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Reducing Guilty Pleas through Exoneree Compensations*

Murat C. Mungan[†] and Jonathan Klick[‡]

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Abstract

A great concern with plea-bargains is that they may induce innocent individuals to plead guilty to crimes they have not committed. In this article, we identify schemes that reduce the number of innocent-pleas without affecting guilty individuals' plea-bargain incentives. Large compensations for exonerees reduce expected costs associated with wrongful determinations of guilt in trial and thereby reduce the number of innocent-pleas. Any distortions in guilty individuals' incentives to take plea bargains caused by these compensations can be off-set by a small increase in the discounts offered for pleading guilty. Although there are many statutory reform proposals for increasing exoneration compensations, no one has yet noted this desirable separating effect of exoneree compensations. We argue that such reforms are likely to achieve this result without causing deterrence losses.

Keywords: Exoneration, Compensation, Wrongful Convictions, Judicial Errors, Deterrence.

JEL classification: K00, K14, K42

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1 Introduction

One of the objectives of the criminal justice system, famously captured in “Blackstone’s ratio,”¹ is to minimize wrongful convictions.² Although there is no consensus on the rate at which the criminal justice system convicts the innocent,³ the advent of post-conviction DNA testing has provided conclusive proof that our system does indeed convict the innocent – by both trial and plea – in non-trivial numbers.⁴

One obvious, although partial, way to remedy this problem is by offering wrongful conviction victims post-exoneration compensation. Despite this, at the time this article is being written, twenty states do not have exoneration statutes.⁵ Moreover, even existing statutes are not uniform⁶ and many are deemed to be problematic. “Common shortcomings in existing legislation”⁷ include (i) the limitation of compensation through private compensation bills only, (ii) the non-compensation of those who are interpreted to have contributed to their convictions, and (iii) the non-compensation of individuals with felonies unrelated to the alleged offense for which the individual was wrongfully convicted.⁸

This situation is troubling for public policy organizations⁹ as well as academic scholars,¹⁰ who have defended exoneree compensations on fairness grounds. The behavioral and efficiency gains from exoneration compensation have also been explored to some extent. For instance, the positive potential general¹¹

¹Blackstone (1765 p. 358).

²*See, e.g., In re Winship*, 397 U.S. 358, 364 (1970) (“It is critical that the moral force of the criminal law not be diluted by a standard of proof [or a procedure for conviction] that leaves people in doubt whether innocent men are being condemned. It is also important in our free society that every individual going about his ordinary affairs have confidence that his government cannot adjudge him guilty of a criminal offense without convincing a proper fact finder of his guilt with utmost certainty.”)

³For instance, Gross (2008) summarizes the findings of previous studies, and states that “there are two estimates of the false conviction rate for death sentences from 1973 through 1989, and they range from 2.3% to 5%.” Prior to this, Justice Scalia had famously greatly under-estimated the false conviction rate of the American criminal justice system as 0.027% in *Kansas v. Marsh*, 126 S. Ct. 2516 (2006).

⁴Gross (2008).

See also http://www.innocenceproject.org/Content/When_the_Innocent_Plead_Guilty.php for a list of the individuals who were wrongfully convicted through pleas.

⁵These states are Alaska, Arizona, Arkansas, Delaware, Georgia, Hawaii, Idaho, Indiana, Kansas, Kentucky, Michigan, Nevada, New Mexico, North Dakota, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, and Wyoming. The remaining thirty states, District of Columbia, and the federal government have compensation statutes. (http://www.innocenceproject.org/Content/Compensating_The_Wrongly_Convicted.php.)

⁶*See, e.g.,* Norris (2012) reviewing existing state exoneree compensation statutes and finding that “the assistance offered varies tremendously from state to state”. Norris (2011 p.1).

⁷http://www.innocenceproject.org/Content/Compensating_The_Wrongly_Convicted.php

⁸*Id.*

⁹*See, e.g.,* the Innocence Project (<http://www.innocenceproject.org>).

¹⁰*See, e.g.,* Armbrust (2004), and the references cited in Mandery et al. (2013 p. 562 note 51).

¹¹Fon and Schäfer (2007).

and specific¹² deterrence effects of exoneration compensation have been pointed out in the existing law and economics literature. Unlike previous work, here, we focus on how exoneree compensation can be used to design mechanisms that achieve better separation between innocent and guilty individuals in the criminal justice system through its effect on a seemingly unrelated mechanism, namely plea-bargaining. As we demonstrate in the remaining parts of this article, our mechanism reduces the occurrence of wrongful convictions (or equivalently, type-I errors) by incentivizing innocent defendants to refuse plea bargains.

