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REBELLION, REPRESSION AND WELFARE

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Abstract

I develop a dynamic model of social conflict whereby manifest grievances of the poor generate the incentive of taking over political power violently. Rebellion can be an equilibrium outcome depending on the level of preexisting inequality between the poor and the ruling elite, the relative military capabilities of the two groups and the destructiveness of conflict. Once a technology of repression is introduced, widespread fear reduces the parameter space for which rebellion is an equilibrium outcome. However, I show that repression–driven peace comes at a cost as it produces a welfare loss to society.

JEL codes: C73, D74

Key words: Rebellion, Repression, Inequality, Markov Perfect Equilibrium

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1 INTRODUCTION

In 1993 president Melchior Ndadaye of Burundi, the first Hutu president after independence from Belgium in 1962, was assassinated by Tutsi extremists. Ndadaye's death ignited an uprise of Hutu peasants against the Tutsi elite. The Burundi military reacted by massacring Hutu civilians. In just over a year, between October 1993 and December 1995, more than 100.000 people including women and children were killed, mostly by government security forces (State Department, 1996). In 1996 the Tutsi regained full control of the government after the coup of Pierre Buyoya. A peace agreement was signed in Arusha in 2000.

Mass killings by government forces seeking to contain popular uprises were also conspicuous in neighbors Rwanda (in 1994) and Congo (1997) as well as in Afghanistan (1998) and Sudan (2003). Other examples of repression-enforced peace despite clear reasons for widespread grievance include Russia under Stalin and Iraq before the 2003 invasion. More recently Robert Mugabe reportedly jailed without trial thousands of alleged "enemies" of the government and human rights activists while trying to hold to political power in Zimbabwe. Historically there have been many societies in which leaders facing political opposition violate civil and political rights of large numbers of citizens. Violations include systematic elimination by murdering or disappearance, as well as torture and illegal imprisonment.

The technology of repression seems to be an effective instrument of appeasement. Eck and Hultman (2007) present a new dataset on one-sided violence against civilians. The authors find that while government violence is only half as frequent as violence by rebel groups, whenever there is violence by the government it generally takes the form of mass killings. So state institutions–such as the army, the police and intelligence services- are more deadly than armed opposition groups when they are repressive, especially in the case of autocracies.

Civil war and repression have been widely studied by economists and political scientists.

However by and large these have been analyzed as separate phenomena.[1] Notable exceptions are the models by Acemoglu and Robinson (2001 and 2005) and Beasley and Persson (2009) as well as the empirical analysis of Collier and Rohner (2008). Beasley and Persson (2009) study the interaction between civil war and repression and show that there is a natural ordering between peace, repression and civil war. The present paper is closer in spirit to Acemoglu and Robinson (2001) and Collier and Rohner (2008) as the technology of repression suppresses the threat of rebellion. I develop a dynamic model of rebellion and repression when there are manifest grievances that encourage a fraction of the population to change the political *status quo*. In the benchmark case, where no repression is allowed, I show the conditions under which the poor rebel against the ruling elite. Whether there is rebellion or peace depends on the initial inequality between the two groups, their relative military power, and the destructiveness of conflict. There are two reasons why rebellion can happen in the model. *Pure rebellion* may occur if conflict is anticipated not to destroy a large share of resources and the elite does not have incentives to expropriate the poor. But the poor might also rebel if they anticipate that the elite will try to expropriate them.

Once the model is extended so that the elite can make use of a repression technology to suppress uprising by the poor, the "peaceful equilibrium" survives for a larger parameter space. However, repression-enforced peace comes at the cost of reducing the aggregate welfare of society, and I show that the welfare loss is proportional to the intensity of repression.

The rest of the paper is organized as follows. Section 2 presents the benchmark model which is based on the dynamic framework by Acemoglu and Robinson (2005), and describes the conditions under which the poor rebel against the ruling elite, both for Markov Perfect and Subgame Perfect Equilibria. Section 3 introduces the technology of repression and shows that if it induces enough fear, it is more likely that the poor refrain from mounting a rebellion,

[1] Studies focusing on the incidence of civil war include Fearon and Laitin (2003) and Collier and Hoefler (2004). The case of one-sided violence by the government has been studied by Eck and Hultman (2007).

even if they have the incentive to do so in terms of the key parameters: inequality, relative military power and conflict destructiveness. Section 4 looks at the social welfare both with and without repression and Section 5 concludes.

2 BENCHMARK MODEL

2.1 Set up

There is a continuum of size 1 of individuals, which is divided in two groups: the *elite* and the *poor*. The elite constitute a fraction δ of the population, with $1-\delta$ being the fraction of poor, which is assumed to be more numerous ($\delta < 1/2$). In spite of being the minority the elite are assumed to have more political power. This reflects the fact that richer groups are more able to capture the political apparatus or manipulate the results of the elections. It may also be the case that, being less numerous, the elite are more likely to solve the collective action problem (Olson, 1965). Indeed, as in the model of social conflict of Acemoglu and Robinson (2001), the failure of the poor to solve the collective action problem at any point in time will be a key element here.

The model is dynamic. Every individual in this economy wants to maximize the present discounted value of her lifetime utility:

$$U^i = E_0 \sum_{t=0}^{\infty} \beta^t y_t^i$$

were, E_0 are the expectations based on the information available at $t = 0$, $\beta \in (0,1)$ is the discount factor and y_t is income in every period. Unlike other dynamic models where the discount factor is fixed, this is a model where repression-driven fear can update the way individuals value the present, so β will also play a key role here.

I assume that all individuals within the same social group are the same and so i only refers to whether a person belongs to the elite or the poor: $i \in \{e, p\}$. This simplification allows me to treat the game as one between only two players, no individual can be pivotal in this model. Still, to make explicit that decisions are taken at the individual level I will denote payoffs in per capita terms.

The income of each individual is equal to the per capita share of the total pie that her group receives in every period. This share depends on the relative political power of the group the individual belongs to. Let $\lambda > \frac{1}{2}$ be a measure of the political power of the elite, with $(1 - \lambda)$ being the political power of the poor. The per capita income of both groups is given by:

$$
\begin{aligned}
y_t^e &= \lambda \frac{R}{\delta} \\
y_t^p &= (1-\lambda)\frac{R}{1-\delta}
\end{aligned}
\tag{1}
$$

where R are the total resources to be distributed. It is clear that, for a given share of the population, the more powerful the elite are, the richer ever elite member will be.[2] Resources in this economy are distrubuted to social groups according to their relative political power. In this sense λ parametrizes the level of inequality in this society. Because the poor are the majority of the population $\left(\delta < \frac{1}{2}\right)$ but the elite are more powerful $\left(\lambda > \frac{1}{2}\right)$, *the poor have a constant desire to change the resource allocation outcome*. I assume that, because the elite cannot commit ex-ante to redistribute resources towards the poor, the allocation of resources

[2]Building on classic ideas by Lindbeck and Weibull (1987), Dixit and Londregan (1996) and Grossman and Helpman (1996), Acemoglu and Robinson (2005) illustrate a number of ways how the elite can be more powerful in a democracy. For instance, in a probabilistic voting setting, if the elite are less ideological than the poor they will be more likely to be swing voters and hence more likely to get higher redistribution towards them. In addition, redistribution may be influenced by campaign contributions and the elite have more resources to outbid the poor and may also be better organized to conduct lobbying activities.

can only be changed by force.[3] So, even if the 'de jure' political power favors the elite, the poor can have 'de facto' power and organize a rebellion to attempt the appropriation of R . Thus, the per-period payoffs in (1) are only relevant for periods of peace, P (defined as the absence of violence by either the poor or the elite).

