)\frac{[1 - q\beta - (1-q)\gamma\alpha^A]f(\breve{g}(\alpha^A, s^A))}{(1-\alpha^A)^2}$$
$$- \frac{q(S - s^A)[\beta - \gamma\alpha^A]f(\tilde{g}(\alpha^A, s^A))}{\lambda(1-\alpha^A)^2} - \gamma[1 - qF(\tilde{g}(\alpha^A, s^A))$$
$$- (1-q)F(\breve{g}(\alpha^A, s^A))] = 0, \tag{9}$$

$$\frac{Z}{1-\alpha^A}\left[\frac{\begin{array}{c}-qf(\breve{g}(\alpha^A, s^A))(1-q\beta\\ -(1-q)\alpha^A\gamma)\end{array}}{1-q} + \frac{qf(\tilde{g}(\alpha^A, s^A))(\beta + \alpha^A\gamma)}{\lambda}\right] \geq 0, \tag{10a}$$

$$s^A \geq 0, \tag{10b}$$

$$s^A \cdot \frac{Z}{1-\alpha^A}\left[\frac{\begin{array}{c}-qf(\breve{g}(\alpha^A, s^A))(1-q\beta\\ -(1-q)\alpha^A\gamma)\end{array}}{1-q}\right.$$
$$\left. + \frac{qf(\tilde{g}(\alpha^A, s^A))(\beta + \alpha^A\gamma)}{\lambda}\right] = 0. \tag{10c}$$

Equation (9) reflects the trade-off in the choice of enforcement. Its first term on the left-hand side represents the marginal cost of increasing enforcement. The three others enter the marginal benefit of more enforcement. The second term reflects the decrease in the number of individuals that turn criminals when enforcement is increased. As for the third term, it represents the marginal benefit of having an increase in the number of individuals that participate in the amnesty. Finally, the fourth term captures the marginal benefit of more frequent social cost recovery (because more criminals are caught when enforcement increases).

The optimal level of the reduced sanction is characterized in equations (10a), (10b), and (10c). The first term in brackets in equation (10a) reflects the marginal benefit of having less individuals turning criminals when s is increased (because they expect a less generous amnesty). As for the second term in brackets, it captures the marginal cost of having less individuals participating in the amnesty when s is larger. Equations (10b) and (10c) simply state the conditions under which the optimal reduced sanction corresponds to a corner solution ($s = 0$). This will occur if, when evaluated at $s = 0$, the marginal benefit of having less individuals turning criminals is smaller than the marginal cost of a reduced participation in the amnesty.

Note that the value of the minimized total cost when an anticipated amnesty is declared is $\Omega^A(\alpha^A, s^A)$.

Clearly, an authority will only declare an amnesty if it is desirable (i.e. if it reduces the total cost of crime). Therefore, we focus on amnesties such that $\Omega^A(\alpha^A, s^A) \leq \Omega^N(\alpha^N)$. Comparing the level of enforcement chosen in the no-amnesty case (α^N) and that chosen in the anticipated amnesty case (α^A) yields no clear cut results given the current level of generality. It is also difficult to assess whether the constraint $s \geq 0$ will be binding. To obtain results, we therefore take two directions. First, we obtain some analytical results by making a number of assumptions regarding the parameters and the functions of the model. The results obtained support the view that enforcement should be increased when an amnesty is introduced. Second, we performed numerical simulations and we report cases in which a smaller level of enforcement, relative to the no-amnesty situation, can be efficient when an amnesty is anticipated.

4.3. Analytical Results: Case Where the Distribution of Gain is Uniform

Assume that $\gamma = 0$. Hence, if an individual does not participate in the amnesty but is later apprehended, nothing is recovered and the net and gross social costs are the same (no co-operation). Also assume that g is uniformly distributed on $[g^\ell, g^h]$. Then, it is possible to show the following:

Proposition 1 *If the probability distribution of g is uniform, $\gamma = 0$, and $\beta \geq \bar{\beta} = \lambda/\bar{\theta}$, then $s = 0$ and the amnesty is optimal.*

Proof: See the Appendix. ■

Thus, under the above parameterization, an amnesty is efficient and the reduced sanction is zero. When g is uniformly distributed, the efficient reduced sanction is one of the two corner solutions, $s = 0$ or $s = S$. When β is large enough (high co-operation), an important portion of the social cost of crimes is recovered and the amnesty is efficient. Under these circumstances, the authority would like to induce as many criminals as possible to participate in the amnesty. This incentive is provided by setting the lowest possible reduced sanction, $s = 0$. On the other hand, if $\beta < \bar{\beta}$, co-operation is too low to justify an amnesty, and setting $s = S$ ensures that no one participates in it.

