On the Dynamics of Corruption, Civil Wars, and the Distribution of Wealth: Is There Hope?

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Very Preliminary and Incomplete - Comments Welcome†

Abstract

In this paper we argue that corruption by politicians works as the key-defining device for the evolution of the distribution of wealth. This idea leads us to the characterization of equilibria in a repeated game between a political elite and the population; corruption is modelized in the context of an allocation mechanism for the control of the economy; every period the population may initiate a civil war in response to the outcome of the auction. The assumed initial distribution of wealth is found to determine the nature of the stationary equilibrium of the game in terms of the level of corruption and the frequency of civil wars: when inequality is low (high), corruption is low (high) and no (frequent) civil wars arise. Finally, incentives for these players to play low corruption (political elite) and no civil war (population) are considered. Two instruments are assumed: credit to the population, and a political elite wage contract (conditional on the level of corruption). Implications concerning their absolute and relative effectiveness are taken.

1 Introduction

Recent studies like Sala-i-Martin (2002) alert for the fact that poverty rates in vast areas of the globe like Sub-Saharan Africa have dramatically increased in the last thirty years. This is in contrast to the also stated substantial overall decrease of income inequality in the world in recent decades. Jones (1997) stresses that the world income distribution has been evolving from a uni-modal distribution to a "twin peaks" distribution (a term

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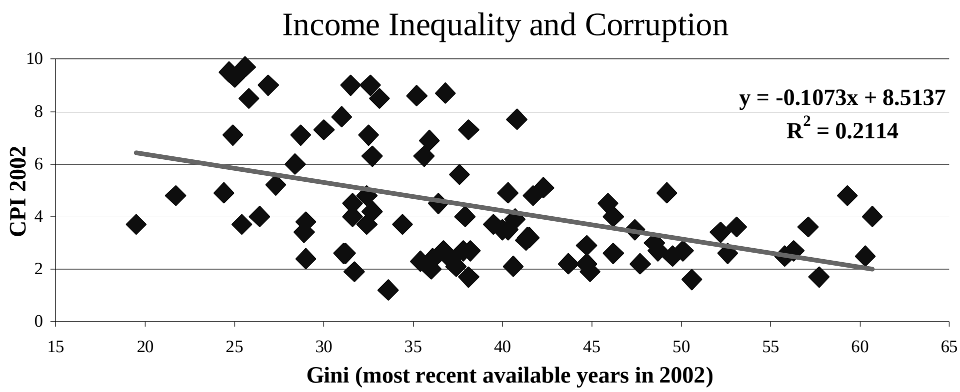
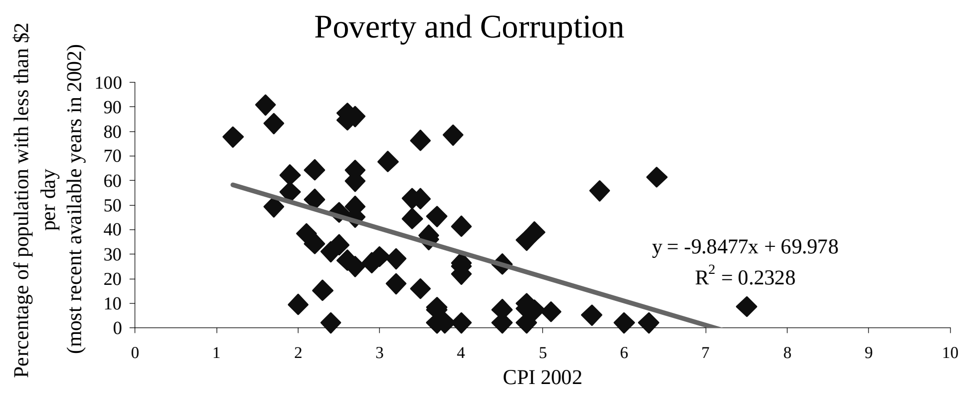
suggested by Quah (1993)), meaning that poorer countries have seen lower increases in income relative to richer nations.

Perhaps not surprisingly, recent empirical work by Gupta, Davoodi, and Alonso-Terme (1998) and Gyimah-Brempong (2002) report an important positive relation between inequality/poverty and corruption (which adds to the earlier result by Mauro (1995) of the link between lower growth and corruption), with the latter paper focusing on African countries alone. This can be seen in the following graphs for a broad set of countries.



