Crime and status: A contribution to strain theory

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Abstract

This paper studies the implications of strain theory for equilibrium crime rates in a simple economic model by assuming that potential offenders care about their relative position. We establish that subjects' status concerns allow for multiple crime rate equilibria and that these positional preferences may modify the results regarding predictions about how crime changes in response to a higher detection probability and a higher sanction. In addition, we argue that the socially optimal level of the detection probability and the sanction will often be higher when potential offenders care about their relative position.

Keywords: Crime; Strain Theory; Status; Multiple Equilibria

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1 Introduction

1.1 Motivation and main results

Crime is a social phenomenon of great importance, adversely affecting many individuals by the minute. Indeed, crime is consistently placed at or near the top of the list of social maladies (see, e.g., Helsley and Strange 1999). When it comes to explaining why criminals offend, strain theory is one of the principal sociological explanations for the emergence of crime, arguing that people are more likely to engage in crime when they cannot obtain what they dearly want through legitimate channels (see, e.g., Agnew 2006a).

In strain theory, criminal undertakings are seen as an instrument to lessen stress experienced. Famously, Merton (1938) argues that crime is a possibility of alleviating the mismatch between the – in many societies dominating – desirability of economic success and the – for many individuals – only limited access to the legitimate means for attaining the goal of economic success, such as an elite education and social networks. Hence, offending may very well be the response for many to the question of "which of the available procedures is most efficient in netting the culturally approved value" (Merton 1968, 189). Relative deprivation (i.e., negatively discrepant comparisons regarding wealth and status, for instance) is an important cause of strain and may be a powerful motivator of crime (see, e.g., Young 2006). In reality, people are indeed found to be more likely to engage in crime when they have a feeling of relative deprivation (see, e.g., Baron 2004, Stiles et al. 2000). Furthermore, strain may occur at all class levels, given that the assessment of the own economic position (i.e., status) is subjective and dependent on the comparison group which likewise is selected by the individual.

This paper explores the implications of strain theory in a simple economic model by allowing individuals to have positional concerns. Hence, we attempt to merge the often con-

trasted economic and sociological approach.[1] In our setup, potential offenders are concerned about their absolute level of consumption, but also about how their consumption compares to that of similar others. Lagging behind the average level of consumption compared to a reference group causes strain, which may make crime an "efficient procedure" in order to arrive at a more favorable relative comparison. However, the individual must take into account the possibility that the offense will be detected and punished, a course of events that would imply an even more unfavorable status comparison. In other words, when opting for criminal activity, the individual accepts a gamble regarding both the absolute level of consumption and status. Specifically, this paper will consider the possibility that social comparisons are relevant due to the disutility from lagging behind in terms of status, and contrast it with the scenario in which both being ahead and lagging behind is important for individual well-being and decision-making. Whereas the usual understanding of strain refers to somebody suffering from being relatively worse off, Merton already suggested that personal success and satisfaction derive not only from attaining goals but also from surpassing others (Lee and Cohen 2008).

Potential offenders' feeling strain from unfavorable comparisons and, possibly, satisfaction from favorable ones implies in our operationalization via status considerations that multiple crime rates may represent equilibrium crime participation. The intuition follows from the fact that the concerns about relative consumption introduce an interdependency between both the decision of a given potential offender regarding whether to participate in crime and the decisions of all other individuals. This is of great interest because crime in the real-world is indeed very unevenly distributed across space and time, despite similar characteristics of respective locations. For example, there are numerous cases of "twin" cities in the US, where cities with similar characteristics nevertheless witness very different crime rates (see, e.g.,

[1]For example, Kelly (2000) summarizes his findings by stating that "Property crime is well explained by the economic theory of crime, while violent crime is better explained by strain and social disorganization theories."

Marceau and Mongrain 2011). Interestingly, we find that crime may be either higher or lower when compared to a scenario in which potential offenders do not attach value to their relative position. This comes as a surprise since the presence of positional concerns is usually considered an *additional* motive for crime in strain theory. Nevertheless, the explanation for our finding is quite intuitive. When many other individuals engage in criminal activity and thereby increase their expected income available for consumption, the individual who complies with the law must tolerate an unfavorable status position. The strain implied may push the individual into crime. At the same time, when only few other individuals engage in crime, then average consumption is not too much different from what a norm-compliant individual can afford. The strain caused by the small discrepancy is not necessarily conducive to making crime privately optimal, whereas the anticipated status loss that would result upon detection contributes to deterrence.

In addition, this paper shows that the presence of status considerations by potential offenders may call into question that the standard comparative-statics predictions regarding changes in the level of the sanction and the level of the detection probability hold. Indeed, it may be that an increase in the detection probability, for example, brings about an increase in the crime rate. This possibility follows from the influence that law enforcement parameters have with regard to the average level of consumption, and the possibility that the varied reference consumption level changes the desirability of crime.

When turning to welfare and policy implications, we argue that the presence of status considerations will often imply higher marginal benefits of stricter law enforcement. The explanation uses the fact that stricter enforcement lowers the average consumption level of the comparison group, which benefits all individuals, while the adversely affected individuals are concentrated among offenders.

Having outlined our main results, we summarize by saying that our article contributes

to the literature in several ways. First, we offer an economic analysis of the implications of one of the principal sociological theories on criminal behavior, namely, strain theory. One of our central findings in this regard is that the presence of positional concerns need not induce more crime, as is often suggested in the literature. Second, the paper at hand contributes an explanation for the variety of crime rates across time and space and thereby responds to a recent call by Ferrer (2010), saying that "differences in crime rates across locations ...remain an open question in the law enforcement literature". Our explanation is complementary to those established in the literature (see the discussion in the next section). Next, building on our result regarding the possibility of multiple equilibria, we find that modest adjustments in law enforcement policy may cause sizable changes in the crime rate, as society may move from one stable equilibrium to another one. Finally, we establish status gains and losses as additional aspects that ought to co-determine optimal law enforcement. We argue that stricter law enforcement is likely to be the adequate response to potential offenders' caring about relative position in many circumstances.

1.2 Related literature

In addition to the literature on optimal law enforcement (see, e.g., Polinsky and Shavell 2009), the present paper is related to the literature that contributes to strain theory, to articles exploring the implications of people having positional concerns, and to contributions that establish the possibility of multiple crime equilibria.

Strain theory started with Merton (1938) and has since then been elaborated in several ways. More recent contributions to strain and crime include the general strain theory by Agnew (2006b) and the institutional anomie theory by Messner and Rosenfeld (2001). Strain theory has accumulated a considerable amount of empirical support (Lee and Cohen 2008). We contribute to the subject by offering a formal operationalization of important aspects of the theory and studying the implications of these aspects. Our implementation relies on the

assumption that potential offenders compare their attainable level of consumption to the one exhibited by peers. In this regard, our approach very closely mirrors the concept of relative deprivation referred to before.