In contrast, let $\rho(r^p, r^e)$, the probability that the elite appropriates by force the resources, be a function of the decision by the poor of whether to launch a rebellion or not: $r^p \in \{0, 1\}$ (with $r^p = 0$ indicating that the poor refrain from rebelling) as well as the decision by the elite of whether to fight back the rebellion: $r^e \in \{0, 1\}$.[4] Naturally, $1 - \rho((r^p, r^e)$ is the probability that the poor succeed in appropriating all the resources. I assume that $\rho(r^p = 0, r^e = 1) = 1$ and $\rho(r^p = 1, r^e = 0) = 0$.

In addition, let W be an indicator on whether fight occurs, $W = 1 - P = \max\{r^p, r^e\} = 1$. Since violence is costly for society, if $W = 1$ a fraction μ of the resources under dispute will be lost leaving only $(1 - \mu)R$ available for appropriation. Thus the per-period payoffs in time of violence are:

$$\begin{aligned} y_t^e(W) &= \rho(1-\mu)\frac{R}{\delta} \\ y_t^p(W) &= (1-\rho)(1-\mu)\frac{R}{1-\delta} \end{aligned} \tag{2}$$

But the poor cannot launch a rebellion any time they want. They first have to overcome potential collective action problems inherent with the fact that coordination into rebelling is difficult to achieve. This coordination can be achieved for reasons like negative income shocks (Miguel et al., 2004) or some sort of political twist, like the raise of a charismatic leader (Roemer, 1985). In this model coordination will only be achieved when the payoff

[3] The inability to commit has been identified by the rational choice literature as the key determinant of social conflict in the presence of disagreement about the dsitribution of the social surplus. See for example Fearon (1995), Acemoglu and Robinson (2001), Garfinkel and Skaperdas (2000) and Powell (2006).

[4] Alternatively ρ can be interpreted as the share of resources that the elite appropriates in war.

from appropriation makes it attractive to rebel. Let μ then take on two values $\{\mu^l, \mu^h\}$. When the proportion of resources destroyed if there is violence is low ($\mu = \mu^l$), what is left for appropriation is high and rebellion is more attractive. In contrast when violence-driven destruction is high ($\mu = \mu^h$), rebellion will be less attractive. Hence one can think of μ as a state variable that summarizes the threat of rebellion.

Let q be the probability that the threat of rebellion is high (i.e., the rate of destructiveness is low): $q = \Pr(\mu = \mu^l)$. Hence $(1 - q) = \Pr(\mu = \mu^h)$ is the probability that the threat of rebellion is low (because a high share of the resources available for appropriation will be lost).

Let Γ denote the infinitely repeated game described above. The timing of the game within a period t is as follows:

1. Nature moves first and sets $\mu_t = \{\mu_t^l, \mu_t^h\}$ with $\Pr(\mu_t = \mu_t^l) = q$
2. The poor observe the realization of μ_t and decide whether to launch a rebellion or not: $r_t^p = \{0, 1\}$
3. The elite observe if a rebellion is mounted and decide whether to fight back or not: $r_t^e = \{0, 1\}$
4. Payoffs are realized[5]

[5]Notice that the present model has several differences with the dynamic framework introduced by Acemoglu and Robinson (2001) –AR–. Notably, in contrast to AR's framework, in this model both the poor and the elite exert violence. Moreover events are swapped in the present model with respect to AR's framework, as rebellion takes place first and the response of the incumbent occurs later.

2.2 Equilibrium

I first solve the model by looking at Markov Perfect Equilibria (MPE). MPE are a subset of Subgame Perfect Equilibria (SPE) where actions at any point in time t do not depend on the history of the game, but only on the current state of the system. Hence, in this model the state μ_t contains all the payoff-relevant information: given the actual opportunity of rebellion each party plays the best strategy for itself irrespective of past promises or how the game was played before. In this sense, focusing on MPE strategies emphasizes potential commitment problems since what matters for decisions at any point in time are only current incentives.[6]

In the next subsection I will illustrate the nature of the commitment problem and look at the SPE. By doing so, I show that allowing for non-Markovian strategies does not produce fundamentally different results.

Definition (**Markov Perfect Equilibrium**) *Let* $\sigma^p = \{r^p\}$ *be the action taken by the poor who, after observing the current state* μ*, decide on launching a rebellion or not:* $r^p : \{\mu^l, \mu^h\} \to \{0, 1\}$*. Similarly* $\sigma^e = \{r^e\}$ *is the action taken by the elite that consist of a decision to contest the rebels or not, where this decision is contingent on the current action of the poor who move before the elite in each period:* $r^e : \{\mu^l, \mu^h\} \times \{0, 1\} \to \{0, 1\}$*. A MPE is a strategy combination* $\{\widetilde{\sigma}^p, \widetilde{\sigma}^e\}$ *such that* $\widetilde{\sigma}^p$ *and* $\widetilde{\sigma}^e$ *are best responses to each other for all* μ*.*

Before proceeding I make two assumptions, neither of which is crucial for the equilibrium outcome but make the analysis simpler:

Assumption 1 Assume that $\mu^h = 1$, so that there is a state in which violence destroys all the resources available. In such case rebellion is not attractive at all. To see this note that

[6] For a complete description of the properties of MPE see Acemoglu and Robinson (2005, Chapter 5).

when $\mu^h = 1$ the stage payoff to the poor is 0 if there is violence and $\frac{(1-\lambda)R}{(1-\delta)}$ if there is not. So the poor will not want to rebel when $\mu = \mu^h$. More formally: $r^p(\mu = \mu^h = 1) = 0$.

Assumption 2 The state μ only fluctuates after periods of peace. It ceases fluctuating once $W = 1$ so that $\mu_t = \mu_{t-1}(W = 1)$.

