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On the Interaction of Individual and Collective Crime

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Abstract

This paper shows that increasing the sanction on collective crime may increase its prevalence. This situation arises when individuals can commit crimes both individually and as part of a collective. Our result is based on an interdependence between detection probabilities where detection of an individual crime may result in the uncovering of the collective crime as well.

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1 Introduction

1.1 Motivation and Main Result

Criminal opportunities are manifold. Some are easily accomplished alone, whereas others require the cooperation of individuals. An example of the former could be an act of deception or street robbery, while protection racketeering or extortion more appropriately fall into the latter category. Given the variety of opportunities for crime, it will often hold that individuals engaged in collective crime do not forfeit the possibility to perform additional individual crimes. However, committing crimes usually leaves traces in one way or another. Consequently, detecting the perpetrator of one offense may lead to her other offenses also being uncovered. For instance, in conducting a search for evidence of a drug offense, stolen goods from a robbery with another individual could also be discovered. It is such interdependencies that this paper investigates.

We establish the counterintuitive result that increasing sanctions on a crime can increase its prevalence. Our finding can be explained as follows: members of criminal organizations can undertake individual offenses in addition to the collective crime without conferring with the other members of the criminal organization. This may happen although the individual offense bears implications for the expected payoff of the collective crime. The latter interdependence follows from our assumption that the detection of individual crimes might uncover sufficient evidence to penalize the collective crime as well. In that sense, the undertaking of the individual crime exerts an externality as it changes the payoffs of other members of the criminal organization without this fact being reflected in the calculus of the individual. As a consequence, it may be that individuals transgress individually although this does not maximize the sum of payoffs. However, members of criminal organizations may find it difficult to credibly commit to abstaining from individual crime. The fact that for certain configurations of enforcement parameters, members of criminal organizations find it privately optimal to undertake an individual crime in addition to the collective transgression and thereby increase the expected sanction for the collective crime, might effect whether or not the latter crime is undertaken in the first place. We then establish that an increase in the sanction for collective crime might allow members of criminal organizations to credibly commit to abstaining from individual crime, which in turn makes collective crime profitable again. In other words, an increase in the sanction for collective crime can increase the prevalence of collective crime.

The fact that a change in the sanction for collective crime can impact an individual's ability to commit to abstaining from the individual offense holds for the following reason: given that the collective crime is agreed on, the undertaking of the individual offense could not only lead to an expected sanction for this crime but could also increase the expected sanction for the collective crime. This latter part of the change in the total expected sanction is affected by a variation in the sanction for collective crime. Given that the sanction for the collective crime is of a sufficient magnitude, the total burden from undertaking individual crime is no longer surpassed by the benefit therefrom, allowing individuals' credible commitment.

1.2 Relation to the Literature

We study the coexistence of individual and collective crime, whereas most contributions to the literature focus on individual crimes.

The bulk of the literature addressing optimal law enforcement with individual potential offenders finds that an increase in the sanction results in higher deterrence (see, e.g., Polinsky and Shavell 2007). In contrast, this study finds that increasing the sanction of a crime may increase its prevalence. Tsebelis (1989) establishes in a 2x2 game in which (i) the individual either offends or does not and the policeman either monitors or does not, and (ii) only a mixed-strategy equilibrium exists, that an increase in the sanction only affects the monitoring probability of the policeman. However, this result is due to the particularities of mixed strategies. Andreoni (1991) also finds that increasing the sanction for a crime may actually encourage it. However, the fact which drives his result is that juries perceiving error costs may be less willing to convict a suspect if the sanction is higher.

We allow for two different types of offenses. Different offense categories may have different implications for society. It then becomes interesting how deterrence is optimally structured in view of these different criminal activities. This topic has been touched upon in the literature addressing optimal law enforcement given individual potential offenders by Shavell (1992) and Mookherjee and Png (1994). For instance, Shavell shows that it may be beneficial to set the sanction for offenses with lower harm at less than the maximal level in order to steer undeterred individuals who choose between acts towards less harmful ones. This is in contrast to our setting, in which we find that increasing the sanction for a given act may be in order if it is preferred that individuals undertake this act rather than another one.