The idea that individuals care about their social rank with regard to their fellow human beings has taken a stronghold in the economics literature.[2] Both the fact that relative concerns are important and that goods differ with regard to their positionality (i.e. that certain goods have a higher relevance for relative standing in society) have been confirmed in several empirical studies, among them Alpizar et al. (2005), Carlsson et al. (2007), Carlsson and Qin (2010), Caporale et al. (2009), Clark et al. (2008), Clark and Senik (2010), Johansson-Stenman et al. (2002), Solnick and Hemenway (1998, 2005), and Solnick et al. (2007). When it comes to the identification of the reference point, there is evidence that the respect and admiration one gets from interaction with face-to-face groups such as colleagues and friends are a major determinant of status concerns (see Anderson et al. 2012, Clark and Senik 2010, Senik 2009). Our study complements this literature by exploring the repercussions of positional concerns for the choice regarding crime.

This paper establishes that the interdependence among potential offenders introduced by status concerns may allow for multiple crime rates in equilibrium. It is an important fact that crime is distributed quite unevenly across space and time, despite similar regional characteristics (see, e.g., Glaeser et al. 1996). This has created an interest in the possibility of multiple equilibria for a long time. The literature has succeeded in showing that there are circumstances that permit multiple crime rates in equilibrium, and thereby can contribute to an explanation of the empirical finding regarding the distribution of crime. One explanation relies on the fact that a given enforcement budget creates a high detection probability when

[2]For instance, Dohmen et al. (2011) provide evidence for the importance of relative income for subjective well-being using functional magnetic resonance imaging (fMRI). Further empirical evidence for the importance of relative income positions for individual happiness and actions can be found in Stutzer (2004) and Frey et al. (2008), for instance.

there is little criminal activity, but only a small detection probability when many individuals engage in crime (see Bar-Gill and Harel 2001, Bond and Hagerty 2010, Conley and Wang 2006, Fender 1999, Ferrer 2010, Freeman et al. 1996, Helsley and Strange 1999, Sah 1991). Another possible explanation uses asymmetric information about individuals' characteristics and self-fulfilling beliefs (Rasmusen 1996, Verdier and Zenou 2004). In contrast, the positive covariance between the individual decisions to commit crime in our framework are due to the fact that well-being depends partly on the comparison of the own consumption level to that of others. There are other social interaction models such as Glaeser et al. (1996), Sah (1991), Schrag and Scotchmer (1997), and Silverman (2004), relying on different reasons responsible for the interdependence. For example, Glaser et al. (1996) consider the case in which some individuals imitate their neighbors, while Schrag and Scotchmer (1997) consider the consequences of several potential criminals having access to a crime opportunity where an individual with access may be sanctioned erroneously. In another line of inquiry, Burdett et al. (2003), Huang et al. (2004), and Marceau and Mongrain (2011) incorporate potential labor market influences. The paper at hand provides a complementary explanation for the empirically observed variance of crime across time and space building on the assumption about the positional concerns of subjects that has convincing empirical support.

In addition to the connections to the literature described above, our paper is related to studies exploring the interconnection of crime and inequality. In this realm, there are theoretical contributions dealing with the fact that law enforcement may also be achieved by granting social transfers, because this influences the opportunity costs of crime (Benoit and Osborne 1995, Demougin and Schwager 2000, 2003). The empirical literature on the association of inequality and crime has in most contributions established a positive link between the two (see Dahlberg and Gustavsson 2008, Demombynes and Özler 2005, Fajnzylber et al. 2002, Whitworth 2012, forthcoming), although other results have also been found (see

Kelly 2000 and Chintrakarn and Herzer 2012). In another line of inquiry, Chiu and Madden (1998) study the consequences of variations in the income distribution when private protection against crime is taken into account.

The remainder of our paper is organized as follows. In Section 2, we describe the model used for our analysis. Section 3 presents our equilibrium analysis, before Section 4 discusses findings from a comparative-statics exercise. Potential welfare implications are addressed in Section 5. The last section concludes.

2 The model

Consider a group of individuals who are identical regarding their preferences for consumption and relative standing. We assume that individual well-being can be represented by the following utility function:

$$U = v(c) + gw(S), \tag{1}$$

where c is the individual's consumption level and S is the individual's status. The utility from consumption is increasing at a diminishing rate (i.e. $v' > 0 > v''$). The marginal utility from an improvement in relative standing is weakly positive (i.e. $w' \geq 0$) and may be either constant, decreasing or increasing. For example, Robson (1992) assumes that utility is strictly convex in status, whereas Corneo (2002) supposes a strictly concave relationship.[3] The parameter g indicates the relative importance of status to absolute consumption. Our specification of U implies that we consider utility separable in consumption utility and utility from status considerations, a case between absolute consumption and relative standing being complements or substitutes. Relative standing is determined by comparing the own level of absolute consumption with the group's average level of absolute consumption $\bar{c}$. We follow Card et al. (2012), Falk and Knell (2004), and Konrad and Lommerud (1993), among others,

[3]According to Robson (1992, p. 839) "... it seems plausible that the difference between a gold medal and silver medal medal should be greater than that between a silver medal and a bronze medal".

when we specify

$$S \equiv c - \bar{c} \tag{2}$$

and $w(0) = 0$. The distinction of whether only lagging behind is behaviorally relevant or both lagging behind and surpassing others affects utility can be incorporated by requiring $w'(S) > 0$ for $S < 0$ in both cases while $w'(S) = 0$ for $S > 0$ in the first and $w'(S) > 0$ for $S > 0$ in the second case.

The individual level of consumption is constrained by available income. All individuals have some income $I > 0$ from legal work. The assumption that all individuals (offenders and non-offenders) have legal income has its empirical support since most criminals also participate in lawful employment (see, e.g., Kleiman 2009). In addition, individuals may take advantage of a criminal opportunity with gain b. In other words, the decision regarding crime is binary (as is standard in the literature on optimal law enforcement, see, for example, Polinsky and Shavell 2001, 2009). The level of the criminal gain differs between individuals, where $b \in [0, B]$ according to the cumulative distribution function $F(b)$. Consideration of individuals who are symmetric apart from their payoffs from crime is a standard procedure in the economic analysis of crime (see, e.g., Bond and Hagerty 2010). Undertaking crime entails the risk that both the criminal benefits are disgorged and a sanction $s > 0$ is imposed with probability p, $0 < p < 1$. As a result, we have to distinguish between three different levels of available income for an individual with criminal benefits b:

$$I_n = I + b \tag{3}$$

$$I_d = I - s \tag{4}$$

$$I_L = I \tag{5}$$

where the subscript n stands for 'no detection', d for 'detection', and L denotes the case in which the individual does not engage in the illegal opportunity.