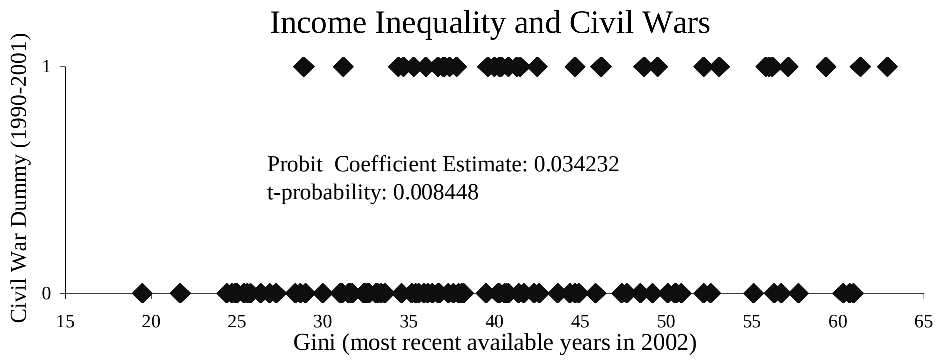
Source: Corruption Perception Index by Transparency International; Gini coefficient from World Bank, World Development Indicators (2002): Distribution of Income and Consumption.



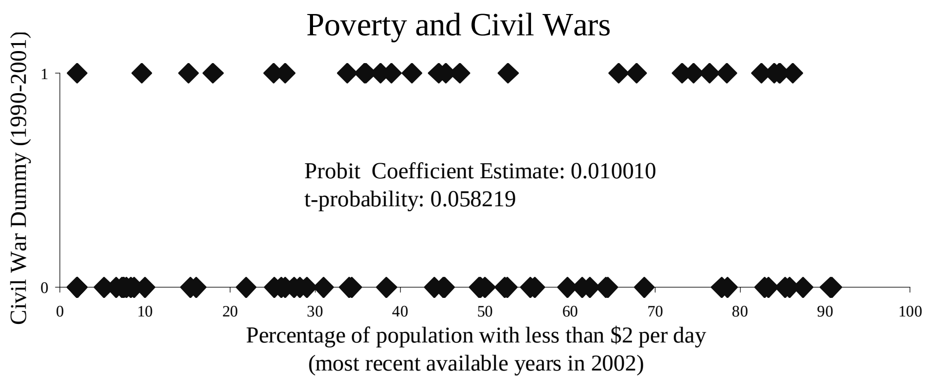
Source: Corruption Perception Index by Transparency International; Poverty measure taken from World Bank, World Development Indicators (2002), Table 2-6 .

In addition, Africa is the only continent that has seen a rise in the armed conflicts in recent years (see Collier and Hoeffler (2000)). Again, the correlation between the occurrence of civil wars and inequality/poverty is clear[1]: Imai and Weinstein (2000) quantify the negative impact of civil wars in growth. We show in the next graphs some data on these correlations.

[1]In addition, if we take democracy as an indicator of political stability (in the sense of



Source: Gini coefficient from World Bank, World Development Indicators (2002): Distribution of Income and Consumption, Table 2-8; Civil War Dummy corresponds to own calculations based on Gleditsch et al. (2002). 'Armed Conflict 1946–2001: A New Dataset', Journal of Peace Research 39(5): 615–637.



Source: Poverty measure taken from World Bank, World Development Indicators (2002), Table 2-6; Civil War Dummy corresponds to own calculations based on Gleditsch et al. (2002). 'Armed Conflict 1946–2001: A New Dataset', Journal of Peace Research 39(5): 615–637.

In this context, a curious story named Botswana is worth presenting (see Acemoglu, Johnson, and Robinson (2001)). Clearly an economic development case-study in the last decades, this African country has managed to be victorious in its quest for balanced growth. Interestingly, two major characteristics of this country recent path are: a stable political regime and developed world envy-causing indices of corruption (e.g. ranked 22nd in 102 countries of the world in Transparency International 2002 Corruption Perceptions Index).

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larger support of the political regime by the population), we can observe that about half of the countries of the world are considered to have non-democratic political regimes, from which the majority is located in Africa (the source used here is the Center for International Development and Conflict Management at the University of Maryland; more precisely the data is for the year of 2000 from a survey, Polity IV, of 161 countries). A survey by Gradstein and Milanovic (2002) presents a broad empirical foundation for the correlation between democratization and decreased inequality.

