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Plea bargaining with budgetary constraints

Steve Mongrain^{a,*}, Joanne Roberts^b

^a Department of Economics, University of Calgary, Calgary AB Canada T2N1N4

^b University of Calgary, Canada

ABSTRACT

In this paper, we construct a simple model that illustrates a perverse effect associated with plea bargaining in which an increase in sanctions can lead to reduced deterrence. This finding is derived from the interaction of binding budgetary constraints and plea bargaining. In an environment with these institutional features, higher sanctions are not always optimal when resources are limited, even if such sanctions are costless. Such potential phenomena may be useful in explaining the fact that many states have introduced limitations on plea bargaining. Prosecutors being concerned with their conviction rates is necessary for such a result to be present.

1. Introduction

In the present U.S. judicial system, few criminal cases are determined by trial. In fact, approximately 90% of cases are resolved by guilty pleas.¹ Although television has popularized the idea that plea bargains are made in exchange for information as studied by Kobayashi (1992), the large majority of the plea bargains in reality are done to save resources. Miceli (2007); Fisher (2000), or Landes (1971) all pointed out that because of severe budgetary pressure on prosecutors, this method of resolving cases is viewed as an essential tool for managing large case loads. Plea bargaining saves money, or perhaps we should more precisely say that it saves time, by reducing the time spent in court by both prosecutors and judges. Court time is often seen as the most significant constraint to a smoothly functioning legal system. In fact, empirical evidence, dating as early as Alschuler (1968), reveals that plea bargaining became more prevalent as these types of constraints became more binding.

Despite these advantages, there is a large opposition to plea bargaining. In a 2004 memo on sentencing to all federal prosecutors, the Justice Department imposed restrictions on plea bargaining.² Five states³ have partial bans on plea bargaining, while eleven states⁴ have some form of restrictions. In 1975, Alaska even intro-

duced a total ban on plea bargaining.⁵ Some lobby groups like Mother's Against Drunk Driving (MADD) advocate for a total ban of plea bargaining in drinking and driving cases. According to Fisher (2000), people are concerned that plea bargaining is unfair and undermines the legitimacy of the legal system.

In a simple model that incorporates a constrained prosecutor, we will show that increased sanctions may lead to reduced deterrence when plea bargaining is taken into consideration. In other words, excessive use of plea bargaining can reduce the effectiveness of higher sanctions. There is a long list of theoretical and empirical research addressing the relative ineffectiveness of higher sanctions as documented by Polinsky and Shavell (2007) and Levitt and Miles (2007) in the first Handbook of Law and Economics. Of special interest for us is Andreoni (1991) who argued that the probability of conviction may fall as sentences rise if jurors use a reasonable doubt test. A similarly argument can be made about the use of plea bargaining by prosecutors. Plea bargaining is characterized by a guilty plea, in which the defendant and the prosecutor agree to a division of the surplus created by the savings generated by avoiding trial. In order to provide more trial effort, the prosecutor must plea bargain with a larger fraction of cases. However, each plea bargain entails a reduced sanction, offsetting the benefit of the increased sanction.

When prosecutors are socially benevolent, in the sense that minimizing criminal activity is their goal, they internalize all of the effects of plea bargaining. Consequently, a benevolent prosecutor is able to take advantage of the increase in sanction to reduce crime. However, when prosecutors have different objectives, this may no longer be the case. Many lawyers and economists acknowledge

* Corresponding author.

E-mail address: mongrain@sfu.ca (S. Mongrain).

¹ United States Sentencing Commission Data. Resolved cases are defined as those dealt with by guilty plea, dismissal or trial.

² See the memo (<http://news.findlaw.com/hdocs/docs/doj/ashcroft92203chrgmem.pdf>) by Attorney General J. Ashcroft. In his memo, Ashcroft stated that it is a prosecutor's duty "to charge and to prove the most serious, readily provable offense." Plea-bargaining is only admissible if it is consistent with such goal.