Refraining from crime implies expected utility EU_L given by

$$EU_L = v(I_L) + gw(I_L - \bar{c}). \tag{6}$$

In contrast, individuals who opt for undertaking the offense have expected utility EU_O following from

$$EU_O = (1-p)[v(I_n) + gw(I_n - \bar{c})] + p[v(I_d) + gw(I_d - \bar{c})]. \tag{7}$$

When deciding on the commission of the crime, the individual takes the level of average consumption $\bar{c}$ as exogenously given. The utility from leaving out the criminal opportunity is the same for all individuals, whereas EU_O varies across the population since $b \in [0, B]$ is drawn randomly for each subject. As a result, for a given average consumption level, a crime rate between zero and one would mean that there is some individual with criminal gain $\tilde{b}$ for whom it holds that

$$\Delta(\tilde{b}, \bar{c}) = EU_O - EU_L = 0. \tag{8}$$

Denoting the critical level of criminal gain that solves (8) by $\tilde{b}$, we can conclude that individuals (do not) offend for a given level of comparison consumption when b $(<)$ $\geq \tilde{b}$. A critical gain level $\tilde{b}$ implies a crime rate given by $1 - F(\tilde{b})$.

Regarding the individual choice, it is interesting to note that offending implies a gamble with respect to the utility from absolute consumption and the utility from relative standing. While individuals are assumed to be risk-averse with respect to variations in the level of absolute consumption, it is possible that they are risk-seeking regarding status considerations. Looking at a given potential offender with criminal gains b, we can calculate the implicit risk premium R from

$$(1-p)[v(I_n) + gw(I_n - \bar{c})] + p[v(I_d) + g(I_d - \bar{c})] - v(I_L - R) - gw(I_L - R - \bar{c}) = 0, \tag{9}$$

where $R < (>)0$ for individuals who do (not) offend for given parameter values. In other words, individuals who would like to offend given the parameters must be paid $-R > 0$ in order to accept refraining from the criminal activity. Starting from this definition, we arrive at

$$\frac{\partial R}{\partial \bar{c}} = -g\frac{w'_L - (1-p)w'_n - pw'_d}{v'_L + gw'_L} = -g\frac{\kappa}{v'_L + gw'_L} \tag{10}$$

$$\frac{\partial R}{\partial g} = -\frac{(1-p)w_n + pw_d - w_L}{v'_L + gw'_L}. \tag{11}$$

where w'_j is a shorthand for $w'(I_j - \bar{c})$, $j = n, d, L$, and so on. We denote by $\kappa = w'_L - (1-p)w'_n\eta_+ - pw'_d$ the way in which the status lottery is influenced at the margin by a variation in the level of average consumption. A value of $\kappa > 0$ indicates that undertaking the criminal activity becomes more attractive when $\bar{c}$ increases (i.e. that the risk premium decreases). In contrast, $\kappa < 0$ shows that crime is less tempting when the others have a higher level of consumption. It is important to note that the sign of κ cannot be unambiguously established given our assumptions. A higher level of reference consumption makes it more difficult to stand out even when engaging in crime, and contributes to having an even more disadvantageous status in the detection state. However, higher average consumption by peers may also result in increased strain for individuals refraining from crime and thereby falling behind the comparison group. Moreover, regarding the risk premium it must follow that R decreases in b since this unambiguously makes crime more attractive

$$\frac{\partial R}{\partial b} = -\frac{(1-p)[v'_n + gw'_n]}{v'_L + gw'_L} < 0. \tag{12}$$

Up to now, we have considered an individual's decision for a given level of reference consumption. In fact, the average level of consumption is defined by

$$\bar{c} = I + (1-p)\int_{\bar{b}}^{B} bdF(b) - ps(1 - F(\bar{b})), \tag{13}$$

where it is assumed that the individual who is just indifferent between committing the offense and refraining from crime has criminal gain $\bar{b}$. The first term on the right-hand side of (13)

is the legal income that is common to all individuals. The second and the third term can be explained as follows: All individuals with $b \geq \bar{b}$ offend, either obtaining the benefits from crime in the 'no detection' state of the world (i.e., with probability $1-p$) or experiencing a reduction in available income due to the imposition of the sanction s in the 'detection' state of the world (i.e., with probability p). The definition of the reference consumption level as in (13) makes clear that we suppose that potential offenders consider other potential offenders as their relevant peers. This is consistent with the empirical literature on the identification of the reference point discussed in Section 1.2. The fact that criminal acts cause social harm will be taken into account when we turn to welfare considerations in Section 5.

The level of average consumption will be equal to the level of legal income when $\bar{b} = B$ (that is, when no crimes are committed), and maximal at $I+(1-p)\int_{b^*}^{B} bdF(b)-ps(1-F(b^*))$ with $b^* = ps/(1-p)$ (when we suppose that $B > b^*$). The latter follows from

$$\frac{\partial \bar{c}}{\partial \bar{b}} = f(\bar{b})[ps - (1-p)\bar{b}] \tag{14}$$

$$\frac{\partial^2 \bar{c}}{\partial \bar{b}^2} = f'(\bar{b})[ps - (1-p)\bar{b}] - (1-p)f(\bar{b}). \tag{15}$$

It is intuitive that the level of average consumption increases when there is a positive level of deterrence ($ps > 0$) and the critical benefit level increases from a very small level (i.e., when $\bar{b} \to 0$). Similarly, average consumption decreases when $\bar{b}$ is increased at levels that are high in view of what is required for maximizing expected payoffs (i.e., when $\bar{b} > b^*$).[4] The level of average consumption is also a function of the law enforcement parameters, and of legal income. Unsurprisingly, stricter deterrence lowers average consumption for a given

[4]Note that average consumption $\bar{c}$ is larger than legal income I as long as $\int_{barb}^{B} ((1-p)b - ps)\, dF(b) > 0$ which is fulfilled even for a wide range of values when $\bar{b} < b^*$.

critical gain level, i.e., we obtain

$$\frac{\partial \bar{c}}{\partial p} = -\int_{\bar{b}}^{B} b dF(b) - s(1 - F(\bar{b})) < 0 \tag{16}$$

$$\frac{\partial \bar{c}}{\partial s} = -p(1 - F(\bar{b})) < 0. \tag{17}$$

The direct effect of higher legal income on the level of average consumption is given by $\partial \bar{c}/\partial I = 1 > 0$.

This concludes the discussion of the two building blocks of our model, the critical gain level that follows from individual utility maximization for a given amount of average consumption on the one hand and the level of average consumption as a function of the critical gain level on the other.

3 Equilibrium

In this section, we first seek to establish that there is at least one equilibrium crime rate. Next, we discuss the possibility of having multiple equilibria, and elaborate on their respective stability. The next section will present results from a comparative-statics analysis.

An individual with a crime opportunity that pays b in the 'no detection' state of the world decides whether or not to commit the offense given the average consumption level $\bar{c}$. The latter is a function of the critical gain level, the enforcement parameters, and the level of legal income, $\bar{c} = \bar{c}\left(\bar{b}, p, s, I\right)$. We assume that all individuals choose simultaneously between offending and not offending. Their decision-making yields a critical gain level for a given level of average consumption (i.e., for an assumed critical gain level). Accordingly, the critical gain level in equilibrium must be consistent in the sense that $\bar{b}$ results from individual decision-making that takes $\bar{c} = \bar{c}\left(\bar{b}, p, s, I\right)$ as given.

