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Forfeiture of Illegal Gains, Attempts and Implied Risk Preferences

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ABSTRACT

In the law enforcement literature there is a presumption—supported by some experimental and econometric evidence—that criminals are more responsive to increases in the certainty than the severity of punishment. Under a general set of assumptions, this implies that criminals are risk seeking. We show that this implication is no longer valid when forfeiture of illegal gains and the possibility of unsuccessful attempts are considered. Therefore, when drawing inferences concerning offenders' attitudes toward risk based on their responses to various punishment schemes, special attention must be paid to whether and to what extent offenders' illegal gains can be forfeited and whether increases in the probability of punishment affect the probability of attempts being successful. We discuss policy implications related to our observations.

1. INTRODUCTION

A presumption that dates back 250 years to Cesare Beccaria's influential work *Dei delitti e delle pene* is that "[c]rimes are more effectually prevented by the *certainty,* than the *severity* of punishment" (Beccaria and Voltaire 1953, p. 93).[1] This presumption can be defined with more pre-

1. The original treatise was published by Cesare Beccaria in 1764.

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cision to avoid potential ambiguity: a 1 percent increase in the probability of punishment increases deterrence more than a 1 percent increase in the severity of punishment.[2] We refer to this presumption as the certainty aversion presumption (CAP).

The CAP is supported by some empirical evidence[3] and is endorsed by legal scholars as well as social scientists.[4] A theoretical implication of CAP seems at first glance to be that criminals are risk seeking.[5] This result is disturbing for many scholars, since it "would make criminals different from the rest of the population, because the other types of analysis have established that law abiding citizens tend to be risk averse" (Neilson and Winter 1997, p. 97).

Some articles have identified ways to reconcile CAP and the intuitive presumption that most people, even criminals, have a preference for avoiding risk. Most of these articles, unlike ours, tend to rely on the nonpecuniary nature of punishment.[6] The article most relevant to our analysis is Brown and Reynolds (1973).

Brown and Reynolds (1973, p. 509) define loss as "the decrement in

2. More precisely, let p and s respectively denote the probability and severity of punishment and D denote deterrence. The presumption is that $[(\partial D)/(\partial p)]p > [(\partial D)/(\partial s)]s$.

3. See, for example, Grogger (1991), Block and Gerety (1995), Paternoster (1987), but see Friesen (2012), which criticizes Grogger (1991) and Block and Gerety (1995) and reaches a conclusion that contradicts the certainty aversion presumption (CAP); see also Section 4 for a brief discussion of existing empirical studies.

4. See, for example, Dressler (2010, p. 36): "In general however, an increase in the detection, arrest and conviction rate is of greater deterrent consequence than an increase in the severity of the penalty upon conviction" (citing Paternoster 1987). See also Becker (1968, p. 178): "The widespread generalization that offenders are more deterred by the probability of conviction than by punishment when convicted turns out to imply in the expected utility approach that offenders are risk preferrers, at least in the relevant range of punishment."

5. See Becker (1968, n. 19), which proves that CAP implies a preference for risk in his model.

6. Neilson and Winter (1997, p. 102), for instance, show that "if criminals' preferences are state-dependent or criminals are rank-dependent expected utility maximizers, it is possible for offenders to be both risk averse and more sensitive to changes in the certainty of punishment." Unlike in Neilson and Winter (1997), Block and Lind (1975) develop a model in which criminals are expected-utility maximizers. In their model, criminals' utility functions have two arguments rather than a single argument: wealth and sentence. By relying on this utility function they prove that criminals can be risk averse in wealth but risk seeking in sentences and still obey CAP. The authors point out that criminals who discount future sentences would appear to be risk seeking with respect to sentences, a point that is also made in Polinsky and Shavell (1999), and thereby supply a rationale as to why risk attitudes have different meanings in different contexts; they also note that criminals need not be different from the rest of society simply because they are risk seeking with respect to sentences.

income from [the offender's] certain *present income* if convicted." They show that a percentage increase in the loss faced by the criminal can lead to less deterrence than a percentage increase in the probability of punishment, even if potential criminals are risk averse. If, as appears to be implicitly assumed by Brown and Reynolds, criminals forgo all illegal gains once caught, criminal losses and sanctions become equivalent, and CAP and risk aversion can be reconciled. Our article, like Brown and Reynolds (1973), does not rely on sanctions being nonmonetary but on criminals more often forgoing illegal gains when the probability of punishment is increased.

