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The complementary role of distributive and criminal equity

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Abstract

We conduct a theoretical analysis to explore how the distribution of wealth in society impacts the social costs of crime and law enforcement. We show that a reduction in inequality reduces these costs when enforcement and nonmonetary punishment are equitable, that is, they do not discriminate among offenders based on their wealth. However, when enforcement or nonmonetary punishment is discriminatory, a reduction in inequality may increase the social costs of crime and law enforcement, in particular when it occurs among poorer individuals. Thus, there is a complementarity between equity in criminal justice and distributional equity.

KEYWORDS

inequality, law enforcement

1 | INTRODUCTION

Redistributing wealth from the rich to the poor is an exercise in balancing marginal social benefits and costs. Social benefits may derive from the notion that individuals have decreasing marginal utilities of wealth, or that the social welfare function exhibits aversion to inequality. The social costs stem from the use of distortionary taxes and from general administrative costs associated with redistribution. In addition, redistribution of wealth may be desirable or detrimental as inequality may affect other social goals, such as growth (Banerjee & Duflo, 2003; Neves et al., 2016, for a meta analysis), health and life expectancy

(Wilkinson, 1992), social capital (Xu & Marandola, 2023), political stability (Alesina & Perotti, 1996), and so on.

In this paper we focus on the effects of redistribution on the social costs of crime and law enforcement. We will use the term crime in a very broad sense, to include any behavior associated with external costs that is publicly enforced, even when it is punished only by a monetary sanction. Using a standard model of law enforcement in the tradition of Becker (1968) and Polinsky and Shavell (2000), we show that redistribution not only affects the social costs of crime and law enforcement, but also that the direction of the effect depends on whether the criminal justice system is or is not equitable. Indeed, we show that if the criminal justice system is equitable in the sense that enforcement and nonmonetary punishment cannot discriminate offenders based on their wealth, then redistribution reduces the social costs of crime and law enforcement. On the other hand, if enforcement or nonmonetary punishment are inequitable, the opposite may be true, that is to say redistribution may actually increase the social costs of crime and law enforcement. We summarize our finding by saying that there is a complementarity between equity in criminal justice and distributional equity.[1]

The first ingredient of our argument is based on the notion that it is generally cheaper to enforce the law on the rich than on the poor. The reason is that monetary sanctions are less costly than nonmonetary sanctions or enforcement in achieving any particular level of deterrence, and, for the obvious reason that a fine cannot exceed individual wealth, the rich can pay higher monetary sanctions than the poor. Thus, the greater offenders' level of wealth, the more deterrence can be achieved at no additional cost, or the lower the social cost associated with the same level of deterrence.

A second observation of our analysis is that any redistribution of wealth from the rich to the poor would increase the possible fine for the latter, thereby reducing the social costs of enforcing the law upon them, and reduce it for the former, thereby increasing these social costs with regard to them. Whether or not redistribution is socially desirable becomes, then, a question of the relative magnitudes of these benefits and costs, involving a trade-off between the social costs of enforcing the law on the rich vis-à-vis the poor. This trade-off depends, amongst other things, on how the benefits from the harmful act are distributed. For example, if the benefits were concentrated at high levels, inequality might be warranted, or otherwise little or no deterrence could have been achieved. However, under reasonable assumptions on the distribution of benefits, we will demonstrate that, as long as the justice system is equitable, redistribution is socially desirable. This conclusion is trivial if the monetary sanction is less than the wealth of the rich and equal to the wealth of the poor, as taking away resources from the rich and giving it to the poor would not affect the level of deterrence of the rich, but it will increase the level of deterrence of the poor. However, even if the monetary sanction is equal to the wealth of both the poor and the rich and even if deterrence of the rich falls to the same extent as deterrence of the poor increases, so there is no change in the total level of the deterrence, redistribution is still socially beneficial. The explanation of this (possibly less intuitive) conclusion stems from the fact that the marginal poor offender imposes greater net social harm than the marginal rich offender. This is so, because the marginal poor offender

[1]To be clear, since the maximum monetary sanction individuals can pay is limited by their wealth, individuals may be subject to different monetary sanctions. However, we do not consider this inequity or discrimination, as it does not reflect an explicit decision by the enforcer to treat individuals differently.

faces a lower expected sanction than the marginal rich offender.[2] We are of course assuming, as it is standard in the law enforcement literature and indeed in public economics in general, that the benefits from offenses are included in the social welfare function.[3] The result that any redistribution reduces the social costs of crime and law enforcement stands as long as the justice system with respect to enforcement or nonmonetary sanctions is equitable.

On the other hand, if the justice system is inequitable, so that enforcement or nonmonetary sanctions can discriminate among offenders and be optimally set based on their wealth, then redistribution can actually increase the social costs of crime and law enforcement. In the case of discriminatory enforcement the explanation is as follows. On the one hand, higher wealth allows for savings in enforcement costs, but on the other hand, it makes enforcement more effective in inducing deterrence. This is so, because deterrence is determined by the expected sanction, which is the multiplication of the probability of punishment by the magnitude of punishment. This means that enforcement and monetary sanctions may be complements (i.e., it is preferable to further increase enforcement where the fine is higher). This suggests that even though wealth reduces the social costs of crime and law enforcement, it may reduce it in decreasing rates, thus making an increase in wealth more beneficial at higher levels of wealth.

The conclusion that an increase in wealth may be more beneficial, in reducing social costs, at higher levels of wealth, applies also to the case of discriminatory nonmonetary sanctions. To see this, one can utilize the results obtained by Polinsky (2006). Indeed, as Polinsky (2006) demonstrated, not only are optimal nonmonetary sanctions higher for the poor than for the rich, but also the combined monetary and nonmonetary sanctions are higher for the poor than for the rich (see Polinsky, 2006, Proposition 3(c)). This implies that the marginal rich offender imposes greater net social harm than the marginal poor offender, thereby justifying a transfer from a poor individual to a rich one. We leave the subtle explanation of Polinsky (2006) results to Section 4.

The arguments in this paper are based on the notion that giving people more (less) to lose can render them more (less) law abiding. It is not based on other channels that were discussed and explored in the literature for why redistribution may affect the propensity to offend and the crime rate. For example, we do not assume that the poor are more likely to break the law because they have greater utility from doing so (i.e., the poor have greater needs), or because the opportunity costs of crime are lower for them (i.e., the poor derive less utility from legitimate alternative activities). Indeed, the tradition of economic analysis of crime, initiated by Becker (1968), has often emphasized that a higher level of inequality, implying lower returns from legal activities, increases the relative reward of the poorer individuals from crime (see also Ehrlich, 1973). In addition, we do not assume that poor individuals suffer less from imprisonment (i.e., the opportunity costs of time are lower for them), as discussed by Lott (1987). Nor do we assume that the greater the level of inequality, the greater the benefits of

[2]To illustrate this, suppose the social harm from an offense is \$100 and the probability of punishment is 0.4 for both the poor and the rich. Let the fine imposed on the rich is \$200 while the fine impose on the poor is \$100, so that their expected sanctions are, respectively, \$80 and \$40. This implies that the marginal rich offender, that is, the offender whose benefit from the offense is just a large as the expected sanction, imposes a net social costs of \$20, while the marginal poor offender imposes a net social harm of \$40.