³ CA, FL, MI, OR and PA.

⁴ AZ, AR, CO, KS, KY, ME, MS, NM, NY and WY.

⁵ Rubinstein and White (1979) mention that even if formal plea bargaining is banned, some bargaining takes place in the form of offense bargaining, where the type of offense charged is what is bargained on.

the fact that prosecutors may have career concerns. In particular, prosecutors may wish to signal their competence in order to win re-election or to earn promotion. There are different ways to evaluate a prosecutor's competency using her track record, the most frequently cited being the number of indictments, the conviction rate, and the total prison months. Since in this paper we abstract from case selection, only the last two performance measures are relevant.⁶ There is evidence that prosecutors care about both of these measures. [Boylan \(2005\)](#) shows that future career outcomes of federal prosecutors are positively influenced by total prison months, but not by conviction rates. He also pointed out the fact that in general – as it will be the case in our paper – maximizing total prison months is consistent with welfare maximizing behavior. Alternatively, an easily measured signal of performance is the conviction rate. Early critics highlighted the potential link between conviction rate and plea bargaining. On page 103, [Raymond Moley \(1928\)](#) noted:

Equally important is the advantage which a plea of guilty gives to the prosecuting attorney. He is not compelled to carry through an onerous and protracted trial. He does not run the risk of losing his case in the trial court. He runs no risk of having to oppose an appeal to a higher court in case he wins the trial . . . What is much more important to the prosecutor is the fact that in such records as most prosecutors make of the work which they have performed, a plea of guilty of any sort is counted as a conviction, and when he goes before the voters for re-election he can talk in large terms about securing convictions when, in reality, these 'convictions' include all sorts of compromises. The district attorney's "record", as he usually interprets it to the public, rests upon the ratio of convictions to acquittals and means as much to him as a batting average means to a baseball player.

This concern with "batting averages" does not seem to have diminished. [Rabin \(1971\)](#) and [Eisenstein \(1978\)](#) show some interview evidence of this objective among federal prosecutors. [Albonetti \(1987\)](#) shows that the decision to prosecute is made with a preference to avoid uncertainty. More importantly, [Raghav, Ramseyer, and Rasmusen \(2005\)](#) show that appointed prosecutors have lower conviction rates than elected ones, suggesting that high conviction rates may be believed to have an electoral reward. [Gordon and Huber \(2002\)](#) argue that under asymmetric information it can be rational for voters to use a prosecutor's conviction rate as a performance measure. [Ramseyer and Rasmusen \(2001\)](#) attributes part of the high conviction rates in Japan to the combination of prosecutors' concerns with conviction rates and limited budgets. Through a mechanism resembling the one presented in this paper, Japanese prosecutors may inflate their conviction rates using advantageous case selection. [Glaser, Kessler, and Piehl \(2000\)](#) argue that the federalization of drug cases is due to the fact that prosecutors care about winning high exposure cases, and that federal prosecutors take on more of these cases due to their deeper pockets. Finally, a simple Google search on conviction rates yields many District Attorney's webpages that report information on conviction rates. For example, a website from the County of San Diego reports:⁷

The District Attorney's Office is very proud of the fact that it has a 94.2 percent conviction rate—one of the highest in the State of California.

⁶ [Boylan and Long \(2005\)](#) argue that young prosecutors may which plea bargain less often to accumulate "trial human capital". This would imply that the perverse effect of higher sanctions is more likely to be present with prosecutors who have longer tenure.

⁷ See the webpage, <http://www.sdca.org/prosecuting/conviction.php>.

Since there is evidence supporting both types of objective function, we assume that prosecutors are concerned with both to some degree. For example, a state elected prosecutor may weigh more heavily her "batting average", while an appointed federal prosecutor may be more concerned with total prison months.