Proposition 2 *If the probability distribution of g is uniform, $\gamma = 0$, and $\beta \geq \bar{\beta} = \lambda/\bar{\theta}$, then $\alpha^A \geq \alpha^N$.*

Proof: See the Appendix. ■

Thus, there exists theoretical support for increasing enforcement when an amnesty is anticipated. But we now show that for more general distribution of gain, this result does not necessarily hold. Moreover, an interior reduced sanction may obtain.

Table 1. Efficient policies.

Example 1: $\lambda = 1/4, q = 1/4, \gamma = 0, \beta = 1$		
$\alpha^N = 1.32$	$\Omega^N = 1.34$	$\hat{g} = 0.32$
$\alpha^A = 1.19, s^A = 0.03$	$\Omega^A = 1.21$	$\breve{g} = 0.25, \tilde{g} = 0.81$
Example 2: $\lambda = 1/2, q = 3/4, \gamma = 0, \beta = 1$		
$\alpha^N = 1.40$	$\Omega^N = 1.09$	$\hat{g} = 0.45$
$\alpha^A = 1.37, s^A = 0$	$\Omega^A = 1.03$	$\breve{g} = 0.27, \tilde{g} = 0.54$
Example 3: $\lambda = 1/4, q = 1/4, \gamma = 1/4, \beta = 1/2$		
$\alpha^N = 1.32$	$\Omega^N = 1.32$	$\hat{g} = 0.32$
$\alpha^A = 1.30, s^A = 0.08$	$\Omega^A = 1.31$	$\breve{g} = 0.29, \tilde{g} = 0.67$

4.4. Numerical Results: Case Where the Distribution of Gain is General

To obtain the above results, we simplified the objective function, in particular, by simplifying the distribution of g. However, we can numerically simulate a richer model. Hence, we worked out a number of examples. Suppose that:

- The probability that a criminal is caught is $\alpha/(10 + \alpha)$; This is slightly different from the case considered in section 4.3 (where the probability of apprehension is simply α), but it ensures that in our numerical simulations, this probability lies in the interval [0,1);
- The cost of enforcement function is $C(\alpha) = (1/2)\alpha^2$, which is increasing and convex;
- The gains g follow a Beta distribution on the interval [0,1]; The parameters of the Beta distribution, (a, b), are set to (1,2) implying a decreasing cumulative distribution function.[24]
- Depending on the example, the value of the bad shock is $\lambda \in \{1/4, 1/2\}$ (i.e. the value of a criminal's gain is reduced by 75% or 50% if he suffers the bad shock) and it occurs with probability $q \in \{1/4, 3/4\}$;
- The criminal sanction if caught is $S = 2$;
- The social cost of a crime is $Z = 2$, which is twice as large as the largest private gain;
- The degree of co-operation of a criminal when caught is $\gamma \in \{0, 1/4\}$; Thus, either catching a criminal does not allow society to recover any portion of the social cost of crime, or it allows to recover 25% of it;
- The degree of co-operation of individuals participating in the amnesty is $\beta \in \{1/2, 1\}$.

In Table 1, we report the efficient policies for different values of the parameters. Note that in these three examples, g is not uniformly distributed so that Proposition 1 and 2 do not apply. Also note that in all examples, introducing an amnesty is desirable.