2.2.1 High-threat state

I start by analyzing the stage-subgame when $\mu = \mu^l$. This is the high rebellion threat state, where violence destroys a low share, μ^l, of the resources.

Let $V^i(r^i|r^{-i}, \mu)$ be the value for group i of her decision $r^i \in \{0, 1\}$ given the decision of the other group, $r^{-i} \in \{0, 1\}$, an the state $\mu = \{\mu^l, \mu^h\}$.

Solving the game by backward induction, I start by showing the elite's best response when the poor's action is to rebel, $r^p(\mu^l) = 1$. The value for elites of fighting back a rebellion when the rebellion threat is high, $V^e(1|1, \mu^l)$, is:

$$\begin{aligned} V^e(1|1,\mu^l) &= \frac{\rho(1-\mu^l)R}{\delta} + \beta V^e(1|1) \\ &= \frac{\rho(1-\mu^l)R}{\delta(1-\beta)} \end{aligned} \tag{3}$$

On the other hand, the value for the elites of fighting back the rebellion in the high threat state is:

$$V^e(0|1,\mu^l) = \frac{\rho(1-\mu^l)R}{\delta} + \beta V^e(0|1)$$

where $\rho(r^e = 0, r^p = 1) = 0$. Here, $\beta V^e(0|1)$ is the continuation value: Because today $W = 1$ (since $r^p = 1$) by Assumption 2 the state stops fluctuating. Tomorrow's value for the elite will recur, and it is discounted by β. Since $\beta \in (0, 1)$, $\rho = 0$ implies:

$$V^e(0|1,\mu^l) = 0 \tag{4}$$

Hence, since $V^e(1|1, \mu^l) > V^e(0|1, \mu^l)$,

Remark 1 *Assume $\mu = \mu^l$ so that the threat of rebellion is high. If the poor rebel the elite is better off fighting back, $r^e(r^p = 1, \mu^l) = 1$*

In contrast, if the poor do not rebel in the high threat state, $r^p(\mu^l) = 0$, the value for the elite from attacking them is:

$$\begin{aligned} V^e(1|0, \mu^l) &= \frac{(1-\mu^l)R}{\delta} + \beta V^e(1|0) \\ &= \frac{(1-\mu^l)R}{\delta(1-\beta)}, \end{aligned} \tag{5}$$

while the value from sustaining peace is:

$$V^e(0|0, \mu^l) = \frac{\lambda R}{\delta} + \beta \left[qV^e(0|0, \mu^l) + (1-q)V^e(r^e|0, \mu^h) \right] \tag{6}$$

Since the state fluctuates after periods of peace, the continuation value $\beta[qV^e(0|0, \mu^l) + (1-q)V^e(r^e|0, \mu^h)]$ depends on the future realization of μ. With probability q the high threat (low destructiveness) state recurs and with probability $(1-q)$ it shifts to the low threat state. The value for the elite in the latter state depends on the best response r^e given $r^p(\mu^h) = 0$. Since $\mu^h = 1$ it turns out that the elite will always prefer not to fight in the low threat state. If they did so their value would be zero:

$$\begin{aligned} V^e(1|0, \mu^h) &= \frac{(1-\mu^h)R}{\delta} + \beta V^e(1|0) \\ &= 0 \end{aligned} \tag{7}$$

This is because $\mu^h = 1$ and $\beta \in (0, 1)$. On the other hand, not fighting gives them the strictly positive value:

$$V^e(0|0, \mu^h) = \frac{\lambda R}{\delta} + \beta \left[qV^e(r^e|r^p, \mu^l) + (1-q)V^e(0|0, \mu^h) \right] \tag{8}$$

Hence *the elite will never attack the poor in the low threat state*, $r^e(r^p = 0, \mu^h) = 0$ and (6) becomes:

$$\begin{aligned} V^e(0|0,\mu^l) &= \frac{\lambda R}{\delta} + \beta V^e(0|0) \\ &= \frac{\lambda R}{\delta(1-\beta)} \end{aligned} \tag{9}$$

Whether the elite attacks or not when the poor refrain from turning violent in the high threat state depends on what option gives them a higher value. From equations (5) and (9) it is clear that $V^e(0|0,\mu^l) > V^e(1|0,\mu^l)$ if and only if:

$$\lambda > 1 - \mu^l.$$

Remark 2 *Assume $\mu = \mu^l$ so that the threat of rebellion is high. If the poor do not rebel the elite will reciprocate as long as $\lambda > 1 - \mu^l$. If however $\lambda < 1 - \mu^l$ then the elite will attack.*

Thus, in deciding whether to turn violent given that the poor remain peaceful the elite compares between the share of the total revenue it can get under peace, λ, and the share that survives destruction if conflict occurs, $1 - \mu^l$. Recall that λ parametrizes the level of inequality. Remark 2 suggests that for a given destructiveness of conflict the greater the inequality the less incentive will have the elite to contest violently the low resource share of the poor.

The poor take into account the best responses of the elite–summarized in Remarks 1 and 2–to decide whether or not to rebel when $\mu = \mu^l$. Combining Remarks 1 and 2, when $\lambda < 1 - \mu^l$, the elite will attack regardless of whether the poor rebel or not. The poor take this into account and compare $V^p(1,1,\mu^l)$ and $V^p(0,1,\mu^l)$ to make their decision. While remaining peaceful will leave them with a value of zero, the payoff from launching an rebellion is:

$$\begin{aligned} V^p(1,1,\mu^l) &= \frac{(1-\rho)(1-\mu^l)R}{(1-\delta)} + \beta V^c(1,1,\mu^l) \\ &= \frac{(1-\rho)(1-\mu^l)R}{(1-\delta)(1-\beta)} \end{aligned} \tag{10}$$

which is strictly positive so $\lambda < 1 - \mu^l$ is a sufficient condition for the poor to rebel and the elite to fight back.

Lemma 3 ***(Rebellion anticipating expropriation by the elite)*** *Assume $\mu = \mu^l$ so that the threat of rebellion is high. Assume further that $\lambda < 1 - \mu^l$ so that the elite get a larger share of resources if they attack the peacefully-behaved poor than if they reciprocate peace. Anticipating this the poor will rebel as they are better off doing so than remaining peaceful. Then $r^p(\mu^l) = r^e(\mu^l) = 1$*

However $\lambda < 1 - \mu^l$ *is* not a *necessary* condition for a violent equilibrium to take place.