Proposition 1 *There exists at least one equilibrium critical gain level* $\bar{b}^* \in [0, B]$*, implying*

a crime rate $1 - F(\bar{b}^*)$*, such that*

$$\Delta\left(\bar{b}^*, \bar{c}\left(\bar{b}^*\right)\right) = 0 \tag{18}$$

for an interior solution or

$$\Delta\left(0, \bar{c}(0)\right) > 0 \;/\; \Delta\left(B, \bar{c}(B)\right) < 0 \tag{19}$$

for corner solutions.

Proof. Individual decision-making yields a critical level $\tilde{b}$ as a function of $\bar{b}$ (which shows in the average consumption level), where both $\tilde{b} \in [0, B]$ and $\bar{b} \in [0, B]$. Defining $y(\bar{b}) = \bar{b} - \tilde{b}(\bar{b})$, we get $y(0) \leq 0$ and $y(B) \geq 0$, so that there is at least one $\bar{b}^*$ for which $y(\bar{b}^*) = 0$ since $y(\bar{b})$ is a continuous function. ■

The fixed-point equations (18) and (19), respectively, state the requirement that individuals' expectations regarding the crime rate must materialize in equilibrium.

In addition to caring about absolute consumption, individuals compare their amount of consumption with the average level of consumption. This creates an interaction among the individuals in our framework, where the privately optimal decision taken by an individual is co-determined by how the other subjects decide. It may be that the individual consumption when restricted by the level of legal income compares relatively unfavorably, because others resort to illegal means to increase their consumption possibilities. Whereas for the individual, resorting to crime may also entail that consumption deteriorates even further due to the imposition of the sanction in the detection state of the world, for the population of potential offenders, the presence of criminal opportunities raises average consumption over a wide range of critical benefit levels. As a consequence, it is possible that there are alternative equilibrium outcomes, for example, one in which only few undertake crime which does not push many individuals to become offenders, and a high crime scenario in which most individuals struggle to uphold individual consumption by resorting to crime.

It is interesting to inquire about the possibility of having more than one equilibrium in our model, and whether a necessary condition for such an outcome can be readily identified in our framework. The function $\Delta\left(\bar{b}, \bar{c}\left(\bar{b}\right)\right)$ reflects whether or not it is advantageous for an individual with criminal gains given by $\bar{b}$ to engage in crime when the average consumption amounts to $\bar{c}\left(\bar{b}\right)$, expressing the expectation that individuals with benefits $b \geq \bar{b}$ will undertake the offense. For an interior equilibrium, we require that $\Delta\left(\bar{b}, \bar{c}\left(\bar{b}\right)\right) = 0$, as in (18), and $\Delta\left(0, \bar{c}(0)\right) > 0$ or $\Delta\left(B, \bar{c}(B)\right) < 0$ for corner solutions.

Considering $\Delta\left(\bar{b}, \bar{c}\left(\bar{b}\right)\right)$ as a function of $\bar{b}$, we obtain

$$\frac{d\Delta\left(\bar{b}, \bar{c}\left(\bar{b}\right)\right)}{d\bar{b}} \equiv D = \underbrace{(1-p)[v'_n + gw'_n]}_{X} + \underbrace{\frac{\partial \bar{c}}{\partial \bar{b}} g[w'_L - (1-p)w'_n - pw'_d]}_{Y}. \tag{20}$$

The direct effect represented by Term X, reflecting higher income in the no-detection state n, is always positive. The existence of more than one equilibrium would require that the indirect effect expressed by Term Y is – over some range of $\bar{b}$ – of opposite sign and dominating the direct effect. Note that Term Y contains the term κ that determined whether or not the status lottery will be more or less attractive as a result of a change in average consumption and was used already in determining how the risk premium changes when average consumption increases, (10). With regard to the distinction between stable and unstable equilibria, we suppose that $D > 0$ has to hold for an equilibrium with $\Delta\left(\bar{b}, \bar{c}\left(\bar{b}\right)\right) = 0$ to be stable. In that case, being to the left of the root means crime is not worthwhile at the given benefit level as $\Delta < 0$ and accordingly this implies a movement toward the equilibrium level $\bar{b}$. A similar argument can be repeated regarding the case of being to the right of the root.

In the absence of status considerations (i.e., when $g = 0$), our model has only one equilibrium since $Y = 0$ in this case. We obtain either $\Delta\left(0, \bar{c}(0)\right) > 0$, $\Delta\left(\bar{b}^*, \bar{c}(\bar{b}^*)\right) = 0$ or $\Delta\left(B, \bar{c}(B)\right) < 0$ which determines the unique equilibrium crime rate. The intuition is clear. The crime opportunity is only evaluated by trading off the material benefit with the expected

sanction and the associated risk implied, so that crime always becomes more attractive when the material benefit is higher.

Similarly, there is only one equilibrium crime rate in case $w'(S) > 0$ and $w''(S) = 0$ for all S. In that scenario, we obtain $\kappa = 0$ which rules out a negative Term Y. In other words, a linear status utility that is equally relevant in all states of the world simply cancels out in our setup. However, the same does not apply when only lagging behind is positionally relevant (i.e., when $w'(S) = 0$ for $S > 0$), as $\kappa > 0$ in that case.

A necessary condition for multiple equilibria is a negative Term D (which can only result from a negative Term Y) over some range. From above, we know with respect to the first part of Term Y that $\partial\bar{c}/\partial\bar{b} < (>) 0$ for $\bar{b} > (<) b^*$. From this, a negative Term Y would follow for all levels of $\bar{b}$ when $\kappa = w'_L - (1-p)w'_n\eta_+ - pw'_d > (< 0)$ for $\bar{b} > (<) b^*$. Referring to the description of the evaluation of the status lottery used before, this implies that if lower crime decreases average consumption, the status lottery implied by crime must get less favorable with respect to crime and vice versa.

The difference in expected utility represented by $\Delta\left(\bar{b}, \bar{c}\left(\bar{b}\right)\right)$ may have a positive slope initially (i.e., for low levels of $\bar{b}$) and a negative slope ultimately (i.e., for high levels of $\bar{b}$). A Term Y that is initially positive (when $\bar{b} < b^*$) but negative for high levels of $\bar{b}$ follows if $\kappa > 0$ for all $\bar{b}$. When only lagging behind is relevant for the individual (i.e., when $w'(S) = 0$ for $S > 0$), a positive κ will be possible for w being convex or for w being concave for $S < 0$ when combined with a sufficiently small level of the detection probability. The case in which only lagging behind regarding status is important is very suggestive of a negative Δ at $\bar{b}$ close to B for the following reason. Refraining from becoming a criminal implies almost no status distutility, because average consumption is about the same as legal income. However, taking advantage of the criminal opportunity would entail a rather hefty status disutility in the detection state of the world. Regarding the possibility of having multiple

equilibria, the suggested curvature of Δ would imply an equilibrium at $\bar{b} = 0$ and one at $\bar{b} = B$ when $\Delta(0, \bar{c}(0)) > 0$ and $\Delta(B, \bar{c}(B)) < 0$. Another possibility would be to have $\Delta(0, \bar{c}(0)) < 0$, $\Delta(B, \bar{c}(B)) < 0$, and $\Delta\left(\bar{b}, \bar{c}(\bar{b})\right) > 0$ for some $\bar{b}$ such that there would be an interior equilibrium and the one at $\bar{b} = B$.