[3]It is common in economic analysis to view crime as an externality, hence the optimal policy is determined by weighting the individual and the social cost and benefits of crime and deterrence. However, some scholars have questioned the inclusion of offenders' benefits into the social welfare function (Stigler, 1970). Although it has been shown that the benefits to offenders play no role in the determination of the optimal sanctioning policy when there is a market alternative to crime (Curry & Doyle, 2016), their inclusion in social welfare is an essential ingredient of our analysis.

criminal behavior and thus the greater the likelihood of its occurrence (i.e., the potential payoff from theft or burglary is higher) as discussed, for example, by Eaton and White (1991).[4] All these important issues have with no doubt bearing on the desirability of redistribution from the perspective of crime and law enforcement. Nevertheless, in this paper, we will set aside these issues to focus our attention on the specific point of interest. We do so by assuming that the distribution of the benefits is the same across all individuals, rich or poor (i.e., independent of wealth), and that the expected social harm of an offense is unaffected by wealth distribution.[5]

These assumptions are, as a matter of fact, quite common in the law enforcement literature (see, e.g., Polinsky & Shavell, 1991). Although they can be regarded as a theoretical simplification, they are a fairly accurate description of a number of situations. Examples are crimes whose effect is the damaging or depletion of common resources (e.g., environment crimes) where the benefit for the offender is represented by the saving of some monetary cost.

Finally, our analysis is not based on the notion that individuals are risk averse and on the possible effects of wealth on the degree of risk aversion (see, e.g., Block & Heineke, 1975). Indeed, as standard in the law enforcement literature, we will assume that individuals are risk neutral.

1.1 | Literature review

The paper is motivated in part by the existing literature on crime and law enforcement, which examines extensively the theoretical and empirical relationships between deterrence and income distribution in society. Both theory and empirical evidence suggest a link, indeed a positive link, between wealth or income inequality and crime, as also evidenced by our discussion above (see also Itskovich & Factor, 2023, and references therein). However, few papers have explored how the distribution of wealth affects the social cost of crime and law enforcement. These questions, it should be stressed, are markedly different, because social welfare may be higher (or lower) as a result of redistribution even if the crime rate remains the same or even rises (falls), as demonstrated in this paper.

Among the papers exploring the effect of redistribution on the social cost of crime and law enforcement, some share with ours the notion that transferring wealth from rich to poor individuals can be beneficial because it increases the punishment that can be imposed on the poor, but otherwise these papers differ significantly from one another as well as from the inquiry undertaken here.

[4]If the benefits from crime are an increasing function of the victim's wealth, a reduction in inequality will make crime more likely if offenses target the poor (made richer by redistribution) or less likely if they target the rich (that redistribution makes poorer). The effect of redistribution depends on the kind of crime, and it is difficult to identify a clear sign of the effect of an increase in wealth equality.

[5]The social cost of harmful activities depends on the type of offense. A relevant part of these costs is represented by avoidance activities by potential victims. Victims' precautions, such as the installment of alarms or other devices, costly precautions, or even lowered incentives to produce wealth, are probably the largest part of the social cost of theft and other crimes involving a transfer of property. In principle, these costs can vary with the distribution of wealth, in a way that is, however, difficult to predict in general. (Will the investment in precautions increase or decrease if the property of valuables is more concentrated?) The distribution of harm among the population of potential victims, which interacts with the distribution of property, can affect the enforcement policy through political mechanisms (Benoit & Osborne, 1995; Friehe & Mungan, 2022). The fact that insecure property rights due to the risk of undue appropriation or theft reduces the incentive to create wealth can be seen as another form of socially costly avoidance (Eaton & White, 1991).

Eaton and White (1991) explore the effect on economic efficiency of the distribution of wealth and systems for enforcing property rights. They construct a two-person, two-period economy in which each person can consume, plant, transfer, or steal corn, and be sanctioned for this. They find circumstances in which redistribution of wealth is more effective than sanctions in preventing crime and is Pareto optimal.[6] A key feature in their model, that plays no role in our analysis, is that the distribution of wealth affects the benefits from stealing. Other differences are that in their model, where crime is identified with theft, the sanction involves the restitution of the stolen good to the victim, enforcement is assumed to be exogenous and nonmonetary sanctions are assumed away. A final difference that contributes to making that model markedly different from ours is that, in their two-individual setting, the interaction between individuals has a strategic dimension which is absent when individuals are numerous and decide atomistically.

İmrohoroğlu et al. (2000) analyze the relationship between income distribution and crime in a general equilibrium model where individuals decide how to allocate their time between legal and criminal activities. Policy variables such as the amount of redistribution and the probability of apprehension are determined by majority voting (the severity of the sanction is not modeled, but it is assumed that convicted individuals are brought to their subsistence level). The analysis developed is different from ours in its political economy approach and in the role assigned to redistribution. In İmrohoroğlu et al.'s model, the effect of subsidies might even increase the crime rate: while recipients of transfers reduce their propensity to commit crime because higher income increases the opportunity cost of criminal activities, subsidies also reduce the incentive to work and, via taxation, the amount of resources available for law enforcement.[7]

In a similar vein, Demougin and Schwager (2000) consider that crime is reduced either by expenditure on enforcement or by social transfers. The latter are forfeited when an agent commits a crime, so higher transfers increase deterrence. The model assumes two types of agents: the poor and the rich. In contrast to our model, in their model, only the poor can become criminals, and a higher wealth of the rich makes crime more rewarding to the poor (with crime being identified as theft). The analysis determines the cost-minimizing mix of redistribution and enforcement for a given crime level and the optimal crime level from the perspective of voters. Conditions are identified under which rich individuals may choose an apparently altruistic policy of increasing transfers to the poor.[8] Again, while Demougin and Schwager (2000) share with our paper the idea that giving more to lose to poorer individuals can reduce crime, the structure of their model and the driving forces are very different than ours.

Another paper worth mentioning is Mungan (2021), which analyzes the use of rewards as an instrument of deterrence alternative to imprisonment. In fact, a monetary reward for not committing a crime is equivalent in its effects to an increase in wealth accompanied by the

[6]Eaton and White (1991) can be viewed as formalizing arguments put forth by the analysis of Johnsen (1986), with reference to ritual gifts to guests during "potlach" ceremonies among the native tribes of Kwakiutl Indians on the Pacific coast of North America. With variable harvest in salmon fishing, gifts serve both as an insurance device and as a way to make trespassing less attractive, so that theft is prevented and property rights systems are enforced.

[7]Benoit and Osborne (1995) is another model that analyzes the combination of instruments resulting from different political mechanisms and different distributions of wealth. However, their model is even more distant from ours in that the role of redistribution is not modeled and no distinction is made between government expenditure on redistribution and enforcement.

