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# Discounting and Criminals' Implied Risk Preferences

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## Introduction

A presumption in the law enforcement literature is that potential offenders are more responsive to increases in the certainty than increases in the severity of punishment. This presumption dates back at least 250 years to Beccaria's influential work,<sup>1</sup> and appears to be endorsed by scholars of law as well as economics. An important implication of this presumption within the Beckerian law enforcement model is that criminals are risk-seeking. Because risk-aversion is assumed in many analyses of economic decision making, this implication appears to be problematic. A number of articles have identified conditions under which this presumption and risk-aversion can coexist by stepping outside the simple Beckerian framework.<sup>2</sup> This note adds to this literature by showing that offenders who discount future monetary benefits can be more responsive to the certainty rather than the severity of punishment, even when they are risk averse, and even when their disutility from imprisonment rises proportionally (or more than proportionally) with the length of the sentence.<sup>3</sup>

Specifically, we consider cases where the criminal may have to delay the enjoyment of the gains from his crimes until after he serves his sentence. A classic example is a thief who buries his loot before being caught by law enforcers, and digs it out after serving his sentence. If the criminal discounts future monetary gains, increases in the probability and severity of punishment have asymmetric effects on his expected utility. While an increase in the probability of punishment increases the odds that the criminal will have to delay consumption, an increase in the severity of the sanction only further increases the amount by which the criminal will have to discount future gains. The former effect is greater than the latter, because discounting occurs at a diminishing rate.

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<sup>1</sup>See ch 27. in Beccaria and Voltaire (1953). *Dei delitti e delle pene*, the original work by Cesare Beccaria was published in 1764.

<sup>2</sup>See, e.g., Brown and Reynolds (1973), Polinsky and Shavell (1999), Neilson and Winter (1997), Block and Lind (1995), Pyne (2012), and Mungan and Klick (2014).

<sup>3</sup>Block and Lind (1975) and Polinsky and Shavell (1999), reviewed below, supply similar rationales when disutility from imprisonment rises less than proportionally.

These observations are most closely related to Block and Lind (1975) and Polinsky and Shavell (1999). Block and Lind (1975) considers criminals who are risk averse in wealth but "risk takers in sentences" (Block and Lind (1975, p. 481)). The latter assumption is equivalent to the case where "the disutility of imprisonment rises less than proportionally with the sentence" as in Polinsky and Shavell (1999).<sup>4</sup> Both studies demonstrate that risk seeking behavior over sentences provides a rationale as to why criminals respond more to the certainty, rather than the severity, of punishment. In this note, we focus on the observation that even if criminals' disutility from imprisonment does not rise less than proportionally due to direct effects of imprisonment (e.g. loss of liberty),<sup>5</sup> the indirect effect of imprisonment on criminals' enjoyment of wealth can cause criminals to be more responsive to increases in the probability rather than the severity of punishment. Next, we formalize this observation with a simple modification of the Beckerian model of law enforcement.

### Model and Analysis

The potential offender's utility is assumed to be a function of his criminal gains and  $s$ , the sentence he expects to serve if convicted for his criminal act.<sup>6</sup> It is assumed that the criminal will have to delay the consumption of his monetary gain from crime until he serves his sentence. The value of consumption of criminal gains is allowed to depend on  $s$ , because the criminal may discount future consumption relative to present consumption. To simplify the analysis it is further assumed that the disutility from punishment and the utility from future criminal gains are additively separable.<sup>7</sup> These assumptions are captured by the utility function  $V(s, m) = \delta^s u(m) - y(s)$  where  $u$  denotes the utility from monetary criminal gains ( $m$ ),  $\delta$  is the offender's discount rate, and  $y(s)$  denotes the disutility from serving a sentence of  $s$ . The probability of conviction is  $p$ . Given this notation, and setting  $u(0) = y(0) = 0$ , a potential offender commits crime if:

$$p(\delta^s u(m) - y(s)) + (1 - p)(u(m)) > 0 \quad (1)$$

This decision making criterion implies the following proposition:

**Proposition:** *Potential offenders are more responsive to increases in the probability rather than the severity of punishment when the direct disutility from punishment does not rise more than proportionally with the length of the sentence. Furthermore, this result does not depend on the offender's risk attitude over monetary gains.*

**Proof:** *The responsiveness of an offender with respect to increases in the*

<sup>4</sup> See Polinsky and Shavell (1999 p. 3) and Block and Lind (1975 p. 481) listing reasons for why disutility may rise less than proportionally

<sup>5</sup> See Polinsky and Shavell (1999 p. 3) discussing why criminals' disutility from imprisonment may not rise less than proportionally.

