

The Role of Moral Values in the Economic Analysis of Crime: a General Equilibrium Approach

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Abstract

In this paper, we develop a general equilibrium model of crime and show that law enforcement has different roles depending on the equilibrium characterization and the value of social norms. When an economy has a unique stable equilibrium where a fraction of the population is productive and the remaining predate, the government can choose an optimal law enforcement policy to maximize a welfare function evaluated at that steady state. If such steady state is not unique, law enforcement is still relevant but in a completely different way because the steady state that prevails depends on the initial proportions of productive and predator individuals in the economy. The relative importance of these proportions can be changed through law enforcement policy.

Keywords: Crime, Punishment, Norms

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1 Introduction

The economic analysis of crime has its starting point with Becker's (1968) seminal work: individuals rationally decide whether to engage in criminal activities by comparing the expected returns to crime with the returns to legitimate business. Hence, crime is less attractive if the government increases the probability (certainty) and severity of punishment. Alternatively, by increasing market opportunities, one makes crime less attractive. Becker's main thesis is that since imposing a fine is costless, this fine should equal an individual's entire wealth and be complemented by a probability of punishment to optimally deter crime.

Most of the literature on crime has focused on the role of deterrence as pointed out in a recent survey by Garoupa (1997). The discussion has been around alternative characterizations of optimal penalties and enforcement strategies in the context of partial equilibrium where the normative criteria is to minimize a given welfare function that measures the social loss resulting from crime.¹

A general equilibrium approach to crime has been rooted in two different literatures. Usher (1986, 1997), Furlong (1987), and Imrohorglu, Merlo and Rupert (1996) have addressed the problems of criminal behavior by explicitly modeling the interaction among the participants in the market for crime. Grossman and Kim (1995) and Hirshleifer (1995) have modeled an economy in anarchy, where there is no third-party enforcement of rules, and show how predation behavior may emerge and affect economic efficiency. In both cases, the existence of criminal activities is derived from the impossibility of deterring crime without damaging productive activities. In the general equilibrium literature, crime exists because there is a prisoner's dilemma: everyone would be better-off if crime did not exist because wealth creation would be at its maximum, but given that all the others are creating wealth,

¹See also Ehrlich (1996).

one has incentives to deviate and steal all created wealth. As a consequence, individuals invest on predation and eventually on defensive activities (private precaution).

The role of criminal law and law enforcement is to deter investment on predation and induce individuals to invest on productive activities. Law enforcement is costly and so one cannot deter completely predation. As Hirshleifer (1995) points out, anarchy can actually be more efficient than an economy with law enforcement. If detecting and punishing individuals is too costly, it may be more efficient not to create law. Moreover, the substitution of private precaution by public enforcement may actually diminish law enforcement and induce more predation (depends on the elasticity of substitution being greater than one).

A general equilibrium approach to crime also highlights the redistribution role of illegal activities. Law obeying individuals pay taxes and may be the recipients of government subsidies. Zhang (1997) shows that welfare payments reduce illegal activity. Imrohorglu, Merlo and Rupert (1996) observe that it is possible for crime rate to increase with redistribution: in an environment where it is impossible to distinguish between criminals and non-criminals as recipients of transfer payments, increasing government subsidies may increase the crime rate because of the distortionary effects of the higher taxes that are necessary to finance the subsidy increase.

A similar approach can be useful to consider education. Usher (1997) argues that education conveys a civic externality because individuals are taught to be law abiding inducing a social return to education. Private and public incentives to acquire such law abiding education usually differ introducing the problem of optimal public funding. Furthermore, as in the argument for anarchy, one should be careful about the elasticity of substitution of private funding by public funding.