We are not the only ones who argue that restrictions on plea bargaining can be beneficial, [Bar-Gill and Gazal Ayal \(2006\)](#) show that imposing a minimum on sanction reductions can prevent innocents from accepting guilty pleas. In our model, we do not consider the problems of asymmetric information. If some agents are innocent, they might want to go to trial in order to separate themselves from guilty defendants as in [Grossman and Katz \(1983\)](#). Prosecutors and defendants could also possess different information about the strength of the prosecutor's case, as discussed in [Reinganum \(1988\)](#). [Baker and Mezzetti \(2001\)](#) also consider a game of asymmetric information.⁸

In the next section of the paper, we discuss the basic model and derive agent behavior. We, then characterize the equilibrium level of crime, and look at the effects of increasing sanctions. All proofs are in [Appendix A](#).

2. The model

There is a measure one of risk neutral agents indexed by their criminal aptitude $\theta \in [0, 1]$, which is uniformly distributed. More able agents are assumed to extract more rents from criminal activities, so the associate payoff is simply θ . If agents do not commit a crime, they receive a reservation utility which is normalized to zero.

If an agent commits a crime, he will be caught with probability $\mu > 0$. For simplicity, we assume that no innocent agents are charged.⁹ We assume that prosecutors cannot observe θ ; and, therefore, no sentences or plea bargains are conditioned on the agent's ability. The expected sanction from going to trial is the product of the legislated sanction S and the probability of conviction.¹⁰ The probability of conviction is given by $P(e)$, where e is the effort provided by the prosecutor in charge of the case. Naturally, $P'(e) > 0$ and $P''(e) < 0$. The cost of going to trial for the prosecutor is simply the effort level e . With some probability λ , the defendant is offered a plea bargain by the prosecutor. The resulting sentence B is the outcome of a bargaining game between the defendant and the prosecutor.

Let $\bar{\theta}$ denote the agent who is indifferent between committing a crime and receiving his reservation utility. This agent is implicitly defined by

$$\bar{\theta} = \mu[(1 - \lambda)P(e)S + \lambda B]. \quad (1)$$

All agents with $\theta \geq \bar{\theta}$ choose to commit a crime, and all agents $\theta < \bar{\theta}$ choose not to. Therefore, $1 - \bar{\theta}$ is the total proportion of criminals in the economy.

The timing of the game is as follows. First, all agents choose whether or not to commit a crime. A fraction μ of all criminals is arrested. The prosecutor, taking the crime rate as given, chooses to

⁸ For a general discussion of asymmetric information, uncertainty, and agency costs in plea bargaining, see [Garoupa and Stephen \(2006\)](#).

⁹ This assumption allows us to abstract from information based arguments about the guilt of a defendant in designing plea bargaining. This type of arguments has been widely investigated in the literature, for example see [Grossman and Katz \(1983\)](#). In reality, a defendant does not have to be objectively innocent to avoid conviction. For example, the prosecutor could fail to turn exculpatory evidence in violation of [Brady vs. Maryland, 373 U.S. 83 \(1969\)](#), or the defense may show that the police conducted an unreasonable search or seizure. Effort by both the defendant and the prosecutor can consequently affect the probability of conviction, even if the defendant is in fact guilty.

¹⁰ Since we want to discuss judicial procedures, we assume that there is always some level of crime in equilibrium. Assuming that $S < 1$ is one way to ensure this.

bargain with λ of the arrested criminals given the limited resources. If an agreement is reached during plea bargaining, the defendant pleads guilty and the agreed sanction B is imposed. The cost of such a plea is assumed to be zero. If the two parties are unable to reach an agreement, the case is transferred to court. The court process is simple. The prosecutor chooses effort levels e , and the defendant is found guilty with probability $P(e)$, in which case the sanction S is imposed.