<sup>6</sup> To simplify the analysis we assume that the sanction does not have a monetary component.

<sup>7</sup> This assumption is not necessary. In particular, a more general utility function of the form  $U(i(s), m(s))$  with  $U_i < 0$  and  $U_m > 0$ , where  $i$  is the identity function, implies the same results.

probability and severity of punishment are respectively given by

$$E_p = -\frac{dV}{dp} \frac{p}{V} = [y(s) + (1 - \delta^s)u(m)] \frac{p}{V} \quad (2)$$

and

$$E_s = -\frac{dV}{ds} \frac{s}{V} = [y'(s) - \ln(\delta)\delta^s u(m)] \frac{ps}{V} \quad (3)$$

Hence,  $E_p > E_s$  iff

$$[y(s) - sy'(s)] > -u(m)[(1 - \delta^s) + s \ln(\delta)\delta^s] \quad (4)$$

The left hand side of (4) is non-negative when  $y'' \leq 0$ . Next, let  $f(s) = (1 - \delta^s)$ , then  $f'(s) = -[\ln(\delta)\delta^s]$ , and  $f''(s) = -[\ln(\delta)^2\delta^s] < 0$ . Hence,  $f(s) = (1 - \delta^s) > -s \ln(\delta)\delta^s = sf'(s)$ , due to the concavity of  $f$ . Accordingly, the right hand side of (4) is always negative, and therefore the inequality in (4) holds regardless of the shape of  $u$ . ■

The proof of this proposition also reveals a simple corollary, namely that a potential offender can be more responsive to increases in the probability rather than the severity of punishment even when his direct disutility from imprisonment rises more than proportionally with the length of the sentence. This follows, because for any negative value on the right hand side of inequality (4) one can find a slightly convex  $y$  that would make the left hand side of (4) negative but still greater than the right hand side of (4).

### Conclusion

A number of articles in the law enforcement literature have identified rationales as to how criminals may respond more to increases in the probability rather than the severity of punishment, and yet be risk-averse with regard to monetary outcomes. This note provides a simple addition to the rationales previously identified. It shows that when criminals discount future enjoyment of wealth they can be more responsive to increases in the certainty than the severity of punishment. Moreover, it shows that this rationale is independent of the shape of criminals' direct disutility from imprisonment, and thereby broadens the conditions under which such rationales exist.

## References

- [1] Beccaria, Cesare and Voltaire. *An Essay on Crimes and Punishments*. Stanford, Ca: Academic Reprints (1953).
- [2] Becker, Gary S. 1968, *Crime and Punishment: An Economic Approach*, *Journal of Political Economy* 76, 169-217.
- [3] Block, Michael K. and Robert C. Lind, *An Economic Analysis of Crimes Punishable by Imprisonment*, 4 *The Journal of Legal Studies* 479-492 (1975).
- [4] Mungan, Murat C. and Jonathan Klick, *Forfeiture of Illegal Gains, Attempts, and Implied Risk Preferences*, 43 *Journal of Legal Studies* \_\_ (2014).

- [5] Neilson, William S. and Harold Winter, *On Criminals' Risk Attitudes*, 55 *Economics Letters* 97-102 (1997).
- [6] Polinsky, A. Mitchell and Steven Shavell, *On the Disutility and Discounting of Imprisonment and the Theory of Deterrence*, 28 *The Journal of Legal Studies* 1 (1999).
- [7] Pyne, Derek, *Deterrence: Increased Enforcement versus Harsher Penalties*, 117 *Economics Letters* 561-562 (2012).