



# A simple model of optimal deterrence and incapacitation



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## ABSTRACT

The deterrence of crime and its reduction through incapacitation are studied in a simple multiperiod model of crime and law enforcement. Optimal imprisonment sanctions and the optimal probability of sanctions are determined. A point of emphasis is that the incapacitation of individuals is often socially desirable even when they are potentially deterrable. The reason is that successful deterrence may require a relatively high probability of sanctions and thus a relatively high enforcement expense. In contrast, incapacitation may yield benefits no matter how low the probability of sanctions is—implying that incapacitation may be superior to deterrence.

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## 1. Introduction

The *deterrence* of crime—its discouragement by means of the threat of imprisonment—and the reduction of crime through *incapacitation*—its direct prevention as a result of actual imprisonment—are two primary purposes of imprisonment. In order to study incapacitation along with deterrence, I examine a setting in which individuals make decisions over time whether to commit crimes. Under that assumption, a person who is not deterred from committing a crime and is caught and imprisoned would be prevented from committing other crimes when he is in prison. This outcome could yield an incapacitation benefit, for the person might have decided to commit further crimes had he not been in prison.<sup>1</sup>

In particular, I consider in Section 2 a simple model involving decision making over time about crime, namely, a model in which individuals live two periods and make decisions each period whether to commit crimes (which are presumed to be socially undesirable acts) in the face of the threat of imprisonment sanctions. Individuals might be *potentially deterrable*—possible to deter employing a feasible sanction and a probability of its imposition—or *undeterrable*—impossible to deter.

I initially determine the optimal choice of imprisonment sanctions, taking the probability of sanctions as given. The conclusions are straightforward. First, it is best to employ sanctions that are sufficient to deter whenever deterrence is achievable given the probability of sanctions. Whether deterrence is achievable depends in part on an *incapacitative enhancement to deterrence*: when a person is imprisoned, he forgoes the gains he would obtain from crimes he would otherwise commit—which serves to deter, along with the disutility of imprisonment.

Second, if deterrence is not achievable given the probability of sanctions, it may still be desirable to employ sanctions in order to incapacitate. The condition under which incapacitation is advantageous is that the cost of imprisonment is less than the incapacitation benefit. This benefit is the net social harm from the crimes the person would commit if he were not in prison (which is endogenous to the model, as the crimes he would commit if he were not in prison will depend on deterrence).

I then find the optimal probability of sanctions. Increasing the probability augments deterrence when that is possible, and it also results in greater incapacitation benefits when such benefits exist (because more individuals who are worth incapacitating are caught). However, raising the probability involves additional costs of enforcement. At the optimal probability of sanctions, potentially deterrable individuals might or might not be deterred, and in the latter case it might be desirable to incapacitate them.<sup>2</sup>

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<sup>1</sup> Such an incapacitation benefit is latent in any multiperiod model of deterrence of crime through the use of imprisonment.

<sup>2</sup> See in particular [Proposition 3\(b\)\(i\)](#).

The possible optimality of not deterring potentially deterrable individuals and instead of apprehending them in order to incapacitate them bears comment. The explanation for this outcome is that, on one hand, it can be expensive, and thus uneconomic, for society to invest enough in enforcement resources to achieve deterrence. (To deter many types of crime, a very high probability of sanctions might be needed.) Yet, on the other hand, it can still be worthwhile for society to invest a lower amount to capture and imprison individuals for the purpose of incapacitation—even though these individuals could have been deterred if the probability of sanctions had been higher. In other words, one may view the use of prison to incapacitate as a rational economic choice reflecting a social desire to save the enforcement resources that would be needed to deter.

In Section 3, I comment on the conclusions from the model.

Before proceeding, let me note that the economic literature on the theory of crime and imprisonment has focused on deterrence, usually to the exclusion of incapacitation.<sup>3</sup> There are, however, three articles addressing incapacitation theoretically to which this article relates. [Miceli \(2010\)](#) examines a model of incapacitation and deterrence and solves for the optimal length of imprisonment, but takes the probability of imprisonment as exogenous; [Kessler and Levitt \(1999\)](#) consider a model of incapacitation and deterrence and describe the effect of an increase in imprisonment sanctions, but do not solve for the optimal length of imprisonment or the optimal probability of sanctions<sup>4</sup>; and [Shavell \(1987a\)](#) determines the optimal length and probability of imprisonment, but in a model of pure incapacitation.<sup>5</sup>

This article appears to be the first to analyze both the optimal length and the optimal probability of imprisonment in a model involving deterrence and incapacitation. Its main contribution is the point that society may find incapacitation an advantageous policy not merely for incorrigible individuals, but also for potentially deterrable individuals—essentially because the policy of incapacitation allows society to conserve on enforcement resources and still to achieve useful prevention of crime.

## 2. The model

Time in the model is divided into periods. In each period, a cohort of identical individuals of size 1 enters the population and lives for two periods. Thus, the population in each period consists of a young cohort that just entered and an old cohort that entered the previous period.<sup>6</sup> The total population is 2 each period.