Plea-bargaining is widely believed to contribute to the generation of type-I errors.¹³ The *Innocence Project* has identified 29 innocent individuals who have pled guilty to various crimes, and was thereby able to document nicely the reasons for why they have done so.¹⁴ This project and academic studies reveal that innocent defendants may plead guilty because, inter alia, they fear even greater punishment after conviction at trial, they are confused about their own conduct or the nature of the charges against them (perhaps due to bad legal advice), the evidence against them appears overwhelming, or pressure from their attorney (perhaps motivated by the attorney's desire to avoid the personal costs of trial). A number of scholars, therefore, have sought ways to encourage the innocent to go to trial, and, possibly, be acquitted.¹⁵ As we demonstrate in this article, exoneree compensation schemes can also be used to reduce the number of false convictions caused by plea-bargaining.

The mechanisms that we study rely on the probability of exoneration being greater for innocent defendants than guilty ones. Due to this probability differential, increasing the compensation to defendants who went to trial increases the expected pay-off associated with the trial option by a larger amount for innocent defendants than for guilty defendants. Hence, the number of innocent defendants taking plea-bargains can be reduced by increasing the amount of compensation available to defendants who go to trial, without causing much of a distortion in the incentives of guilty individuals.

Incentive distortions may exist and cause a small increase in the number of guilty individuals refusing pleas, only if false exoneration is probable. These increases can be overturned by a small increase in the discount offered through plea-bargains. Hence, by simultaneously increasing the exoneration compensation and the discounts offered through plea-bargains, one can keep guilty defendants' plea-bargain incentives constant. The same increases, however, incentivize innocent individuals to refuse plea-bargains more often, because the increase in the value of going to trial is increased by more than the increase in the value of taking plea-bargains for innocent defendants.

Our proposal to increase post-trial exoneration compensation should not be understood as incompatible with the existence of post-plea-bargaining compensation for exonerees. Our main focus throughout this article is the post-trial compensation of exonerees and its increased separation effect which induces

¹²Mandery et al. (2013).

¹³See, e.g., the numerous references cited in Bowers (2008 p.1119 note 1).

¹⁴http://www.innocenceproject.org/Content/When_the_Innocent_Plead_Guilty.php

¹⁵See, e.g., Gazal-Ayal (2006) and Bar-Gill and Gazal-Ayal (2006).

a lower rate of type-I errors. This does not mean that there are not other, fairness-related, gains that can be achieved by compensating those who have pleaded guilty to crimes they did not commit. Although we abstract from the issue of post-plea exoneration in the modeling section of our article, in the discussion section we suggest that post-plea exoneration related considerations are unlikely to disrupt the functioning of the mechanism that we propose because, inter alia, the probability of exoneration post-plea is very low, and in addition, the mechanism requires only that compensation be greater after trial.

Our proposed mechanism adds to the two strands of the law and economics literature on plea bargaining and exoneration compensation. It complements previously proposed mechanisms to minimize wrongful convictions caused by plea-bargaining (Gazal-Ayal (2006) and Bar-Gill and Gazal-Ayal (2006)), and is an addition to the sparse literature discussing the beneficial effects of exoneration compensation (Fon and Schäfer (2007) and Mandery et al. (2013)). After we propose a plea-bargaining model in section 2 to formalize our proposed mechanism, we discuss, in section 3, how our model interacts with some of the previous law and economics literature on plea-bargaining and exoneration compensation. Section 3 also discusses potential effects of our mechanism on deterrence. We conclude in section 4.

2 Model

We assume that the government possesses an imperfect detection mechanism that leads to the prosecution of guilty (*type G*) as well as innocent (*type I*) individuals. Prosecuted individuals differ in their risk attitudes (σ) and their utility is represented by $U = M^\sigma$, where M represents the monetary equivalent of an individual's state and $\sigma \in (0, \infty)$. Hence, $\sigma < 1$ [$\sigma > 1$] implies risk-aversion [a preference for risk] and $\sigma = 1$ implies risk-neutrality. Individuals are initially endowed with wealth w . The prosecution offers each individual a plea bargain which discounts the sanction (s) for the underlying offense by δs . Hence, accepting the plea bargain results in a change in the person's wealth position of $-(1 - \delta)s$. We assume that δ induces at least some very risk averse innocent defendants to take the bargain option, since, otherwise, all defendants who take bargains are guilty, and therefore, there is no type-I error to be mitigated.¹⁶ If the individual rejects the plea bargain, his likelihood of being convicted in court depends on his type. An innocent individual is convicted with probability α_1 whereas a guilty individual is convicted with probability $(1 - \alpha_2)$, such that α_1 and α_2 respectively denote the probability of wrongful conviction (i.e. type-I errors) and the probability of false acquittal (i.e. type-II errors) through trial, and $1 > \alpha_1 + \alpha_2$. We assume that the government can chose between two general policies: allowing post-conviction exoneration and compensation, and not. If the government allows post-conviction exoneration, convicts are given an