In the following, we will refer to an example that we will be useful also in our comparative-statics analysis. We suppose that $v(I_j) = 1 - e^{-2I_j}$, $I = 7/4$, $g = 3/2$, $s = 1/2$, $B = 1$, and a uniform distribution for b on $[0, 1]$. In other words, we make use of a standard CARA utility function regarding utility from absolute consumption with a coefficient of absolute risk aversion equal to two. With respect to status utility, we rely on

$$w(S) = \begin{cases} \eta_+(|S|)^u & S > 0 \\ -(|S|)^u & S \leq 0 \end{cases} \tag{21}$$

where the parameter η_+ equals one in the event of above average consumption being relevant for status concerns ($\eta_+ = 1$) and $\eta_+ = 0$ otherwise.

Assuming that $\eta_+ = 0$, we obtain Figure 1 when $u = 1/2$ and $p = 25/100$. Since $\Delta(0, \bar{c}(0)) > 0$, $\Delta(B, \bar{c}(B)) < 0$, and $D < 0$ when $\Delta\left(\bar{b}, \bar{c}(\bar{b})\right) = 0$, this function implies an equilibrium at $\bar{b} = 0$ and one at $\bar{b} = B$.[5] In contrast, when there are no status concerns (i.e., when $g = 0$), the equilibrium critical benefit level is $\bar{b}^* = .425$. In other terms, this scenario allows for having a much higher crime rate only due to the presence of positional concerns. At the same time, when we suppose that the no crime equilibrium materializes in the presence of status effects, then the comparison points the other way. The use of $u = 2$ instead of one half yields comparable results when the detection probability is adjusted accordingly. In other words, the equilibria that arise for $u = 1/2$ (such as the case in which $\bar{b} = 0$ and $\bar{b} = B$ are equilibria) may also arise when status utility has the other curvature.

However, matters change when we assume that offenders are influenced by positional concerns in all states of the world, i.e., when $\eta_+ = 1$. Figure 2 illustrates Δ for $u = 1/2$ and

[5]The lower equilibrium will be interior for a higher detection probability, for example. When $p = 55/100$, the two stable equilibria result at $\bar{b} = .07$ and $\bar{b} = B$.

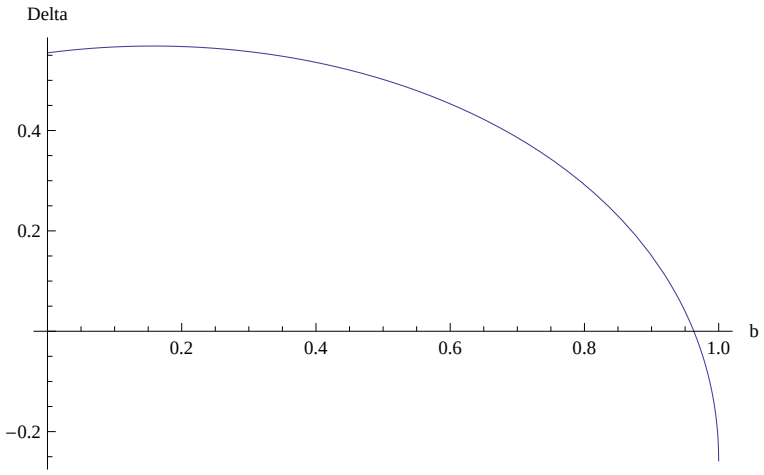

Figure 1: Multiple crime equilibria; horizontal axis: $\bar{b}$, vertical axis: $\Delta(\bar{b}, \bar{c}(\bar{b}))$

Figure 3 for $u = 2$. Simultaneously enjoying being ahead and suffering from lagging behind causes $\Delta\left(0, \bar{c}(0)\right) < 0$ and $\Delta\left(B, \bar{c}(B)\right) > 0$, combined with $D > 0$ when $\Delta\left(\bar{b}, \bar{c}(\bar{b})\right) = 0$. Accordingly, these constellations lead to one stable interior equilibrium crime rate that is higher (when $u = 1/2$) or lower (when $u = 2$) than in the scenario without positional concerns (where $\bar{b}^* = .425$). In other words, potential offenders with status utility that is convex on status losses and concave on status gains evaluate crime as more attractive than peers without positional concerns, whereas potential offenders with status utility that is concave on status losses and convex on status gains evaluate crime as less attractive than peers without positional concerns.

For the case in which status utility is quadratic, we obtain two stable interior equilibria by a slight modification of law enforcement parameters. Using $p = 75/1000$ and $s = 1$, we obtain Figure 4. For our specification, we obtain three equilibria with an interior crime rate ($\bar{b}^* = .278$; $\bar{b}^* = .4$; $\bar{b}^* = .463$), whereas $\bar{b}^* = .365$ results without status concerns. With regard to the distinction between stable and unstable ones, we argue that stability requires that $D > 0$ at the root in question (as described before). This leads us to conclude that we obtain two stable equilibrium are at $\bar{b}^* = .278$ and $\bar{b}^* = .463$, whereas the equilibrium at

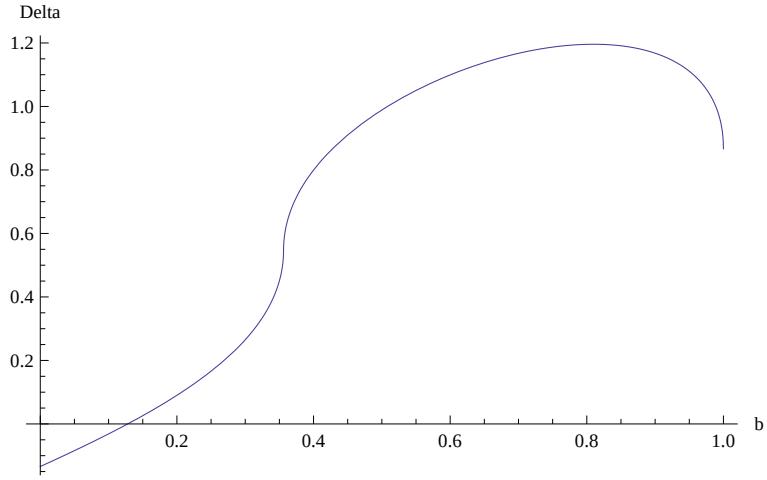

Figure 2: Crime equilibrium; horizontal axis: $\bar{b}$, vertical axis: $\Delta(\bar{b}, \bar{c}(\bar{b}))$

$\bar{b}^* = .4$ is unstable.

We contend ourselves with these exemplary illustrations and summarize our analysis of the possibility of having multiple equilibria as follows.

Proposition 2 *(1) The equilibrium crime rate is unique when $D > 0$ for all $\bar{b}$ (with D defined in* (20)*). (2) There may be multiple stable equilibria in a framework in which individuals are concerned about relative standing (i.e., when $g > 0$). A necessary condition is $D < 0$ over some range of $\bar{b}$.*

Proof. Follows from above. ■

The intuition for having multiple stable crime rates in equilibrium can be given by referring to the fact that the attractiveness of the criminal opportunity is determined not only by the criminal gain but also by the extent to which others engage in crime (since this influences the point of reference regarding status considerations).