In this paper, we develop a general equilibrium model of crime and show that law enforcement has different roles depending on the equilibrium

characterization. When an economy has a unique stable equilibrium where a fraction of the population is productive and the remaining predate, the government can choose an optimal law enforcement policy to maximize a welfare function evaluated at that steady state. If such steady state is not unique, law enforcement is still relevant but in a completely different way because the steady state that prevails depends on the initial proportions of productive and predator individuals in the economy. The relative importance of these proportions can be changed through law enforcement policy.

We argue that law enforcement is important because it can affect social welfare in the long-run. Furthermore, the importance of law enforcement policy depends on how sensitive a steady state is to changes on severity and probability of punishment. However, we accept that law enforcement in any case can also affect the rate of convergence to equilibrium. In our specification of the model, this rate of convergence is ignored in the sense that there is no associated social cost. Alternatively, we assume that individuals adjust very rapidly and the long-run equilibrium is achieved almost instantly.

The economic approach to crime and criminal law employs a typical value assumption, that actors are motivated to pursue private and instrumental goods such as wealth that are usually exchangeable in the market. Individuals always seek to maximize an instrumental good subject to external constraints to which the actor is subject. Skeptics of rational choice regard the typical value assumption as one of their principal targets of criticism, the other being the assumption of rationality.² Some literature has pointed out that the economic approach to crime is not interesting because it ignores the role of moral values as a driving force of honest behavior.

The economics literature has developed a theory of social norms which includes work by Axelrod (1986), Campbell (1986), Binmore and Samuelson (1994), Sethi (1996), and Cooter (1997). People use the term ‘social norm’

²See Hechter (1994) for a discussion of these two criticisms.

to refer different things. We propose Cooter's (1997) definition: a social norm refers to a consensus in a community about an obligation. A social norm exists if the members of a community agree that they ought to behave accordingly.

The presence of social norms provides a basis for an equilibrium where different payoffs are sustained in the long-run. We divide the population in norm-guided individuals and opportunistic self-interest individuals. We argue that law enforcement is only relevant if there is a sufficiently large proportion of opportunistic individuals. Otherwise, if a population is norm-guided, there is no need for law.

Observing that people may learn to be norm-guided by internalizing norms, we propose that there should be an overshooting of punishment in initial stages. Once part of the population has internalized norms, we can opt for a lax policy. This rule is used to derive results on public funding of education and the role of welfare state.

The paper goes as follows: in section 2, we introduce the basic model where a stable equilibrium always exists. The role of moral values and internalization of social norms is debated in section 3. Finally, in section 4, we allow for unstable equilibria. Final remarks are presented in section 5.

2 Basic model

Consider an economy with a continuum of agents. Each risk neutral individual chooses to work as a farmer or as a robber. As a farmer, an individual gets an expected income $ws(1-t)$, where w is the monetary value of producing grains, t is the tax rate charged by the government in this economy, and s is the expected share of net income that a farmer is able to keep given that robbers will be active in this economy. The parameter s can be described as the technology of banditry. A more efficient technology induces a smaller s . As a robber, an individual gets an expected income $wr(1-t)$, where r is the

expected share of net income that a robber is able to steal from a farmer.

The number of farmers in this economy is given by n , and consequently the number of robbers is given by $1 - n$.

The farmers pay taxes to fund the law enforcement agency budget. This enforcement agency hires policemen to patrol the farming zone. The tax revenues are tn and the expenditure is $c(p)$. The county sheriff budget is necessarily balanced and so $t = c(p)/(nw)$

Assumption 1 *The expected share $s(n, p)$ has the following properties: (i) $s_n > 0$; (ii) $s_{nn} < 0$; (iii) $s_p > 0$; (iv) $s_{pp} = 0$; (v) $s_{np} < 0$; and (vi) $s(0, p) = 0$.*

Assumption 2 *The expected share $r(n, p)$ has the following properties: (i) $r_n > 0$; (ii) $r_{nn} > 0$; (iii) $r_p < 0$; (iv) $r_{pp} = 0$; (v) $r_{np} < 0$; and (vi) $r(0, p) = 0$.*

Figure 1 shows both curves. We can observe that at a point such that $s(n, p) = r(n, p)$, the following property is satisfied: $s_n < r_n$. This last property introduces stability in the model. It states that an increase in the number of farmers has more impact on the expected income of a robber than on the expected income of a farmer. In section 4, we consider the model with unstable points.