¹⁶Formally, we assume that δ is such that inequality (1) below does not (and therefore (2) does not) hold around $\sigma = 0$. As can be inferred from the proof of Lemma 2, this condition corresponds to $\delta > \frac{w^{(1-\alpha_1)}(w+\psi-s)^{\alpha_1\rho_1}(w-s)^{\alpha_1(1-\rho_1)}+s-w}{s}$.

opportunity to prove their innocence after being imprisoned. If exonerated, the government offers an exoneration compensation of ψ to the convicted individual. We assume that ex-post exoneration happens with a probability of ρ_1 [$1 - \rho_2$] if the person is innocent [guilty], such that $1 - \rho_1$ and $1 - \rho_2$ denote likelihoods of erroneous exoneration determinations. Hence, an innocent individual refuses a plea bargain if:

$$I(\sigma, \psi) \equiv$$

$$\sqrt[\sigma]{(1 - \alpha_1)w^\sigma + \alpha_1\rho_1(w + \psi - s)^\sigma + \alpha_1(1 - \rho_1)(w - s)^\sigma} > w - (1 - \delta)s \quad (1)$$

And, guilty individuals refuse plea bargains if:

$$G(\sigma, \psi) \equiv$$

$$\sqrt[\sigma]{\alpha_2w^\sigma + (1 - \alpha_2)(1 - \rho_2)(w + \psi - s)^\sigma + (1 - \alpha_2)(\rho_2)(w - s)^\sigma} > w - (1 - \delta)s \quad (2)$$

We express individuals' constraints with reference to I and G as in (1) and (2) above, because it allows us to separate out the incentive effects of plea bargain discounts, exoneree compensations, and risk attitudes. In particular, I and G capture the desirability of the trial option as a function of the risk-attitude and exoneree compensation, whereas the right hand side, namely $w - (1 - \delta)s$, captures the value of plea bargains to defendants. The former of these is affected only by the level of exoneration compensation and risk-attitudes, whereas the latter is only affected by δ . Next, we prove that, as expected, risk-loving defendants find the trial option more attractive than risk-averse defendants.

Lemma 1: $I_\sigma > 0$, $G_\sigma > 0$.

Proof: Let

$$\begin{aligned} k_1 &\equiv (1 - \alpha_1), \quad k_2 \equiv \alpha_1\rho_1, \quad k_3 \equiv \alpha_1(1 - \rho_1), \\ K_1 &\equiv w, \quad K_2 \equiv w + \psi - s, \quad K_3 \equiv w - s, \quad \text{and } f(\sigma) \equiv \sum_{i \in \{1,2,3\}} k_i K_i^\sigma \end{aligned} \quad (3)$$

Then, it follows that

$$I = f(\sigma)^{\frac{1}{\sigma}}, \quad \text{and, therefore } I_\sigma = -\frac{1}{\sigma^2} \ln(f(\sigma))f(\sigma)^{\frac{1}{\sigma}} + \frac{1}{\sigma} f(\sigma)^{\frac{1}{\sigma}-1} f'(\sigma) \quad (4)$$

Hence, $I_\sigma > 0$ iff

$$\sigma f'(\sigma) > f(\sigma) \ln(f(\sigma)) \quad (5)$$

differentiating f , and using the power and product rules of logarithms on both sides we have:

$$\sum_{i \in \{1,2,3\}} k_i \ln((K_i^\sigma)^{K_i^\sigma}) > \ln(f(\sigma)^{f(\sigma)}) \quad (6)$$

Next, let, $g(x) \equiv \ln(x^x)$. It follows from the definition of $g(x)$ and (6) that $I_\sigma > 0$ if

$$\sum_{i \in \{1,2,3\}} k_i g(K_i^\sigma) > g\left(\sum_{i \in \{1,2,3\}} k_i K_i^\sigma\right) \quad (7)$$

But, $g(x)$ is convex, and therefore, due to Jensen's inequality, the above inequality holds. Hence, $I_\sigma > 0$. By following analogous steps one can show that $G_\sigma > 0$, too. ■

Lemma 1 formalizes the intuitive result that a person is more willing to take a plea bargain if he is risk-averse. The next lemma builds on this observation.

Lemma 2: (i) For any $s > 0$ there exist $\sigma_I(\psi, \delta)$ and $\sigma_G(\psi, \delta)$, such that innocent [guilty] individuals take plea bargains if and only if their risk attitudes are such that $\sigma < \sigma_I$ [$\sigma < \sigma_G$].¹⁷ (ii) Moreover, the threshold risk-attitude for guilty individuals is greater, i.e. $\sigma_G > \sigma_I$.