We generalize and extend Brown and Reynolds (1973) by identifying two separate but related explanations as to how risk aversion and CAP can coexist. We show that if gains from illegal activity can be taken away, or if they may simply not be realized when an offender is unsuccessful in his criminal attempt, then the criminal may act in a manner consistent with CAP yet be risk averse. We use the expression "forfeiture of illegal gains"[7] to refer to the former situation and term the latter situation "attempts."

Incidentally, we reveal the similarities and distinctions between the law and economics of attempts and forfeiture of illegal gains. We thereby add to the economic understanding of attempts, which appears to be understudied and mostly abandoned.[8] To see how attempts and forfeiture of illegal gains are interrelated, note that in the standard law enforcement model, as pioneered by Becker (1968) and described in Polinsky and Shavell (2007), apprehension occurs after the offender obtains criminal gains. These gains are assumed to be kept, or enjoyed, by the criminal even if he is detected and punished. There are at least two ways in which this assumption can be violated. First, the offender can be apprehended before he successfully completes his crime, in which case we refer to the

7. There is a related and expanding literature analyzing the effects of forfeiture of illegal gains on optimal law enforcement policies. See, for example, Bowles, Faure, and Garoupa (2000, 2005). This literature focuses mainly on the normative implications of forfeiture of illegal gains by taking offenders' risk attitudes as given. (But see Friehe [2011], which takes offenders' risk preferences as given—by assuming that they are risk neutral—and makes the positive assertion that forfeiture of illegal gains can reduce deterrence if avoidance activities are possible.) Our article contributes to the complementary and positive side of this literature by pointing out a potential inferential fallacy if forfeiture of illegal gains are not considered when evaluating offenders' risk preferences.

8. Posner (1985), Shavell (1990), Friedman (1991), and Ben-Shahar and Harel (1996) stand out as the most comprehensive articles studying the law and economics of attempts. We were unable to locate more recent articles studying attempts, aside from those that briefly revisit the subject, for example, Mungan (2011).

case as an attempt. Second, criminal gains can be forfeited even if apprehension occurs after the crime is successfully committed.

Although these two cases may seem equivalent, or the differences between them may seem nonconsequential, there are subtle but important differences between them, at least for purposes of studying the implications of CAP. In particular, (i) a degree of forfeiture upon punishment is sufficient to reconcile CAP and risk aversion, but (ii) the prospect of being punished for an uncompleted crime is insufficient for CAP and risk aversion to coexist. More is needed, namely, a correlation between the probabilities of crime prevention and punishment.

To see how this distinction arises, first note that when forfeiture is possible, an increase in the probability of punishment leads to an increase in expected losses but also a reduction in expected benefits through the taking away of criminal gains. In contrast, when unsuccessful attempts are possible, an increase in the probability of punishment does not necessarily affect the likelihood that the potential offender will be punished in the act rather than on successful commission of the crime. Therefore, absent an expectation of forfeiture of illegal gains, an increase in the probability of punishment may affect only expected punishment and not expected benefits, which depend only on the probability of successful commission of crimes. For these reasons, unless there is a correlation between the probabilities of crime prevention and punishment—which we argue is likely to exist—the prospect of being punished for an attempt does not reconcile CAP and risk aversion.

It is also worth briefly mentioning that although our explanations do not rely on the nonpecuniary nature of punishment, considerations related to imprisonment are likely to increase the empirical relevance of our forfeiture model. Even if no physical forfeiture takes place, a person who is imprisoned must, in many circumstances, delay the enjoyment of his criminal gains while in prison. As long as the criminal discounts the future use of these gains, he will derive a lower utility from his criminal proceeds. Therefore, a forfeiture effect is present even in cases in which physical forfeiture is not.