Lemma 4 ***(Pure rebellion)*** *Assume $\mu = \mu^l$ so that the threat of rebellion is high. Assume further that $\lambda > 1 - \mu^l$ so that it is not worthwhile to the elite to attack the peacefully-behaved poor. Then:*

- $r^p(\mu^l) = r^e(\mu^l) = 1$ *If* $\mu^l \leq \mu^*$
- $r^p(\mu^l) = r^e(\mu^l) = 0$ *If* $\mu^l > \mu^*$

where $\mu^* = 1 - \frac{1-\lambda}{1-\rho}$

Proof. See appendix. ■

Lemma 4 says that in the high threat state, when the level of inequality is such that they can get a greater share of the total resources under peace, the poor will rebel as long as war doesn't waste too much resources. If this is the case the elite will fight back. But when war is destructive enough both the poor and the elite will remain peaceful. Note that the critical value of destructiveness μ^* depends positively on the level of inequality (λ) and in the probability that the poor appropriates all the resources violently ($1 - \rho$).

2.2.2 Low-threat state

Let's now look at the stage-subgame where $\mu = \mu^h$, and by assumption 1, $r^p(\mu^h) = 0$.

Recall from (7) and (8) that $V^e(0|0, \mu^h) > V^e(1|0, \mu^h) = 0$ and the elite will never attack the poor in the low-threat state. Hence we have:

Lemma 5 ***(Destruction-enforced peace)*** *Assume $\mu = \mu^h$ so that the threat of rebellion is low. Then $r^p(\mu^h) = r^e(\mu^h) = 0$.*

Lemmas 3, 4 and 5 fully characterize the MPE of the infinitely repeated game Γ:

Proposition 6 *There is a unique Markov Perfect Equilibrium, $\{\widetilde{\sigma}^p, \widetilde{\sigma}^e\}$, of the infinitely repeated discounted game Γ. Let μ^* be defined as in Lemma 4. In in equilibrium:*

I. When $\mu = \mu^l$:

1. *If* $\lambda < 1 - \mu^l$, *then* $r^p = r^e = 1$
2. *If* $\lambda > 1 - \mu^l$:

- If $\mu^l \leq \mu^*$ *then* $r^p = r^e = 1$
- *If* $\mu^l > \mu^*$ *then* $r^p = r^e = 0$

II. When $\mu = \mu^h$ then $r^p = r^e = 0$

Figure 1 describes the parameter space that characterizes de equilibrium of the benchmark scenario. In the low destruction (high rebellion threat) state, when the share of the state revenue the elite can grab is bigger under violence ($\lambda < 1 - \mu^l$) then the poor anticipate an elite's aggression and will always launch a rebellion. The elite in turn will always fight back (*rebellion anticipating expropriation by the elite*, area A in Figure 1a). But when peace is more profitable than violence for the elite ($\lambda > 1 - \mu^l$), the poor will only rebel when the destructiveness of violence is lower than the threshold μ^*. If the rebellion is carried out the elite will fight back (*pure rebellion*, area B). On the other hand, if such threshold is not met ($\mu < \mu^*$), then both the poor and the elite will remain peaceful (*destruction-enforced peace*, area C).

In turn, in the high destruction (low rebellion threat) state the poor will not revolt and the elite will not turn violent either.

<Figure 1 about here>

That is, in a dynamic setting, the ability of the poor/elite to restrain from fighting (i.e, the credibility of their promises) depends on the future state of the system –which fully determines the allocation of *de facto* political power–. If the probability q of a high threat state is high the poor are likely to have (de facto) power in the future so any promises made today not to fight are not credible and the elite prefers to attack ($r^e = 1$) when it's not attacked ($r^p = 0$) to secure control thereafter over all the resources.

I will now show that allowing for non-Markovian strategies by focusing on subgame perfection instead does not produce fundamentally different results.

2.3 The role of promises in sustaining peace

The inability to commit has been identified as the key determinant of social conflict in the presence of disagreement about the distribution of the social surplus (see Fearon, 1995 and Powell, 2006 amidst other authors). In this subsection I start by illustrating how the commitment problem arises in this model: the elite cannot commit to reciprocate a peaceful initiative by the poor irrespective of the state of the system and hence the poor cannot commit not to rebel when there is the opportunity to do so and the rebellion is profitable. Then I show how looking at non-Markovian strategies can overcome the inherent inability to commit only partially, so that the spirit of Proposition 6 remains even if one looks at the SPE.

The ability of the elite to reciprocate peace depends of the state of nature. Recall from (12) and (7) that If $\mu = \mu^h$ then $V^e(0|0, \mu^h) > V^e(1|0, \mu^h) = 0$ and hence it is in the best interest of the elite not to attack the poor in the low-threat state.

However, if $\mu = \mu^l$ whether or not $r^e(r^p = 0, \mu^l) = 0$ depends on the share of revenue the elite can get if they attack, $1-\mu^l$, *vis-a-vis* the share they can get if remaining peaceful, which is in turn given by their political power, λ. From (9) and (5) we have that $V^e(0|0, \mu^l) > V^e(1|0, \mu^l)$ if and only if $\lambda > 1-\mu^l$. If that is the case then peace will be reciprocated but if the inequality does not hold then it is not in the best interest of the elite to reciprocate peace in the high-threat state and any promise of doing so is not credible.

Hence if $\mu = \mu^l$ and $\lambda < 1 - \mu^l$ the elite cannot commit not to reciprocate peace, $r^e(r^p = 0, \mu^l) = 1$, so in turn the poor cannot commit not to launch a rebellion given that $V^p(1, 1, \mu^l) > V^p(0, 1, \mu^l) = 0$.

Now I turn to the analysis of SPE. Since the MPE solution concept abstracts from the history of the game, past promises are not taken into account and all that matters for current decisions is the current realization of the state of nature. In this way MPE emphasizes the inability to commit not to fight. In turn the SPE solution concept does take into account how the game was played so promises do play a role. The question is to what extent these are enough to make peace sustainable. Alternatively, the question is to what extent the MPE solution concept bias the results towards fighting rather than peace. As it turns out, this bias is very small, and the essence of Proposition 6 lingers in the sense that war will happen in the high-threat state as long as it's destructiveness is below a critical threshold, $\mu^l < \mu^*$.

To illustrate this, suppose the elite and the poor promise not to fight regardless of the state of the system and this promise is reciprocated and supported by the threat of future punishments. Under what conditions can this be an equilibrium? The payoff of the poor if they stick to the promise is equal to the present value of remaining peaceful for ever: $V^p(0,0,\mu) = \frac{(1-\lambda)R}{(1-\delta)} + \beta V^p(0,0,\mu)$, so $V^p(0,0,\mu)$ recurs regardless of the state. This can be written as:

$$V^p(0,0,\mu) = \frac{(1-\lambda)R}{(1-\delta)(1-\beta)}$$

However, if they deviate and rebel they will get:

$$V^p(1,1,\mu^l) = \frac{(1-p)(1-\mu^l)R}{(1-\delta)(1-\beta)}$$

which captures the idea that rebellion can only happen in the high-threat state and that any deviation from the promised behavior will be punished for ever after. Hence the poor will keep the promise as long as $V^p(0,0,\mu) > V^p(1,0,\mu^l)$ which implies: $(1-p)(1-\mu^l) < 1-\lambda$ or $\mu^l > \mu^*$. Note that this condition is identical to part I-2 of Proposition 6.

