Economic Analysis of Law Review

Does Uncertainty Deter Crime?

A Incerteza Determina o Crime?

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RESUMO

Quando a probabilidade de apreensão e convicção é observada com o ruído, a decisão de cometer um crime é influenciada pela incerteza sobre a probabilidade real. Nesta nota, mostramos que o aumento da incerteza desestimula o comportamento criminoso apenas em sociedades com altas taxas criminais - onde os indivíduos já são altamente propensos a agir ilegalmente. Nossas descobertas também mostram que a severidade da punição e a incerteza sobre a probabilidade de apreensão e condenação são instrumentos substitutivos (complementares) de política anticrime sempre que o tamanho da sanção é alto (baixo, respectivamente) o suficiente.

Palavras-chave: incerteza; economia do crime; incentivos

JEL: D03; D81; K00

ABSTRACT

When the probability of apprehension and conviction is observed with noise, the decision to commit a crime is influenced by the uncertainty about the true probability. In this note we show that increases in the uncertainty discourage criminal behavior only in societies with high criminal rates – where individuals are already highly prone to act illegally. Our findings also show that severity of punishment and uncertainty about the probability of apprehension and conviction are substitute (complementary) anti-crime policy instruments whenever the size of sanction is high (low, respectively) enough.

Keywords: uncertainty; economics of crime; incentives.

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1. Introduction

Since the seminal paper by Becker (1968), literature on Economics of Crime has been investigating the effects on criminal behavior of both the size of the sanctions imposed on criminals and the probability of apprehension and conviction (Garoupa, 2003). However, how the uncertainty about those variables affects the decision to commit a crime has been much less studied. The exceptions generally focus on uncertainty about the size of the sanction, such as in cases of legal errors (Lando, 2006; Png, 1986; Polinsky and Shavell, 1989, 2000), or analyze the benefits of uncertainty in specific applications, such as insurance fraud (Lang and Wambach, 2013) and tax enforcement (Osofsky, 2011).

The absence of models which address the impact of uncertainty about the probability of apprehension and conviction on the incentives to commit a crime is relevant for two main reasons. First, while it is reasonable to assume that potential criminals have high level of certainty about the size of the sanction, they generally are very unsure about the true value of the probability of being caught and punished. This is so because the former depends substantially on what is established in law and executed by courts, which is clearly observable, since law codes and sentences are public. Yet the probability of apprehension and conviction is a result of public security policies, police efforts and judicial system effectiveness, among other hardly observed variables.

Second, Harel and Segal (1999) shows that the practice of reinforcing certainty with respect to the sanction while maintaining uncertainty about the true probability of apprehension and conviction is pervasive. In fact, that study argues that legal systems aim at providing greater certainty about the size of the sanction and, at the same time, it is indifferent to the certainty about the probability of detection and conviction. Although it models other type of uncertainty, Lang (2017) also argues that it may influence criminal behavior by showing that uncertainty about the legality of a specific action raises welfare. Finally, in specific applications, Lang and Wambach (2013) and Osofsky (2011) also demonstrate that uncertainty may have a decisive role in discouraging crime.

This note innovates by investigating how uncertainty about the true probability of apprehension and conviction affects the criminal behavior through a simple microeconomic model. We assume that a generic potential criminal observes such a probability with noise, and thus we are able to evaluate the effects of changes in the noise's variance (uncertainty) on the probability of being a criminal. Our findings indicate that increases in the uncertainty cause a decrease (an increase) in the probability of committing a crime for individuals who have high (low, respectively) probability of acting illegally. Therefore, on the one hand our results explain empirical regularities like those reported by Harel and Segal (1999), and on the other hand they suggest that increasing levels of uncertainty are effective to deter crime only in societies where crime rates are high.

The note is divided as follows. The next section presents the model and our main result. Section 3 concludes by providing some policy recommendations. Finally, the proof of our main result is presented in the appendix A.

2. The effects of uncertainty on crime

Consider a representative individual who must decide whether or not to commit a crime. The benefit from such a criminal activity, measured in terms of utility, is $b > 0$. We can think of b as the utility derived from monetary gains from theft, for example. There is no "production cost", such that if the individual is not caught committing the crime, his total utility is b. On the other hand, if he is caught acting illegally, the punishment, measured in terms of utility, is $-(c + b)$, where $c > 0$. In other words, when the individual is caught, he does not keep the object of the crime and is punished in the amount c. We can think of $-c$ as being the disutility from being arrested and convicted.

The expected utility from committing the crime is therefore $EU^{crime} = (1 - p)b - pc$, where $p \in [0,1]$ is the probability of being caught and convicted. For the sake of simplicity, we assume that the individual's reserve utility is null, such that the expected utility of not committing the crime is $EU^{honest} = 0$. Thus, the individual chooses to act illegally if and only if $p \leq b/(b + c)$. However, we assume that the individual does not know the true value of p, instead he must choose under uncertainty.

Assumption 2.1 *The individual observes the probability of apprehension and conviction with noise. Formally, the probability he observes is* $\tilde{p} = p + \varepsilon$*, where* p *is the true probability and* $\varepsilon \sim N(0, \sigma^2)$.

As we argued in the introduction, the true probability of apprehension and conviction depends on several variables which are hardly observable by individuals. In particular, it is a function of how much resources the police are investing in detecting criminals as well as of the effectiveness of their efforts. Therefore, it does not seem to be strong to assume that such variables are imprecisely observed. Other important determinants of the true probability are the effectiveness of the judicial system and the public security policies in general, which are also not publicly observed with precision.