Proof: (i) Let k_i and K_i for $i \in \{1, 2, 3\}$ and $f(\sigma)$ be defined as in (3). Then, it follows from l'Hôpital's rule that

$$\lim(\ln(I)) = \lim\left(\frac{d \ln(f(\sigma))/d\sigma}{d\sigma/d\sigma}\right) = \lim\left(\frac{d \ln(f(\sigma))}{d\sigma}\right) = \lim\left(\frac{\sum_{i \in \{1,2,3\}} k_i K_i^\sigma \ln(K_i)}{f(\sigma)}\right) \quad (8)$$

Dividing the numerator and the denominator by K_1^σ yields:

$$\lim(\ln(I)) = \lim\left(\frac{k_1 \ln(K_1)}{k_1 + k_2 \left(\frac{K_2}{K_1}\right)^\sigma + k_3 \left(\frac{K_3}{K_1}\right)^\sigma} + \frac{k_2 \ln(K_2) \left(\frac{K_2}{K_1}\right)^\sigma + k_3 \ln(K_3) \left(\frac{K_3}{K_1}\right)^\sigma}{k_1 + k_2 \left(\frac{K_2}{K_1}\right)^\sigma + k_3 \left(\frac{K_3}{K_1}\right)^\sigma}\right) \quad (9)$$

Hence, $\lim_{\sigma \rightarrow \infty} (\ln(I)) = \ln(K_1)$, which implies that $\lim_{\sigma \rightarrow \infty} I = K_1 = w$. The same steps can be used to show that $\lim_{\sigma \rightarrow \infty} (G) = K_1 = w$. Next, by manipulating (8) we have that

$$\lim_{\sigma \rightarrow 0} (\ln(I)) = \lim_{\sigma \rightarrow 0} \left(\frac{\sum_{i \in \{1,2,3\}} k_i \ln(K_i)}{\sum_{i \in \{1,2,3\}} k_i}\right) = \lim_{\sigma \rightarrow 0} \left(\sum_{i \in \{1,2,3\}} k_i \ln(K_i)\right) \quad (10)$$

since $\sum_{i \in \{1,2,3\}} k_i = 1$. Hence,

$$\lim_{\sigma \rightarrow 0} I = w^{(1-\alpha_1)} (w + \psi - s)^{\alpha_1 \rho_1} (w - s)^{\alpha_1 (1-\rho_1)} \quad (11)$$

By using almost identical steps, one can show that

$$\lim_{\sigma \rightarrow 0} G = w^{\alpha_2} (w + \psi - s)^{(1-\alpha_2)(1-\rho_2)} (w - s)^{(1-\alpha_2)\rho_2} \quad (12)$$

It is assumed, as stated in the first paragraph of section 2, that $\lim_{\sigma \rightarrow 0} I < w - (1 - \delta)s$ for the relevant δ . Finally, as demonstrated in lemma 1 $I_\sigma, G_\sigma > 0$. Hence, the intermediate value theorem implies that there exist σ_j for $j \in \{I, G\}$ such that $G(\sigma_j, \psi) \geq w - (1 - \delta)s$ iff $\sigma \geq \sigma_j$. (ii) Moreover, $I(\sigma, \psi) > G(\sigma, \psi)$ for all $\sigma > 0$, since $1 > \alpha_1 + \alpha_2$. To see this, note that per (1) and (2), this condition holds whenever

$$(1 - \alpha_1 - \alpha_2)w^\sigma >$$

¹⁷We assume that indifferent individuals go to trial.

$$[(1 - \alpha_2)(1 - \rho_2) - \alpha_1 \rho_1] (w + \psi - s)^\sigma + [(1 - \alpha_2)\rho_2 - \alpha_1(1 - \rho_1)] (w - s)^\sigma \quad (13)$$

and

$$(1 - \alpha_1 - \alpha_2)w^\sigma \geq (1 - \alpha_1 - \alpha_2) (w + \psi - s)^\sigma >$$

$$[(1 - \alpha_2)(1 - \rho_2) - \alpha_1 \rho_1] (w + \psi - s)^\sigma + [(1 - \alpha_2)\rho_2 - \alpha_1(1 - \rho_1)] (w - s)^\sigma \quad (14)$$

since $\psi \leq s$. That $I_\sigma > 0$, $G_\sigma > 0$, and $I > G$ for all $\sigma > 0$ together imply that $\sigma_G > \sigma_I$. ■

Lemma 2 exploits the observation that innocent individuals are more willing to go to trial because their probability of being convicted is lower. This implies that innocent individuals' threshold risk attitude for refusing plea bargains is lower than the corresponding threshold for guilty individuals. Proposition 1 below relies on this result to identify exoneration schemes that incentivize innocent individuals to refuse plea-bargains, without affecting guilty individuals' incentives. For purposes of proposition 1 and 2, it is assumed that the number of guilty and innocent individuals being prosecuted is fixed. The effects of compensation and plea-bargaining policies on deterrence is considered separately in section 3.