In turn, the elite promise to reciprocate peace under the threat of being punished forever after if they deviate. Sticking to the promise gives them a payoff:

$$V^e(0|0,\mu) = \frac{\lambda R}{\delta(1-\beta)},$$

and deviation will be punished forever after so that:

$$\begin{aligned} V^e(1|0,\mu^l) &= \frac{(1-\mu^l)R}{\delta} + \beta V^e(1|1,\mu^l) \\ &= \frac{(1-\mu^l)R}{\delta} + \beta\frac{p(1-\mu^l)R}{\delta(1-\beta)} \end{aligned}$$

where the first term gives the one-time-only value of defection and the second is the present discounted value of future reprisals. Hence elite will renege from their promise if:

$$\lambda < (1-\mu^l)\left[1-\beta(1-p)\right]$$

Thus we have:

Proposition 7 *There is a unique Subgame Perfect Equilibrium,* $\{\widehat{\sigma}^p, \widehat{\sigma}^e\}$, *of the infinitely repeated discounted game* Γ*. Let* μ^* *be defined as in Lemma 4. In in equilibrium:*

I. When $\mu = \mu^l$:

1. *If* $\lambda < (1 - \mu^l)\left[1 - \beta(1-p)\right],$ *then* $r^p = r^e = 1$
2. *If* $\lambda > (1 - \mu^l)\left[1 - \beta(1-p)\right]:$

- If $\mu^l \leq \mu^*$ *then* $r^p = r^e = 1$
- *If* $\mu^l > \mu^*$ *then* $r^p = r^e = 0$

II. When $\mu = \mu^h$ then $r^p = r^e = 0$

This proposition is equivalent to Proposition 6 with the only difference that when looking at Markovian strategies the condition condition for λ is $\lambda < (1 - \mu^l)$ instead of $\lambda < (1 - \mu^l)\left[1 - \beta(1-p)\right]$. Note that $(1 - \mu^l)\left[1 - \beta(1-p)\right] < (1 - \mu^l)$ because $\beta(1-p) > 0$. So once we allow for non-Markovian strategies we have survival of peace for a larger set of parameter values (area $C' > C$, see Figure 2). That is, promises can go some way toward solving commitment problems but the underlying commitment problem will remain. So there is a limited ability to keep peace promises and the spirit of Proposition 6 applies also to non-Markovian strategies (Proposition 7).

<Figure 2 about here>

3 Repression

Turning back to the focus on Markovian strategies I now introduce a simple extension to the benchmark model. Suppose that, in addition to contesting the rebellion, the elite can use repression to punish a rebellion attempt. Repression is defined as one-sided indiscriminate violence by the incumbent to hold political power, effectively reducing the challenge by the opposition. It includes extra-judicial executions and political murder, illegal jailing and torture. Such unmeasured repression is common in weakly institutionalized states that experience a rebellion threat. The purpose of indiscriminate repression is to generate a general climate of fear in order to meet a particular political objective. Fear is widespread because, beyond the victim, repression persuades a much wider audience.

I model this fear in a reduced-form way: in the face of repression (say mass killings) the poor assign a higher value to the present relative to the future. Hence, the discount factor of the poor under repression is $\widehat{\beta}$, which I assume lower than the benchmark β. Alternatively, in the context of dynamic games one can think of β as the probability of surviving to the next period $t+1$. Under this interpretation repression can be thought as reducing the survival probability for the average poor.

Let then $\widehat{\beta} < \beta$ be the discount value for the poor when there is repression. Let Γ' denote the new infinitely repeated game. The poor and the elite play now the same game as before, but with the following exception:

Assumption 3 Assume the elite only use repression after periods of violence. That is, repression in t will not happen if $W_{t-1} = 0$.

The timing of the game within a period t is as follows:

1. Nature moves first and sets $\mu_t = \{\mu_t^l, \mu_t^h\}$ with $\Pr(\mu_t = \mu_t^l) = q$
2. The poor observe the realization of μ_t and decide whether or not to mount a rebellion: $r_t^p = \{0, 1\}$
3. The elite observe if a rebellion is mounted and decide whether or not to fight back: $r_t^e = \{0, 1\}$

4. If $W_t = \max\{r_t^p, r_t^e\} = 1$ then the elite will launch a repression campaign

5. Payoffs are realized

Proposition 8 *There is a unique Markov Perfect Equilibrium,* $\{\widetilde{\sigma}^p, \widetilde{\sigma}^e\}$, *of the infinitely repeated discounted game* Γ'. *Let* $\mu^{**} = 1 - \frac{(1-\lambda)(1-\widehat{\beta})}{(1-\rho)(1-\beta)}$, *in equilibrium:*

I. When $\mu = \mu^l$:

1. *If* $\lambda < 1 - \mu^l$, *then* $r^p = r^e = 1$

2. *If* $\lambda > 1 - \mu^l$:

- If $\mu^l \leq \mu^{**}$ *then* $r^p = r^e = 1$

- *If* $\mu^l > \mu^{**}$ *then* $r^p = r^e = 0$

II. When $\mu = \mu^h$ then $r^p = r^e = 0$

The proof of Proposition 8 follows the same steps than that of Proposition 6 (see appendix), with $\widehat{\beta}$ as the discount factor for the value of the poor when $W_t = 1$.

Note that because of the assumption $\widehat{\beta} < \beta$ it follows that $\mu^{**} < \mu^*$. This implies that in the presence of repression the violent equilibrium $r^p = r^e = 1$ when $\lambda > 1 - \mu^l$ (that is *pure rebellion*) is more difficult to achieve as it is necessary a realization of μ such that the resources left over after war are bigger than in the case without repression (area $B'' < B$, see Figure 3). That is, in this model (the threat of) repression makes peace more likely (area $C'' > C$) and thus elite members can continue appropriating a bigger share of the resources $\frac{\lambda R}{\delta}$ every period at the expense of the poor who receive only $\frac{(1-\lambda)R}{(1-\delta)}$, with $\lambda > \frac{1}{2} > \delta$. In addition it is worth noting that $\frac{\partial \mu^{**}}{\partial \widehat{\beta}} > 0$, which implies that the *intensity of repression* (and thus the gap between β and $\widehat{\beta}$) is also positively related with the hazard of peace (C'' increases as μ^{**} reduces whit lower $\widehat{\beta}$). More repressive incumbents are more likely to repress rebellion attempts.