Our story makes consistent these empirical facts on income distribution, corruption, and political power. It states that a possibly finitely lived political elite (may die with successful revolution) and the population play a repeated game where every period shares of the economy are allocated by a mechanism where a political elite has an asymmetric power given by the possibility of engaging in corruption; after that, the population may respond by initiating a civil war; finally the civil war is successful or not depending stochastically on the distribution of wealth (if it succeeds, the political elite is substituted), and consumption takes place. We prove that: for some upper interval of the proportion of wealth in the political elite, it is dominant for the political elite to play high levels of corruption, for which the best response from the population is initiating a civil war; for a lower interval of the proportion of wealth in the political elite the equilibria entail low corruption and no civil war. These equilibria are self-perpetuating in the sense that the relative positions of the political elite and the population are reinforced in the resulting distributions of wealth.

This means that our basic argument corresponds to corruption being the engine through which relative power between the political elite and the population is defined dynamically. This is an inescapable game at the state level, with quite powerful equilibria at the extremes of the relative wealth.

This idea is related to the literature in several ways.

Acemoglu and Robinson (2000a, 2001), inspired by the experiences of Western Europe and Latin America, present a theory of political transitions which emphasizes the role of the threat of revolution in leading to democratization (these authors view institutional change as a credible commitment to future redistribution) and the desire of a rich elite to limit redistribution in causing switches to nondemocratic regimes: inequality emerges as a crucial determinant of political instability in both situations; democracy is more likely to be consolidated in more equal societies. Our model, aiming to a more general description of political equilibria (encompassing the present relative situation of African developing countries), substitutes fiscal redistribution (which relies on a fiscal infrastucture that does not exist in many developing countries) by corruption at the political power instrument. In addition, we are not worried about the rich elite - which in many cases just flies to other countries - but about the political elite, which may depart from zero personal wealth. Finally, we defend that the issue of democratization or switch to non-democratic regimes is not interesting by itself since it does not necessarily help us in understanding political equilibria in the developing world. We argue that the referred issue is just a possible side effect of a much more fundamental process of augmenting or diminishing corruption levels as a result of respectively decreasing or increasing shares of economic power by the population. In other words, although in many cases the political (institutional) changes are implied in the referred movements of the structure of the economy (we can think effective democratization as inherently implying a process of lowering corruption, provided different groups begin having access to political power), the latter are, in our view, more fundamental, and therefore the best perspective for analysis. To support this claim in informal terms we recall two counterexamples for the importance of democracy: many countries in Africa are "officially" democratic and still suffer from extreme corruption and inequality as well as from the civil war menace; also, many Asian states do not severely suffer from corruption and inequality but had not democratized at least in the western sense. These cases will be encompassed in our framework and results provided we focus on the fundamentals of democracy and not on democracy itself.

Other contributions on the theoretic approach to democratization are Acemoglu and Robinson (2000b) - who focus on why the choice of the rich elite may be between full democratization and repression -, Neeman and Wantchekon (2002) - who analyze the conditions under which a democracy is most likely to follow a civil war (those necessary to secure property) -, Wantchekon (2002) - who study the foundations of democracy as a long term risk sharing contract between minority and majority groups.

Robinson and Verdier (2001) present a foundation for clientelism (political exchange between a politician and a voter) as an optimal political strategy in situations where politicians cannot commit to policies: it is a way to tie the continuation utility of a voter to the political success of a particular politician. They argue that this practice is relatively more attractive in situations with high inequality and low productivity, which reinforces some of our conclusions. We essentially use this paper as a foundation for our hypothesis of the corruption step in our model (as being the considered instrument of political power). However, our concept of corruption is broader: it concerns the control of more of the economy by the political elite (who "legitimately" should control a measure zero set of the economy). This is related to a general postulate of corruption modeled in earlier work (Vicente (2003)) and introduced to the economics literature by Becker and Stigler (1974) and Rose-Ackerman (1978): a corruption game is composed of the establishment and realization of a contract (between a *principal*, whose utility increases with the enforcement of some pre-defined rule, and an *enforcer*) which defines the payoffs of an allocation game (where the *subjects* of the pre-defined rule bid for the violation or enforcement of the rule in their favor - in the auction-like game implied here the enforcer takes the role of auctioneer).