The theoretical contributions of our article, to sum up, include not only demonstrating how and under what conditions the incorporation of forfeiture of illegal gains and/or unsuccessful criminal attempts reconciles CAP and risk aversion but also highlighting the interrelations and distinctions between the law and economics of forfeiture of illegal gains and attempts. Future empirical studies on criminals' risk attitudes are likely to benefit from these clarifications and contributions, because

studies that do not account for potential and systematic differences in the degree of expected forfeiture of illegal gains or correlations between probabilities of crime prevention and punishment across different offense categories may produce misguided policy prescriptions.

The remaining sections of this article are structured as follows. In Section 2 we construct a crime and deterrence model that incorporates forfeiture of illegal gains and thereby reconciles CAP and risk aversion. Section 3 contains a similar model incorporating criminal attempts and shows that CAP and risk aversion can coexist if there is correlation between the probability of an unsuccessful attempt and the probability of detection. Section 4 contains a discussion of existing empirical and experimental work analyzing criminals' responsiveness to increases in the severity versus certainty of punishment and makes observations about how future empirical studies can be designed to account for our theoretical observations and thereby provide more accurate inferences regarding criminals' risk preferences. Policy implications are discussed in Section 5, and Section 6 contains a brief discussion of results and concluding remarks.

2. FORFEITURE OF ILLEGAL GAINS AND IMPLIED RISK PREFERENCES

When forfeiture of illegal gains is a significant concern for the criminal, increasing the probability of detection leads to an increase in the expected monetary fine as well as a reduction in expected benefits. In contrast, an increase in the sanction increases only the expected monetary fine but does not affect the expected benefits of crime. Therefore, it is only natural that potential offenders contemplating such crimes are more sensitive to increases in the probability of detection rather than an increase in monetary fines, even if they are risk-averse expected-utility maximizers.

To formalize this intuitive idea, it is sufficient to relax the assumption that offenders reap the entire benefit of their criminal activity regardless of whether they are caught. In the standard Beckerian framework, an individual obtains a payoff of b immediately after committing a crime, and this is not contingent on evading detection; hence, the expected benefit from crime is

$$b - ps, \tag{1}$$

where b is the benefit from crime, p is the probability of detection, and s is the monetary sanction. If, however, b is partially or entirely taken

away from the criminal after he is caught, then the expected benefit from crime is

$$(1 - p)b + p(1 - \alpha)b - ps, \tag{2}$$

or with slightly less notation

$$b - p\alpha b - ps, \tag{3}$$

where $1 \geq \alpha \geq 0$ is the proportion of the benefit that the criminal is unable to reap if caught.

Expected benefits are equivalent to expected utility (U) for risk-neutral criminals. It is a straightforward task to show that a risk-neutral individual is more responsive to an increase in the probability of detection when forfeiture of illegal gains is considered (that is, $\alpha > 0$):

$$\begin{aligned} -\frac{\partial U}{\partial p}\frac{p}{U} &= (\alpha b + s)\left(\frac{p}{b - p\alpha b - ps}\right) > -\frac{\partial U}{\partial s}\frac{s}{U} \\ &= p\left(\frac{s}{b - p\alpha b - ps}\right) \end{aligned} \tag{4}$$

if $\alpha > 0$.

Since a risk-neutral individual is more responsive to the probability of detection, it should be intuitively clear that some risk-averse individuals are also more responsive to increases in the probability of detection. This can be formalized by considering conditions under which any expected-utility maximizer exhibits behavior consistent with CAP. To do this, consider the incentives an expected-utility-maximizing offender faces. He commits a crime if[9]

$$(1 - p)V(b) + pV[(1 - \alpha)b - s] \geq V(0), \tag{5}$$

where V is the criminal's von Neumann–Morgenstern utility with $V' > 0$. It follows from expression (5) that there is some b with a value greater than 0, denoted b^*, that makes a criminal indifferent between committing a crime and remaining innocent. Hence,

$$(1 - p)V(b^*) + pV[(1 - \alpha)b^* - s] - V(0) = 0. \tag{6}$$

Applying the implicit function theorem, we have that

$$\frac{\partial b^*}{\partial p}\frac{p}{b^*} \geq \frac{\partial b^*}{\partial s}\frac{s}{b^*} \tag{7}$$

if and only if $V(b^*) - V[(1 - \alpha)b^* - s] \geq sV'[(1 - \alpha)b^* - s]$. This condition can be rewritten as

