The Role of Nuisance Arrest in Fighting Crime

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Abstract

Intensive police activities are usually observed in high crime rate areas. However, these activities, especially nuisance arrest, bring on high pressure to the public and do not always play a positive role when aganist crime. In this paper, we use an economic approach to analyze individual's choice and government response under nuisance arrest. We find that a high level of nuisance arrest weakens the effeciency of tools (high apprehension probability or high level of punishment) when government fights crime. After endogenizing nuisance arrest, the results indicate that statistical discrimination makes nuisance arrest a more serious problem.

1 Introduction

As more public and private resources are spent in order to prevent offenses and to apprehend offenders, the cost of crime has become a public concern. Becker (1968) first point out that "crime" is an economically important activity and developed a social loss function for crime activity. The government needs to trade off between low crime rate and high cost of apprehension and punishment. Moreover, an economists' approach is taken to charaterize the motivation for crime activities. People are not assumed to engage in crime activity because of biological traits to family or disenchantment with society, but commit a crime if what they get from crime exceeds other activities. Crime, in this sense, is a economic activity with risk, like a gamble. People receive high payoff from crime while at the same time, face a probability of being convicted and suffer a loss from punishment.

A natural inference from this approach is, with higher probability of being apprehended and higher level of punishment, the crime rate should decrease since the expected payoff of commiting a crime decreases. However, we also observe that in some areas with intensive police activities, the crime rate is rather high. A explanation of this phenomenon is, the intensive police activities not only increase the probability of apprenhension for criminals, but also let innocent people face higher risk of being arrested. In this paper, we build a model to characterize how nuisance arrest will influence the crime rate. By assuming a risk neutral preference, we find that the nuisance arrest plays a different role to people who commit a crime and who are

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innocent due to the effect of competing risks. As police harassment become more severe, the effectiveness of increasing probability of conviction and punishment is reduced. We also provide two ways to endogenize the nuisance arrest and find that stereotype or distrust to certain group make nuisance arrest a more serious problem for this group.

This paper is related to a number of literatures. The first category is about police harassment and crime rate. Most research about police harassment focus on disenfranchised groups (such as homeless persons or sexual minorities) or racial/ethnic minorities (Aulette and Aulette (1987) and Feelemyer et al. (2021)). Field study in Aulette and Aulette (1987) indicates that homeless people are usually labeled as criminals and need to show identification to defend themselves. Many papers also focus on police harassment to different races. Tatum (1999) points out the racial bias in the criminal justice system and discusses influence of disproportionate black crime rates. The crime rate is also related to police harassment. La Vigne et al. (2017) suggests that residents of high-crime, heavily disadvantaged communities witness and experience intensive police presence, high rates of incarceration and community supervision, and concentrated violence. People in these areas question the intent, effectiveness, and equity of the criminal justice system.

The result of this paper is also consistent with research about competing risks. Dow et al. (1999) argues that the investments in the prevention of cause specific mortality risks is complementary. The marginal benefit of investing to avoid one cause of death is increasing as a function of the survival rates of the other causes. Chang (2005) also find similar spillover effect under multiple risks of death.

The rest of the article is organized as follows. Section 2 introduces our basic model about offense functon and social loss funtion. In Section 3, we analyze the equilibria of the model and study the comparative statics. In Section 4, we provide two methods to endogenize the nuisance arrest.

2 Model

2.1 Supply of Offense

We adapt basic model in Becker (1968) to analysis the impact of police harassment on offenses and social cost. Denote α the probability of nuisance arrest and being punished. One can also explain nuisance arrest as the probability of being arrested with no evidence about whether you commit a crime. And let p be the probability of being arrested if one commits a crime and f the income equivalence of punishment. We assume all individuals are risk neutral and have personal preference for crime [1]. Each person gains ε from the crime activity: $\varepsilon > 0$ means the person enjoys crime activity itself, while $\varepsilon < 0$ means he dislike crime [2]. Denote the distribution of ε as Φ and its density as φ. If the income payoff of crime is Y, then one will commit a

[1]One important point in Becker (1968) is that at equilibrium point, p and f will lie in the region where crime does not pay which is related to the risk preference of individual. However, in this paper our focus is not on optimal p and f and to better catch the impact of α, we assume risk neutral here.

[2]Here ε can partially represents the risk preference for crime activity. Person who commits a crime even though the payoff of crime is not high can be explained as he is risk preferer or he gain extra utility (mentally) ε from risk activity.

crime if

$$p(Y-f)+(1-p)\alpha(Y-f)+(1-p)(1-\alpha)Y+\varepsilon > \alpha(-f)$$

So people with preference

$$\varepsilon > p(1-\alpha)f - Y$$

will commit a crime. From the distribution of ε, we get the number of offenses or crime rate

$$O = 1 - \Phi(p(1-\alpha)f - Y) = O(p, f, Y, \alpha) \tag{1}$$

From the offense function (1), we can derive

$$O_\alpha = pf\varphi(p(1-\alpha)f - Y) > 0, \tag{2a}$$

$$O_p = -(1-\alpha)f\varphi(p(1-\alpha)f - Y) < 0, \tag{2b}$$

$$O_Y = \varphi(p(1-\alpha)f - Y) > 0, \tag{2c}$$

$$O_f = -p(1-\alpha)\varphi(p(1-\alpha)f - Y) < 0 \tag{2d}$$

It is noteworthy that $O_\alpha > 0$. Increasing of α have different impact on people who commit a crime and who do not. For individual who commit a crime, although he face higher risk of nuisance arrest, this risk will only be realized when he escapes apprehension for a real crime. So the fluctuation of α have larger impact to the expected utility of innocent people. An extreme case is when $p = 1$ and all criminals are arrested. Then increasing α will only decrease the utility of being innocent and thus push more people to commit a crime.