Assumption 3 *The punishment in this economy is the maximal fine.*

Robbers are detected and punished with probability p . In that state of the world, robbers lose all their income to farmers. This assumption is based on Becker's (1968) argument that if probability and severity of punishment are both effective crime deterrents then the severity of punishment should be maximal because it is costless whereas the probability of punishment is costly. The literature on crime has been extended in order to assess this

result as can be found in Garoupa (1997). In this economy, we assume that courts apply this rule and so government's intervention is limited to setting the probability of punishment.

Given that we consider a closed economy, it must be the case that the following expression holds for all n :

$$(1 - s(n, p))n \geq r(n, p)(1 - n)$$

If this expression holds in equality, then there is no destruction of loot when crime occurs. However, if it is the case of a strict inequality, some destruction takes place. Let us define:

$$\beta(n, p) = r(n, p)(1 - n) / ((1 - s(n, p))n)$$

where β is a technological parameter such that if β is less than one some income is destroyed during the process of stealing. As a consequence, we can say that $1 - \beta$ measures the transaction cost of crime. If β is one, all income lost by farmers is gained by robbers, and so the transaction cost is zero. However, if β is less than one, some income lost by farmers is not gained by robbers, and so the transaction cost is strictly positive (some loot is destroyed).

An example can be specified by assuming that

$$s(n, p) = \alpha(n) + p(1 - \alpha(n))$$

$$r(n, p, \gamma) = (1 - p)\gamma(1 - \alpha(n))n / (1 - n)$$

where γ is a technology shift parameter. We can show that for all n we have $\beta(p, n) = \gamma$ so that the transaction cost of crime decreases with the technology shift parameter γ and is independent of the probability p and the number of farmers n . In this example, the probability is a measure of the actual ability of robbers getting their hands on the loot.

Assumption 4 *The evolution of this economy can be described by the replicator dynamics mechanism.*

The use of the replicator dynamics to model the evolution of a population has been justified in evolutionary game theory. It begins with the observation that selection favors the behavior with a higher payoff. As a consequence, the number of players using a particular strategy increases as long as that strategy produces above-average payoffs. Conversely, the proportion of players using a strategy decreases as long as that strategy produces below-average payoffs. In equilibrium, only players with the highest payoff survive, and consequently all players must have the same payoff. In other words, an equilibrium should be interpreted as a steady state of a dynamic process of adjustment or learning.³

The replicator dynamics postulates that the fraction of the population playing a strategy increases if the payoff received from that strategy is above average. The application of replicator dynamics in economics has been justified in the literature as a learning mechanism as in Börgers and Sarin (1997). Each farmer in this economy compares the payoff of remaining a farmer with the alternative payoff of becoming a robber next period. Alternatively, each robber in this economy compares the payoff of remaining a robber with the the alternative payoff of becoming a farmer next period. Individuals change activity if and only if the other sector yields a higher payoff than that of the current activity. This mechanism works as long as individuals can enter and exit sectors without additional costs. Moreover, at day one, there is a random strictly positive number of both farmers and robbers in this economy. Using the usual replicator dynamics approach, we can say that:

$$\dot{n} = n(1 - n)\{s(n, p) - r(n, p)\}$$

where \dot{n} is the change in the number of farmers in continuous time.

³See Fudenberg and Levine (1996) and Osborne (1997).

There are three solutions to the replicator dynamics: (i) everyone is a farmer and $n^* = 1$; (ii) everyone is a robber and $n^* = 0$; and (iii) an interior solution such that $s(n^*, p) = r(n^*, p)$.