[8]Cassone and Marchese (2006) extend the approach of Demougin and Schwager (2000) by taking into account agents' risk aversion, and by considering a continuous labor supply, to address some important unintended consequences of transfer policy.

introduction of a monetary sanction of equal size to be applied when the crime is committed and detected. Although the relationship between inequality and the social cost of crime and law enforcement is not the main focus of the paper, the analysis of one of the cases considered, where rewards are used along with monetary sanctions and they are targeted to judgment-proof individuals, presents some similarities to ours. However, the analysis in Mungan (2021) is markedly different from ours, as it does not consider how the financing of transfers can adversely affect the monetary sanctions on individuals whose wealth is reduced (i.e., taxpayers).[9]

Indeed, when examining the aggregate impact of wealth distribution on crime, it is important to acknowledge that any increase in someone's wealth typically corresponds to a decrease in someone else's wealth of an equivalent magnitude (while abstracting the deadweight loss we would have if the change in distribution had been financed by distortionary costly taxation). Any attempt at determining the sign of the effect of a change in wealth distribution on the social cost of crime and law enforcement must take into account how the two effects compare. To claim, for example, that a more equal distribution reduces the social cost of crime and law enforcement, we must explain why the decrease in the wealth of the rich is not matched by an (equivalent in size but the opposite) effect of the increase in the wealth of the poor. To our knowledge, this aspect is largely ignored in previous contributions on the relation between wealth distribution and the social cost of crime and law enforcement, with the notable exception of Tabbach (2012), which inspired the present analysis. In that paper, however, the analysis was limited to the case of only two levels of wealth and monetary sanctions alone, making the characterization of redistribution straightforward. In our paper we consider a richer set of sanctioning policies, including nonmonetary sanctions, and address a more general question: given any two distributions of wealth, where the first is less equal than the second, how does the social cost of enforcement change as we move from the former to the latter? Moreover, we identify a new relationship—the complementary role between the criminal justice system and the welfare distribution system—which is absent in Tabbach (2012). Thus, the present paper not only generalizes Tabbach (2012) regarding the distribution of wealth and extends the analysis to nonmonetary sanctions, but also derives new insights and results.

This paper utilizes the works of Polinsky and Shavell (1984, 1991) and of Garoupa (2001), which explore the optimal probability and severity of monetary sanctions when wealth varies across individuals. In addition, it draws on the work of Polinsky (2006) and Garoupa and Mungan (2019), which explore the optimal enforcement and punishment scheme when nonmonetary sanctions are utilized and wealth differs across individuals. However, these authors did not consider either the possibility or the social desirability of wealth redistribution as a policy instrument in reducing the social costs of crime and law enforcement, which is the focus of this paper.

1.2 | Organization of the paper

The paper is organized as follows. In Section 2, we introduce the benchmark case where enforcement is nondiscriminatory and sanctions are in the form of fines. In Section 3, we analyze the effects of allowing for nonmonetary sanctions, contrasting the cases in which

[9]Another difference is that in Mungan's 2021 model imprisonment is never conditional on wealth, while we discuss both cases, where imprisonment can be made conditional on the offender's wealth and where it cannot.

nonmonetary sanctions can and cannot be discriminatory. In Section 4, we analyze the consequences of relaxing the assumption that enforcement is nondiscriminatory, allowing it to vary with the offender's wealth. In Section 5, we discuss the implication of relaxing the assumption that the cost of nonmonetary sanctions is unrelated to wealth. Section 6 summarizes and concludes.

2 | MONETARY SANCTIONS

Our baseline model of enforcement in a society with individuals characterized by different levels of wealth considers only monetary sanctions and follows Polinsky and Shavell (1991). By committing a harmful act, an individual can inflict a harm $h > 0$ on society at large. To control individual behavior, the social planner can impose a monetary sanction f on individuals. Effectively this monetary sanction, or fine, cannot exceed the wealth of an individual (w). Thus for a given "statutory" fine $\hat{f}$, the "effective" fine paid by an individual of wealth w will be the minimum between $\hat{f}$ and w. Wealth in society is distributed according to a cumulative distribution function $G(w)$, with $G(0) = 0$.

In addition to the fine, the social planner sets the probability of punishment p. In this section we assume that p must be common to all individuals regardless of their wealth; in other words, we assume that p cannot depend on the wealth of an individual. This can be justified, for example, if the criminal justice system is equitable. We shall relax this assumption in Section 4 where we allow for discriminatory enforcement. The cost of enforcement is given by an increasing and convex function $c(p)$, with $c' > 0$ and $c'' > 0$. As they only involve a monetary transfer, fines are socially costless.

Risk-neutral individuals contemplate whether to commit the harmful act by comparing the expected sanction to the benefit b they receive from the act. Individual benefits are private information, distributed according to a cumulative distribution function $R(b)$ with density $r(b)$ defined on the interval $[0, \infty)$. We allow for cases where $b > h$, that is, some offenses may imply a net social gain, but this possibility plays no crucial role in our analysis.

Since our emphasis is on examining the role played by the sanctioning policy, we assume that the (monetary) benefit from the act is independent on individual wealth, that is, b and w are independently distributed. This ensures that our conclusions regarding the impact of redistribution on crime depend on the sanctioning policy and are not contingent on an assumed higher or lower return from criminal activities for poorer individuals.

2.1 | Optimal sanctioning policy

Given the distribution of wealth in society, the social planner's problem is to choose p and the statutory fine $\hat{f}$ to minimize the social costs, given by the sum of the costs from the harmful act (net of the offenders' benefit) and the enforcement costs:

$$\int_0^\infty \left[\int_{pf(w)}^\infty (h - b) r(b)\, db \right] dG(w) + c(p), \tag{1}$$

where $f(w) = \min\{\hat{f}, w\}$.

The optimal sanctioning policy, characterized by Polinsky and Shavell (1991), involves that:

- the optimal level of the statutory fine is $\hat{f} = h/p$, so that the optimal effective fine is $f^*(w, p) = \min\{h/p, w\}$[10];
- the optimal p, assuming it is positive, is such that for some individuals the optimal fine h/p may be lower than wealth w[11];
- Individuals whose wealth is less than h/p will be underdeterred, in the sense that they will violate even if $b < h$, while all individuals with wealth higher than or equal to h/p will be efficiently deterred (they will violate if and only if $b > h$).

The planner's optimization problem can be conveniently restated as a two-step process. For this intent, we define

$$\Psi(f, p) = \int_{pf}^{\infty} (h - b) r(b)\, db, \tag{2}$$

which represents the net cost of violations and sanctions as a function of the effective sanction f and the probability p.[12] For given p and w, the optimal fine $f^*(w, p) = \min\{h/p, w\}$ minimizes Ψ. Taking into account the distribution of wealth, the optimal probability p is found by minimizing the social cost, now written as

$$\int_0^{\infty} \Psi(f^*(w, p), p)\, dG(w) + c(p). \tag{3}$$

2.2 | Inequality and the social cost of enforcement

To analyze the effect of wealth inequality on the (optimal) social cost of crime and law enforcement as given by (1), we need to clarify what we mean by higher or lower inequality.

To this purpose, consider two distributions G and $\tilde{G}$, defined on $[0, \infty)$, and having the same mean. According to a common definition, the distribution $\tilde{G}$ is more equal than the distribution G if the former can be obtained from the latter by a sequence of equalizing transfers, such as Pigou–Dalton transfers.

[10]For a given p, the optimal fine f at wealth w is obtained by minimizing $\int_{pf}^{\infty} (h - b)\, dR(b) + c(p)$ under the constraint $f \leqslant w$. Because the derivative with respect to f is $-p(h - pf)r(pf)$, whose sign depends on $h - pf$, the optimal fine is the lowest value between w and h/p.

[11]The optimal p is assumed to be an interior solution, that is, it is less than 1, and its value is obtained from the first-order condition:

$$\int_0^{h/p} w(pw - h) r(pw)\, dG(w) + c'(p) = 0.$$

[12]Observe that such cost does not depend directly on w, as wealth affects deterrence and violations only inasmuch as it constrains the fine f.

As is well known (Rothschild & Stiglitz, 1970), such notion of $\tilde{G}$ being more equal than G is equivalent to the requirement that, for any (strictly) convex and decreasing ϕ,[13]

$$\int_0^\infty \phi(w)\, dG(w) > \int_0^\infty \phi(w)\, d\tilde{G}(w). \tag{4}$$

Given the similarity between (4) and (3), this result allows us to reach conclusions on the effects of changes in wealth distribution based on the shape of Ψ, defined by (2) in the case of monetary sanctions.