At the beginning of every period, each person chooses whether to commit a harmful act, called a crime, unless he is in prison at the beginning of the period (a possibility to be described). If a person

<sup>3</sup> The earliest economically oriented writing on crime is almost entirely devoted to deterrence. Specifically, [Beccaria \(1764\)](#) and [Bentham \(1789\)](#) elaborately analyze deterrence but mention incapacitation only in passing (Beccaria on p. 36, Bentham on pp. 196–97). Modern economic literature on crime begins with [Becker \(1968\)](#), who restricts his attention to deterrence. Surveys of the economic theory of crime are in the same vein. For example, [Garoupa \(1997\)](#) does not address incapacitation, and [Polinsky and Shavell \(2000\)](#) refer to it only on pp. 68–70. The empirical economic literature on crime has paid somewhat more, but still limited, attention to incapacitation. See, for example, the reviews of empirical work in [Miles and Levitt \(2007\)](#) on pp. 471–74 and 487–89 and in [Abrams \(2013\)](#) on pp. 936–39.

<sup>4</sup> Their purpose is instead to motivate their empirical analysis, in which they are able to separate the influence of deterrence from that of incapacitation.

<sup>5</sup> [Ehrlich \(1973, 1981\)](#) is also of note, as he studies incapacitation along with deterrence. Ehrlich emphasizes the idea that the social benefit of incapacitation may be offset by the replacement of imprisoned criminals by new criminals. For example, if car thieves are imprisoned, new car thieves may emerge in order to satisfy the demand for stolen cars. However, Ehrlich does not analyze an explicit multiperiod model of crime (nor does he need to do so in order to advance his argument concerning replacement effects).

<sup>6</sup> I confine attention to a steady state, so that there will always be a past period in which a cohort entered.

commits a crime, he obtains a benefit  $b > 0$  and causes a harm  $h > 0$ , where  $b < h$ . This latter assumption is made in order that the acts called crimes are socially undesirable (the social objective is defined below).

A person who commits a crime in a period might be caught and suffer a sanction of imprisonment, which will begin in the period of the crime. If an individual is not caught for committing a crime in the first period of his life, he will not be caught in the second period for his crime in the earlier period. Also, individuals who decide not to commit a crime in a period are never mistakenly caught and sanctioned.

The sanction of imprisonment is a discrete number of periods. The sanction for a young person, denoted  $s_1$ , can be 0, 1, or 2 periods; if the sanction is 1 period, it is suffered over the first period of the person's life, and if the sanction is 2 periods, it is suffered over both periods of his life. The sanction for an old person, denoted  $s_2$ , can be 0 or 1.

When a person is in prison, he suffers disutility  $d > 0$  per period and the state incurs a cost  $k > 0$  per period associated with the operation of prisons. If  $b \leq d$ , I will say that the person is *potentially deterrable* because it will be seen to be possible to deter him from committing the crime in both periods if the probability of sanctions is sufficiently high. This assumption will be my focus because my chief object is to investigate deterrence together with incapacitation. However, I will also consider the case in which  $b > 2d$ , which I will refer to as that in which a person is *undeterrable* because it will be seen to be impossible to deter him from committing the crime in either period regardless of the probability of sanctions.<sup>7</sup>

The probability of being caught and sanctioned for committing a crime is  $p$  and is the same for young and for old individuals. The cost to the state per period of maintaining  $p$  is  $c(p)$ , where  $c(0) = 0$  and  $c'(p) > 0$ .

The social objective is to minimize total social costs: the net social costs due to crime, that is,  $h - b$  multiplied by the number of crimes committed; plus the costs of imprisonment, that is,  $d + k$  multiplied by the number of periods of imprisonment experienced; plus the costs  $c(p)$  of law enforcement.

More precisely, the social objective is to minimize social costs on a per period basis in a steady state. It should be noted that minimization of social costs per period in a steady state is equivalent to minimization of social costs per cohort of individuals over its lifetime: in each period, there is a cohort of young individuals and a different cohort of old individuals; and each cohort experiences one period when it is young and one period when it is old.

The policy instruments employed by the state to minimize social costs are the sanctions  $s_1$  and  $s_2$  and the probability  $p$  of sanctions.

Let me now examine the behavior of individuals as a function of the  $s_i$  and  $p$ .

Consider first an old person, presuming that he is not already in prison in the beginning of the second period of his life. (If he is in prison then, there is no behavior to consider.) If he faces no sanction,  $s_2 = 0$ , then he will commit a crime when

$$b > 0, \quad (1)$$

so that he will definitely do so. If, however,  $s_2 = 1$ , an old person will commit a crime only when

$$b > pd \text{ or } p < \frac{b}{d}, \quad (2)$$

<sup>7</sup> It will be evident that if  $2d \geq b > d$ , then a person is neither undeterrable nor potentially deterrable: he can be deterred from committing the crime in period 1 if  $p$  is high enough and  $s_1 = 2$  (so is not undeterrable); but he cannot be deterred from committing the crime in period 2 (so is not potentially deterrable). For simplicity, I do not analyze this case.

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