There is also literature that deals with organized or collective crime. Analysts often conceptualize organized crime as a monopolistic firm and build their analysis on that. For instance, Schelling (1967), Buchanan (1973), Gambetta and Reuter (1995), and Garoupa (2000) feature this approach. Given that criminal activity is usually considered detrimental, any contraction in the number of offenses due to imperfect competition may be welcome. We do not delve into the subject of market structure but simply allow for strictly positive gross benefits from individual and collective crime. Garoupa (2007) instead focuses on the internal structure of a criminal organization. The study by Chang et al. (2005) is closest to our pursuit but still very different in its objective. They allow for the coexistence of individual and collective crime but require potential offenders to choose between the two in order to arrive at conclusions about the endogenous organizational structure. For instance, Chang et al. (2005) contrast a uniform and an ability-adhering payoff sharing scheme to determine whether high-ability or low-ability offenders are organized. In contrast, we posit that both kinds of criminal opportunities might be undertaken at the same time and analyze the potential repercussions this fact bears on the effects flowing from law enforcement.

In view of the above discussion, we assert that our analysis contributes to the literature in two ways: we are the first to allow for individual and collective crime to be undertaken at the same time, and, in so doing, introduce possibly important interdependencies. Next, we illustrate a context in which an increase in the sanction for collective crime may increase the prevalence of collective crime.[1] Our analysis focuses on the comparative statics with respect to the sanction for collective crime, highlighting our counterintuitive central finding but refraining from a full-fledged discussion of optimal law enforcement. The structure of the paper in which we bring these aspects to the fore is as follows. Section 2 presents the model. Section 3 presents decision-making by potential offenders. Section 4 concludes.

[1]Kugler et al. (2005) also find that harsher punishment can encourage collective crime. However, their line of reasoning requires corruption of law enforcers, which is absent in our setup.

2 The Model

We investigate a three-stage game involving three players, two (symmetric) individuals and nature. At Stage 1, the two individuals agree on whether to commit a collective crime. At Stage 2, individuals non-cooperatively decide whether to commit the individual offense. Finally, at Stage 3, a draw by nature determines whether crimes are detected by law enforcement authorities. We consider this sequence to be the most natural as individuals who have agreed to participate in collective crime may also offend individually on the side.

The benefit derived from collective [individual] crime is C $[I]$ for each individual. If potential offenders opt only for collective [individual] crime, each faces an expected sanction of pF_C $[qF_I]$, where $p\,[q] \in (0,1)$ is the detection probability and F_C $[F_I]$ the applicable sanction.[2] We are interested in the effects when the crimes are interrelated in that the detection of one crime may result in uncovering the other transgression. We focus on the case in which the detection of the individual crime reveals information about the collective crime, i.e. a unidirectional interdependency.

3 The Analysis

Given the extensive structure of the game with perfect information, we apply backward induction, starting at Stage 2, the stage where the individual decides on the undertaking of the individual crime.

If potential offenders have agreed at Stage 1 not to opt for the collective crime, individuals choose the individual offense at Stage 2 if $I \geq qF_I$, i.e. if the individual crime yields a positive net benefit.

If potential offenders have agreed at Stage 1 to opt for the collective crime, an individual's decision with respect to the individual crime at Stage 2 not only affects his own payoff but also exerts a negative externality on his accomplice. Table 1 represents the corresponding subgame. Σ_1 $[\Sigma_2]$ denotes the compound detection probability for the collective crime if one [both] individual[s] undertake[s] the individual crime. These probabilities are given by

$$\Sigma_1 = p + (1-p)q \tag{1}$$

$$\Sigma_2 = p + (1-p)\{q + (1-q)q\} \tag{2}$$

$$= p + (1-p)q(2-q) \tag{3}$$

These definitions reflect our assumption that the detection of an individual crime implies the uncovering of the collective crime. It holds that $\Sigma_2 > \Sigma_1 > p$. Σ_1 may be explained as follows. The direct detection of collective crime occurs with probability p. However, the collective crime may be detected even if it is not directly detected, which occurs with probability $(1-p)$, but is uncovered in connection with the detection of the single individual offense undertaken, which occurs with probability q. Σ_2 applies if both individuals undertake an individual crime in addition to the collective crime. The indirect uncovering of the collective crime is possible by detecting either of the two individual acts. This explains the term $q + (1-q)q$ in (2). As a consequence, the probability of uncovering the collective crime is concave with respect to the number of group members that commit the individual crime. This is due to the fact that the undertaking of the second individual crime increases