After we characterize the basic game and its equilibria as a function of different parameterizations of the initial distribution of wealth, we pose a different question: what can be done by a third party to avoid the bad paths - characterized by high patterns of corruption and civil war - we observe? This is a policy question we help answering by considering two channels of help: direct credit to the population aimed at alleviating its credit constraint, and therefore improving its bidding power, and incentive contracts on the political elite depending on the existing past path of corruption each period. The second is to the best of our knowledge a new theoretical idea in this context, while the first is the idea usually in place in help programs sponsored by institutions such as the IMF or World Bank.

In Section 2 we present the basic repeated game model. In Section 3 we characterize equilibria of the game and argue these provide an answer to the above presented empirical puzzle. In Section 4 we analyze the role of a third party interested in protecting the interests of the population, by considering different instruments for intervention. In Section 5 we conclude and provide possible ways forward for this research.

2 The Model

We present an infinitely (for dates $t = 0, ..., \infty$) repeated game model.

The agents in the model are: a continuum of households of dimension 1 representing the population, whose aggregate is denoted P; a political elite, denoted E.

We also consider in our model a set of homogeneous land of dimension 1 where wheat can be grown.

Each household x in the population, for $x \in [0,1]$, is characterized by two numbers, $a^P(x)$ and $w_0^P(x)$, respectively denoting ability (productivity) and initial wealth (which compose the household's type in the game). For simplicity of exposition we uniquely order the households (from the highest to the lowest ability and wealth) so that $a^P(.) \in A^P \subset \Re$ (representing the distribution of ability in the population), and $w_0^P(.) \in W^P \subset \Re$ (representing the distribution of wealth in the population at the beginning of period 0) are decreasing functions in x. For this we are making the simplifying assumptions of equal ranking in ability and wealth of each member of the population, and of differing ability and initial wealth among households. See Figure ahead for an illustration.

The weightless (just like any household in the population) political elite is described by a very common exogenous non-increasing (in additional infinitesimal pieces of land) marginal ability (productivity) function (her type). For graphical convenience we represent this function as a non-decreasing function $a^E(x)$, for $x \in [0,1]$ ($a^E(.) \in A^E \subset \Re$) with the interpretation for $a^E(x)$ being the marginal valuation of the $(1-x)$th infinitesimal unit of land; we use argument x here for graphical convenience provided the set of population is of the same dimension as the set of land, and land is homogeneous. We also define $w_0^E \in W^E \subset \Re$ as the wealth in the political elite at the beginning of period 0. See illustration below.

The economy in our model is a very simple one. Every period the fixed set of land (the economy) is available for use. Population and political elite compete for the control of this land (possibility of producing on a share).

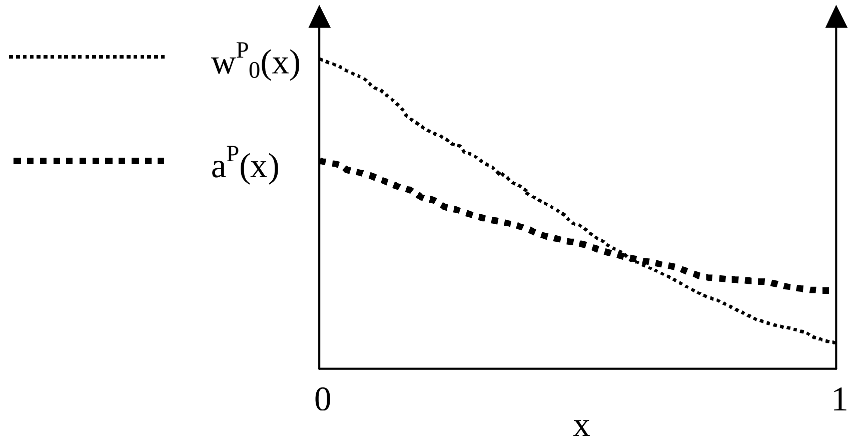


Figure 1: An illustration of the ability and wealth functions of the population.

Each of them has a marginal productivity function (benefit of the cultivated wheat) of shares of this land, which correspond to the already presented $a^P(.)$ and $a^E(.)$.

The way allocation is modeled in our stage game is by way of the following basic rules: each member of the population bids for an infinitesimal unit of land (we denote the corresponding bid function as $b_t^P(x)$ for $x \in [0,1]$, assuming that $b_t^P(.) \in B^P \subset \Re$); given the move by the population, the political elite chooses a share of the land for herself (and therefore for the population, where the highest bidders get the control). This procedure defines, for the winners over the land control, a level of necessary expenditure p_t (for each infinitesimal unit of land) in "wheat seeds" for production: this correponds to the bid level of the population at the chosen share.