We can now state:

Proposition 1. *Assuming a population with individual wealth described by the distribution function G, consider a social planner implementing an optimal sanctioning policy characterized by a common probability p and maximal fine $\hat{f} = h/p$. Let $\tilde{G}$ be a new distribution, more equal than G. Let $r(b)$ be nonincreasing. Then, the social cost of crime and law enforcement is lower under the new distribution $\tilde{G}$.*

Proof. From (2) we have

$$\Psi_f = -p(h - pf)r(pf) < 0. \tag{5}$$

Since $r(b)$ is decreasing in $b = pf$, Ψ_f is increasing, hence $\Psi(f^*(w, p), p)$ is convex, in f. Under our assumption, this will be the case for $b \geqslant p\bar{w}$, hence for all $f \geqslant \bar{w}$.

With $f^*(w, p)$ an increasing and concave function of w, we conclude that Ψ is a nondecreasing and convex function of w. Namely, Ψ is strictly decreasing and strictly convex in w for all $w < h/p$, while it is constant in w when $f^*(w, p)$ is also constant, that is, for $w \geqslant h/p$.

We need to consider that a change in the distribution implies also a change in the optimal value of p. Let $\tilde{p}$ be the level of enforcement that minimizes the social cost (3) when the distribution is $\tilde{G}$. For any p, we have

$$\begin{aligned} \int_0^\infty \Psi(f^*(w, p), p)\, dG(w) - c(p) &\geqslant \int_0^\infty \Psi(f^*(w, p), p)\, d\tilde{G}(w) - c(p) \\ &\geqslant \int_0^\infty \Psi(f^*(w, \tilde{p}), \tilde{p})\, d\tilde{G}(w) - c(\tilde{p}), \end{aligned} \tag{6}$$

where the first inequality follows from the fact that $\tilde{G}$ is more equal than G and Ψ is concave and decreasing in w, while the second inequality follows from the fact that $\tilde{p}$ minimizes the social cost when the distribution is $\tilde{G}$.

The specification that the change in distribution must involve individuals with wealth $w < \hat{f}$ is necessary to exclude the case that G and $\tilde{G}$ differ only for $w \geqslant h/p$, in which case passing from G to $\tilde{G}$ will affect neither f nor Ψ, so that the social cost will be unchanged.

[13]This, on turn, amounts to an "integral condition" which, for distributions having the same mean, can be interpreted in terms of the Lorenz curve. Namely, condition (4) is a necessary and sufficient condition for the Lorenz curve corresponding to G to always lie above the Lorenz curve corresponding to $\hat{G}$ (Atkinson, 1970).

In fact, when $G(w) \neq \tilde{G}(w)$ for some $w < h/p$, the first inequality in (6) is strict and the social cost is strictly lower with $\tilde{G}$. □

Proposition 1 reflects two effects of redistribution on the cost of deterrence and violation: first, and possibly more obvious, when wealth is moved from richer individuals who are not wealth constrained to poorer individuals who are wealth constrained, redistribution increases deterrence of the latter without reducing deterrence of the former, that is, it increases deterrence at no costs. Second, even when overall deterrence is not increased, the net social cost of violations is reduced when we increase the deterrence of poorer individuals while decreasing the deterrence of the richer ones. The reason for this is that the marginal poorer offender faces a lower expected sanction than the marginal richer offender, and therefore, the benefits the former obtains from committing the offense are lower than the benefits obtained by the latter. As both offenses impose the same harm, the net social harm associated with the poorer marginal offender is higher than the one associated with the rich marginal offender.

A few comments are in order about the (sufficient) condition on $r(b)$, namely, the requirement that $r(b)$ is nonincreasing.[14]

Deterrence is affected by the distribution of wealth and the shape of the distribution of benefits.

In fact, whenever $r(pw_2) > r(pw_1)$, a marginal transfer of wealth from individuals with wealth w_1 to individuals with wealth w_2 will result in a net increase in deterrence, regardless of whether w_1 is higher or lower than w_2. As a consequence, for given p, deterrence will be increased at the margin whenever we transfer wealth where $r(pw)$ is the highest. In this regard, any conclusion about the optimal distribution of wealth is sensitive to our assumption on the shape of r. On the other hand, the effect of the distribution of b on deterrence is nullified, and the role of other aspects affecting the social cost of crime and enforcement can be analyzed in isolation, under the assumption that r is constant.

In what follows, we will allow the density to be constant, thus including the case where r does not affect deterrence, and to decrease with b. The latter is implicitly necessary when, in the sections to come, we deal with nonmonetary sanctions, as no internal solution is possible when $r(b)$ is increasing.[15]

Moreover, we contend that assuming a decreasing density distribution of benefit from violation may be realistic in many circumstances, where it is reasonable to assume that the marginal effect of sanctions decreases with their severity.

Admittedly, the case of decreasing r introduces a bias in favor of redistribution. However, it is remarkable and particularly interesting that, even in the presence of such bias, we identify specific circumstances in which the conclusion regarding the desirability of redistribution from the point of view of the social cost of crime and law enforcement does not hold.

[14]In fact, the condition is sufficient but not necessary. The result holds with a less restrictive assumption allowing for a moderately increasing r, namely,

$$r'(b) < \frac{r(b)}{h - b}.$$

[15]As shown by D'Antoni et al. (2022, 2023), the condition for an internal solution is, in fact, more stringent, as it requires the hazard rate to be decreasing.

Before proceeding, it is worth considering a consequence that follows from Proposition 1 in the extreme situation when all inequality is eliminated.

Corollary 1. *The social cost of crime and law enforcement is minimized when wealth is perfectly equalized.*

Proof. It follows from the fact that the perfectly egalitarian distribution can be obtained from any other distribution by a set of equalizing transfers. □

3 | NONMONETARY SANCTIONS

In Section 2, we analyzed the case in which only monetary sanctions were utilized. However, the fact that some individuals are wealth-constraint and therefore underdeterred provides a justification for using nonmonetary sanctions as well. Because nonmonetary sanctions are more costly from a social perspective, as they impose a cost on the individual and also on society, the law and economics literature argues that they should be employed only when monetary sanctions are used to their maximum extent (Becker, 1968; Polinsky & Shavell, 1984).

When wealth is observable, the optimal nonmonetary sanction, at least in principle, could depend on the wealth of offenders. Nevertheless, the notion that nonmonetary sanctions can vary among offenders according to their wealth has been challenged by some scholars on both practical and moral grounds. Accordingly, Garoupa and Mungan (2019) analyze the optimal sanctioning policy assuming that the social planner cannot discriminate among offenders, so the same additional nonmonetary sanction s must apply to all offenders irrespective of their wealth. Polinsky (2006), on the other hand, assumes that the nonmonetary sanctions need not be uniform to all offenders. We will analyze the effects of redistribution under these alternative scenarios.

To proceed in our analysis, the function Ψ defined in (2) must be amended to take into account the presence of nonmonetary sanctions[16]:

$$\Psi(f, s, p) = \int_{p(f+s)}^{\infty} (h + p(1+\gamma)s - b) r(b)\, db, \tag{7}$$

where $s \geqslant 0$ is the nonmonetary sanction, or more precisely, its monetary cost to the offender; γ is the additional unitary cost of the nonmonetary sanction for society at large.