Proposition 1 *The unique stable equilibrium in replicator dynamics is an interior solution such that $s(n^*, p) = r(n^*, p)$. Moreover, the number of farmers in equilibrium increases with the probability of punishment p .*

Proof of Proposition 1

The stability of those three solutions is determined by a first-order approach to the problem. Given that $r_n > s_n$ is satisfied for n such that $s(n, p) = r(n, p)$ then solution (iii) is the only stable solution of this economy and is consequently the equilibrium in this replicator dynamics.

By the implicit function theorem we know that the sign of n_p^* is given by the sign of $s_p - r_p$ which is strictly positive. \square

The equilibrium of this economy is depicted in figure 1. In this internal equilibrium, some individuals are farmers and others are robbers, and all earn the same expected payoff, as required to survive. It is easy why both occupations must have the same payoff. Suppose that at equilibrium a farmer decides to become a robber. Then, by assumptions 1 (ii) and 2 (ii), we know that the expected income of a robber decreases more than the expected income of a farmer. As a consequence, there is a clear incentive to remain a farmer because this individual is making more money as a farmer than as a robber. Conversely, suppose that at equilibrium a robber decides to become a farmer. Then, by the same assumption, we know that the expected income of a robber increases more than the expected income of a farmer. Again, as a consequence, there is a clear incentive to remain a robber. So there are no incentives to move out of that interior solution, and naturally this interior solution is a stable equilibrium.

By announcing a tougher law enforcement policy, the authorities guarantee that more individuals will be farmers at equilibrium. Note that such announcement can be made any time during the game. In the particular case of an announcement during the period when more individuals are becoming robbers, it simply changes the dynamics of the game in direction of the new stable equilibrium.

Let us now consider welfare maximization: a social planner decides p to maximize total wealth at the stable equilibrium. We call this government a W -type of planner. The total income at the stable equilibrium to be maximized is:

$$W = w(1 - t)s(n^*, p) = s(n^*, p)(n^*w - c(p))/n^*$$

and the first order condition is:

$$\begin{aligned} W_p &= \{s_n(w - c(p)/n^*) + s(n^*, p)c(p)/n^{*2}\}n_p^* \\ &\quad + s_p(w - c(p)/n^*) - c_p s(n^*, p)/n^* = 0 \end{aligned}$$

and we derive the optimal probability $p^*(w)$.⁴

Alternatively, consider a U -type of social planner who maximizes total wealth of farmers:

$$U = w(1 - t)s(n^*, p)n^* = s(n^*, p)(n^*w - c(p))$$

and the first order condition is:

$$\begin{aligned} U_p &= \{s_n(n^*w - c(p)) + s(n^*, p)w\}n_p^* \\ &\quad + s_p(n^*w - c(p)) - c_p s(n^*, p) = 0 \end{aligned}$$

and we derive the optimal probability $p^{**}(w)$.

⁴We assume that second-order conditions are satisfied. A sufficient condition is that c_{pp} is sufficiently positive; the production of the probability of detection and punishment exhibits decreasing returns to scale.

Proposition 2 *A W -type of planner chooses a smaller probability of punishment than a U -type of planner. In both cases, the probability of punishment increases with wealth w .*

Proof of Proposition 2

By the envelope theorem, replacing p^{**} in W_p and consequent rearranging of expressions, we can show that

$$W_p(p^{**}) = \{c(p)/n^* - w\}s(n^*, p)n_p^*/n^* \leq 0$$

from the definition of W . Moreover, applying the implicit function theorem, it is clear that W_{pw} and U_{pw} are both positive. \square

In summary, there is an optimal probability such that some robbers are apprehended and punished. This optimal probability increases with wealth w because a more productive agriculture implies that the loot to be stolen is greater and consequently more attractive.