This could be viewed as the result of a *share auction* (see Wilson (1979)), though we will not use this postulate explicitly, where an auctioneer sells shares of this land. However, this auctioneer does not require other "payments" than the anticipated purchase of the seeds for production (there are no revenues for the auctioneer). This means that before engaging in production, each player has to bid seeds for an infinitesimal piece of land (in the case of a household) or for a share of land (in the case of the political elite). The payment for each infinitesimal piece of land would be defined by the intersection of the bid functions of the population (composed of all the households' bids ordered from the highest to the lowest) and the political elite (ordered from the lowest marginal bid to the highest).

In addition, we assume that the members of the population are credit constrained in the sense that if their wealth is lower than the amount they want to bid, they can just bid what they have; the political elite is assumed

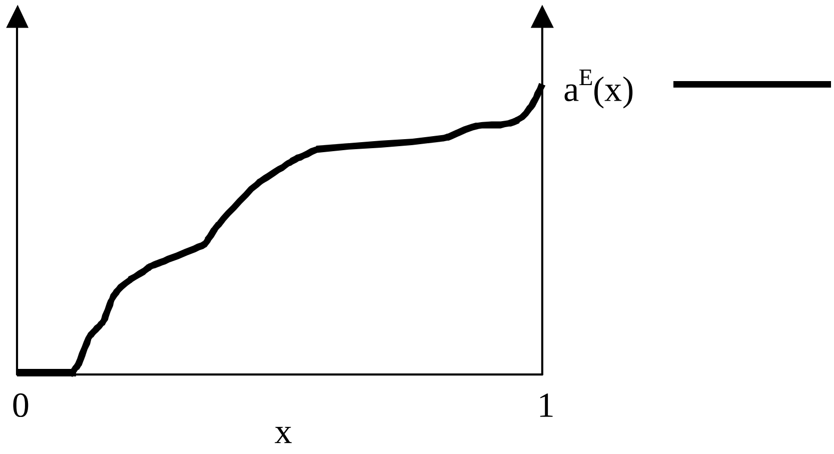


Figure 2: An illustration of the ability function for the political elite.

not to be credit constrained for simplicity.

We now describe more precisely the complete stage game we consider. We can divide it in four sequential playing nodes:

1. every household in P plays by bidding for an infinitesimal piece of the control of the economy, therefore presenting an overall action b_t^P : $[0,1] \rightarrow \Re$;

2. E plays by deciding the share of the land she wants to control in the period; we define this share as λ_t^c, with $\lambda_t^c \in [0,1]$; this share is interpreted as the measure of corruption in our model provided the political elite is assumed to control the enforcement of the rule *every agent* (all are weightless) *should have a weighless control of the economy* (i.e. the political elite should not use her asymmetric power at own benefit); this means that no corruption chosen would correspond to a weigthless share of the land chosen by E; notice that at this stage the allocation of shares is defined and so are the payments (the seeds purchases); an illustration of the allocation mechanism is below;

3. P plays as an aggregate by deciding to initiate or not a civil war; we define this strategy as the value for variable ω_t, which may be 1 in case a civil war is decided and 0 otherwise ($\omega_t \in \{0,1\}$); if $\omega_t = 1$, the economy does not work in period $t+1$ (the allocation of the control of the land does not take place) so that there are no decisions to be made at that period (as we will see shortly) - the stage game returns at period $t+2$;

4. in the case a civil war was initiated in the last step, nature plays by

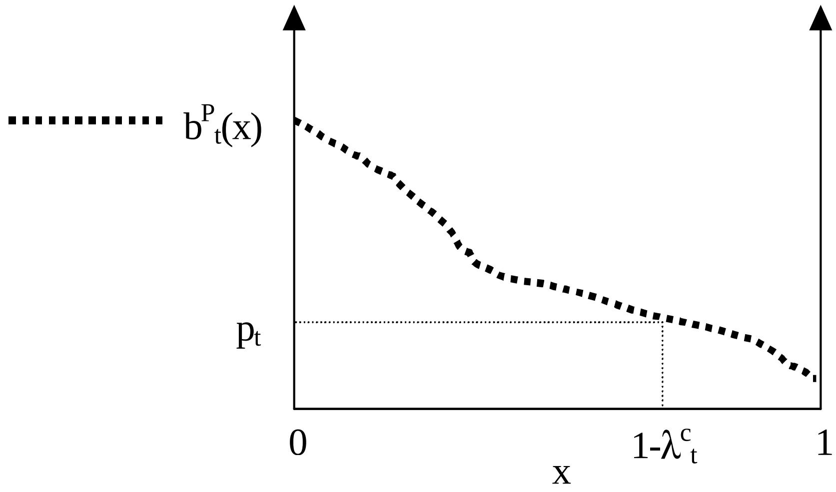


Figure 3: An illustration of the allocation mechanism: price and shares.