3.1 | Nondiscriminatory nonmonetary sanctions

When the nonmonetary sanction imposed by the planner is the same for all offenders irrespective of their wealth, its optimal value depends on the distribution of wealth. Given the optimal fine $f^*(w, s, p)$, which minimizes (7) under the constraint $f \leqslant w$, the optimal s and p solve

[16]We will abuse notation by using the same symbol Ψ to indicate both the function defined in (2) and in (7). In fact, (7) is reduced to (2) when $s = 0$.

$$\min_{\substack{s\geqslant 0\\ 0\leqslant p\leqslant 1}} \int_0^\infty \Psi(f^*(w,s,p),s,p)\,dG(w) - c(p). \tag{8}$$

The optimal sanctioning policy has been characterized by Garoupa and Mungan (2019, Proposition 1) as follows:

- the optimal statutory fine is $\hat{f} = h/p + \gamma s$, as the cost to society of a violation now includes the cost of the nonmonetary sanction; as a result, $f^*(w,s,p) = \min\{h/p + \gamma s, w\}$;
- some individuals with $w < \hat{f}$ will be underdeterred, in the sense specified in Section 2;
- at the optimum we may have $s > 0$ even for individuals for whom $w > \hat{f}$, that is, the optimal sanctioning policy may require that high wealth individuals are subject to nonmonetary sanctions even if they could still pay a fine higher than $\hat{f}$.

Notably, the presence of a nonmonetary sanction in addition to the fine may reduce dependence on the latter, but it does not alter the overall characteristics of the optimal sanctioning policy. Proposition 1 can be straightforwardly extended to this case.

Proposition 2. *Assuming a population with individual wealth described by a distribution function G, consider a social planner implementing an optimal sanctioning policy characterized by a common probability p, a uniform nonmonetary sanction $s \geqslant 0$, and a maximal fine $\hat{f} = h/p + \gamma s$. Let $\tilde{G}$ be a new distribution, more equal than G. Let $r(b)$ be nonincreasing. Then, the social cost of crime and law enforcement is lower under the new distribution $\tilde{G}$.*

Proof. The proof is similar to the proof of Proposition 1. Taking the partial derivatives of (7) we have

$$\Psi_f = -p(h + p\gamma s - pf)r(p(f+s)) < 0. \tag{9}$$

With $r(b)$ decreasing in b and $b = p(s+f)$, Ψ_f is increasing, hence Ψ is convex, in f.

To make notation more compact, we define $\Phi(w,s,p) \equiv \Psi(f^*(w,s,p),s,p)$. With $f^*(w,s,p) = \min\{\hat{f}, w\}$ an increasing a concave function of w, we conclude that $\Phi(w,s,p)$ is a nondecreasing and convex function of w. Namely, Φ is strictly decreasing and strictly convex in w for all $w < \hat{f}$ where G and $\tilde{G}$ differ, and constant in w for $w \geqslant \hat{f}$.

Let $\tilde{s}$ and $\tilde{p}$ be, respectively, the nonmonetary sanction and the level of enforcement that minimizes the social cost (8) when the distribution is $\tilde{G}$. For any s and p (including the values that minimize the social cost when the distribution is G), the social cost of enforcement satisfies

$$\begin{aligned}\int_0^\infty \Phi(w,s,p)\,dG(w) - c(p) &\geqslant \int_0^\infty \Phi(w,s,p)\,d\tilde{G}(w) - c(p)\\ &\geqslant \int_0^\infty \Phi(w,\tilde{s},\tilde{p})\,d\tilde{G}(w) - c(\tilde{p}),\end{aligned} \tag{10}$$

which proves the proposition. □

The condition imposed on r, once again, places a restriction on the shape of this function, preventing it from increasing too rapidly. In comparison to the condition in Proposition 1, the current condition is more stringent at each b due to the inclusion of the term $(1+\gamma)ps$. However, it is less stringent in mandating that the inequality holds for higher values of b.

3.2 | Discriminatory nonmonetary sanctions

The optimal structure of the nonmonetary sanction under the assumption that the sanction can vary with wealth has been analyzed by Polinsky (2006) and recently by D'Antoni et al. (2022).

The net cost of violations and sanctions as a function of the sanctioning strategy is still given by (7), but now s can be chosen to vary across individuals with different wealth w. This is to say that, for given p, the optimal sanctions $f^*(w,p)$ and $s^*(w,p)$ minimize the expression (7), while the optimal probability p takes into account the distribution of wealth, that is, it solves

$$\min_p \int_0^\infty \Psi(f^*(w,p), s^*(w,p), p)\, dG(w) + c(p). \tag{11}$$

To find the optimal level of the nonmonetary sanction s at each w, Polinsky (2006) assumes the problem admits an internal minimum, obtained by solving the first-order condition[17]:

$$\Psi_s = -p[h + (1+\gamma)s - b]r(b) + p(1+\gamma)[1 - R(b)] = 0 \tag{12}$$

with $b = p(f+s)$.

The optimal sanctioning policy is characterized as follows (Polinsky, 2006, Proposition 3, p. 831). At levels of wealth where $s^*(w,p) > 0$:

- the optimal fine equals the offender's wealth, that is, $f^*(w,p) = w$;
- the optimal imprisonment term decreases with wealth, that is, $\partial s^*/\partial w < 0$;
- moreover, the optimal combined monetary and nonmonetary sanction, that is, $f^*(w,p) + s^*(w,p)$, also decreases with wealth.[18]

Bearing in mind these conclusions, we can state the following:

Proposition 3. *Assuming a population with individual wealth described by a distribution function G, consider a social planner implementing an optimal sanctioning policy characterized by a common probability p, a maximal fine $\hat{f} = h/p$, and a nonmonetary sanction $s(w)$ dependent on individual wealth, with $\bar{w}$ the supremum of the interval of wealth for which $s(w) > 0$. Let $\tilde{G}$ be a new distribution, less equal[19] than G, with*

[17]D'Antoni et al. (2022) question the generality of this case, as there are quite common circumstances where the optimization problem does not admit an internal solution and the optimal nonmonetary sanction is either zero or maximal (where the maximum is defined exogenously). As pointed out by D'Antoni et al. (2023), for an internal solution to attain a maximum, additional assumptions about the distribution's shape, specifically that the hazard rate is decreasing, are necessary.

[18]A proof of this result is provided in Appendix A.1.

[19]By "less equal than," we mean that G can be obtained from $\tilde{G}$ through a series of equalizing transfers.

$G(w) = \tilde{G}(w)$ at $w \geqslant \bar{w}$. Then, the costs of law enforcement is lower under the new distribution $\tilde{G}$.

Proof. Consider Ψ as defined in (7). We calculate

$$\Psi_f = -p[h + (1+\gamma)s - b]r(b), \tag{13}$$

where $b = p(f + s)$. From (12) we have

$$\Psi_f = -p(1+\gamma)[1 - R(b)], \tag{14}$$

where the right-hand side is always negative and it is increasing in b, hence in the total sanction $f + s$.