<*Figure 3 about here*>

4 Welfare

The main result of the model described above is that the violent equilibrium, $r^p = r^e = 1$, is less likely to occur when there is a repressive elite than in the absence of the repression technology. This is because when indiscriminate repression is carried out the poor is less willing to turn violent unless their payoff from doing so is sufficiently large to offset the higher probability of getting killed. Hence, the realization of μ needs to be small enough such that most of the resources under dispute survive destruction (and the rebellion threat is sufficiently high). Peace is then more likely when there is repression, but this occurs at a cost. In addition to the fact that repression involves massive assassination and thus its threat enforces a fear-based peace, the total welfare in this scenario shrinks compared to a scenario in which repression is absent. To see this I define Social Welfare (SW) as the sum of the value of all the elite members and the value of all the poor.

To simplify the analysis I assume that $\lambda > 1 - \mu^l$ and that $\mu^l \leq \mu^{**} < \mu^*$ so that the Markov Perfect equilibria described in propositions 6 and 8 can be reduced to the following statement:

Proposition 9 *If $\mu = \mu^l$, then $r^p = r^e = 1$. But if $\mu = \mu^h$, then $r^p = r^e = 0$.*

So a rebellion will be launched –and it will also be contested–whenever the state is such that destructiveness is low and hence the threat of rebellion is high. On the other hand there will be no violence by neither group under the low threat state. Then, total welfare will be given by:

$$
\begin{aligned}
SW &= q[\delta V^e(1|1,\mu^l) + (1-\delta)V^p(1,1,\mu^l)] \\
&\quad +(1-q)[\delta V^e(0|0,\mu^h) + (1-\delta)V^p(0,0,\mu^h)] \qquad (11)
\end{aligned}
$$

where the state is μ^l with probability q and μ^h with probability $(1-q)$, and the value functions $V^e(\cdot)$ and $V^p(\cdot)$ are summed-up across all elite members, δ, and all the poor, $(1-\delta)$, respectively.

Expressions for $V^e(1|1,\mu^l)$ and $V^p(1,1,\mu^l)$ are given respectively by (3) and (10). Recall from (8) that $V^e(0|0,\mu^h)$ depends on the continuation value if the state shifts to $\mu^l : V^e(r^e|r^p,\mu^l)$. Since here I am focusing on the special case in which $\mu = \mu^l$ implies $r^p = r^e = 1$ then:

$$
V^e(0|0,\mu^h) = \frac{\lambda R}{\delta} + \beta\left[qV^e(1|1,\mu^l) + (1-q)V^e(0|0,\mu^h)\right]
$$

which using (3) becomes:

$$
V^e(0|0,\mu^h) = \frac{R}{\delta\left[1-\beta(1-q)\right](1-\beta)}\left[\lambda(1-\beta) + \beta qp(1-\mu^l)\right] \qquad (12)
$$

Likewise, $V^p(0,0,\mu^h)$ is a function of the continuation value $V^p(r^p,r^e,\mu^l)$ which under the current scenario is equal to $V^c(1,1,\mu^l)$. This in turn is given by (10). Hence,

$$
\begin{aligned}
V^p(0,0,\mu^h) &= \frac{(1-\lambda)R}{(1-\delta)} + \beta\left[qV^p(1,1,\mu^l) + (1-q)V^p(0,0,\mu^h)\right] \\
&= \frac{R}{(1-\delta)\left[1-\beta(1-q)\right]}\left[(1-\lambda) + \frac{\beta q(1-p)(1-\mu^l)}{(1-\beta)}\right] \qquad (13)
\end{aligned}
$$

After some algebra, substitution of (12) and (13) into (11) yields the equilibrium Social Welfare expression:

$$
SW = \frac{Rq(1-\mu^l)}{(1-\beta)} + \frac{R(1-q)}{[1-\beta(1-q)]}\left[1 + \frac{\beta q(1-\mu^l)}{(1-\beta)}\right] \qquad (14)
$$

Recall that when repression is introduced in the game the discount factor for civilians is $\widehat{\beta} < \beta$ whenever $W_t = 1$. This implies that:

$$V^p(1,1,\mu^l) = \frac{(1-p)(1-\mu^l)R}{(1-\delta)\,(1-\widehat{\beta})}$$

Substitution of this expression into (11) both directly and through the continuation value of $V^p(0,0,\mu^h)$ yields a total Social Welfare (under repression, SW^r) of:

$$\begin{aligned} SW^r &= Rq(1-\mu^l)\left[\frac{\overline{p}}{(1-\beta)} + \frac{(1-p)}{(1-\widehat{\beta})}\right] + \\ &\quad + \frac{R(1-q)}{[1-\beta(1-q)]}\left[1 + \frac{\beta q p(1-\mu^l)}{(1-\beta)} + \frac{\beta q(1-p)(1-\mu^l)}{(1-\widehat{\beta})}\right] \end{aligned} \tag{15}$$

Note that (14) and (15) are equivalent if and only if $\widehat{\beta} = \beta$. Conversely, it can be shown that $SW^r < SW$ as long as the assumption $\widehat{\beta} < \beta$ holds. Note also that the bigger the gap between $\widehat{\beta}$ and β, the bigger the difference between SW and SW^r. Hence we have:

Proposition 10 *i) Repression increases the probability of peace but reduces the total welfare: $SW^r < SW$; ii) The welfare loss is proportional to the intensity of the repression: $\frac{\partial SW^r}{\partial(\beta-\widehat{\beta})} < 0$.*

5 Conclusion

While rebellion and repression have been widely studied by social scientists they have analyzed independently. I build on the dynamic framework to study political transitions by Acemoglu and Robinson (2001, 2005) and develop a model of social conflict whereby manifest grievances give the poorer fraction of the population the incentive to challenge the political power of a ruling elite. Allowing for both Markovian strategies and past promises

I show that rebellion can be an equilibrium outcome depending on the parameters of the model. Given a low destructiveness of the conflict, a higher level of preexisting inequality between the two groups increases the probability of rebellion. The chances of peace are also reduced the greater the military capability of the poor relative to the elite. In the model, the destructiveness of war is the state variable which determines whether the poor are able to solve the collective action problem and rebel against the elite.

I then introduce a technology of repression whereby the elite is allowed to respond to rebellion attempts with, say, mass killings of opposition members. The key assumption is that repression makes the poor overvalue the present relative to the future, or alternatively the probability of surviving to the next period of the average poor is lower in the presence of a repressive incumbent. Under this scenario the peaceful equilibrium becomes more likely in the sense that it survives to a larger parameter space.

Despite the fact that repression is positively related with the probability of peace, I show that society as a whole is worse off in terms of welfare when indiscriminate repression is at hand. Moreover, the welfare loss is proportional to the intensity of repression. This means that given some reasonable assumptions a repression-induced peaceful society may be worse-off than a society in which the poor manage to carry-out a rebellion.