randomly choosing the success or failure of the civil war[2]; the variable depicting this move is defined as s_t, which may be valued 1 in case the civil war is successful and 0 otherwise ($s_t \in \{0, 1\}$); for this, nature uses the function $\rho(\lambda_t^w)$, which is defined as the probability of success of civil war when the share of wealth in the political elite is λ_t^w, with $\lambda_t^w \equiv \frac{w_t^E}{w_t^E + \int_0^1 w_t^P(x)dx} \in [0, 1]$ and $\rho : [0, 1] \to [0, 1]$; if $s_t = 1$, the current generation of the political elite dies and is substituted by another with the same $a^E(.)$ at date $t+2$; moreover, in the same situation, a constant γ is transferred to the population representing pillage, which means the wealth of the new generation of the political elite is decreased by γ, with $\gamma \in \Gamma \subset \Re$.

At the end of the stage game, and sequentially, the payments of the allocation mechanism take place, production happens, and the eventual transfers for the successful civil war are materialized. This means we can create a variable for each agent in the economy depicting before consumption wealth:

$$\widehat{w}_t^P(x) = \begin{array}{c} 1_t^P(x)\left[a^P(x) - p_t\right] + w_t^P(x)(1+r), \text{ if } \omega_t = 0 \text{ or if } \omega_t = 1, s_t = 0 \\ 1_t^P(x)\left[a^P(x) - p_t\right] + w_t^P(x)(1+r) + \gamma, \text{ otherwise} \end{array}$$

$$\widehat{w}_t^P = \int_0^1 \widehat{w}_t^P(x)dx$$

[2]This move is aimed at representing the fundamental uncertainty associated with the collective action problem the population has to solve once a civil war is decided.

$$\widehat{w}_t^E = \begin{cases} \int_0^1 1_t^E(x)\left[a^E(x)-p_t\right]dx + w_t^E(1+r), \text{ if } \omega_t = 0 \text{ or if } \omega_t = 1, s_t = 0 \\ \int_0^1 1_t^E(x)\left[a^E(x)-p_t\right]dx + w_t^E(1+r) - \gamma, \text{ otherwise} \end{cases},$$

where $1_t^i(x)$ is an indicator function having value 1 if i (for $i \in \{P, E\}$) wins the infinitesimal piece of economy x at the allocation mechanism and 0 otherwise, and r is an exogenous interest rate.

After $\widehat{w}_t^P(x), \widehat{w}_t^E$ for $x \in [0,1]$ are realized, we then have consumption of a fixed percentage of these wealths, $(1-\alpha)$, where $\alpha \in [0,1]$. This means the payoffs in the stage game are:

$$g_t^i = \begin{cases} (1-\alpha)\widehat{w}_t^P(x), \text{ for a household } x \text{ from } P, \text{ i.e. } i = (P, x) \\ (1-\alpha)\widehat{w}_t^P, \text{ for the aggregate } P, \text{ i.e. } i = P \\ (1-\alpha)\widehat{w}_t^E, \text{ for } E, \text{ i.e. } i = E \end{cases}.$$

Note that this stage game is one specific example of the general model of corruption we referred in the introduction (as thought by Becker and Stigler (1974), Rose-Ackerman (1978), and Vicente (2003)).[3]

Looking at the whole game, note that $w_{t+1}^P(x)$, w_{t+1}^P, w_{t+1}^E are trivially given by $\alpha\widehat{w}_t^P(x)$, $\alpha\widehat{w}_t^P$ and $\alpha\widehat{w}_t^E$, respectively. Moreover, we have as payoffs $u_t^i = \sum_{\tau=t}^{\infty} \delta^{\tau-t} 1^i(s_0, ..., s_\tau) g_\tau^i$ for $i \in \{(P,x), P, E\}$, where E respects the initial generation of the political elite ($\delta \in [0,1]$ is defined as the discount factor, the time preference parameter of the agents in this model; $1^i(s_0, ..., s_\tau)$ is an indicator function having value 1 if any of the variables $s_0, ..., s_\tau$ take value 1 and $i = E$). In the next sections, when referring to E we always mean the present generation of the political elite.