With $s > 0$ it is $f^*(w, p) = w$. Define $\psi(w, p) = \Psi(w, s^*(w, p), p)$. The envelope theorem implies that $\psi_w = \Psi_f$. Since, as shown by Polinsky (2006), the optimal total sanction $w + s^*$ is decreasing in w, from (14) it follows that, when the optimal sanction s^* is positive, ψ is decreasing and concave in w.[20] The fact that ψ is *concave* whenever $s > 0$ implies that, when $\tilde{G}$ is less equal than G and $\tilde{p}$ is the optimal level of enforcement when the distribution is $\tilde{G}$:

$$\begin{aligned}\int_0^\infty \psi(w,p)\, dG(w) - c(p) &\geqslant \int_0^\infty \psi(w,p)\, d\tilde{G}(w) - c(p) \\ &\geqslant \int_0^\infty \psi(w,\tilde{p})\, d\tilde{G}(w) - c(\tilde{p}),\end{aligned} \tag{15}$$

that is, a wealth equalizing redistribution among individuals subject to positive nonmonetary sanctions determines an *increase* in social cost. □

In this case, the conclusion we reach differs from Propositions 1 and 2. The reason is that, while in the previous cases, a redistribution of wealth to the poor increased deterrence on individuals with a lower benefit from violation, the fact that now the total sanction is higher for the poor implies the opposite. Namely, as long as they are subject to nonmonetary sanctions, wealthier individuals who violate will, on average, derive less benefit from the violation than poorer individuals. Proposition 3 pertains to the case in which redistribution impacts individuals subject to a nonmonetary sanction. It may be the case that some individuals, typically the wealthiest, are optimally subject solely to a monetary sanction; redistributing wealth among them reduces the social cost (this follows from Proposition 1).

Moreover, redistribution can affect the number of individuals subject to nonmonetary sanctions, that is, individuals whose wealth is above or below $\bar{w}$. Given that the effects of redistribution on social cost have different signs at different levels of wealth, we cannot conclusively determine the sign of the effect of a reduction of inequality involving a redistribution across both groups of individuals.

[20] Appendix A provides an alternative proof of the concavity of ψ with respect to w employing second-order derivatives.

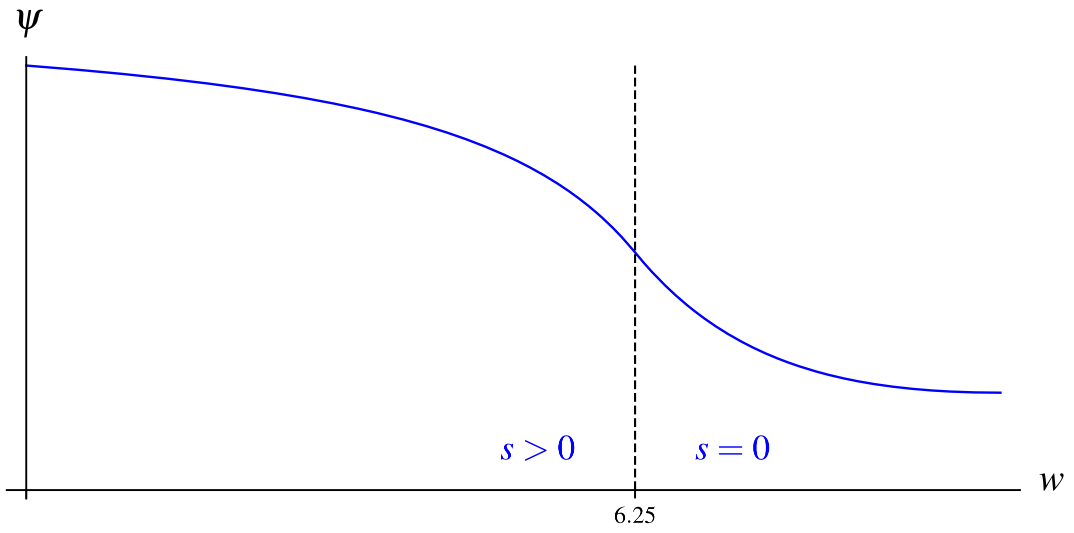

FIGURE 1 $\psi(w, p)$ when $h = 5, p = 0.5, \gamma = 0.2$, and $b \sim Pareto(1, 2)$.

We finally observe that the proposition does not require any explicit restriction on the shape of r. This is because for $s(w)$ to be an internal solution, a necessary condition is that r is decreasing at $b = p(s(w) + w)$.

3.3 | An example

To illustrate, consider that the benefits from violations are distributed according to a Pareto distribution[21] with minimum parameter $k = 1$ and shape parameter $\alpha = 2$.

Assume that $h = 5$ and $\gamma = 0.2$ and let the optimal enforcement be $p = 0.5$. The optimal nonmonetary sanction is given by $s(w) = 25 - 4w$, which decreases with w. The function representing the social costs of crime and law enforcement under the optimal sanctioning strategy is illustrated in Figure 1: it is concave for $1 < w < 6.25$. For $w > 6.25$, the optimal nonmonetary sanction is 0, and we are back to 1, where the function is convex.

4 | DISCRIMINATORY ENFORCEMENT

Our analysis thus far assumed uniform enforcement effort across all offenders. We now demonstrate that, even when the sanction is only monetary, Proposition 1 does not extend to the case where the social planner can discriminate among offenders by adjusting the enforcement level based on the offender's wealth.

[21]The Pareto distribution is suitable to illustrate the case of an optimal nonmonetary sanction because it satisfies the condition on the hazard rate stated by D'Antoni et al. (2022, 2023).

When enforcement (represented by the probability p) can be adjusted to the offender's wealth, both f and p are optimally set to minimize[22]

$$\hat{\Psi}(f, p) \equiv \int_{pf}^{\infty} (h - b) r(b)\, db + c(p), \tag{16}$$

under the usual constraint $f \leqslant w$.

When enforcement can be adjusted to wealth, fines should be set at their maximum level. Overdeterrence of individuals with high wealth can be avoided by selectively reducing p, thereby also saving enforcement costs. Hence, the optimal fine is $f^*(w) = w$ for everyone.

The optimal enforcement probability $p^*(w)$ for an individual with wealth w minimizes (16), hence it solves the first-order condition:

$$\hat{\Psi}_p(w, p) = -w(h - pw) r(pw) + c'(p) = 0. \tag{17}$$

As demonstrated by Garoupa (2001), the expected fine $p^*(w)w$ is increasing in w; however, $p^*(w)$ may be either increasing or decreasing in w, so that enforcement and punishment may be either complement or substitute, depending on the shape of $r(b)$, namely, on its elasticity $\epsilon = br'(b)/r(b)$ calculated at $b = p^*(w)w$. In particular, p and w will be substitutes $(dp^*/dw < 0)$ if and only if,

$$p^*(w)w > \frac{h(1 + \epsilon)}{2 + \epsilon}. \tag{18}$$

This affects the conclusion on the effect of a reduction in wealth inequality on the social cost, as stated in the following:

Proposition 4. *Assuming a population with individual wealth described by the distribution function G, consider a social planner implementing an optimal sanctioning policy characterized by a probability p and a fine f that can both differ across individuals depending on their wealth. Let $\tilde{G}$ be a new distribution, more equal than G. Let $r(b)$ be nonincreasing. Then, a sufficient condition for the social cost of crime and law enforcement to be lower under the new distribution $\tilde{G}$ is that the fine and the probability are substitutes, while the cost may be higher when they are complements.*

Proof. Let $\psi(w) \equiv \hat{\Psi}(w, p(w))$, with $\hat{\Psi}$ defined in (16), represent the social cost of crime and law enforcement at wealth w when f and p are chosen optimally, that is, when $f = w$ and $p = p^*(w)$. When the distribution of wealth is G, the average social cost is $\int_0^{\infty} \psi(w)\, dG(w)$; hence, the effect of a change in distribution can be analyzed by looking at the shape of ψ. We have

$$\psi' = -p(h - pw) r(pw) < 0, \tag{19}$$

[22]This function differs from (2) in that it includes the term $c(p)$, which now depends on w and its distribution.

$$\psi'' = p\frac{d(p^*w)}{dw}[r(pw) - (h - pw)r'(pw)] - \frac{dp^*}{dw} \cdot (h - pw)r(pw). \tag{20}$$

Since $p^*(w)w$ is increasing in w and we assumed that $r' \leqslant 0$, the convexity of ψ depends on the sign of dp^*/dw. As it is clear from (20), given that in the optimum we have $pw < h$, a sufficient condition for $\psi'' > 0$ is that $dp^*/dw < 0$, that is, w and p are substitutes.