[2] The probabilities p and q might both depend on enforcement effort and be interdependent in some way. We refrain from a complete specification of p and q since the focus of our comparative statics analysis lies with the sanction for the collective crime F_C.

the probability of the collective crime being uncovered only in the event that the first accomplice's individual crime has not been detected.[3]

Action	Offend individually (OI)	Do not offend individually (NI)
OI	$I + C - \Sigma_2 F_C - qF_I$, $I + C - \Sigma_2 F_C - qF_I$	$I + C - \Sigma_1 F_C - qF_I$, $C - \Sigma_1 F_C$
NI	$C - \Sigma_1 F_C$, $I + C - \Sigma_1 F_C - qF_I$	$C - pF_C$, $C - pF_C$

Table 1: Stage 2 subgame given collective crime

Looking at Table 1, we inquire into the potential equilibria of this subgame at Stage 2. In order to establish an equilibrium in which both individuals do (not) offend, we make use of critical values for the sanction F_C.

Lemma 1 *Given that individuals agree on committing the collective crime,*
(i) the individual offense by both is an equilibrium if $F_C \leq \frac{I-qF_I}{q(1-p)(1-q)} = \bar{F}_C$,
(ii) no individual offense by both is an equilibrium if $F_C \geq \frac{I-qF_I}{(1-p)q} = \hat{F}_C$.

Proof. To obtain the equilibrium (NI, NI), it is required that the benefit from the individual crime, I, falls short of the increase in the individually expected sanction, $qF_I + (\Sigma_1 - p)F_C$, which is equivalent to $F_C \geq \frac{I-qF_I}{q(1-p)}$. For (OI, OI) to be an equilibrium, the reduction in the individually expected sanction from not committing the individual act, $qF_I + [(\Sigma_2 - p) - (\Sigma_1 - p)]\, F_C$, must not exceed foregone benefits, I, i.e. $F_C \leq \frac{I-qF_I}{q(1-p)(1-q)}$. ■

With respect to an ordering of critical values of the sanction for collective crime, we note that $q(1-p) > q(1-p)(1-q)$ holds. The term $q(1-p)$ represents the increase in the compound probability that the collective crime is detected if one instead of no individual offends individually. The term $q(1-p)(1-q)$ represents the increase in the compound probability that the collective crime is detected if two instead of one individual offend individually. The inequality implies that $\hat{F}_C < \bar{F}_C$.

We may summarize that, given a collective crime, there is an equilibrium in (NI,NI) if $F_C > \bar{F}_C$, there is one equilibrium in (NI,NI) and one equilibrium in (OI,OI) if $\hat{F}_C < F_C < \bar{F}_C$, and there is an equilibrium in (OI,OI) if $F_C < \hat{F}_C$. Both equilibria exist if the sanction for collective crime is set at some intermediate level, i.e. if $F_C \in [\hat{F}_C, \bar{F}_C]$. Since we are analyzing decisions of individuals with a cooperative interaction at Stage 1, we assume that both agree on the equilibrium with higher payoffs in case both equilibria exist. Furthermore, we deduce that (OI, NI) can never be an equilibrium. For $F_C < \bar{F}_C$, NI is not a best answer to OI. For $F_C > \hat{F}_C$, OI is not a best answer to NI.

Lemma 2 *(i) Given that individuals agree on undertaking the collective crime and* $F_C \in [\hat{F}_C, \bar{F}_C]$, *both individuals credibly commit to not offending individually.*
(ii) Given that individuals agree on undertaking the collective crime, undertaking individual offenses as well maximizes the sum of payoffs only if $F_C < \frac{I-qF_I}{q(1-p)(2-q)} = \tilde{F}_C$.

Proof. For payoffs from (OI, OI) to be higher than payoffs from (NI, NI), benefits of the individual crime I have to surpass the increase in the expected sanction $qF_I + (\Sigma_2 - p)F_C$, which is equivalent to $F_C < \tilde{F}_C$. Since $\tilde{F}_C < \hat{F}_C$, when choosing between two equilibria, individuals always agree on not undertaking the individual crime if $F_C \in [\hat{F}_C, \bar{F}_C]$. ■

We summarize our findings in

[3]For small values of q, Σ_2 could be approximated by $p + (1-p)2q$, resulting in a linear relationship. This would not affect the main results derived in the paper.