2.2 Social Loss Function

We assume the total social loss in real income from offenses, convictions, and punishments as:

$$L = D(O) + C(p, O) + H(\alpha, f) \tag{3}$$

where D represents net cost or damage of crime to society, and $C(p, f)$ is cost of apprehension and conviction. In our model, we add an additional term $H(\alpha, f)$ to represent social loss for nuisance arrest, which can be regarded as mental harm of arrest and punishment to innocent people. An intuitive assumption for H is $H(0, f) = 0$: if there is no nuisance arrest, this part vanishes from the social loss function. For simplicity, we assume there is no social cost for punishment [3].

2.3 Assumptions for Offense Function and Social Loss Function

To make the second order condition satisfied, we need to impose some assumptions for the offense function and social loss function. For offense function, we need

$$\begin{aligned} O_{\alpha\alpha} &= -p^2 f^2 \varphi'(p(1-\alpha)f - Y) \geq 0 \\ O_{pp} &= -(1-\alpha)^2 f^2 \varphi'(p(1-\alpha)f - Y) \geq 0 \\ O_{ff} &= -p^2(1-\alpha)^2 \varphi'(p(1-\alpha)f - Y) \geq 0 \end{aligned} \tag{4}$$

[3] This means $b = 0$ in Becker (1968). We can regard the punishment as fine and f the amount of fine.

These three conditions all imply

$$\varphi' \leq 0 \tag{5}$$

which indicate the density is decreasing as ε increases. This is a natural assumption since people who extremely prefer crime activity is minority.

The assumption for social loss function is well discussed in Becker (1968), so we use them directly here. For first order derivatives, we require

$$D' > 0, C_O > 0, C_p > 0 \tag{6}$$

For second order derivatives, we require

$$D'' > 0, C_{pp} > 0, C_{OO} > 0, C_{pO} = C_{Op} = 0 \tag{7}$$

For the new term $H(\alpha, f)$ in social loss function, we assume that

$$H_\alpha > 0, H_f > 0, H_{ff} > 0, H_{\alpha\alpha} > 0 \tag{8}$$

As α and f increases, innocent people face higher risk of being arrest and higher level of punishment, which increase the social harm. The assumption for second order condition can be regarded as the incresing marginal harm to arrested innocent. We can also explain it as the spilt over of nuisance arrest to the whole society. As there are more injustice in arrest or innocent people are punished severely, it may not cause some negative effect to the whole society like questioning to the justice of law enforcement.

3 Preliminary Analysis

3.1 Optimal Condition

In our model, government can determine the probability of arrest p and punishment f to minimize the social cost. In this section, we assume that the probability of nuisance arrest is pre-determined. In next section, we will endogenize α. Then we can find the two first order optimality conditions[4]:

$$\frac{\partial L}{\partial p} = L_p = D'O_p + C_p + C_O O_p = 0 \tag{9}$$

and

$$\frac{\partial L}{\partial f} = L_f = D'O_f + C_O O_f + H_f = 0 \tag{10}$$

Since we assume risk neutrality and no social loss for punishment, the first order condition does not indicate the risk preference in equlibrium region. However, these results follow the discussion for fines in Becker (1968). Decomposing the net damage of offenses into the gain of criminal G and harm to victim HV

$$D(O) = HV(O) - G(O) \tag{11}$$

[4]See second order condition in appendix

Denote O^* as the optimal number of offenses from the two FOCs. If there is no cost of apprehension, from (10), we have the optimal level of punishment is[5]

$$f = HV'(O^*) + H_f \frac{1}{O_f} \tag{12}$$

If we fix the probability of apprehension $p = 1$, we get

$$f = HV'(O^*) + C_O(1, O^*) + H_f \frac{1}{O_f} \tag{13}$$

In Becker (1968), offenders have to compensate for the cost of catching them as well as the harm they directly do. However, since $O_f < 0$, they pay less than that in our model. The existence of nuisance arrest ties hands of government to increase the punishment when government does care for the welfare of innocents. When they increase the punishment, they not only punish criminal, but also cause harm to innocent people who are arrested. Moreover, a lower level of punishment increases the incentive to commit a crime. Thus, the optimal offenses in our model is slightly higher than in Becker (1968).

We can derive from (9) and (10)

$$D' + C_O = -\frac{C_p}{O_p} \tag{14}$$

and

$$D' + C_O = -\frac{H_f}{O_f} \tag{15}$$

The left hand side is the marginal cost of increasing offenses through reduction of p or f. In (14), a reduction in p has two effect to the cost of apprehension. It directly decreasing the cost, and at the same time, lower p incur higher level of offenses, which indirectly increases the cost. Also, more offenses lead to higher net social damage D; in (15), increasing f does more harm to innocents, while higher punishment level decreases the offenses, and thus lower the social damage of offenses and cost of apprenhension. Figure 1 shows how marginal cost and marginal revenue determine optimal offenses.