9. The criminal's initial wealth position is normalized to zero.

$$\int_{(1-\alpha)b^*-s}^{b^*} V'(y)dy = \int_{(1-\alpha)b^*-s}^{(1-\alpha)b^*} V'(y)dy + \int_{(1-\alpha)b^*}^{b^*} V'(y)dy \tag{8}$$

$$\geq \int_{(1-\alpha)b^*-s}^{(1-\alpha)b^*} V'[(1-\alpha)b^* - s]dy$$

or

$$\int_{(1-\alpha)b^*}^{b^*} V'(y)dy \geq \int_{(1-\alpha)b^*-s}^{(1-\alpha)b^*} \{V'[(1-\alpha)b^* - s] - V'(y)\}dy. \tag{9}$$

Expression (9) establishes that if CAP is a valid presumption, then V cannot be concave unless $\alpha > 0$—since $V'' < 0$ implies that the second term in expression (9) is always positive. Hence, $\alpha > 0$ is a necessary condition to have risk aversion and CAP simultaneously. That risk aversion and CAP can simultaneously exist follows immediately from the fact that expression (9) holds when V is linear and $\alpha > 0$, which implies that one can construct a slightly concave function for which expression (9) continues to hold.[10]

The best way to interpret these results is by focusing on the simple expression (3), which represents the expected benefit from crime. As stated earlier, when forfeiture of illegal gains is a valid consideration, increasing p has two effects: it increases the expected sanction (ps) and reduces the expected benefit from crime ($(1 - p\alpha)b$). An increase in the penalty, however, increases only the expected sanction (ps). This is what drives the result that we derive in this section, namely, that CAP and risk aversion can coexist when partial or complete forfeiture of illegal gains is expected.

Before concluding the analysis of forfeiture of illegal gains and proceeding with the analysis of attempts, it is worth highlighting how the

10. Formally, consider utility functions of the form $V = y^z$. The difference between the left- and right-hand sides of expression (9) can be rewritten as a function of z:

$$H(z) = z\left(\int_{(1-\alpha)b^*}^{b^*} y^{z-1}dy - \int_{(1-\alpha)b^*-s}^{(1-\alpha)b^*} \{[(1-\alpha)b^* - s]^{z-1} - y^{z-1}\}dy\right).$$

Hence, $H(1) = \alpha b^* > 0$. Since H is continuous in z around $z = 1$, there exists $\varepsilon > 0$ such that $H(1 - \varepsilon) > 0$.

preceding analysis relates to Brown and Reynolds (1973). Brown and Reynolds appear to implicitly assume that criminals obtain a payoff of $-s$ (in our notation) when they are caught. If the authors were making this assumption to incorporate the effects of forfeiture of illegal gains, then their model becomes a special case of the simple model presented above, in which $\alpha = 1$. Since the main result (namely, CAP does not imply risk-seeking preferences) holds for all $\alpha > 0$, their assumption that forfeiture is complete, rather than partial, is harmless for purposes of demonstrating this result.

But the authors might have had other motivations in mind while making the implicit assumption that illegal gains are not realized when the criminal is caught. The motivating example in Brown and Reynolds (1973, p. 508) seems to suggest that the authors made this assumption because they had unsuccessful attempts in mind: "R. Hood tries to rob an armored car containing $1,000,000. He is caught in the act, tried and convicted." In Section 3, we study unsuccessful attempts and show that the incorporation of unsuccessful attempts, without more, is insufficient to reconcile CAP and risk aversion.