Proposition 1 *Given that individuals agree on committing the collective crime, both individuals choose the individual crime if $F_C \leq \hat{F}_C$, but there is no individual crime otherwise.*

Proof. Follows from the above. ■

The proposition in combination with Lemma 2 highlight that individual crime by both individuals occurs if $\tilde{F}_C < F_C < \hat{F}_C$ although this is to the detriment of the sum of payoffs. Given that both individuals agree on committing the collective crime, there is an upside, represented by I, to also offending as an individual. The downside of offending as an individual depends on whether only one actor or both actors do so. The reason is that the individual offense increases the detection probability of the collective crime.

Suppose that one individual does not offend individually. If the other individual decides to offend individually, the downside from this decision for this individual is given by $(\Sigma_1 - p)F_C + qF_I$. That is why the individual in this case would prefer to offend individually as long as $F_C < \hat{F}_C$. Consequently, committing to the equilibrium (NI, NI) is credible only if $F_C > \hat{F}_C$. Although the sum of individual payoffs would be higher by not committing any individual offenses as long as $\hat{F}_C > F_C > \tilde{F}_C$, coordination on not committing the individual crime is no longer credible for $F_C < \hat{F}_C$, due to the negative externality inherent in individual crimes.

Next, we move to Stage 1 where individuals decide on collective crime. Without collective crime, individuals gain $\max\{0, I - qF_I\}$. With collective crime, individual payoffs are $I + C - \Sigma_2 F_C - qF_I$ for $F_C < \hat{F}_C$ or $C - pF_C$ otherwise.

We are interested in the effect of changes in F_C on offenses committed. To make the analysis interesting, suppose that $I > qF_I$, so that the individual crime is in itself attractive.[4] The payoff $I - qF_I$ will thus be the alternative to any payoffs associated with collective crime. It follows that collective crime will be deterred by setting F_C very high. In contrast, for small F_C, it is clearly optimal for criminals to commit the collective as well as the individual crime as long as $C > \Sigma_2 F_C$. This option, however, quickly loses attractiveness with increasing F_C due to Σ_2 being relatively large. It becomes of interest what outcome results next.

As established above, the case in which both individuals only commit the collective offense yields higher payoffs than the case in which they undertake both offenses if $F_C \geq \tilde{F}_C$. However, (NI, NI) is an equilibrium only if $F_C \geq \hat{F}_C$. Individuals might also agree not to perform the collective act. When comparing payoffs of the case in which both crimes are committed $(C + I - \Sigma_2 F_C - qF_I)$ to the one in which only individual crimes take place $(I - qF_I)$, benefits from the former only exceed those from the latter for $F_C < \frac{C}{\Sigma_2} = F_C^*$. Note that $\hat{F}_C$ and F_C^* cannot be ranked unambiguously. Consequently, the outcome "collective and individual crime", which results for small F_C, changes when increasing the sanction for collective crime, to the outcome "individual crime only" at F_C^* if $F_C^* < \hat{F}_C$. Alternatively, the increase may change the outcome to one in which only collective crime takes place. This would occur at $\hat{F}_C$ if $\hat{F}_C < F_C^*$ were to hold. In this latter case, increasing the sanction on collective crime even further eventually results in individual crime only for $F_C > \frac{C - I + qF_I}{p} = F_C^+$ so that collective crime is eradicated.

Having introduced all critical values for the sanction of collective crime which are of importance for our analysis, we summarize these for quick reference in Table 2.

Suppose now that $F_C^* < \hat{F}_C$. In this case, the outcome "individual crime only" is obtained for $F_C \in [F_C^*, \hat{F}_C)$. At $F_C = \hat{F}_C$, individuals compare $I - qF_I$ and $C - pF_C$ as the commitment to no individual offenses becomes credible. Consequently, individuals may

[4] If the net benefit from individual crime were not positive, our analysis would reduce to one considering only whether collective crime is profitable or not, i.e. a comparison of C and pF_C.