6 References

Acemoglu, K. D. and Robinson, J. A. (2001) A Theory of Political Transitions. *American Economic Review* 91(3): 938-963.

Acemoglu K. D. and Robinson, J. A. (2005) *Economic Origins of Dictatorship and Democracy.* Cambridge University Press.

Beasley, T. and Persson, T. (2009) Repression or Civil War. *American Economic Review, Papers and Proceedings* 99: 292-297.

Collier, P. and Hoeffler, A. (2004) Greed and Grievance in Civil War. *Oxford Economic Papers* 56: 563-595.

Collier, P. and Rohner, D. (2008) Democracy, Development and Conflict. *Journal of the European Economic Association* 6(2-3): 531-540.

Dixit, A. K. and Londregan, J. B. (1996) The Determinants of Success of Special Interests in Redistributive Politics. *Journal of Politics* 58: 1132:1155.

Eck, K. and Hultman, L. (2007) One-Sided Violence Against Civilians in War: Insights from New Fatality Data. *Journal of Peace Research* 44(2): 233-246.

Fearon, J. D. (1995) Rationalist Explanations for War. *International Organization* 49: 379-414.

Fearon, J. D. and Laitin, D. (2003) Ethnicity, Insurgency, and Civil War. *American Political Science Review* 97(1): 75-90.

Garfinkel, M. and Skarperdas, S. (2000) Contract or War?. *American Economist* 441(1): 5–16.

Grossman, G. and Helpman, E. (1996) Electoral Competition and Special Interest Politics. *Review of Economic Studies* 63: 265-286.

Lindbeck, A. and Weibull, J. (1987) Balanced-Budget Redistribution as the Outcome of Political Competition. *Public Choice* 52: 272-297.

Miguel, E., Satyanath, S. and Sergenti, E. (2004) Economic Shocks and Civil Conflict: An Instrumental Variables Approach. *Journal of Political Economy* 112(4): 725-753.

Olson, M. (1965) *The Logic of Collective Action: Public Goods and the Theory of Groups,* Cambridge, Harvard Economic Studies.

Powell, R. (2006) War as a Commitment Problem. *International Organization* 60: 169–203.

Roemer J. (1985) Rationalizing Revolutionary Ideology. *Econometrica* 53(1): 85-108.

State Department (1996). *Burundi Country Report on Human Rights Practices for 1996*, available online at: http://www.state.gov/www/global/human_rights/1996_hrp_report/burundi.html (last access 05/03/09).

7 Appendix

7.1 Lemma 4

Proof. Recall from Remark 2 that if $\lambda > 1 - \mu^l$ then $V^e(0|0, \mu^l) > V^e(1|0, \mu^l)$. In addition, Remark 1 implies that $V^e(1|1, \mu^l) > V^e(0|1, \mu^l)$, so overall, when $\lambda > 1 - \mu^l$ the elite will fight back if attacked and remain peaceful if no rebellion is carried out. The poor take this into account and decide whether it is in their best interest to turn violent or stay peaceful. In the first case their value is given by equation (10). In turn, their payoff from staying peaceful :

$$V^p(0, 0, \mu^l) = \frac{(1-\lambda)R}{1-\delta} + \beta[qV^p(0, 0, \mu^l) + (1-q)V^p(0, 0, \mu^h)]$$

where the continuation value in the low threat state has $r^e(r^p = 0, \mu^h) = 0$ since $V^e(0|0, \mu^h) > V^e(1|0, \mu^h) = 0$ which follows from comparing (8) and (7). Hence:

$$V^p(0, 0, \mu^l) = \frac{(1-\lambda)R}{(1-\delta)(1-\beta)} \tag{16}$$

The poor will revolt as long as $V^p(1, 1, \mu^l) > V^p(0, 0, \mu^l)$, a condition which is met as long as the expected share of revenue after rebellion is greater than the share they can obtain by remaining peaceful, which is in turn determined by the political power of the elite, λ. Formally,

$$(1-p)(1-\mu^l) > (1-\lambda)$$

Solving for μ, this implies that the poor will rebel (and the elite will fight back) when the high state is such that the destructiveness of war is lower than a critical threshold: $\mu^l \leq \mu^*$, with μ^* defined as:

$$\mu^* = 1 - \frac{1-\lambda}{1-p}$$

Otherwise, if $\mu^l > \mu^*$, destructiveness is high enough to dissuade the poor not to rebel; a choice that the elite will reciprocate. ■

7.2 Proposition 8

Proof. When repression is allowed, since the discount factor of the elite is unchanged, $V^e(1|1,\mu^l)$ is still equal to $\frac{\rho(1-\mu^l)R}{\delta(1-\beta)}$ and $V^e(0|1,\mu^l)$ is still 0 as in equations (3) and (4) respectively. Hence Remark 1 of the benchmark case holds in this scenario. Because $V^e(1|0,\mu^l)$ and $V^e(0|0,\mu^l)$ from equations (5) and (9) are also unchanged, Remark 2 also holds.

However, the discount factor of the poor does change, becoming $\widehat{\beta} < \beta$ whenever there is repression, which by *Assumption 3* only happens after periods of violence. Hence $V^p(1|1,\mu^l)$ changes to $\frac{(1-\rho)(1-\mu^l)R}{(1-\delta)(1-\widehat{\beta})}$ which is smaller than its previous value $\frac{(1-\rho)(1-\mu^l)R}{(1-\delta)(1-\beta)}$ since $\widehat{\beta} < \beta$.

The poor will revolt as long as $V^p(1|1,\mu^l) > V^p(0|0,\mu^l)$. Because it does not involve repression, the latter value remains unchanged and it is given by equation (16) in the previous section of the appendix. Thus the poor will revolt as long as:

$$\frac{(1-\rho)(1-\mu^l)R}{(1-\delta)\,(1-\widehat{\beta})} \geq \frac{(1-\lambda)R}{(1-\delta)\,(1-\beta)}$$

$$\mu \leq \mu^{**}$$

where $\mu^{**} = 1 - \frac{(1-\lambda)(1-\widehat{\beta})}{(1-\rho)(1-\beta)}$. Otherwise (if $\mu^l > \mu^{**}$) the poor will remain peaceful. ■