It can be seen that in all examples, it is *efficient* to have less enforcement when an amnesty is anticipated relative to the no-amnesty situation ($\alpha^A < \alpha^N$). To understand the intuition of such a possibility, it is useful to consider an example closely. In Example 1, if there was no amnesty, the authority would select $\alpha^N = 1.32$. This choice would translate into $\hat{g} = 0.32$ so that 45.4% of the population would become (and remain) criminals.[25] The total cost of crime would be 1.32.[26] Now consider what happens in the case of an anticipated amnesty. If participants in the amnesty are very co-operative, then what matters when setting α is really the number of criminals *post*-amnesty. Our calculations show that the efficient level of enforcement when an amnesty is anticipated is $\alpha^A = 1.19$. This in turn implies that $\breve{g} = 0.25$ so that 56.1% of the population initially become criminals. It turns out that after criminals have participated in the amnesty (all those that have g in the interval [0.25,0.81] and that suffer a bad shock will), we are left with 42.9% of the population that remain criminals. This is less than in the no-amnesty situation and it has been achieved with a lower level of enforcement. Hence, we obtain a lower total cost of 1.21. The anticipated amnesty is therefore efficient.

The reason why the efficient level of enforcement can be lower when an amnesty is anticipated is that despite the increase in the initial number of criminals brought by an anticipated amnesty, many criminals eventually participate in the amnesty and those participants can be very co-operative (β large) so that a large proportion of the social cost is recovered. Moreover, even with less enforcement, the number of criminals *post*-amnesty can be smaller than that in the no-amnesty situation, thereby diminishing the return on further enforcement. Thus, when individuals co-operate a lot when participating in an amnesty, it is not necessarily efficient to have more enforcement relative to the no-amnesty level.

Comparing Example 2 and 3 to Example 1 is useful to better understand the determination of the level of the reduced sanction s. Starting from the parameters of Example 1 and moving to those of Example 2, note that a simultaneous increase in λ and q (i.e. the bad shock is not as bad but it occurs more frequently) such that the expected shock $\bar{\theta}$ is reduced (recall that $\bar{\theta} = q\lambda + 1 - q$) leads to a reduction in s. This is due to the fact that the reduction in $\bar{\theta}$ reduces the expected payoff from criminal activity. At the same time, the increase in frequency of the bad shock implies that criminals are more likely to participate in the amnesty. These two effects reduce the marginal benefit of s (see equation (10)), and thus its optimal level. In the example, the optimal s would be negative so that the constraint $s \geq 0$ is binding.

Now comparing Example 1 and 3, note that in the latter, the level of co-operation of criminals that are caught increases while that of those that participate in the amnesty is decreased. These changes imply that the benefit of having criminals participating in the amnesty relative to that of catching them is reduced. As a consequence, it is profitable for the authority to decrease the number of participants in the amnesty (increase in s^A) but to increase the number of criminals that will be caught (increase in α^A).

5. Conclusion

In this paper, we have taken explicit account of the possible co-operation with the authorities of individuals participating in an amnesty. We have characterized the efficient level of enforcement in the case of no-amnesty and in the case of an anticipated amnesty. We have shown that the latter may be larger, but that this is not guaranteed. We have also shown that the efficient reduced sanction imposed on participants in an amnesty may be zero or positive.

Other factors that could enrich the analysis and that should be considered in future research are: Studying amnesties offered to criminals who have already been convicted; Introducing various information asymmetries or uncertainties making the decision to participate in the amnesty less obvious (unknown probability of detection, unknown sanctions, etc.); Dealing with the possibility that an authority cannot commit to some levels of the sanction or not to use the information provided by the participation in the amnesty (ratchet effect). These topics have received almost no attention in previous work.

7. Appendix

Proposition 1 *If the probability distribution of g is uniform,* $\gamma = 0$*, and* $\beta \geq \bar{\beta} = \lambda/\bar{\theta}$*, then* $s = 0$ *and the amnesty is optimal.*

Proof of Proposition 1: First, we have to prove that $s = 0$. The proof simply consists in evaluating the first order condition (10a) when $\gamma = 0$, and $f(g) = f\ \forall g$:

$$\frac{q\beta}{\lambda} - (1 - q\beta)\frac{q}{(1-q)} \geq 0. \tag{A.1}$$

The constraint $s \geq 0$ is not binding when condition (A.1) is satisfied with equality. Consequently, this constraint is binding, and $s = 0$, only if $\beta \geq \bar{\beta} = \lambda/\bar{\theta}$.