Critical level	Explanation
$\tilde{F}_C$	Payoffs from (OI,OI) are equal to payoffs from (NI,NI), given collective crime
F_C^*	Payoffs from collective crime and (OI,OI) are equal to payoffs from individual crime alone
$\hat{F}_C$	Individual payoffs from (NI,NI) are equal to payoffs from (OI,NI) for the first individual, given collective crime
$\bar{F}_C$	Individual payoffs from (OI,OI) are equal to payoffs from (OI,NI) for the second individual, given collective crime
F_C^+	Payoffs from collective crime alone are equal to payoffs from individual crime alone

Table 2: Critical values for the sanction of collective crime

switch to undertaking only the collective crime. This implies that an increase in the sanction for collective crime may re-introduce the undertaking of collective crime.

For this sequence of outcomes, we need both $F_C^* < \hat{F}_C$ and $C - p\hat{F}_C > I - qF_I$, i.e. $\hat{F}_C < F_C^+$, to hold. These conditions can be simultaneously fulfilled and intuitively interpreted by comparing the benefits from collective crime C, on the one hand, and the individual net benefit from the individual act, $I - qF_I$, on the other. The first condition, $F_C^* < \hat{F}_C$, requires the benefit from the collective act not to be too large in comparison to $I - qF_I$. For $F_C > F_C^*$, the individual act implies a higher payoff than the undertaking of both kinds of acts, while $F_C < \hat{F}_C$ implies that undertaking only the collective crime is not credible. As a consequence, $F_C^* < F_C < \hat{F}_C$ implies that collective crime is eradicated, necessitating that C is not too large. The second condition, $\hat{F}_C < F_C^+$, demands a C of sufficient size in comparison to $I - qF_I$. This results from the fact that, given commitment is possible due to a higher sanction on the collective crime, payoffs from the collective crime alone must outweigh foregone benefits from individual crimes in order to re-introduce the undertaking of collective crime. Note that $\tilde{F}_C < F_C^* < \hat{F}_C$ is a necessary prerequisite for both conditions to be fulfilled, which again highlights the negative externality entailed in individual crimes as the distinctive feature generating our result. As a consequence of the externality there is a divergence between individual and collective incentives with regard to the individual transgression, represented by the existence of the interval $[\tilde{F}_C, \hat{F}_C]$. If F_C is increased further, $F_C > F_C^+ = \frac{C-I+qF_I}{p}$ holds eventually, which implies - as alluded to before - that only individual crimes take place for very large F_C.

We distinctly summarize our central finding in

Proposition 2 *If $F_C^* < \hat{F}_C < F_C^+$, we obtain the following outcomes:*
(i) Collective and individual crime if $F_C < F_C^*$,
(ii) Individual crime if $F_C^* \leq F_C < \hat{F}_C$,
(iii) Collective crime if $\hat{F}_C \leq F_C < F_C^+$,
(iv) Individual crime if $F_C \geq F_C^+$.

Proof. Follows from above. ■

Proposition 2 summarizes our central result: an increase in the sanction for collective crime may increase its prevalence. The rationale can be provided by reference to whether members of criminal organizations can credibly commit not to undertake individual transgressions. This is not the case if $F_C^* \leq F_C < \hat{F}_C$. In that case, the fact that individuals

anticipate at the first stage that individual transgressions, which increase the expected sanctioning of collective crime, will occur, makes actors opt against collective crime. In contrast, if $\hat{F_C} \leq F_C < F_C^+$, the individual offense given collective crime is no longer tempting at Stage 2, which makes the attainment of an outcome with only collective crime possible. This fact makes collective crime more profitable, where this type of crime is more profitable than individual crime alone if $F_C < F_C^+$. As a consequence, collective crime occurs after elevating the sanction for collective crime from the interval $F_C^* \leq F_C < \hat{F_C}$ to the interval $\hat{F_C} \leq F_C < F_C^+$.

4 Conclusion

This paper establishes that an increase in the sanction for a certain act may increase its prevalence in equilibrium. This result stands in contrast to the standard findings in law enforcement literature. We derive the result in a setting which allows potential offenders to undertake individual and collective crime. Thus, our analysis considers interdependencies between crimes and their enforcement. Our result can be used to counter seemingly straightforward policy recommendations, such as that an increase in the sanction for some behavior acts like an increase in the price for undertaking this behavior and therefore induces less behavior of this type. In our setting, the policy maker might rather reduce the sanction on collective crime if his priority is on preventing this type of crime.

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