At the equlibrium point, we require

$$-\frac{C_p}{O_p} = -\frac{H_f}{O_f} \tag{16}$$

Equation (16) means at equilibrium point, the marginal cost of increasing p is equal to the marginal cost of increasing f relative to their contribution to reduction of offenses.

3.2 The Impact of α

Now we consider how police harassment will influence the equlibrium offenses. From (2b) and (2d), we can calculate

$$O_{p\alpha} = (1-\alpha) f^2 p \varphi' + f\varphi$$

$$O_{f\alpha} = (1-\alpha) p^2 f \varphi' + p\varphi$$

[5] See Becker (1968) Secton 5A, equilibrium requires that $f = G'(O^*)$

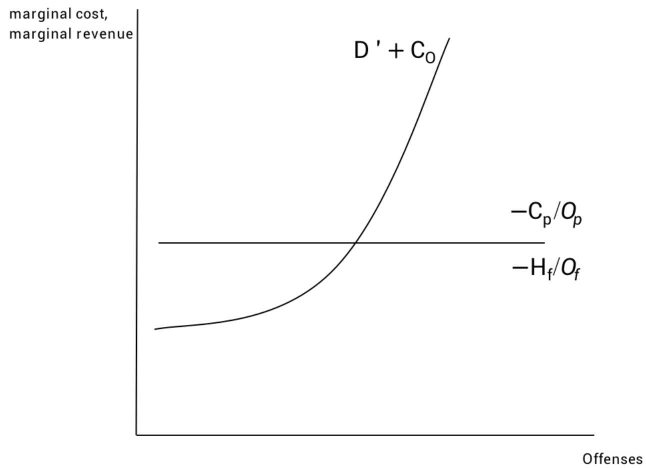

Figure 1: Optimal Offenses Level. The upward sloping curve is the marginal cost of increasing offenses while the flat one is marginal revenue. $-\frac{C_p}{O_p}$ and $-\frac{H_f}{O_f}$ indicate marginal revenue of increasing offenses through p and f respectively. The intersection shows how optimal offenses level is determined by selecting an optimal p and f.

To make it clear, we further assume that

$$\varphi' = 0 \tag{17}$$

This means the personal preference for crime is uniformly distributed. Under this assumption, we have

$$O_{p\alpha} > 0, O_{f\alpha} > 0 \tag{18}$$

Condition (18) implies when α increases, the marginal effects of p and f decreases. With a larger probability of nuisance arrest, the government need to set higher level of p and f to deduce the same amount of offense. Since the payoff of increasing p and f is smaller now, the optimal number of offenses will increase. For the similar reason, the optimal p and f will also decrease. As we assume a uniform distribution, it is easier to understand the impact of α from the threshold preference when an individual is indifferent between commiting a crime and not

$$\varepsilon^* = p(1-\alpha)f - Y \tag{19}$$

Equation (19) shows that the effect of increasing p or f are discounted by $1-\alpha$. As α is larger, increasing p and f become less effective. This is consistent with results in competing risk model. The decreasing of α will not only reduce the crime rate, but improve the efficiency of government expenditure in punishment and apprenhension.

4 Endogenize α

In this section, we propose two ways to endogenize α. The first method is to allow the government to reduce the probability of nuisance arrest with some extra cost. In section 4.2, we assume that the probability of nuisance arrest is correlated with the crime rate.

4.1 Government Expenditure and Nuisance Arrest

As we discussed in Section 3.2, the existence of nuisance arrest will make increasing p and f less effective in reduction of crime. So in this section, we will discuss how government will determine the equilibrium nuisance arrest probability if it can be reduced with some cost. The nuisance arrest arises for different reasons. First, errors in accuracy in finding perpetrators may cause nuisance arrest a common phenomenon in specific crime activities. There are some crimes with strong concealment, which make them difficult to be found or detected. Clues in these activities may mislead to innocent people. Similarly, some offenses with vague standard of conviction can also cause nuisance arrest. The form of nuisance arrest does not limit to unintentionally mistakes during law enforcement process. Racism and oppressive harassment can, to some extent, be regarded as “nuisance arrest”. Innocent people suffer a loss from these implicit behavior which is part of social loss when fighting crime. Local police will arrest innocent people deliberately to finish their work target or get fined. These oppressive harassment is common especially in countries where police system is lack of regulation. In these cases, government can spend more in legislation, investigation technology or police system regulation to reduce the probability of nuisance arrest.