We will now prove that the total cost differential between the case with and without amnesty is zero at $\beta = \bar{\beta}$, and that this differential decreases (becomes negative) when β increases above $\bar{\beta}$. As a first step, denote by $A(\alpha^N)$ the left-hand side of equation (9) (the first-order condition on α in the presence of an amnesty) when evaluated at $\beta = \bar{\beta}$ and $\alpha = \alpha^N$ (recall that α^N solves equation (7)). We have the following:

$$\begin{aligned} A(\alpha^N) \;=\; & \frac{C'(\alpha^N)}{Z} - S\frac{[1 - q\bar{\beta} - (1-q)\gamma\alpha^N]\, f(\breve{g}(\alpha^N, 0))}{(1-\alpha^N)^2} \\ & - \frac{qS[\bar{\beta} - \gamma\alpha^N]\, f(\tilde{g}(\alpha^N, 0))}{\lambda(1-\alpha^N)^2} - \gamma[1 - qF(\tilde{g}(\alpha^N, 0)) \\ & - (1-q)F(\breve{g}(\alpha^N, 0))] \end{aligned} \tag{A.2}$$

Using equation (7), $\gamma = 0$ and $f(g) = f, \forall g$, $A(\alpha^N)$ can be rewritten as:

$$A(\alpha^N) = \left[\frac{1}{\bar{\theta}} - (1 - q\bar{\beta}) - \frac{q\bar{\beta}}{\lambda}\right]\frac{Sf}{(1-\alpha^N)^2} \tag{A.3}$$

With $\bar{\beta} = \lambda/\bar{\theta}$, we can show that $A(\alpha^N) = 0$. This implies that $\alpha^A = \alpha^N$ when $\beta = \bar{\beta}$. Now let $\Delta(\alpha^A, \alpha^N) = \Omega^A(\alpha^A, s^A) - \Omega^N(\alpha^N)$ be the total cost differential between the case with and without an amnesty:

$$\begin{aligned}\Delta(\alpha^A, \alpha^N) \;=\; & C(\alpha^A) - C(\alpha^N) + Z\int_{\breve{g}(\alpha^A,0)}^{g^h} f(g)\,dg - q\beta Z\int_{\breve{g}(\alpha^A,0)}^{\tilde{g}(\alpha^A,0)} f(g)dg \\ & - (1-q)\alpha^A\gamma Z\int_{\breve{g}(\alpha^A,0)}^{\tilde{g}(\alpha^A,0)} f(g)\,dg - \alpha^A\gamma Z\int_{\tilde{g}(\alpha^A,0)}^{g^h} f(g)\,dg \\ & - \int_{\hat{g}(\alpha^N)}^{g^h} [1-\gamma\alpha^N]Zf(g)\,dg \end{aligned} \tag{A.4}$$

When $\gamma = 0$, $\beta = \bar{\beta}$, and $f(g) = f$, $\forall g$, we get:

$$\Delta(\alpha^A, \alpha^N) = \left[\frac{1}{\bar{\theta}} - (1 - q\bar{\beta}) - \frac{q\bar{\beta}}{\lambda}\right]\frac{Sf\alpha^A}{(1-\alpha^A)} \tag{A.5}$$

Routine manipulations yield that $(1/\bar{\theta}) - (1 - q\bar{\beta}) - (q\bar{\beta}/\lambda) = 0$. Thus, $\Delta(\alpha^A, \alpha^N) = 0$ at $\beta = \bar{\beta}$, and we can conclude that at such a level of co-operation, the authority is indifferent between declaring an amnesty or not (we assume that the authority offers the amnesty in that case). An increase in β does not affect the total cost for the case without an amnesty. However, using the Envelop theorem, it is possible to show that an increase in β leads to a decrease in the total cost for the case with an amnesty. Therefore, for any $\beta > \bar{\beta}$, the total cost differential becomes negative. In such circumstances, the amnesty is optimal.

Proposition 2 *If the probability distribution of g is uniform, $\gamma = 0$, and $\beta \geq \bar{\beta} = \lambda/\bar{\theta}$, then $\alpha^A \geq \alpha^N$.*

Proof of Proposition 2: We already showed that $A(\alpha^N) = 0$. Using equation (A.3) above, it is possible to show that $A(\alpha^N)$ is decreasing in β. Since $A(\alpha^N) = 0$ at $\bar{\beta}$, $A(\alpha^N)$ will be negative if evaluated at any value of $\beta > \bar{\beta}$. Because the second order conditions are assumed to hold, the total cost function is strictly convex, and we can conclude that $\alpha^A > \alpha^N$ for $\beta > \bar{\beta}$.