3. ATTEMPTS AND IMPLIED RISK PREFERENCES

Following Shavell (1990), we assume that a criminal is successful in committing the crime only with a probability of $q < 1$. Successful crimes lead to illegal gains, which, if the criminal is caught later, may (in the case of $\alpha > 0$) or may not (in the case of $\alpha = 0$) be forfeited. Attempts, however, confer no benefits to criminals.[11] The probability of catching a criminal successfully committing or attempting to commit a crime is p.[12] To allow for different sanctions for attempts and completed crimes, we assume that the sanction for attempts (ks) is a fraction of the sanction for completed crimes (s), where $k \leq 1$. To incorporate potential correlations between probabilities of detection and the probability that a criminal successfully completes a crime, we express q as $q(p)$.

Given this notation, the aggregate probability with which an individual is punished is given by $p = [q(p)p] + [(1 - q(p))p]$, where the first and second bracketed terms, respectively, describe the probability of

11. This assumption is invoked in Friedman (1991) and Mungan (2011) and appears to be more realistic than the alternative and simplifying one in Shavell (1990), which assigns benefits to criminals even for attempts.

12. We are assuming that these probabilities are equal to save on notation and to simplify the analysis. Our conclusion does not depend on this particular assumption.

punishment for a completed crime and an attempt. Thus, a potential risk-neutral offender's expected utility from committing a crime can be described as

$$U = q(p)(b - p\alpha b - ps) - [1 - q(p)]pks. \tag{10}$$

Therefore, a risk-neutral individual commits a crime if $U \geq 0$, or

$$b \geq \frac{ps}{1 - p\alpha}\left[1 - k + \frac{k}{q(p)}\right] \equiv b^*. \tag{11}$$

These individuals are more responsive to increases in the probability rather than the severity of the sanction if

$$\begin{aligned} -\frac{\partial U}{\partial p}\frac{p}{U} &= \{q'[p(\alpha b + s) - b] + q(s + \alpha b) + (1 - q)ks - q'pks\}\frac{p}{U} \\ &> -\frac{\partial U}{\partial s}\frac{s}{U} = [qp + (1 - q)pk]\frac{s}{U}, \end{aligned} \tag{12}$$

where $q(p)$ and $q'(p)$ are respectively denoted q and q' to save on notation. Equation (12) can be simplified by subtracting the right-hand side of the inequality from the left-hand side and dividing by p so that the condition becomes

$$q'(p(\alpha b + s) - pks - b) + q\alpha b > 0. \tag{13}$$

Expression (13) immediately reveals that if illegal gains cannot be forfeited (that is, $\alpha = 0$), and if there is no correlation between the probabilities of punishment and criminal success (that is, $q'(p) = 0$ for all p), risk-neutral criminals are equally responsive to the certainty and severity of sanctions. This implies that CAP and risk aversion cannot coexist.[13]

However, there are persuasive reasons to believe that such correlations in fact exist.[14] First, because similar expenditures are used to in-

13. This result has a simple implication concerning Brown and Reynolds (1973). If the authors had criminal attempts in mind (see the last paragraph in Section 2) when they were implicitly assuming that criminals obtain a payoff of $-s$ when caught, then their conclusion that CAP does not imply risk aversion is incomplete. As demonstrated by expression (13), this conclusion requires some correlation between the probabilities of criminal success and punishment. It should also be noted that if interpreted as analyzing attempts, Brown and Reynolds (1973) must have made the unrealistic assumption that $(p = 1)\ p = 0$ when the offender is (un)successful in committing a crime and assumed that the government directly controls q. That this assumption is unrealistic is revealed simply by noting that there are many criminals who are caught after successfully committing crimes, which implies that $p \neq 0$ for successful crimes.

14. Ben-Shahar and Harel (1996) identify the analogues of these reasons in the context of precautionary behavior by potential victims.

crease the probability of punishment and the probability of crime prevention, it is plausible to assume that there is some positive correlation between them.[15] Such expenditures can simply lead criminals to be caught more often in the act and prevent them from successfully carrying out their plans.[16] Second, when the government spends more on law enforcement, criminals are expected to spend more time and effort in preparation for crime, which increases the likelihood that they will be caught.[17] Therefore, we believe it is plausible to assume that $q'(p) < 0$.