We assume that the government can decrease α but will increase $C(O, p, \alpha)$, that is $C_\alpha < 0$. So the total social loss change to

$$L = D(O) + C(p, O, \alpha) + H(\alpha, f) \tag{20}$$

The first order condition of α is given by

$$L_\alpha = D' O_\alpha + C_\alpha + C_O O_\alpha + H_\alpha = 0 \tag{21}$$

To make the second order condition satisfied, we further assume that

$$C_{\alpha\alpha} > 0, C_{\alpha O} = C_{O\alpha} = 0 \tag{22}$$

These assumptions are similar to our assumptions for partial derivative on p. $C_{\alpha\alpha} > 0$ implies that when α is smaller, it will be harder to reduce the probability of nuisance arrest. This is a natural setting since some accident nuisance arrest is unavoidable and hard to govern. From the FOC we get

$$D' + C_O = -\frac{H_\alpha + C_\alpha}{O_\alpha} \tag{23}$$

Combine equation (14),(15) and equation (23), we get similar result as equation (16)

$$-\frac{C_p}{O_p} = -\frac{H_f}{O_f} = -\frac{H_\alpha + C_\alpha}{O_\alpha} \tag{24}$$

The marginal cost of increasing p, reduce α and increasing f are equal relative to their contribution to reduction of offenses.

To better understant how optimal α will change, we write the FOC as

$$D' O_\alpha + C_O O_\alpha + H_\alpha = -C_\alpha \tag{25}$$

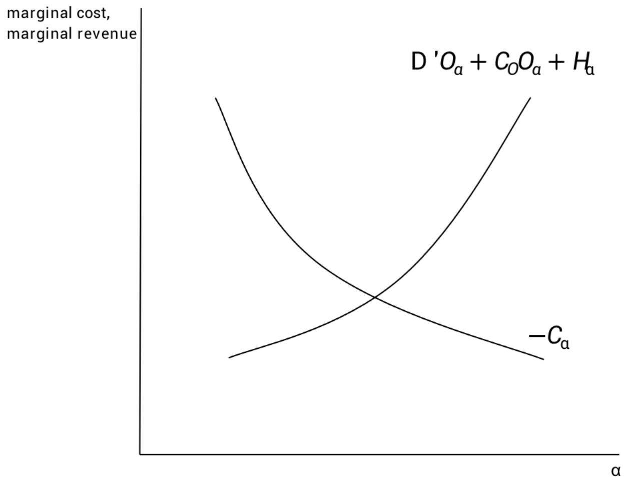

Figure 2: Optimal α. The upward sloping curve is marginal cost of increasing probability of nuisance arrest while the downward sloping curve shows marginal revenue. The optimal α is determined by the intersection.

where the left hand side of (25) is the marginal revenue of decreasing α while the right hand side is marginal cost. Figure 2 shows how optimal α is determined by the marginal revenue and marginal cost. An increase in the marginal damages from a given number of offenses, D', increases the marginal revenue in changing offense by decreasing α. So the optimal α will decrease. This property indicates that nuisance arrests are more likely to happen when the marginal increase of offenses does less harm to victims. In offenses like murder or rape, which generally do more damage, the nuisance arrest are less likely to happen. The police will mostly get clear evidence before arrest criminals. Since nuisance arrest push more people to commit a crime which will casue high level of damage to victims, police are more cautious in these cases. Similarly, as

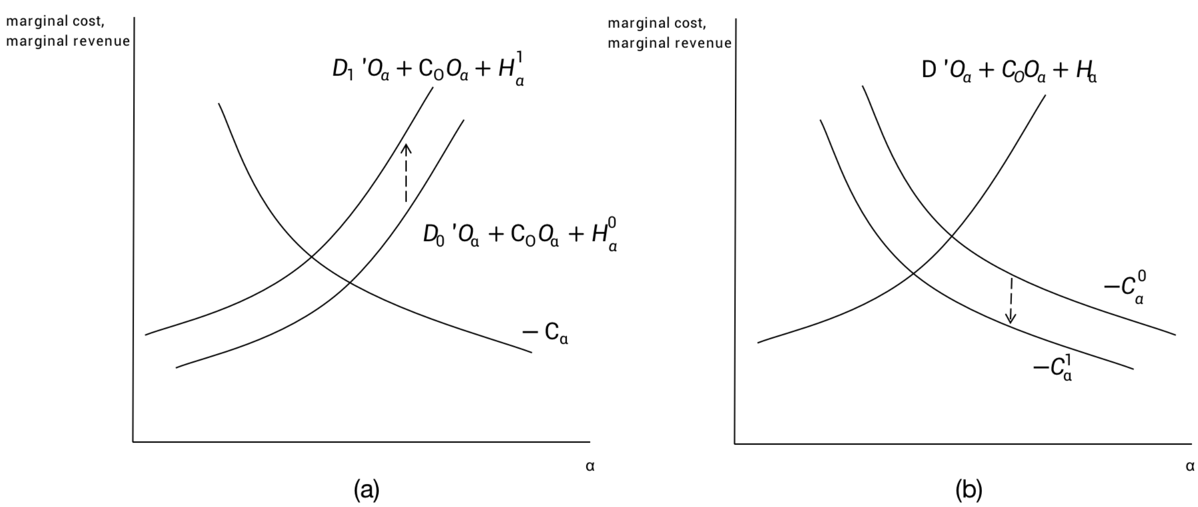

Figure 3: Shifts of Marginal Cost and Marginal Revenue. Panel (a) plots a shift of marginal cost and Panel (b) depicts a shift of marginal revenue. The increase of H_α implies a higher social cost of nuisance arrest and the decrease of C_α indicates a smaller cost to reduce nuisance arrest, so the optimal α in both cases are smaller.

shown in Figure 3(a), the optimal α decreases when H_α is larger. When government care more about the harm to innocents from nuisance arrest, the optimal α is smaller.