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Notes

1. Twenty-eight states offered amnesty programs for income tax evasion between December 1981 and March 31, 1990, according to Dubin, Graetz and Wilde (1992).

2. According to Leonard and Zeckhauser (1987), Philadelphia collected over 160 000 volumes in a one-week library amnesty held in 1983.
3. On 21 January 1977, President Jimmy Carter gave an amnesty for Vietnam war draft evaders (but not military deserters).
4. Indeed, following the election of Jacques Chirac in May 1995, an amnesty was given on 28 June 1995 that included violations to the traffic code (parking and moving) and to the labor laws, as well as all individuals sentenced to less than three months of prison (*Le Monde*, 22 June 1995, p. 9, and 30 June 1995, p. 7). The amnesty given by Fracçois Mitterand in 1981 included all individuals sentenced to less than six months and it lead to the release of 23% of all French prisoners (*Le Devoir*, 7 June 1995, p. 1). Note that despite the constant decline in the number of car accidents in France, the number of car accidents and of car accident victims has risen dramatically in the last three presidential years (1981, 1988, 1995) (*Le Devoir*, 7 June 1995, p. 1).
5. Going through several years of *Tax News Service* and *European Taxation*, we found that fiscal amnesties were given in the following 21 countries (year in which it was held in parenthesis): Argentina (1956, 1961, 1968, 1976, 1986, 1989), Australia (1985), Austria (1983), Bangladesh (1989), Brazil (1982), Chile (1984, 1991), Columbia (1986, 1990), France (1986), Guatemala (1990), Indonesia (1981, 1984), Iran (1983), Italy (1963, 1966, 1980, 1989), Nicaragua (1990), Panama (1990), Paraguay (1990), Peru (1971), Phillipines (1972, 1975, 1981), San Salvador (1990), Switzerland (1968), Thailand (1985, 1991), and West Germany (1989).
6. Amnesties have other benefits. For example, for a given level of resources devoted to detection, the probability of detecting a criminal typically decreases over time. With an amnesty, a portion of the "old" crimes are solved. Effort in detection, therefore, becomes more efficient as it is targeted to more recent crimes. Another benefit is that an individual who participates in an amnesty reveals some of his characteristics. This information can be used later on by the authority and make enforcement cheaper. This benefit is often mentioned in the case of tax amnesties.
7. They mention some more costs and benefits of *tax* amnesties specifically.
8. In India, tax amnesties took place in 1965–66, 1975–76, 1980–81, 1985–87, and 1990–91. Das-Gupta and Mookherjee (1995) were able to show that the level of compliance with tax laws decreased in pre-amnesty years for the *post*-1980 amnesties.
9. There are also amnesties in which the authority reduces the sanction of criminals which have already been convicted.
10. In this case, the social cost comes from the larger tax rate that has to be imposed on those who pay their taxes; this assumes that the marginal cost of public funds increases when the tax rate increases.
11. Considering the case of tax evasion, it is possible to justify that $\beta \geq \gamma$ as follows. When a tax evader is caught through an audit, he has an incentive to continue to hide income because he will have to pay the fine and taxes on any income that is discovered. On the other hand, the incentive to continue to hide income is less for a participant in an amnesty because he only has to pay the taxes on the income originally hidden (usually, participants pay no fine). Because more taxes should be recovered from a participant in the amnesty than from an audited individual, we conclude that $\beta \geq \gamma$.
12. Co-operation is sometimes a condition for participation in the amnesty.
13. The net social cost of crime is the social cost of all crimes less the portion of it that is recovered because criminals are caught or because some individuals participate in the amnesty.
14. Note that the probability of detection is independent of the number of criminals. This approach is correct when individuals, not crimes, are the object of investigation. For example, tax evaders are usually identified through an audit of a random sample of the population of all taxpayers (both the honest and the dishonest ones). This assumption is standard in the economics of crime.
15. This assumption is without consequences.
16. On regret, see Cooter (1991).
17. Melumad and Mookherjee (1989) argue that an authority can commit to a level of monitoring by setting up an agency (e.g. the IRS) responsible for the enforcement of law.
18. A criminal that has drawn a good realization of the shock, $\theta = 1$, will not participate in the amnesty because $y + (1 - \alpha)g - \alpha S > y - s$ holds. The last inequality can be obtained as follows. First note that an agent will choose to commit a crime only if his expected utility from doing so is larger than that of not committing it: $E[U^C] \geq y$. Second, note that by the definition of $\bar{\theta}$, the following holds: $y + (1 - \alpha)g - \alpha S > y + (1 - \alpha)\bar{\bar{\theta}}g - \alpha S = E[U^C]$. Combining those inequalities yield $y + (1 - \alpha)g - \alpha S > y > y - s$, which is the desired result.
19. If it is efficient to offer an amnesty, then the efficient parameters will be such that this inequality is satisfied.