Revisiting expression (13) under this assumption reveals that risk-neutral individuals are more responsive to increases in the probability than the severity of punishment. This can be confirmed by substituting b with the expression for b^*, as defined in expression (11). This observation, coupled with the fact that $q' < 0$, implies that expression (13) always holds and that this is true even when $\alpha = 0$ and for all $k \in [0, 1]$.

Thus any positive correlation between the probability of punishment and the likelihood of catching criminals before they complete their crimes is sufficient to explain why risk-neutral individuals are deterred more by an increase in the certainty than in the severity of punishment. Furthermore, this result does not depend on whether illegal gains are forfeitable or on the severity of the punishment for attempts.

It is relatively straightforward to exploit this result, as in Section 2, to demonstrate that one can reconcile CAP and risk aversion. Because the difference between risk-neutral criminals (namely, individuals whose utility functions are of the form $V(x) = x^1$) in their responsiveness to increases in the certainty and severity of punishment is positive, one can find risk-averse individuals (individuals whose utility functions are of

15. Shavell (1991) makes a similar point concerning correlations between probabilities of detecting various crimes.

16. Ben-Shahar and Harel (1996, p. 336) make the analogous point in considering the effects of potential victims' precautions on the likelihood of criminal success: "Precautions against crime taken by potential victims reduce the chances of successful completion of the crime either by increasing the chances that the perpetrator will not complete the activities he plans to commit, or by increasing the chances that, even if the perpetrator completes his plan, the desired consequences of the plan will not be realized."

17. This point is also identified by Ben-Shahar and Harel (1996, p. 336): "Precautions taken by potential victims of crime force potential criminals to go through a longer sequence of pre-crime activities. The longer sequence of pre-crime activities exposes the perpetrator to a greater risk of being interrupted before the completion of the crime. Hence, a crime directed against a more cautious victim is more likely to wind up being classified as an attempt than a crime directed against a less cautious victim."

the form $V(x) = x^{1-\varepsilon}$) for whom this difference is smaller but still positive.[18]

4. THE EMPIRICAL RELATIONSHIP BETWEEN CERTAINTY AND SEVERITY

As suggested above, it has largely been taken for granted that certainty of punishment has a larger proportionate effect on deterrence than does severity of punishment. As noted in surveys by Paternoster (1987, 2010), Beccaria wrote, "The certainty of a punishment, even if it be moderate, will always make a stronger impression than the fear of another which is more terrible but combined with the hope of impunity" (Beccaria 1963, p. 58). Paternoster goes on to note that the general consensus remained unmodified through the 1970s and 1980s, citing the agreement of the well-known text Zimring and Hawkins (1973). Paternoster (1987, p. 188) also notes that empirical examination by criminologists using observational and experimental data consistently finds a deterrent effect for increases in certainty of punishment but fails to find similarly robust effects for increases in severity, which leads him to conclude that "within a few years, those working in the area came to understand that if the deterrence process works, it does so solely through perceived certainty."

The conventional wisdom continues on into more recent times. In describing the literature on certainty and severity, Nagin and Pogarsky (2001, p. 865) state that a prominent finding in this literature is "that punishment certainty is far more consistently found to deter than is punishment severity." More recently, Durlauf and Nagin (2012, p. 43) evaluate the modern empirical literature as indicating "there is little evidence that increases in the severity of punishment yield strong marginal deterrent effects," while "[b]y contrast there is very substantial evidence that increases in the certainty of punishment produce substantial deterrent effects."