3 Introducing moral values

Following Cooter (1997), we can think that being honest is a social norm internalized by many individuals in society. In terms of the model, we say that a proportion l of the population is always farmer because they have internalized a social norm. We define internalization of a social norm as non-opportunistic behavior according to a given convention or rule by which individuals obey. In other words, l individuals are farmers even when it gives them a lower expected monetary payoff because they have some moral values that more than compensate them for any monetary loss. Therefore, only $1 - l$ individuals are opportunistic and are willing to choose the job that gives them the highest payoff.

In terms of the replicator dynamics, we impose the condition the number of farmers in this economy must be at least l . By observing figure 2 and

figure 3, it is clear that there are only two cases. If $n^* \geq l$, then the existence of moral values is not important because it is still worthwhile for some opportunistic individuals to be farmers. However, if $n^* < l$, all opportunistic individuals are robbers and moral values are important because even though robbers are making more money than farmers, nobody wants to move out of equilibrium. Let us define the probability of detection and punishment q such that $n^*(q, w) = l$.

Let us consider a U – type social planner. If $p > q$, the objective function is U defined before. However, if $p \leq q$, the objective function is V given by:

$$V = w(1 - t)s(l, p)l = s(l, p)(lw - c(p))$$

and the first order condition is:

$$V_p = s_p(lw - c(p)) - c_p s(l, p) \leq 0 \quad p \geq 0$$

and we derive an optimal probability $p^{***}(w)$.

It is intuitive that $p^{***} < p^*$ since in the case of V the impact of increasing punishment in the number of farmers is zero. Without loss of generality, let us assume that p^{***} is zero. The choice of optimal policy will depend on the number of individuals who have internalized social norms in this economy. If l is small, then the optimal solution is p^* and the existence of some righteous people in population is not important (figure 4); if l is very large, then the optimal solution is zero probability of detection and punishment (figure 5).

Proposition 3 *If the number of norm-guided individuals l in this economy is less than a given L , the optimal policy is to set p^* such that some opportunistic individuals are farmers. If that number l is greater than L , the optimal policy is to set a zero probability of punishment and all opportunistic individuals are robbers.*

Proof of Proposition 3

We start by comparing p^* and $q(l)$ to define $l_0(p^*)$ such that if $l < l_0(p^*)$ then $p^* > q(l)$. Also l_0 increases with p^* . There are two possible cases:

Case 1: $l < l_0(p^*)$ and so we have to compare $U(p^*)$ and $V(l, 0)$.

Case 2: $l \geq l_0(p^*)$ and we have to compare $V(l, p^*)$ and $V(l, 0)$.

In case 2, it is clear that the optimal solution is to set zero probability. In case 1, it depends on the specific value of l . Let us define $l_1(p^*)$ such that $V(l_1, 0) = U(p^*)$. If $l \geq l_1(p^*)$, the optimal policy is to set a zero probability. As a consequence, we can say that the optimal policy is to set a zero probability if and only if the number l is greater than L such that $L(p^*) = \min\{l_0(p^*), l_1(p^*)\}$. \square

The importance of internalization of social norms varies with the proportion of individuals who behave accordingly. There is a critical mass below which internalization of social norms is not relevant to support a socially optimal number of honest individuals, and so law enforcement policy has a role. Once internalization of norms is generalized, law enforcement policy has a limited role because it is too costly to deter and punish the remaining opportunistic individuals.

An alternative interpretation is to say that while norms are not internalized, we should assist an overshooting of expected punishment to deter opportunistic individuals. Once a minimum critical mass is achieved, investment in criminal punishment can be cut without affecting the crime rate.

Let us suppose that there are l norm-guided people in this economy. These people have fully internalized social norms. We already know that if $l < L$, the county sheriff has set the optimal probability of punishment equal to p^* . However, if $l \geq L$, the optimal probability is zero. We can discuss the case for the government to increase the proportion of norm-guided people by investing e on internalization of norms. This investment on internalization of norms if funded by lump-sum contributions from farmers. Therefore, we

can define $l(e)$, where $l_e > 0$ and $l_{ee} > 0$. How much should the government invest? Obviously the answer depends on l . The objective function to be maximized varies with l . If l is less than L , the objective function is $W - e$; if l is greater than L , the objective function is $V(e) - e$.