Figure 3(b) presents how the optimal α will change according to C_α. When the marginal cost for decreasing α is smaller, the optimal probability of nuisance arrest decreases. The decreasing cost may result from the innovation for police technology, more specific legal provisions or police system revolution. Conversely, nuisance arrest are more likely to happen when local police involved in corruption or police tend to arrest certain group of people. An typical example is mass repressions during Stalin period when eliminations of certain group is hard to regulated and controlled by the legislation or police system and thus the number of "false" convictions is high during this period. This result is also consistent with the proposition in Gregory et al. (2011) that repression of innocents rises with the declining quality of information. Once the standard of arrest is vague and valid information is hard to get, nuisance arrests are more likely to happen. Analogously, normal people face more police harassment for the reason of noise, disturbances or drunkenness which is hard to judge and determined.

4.2 Crime Rate and Nuisance Arrest

In this section, we keep the basic model in which the government cannot change the probability of nuisance arrest. To discuss how α is endogenously determined, we assume that α is positively related to the crime rate $\alpha(O)$, where $\alpha' = \frac{d\alpha(O)}{dO} > 0$. This function characterizes the statistical discrimination of police system to groups with certain crime rate. If the crime rate of this group is high, then the police is more likely to arrest people of that group, even when there is no clear evidence. One example of this property is whether the police choose to shoot when handling a case. When facing group of people with high level of crime rate, the police are more likely to shoot when the suspect acts tensely and maybe it finally turn out to be nervousness of a normal people. Under these circumstances, the police system behaves rationally based on the information they have and shows different attitude toward different group. Hemenway et al. (2019) pointed out that the USA has very high rates of homicide by police compared to other high-income countries, with approximately 1000 civilians killed annually and police are more likely to shoot unarmed African American men than unarmed White men. From the perspective of statistical discrimination, this phenomenon may not be simply explained as racism or discrimination to certain group.

A natural assumption for $\alpha(O)$ is $\alpha(0) = 0$ and $\alpha(1) = 1$. When the crime rate of a group is zero, the police will not arrest people in this group with no clear evidence. On the contrary, they will arrest people for no reason if the crime rate of the group is 1. This is a also a natural result and easy to implement in reality. If one group of people never commit a crime, then the government won't put any resources on them so they will not face nuisance arrest. On the other hand, if people in this group will commit a crime for sure, since we assume no social cost for punishment, the government can set $\alpha = 1$. Arresting all people in this group is not, in some sense, nuisance arrest, but action against criminal.

Since the probability of nuisance arrest can be determined as a result statistical discrimination based on crime rate, we can explain the equilibrium crime rate through a self-fulfilling process. Section 3.2 discussed how optimal offenses will change according to α. Once the crime rate of certain group is observed by the police system, they set a probability of nuisance arrest based on the crime rate. Subsequently, the optimal offense level is adjusted accroding to the probability of nuisance arrest and observed by the police system. The process goes on until an equilibrium crime rate and probability of nuisance arrest is reached.

We first consider the case when $\alpha(O)$ is linear. To get the shape of $O(\alpha)$, we can further assume that [6]

$$D''' + C_{OOO} \leq 0$$

Draw these two functions in the box as shown in Figure 4. Starting from an initial α_0, then from the FOC

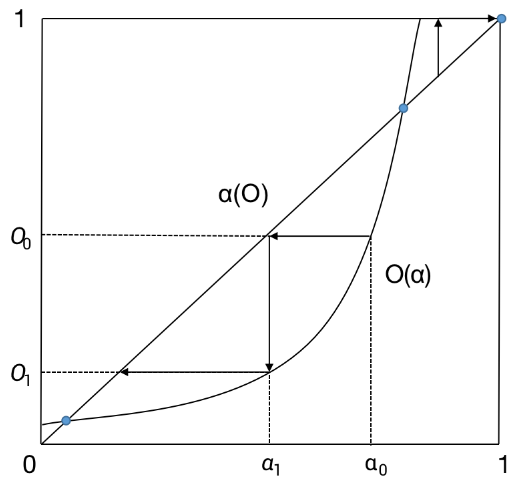

Figure 4: Multi-Equilibrium in Exogenous Model. The x-axis is probability of nuisance arrest and the y-axis is number of offenses or crime rate. Both α and O lies between $[0, 1]$. Blue points are equilibrium points.

condition of social loss function, the government set an optimal p and f and people make their decision to whether commit a crime. Then we get the optimal offenses O_0, which is also the crime rate. Given the crime rate, the police system adjust the probability of nuisance arrest to α_1, which will lead to a new optimal offenses level O_1. Finally, it will converge to the cross point of two functions with relative low α and O. If the initial α is set to be high, it will finally converge to $(1, 1)$. This extreme equlibrium is the result of our assumption for $\alpha(O)$ and the distribution of ε. It may not exist if ε is not uniformly distributed.