In their influential book, Gottfredson and Hirschi (1990) deduce from this conventional wisdom and the available empirical evidence that criminals appear to be risk loving. To the extent that conclusions like this are based on systematic empirical findings, those findings are perhaps too blunt to make such strong conclusions about the decision making of criminals. The general conclusion of criminologists that the absence of evidence for severity effects implies that certainty effects are larger is

18. See note 10 for a proof of the corresponding case in the context of forfeiture of illegal gains when q is fixed at 1. The complete proof for the case of attempts is very similar but lengthier because it involves more notation and has therefore been omitted.

too quick. For various reasons, the research designs examining severity may lack power or may be more susceptible to bias, given that there are fewer large shocks to punishments than there are to the policy inputs for the certainty of punishment (for example, changes to police staffing). However, the existing experimental evidence, by and large, provides evidence in favor of CAP among criminals (see Block and Gerety 1995; Faragó, Kiss, and Boros 2008; Pachur, Hanoch, and Gummerum 2010). Lee and McCrary (2009) also provide some econometric evidence consistent with CAP.[19]

Existing empirical evidence does not allow us to distinguish our model from one assuming that criminals have risk preferences that are systematically different than those of noncriminals. However, going forward, empirical researchers could focus on ways to distinguish the two models.

The most promising avenue in this regard is to examine heterogeneity of estimated police elasticities across types of crimes, with forfeiture or failed attempts being more relevant for some kinds of crimes than others, and across jurisdictions. Regarding heterogeneity of effects by crime type, there may be differentials based on how quickly the fruits of a crime can be enjoyed. For example, in our model (but not the risk-loving criminal model), an increase in police staffing would likely have a larger effect on the theft of property a criminal intends to fence than it would on the theft of cash. Because it takes time to sell the stolen goods, the likelihood of forfeiture increases, all other things equal.

On the point regarding heterogeneity of effects by jurisdiction, researchers could distinguish between police shocks that lead to more police on the beat (which increases the number of foiled attempts and makes it more likely that apprehension will occur before the gains from a crime can be consumed) versus shocks to resources available for investigation (which increase the likelihood of punishment but do not add as much to the imminence of discovery and apprehension). Similarly, researchers may begin to compare the elasticities resulting from shocks to apprehension probability coming from increased number of police versus procedural changes that affect the probability of conviction.

This model may also help us understand differences in deterrence elasticity differentials between violent crime categories (in which forfeiture is largely irrelevant) and property crime categories (in which

19. Lee and McCrary (2009) find that the magnitude of the elasticity of crime with respect to the likelihood of apprehension exceeds the elasticity with respect to expected sentence lengths, sometimes by a factor of 10.

forfeiture is a real consideration). Care must be taken, though, in these comparisons since both violent and property crimes involve the potential for foiled attempts. As empirical crime deterrence research becomes more mature, examining the sources of heterogeneity of effects[20] will assume a more central role in the econometric research. More precise theoretical modeling will also become more important as empirical research moves in the structural direction.

5. POLICY IMPLICATIONS AND REMARKS

Recent policy work, such as Kleiman (2010), argues strongly in favor of rebalancing law enforcement resources and strategy away from tools affecting severity (for example, long prison sentences) to those affecting probability (for example, police). Much of this work is based on the empirical evidence showing that police generate deterrence while increasingly severe sentences do not generate similar results as reliably. These policy recommendations often cite the conventional wisdom regarding certainty aversion among criminals.

Our model suggests that perhaps these recommendations should be qualified more and the empirical evidence revisited. The degree to which probability-enhancing tools should be favored over severity-enhancing tools may depend on the type of crime considered, especially the degree to which forfeiture is relevant and whether attempts can be foiled. Along those lines, in the allocation of resources affecting the probability of apprehension and sanction between preventive or investigatory, our model provides some insight regarding policy trade-offs.

For example, if the forfeiture rate is low, preventive law enforcement is more cost-effective. When coupled with preventive law enforcement, small sanctions for incomplete attempts could be effective, because the person is already deprived of the benefit from crime. Similarly, when the forfeiture rate after a crime is high, small sanctions may be sufficient, since a portion of the penalty has already been imposed through forfeiture. Accordingly, given that sanctions are costly, ceteris paribus, it may be optimal to reserve large sanctions for crimes for which the forfeiture rate is low and the criminal overcomes preventive measures and successfully completes his crime. If this reasoning is correct, this also gives us a way to look at the optimal difference between the punishments for completed versus noncompleted offenses. The difference should be

20. In addition to the heterogeneity across crime types discussed above, there is likely heterogeneity across jurisdictions.

greater, everything else equal, for crimes for which forfeiture rates are low.