Let us start with the case that $l \geq L$: the number of norm-guided individuals in this economy is already sufficiently relevant. In this case, the optimal investment on internalization of norms e^* satisfies the following first-order condition:

$$(s_l l w + s(l, 0) w) l_e - 1 \leq 0 \quad e \geq 0$$

Given this optimal investment, we know that the optimal value of farmers' income is $V(e^*) - e^*$. Consider now the case where $l < L$: a marginal increase of investment on internalization of norms has no effect on the number of farmers in this economy. Farmers in this case can be divided in two groups: those who are norm-guided and those who are opportunistic. A marginal increase of investment on internalization of norms changes the weight of these two groups within the farming job but does not affect the overall number of farmers: one opportunistic farmer becomes norm-guided. As a consequence, we have to consider a discrete investment E such that at least L individuals become norm-guided. Once L individuals are norm-guided, the government invests further e^* to achieve the optimum. The discrete investment E has a maximum value given by:

$$E^{\max} = V(e^*) - e^* - U(p^*)$$

The cost of investing on internalization of social norms is smaller when these norms are actually accepted by society. Social norms are supposed to be shared by the majority of individuals in a community. As a consequence, the number of individuals who have internalized social norms must be significant, otherwise such a norm can hardly be considered a social norm. In

terms of this model, an internalized norm is a social norm if the number l is significant and consequently the optimal investment on social internalization of norms is small. This observation relates to recent work on social norms: it is much more expensive, eventually inefficient, for the government to impose a behavior conduct that differs from a social norm. Enforcing criminal law is much easier if it corresponds to set of social norms which have been internalized by a significant proportion of the community.

The decision of investing on social internalization of norms is related to monitoring and enforcement cost. When such cost is high (in terms of the model, $c(p^*)$ is large), we know that it is more likely that a zero probability policy is followed. All opportunistic individuals are likely to be dishonest if the cost of monitoring and enforcement is high. Consequently, investment on social internalization of norms becomes more relevant.

We explore these observations in the context of two different stories. One application is to discuss the role of education. We take as given that some people are more socially educated and so they have internalized a set of social norms and conventions. We can consider investment on internalization of norms as public investment on education. We are saying that if the judicial system is highly inefficient, the government should invest more on civic education to induce more people to internalize norms and behave accordingly.

A second application is to discuss the role of welfare state, and transfer payments in particular. Suppose some individuals in this economy have land (by inheritance) and others have no land (they cannot work as farmers). Let us say that $1 - l$ individuals have no land (they are said to be unemployed) and get zero income. Assume that they are opportunistic and so they are always necessarily dishonest. We can then analyze the relevance of endorsing a unemployment subsidy policy and its relevance for the crime rate.

In this economy the number of farmers is necessarily less (not strictly) than l . We can redefine $n^*(q) = l$ and say that if the probability of pun-

ishment is greater than $q(l)$, the number of farmers is l and all employed individuals are farmers. This is a situation where criminal behavior is described according to one's employment status. However, if the probability of punishment is less than $q(l)$, the number of farmers is typically less than k and some employed individuals are robbers.

We can further say that if l is less than L such that $p^* = q(L)$, the optimal value of the objective function is $V(l, q(l))$. Conversely, if l is greater than L , the optimal value of the objective function is $U(p^*)$. In English, we are saying that if the number of unemployed individuals is sufficiently large, the optimal policy is to set a probability equal to $q(l)$ and all employed individuals are farmers and get more money than being robbers: some unemployed would like to be farmers but are not able to find a piece of land. When the number of unemployed individuals is small, then it is irrelevant for the determination of equilibrium in this society.