The equilibrium point in the middle is not a stable point. We can regard this equilibrium result as the probability of nuisance arrest and crime rate of a certain group (certain income level or certain race) and this property provides a good strategy for the government. If there is a group with high level of crime rate, at the same time, face high risk of nuisance arrest, the government may need to set p and f which is higher than optimal value so the offenses will be smaller than the equlibrium value. As the crime rate decrease, the probability of nuisance arrest also decreases and finnaly converge to the point with low α and O. Or the government should spend extra money to reduce α and then the unstable equilibrium will slip

[6] See Appendix for how the shape is derived. Note we keep the assumption (17) in Section 3.2.

to the equilibrium with low α and O. This is a globally profitable strategy since with lower level of α, the effectiveness of increasing p and f increases and the final offense level decreases.

Figure 5 shows how the equlibrium result will change when the two functions changes. In Figure 5 (a), the offense function shift downwards and for the stable equilibrium point, probability of nuisance arrest and crime rate decreases while the unstable one both increase. The change of $O(\alpha)$ may result from reasons we discussed in Section 4.1, like the innovetion of police technology which makes the offenses decreases for a certain level of α. More importantly, consider the case when the world is at unstable equlibrium point at the beginning, if the change of O_α is due to a short term breakthrough, since α will not change immediately, this point will slip to equilibrium with low crime rate and low probability of nuisance arrest.

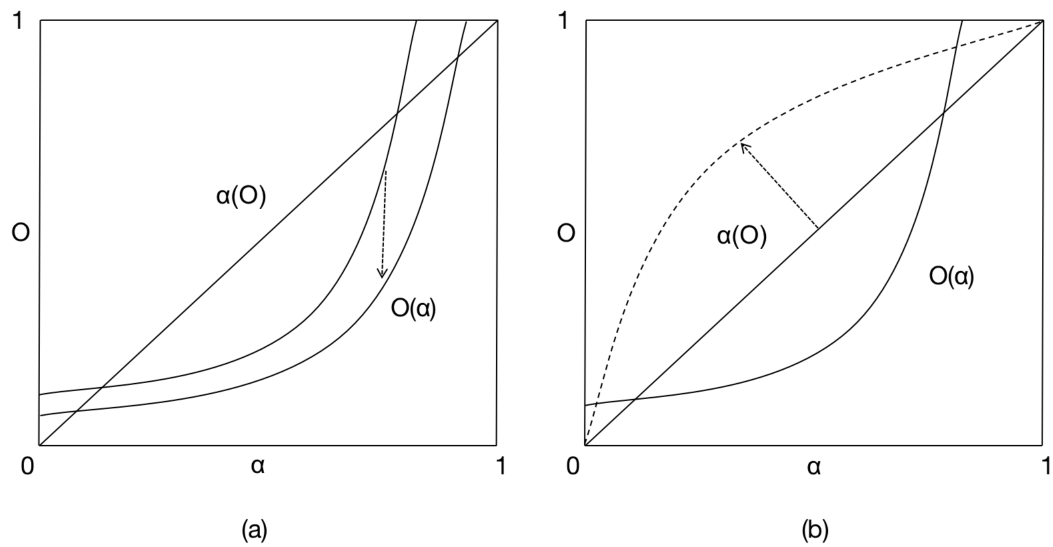

Figure 5: Change Offense Function and $\alpha(O)$. Figure (a) indicates the new equilibria if offense function shift downwards. Figure (b) shows the movement of equlibria when $\alpha(O)$ is not a straight line.

If we assume $\alpha(O)$ is not linear but quadratic, from Figure 5 (b), the stable equilibrium point will shift towards origin while the unstable one will shift to (1,1). We can also get similar result as long as $\alpha''(O) > 0$. $\alpha'' > 0$ may reflect distrust to high crime rate groups. Even when the crime rate slightly increases, police will over-react. This further makes the crime rate of unstable equlibrium extremely high compared with the stable equlibrium.

If the assumption $\alpha(0) = 0$ is relaxed, that is, even in the group with zero crime rate, there are still some "accidents" and innocent people in this group are arrest. We focus on the stable equilibrium with low α and O. As shown in Figure 6, when $\alpha(O)$ move to right, the probability of nuisance arrest and crime rate both increase. Recall the reason why α will increase when crime rate increases. As crime rate increases, police face higher risk when handling as case, so the nuisance arrest are more likely to happen. If the risk police evaluate is not the actual crime rate, but their belief for crime rate, then the stereotype of police for certain group of people will shift $\alpha(O)$ to right and lead to a higher crime rate which will further strengthen this stereotype. Racial bias of part of police or if certain group of suspects behave more aggressively (Scott et al.

(2017)) will lead to a right shift of $\alpha(O)$. In this case, although the distribution of ε does not change, the probability of nuisance arrest and crime rate are larger.