We now present a condition assumed in our model.

Condition 1 *$\rho(\lambda_t^w)$ is non-increasing in λ_t^w. In addition, $\rho(\lambda^w)$, with $\lambda^w \leq \overline{\lambda}^w$, is arbitrarily close to 1 and $\rho(1)$ arbitrarily close but not equal to 0.*

[3] Indeed, the *rule* defined implicitly is, as we pointed out, *the political elite should not use public office at her own benefit* (as a matter of fact, corruption as the use of public office at own benefit of public officials is the most widely used definition of corruption in the literature - see the survey by Bardhan (1997)).

Moreover, the population works as a *principal* in the sense that she has the last word in terms of payoffs (given the action by the political elite, the payoffs are ultimately defined by the the fact that the population may initiate a civil war), which arises from the underlying social contract.

Definitively, the political elite works as the *enforcer* of the rule, provided she is the one with direct power over the allocation of the land. As we underlined above, this allocation mechanism could be thought explicitly as an auction where the political elite has asymmetric power (this could be thought as a reduced form of a model where members of the political elite would work as auctioneer and bidder and bribes would take place).

The population and the political elite are the *subjects* of the rule, competing for the alocation of land.

The social contract considered is exogenous and corresponds to the basic assumption of our model: it can be identified with the assumption that the population has no option but to delegate an asymmetric power to the political elite in the mechanism for the allocation of the land.

With this condition we mean that for a higher share of the wealth in E, the probability that an already initiated civil war succeeds weakly decreases, knowing that if all the wealth is on the hands of P, the civil war will be successful almost surely, and that if all the wealth is on the side of E, the probability of success is very small.

3 Equilibria

In this section we characterize stationary equilibria of our model as a function of the parameters introduced: initial wealths w_0^E, $w_0^P(.)$, ability of the political elite $a^E(.)$ and population $a^P(.)$, time preference parameter δ, savings parameter α, $\overline{\lambda}^w$.

We start by defining the stationary equilibrium concept we will be working with[4]. For this we must be totally precise and therefore must define some more notation:

- $d_t \equiv \{d_t^i\}_{i\in\{(P,x),E,P\}}$, where $d_t^i \equiv \begin{cases} b_t^P(x), \text{ if } i=(P,x) \\ \lambda_t^c, \text{ if } i=E \\ \omega_t, \text{ if } i=P \end{cases}$ and $d_t^i \in D^i \equiv \begin{cases} B^P, \text{ if } i=(P,x) \\ [0,1]\,, \text{ if } i=E \\ \{0,1\}, \text{ if } i=P \end{cases}$;
- $$\theta_t \equiv (a^P(.), a^E(.), w_t^P(.), w_t^E, s_{t-1}, \delta, \alpha)$$
  with $\theta_t \in \Theta \equiv [0,1] \times A^P \times A^E \times W^P \times W^E \times \{0,1\} \times [0,1] \times [0,1]$ and $s_{-1} \equiv 0$;
- also, we define the sets
  $$\Sigma^i \equiv \begin{cases} \{\sigma^i = (\sigma_t^i)_{t=0}^{\infty} | \sigma_t^i : \Theta^{t+1} \times (D^{-i})^t \to \triangle(D^i)\}, \text{ if } i=(P,x) \\ \{\sigma^i = (\sigma_t^i)_{t=0}^{\infty} | \sigma_t^i : \Theta^{t+1} \times (D^{(P,x)})^{t+1} \times (D^P)^t \to \triangle(D^i)\}, \text{ if } i=E \\ \{\sigma^i = (\sigma_t^i)_{t=0}^{\infty} | \sigma_t^i : \Theta^{t+1} \times (D^{-i})^{t+1} \to \triangle(D^i)\}, \text{ if } i=P \end{cases},$$
  as respectively, the sets of behavioral strategies for player x in the population, for the political elite, and for the aggregate population.

We are now ready for the aimed definition.