An introduction of a welfare state that provides transfer payments makes sense when the number of unemployed individuals is greater than $1 - L$ because some unemployed individuals are willing to be honest but they cannot because there is no land. The government may try to buy land to $L - l$ individuals so that the optimal value $U(p^*)$ can be achieved. Suppose the cost of each piece of land is h . The cost of financing this plan is $h(L - l)$ which is paid by lump-sum contributions from all farmers. The maximum cost of land that a U -type government is willing to pay is:

$$h^{\max} = (U(p^*) - V(l, q(l)))/(L - l)$$

and so a welfare state is created if the gains are sufficiently large.

Transfer payments are important when the effectiveness of law enforcement is constrained by unemployment. Otherwise, there is no need for a welfare state because those unemployed individuals would be robbers even if they had access to productive activities.

4 Model with unstable steady-state

The stability of the steady state obtained in section 2 is based on the properties imposed by assumptions 1 and 2. We change now these assumptions to obtain a unstable interior steady state and discuss the role of law enforcement in such case. In the basic model, assumptions 1 and 2 are replaced by the following two assumptions:

Assumption 5 *The expected share $s(n, p)$ has the following properties: (i) $s_n > 0$; (ii) $s_p > 0$; (iii) $s_{pp} = 0$; (iv) $s_{np} < 0$; (v) $s(0, p) = 0$; and (vi) it is a S shaped curve in n .*

Assumption 6 *The expected share $r(n, p)$ has the following properties: (i) $r_n > 0$; (ii) $r_p < 0$; (iii) $r_{pp} = 0$; (iv) $r_{np} < 0$; (v) $r(0, p) = 0$; and (vi) it is an inverted S shaped curve in n .*

Figure 6 shows both curves. We can observe that at a point such that $n = n'(p)$, the following property is satisfied: $s_n > r_n$. This last property induces unstability in the model. An increase in the number of farmers has less impact on the expected income of a robber than on the expected income of a farmer. As a consequence, the number of farmers increases and so we diverge from $n'(p)$. One can also show that $n'(p)$ decreases with the probability of punishment.

The solution to the replicator dynamics depends on the initial number of farmers and robbers, say n^0 and $1 - n^0$. If $n^0 > n'(p)$, the steady state equilibrium is $n^*(p)$ and a U - type of government chooses p^* achieving $U(p^*)$. If $n^0 < n'(p)$, the steady state is zero farmers achieving zero welfare. The existence of a unstable solution is not problematic as long as $n^0 > n'(p^*)$ since we obtain the same equilibrium as in section 2. However, if the number of initial farmers is very small, we cannot achieve that stable steady state and the economy converges for a zero wealth situation. We can then define

p^0 as the minimum enforced probability of punishment such that the economy converges for an interior solution. In this case, the achieved welfare in equilibrium is $U(p^0) < U(p^*)$. As long as $U(p^0)$ is positive, a U -type of government prefers to enforce p^0 . However, if $U(p^0)$ is negative because the probability is too costly, the government prefers to cut completely law enforcement expenditure and the economy converges to zero wealth because all wealth is depleted.

Let us show that the role of social norms is not affected by the existence of a stability problem. If p^0 is enforced, the results obtained previously are directly applicable. In the case that p^0 is too costly, the government applies a zero probability policy. If there are $l \leq n^0$ farmers that have internalized social norms, this economy converges to $s(l, 0)lw$. As a consequence, investing on internalization of norms is valuable for two reasons: (i) a marginal investment increases directly welfare since everyone else is opportunistic and thus predates; (ii) a discrete investment may change the initial number of farmers to $n^0 > n'(p^*)$ such that this economy can achieve a stable interior solution. In that case, the results obtained in section 3 also apply.

5 Conclusion

This paper is a contribution to the current economic literature on criminal law by extending it to a general equilibrium environment where internalized social norms matter. The importance of social norms varies with the proportion of individuals who behave accordingly. There is a critical mass below which internalization of norms is irrelevant to support a socially optimal number of honest individuals, and so law enforcement policy has a very active role. Once that critical mass is achieved, law enforcement is socially too costly and should be cut.