FIGURE 1

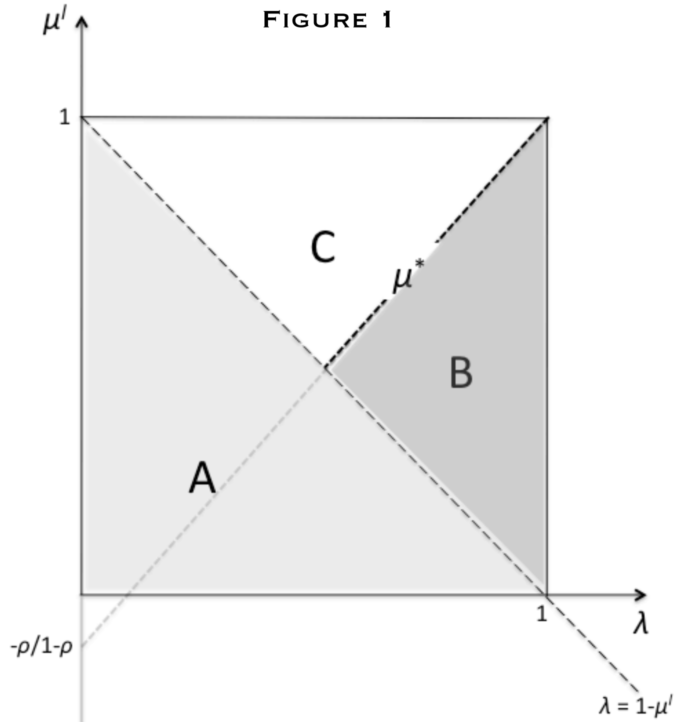

Figure 1 relates the destructiveness of war under the low-threat state, μ^l, with the political power of the elite under peace, which is give by the level of inequality, λ (the maximum value the two parameters can take is 1) The negative-sloped line $\lambda = 1-\mu^l$ divides the parameter space in two. Area A describes the space in which rebellion occurs in anticipation of expropriation by the elite. This happens because the elite get a larger share of resources if they attack the peacefully behaved poor than if they reciprocate peace, $\lambda < 1-\mu^l$. Anticipating this the poor will rebel, as they are better off doing so than remaining peaceful (see Lemma 3). If the opposite is true, $\lambda > 1-\mu^l$, whether war occurs or not depends on how destructive it is. If μ^l is larger than a threshold, μ^*, which is in turn positively related with inequality (and the intercept of which depends on the probability, ρ, that the elite wins the war) then war will be avoided because it is too destructive (area C, see Lemma 5). If not, the poor will find it profitable to rebel and the elite will fight back (area B, Lemma 4).

FIGURE 2

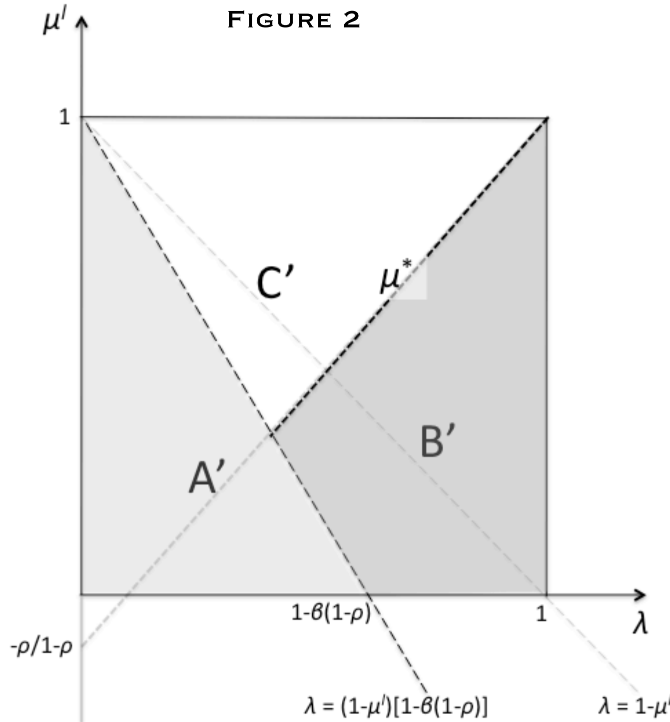

Figure 2 shows how the Markov Perfect Equilibrium described in Figure 1 changes when looking at Subgame Perfect Equilibria. What changes with respect to Figure 1 is the condition for a rebellion anticipating expropriation by the elite. This outcome becomes less likely (A’ < A) because the elite can now make promises not to expropriate if the poor refrain from attacking in the first stage of the game. This in turn increases the probability both of a “pure rebellion” outcome (B’ > B) and a destruction-enforced peace (C’ > C), the realization of which depends on whether war is more destructive that the threshold μ^*.

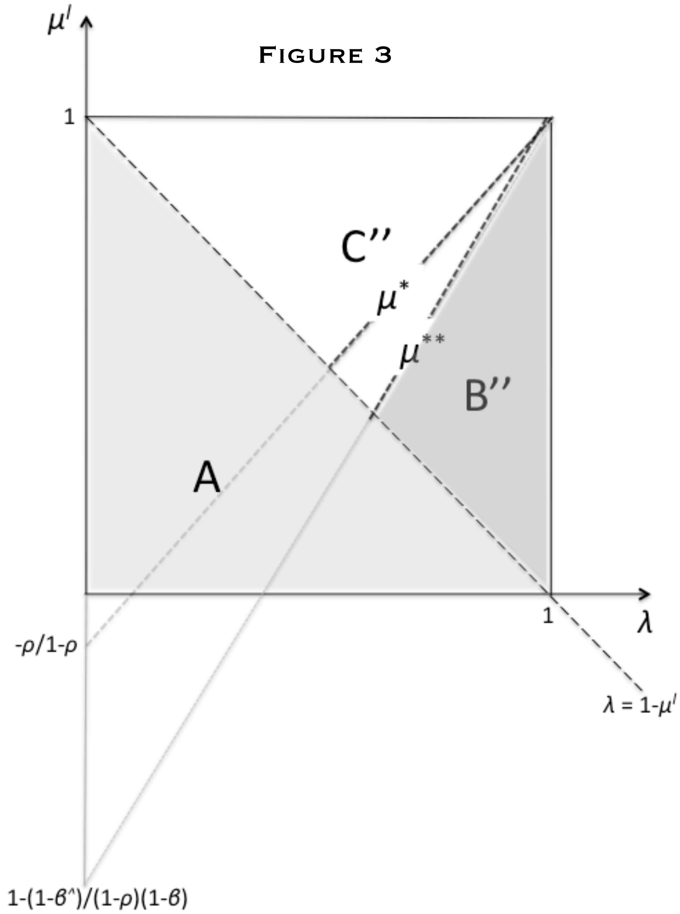

Figure 3 relates the benchmark scenario of Figure 1 with the case of repression. The useof the latter by the elite lowers the destructiveness threshold below which the poor have incentives to rebel, hence this outcome is less likely to happen (B'' < B). This is because such threshold is now positively related with the discount factor of the poor, $\hat{\beta}$, which is smaller than the benchmark. Notice that under this scenario C'' > C, which implies that the peaceful outcome is now more likely.