In previous work, prosecutors have been modeled as maximizing total expected sentences as in Landes (1974), or social welfare as in Grossman and Katz (1983) and Reinganum (1988). Obviously, if prosecutors were to have unlimited budgets, the two objectives may differ; a prosecutor who maximizes expected sentences may dedicate too many resources to this objective. However, when the total prosecutorial budget is fixed, both of those objectives can be equivalent; the cost of prosecutorial effort does not enter in the objective function of the prosecutor, it enters as a constraint instead.¹¹ Consequently, maximizing the per defendant expected sentences can be thought of as having one of two motives. The prosecutor may be maximizing deterrence, therefore, acting in the social interest. Alternatively, the prosecutor may be self-interested, and higher total sentences contribute to furthering their career as suggested by Boylan (2005). We also allow prosecutors to independently care about their conviction rates, as motivated in the introduction. Prosecutors are assumed to be maximizing a weighted sum of the expected average sentence and the conviction rate. This objective function is given by

$$\Omega[\lambda, e] = (1 - \delta)[(1 - \lambda)P(e)S + \lambda B] + \delta[(1 - \lambda)P(e) + \lambda], \quad (2)$$

where δ represents the weight put on conviction rates. For example, elected prosecutors could be facing a larger δ , which is consistent with the empirical literature discussed previously.

The trial stage is very simple. The prosecutor is resource constrained, which can be interpreted as the total time or financial resources available. Given these resources M , the prosecutor's effort level e at each trial is a function of plea bargaining rate λ . More precisely the level of effort at each trial is determined by:

$$e(\lambda) = \frac{M}{(1 - \lambda)\mu(1 - \theta)}, \quad (3)$$

where the plea bargaining rate λ is determined in the previous stage. Obviously, an increase in the number of cases plea bargained allows the prosecutor to devote more effort in each trial, so $e(\lambda)$ is increasing in λ .

Alternatively cases can be resolved by guilty pleas. Entering into a plea bargain results in the defendant pleading guilty and receiving an agreed upon sentence, which we denote by B . A plea bargain divides the surplus generated by foregoing trial. In particular, the defendant benefits from having his sentence reduced by $P(e(\lambda))S - B$. The prosecutor loses from receiving a lower expected sentence, but saves the cost of the trial, $e(\lambda)$.

We assume a Nash bargaining solution, where the resulting plea bargain is given by $B = P(e(\lambda))S - \alpha e(\lambda)$, where α represents the defendant's bargaining power and therefore the share of the bargaining surplus he receives. Rubinstein and White (1979) found that following Alaska's ban on plea bargaining, sentences for Class 3 (burglary, larceny, etc.) increased by 53%, while sentences for Class 4 (fraud, forgery, etc.) and Class 5 (drug felonies) increased by 117%

¹¹ Imagine a simple environment where a prosecutor allocates effort e_1 and e_2 to two cases involving the same sanction S , and probabilities of conviction $P_1(e_1)$ and $P_2(e_2)$. If a prosecutor cares about expected sanctions, she will try to maximise $P_1(e_1)S + P_2(e_2)S$, while a prosecutor who care about social welfare may maximise $P_1(e_1)S + P_2(e_2)S - e_1 - e_2$. If the two prosecutors face the constraint $e_1 + e_2 = M$, both objectives coincide. In the context of our model, the two objectives differ slightly, but all the tradeoffs operate in the same way.

and 223% respectively. This suggests that reduced sanctions were a consequence of plea bargaining, and that the defendant's bargaining power was not negligible. Obviously, if α is low, the reduction in deterrence associated with the use of plea bargaining will also be small. Note that an increase in the legislated sanction S leads directly to an increase in the plea bargained sanction B .