Proposition 1: *If the probability of false exoneration is small, i.e. $\rho_2 \approx 1$, then for all regimes where $\psi = 0$ and $\delta = \delta_N > 0$, that is, no exoneration compensation is offered, one can construct a continuum of new regimes where $\psi = \psi_E > 0$ and $\delta = \delta_E > \delta_N$ in which (i) fewer innocent individuals take plea bargains, i.e. $\sigma_I(\psi_E, \delta_E) < \sigma_I(0, \delta_N)$, and (ii) the number of guilty individuals taking plea bargains is unchanged, i.e. $\sigma_G(\psi_E, \delta_E) = \sigma_G(0, \delta_N)$.*

Proof: Fix $\delta_N \in (0, 1)$. Then, $\sigma_{G_N} \equiv \sigma_G(0, \delta_N)$ can be implicitly defined as:

$$w - (1 - \delta_N)s = G(\sigma_{G_N}, 0) \quad (15)$$

Hence, the set of ψ 's and δ 's that keep guilty individuals' incentives to take plea bargains unchanged are given by pairs of ψ 's and δ 's that satisfy:

$$w - (1 - \delta)s = G(\sigma_{G_N}, \psi) \quad (16)$$

Therefore, one can define $\delta^*(\psi)$, the discount rate as a function of ψ that keeps guilty defendants' incentives unchanged, as:

$$\delta^*(\psi) = \frac{G(\sigma_{G_N}, \psi) - (w - s)}{s} \quad (17)$$

Hence,

$$\delta^*(0) = \delta_N \text{ and } \delta_\psi^* > 0 \quad (18)$$

When $\psi = s$, by plugging in the expression for $G(\sigma_{G_N}, \psi)$ given in (2) we have:

$$\delta^*(s) = \quad (19)$$

$$\frac{\sigma_{G_N} \sqrt{\alpha_2 w^{\sigma_{G_N}} + (1 - \alpha_2)(1 - \rho_2)w^{\sigma_{G_N}} + (1 - \alpha_2)(\rho_2)(w - s)^{\sigma_{G_N}}} - (w - s)}{s}$$

Letting $\alpha_3 \equiv \alpha_2 + (1 - \alpha_2)(1 - \rho_2)$, this is equivalent to:

$$\delta^*(\psi) = \frac{\alpha_3 \sqrt{\alpha_3 w^{\sigma_{G_N}} + (1 - \alpha_3)(w - s)^{\sigma_{G_N}}} - (w - s)}{s} \quad (20)$$

There exists $\varpi \in (w - s, w)$ such that $\varpi^{\sigma_{G_N}} = \alpha_3 w^{\sigma_{G_N}} + (1 - \alpha_3)(w - s)^{\sigma_{G_N}}$. Hence,

$$\delta^*(\psi) = \frac{\alpha_3 \sqrt{\varpi^{\sigma_{G_N}}} - (w - s)}{s} = \frac{\varpi - (w - s)}{s} \quad (21)$$

Therefore $\delta^*(\psi) \in (0, 1)$.

Next, note that the critical risk attitude σ_I , which keeps innocent individuals indifferent between taking and refusing plea bargains in regimes that keep guilty defendants' plea bargain incentives constant (i.e. when the compensation level is ψ and the discount rate is $\delta = \delta^*(\psi)$), can be defined as:

$$H(\sigma_I, \psi) = I(\sigma_I, \psi) - w + (1 - \delta^*(\psi))s = 0 \quad (22)$$

The implicit function theorem can be used to identify how an increase in the exoneration compensation affects σ_I .

$$\frac{d\sigma_I}{d\psi} = -\frac{dH/d\psi}{dH/d\sigma_I} = -\frac{I_\psi - s\delta_\psi^*}{I_\sigma} < 0 \quad (23)$$

which holds if

$$I_\psi > s\delta_\psi^* \quad (24)$$

since $I_\sigma > 0$ as proven in lemma 1. Next, recall that

$$s\delta^*(\psi) = \quad (25)$$

$$\frac{\alpha_3 \sqrt{\alpha_2 w^{\sigma_{G_N}} + (1 - \alpha_2)(1 - \rho_2)(w + \psi - s)^{\sigma_{G_N}} + (1 - \alpha_2)(\rho_2)(w - s)^{\sigma_{G_N}}} - (w - s)}{s}$$