On the other hand, with $dp^*/dw > 0$, ψ'' can be either positive or negative. Indeed, a sufficient condition for $\psi'' < 0$ is that

$$p^2 + \frac{dp^*}{dw}pw < \frac{dp^*}{dw}(h - pw), \tag{21}$$

which is possible with p and w small enough (a numeric example when r is uniform is presented below).

Given that the convexity of ψ determines the effect of a change in distribution on the social cost of crime of law enforcement, this proves the proposition. □

As claimed by Proposition 4, a reduction in inequality may yield either a positive or a negative impact on the social cost, contingent upon the wealth levels involved. Given that fines and enforcement are complements at low level of expected sanctions, we expect that redistribution may increase the social cost when it takes place at lower levels of wealth.

This conclusion can be verified by considering the special case of a uniform distribution, where $\epsilon = 0$ in condition (18). Under this circumstance, fines and the probabilities will be complemented when the expected sanction $p^*(w)w$ is below $h/2$, while they will be substituted above this threshold. Figure 2 illustrates the function representing the social cost in terms of wealth (function ψ defined in the proof of Proposition 4) when r is uniform over the interval $[0, 1]$ and $c(p) = p^2$. Notably, the function is concave up to the wealth level $w = \sqrt{2/3}$, beyond which it becomes convex.[23] Therefore, when equalizing transfers take place at high levels of wealth, their effect is to reduce the social cost. Conversely, when such transfers occur at low levels of wealth, a more equal distribution will lead to an increase in social costs.

The intuition behind this result is that, when enforcement and fines are complementary, greater wealth w is associated with higher probability p, thereby making a marginal increase in the fine more effective in deterring crime as wealth increases. Hence, transferring wealth from a richer to a poorer individual will reduce the expected sanction (and hence deterrence) for the former more than it increases for the latter. This effect can more than compensate for the fact that the level of deterrence increases with wealth, which was at the basis of the results in Propositions 1 and 2, where the probability p remained constant across different wealth levels.

[23]We have in this case

$$p^*(w) = \frac{hw}{w^2 + 2}, \quad \psi(w) = \left[h - \frac{1}{2}\right] - \frac{h^2w^2}{2(2 + w^2)}.$$

It is easy to check that $dp^*/dw > 0$ at $w < \sqrt{2}$ and $\psi'' < 0$ at $w < \sqrt{2/3}$.

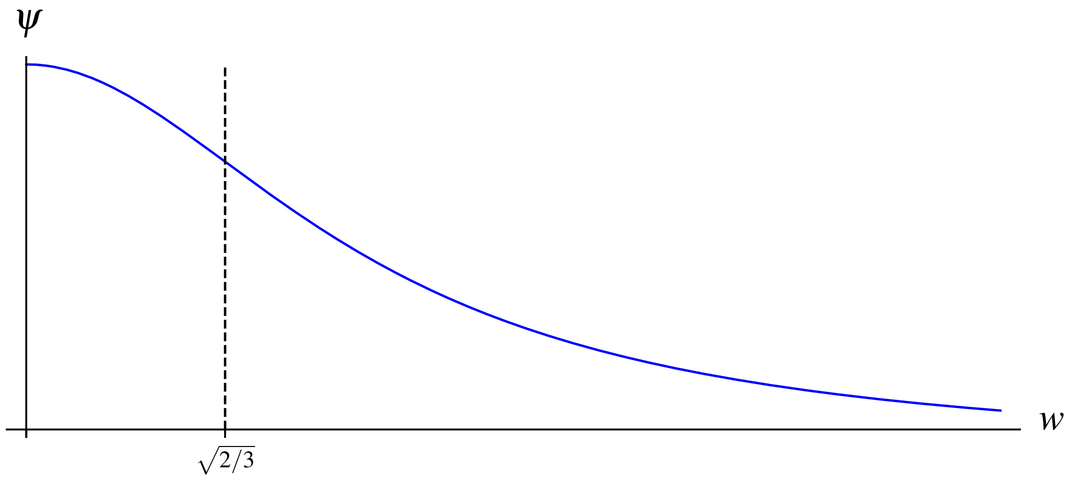

FIGURE 2 $\psi(w)$ when $b \sim \mathcal{U}(0, 1)$, $c(p) = p^2$, and $h = 0.8$.

5 | DISCUSSION: COST OF NONMONETARY SANCTIONS AND WEALTH

As emphasized in the introduction, there are a number of possible channels through which wealth affects crime that we leave out of our analysis. However, limiting our attention to sanctions and their costs, it is worth considering what happens if we relax the assumption that the cost of nonmonetary sanctions is constant (in monetary equivalent terms) across the population. Indeed, a number of papers discussing the relation between crime and inequality have assumed that such costs increase with wealth and/or income (see, e.g., Garoupa & Mungan, 2019; Polinsky & Shavell, 1984).[24]

Under this assumption, the expression (7) should be modified by introducing a variable $\delta(w)$, representing the wealth-related correction of the (monetary) cost of a nonmonetary sanction[25]:

$$\int_{p(f(w)+s)}^{\infty} (h + p(\delta(w) + \gamma)s - b)r(b)\,db. \tag{22}$$

To understand how it may affect and modify our conclusions, the assumption that the individual cost of s varies with wealth must be better qualified.

A possible explanation for why the cost of imprisonment may be influenced by wealth is that a nonmonetary sanction like imprisonment consumes time, and time is complementary to consumption. Consequently, wealthier individuals derive higher utility from their time when

[24]Another potential source of cost stemming from sanctions, both monetary and nonmonetary, is punishment avoidance by offenders, that is, resources spent to reduce the probability or size of sanctions (Malik, 1990; Tabbach, 2010). Such costs depend on the size of the sanction itself, as well as the resources (wealth) available to offenders, and they might in turn reduce the wealth available to pay the sanction. The analysis of these secondary effects would add complexity to the model and possibly affect some conclusions. We leave this to future research.

[25]If s is the *average* monetary cost of a nonmonetary sanction, we will have that $\int_0^{\infty} \delta(w)\,dG(w) = 1$. The assumption made in previous sections corresponds to the case of $\delta(w) = 1$ for all w.

not in prison. However, a counterargument to this claim could be raised in the context of our analysis, where nonmonetary sanction is only imposed when an individual's wealth is reduced to zero (or more realistically to a level of subsistence, which can be considered a normalized zero) by the monetary sanction. All individuals subject to a nonmonetary sanction *and* wealth constrained will have the same, that is, zero, wealth. Therefore, if the value of their time depends on the available wealth at the time of the sanction, the marginal value of time should be identical for all.[26]

A more common argument is that higher wealth reflects a higher level of human capital. Individuals with higher wealth are also more productive, hence imprisonment or other restrictions on their ability to work imply a higher individual cost. In this case, it is not the level of wealth available after the sanction that matters; hence, the cost remains unaffected by a monetary sanction that seizes all their wealth.