The central decision this paper tries to address is the determination of how many cases get offered a plea, and of those offers how many are accepted.¹² As Miceli (2007) pointed out that with common information, if defendants care about the expected sanction plus legal cost, while prosecutors care about the expected sanction net of those costs, there will always exist a negotiated sentence that makes both parties better off. In such an environment, all cases would be resolved out of court. There exist important features of the judicial process that may prevent prosecutors and defendants from reaching agreements. For example, if the parties' evaluations of the strength of the case diverges, trial may be unavoidable as discussed in Priest and Klein (1984) or Reinganum (1988). In our model, none of these reasons are present, and so as is expected defendants will always accept offers. Prosecutors however, will not offer a plea to every defendant. This is because prosecutors are not assumed to maximize expected sentences net of cost, they maximize expected sentences and/or conviction rates subject to the resources available. Even a prosecutor who cares only about expected sentences will choose to bring some cases to court. The benefit of plea bargaining is that it allows more resources to be devoted to cases that go to court, but at a cost of it reducing sentences on plea bargained cases. When choosing how many cases to plea bargain with, a prosecutor is able exploit the trade off that exists between the number of plea bargains and the amount of effort at each trial. A prosecutor chooses the proportion of cases to plea bargain with to maximize $\Omega[\lambda, e(\lambda)]$. The trade-off is fairly simple. Imagine a prosecutor who only cares about maximizing expected sentences ($\delta = 0$). Increasing the number of pleas directly reduces the expected sanction by $\alpha e(\lambda)$ due to the more lenient sentences. However, it also free up resources and increases the probability of conviction in cases that ultimately go to court. A prosecutor concerned with conviction rates ($\delta > 0$) will have even more incentive to plea bargain. Not only does it increases the probability of winning trials, it also directly increases the conviction rate by securing convictions with certainty in all the cases resolved in this manner.

Lemma 1. *The proportion of cases resolved through plea bargaining increases with the sentence S .*

When the sanction S increases, the marginal benefit of increasing the probability of winning a case for the prosecutor goes up. So, the prosecutor prefers to plea more often and benefit from the higher probability of winning cases taken to trial.

The equilibrium level of crime in this economy can be solved using the behavior derived above. Given the number of cases, the prosecutor will plea bargain with a proportion λ^* . The effort in each trial is given by $e(\lambda^*)$. For cases resolved by plea bargain, the reduced sanction is $B = P(e(\lambda^*))S - \alpha e(\lambda^*)$. Finally, only individuals with $\theta > \theta$ choose to a commit crime. The equilibrium level of crime satisfies all of these conditions.

Proposition 1. *There exists a unique equilibrium with a positive crime rate.*

¹² Plea bargains are allocated randomly since prosecutors cannot observe θ . This allocation may appear 'unfair'. If θ were observable, a deterrence-motivated prosecutor would allocate plea bargains to the most severe criminals in order to target trial effort and therefore punishment severity at the marginal criminals who it may be possible to deter. In this way, unless fairness was explicitly included in the prosecutorial objective, more information would result in an even more 'unfair' allocation of sentences.

Obviously, an increase in the legislated sentence directly changes the expected outcome of trial, as well as the resulting sanction from a plea bargain. It also alters the likelihood of trial relative to a guilty plea. Through these avenues, it influences the crime rate.

Proposition 2. *The crime rate is increasing with the legislated sanction S if the prosecutor is sufficiently concerned with the conviction rate.*

When the prosecutor cares only about expected sanction ($\delta = 0$), there is no conflict between her objective and deterrence maximization. Therefore, such a prosecutor cannot do worse when the sanction increases. She will only increase plea bargaining to the point where it maximizes crime reduction. However, if the prosecutor is concerned with her conviction rate, this result may change. A prosecutor with such an objective, will plea bargain too often to keep her conviction rate high, which can have a detrimental effect on overall deterrence. This becomes more problematic when sanctions are high because the reduction in sentence αe is larger. Higher sentences imply that more effort is devoted at trial, and so plea bargaining generates larger savings. Since defendants get a share α of these savings the negative effect on deterrence is more likely with higher sentences.