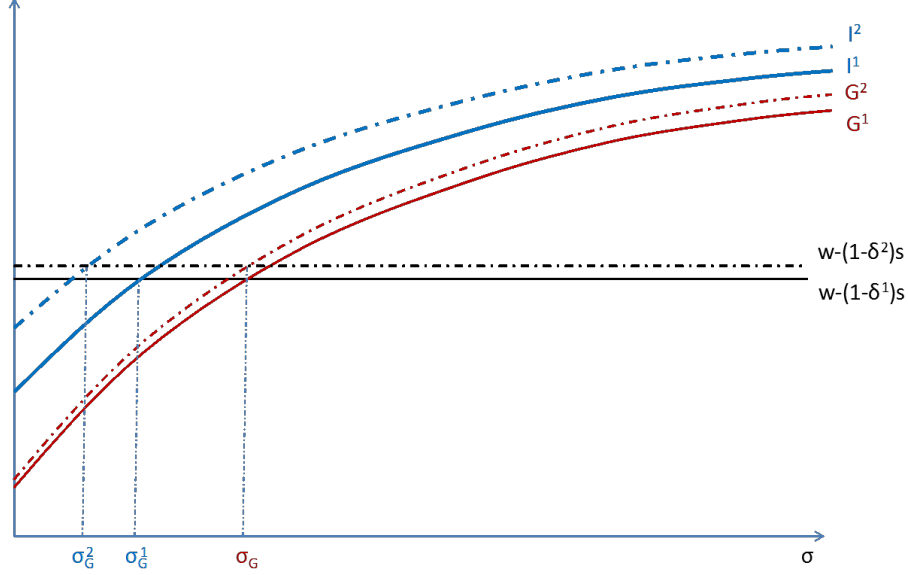
hence, $s\delta_\psi^* \approx 0$ since $(1 - \rho_2) \approx 0$. Finally, note that

$$I_\psi = \alpha_1 \rho_1 (w + \psi - s)^{\sigma_I - 1} I(\sigma_I, \psi)^{1 - \sigma_I} > 0 \quad (26)$$

Thus, σ_I is decreasing in ψ . ■

The intuition behind proposition 1 can be illustrated with reference to figure 1, below, which represents the relative returns for guilty and innocent individuals from going to trial (i.e. I and G as defines in (1) and (2)), as well as the return from taking the plea bargain (i.e. $w - (1 - \delta)s$). Figure 1 illustrates two schemes, denoted with superscripts 1 and 2, where the second scheme is generated through simultaneous increases in δ and ψ .

Figure 1: Simultaneous increases in ψ and δ that keep σ_G unchanged.



An increase in the amount of exoneration compensation has a disproportionately larger impact on the expected return from going to trial for innocent individuals. In particular, because the probability of post-conviction exoneration for innocent individuals (i.e. ρ_1) is much larger than the same for guilty individuals (i.e. $(1 - \rho_2)$), increasing the amount of exoneration compensation reduces the requisite risk-tolerance to refuse a plea by a much greater amount for innocent individuals, than for guilty individuals. This observation is reflected by a greater shift in I versus G in figure 1. Moreover, any increase in the number of guilty individuals refusing pleas caused by greater exoneration compensations can be overturned by a small increase in the discount offered through plea-bargains. This is reflected in figure 1 by a shift in the return from the plea option that keeps σ_G constant. Therefore, simultaneous increases in exoneration compensations and plea-discounts keep guilty defendants' plea-bargain incentives unchanged, but induce more innocent individuals to refuse pleas, i.e. σ_G remains constant while σ_I is reduced.

The next proposition builds on these observations and identifies the sanction scheme that minimizes the number of guilty pleas by innocent individuals.

Proposition 2: *Among regimes that keep guilty individuals' plea bargain incentives unchanged, that which offers maximal compensation, i.e. $\psi_E = s$ and $\delta_E = \delta^*(s)$, (i) maximizes the expected utilities of all defendants, (ii) minimizes the number of innocent individuals who plead guilty, and (iii) minimizes the number of wrongful convictions.*

Proof: (i) The utility of individuals who take [refuse] plea bargains is increasing in ψ [δ]. Hence, these utilities are maximized when ψ and δ are at

their maximal levels. (ii) The number of innocent individuals taking pleas is increasing σ_I , since individuals with $\sigma < \sigma_I$ take plea bargains. And, as shown in the proof of proposition 1, σ_I is decreasing in ψ . Therefore, the number of innocent individuals pleading guilty is decreasing in ψ , and is minimized when $\psi = s$. (iii) Individuals who take pleas are convicted with certainty, whereas trial implies a small probability of wrongful conviction. Therefore, wrongful convictions are increasing in the number of pleas taken by innocent individuals, and minimized when $\psi = s$. ■

Proposition 2 formalizes the main function of the mechanism that we propose, namely the reduction of wrongful convictions through the use of exoneration compensation. Because the number of wrongful convictions is declining in the amount of compensation, offering the highest exoneration compensation possible minimizes the number of wrongful convictions. One may question whether this comes at the cost of reduced deterrence. In the next section, we argue that our mechanism affects deterrence most likely in a positive manner, if at all.