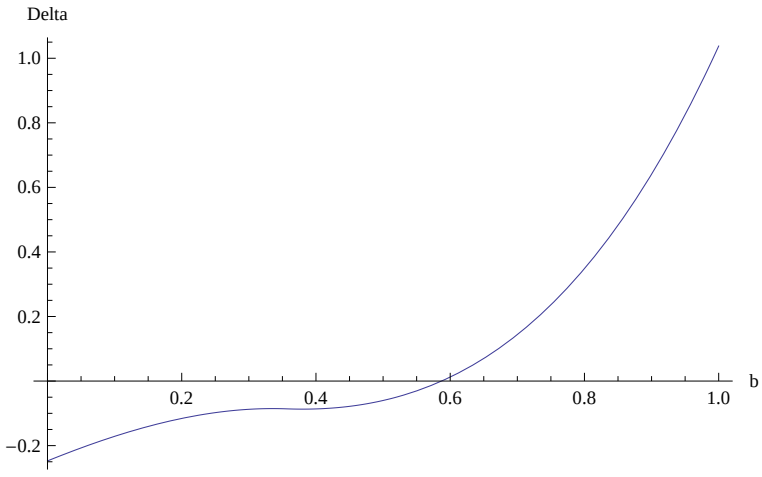

Figure 3: Crime equilibrium; horizontal axis: $\bar{b}$, vertical axis: $\Delta(\bar{b}, \bar{c}(\bar{b}))$

4 Comparative-statics analysis

In the following, we will present results from a comparative-statics analysis. We will first consider small variations in the exogenous parameters starting from a stable interior equilibrium. The focus on stable equilibria will be assured by maintaining that $D > 0$ must hold. Next, we discuss briefly the possible repercussions that follow from having multiple equilibria.

The equilibrium critical gain level is a function of the detection probability, the level of the sanction, the level of legal income, the importance attached to relative standing, and whether or not being ahead produces status utility (i.e., whether or not $w'(S) > 0$ for $S > 0$). Average consumption is directly affected by the first three of these exogenous variables and, in addition, reacts to changes in the equilibrium critical gain level. In order to arrive at how the critical benefit level responds to variations, we start from

$$\Delta\left(\bar{b}^*\left(p, s, I, g\right), \bar{c}\left(p, s, I, \bar{b}^*\left(p, s, I, g\right)\right)\right) = 0 \tag{22}$$

In the absence of interaction effects, an increase in the level of the detection probability and the level of the sanction unambiguously lead to an increase in $\bar{b}^*$, which is synonymous

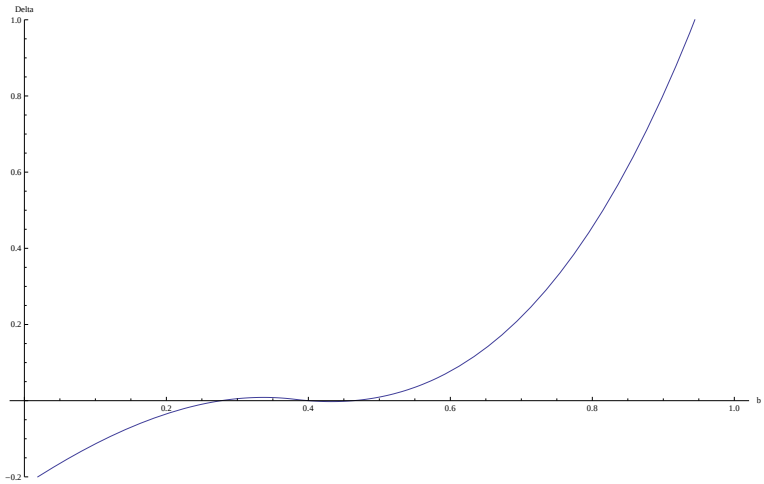

Figure 4: Multiple crime equilibria; horizontal axis: $\bar{b}$, vertical axis: $\Delta(\bar{b}, \bar{c}(\bar{b}))$

to a decrease in crime frequency. When we consider individuals who are partly motivated by status considerations, we obtain

$$\frac{d\bar{b}}{dp} = D^{-1}\left[v_n + gw_n - (v_d + gw_d) - g\frac{\partial \bar{c}}{\partial p}\kappa\right] \tag{23}$$

$$\frac{d\bar{b}}{ds} = D^{-1}\left[p(v'_d + gw'_d) - g\frac{\partial \bar{c}}{\partial s}\kappa\right] \tag{24}$$

It follows that the analysis of our framework delivers standard conclusions whenever the weight g attached to status utility or the response of average consumption to changes in law enforcement is negligible, because both $v_n + gw_n - (v_d + gw_d) > 0$ and $p(v'_d + gw'_d) > 0$. However, the fact that both $\partial\bar{c}/\partial s < 0$ and $\partial\bar{c}/\partial p < 0$ implies that a counterintuitive comparative-statics finding is possible whenever $\kappa < 0$, i.e., whenever the implied change in the reference consumption makes the crime opportunity more appealing. The intuition for this result goes as follows: The stricter law enforcement depresses the average consumption benchmark. This fact influences an individual's status in at least two and possibly three different states (depending on the level of $w'(S)$ for $S > 0$), and can make it more tempting to opt for the status gamble implied by undertaking the offense. The condition states that the marginal expected utility from an improvement in status is lower for the offender than the

non-offender. The comparative-statics finding will then arise locally whenever the influence from the status gamble dominates the standard direct effect. Note that $D > 0$ always follows when $\partial\bar{c}/\partial\bar{b}g\kappa > 0$, where $\partial\bar{c}/\partial\bar{b} < 0$ for $\bar{b} > b^*$. In other words, the necessary condition for a non-standard comparative-statics result is compatible with the sufficient condition for a stable equilibrium.

Figure 5 highlights the possibility of the counterintuitive comparative-statics effect for variations in the level of the detection probability, relying on our exemplary specification used above and $\eta_+ = 1$, $s = 1$, and $u = 1/2$. For some intermediate levels of p between 0.3 and 0.4, an increase in the detection probability actually entails a decrease in $\bar{b}$, concomitant with an increase in the crime rate.