Other aspects of the judicial system contribute to this result. For example, how much extra effort can be allocated per case following an increase in the sanction ($\frac{\partial e(\lambda)}{\partial \lambda} \frac{\partial \lambda(S)}{\partial S}$) and the effectiveness of such an increase in effort ($P'(\cdot)$) also contribute to this result. Intuitively, when effort is very effective at trial, prosecutors concerned with conviction rate have a larger benefit from plea bargaining. This translates into too few cases going to trial, and to lower overall expected sentences.

In a more dynamic version of this model, increased crime rates could lead to more cases and congestion in the legal system which in turn could lead to more plea bargaining. This indirect effect would magnify the initial reduction in deterrence.

Before concluding, it is important to point out that we chosen to completely ignore defendants' trial effort decisions. The inclusion of such effort choices would likely only reinforce our results. First, with defendants' effort the total surplus generated by plea bargaining would be more substantial, and therefore so would the reduction in the overall cost associated with crime for a defendant who accepts a plea. Let f denote the cost of trial for a defendant. The bargained sentence would then be given by $PS - \alpha(e - f)$ as pointed out in Miceli (2007), and the overall cost associated with crime for such individual would only be $PS - \alpha e - (1 - \alpha)f$. Secondly, with harsher potential punishments imposed at trial, defendants would have more incentive to provide additional effort at trial, so higher f . As discussed in Sanchirico (2007), it is important to acknowledge that the probability a prosecutor wins a trial depends of the relative efforts provided by both parties, $e/e + f$ for example. Consequently, prosecutors' conviction rates would suffer due to the increase in defendants' efforts. Prosecutors who are overly concerned with their conviction rates would react by increasing their own trial effort, and the only way to do it given the resources available is to plea bargain more often.

3. Conclusion

Policies to limit plea bargaining have been implemented. For example, 13 US states have done so for DWI infractions. This can be viewed as response to the argument that plea bargaining undermines the effectiveness of sanctions. Another method of deterring crime would be to increase the budgets and number of prosecutors. However, given the current judicial system, where less than 10% of cases go to trial, the budget necessary to take a significant proportion of cases to trial seems infeasible. Alternatively, one could reduce the cost of trial directly: for example, by reducing the burden

of proof. However, this possibility has other obvious disadvantages in a system where guilt is to be ascertained.

Not all forms of harsher punishments will cause the same response. For example, the "Three strikes" laws, like those in California, where a third felony conviction results in life-imprisonment may reduce the benefits of plea bargaining to career criminals. Even if the defendant is risk-neutral, and the expected sentence from plea bargaining is less than that of going to trial, the defendant may not wish to plead guilty to a felony, and may rather risk being sentenced to a much more severe sanction in the hope of being found innocent. The benefit to being found innocent is now much higher than in a system where punishment increases more slowly following previous guilty decisions.

This paper also highlights a weakness of relying on conviction rates as a measure of prosecutor performance. Of course, too much concern with high conviction rates has obvious disadvantages in a system where prosecutors are relied upon to ascertain guilt. However, even in this environment where all defendants are guilty, such a reliance on conviction rate measures may have a perverse effect on the level of deterrence by encouraging too many and too generous plea bargains.

Although beyond the scope of this paper, our model suggests some empirical implications that would be worth exploring in future work. Perhaps, most directly, it suggests that the generosity of pleas should be positively correlated with their frequency in a jurisdiction. It also suggests that we should observe more plea bargaining and more generous plea bargains in jurisdictions with elected prosecutors than in those with appointed prosecutors.

Obviously, this model lacks important features of the judicial process that motivate the use of plea bargains. Most importantly, we do not incorporate risk aversion which is a primary reason why prosecutors and defendants reach agreements. In this model, we also do not consider the problems of asymmetric information about agents' guilt or innocence. If some agents are innocent, they might want to go to trial in order to separate themselves from guilty defendants as in Grossman and Katz (1983). Prosecutors and defendants could also possess different information about the strength of the prosecutor's case, as discussed in Reinganum (1988). Baker and Mezzetti (2001) also consider a game of asymmetric information. But even if all those features were to be introduced, it would still be true that a reduction in deterrence could be driven by an increase in trial costs and binding budgets.