3 Discussion

3.1 Deterrence Effects

In the previous section, we have demonstrated how one may reduce the number of wrongful convictions by simultaneously increasing the amount of exoneration compensation and the discount for plea-bargaining. However, as stated in proposition 2, this scheme increases the expected utility of guilty defendants. Initially it may seem that this would significantly reduce deterrence, since the expected cost associated with the commission of a crime is lowered. This conjecture is incorrect for three reasons.

First, as discussed in the existing literature, the probability of false exoneration is most likely very low. As Gross (2008 p. 175) states:¹⁸

Some exonerated defendants are no doubt guilty of the crimes for which they were convicted, in whole or in part, but the number is likely very small. It is extremely difficult to obtain this sort of relief after a criminal conviction in America, and it usually takes overwhelming evidence.

Therefore, any increase in guilty individuals' expected utility from going to trial is quite small. This also implies that the simultaneous increase in the plea-discount necessary to keep guilty individuals plea-incentives constant is minimal.

¹⁸Citing (Gross et al. 2005). *See also* Fon and Schäfer (2007 p. 278 note 21): "For convenience, we assume that only the wrongfully convicted has a chance of getting a retrial. This is justified on the grounds that usually a (successful) retrial is only possible if substantial new evidence in favor of the convicted shows up. This is unlikely if the criminal was rightfully convicted" and Gazal-Ayal and Tor (2012 p. 351): "To overcome the challenge of identifying truly innocent defendants, we turned to the one group whose innocence is nearly certain: defendants who were wrongfully convicted and later exonerated."

Hence, the reduction in the expected cost associated with committing crime is most likely very small.

Second, as Fon and Schäfer (2007) demonstrate, exoneree compensation can increase deterrence by reducing the cost of refraining from crime and thereby mitigating the negative effect of type-I errors on deterrence. Although recent research demonstrates that the effect of type-I errors on deterrence is not entirely clear,¹⁹ Fon and Schäfer's (2007) main point remains valid: any deterrence effect due to type-I error is mitigated by exoneree compensations.

Third, as we discuss below, large exoneree compensations are likely to incentivize prosecutors to channel their efforts towards prosecuting strong cases.²⁰ This is likely to cause more prosecutions of truly guilty individuals and fewer prosecutions of truly innocent individuals. Hence, deterrence is likely to be enhanced by an increase in the probability of conviction for guilty individuals.

These three observations reveal that the deterrent effect of our mechanism is far from being clearly negative. In fact, because the increases in the utility from crime are very small, our mechanism likely enhances deterrence through the two aforementioned reductions in type-I and type-II errors.

3.2 'Selection of Cases' Effect

Bar-Gill and Gazal-Ayal (2006) focus on the budget constraint of prosecutors to identify what they term the 'selection of cases' effect of "restricting the permissible sentence reduction in a plea bargain".²¹ They observe that if prosecutors cannot offer substantial discounts in return for a guilty plea, defendants in weak cases will not be willing to plea bargain. As a result, a prosecutor who is pressured by budget constraints will have an incentive not to charge defendants when the probability of conviction is low, and hence the defendant is unlikely to accept a plea bargain offer. Therefore, prosecutors have no credible threats of pursuing cases against defendants for whom the probability of being convicted in trial is low. Hence, prosecutors have to substitute potentially weak cases with strong cases ex-ante to better administer their resources and to secure a high success rate.

This selection of cases effect identified by Bar-Gill and Gazal-Ayal (2006) is generated by exoneree compensations as well. The primary effect of exoneree compensation is to reduce the expected cost of going to trial, relative to taking plea-bargains, for the innocent, and thereby increasing the number of innocent individuals who are willing to go to trial when prosecuted. Prosecutors who know that they do not have credible threats against such defendants are unlikely to bring cases against them in the first place.

These selection effects are likely to increase the value of post-conviction exoneration compensation further through two interrelated channels. First, because fewer innocent individuals will be prosecuted, the number of type-I errors

¹⁹ See Lando (2006), Garoupa and Rizzolli (2012), and Lando and Mungan (2014), for the existing debate on the effects of type-I errors on deterrence.

²⁰ As we discuss below this point is due to Bar-Gill and Oren Gazal-Ayal (2006).

²¹ Bar-Gill and Gazal-Ayal (2006 p. 353).

is likely to be reduced. Second, deterrence will be increased, because prosecutors will be devoting more resources for the prosecution of the truly guilty, they will thereby be increasing the sensitivity, in a statistical sense, of the law enforcement system.