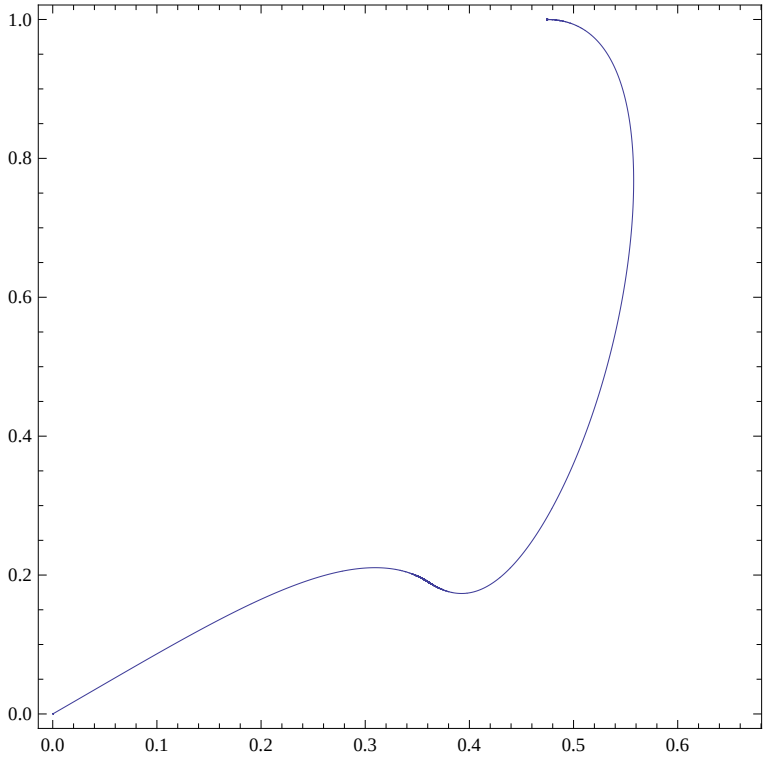

Figure 5: Equilibrium critical gains as a function of the detection probability; horizontal axis p; vertical axis $\bar{b}$

Next, we inquire about possible wealth effects by turning to the response to an increase

in the level of legal income.

$$\frac{d\bar{b}}{dI} = D^{-1}\left[v'_L - (1-p)v'_n - pv'_d - g\frac{\partial\bar{c}}{\partial I}\kappa\right] \tag{25}$$

This leads to the conclusion that the curvature of v and of w are critical for determining the response of the critical gain level to a variation in the level of legal income, which is ambiguous in general.

Finally, we seek to establish the consequence of increasing the weight attached to status considerations for the level of crime in equilibrium.

$$\frac{d\bar{b}}{dg} = D^{-1}\left[w_L - (1-p)w_n - pw_d\right] \tag{26}$$

In most circumstances, commission of crime for $\bar{b}$ will result in higher than average income in the no-detection state. When $w'(S) > 0$ for $S > 0$ and therefore $w_n > 0$, we obtain a finding that is in line with the central result of Konrad and Lommerud (1993). An increase in the weight g will increase the level of risk-taking (that is, induce more crime) whenever individuals are relatively less risk-averse regarding variations in status than they are with respect to variations in the level of absolute consumption. The alternative case in which $w_n = 0$ rules out this outcome.

Implications of multiple equilibria:

In the comparative-statics analysis described above, we have considered only small variations starting from a stable equilibrium. In Figure 6, we return to the example introduced at the end of Section 3 where $u = 2$, $s = 1$, $\eta_+ = 1$, and $p = 75/1000$ in order to assert that the presence of multiple equilibria may allow for discontinuous changes in the level of deterrence. When increasing the detection probability from .06 to .08, there is a discrete increase in the level of deterrence. The figure additionally once more shows that status concerns may bring about more or less crime, as becomes clear from comparing the equilibrium crime rate that is represented by the strictly monotonous curve with $g = 0$ to the up to two stable equilibrium

crime rates we obtain when $g = 3/2$. A similar picture would emerge for variations in the level of the sanction.

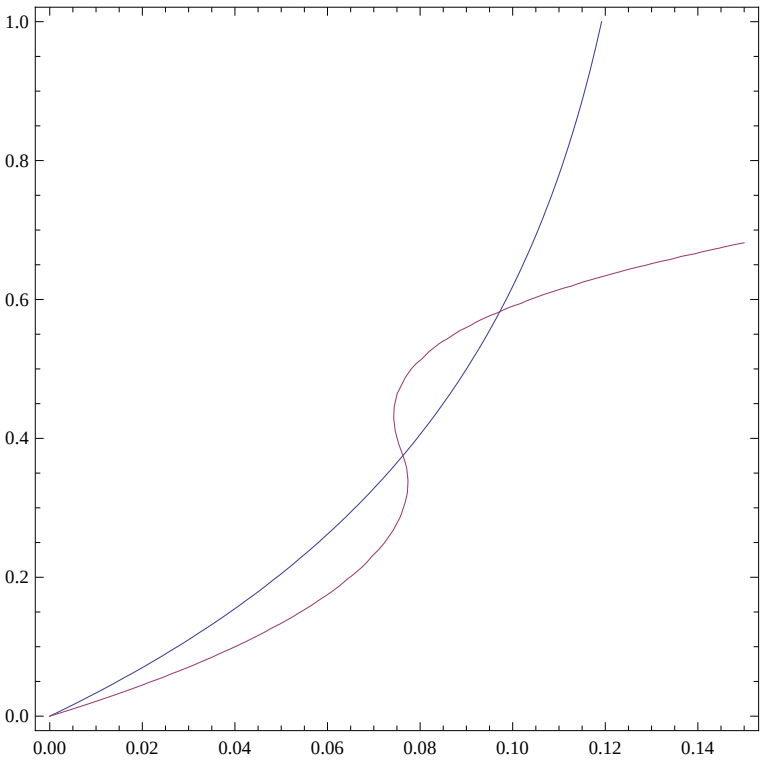

Figure 6: Equilibrium critical gains as a function of the detection probability; horizontal axis p; vertical axis $\bar{b}$

In Figure 7, we show that there is a minimum level of the importance attached to status considerations that allows for multiple equilibria. When $g \to 0$, there is only one equilibrium crime rate (represented by the horizontal line). An increase in g away from zero clearly increases crime in this example. It is once again interesting to note that status concerns may bring about more or less crime, as becomes clear from comparing the equilibrium crime rate with $g = 0$ to the two stable equilibrium crime rates we obtain when $g = 3/2$.

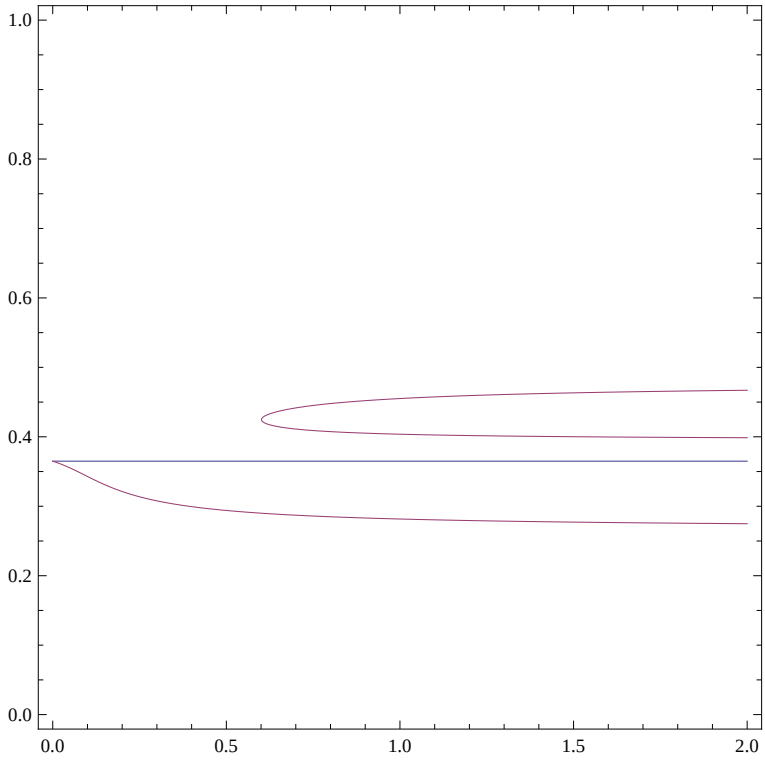

Figure 7: Equilibrium critical gains as a function of the weight g; horizontal axis g; vertical axis $\bar{b}$