Given that the support of the normal distribution is the whole real line, but $\tilde{p} \in [0,1]$, we define

$$\tilde{p} = \begin{cases} 0, \text{ if } p + \varepsilon < 0 \\ p + \varepsilon, \text{ if } p + \varepsilon \in [0,1] \\ 1, \text{ if } p + \varepsilon > 1. \end{cases}$$

We are now able to compute the probability of an individual who observed committing a crime:

$$Prob(crime) = Prob\left(p \leq \frac{b}{b+c} | \tilde{p}\right) = 1 - Prob\left(\varepsilon \leq \tilde{p} - \frac{b}{b+c} | \tilde{p}\right) = 1 - \Phi\left(\frac{\tilde{p} - \frac{b}{b+c}}{\sigma}\right),$$

where $\Phi(\cdot)$ is the c.d.f of the normal distribution with zero mean and variance σ^2.

It is straightforward to see that the known marginal effects of the benefit and of the punishment on the propensity for acting illegally hold in our model: increases in b and decreases in c increase the probability of committing the crime. In addition, one can see that

$Prob(p \leq b/(b+c))$ is monotonic both in b and c. On the other hand, the effect of increases in the uncertainty about the true probability, namely increases in σ, can be positive, negative and even null.

Proposition 2.2 *A higher uncertainty about the true probability of apprehension and conviction increases (decreases) the probability of committing the crime whenever* $\tilde{p} > b/(b+c)$ *(*$\tilde{p} < b/(b+c)$*, respectively). Further, there is no change in the probability whenever* $\tilde{p} = b/(b+c)$.

There are two ways of interpreting the above result. The first is that higher uncertainty discourages criminal behavior only for individuals who already have a probability of committing crime greater than 0.5[2]. In other words, a policy based on increasing the variance of the probability observed by the individual makes the criminal rates decrease only in societies where crime prevalence is high. This implies that the best policy for societies with high criminal rates is to invest in uncertainty, by making the individuals less aware of the chances of being caught and punished.

The reason why only individuals who are already highly prone to commit crimes are discouraged to behave dishonestly by higher uncertainty is that increases in the noise's variance implies in higher chances of extremes values (both positive and negative) for the random part of the observed probability. Therefore, given that $p \in [0,1]$, higher uncertainty increases the chances of the determinist part of the observed probability – namely p – being low (high) whenever $\tilde{p}$ is high (low, respectively) enough. As a result, when the variance increases, by observing $\tilde{p} < b/(b+c)$ individuals know that there is a higher chance of $p > b/(b+c)$, which discourages them to commit a crime.

One can also interpret the above result from the point of view of the government or the public security authority. As we have commented, for a given $\tilde{p}$, the higher the size of the sanction c the lower the threshold $b/(b+c)$, which implies in lower probability of committing a crime. Thus, for fixed $\tilde{p}$, c may be high (low) enough to guarantee that $\tilde{p} > b/(b+c)$ ($\tilde{p} < b/(b+c)$, respectively). Our result therefore states that in societies where the sizes of sanctions (e.g. time in prison, monetary fee) are sufficiently high (low), more uncertainty makes individuals more (less, respectively) prone to commit crimes. In other words, severity of punishment and uncertainty about the probability of apprehension and conviction are substitute (complementary) anti-crime policy instruments whenever c is high (low, respectively) enough.

3. Concluding remarks

If we assume that governments or public security authorities have power to affect the variance of the observed probability of apprehension and conviction potential criminals face – e.g. by making public security policies less transparent or by changing the size the police force periodically –, then our results provide another effective instrument to deter crime.

[2] Recall that $\Phi(0) = 0.5$ and $\Phi'(\cdot) = \varphi(\cdot) > 0$, such that if $\tilde{p} > b/(b+c)$, $\Phi(\tilde{p} - b/(b+c)) > 0.5$, and then $Prob(honest) = 1 - Prob(crime) > 0.5$.

However, contrary to the literature's findings, in our model uncertainty may increase or decrease the probability of committing a crime. As we have seen, societies with high criminal rates – where individuals are already highly prone to act illegally – are those which would benefit the most by increasing uncertainty.

The same approach adopted here can be applied to other models of choice under uncertainty, in which the probabilities of some state of nature are observed imprecisely. Yet, the assumption of normal distribution of the noise may not be suitable for all applications. In fact, in some environments uncertainty can be better modeled through asymmetric distributions, which would change substantially the results. In fact, even our findings would change if we adopted a probability distribution different from the normal.

4. References

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A Omitted proofs

A.1 Proposition 2.2

We are interested in the sign of

$$\frac{d}{d\sigma}Prob(crime) = -\frac{d}{d\sigma}\Phi\left(\frac{\tilde{p}-\frac{b}{b+c}}{\sigma}\right) = \frac{\tilde{p}-\frac{b}{b+c}}{\sigma^2}\varphi\left(\frac{\tilde{p}-\frac{b}{b+c}}{\sigma}\right),$$

where $\varphi(\cdot)$ is the p.d.f. of the normal distribution with zero mean and variance σ^2.

Thus, given that $\varphi(\cdot) > 0$ if $\tilde{p} > \frac{b}{b+c}$, $\frac{d}{d\sigma}Prob(crime) > 0$and then the higher the uncertainty about the true probability of apprehension and conviction, the higher the probability of committing a crime. Further, if $\tilde{p} < \frac{b}{b+c}$, $\frac{d}{d\sigma}Prob(crime) < 0$ and then the higher uncertainty about the true probability of apprehension and conviction, the lower the probability of committing a crime. Finally, when $\tilde{p} = \frac{b}{b+c}$, changes in σ causes no change in $Prob(crime)$. ■