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Appendix A

Proof of Lemma 1. The first order condition of the prosecutor's maximization problem is given by:

$$(1 - \delta) \left\{ -\alpha e(\lambda) + [P'(\cdot)S - \lambda \alpha] \frac{\partial e(\lambda)}{\partial \lambda} \right\} + \delta \left\{ (1 - \lambda)P'(\cdot) \frac{\partial e(\lambda)}{\partial \lambda} + [1 - P(\cdot)] \right\} = 0.$$

Using the fact that $\partial e(\lambda)/\partial \lambda = e(\lambda)/(1-\lambda)$, we can show that the prosecutor's optimal level of plea λ^* is given by:

$$P'(e(\lambda^*))S - \alpha = -\frac{\delta}{1-\delta}(1-\lambda^*)[P'(e(\lambda^*)) + 1 - P(e(\lambda^*))].$$

Comparative static analysis shows that:

$$\frac{\partial \lambda(S)}{\partial S} = \frac{-P'(\cdot)}{(S/(1-\lambda^*)) + (\delta/(1-\delta))P''(\cdot)e(\lambda^*) - (\delta/(1-\delta))P'(\cdot)[1 + e(\lambda^*)]}$$

The expression above is positive. \square

Proof of Proposition 1. The crime rate in this economy is given by

$$1 - \bar{\theta}(S) = 1 - \mu[P(e(S))S - \lambda(S)\alpha e(S)], \quad (A1)$$

and from the prosecutor's budget constraint we know that $\lambda(S) = 1 - M/\mu[1 - \bar{\theta}(S)]e(S)$. Consequently, the equilibrium level of $\bar{\theta}(S)$ solves the following equation:

$$\bar{\theta}(S) = \mu[P(e(S))S - \alpha e(S)] + \alpha \frac{M}{1 - \bar{\theta}(S)}. \quad (A2)$$

First, note that the left hand side of this equation is an increasing linear function of $\bar{\theta}$, while the right hand side is an increasing convex function of $\bar{\theta}$. More importantly, note that at $\bar{\theta} = 0$, the left hand side of Eq. A2, is smaller than the right hand side. This implies that the cost of being a criminal for the least able agent always exceeds the benefit. Since we assumed that $S < 1$, the left hand side of Eq. A2 is larger than the right hand side for $\bar{\theta} = 1$, implying that the benefit of committing crime for the most able agent always exceeds the cost. Consequently, there exists one equilibrium with a positive crime rate. Given that we have a unique equilibrium, the stability condition will be satisfied. It is to say that the slope of the right hand side of Eq. A2 is smaller than one. This property will be used in the proof of proposition 2. \square

Proof of Proposition 2. Comparative statics in Eq. A2 reveal that

$$\frac{\partial \bar{\theta}(S)}{\partial S} = \mu \frac{P(\cdot) + [P'(\cdot)S - \alpha] \partial e(S)/\partial S}{1 - \alpha(M/[1 - \bar{\theta}(S)]^2)}.$$

First, note that given the stability condition, the denominator has to be positive. Using the prosecutor's first order condition, the derivative above can be re-written as

$$\frac{\partial \bar{\theta}(S)}{\partial S} = \mu \frac{P(\cdot) - (\delta/(1-\delta))(1-\lambda^*)[P'(\cdot) + 1 - P(\cdot)] \partial e(S)/\partial S}{1 - \alpha(M/[1 - \bar{\theta}(S)]^2)}.$$

If $\delta/1 - \delta[P'(\cdot) + 1 - P(\cdot)]e(\lambda^*)\partial \lambda^*/\partial S > P(\cdot)$, then the crime rate would be an increasing function of the sanction S . A neces-

sary condition for crime to be increasing in S is that δ be large enough. \square

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