In addition, though our model is not normative, its implications may be important for those engaging in social welfare analyses. If such analyses include the benefits of criminals in the social calculus, then attitudes toward risk are important, because we want to figure out whether policy should be geared toward reducing risk-bearing costs for risk-averse people (or risk-bearing benefits for risk-seeking individuals). If, however, criminal benefits are ignored, for purposes of achieving deterrence, it is important to know only how criminals respond to various punishment schemes and which punishment scheme can be achieved at the lowest cost. It is thus unnecessary to identify criminals' risk preferences. But even then, our article cautions against drawing broad conclusions regarding criminals' risk preferences based on limited empirical evidence, which could lead to policy recommendations hinging on the potentially mistaken belief that criminals are risk seeking.

6. CONCLUSION

We demonstrate that forfeiture of illegal gains and/or the possibility of preventing crime before it is completed are sufficient to reconcile risk aversion with the presumption that criminals are more responsive to increases in the probability of detection than increases in the punishment. This is an important result drawing into question the idea that criminals have different risk attitudes than the rest of society. This conclusion regarding differential risk preferences has been too readily embraced by criminal law scholars. It also has important implications for empirical methods used to identify criminals' risk preferences. In particular, it suggests that empirical studies that do not account for potential and systematic differences in α or correlations between probabilities of crime prevention and punishment across different offense categories may produce biased results.

Whether forfeiture of illegal gains is an important consideration for potential criminals is a question that can potentially be answered through empirical analyses. Violent crimes such as rape, murder, and battery typically involve instant criminal benefits. Theft-type crimes,[21] in contrast, typically require the spending or consumption of the wrongfully acquired gains. As a result, the forfeiture rate (that is, α) is expected to

21. Examples are larceny, robbery, shoplifting, looting, fraud, and embezzlement.

be higher for crimes involving theft than for crimes such as murder, rape, and battery. If so, ceteris paribus, the difference between criminals' responsiveness to certainty and responsiveness to severity should be greater for crimes involving theft than for violent crimes.[22] Therefore, our observation can be used to form a testable hypothesis that can guide future research to identify the importance of forfeiture of illegal gains.

Before concluding, it is worth making a brief remark about the way in which our result could be interpreted. If one measures severity by aggregating forfeited gains and the exogenously imposed sanction and formulates CAP by referring to this meaning of severity, then the presence of CAP would imply risk-seeking behavior. We do not believe that scholars studying law enforcement ordinarily use the word "severity" in this sense.[23] This distinction is important and not merely a semantic point. As stated, if empirical studies fail to account for forfeitable gains in measuring changes in severity, then one cannot rely on them to draw valid inferences concerning offenders' risk preferences.

Finally, it should be noted that the assumption of monetary fines is used to make the argument as general as possible. As demonstrated in the literature, when sanctions are nonmonetary, there may be other considerations that may reconcile CAP and risk aversion. To isolate the problem from such considerations, we assume monetary sanctions and that stigma and other costs from incarceration are not present. But the explanation that we provide should not be affected by the nature of the sanction. Assuming that criminals reap the entire benefit of crime simply underestimates the deterrent value of p and overestimates the preferences for risk implied by CAP.

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22. The difference between criminals' responsiveness to certainty and responsiveness to severity of punishment can formally be expressed as $\Delta = (\partial b^*/\partial p)(p/b^*) - (\partial b^*/\partial s)(s/b^*)$.

23. Becker (1968) refers to s, the exogenously imposed sanction, as the severity of punishment to conclude that CAP implies risk-seeking behavior. Similarly, empirical studies such as Friesen (2012) and Block and Gerety (1995) focus on exogenously imposed sanctions.

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