3.3 Post-plea Exoneration Compensations

In section II, we demonstrated how one can achieve better separation between innocent and guilty individuals in the plea-bargaining stage by increasing the post-trial compensation made available to exonerees, and did not consider post-plea-bargaining exoneration compensation. We would like to clarify that we are not suggesting that post-plea compensation may not have a function or a value. In general, such compensation may carry fairness related benefits, and perhaps some administrative costs caused by an increased number of exoneration proceedings initiated by guilty individuals. Our objective in this sub-section is not to debate the normative desirability of having post-plea exoneree compensations, but to demonstrate that the utility of our mechanism is unaffected by considerations related to such compensations.

First, and perhaps most importantly, our mechanism is independent of the availability of the existence of post-plea compensations. The two types of compensation are conceptually separable, as demonstrated by the split among the 30 states that have some form of exoneration statute; currently, post-plea compensation is either completely²² or partially²³ unavailable in the District of Columbia and 12 states out of the 30 states²⁴ with exoneration statutes, whereas the remaining states do not place conditions based on whether the exoneree has plead guilty. Hence, independent of the level of post-plea compensation available, post-trial compensation can be increased simultaneously with plea-bargain discounts, as specified in section II, to achieve better separation between innocent and guilty individuals.

Despite the conceptual separability of post-plea and post-trial compensation mechanisms, one may wonder whether simultaneous increases in the amount made available through the two compensations is likely to induce the type of separation we discussed in section II. The answer is definitely 'yes', if one is willing to increase post-trial compensations by more than post-plea compensations. In order to achieve the type of separation considered in our model, all that needs to be achieved is an increase in the innocent individuals' expected utility of going to trial that is greater than the increase in their expected utility of pleading guilty. This can easily be achieved by increasing the post-trial compensation by more than the post-plea compensation for exonerees.

²²E.g., Iowa Code Ann. §663A.1, 51, NJ Stat Ann §§ 52:4C-1 to 4C-7, Okl. St. § 154, and Ohio Rev Code Ann § 2305.02 & § 2743.48 require that the person did not plead guilty.

²³For instance, the Nebraska statute, NE ST 29-4601, et seq., hinders compensation for those who have plead guilty unless the guilty plea was coerced by law enforcers.

²⁴These states are: California, Iowa, Massachusetts, Nebraska, New Jersey, New York, Ohio, Oklahoma, Virginia, Washington, West Virginia, Wisconsin (2014 Compensation Chart, *Innocence Project Internal Document*)

Finally, even if one only focuses on compensation schemes that offer equal amounts of compensation to those who have pleaded guilty and those who have been wrongfully convicted through trial, empirical considerations suggest that increases in compensation will have a larger effect on the expected utility of the trial option of innocent individuals. Three empirical considerations are relevant.

First, a person who has pleaded guilty in the past is likely to lose credibility in exoneration proceedings. Therefore, given heightened requirements in exoneration proceedings, the probability of a post-plea exoneration is much smaller than the probability of a post-trial exoneration. As Dan Simon states: "Overturning a conviction is close to impossible for inmates who were convicted based upon their pleas."²⁵ Second, recent scholarship has demonstrated an 'innocence effect' in plea-bargaining (Gazal-Ayal and Tor (2012) and Tor, Gazal-Ayal and Garcia (2010)): "innocents are less willing to accept plea offers than guilty defendants".²⁶ One plausible cause for this effect is innocent individuals discounting the difference between the expected utility associated with the plea option and being convicted in trial. This implies that an increase in the expected value of trial due to increased exoneree compensation is likely to be valued more in comparison to similar increases associated with the expected value of pleading guilty. Third, because individuals who have pleaded guilty have less to gain from being exonerated in comparison to people convicted through trial, they are less likely to initiate exoneration proceedings.

These three observations imply that an increase in post-trial compensation is likely to increase the expected utility of the trial option by more than the increase in the expected utility associated with pleading guilty due to similar increases in the post-plea exoneration compensation. Therefore, the separating function identified in our model can be obtained even in cases where the post-trial and post-plea compensations are constrained to be equal.

4 Conclusion

Policy organizations and scholars, most notably the Innocence Project, are urging states to adopt statutes that either enable exoneration, or increase the amount of compensation available to exonerees. Although there are many fairness related effects associated with these proposed statutory reforms, the wrongful conviction reducing aspect of increased exoneration compensations has been unnoticed or over-looked. In this article we have proposed a mechanism that relies on large exoneree compensations that reduces wrongful convictions without affecting guilty individuals' incentives and that is unlikely to affect deterrence. Accordingly, our analysis adds another item, in the form of reduced wrongful convictions, to the list of benefits that are associated with large exoneree compensations.

²⁵Simon (2012 p. 227-228) n. 17.

²⁶Tor, Gazal-Ayal and Garcia (2010 p. 97).

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