If this is the case, however, it is necessary to clarify the focus of our comparison. If we are concerned with the impact of wealth *redistribution* on the cost of enforcement—that is, if one distribution is derived from the other through a wealth redistribution scheme—then δ should remain unaffected, as productivity does not change with a transfer of wealth. In our analysis, this implies that the change in w affects f, while δ is the same under the two distributions for each individual. Consequently, the analysis of the concavity of Ψ in our Proposition 2, and thus our conclusion on the effect of more or less inequality, remains unaffected. This is also true of Proposition 3, as long as the conclusion that the total sanction decreases with wealth still holds, even when δ is a decreasing function of w. This extension of Polinsky's (2006) result is proven in Appendix A.[27]

6 | CONCLUSIONS

This paper offers an analysis regarding the effects of wealth inequality on the social costs of crime and law enforcement. In particular, we analyze whether redistributing wealth leading to a decrease in measures of inequality is socially desirable. The key insight of the analysis is that the social desirability of wealth redistribution hinges on the design of the criminal justice system, and in particular on whether it is equitable or not, in the sense that enforcement or nonmonetary sanctions can discriminate among offenders based on their wealth.

Utilizing standard law enforcement models, we have shown that there is a complementarity between criminal equity and distributional equality. If the criminal justice is equitable, greater equality in the distribution of wealth reduces the social costs of crime and law enforcement and

[26]This counterargument does not apply to individuals who are subjected to the nonmilitary sanction and are not wealth-constrained, that is, individuals with wealth exceeding $h/p + \gamma s$ in Section 3.1. Therefore, a redistribution of wealth involving this group of individuals would reduce the cost of the nonmonetary sanction for some of them, with effects on the total social cost that depends on how the marginal change varies with wealth, that is, on second-order effects.

[27]Other arguments can be put forth to question the assumption that the cost of imprisonment is greater for more productive individuals, whose opportunity cost of time is greater. However, adopting a longer-term perspective that considers future earnings, we should redefine the wealth constraint to encompass human capital as well. In many cases, when an individual is judgment proof, the legal system stipulates some form of installment payment to be paid off in the future, which essentially corresponds to a claim on human capital. This implies that individuals deprived of their wealth may not benefit from their higher human capital and, as a result, their opportunity cost of being in prison might not necessarily be higher.

is therefore socially desirable. Indeed, under plausible assumption, the optimal distribution of wealth is perfect equality. On the other hand, if the criminal justice system is inequitable, such that enforcement or nonmonetary sanctions can discriminate among offenders based on their wealth, then redistributing wealth from richer to poorer individuals may actually increase the costs of crime and law enforcement.

Our analysis does not imply that the effect on the social cost of enforcement is the only, or the most relevant, positive effect of redistribution. Our more limited claim is that, on top of other welfare effects and under some conditions of "criminal equity," redistribution will have some benefits on the cost of enforcement. Noteworthy, such an effect is independent of the possible direct effect of wealth on individual benefits from violations.

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DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no data sets were generated or analyzed during the current study.

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APPENDIX A

When nonmonetary sanctions are discriminatory, the total sanction is decreasing with wealth

This proof follows the one provided in Proposition 3 by Polinsky (2006). Consider the expression (7). Let the optimal sanctions at wealth w be $s(w) > 0$, so that $f(w) = w$ and the first-order condition (12) is satisfied, that is,

$$-p[h + (1+\gamma)s(w) - b(w)]r(b(w)) + p(1+\gamma)[1 - R(b(w))] = 0 \tag{A1}$$

with $b(w) = p(s(w) + w)$. Consider now a lower level of wealth $w' < w$. At wealth w', we set the nonmonetary sanction at the level s' such that the total sanction is $s' + w' = s(w) + w = b(w)$, so that $s' = s(w) + (w - w') > s(w)$. The expression in (A1) is

$$\begin{aligned} &-p[h + (1+\gamma)s' - b(w)]r(b(w)) + p(1+\gamma)[1 - R(b(w))] \\ &\quad < -p[h + (1+\gamma)s(w) - b(w)]r(b(w)) + p(1+\gamma)[1 - R(b(w))] = 0. \end{aligned} \tag{A2}$$

Therefore, at wealth w', an expected total sanction equal to $b(w)$ is less than optimal, as an increase of s above s' reduces the social cost. This implies that $s(w') + w' > s(w) + w$, which proves the conclusion.

We now extend the result to the case in which the cost of the nonmonetary sanction to the individual is increasing in wealth, a circumstance not taken into consideration in Polinsky (2006). Let the cost to the individual be $\delta(w)s(w)$, with $\delta' > 0$.

In this case, expression (A1) becomes

$$-p[h + (\delta(w)+\gamma)s(w) - b(w)]r(b(w)) + p(1+\gamma)[1 - R(b(w))] = 0 \tag{A3}$$

with $b(w) = \delta(w)s(w) + w$. To an individual with wealth $w' < w$ we set the sanction s' so that $\delta(w)'s' + w' = \delta(w)s(w) + w = b(w)$. Notice that $w > w'$ and $\delta(w)' < \delta(w)$ imply $\delta(w)'s' > \delta(w)s(w)$ and $s' > s(w)$.

Since $(\delta(w)' + \gamma)s' > (\delta(w) + \gamma)s$, the expression in condition (A3) is

$$\begin{aligned} &-p[h + (\delta(w)'+\gamma)s' - b(w)]r(b(w)) + p(1+\gamma)[1 - R(b(w))] \\ &\quad < -p[h + (\delta(w)+\gamma)s(w) - b(w)]r(b(w)) + p(1+\gamma)[1 - R(b(w))] = 0. \end{aligned} \tag{A4}$$

Hence, just as in the case where the cost of a nonmonetary sanction is not affected by wealth, we conclude that a total sanction $b(w)$ is suboptimal at wealth w'.

Concavity of ψ in Proposition 3

We provide a direct formal proof that Ψ is concave when the nonmonetary sanction is discriminatory (as stated in the proof of Proposition 3).

Consider $\Psi(f, s)$ and let $f^*(w) = w$ and $s^*(w)$ be the optimal sanctions (we omit the argument p, which is held constant, for the sake of notational simplicity). We want to demonstrate that $\psi(w) \equiv \Psi(w, s^*(w))$ is decreasing and concave in w. From the envelope theorem, we have that

$$\psi' = \Psi_f < 0, \psi'' = \Psi_{ff} + \frac{ds^*}{dw}\Psi_{fs}. \tag{A5}$$

If $s^*(w)$ minimizes Ψ, then $\Psi_s = 0, \Psi_{ss} > 0$, and

$$\frac{ds^*}{dw} = -\Psi_{sf}/\Psi_{ss}. \tag{A6}$$

Substituting in the expression of ψ'' we have

$$\psi'' = \frac{\Psi_{ss}\Psi_{ff} - \Psi_{fs}^2}{\Psi_{ss}}. \tag{A7}$$

We calculate from (7):

$$\Psi_{ff} = p^2[r(b) - r'(b)(h - pf + \gamma ps)], \tag{A8}$$

$$\Psi_{ss} = -p^2[(2\gamma + 1)r(b) + r'(b)(h - pf + \gamma ps)], \tag{A9}$$

$$\Psi_{fs} = p^2[\gamma r(b) - r'(b)(h - pf + \gamma ps)], \tag{A10}$$

with $b = p(f + s)$. Then

$$\Psi_{ss}\Psi_{ff} - \Psi_{fs}^2 = -p^4(1 + \gamma)^2 r(b)^2 < 0. \tag{A11}$$

This implies that $\psi'' < 0$, so that ψ is concave.