5 Welfare

In the following, we briefly conjecture about the implications of positional concerns of potential offenders for welfare and the socially optimal levels of the sanction and the detection probability. Our discussion will not consider discrete changes in the crime rate that may be possible when there are multiple equilibria (as discussed at the end of Section 4) but concentrate on small variations starting from a stable interior equilibrium. The level of social welfare will be represented by a utilitarian welfare function that takes potential offenders' utility into account and specifies that every criminal act implies social harm h, and is thereby aligned with the standard representation used in the literature (see, e.g., Polinsky

and Shavell 2009). Accordingly, the policy maker seeks to maximize

$$\begin{aligned} W =& F(\bar{b})\left[v(I_L) + gw(I_L - \bar{c})\right] \\ &+ \int_{\bar{b}}^{B} \left[(1-p)\{v(I_n) + gw(I_n - \bar{c})\} + p\{v(I_d) + gw(I_d - \bar{c})\}\right] dF(b) \\ &-(1 - F(\bar{b}))h - \big(K(p) - p(1 - F(\bar{b})s\big) \end{aligned} \tag{27}$$

by the use of the sanction s and the detection probability p, where $\bar{c} = \bar{c}(p, s, I, \bar{b})$ and $K(p)$, $K', K'' > 0$, denotes enforcement costs from which the collected sanctions are deduced.

The change in the level of welfare in response to a variation in one of the law enforcement parameters will be composed of a direct effect and the consequences of the variation for the level of the critical benefit level and the level of average consumption. Introducing $\mu = s, p$ and the indicator variable χ that is equal to one (zero) should μ represent p (s), we obtain

$$\begin{aligned} \frac{\partial W}{\partial \mu} =& -\chi \underbrace{\left[\int_{\bar{b}}^{B} (v_n + gw_n - v_d - gw_d) dF(b) + \big(K'(p) - (1 - F(\bar{b}))s\big)\right]}_{x_1} \\ &- (1-\chi) \underbrace{p\left[\int_{\bar{b}}^{B} (v'_d + gw'_d) dF(b) - p(1 - F(\bar{b}))\right]}_{x_2} \\ &+ \underbrace{\frac{\partial \bar{b}}{\partial \mu}\left[f(\bar{b})(h - ps) - g\frac{\partial \bar{c}}{\partial \bar{b}}\left\{F(\bar{b})w'_L + \int_{\bar{b}}^{B} ((1-p)w'_n + pw'_d) dF(b)\right\}\right]}_{y} \\ &- \underbrace{g\frac{\partial \bar{c}}{\partial \mu}\left[F(\bar{b})w'_L + \int_{\bar{b}}^{B} ((1-p)w'_n + pw'_d) dF(b)\right]}_{z} \end{aligned} \tag{28}$$

using that $\Delta = 0$ at the critical equilibrium benefit level. The direct effect of the change in law enforcement is represented either by the term x_1 or the term x_2 for p and s, respectively. A higher detection probability makes the loss in utility consequent to a conviction more likely for actual offenders and increases enforcement costs as well as sanctions collected. A higher sanction lowers utility for actual offenders in the detection state of the world mirrored by an increase in revenue for the state. The term y mirrors the consequences of the implied change

in the critical benefit level. In addition to the influence on the likelihood of incurring social harm h and its effect on the total amount of sanctions, the change in the critical benefit level causes the average consumption level to change. As soon as $\bar{b} > b^*$, it holds that $\partial\bar{c}/\partial\bar{b} < 0$. A lower average consumption level implies marginal status gains for all individuals (including compliant subjects). The same applies to the indirect effect represented by the term z, which gives the repercussions of the decrease in the average consumption due to the change in enforcement. In other words, the increase in the strictness of law enforcement has the direct effect of lowering the level of the comparison consumption. This is beneficial for all individuals. The negatively affected individuals are concentrated among offenders. These individuals either suffer from a utility loss with a higher probability (when the level of the detection probability is increased) or are worse off in the detection state of the world (when the level of the sanction is increased). However, these adverse consequences are likely to be welcomed from a social standpoint, given that they imply higher deterrence.

Remark: *Assume that the marginal productivity of the detection probability and the sanction with regard to the level of deterrence measured by $\bar{b}$ is relatively unaffected by the presence of status concerns and that standard comparative-statics effects apply. Then, stronger status effects rationalize stricter law enforcement (i.e., relatively higher levels of the detection probability and the sanction) when $\partial\bar{c}/\partial\bar{b} < 0$ holds at the optimum and the additional costs imposed on offenders are not dominant.*

It is clear from (28) that stronger status effects (i.e., a higher level of g) magnify the additional marginal benefits of an increase in the law enforcement parameter represented by term z and the second part of term y. At the same time, a greater importance attached to relative standing will imply direct costs on actual offenders (represented by either x_1 or x_2). The fact that the marginal productivity of the detection probability and the sanction will sometimes be strongly influenced by the presence of status concerns complicates the

comparison for the general case further.

6 Conclusion

Strain creates pressure that requires coping behaviors, one of which is criminal activity. We consider the case in which a discrepancy between the individual consumption level and the comparison consumption level causes strain that may induce criminality. The focus on relative deprivation creates an interdependence between potential offenders that may cause multiple stable crime rates. When many people resort to crime to improve their expected income, this entails an unfavorable position for law-compliant individuals in expected terms and may thereby push more individuals into criminal activity. Likewise, when most individuals refrain from crime, then average consumption is not too different from legal income, implying little potential for strain. Interestingly, our exploration of the implications of strain theory unearthes a surprising finding: Positional concerns need not cause more crime. This is explained by – inter alia – the fact that incurring a sanction is more detrimental to individuals when it also connotes that they fall more behind with regard to status.

The individual concern for relative position influences how individuals respond to changes in law enforcement parameters. Indeed, classic results regarding the additional deterrence effects of higher detection probabilities or higher sanctions no longer follow unambiguously. The change in law enforcement influences the comparison level of consumption and thereby may provoke more offenses. When stricter law enforcement in fact increases deterrence, then our setup presents reasons to implement higher levels of the detection probability and sanction when compared to a setup without status concerns. This finding can be attributed to the fact that stricter law enforcement lowers the reference consumption level, which thereby lowers disutility due to an otherwise high comparison standard.

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