We explore these observations in the context of two different stories. One application is to discuss the role of education. We take as given that

some people are more socially educated and so they have internalized a set of social norms and conventions. We can consider investment on internalization of norms as public investment on education. We are saying that if the judicial system is highly inefficient, the government should invest more on civic education to induce more people to internalize norms and behave accordingly.

A second application is to discuss the role of welfare state, and transfer payments in particular. Transfer payments are important when the effectiveness of law enforcement is constrained by unemployment. Otherwise, there is no need for a welfare state because those unemployed individuals would be dishonest even if they had access to productive activities.

References

1. Axelrod, R., 1986, An Evolutionary Approach to Norms, *American Political Science Review*, vol. 80, pp. 1095-1111.
2. Becker, G. S., 1968, Crime and Punishment: an Economic Approach, *Journal of Political Economy*, vol. 78, pp.169-217.
3. Binmore, K. G., & Samuelson, L., 1994, An Economist's Perspective on the Evolution of Norms, *Journal of Institutional and Theoretical Economics*, vol. 150, pp. 45-63.
4. Börgers, T., & Sarin, R., 1997, Learning Through Reinforcement and Replicator Dynamics, *Journal of Economic Theory*, Forthcoming.
5. Campbell, D. T., 1986, Rationality and Utility from the Standpoint of Evolutionary Biology, *Journal of Business*, vol. 59 (Supplement), pp. 355-364s.

6. Cooter, R. D., 1997, Law from Order: Economic Development and the Jurisprudence of Social Norms, *Cornell Law Review*, Forthcoming.
7. Ehrlich, I., 1996, Crime, Punishment and the Market for Offenses, *Journal of Economic Perspectives*, vol. 10, pp. 43-67.
8. Fudenberg, D., & Levine, D. K., 1996, Learning and Evolution in Games, Paper presented at the 1996 Summer Meeting of the Econometric Society. It can be downloaded from Prof. Levine's homepage.
9. Furlong, W. J., 1987, A General Equilibrium Model of Crime Commission and Prevention, *Journal of Public Economics*, vol. 34, pp. 87-103.
10. Garoupa, N., 1997, Theory of Optimal Law Enforcement, *Journal of Economic Surveys*, vol. 11, pp 267-295.
11. Grossman, H., & Kim, M., 1995, Swords or Plowshares? A Theory of the Security of Claims to Property, *Journal of Political Economy*, vol. 103, pp. 1275-1288.
12. Hechter, M., 1994, The Role of Values in Rational Choice Theory, *Rationality and Society*, vol. 6, pp. 318-333.
13. Hirshleifer, J., 1995, Anarchy and its Breakdown, *Journal of Political Economy*, vol. 103, pp. 26-52.
14. Imrohoroglu, A., Merlo, A., & Rupert, P., 1996, On the Political Economy of Income Redistribution and Crime, Federal Reserve Bank of Minneapolis, Research Department Staff Report 216.
15. Osborne, M. J., 1997, *An Introduction to Game Theory*, Forthcoming. Chapter 7 on Evolutionary Equilibrium can be downloaded from Prof. Osborne's homepage.

16. Sethi, R., Evolutionary Stability and Social Norms, *Journal of Economic Behavior and Organization*, vol. 29, pp. 113-140.
17. Usher, D., 1986, Police, Punishment and Public Goods, *Public Finance*, vol. 41, pp. 96-115.
18. Usher, D., 1997, Education as a Deterrent to Crime, *Canadian Journal of Economics*, vol. 30, pp. 367-384.
19. Zhang, J., 1997, The Effect of Welfare Programs on Criminal Behavior: a Theoretical and Empirical Analysis, *Economic Inquiry*, vol. 35, pp. 120-137.