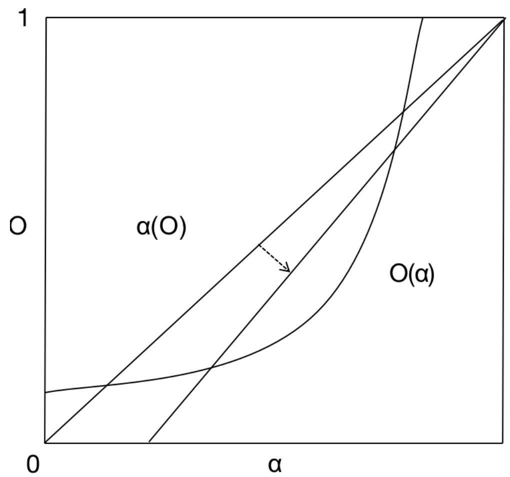

Figure 6: Relax Assumption $\alpha(0) = 0$. When $\alpha(0) > 0$, the slope become larger and both offense level and probability of nuisance arrest in stable equilibrium increases.

5 Conclusion

In this paper, we extend the model of Becker (1968) to discuss the impact of nuisance arrest on the number of offenses and social loss function. We assume a social loss function which can be minimized by choosing optimal probability of arrest p and punishment level f. Comparing with results in Becker (1968), the optimal punishment level is smaller since increasing punishment will also cause higher social loss from nuisance arrest. Thus, the optimal number of offenses O^* is also higher in our model.

Increasing p and f will reduce the number of offenses, but due to the existence of competing risk of nuisance arrest, this effect is weakened. As the risk of nuisance arrest α, become larger, the government need to set higher level of p and f to reduce the same amount of offenses which also means more investment in police system. Since the effect of increasing p and f on reduction of crime is discounted by nuisance arrest, in areas with high α, we observe higher crime rate.

If the government can reduce the probability of nuisance arrest by spending in police system, we show that decreasing α is as important as increasing p. In areas with high probability of nuisance arrest where the marginal revenue of decreasing α is high, it is more efficient to invest in reducing police harassment. An increase in the marginal damages from offenses will evoke the gorvenment to spend more in reducing nuisance arrest. Police as well as court are more cautious when handling these activites.

We also endogenize α by adding a "supply" function of nuisance arrest, $\alpha(O)$. Due to statistical discrimination, the police are more likely to arrest a person with no evidence when the group this person in has a very high crime rate. This effect is more obvious when police handle highly dangerous criminal activities in which they are possible to get hurt. We find there are multiple equilibria with very different crime rate and probability of nuisance arrest. It is possible that in two similar group with same preference, one have high crime rate and are more likely to suffer police harassment while the other have low crime rate and rarely face nuisance arrest. Since the equlibrium with high crime rate and high probability of nuisance arrest is unstable, government can set p and f higher than optimal value or spend in reduction of α to break the equlibrium and get a better result. We also find that sterotype or distrust to high crime rate groups will make nuisance arrest a more severe problem. This further makes the crime rate in these groups keep at a high level. Our main results are established based on the positiveness of first derivative of $\alpha(O)$. A more detailed model are needed to explains how statistical discrimination will determine the signs of first derivative and the shape of $\alpha(O)$. A reasonable guess is that they are related to the risk preference of police system.

Some assumptions in Becker (1968) are relaxed in our model to get more straightfoward result when discuss the impact of nuisance arrest. In fact, the first order condition will not change a lot if we incorporate risk preference and the social cost of punishment. However, since we add addtional term $H(\alpha, f)$ to represent social loss of nuisance arrest, the optimal p and f now do not necessarily lie in region where 'crime does not pay'. Also, it is worth discussing about the distribution of ε, which can represent different structure of preference. Another aspect we need to point out is that, when we consider the impact of nuisance arrest to innocent people, we assume that they will lose f is they are arrest. However, in reality, the impact of police harassment maybe smaller than that, like search for drugs. If you do not have drug, you will not be punished and only loss your time or maybe, get some mental harm. This kinds of harassment will not significantly increase the loss for the innocent but will decrease the expected payoff of commiting a crime. We can also incorporate this case into our model and may have different result since police harassment like searching drugs will reduce the crime rate and government need to pay for the search. More interesting results may emerge if the harm of nuisance arrest is larger than f. In this case, the negative effect of nuisance arrest is so strong that increasing p and f is no longer effective in reduction of crime.

A Appendix

A.1 Second Order Conditions

In this section, we prove that the second order conditions for different parameters are satisfied under our assumptions. Recall we derive that the offense function satisfies

$$O_{pp} \geq 0, O_{ff} \geq 0, O_{\alpha\alpha} \geq 0$$

and assume the social loss function satisfies

$$D'' > 0, C_{OO} > 0, C_{pp} > 0, C_{\alpha\alpha} > 0, C_{pO} = C_{Op} = 0, C_{\alpha O} = C_{O\alpha} = 0, H_{\alpha\alpha} > 0, H_{ff} > 0$$

The second order derivative of p is

$$L_{pp} = D''O_p^2 + D'O_{pp} + C_{pp} + C_{pO}O_p + C_{OO}O_p^2 + C_{Op}O_p + C_O O_{pp} > 0$$

The second order derivative of f is

$$L_{ff} = D''O_f^2 + D'O_{ff} + C_{OO}O_f^2 + C_O O_{ff} + H_{ff} > 0$$

When incoporate α in to C (Section 4.1), The second order derivative of α is

$$L_{\alpha\alpha} = D''O_\alpha^2 + D'O_{\alpha\alpha} + C_{\alpha\alpha} + C_{\alpha O}O_\alpha + C_{OO}O_\alpha^2 + C_{O\alpha}O_\alpha + C_O O_{\alpha\alpha} + H_{\alpha\alpha} > 0$$

So the second order conditions are satisfied and L is minimized at extreme point.