20. See Shavell (1991) and Mookherjee and Png (1992) (and the references therein) for explanations of why efficient sanctions are not necessarily maximal.
21. In the current analysis, the authority is minimizing the total cost of crime, which has no implication for the weight given to various individuals. In particular, this objective function does not imply that the weight given to criminals is zero. Our results could be obtained with a utilitarian social welfare function (putting an equal weight on all individuals, whether honest or criminals), albeit at the cost of introducing some more simplifying assumptions.
22. Throughout, we assume that second order conditions are satisfied. This simply requires a sufficiently large $C''(\alpha)$.
23. Note that it would be possible to reward criminals for their participation in the amnesty ($s < 0$). But it would not be difficult to build a model in which a lower bound must be set on s for the legal system to maintain its credibility. For simplicity, we decided not to model this phenomenon explicitly, and we restricted the analysis to the case where $s \geq 0$.
24. See Johnson and Kotz (1970, ch. 24) for a discussion on the Beta distribution. Note that our results are robust to some (but not all) changes in those parameters.
25. In the examples, the number of criminals may seem unreasonably large. By assuming that individuals with non-negative gains from crime represent only, say, 10% of the population (the remaining obtaining a negative payoff from crime), the crime rate would fall from 45.4% to 4.54%. Note that for consistency with the rest of the analysis, the authority should then be able to identify at no cost all the individuals that would obtain a negative payoff from crime.
26. Note that without enforcement, the total cost is 2. If the optimum with enforcement leads to a total cost larger than 2, then the authority will prefer to undertake no enforcement.

References

Alm, J., M. McKee, and W. Beck. (1990). “Amazing Grace: Tax Amnesty and Compliance.” *National Tax Journal* 43, 23–37.

Andreoni, J. (1990). “The Desirability of a Permanent Tax Amnesty.” *Journal of Public Economics* 45, 143–159.

Becker, G. S. (1968). “Crime and Punishment: An Economic Approach.” *Journal of Political Economy* 76, 169–217.

Cooter, R. D. (1991). “Lapses, Conflict, and Akrasia in Torts and Crimes: Towards an Economic Theory of the Will.” *International Review of Law and Economics* 11, 149–164.

Das–Gupta, A., and D. Mookherjee. (1995). “Tax Amnesties in India: An Empirical Evaluation.” IED Discussion Paper 53, Boston University.

Dubin, J., M. Graetz, and L. Wilde. (1992). “State Income Tax Amnesties.” *The Quarterly Journal of Economics* 107, 1057–1070.

Johnson, N. L., and S. Kotz. (1970). *Continuous Univariate Distribution–II*. New York: Wiley.

Leonard, H. B., and R. J. Zeckhauser. (1987). “Amnesty, Enforcement, and Tax Policy.” In L. H. Summers (ed.), *Tax Policy and the Economy* 1. Cambridge: MIT Press.

Malik, A. S., and R. M. Schwab. (1991). “The Economics of Tax Amnesties.” *Journal of Public Economics* 46, 29–49.

Melumad, N. D., and D. Mookherjee. (1989). “Delegation as Commitment: The Case of Income Tax Audits.” *Rand Journal of Economics* 20, 139–163.

Mookherjee, D., and I. P. L. Png. (1992). “Monitoring vis-a-vis Investigation in Enforcement of Law.” *American Economic Review* 82, 556–565.

Shavell, S. (1991). “Specific Versus General Enforcement of Law.” *Journal of Political Economy* 99, 1088–1108.