A.2 Shape of Graphs

In this section, we discuss the shape of our graphs.

1. Figure 1

   $$\frac{\partial D' + C_O}{\partial O} = D'' + C_{OO} > 0$$

   So $D' + C_O$ increases as O increases. Since we assume $C_{pO} = 0$, $\frac{-C_p}{O_p}$ is a flat line.
2. Figure 2

   $$\frac{\partial D'O_\alpha + C_O O_\alpha + H_\alpha}{\partial \alpha} = D''O_\alpha + D'O_{\alpha\alpha} + C_{OO}O_\alpha^2 + C_{O\alpha}O_\alpha + C_O O_{\alpha\alpha} + H_{\alpha\alpha} > 0$$

   It is assumed that $C_{\alpha\alpha} > 0$.
3. Figure 4

   Note we further assume ε are uniformly distributed, so we have $\varphi' = c$ is a constant. Then we can rewrite the FOC of p and get

   $$D' + C_O = \frac{C_p}{(1-\alpha)fc}$$

Since $C_{Op} = C_{pO} = 0$, we have

$$C_O = f(O), C_p = g(p)$$

Then the optimal offense $O^*(\alpha)$ satisfies

$$D'(O^*) + f(O^*) = \frac{g(p)}{(1-\alpha)fc}$$

Take derivative to α on both sides, we get

$$(D'' + f')O^*_\alpha = \frac{g(p)}{(1-\alpha)^2 fc}$$

$C_{OO} > 0$, $C_p > 0$ and $D'' > 0$, so we have $O^*_\alpha > 0$. To get the shape of $O^*(\alpha)$, again take derivative on α

$$(D''' + f'')O^{*2}_\alpha + (D'' + f')O^*_{\alpha\alpha} = \frac{2g(p)}{(1-\alpha)^3 fc}$$

Since we assume $D''' + C_{OOO} \leq 0$, we have $O^*_{\alpha\alpha} > 0$. When $\alpha = 0$, the optimal crime rate is just as discussed in Becker (1968). We focus on the situation when the payoff of crime is high enough to intrigue part of people engaging crime activities so $O(0) > 0$. And note that as $\alpha \to 1$, $\frac{C_p}{(1-\alpha)fc} \to \infty$. So the optimal crime rate will reach 1 before α reach 1.

If $D''' + C_{OOO} > 0$, the shape of $O^*(\alpha)$ is ambiguous. In this case, O_α may have several inflection point and the curvature of $O(\alpha)$ will be complex. It is also possible that there are more than three equlibriums, but this will not change our discussion for stable equlibrium and unstable equlibrium, e.g Figure 7.

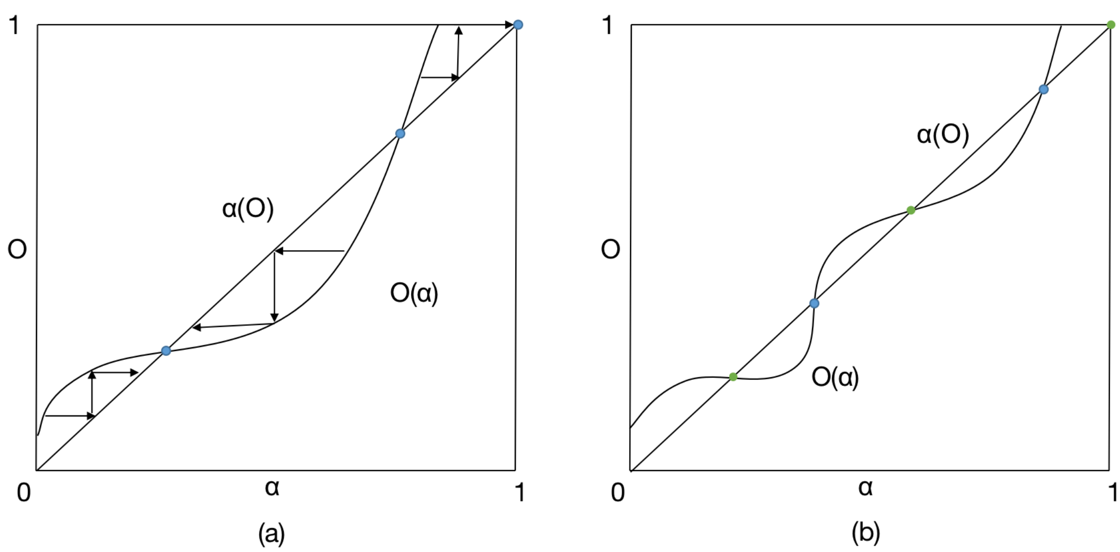

Figure 7: This graph shows the existence of stable and unstable equlibrium when $D''' + C_{OOO} > 0$; In (a), the equlibrium with low α and O is stable; In (b), stable equlibriums are label by green points while unstable points are blue.

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