Definition 2 *A behavioral strategy profile $\sigma \equiv \{\sigma^{(P,x)}, \sigma^E, \sigma^P\} \in \Sigma^{(P,x)} \times \Sigma^E \times \Sigma^P$ is a stationary equilibrium iff*

[4] In Myerson (1991), this is presented as stationary equilibria (the move probabilities depend only on the current state) of repeated games with complete state information (at every round every player knows the current state of nature) and discounting (section 7.3).

- *for every player i, there is a function $\tau^i : \Theta \times D^{-i} \rightarrow \triangle(D^i)$ such that*

$$\sigma_t^i(.|\theta_0, ..., \theta_t, d_0^{-i}, ..., d_{t-1}^{-i}) = \tau^i(.|\theta_t, d_{t-1}^{-i}), \text{ if } i = (P, x)$$
$$\sigma_t^i(.|\theta_0, ..., \theta_t, d_0^{(P,x)}, ..., d_t^{(P,x)}, d_0^P, ..., d_{t-1}^P) = \tau^i(.|\theta_t, d_t^{(P,x)}, d_{t-1}^P), \text{ if } i = E$$
$$\sigma_t^i(.|\theta_0, ..., \theta_t, d_0^{-i}, ..., d_t^{-i}) = \tau^i(.|\theta_t, d_t^{-i}), \text{ if } i = P$$

(each behavioral strategy is stationary);

- *for every player i and every behavioral strategy $\widehat{\sigma}^i$*

$$v^i(\sigma, \theta_0, d_0^{-i(b)}) \geq v^i(\widehat{\sigma}^i, \sigma^{-i}, \theta_0, d_0^{-i(b)}),$$

where $i \in \{(P, x), E, P\}$.

This is given

$$v^i(\widehat{\sigma}^i, \sigma^{-i}, \theta_0, d_0^{-i(b)}) \equiv \sum\nolimits_{d_0^i \in D^i} \{\widehat{\sigma}_0^i(d_0^i|\theta_0, d_0^{-i(b)})$$
$$\sum\nolimits_{d_0^{-i(a)} \in D^{-i(a)}} \left[\prod\nolimits_{j\in\{-i(a)\}} \sigma_0^j(d_0^j|\theta_0, d_0^{-j(b)})\right] \times$$
$$\left[\begin{array}{c} \sum_{s_0\in\{0,1\}}\{\varphi(s_0|d_0, \theta_0)1^i(s_0)g_0^i(d_0, s_0, \theta_0)+ \\ \delta\sum_{\theta_1\in\Theta}\phi(\theta_1|d_0, s_0, \theta_0)\times\sum_{d_1^{-i(b)}\in D^{-i(b)}} \\ \left[\prod_{j\in\{-i(b)\}}\sigma_1^j(d_1^j|\theta_0, \theta_1, d_0^{-j(b)}, d_1^{-j(b)})\right]v^i(\widehat{\sigma}^i, \sigma^{-i}, \theta_1, d_1^{-i(b)})\} \end{array}\right]\},$$

*where $d_0^{-i(b)}$ are the moves by agents $-i$ on date 0 **before** the move by i, and $d_0^{-i(a)}$ are the moves by agents $-i$ on date 0 **after** the move by i;*

$$\varphi(s_0|d_0, \theta_0) \equiv \begin{array}{ll} \begin{array}{c} \rho(\lambda_0^w), \text{ if } s_0 = 1, \\ 1-\rho(\lambda_0^w), \text{ if } s_0 = 0, \end{array} & \text{if } \omega_0 = 1 \\ \begin{array}{c} 0, \text{ if } s_0 = 1, \\ 1, \text{ if } s_0 = 0, \end{array} & \text{if } \omega_0 = 0 \end{array}$$

is the conditional probability that the nature's move is s_0 given the moves and state at date 0, d_0 and θ_0; $1^i(s_0)g_0^i(d_0, s_0, \theta_0)$ is the payoff of the stage game at date 0 defined above (which is a function of (d_0, s_0, θ_0)); and

$$\phi(\theta_1|d_0, s_0, \theta_0) \equiv \begin{array}{ll} \begin{array}{cc} \rho(\lambda_0^w), \text{ if } & \begin{array}{c} w_1^P(x) = \alpha\widehat{w}_0^P(x)(d_0, s_0 = 1, \theta_0), \forall x \\ w_1^E = \alpha\widehat{w}_0^E(d_0, s_0 = 1, \theta_0) \end{array} \\ 1-\rho(\lambda_0^w), \text{ if } & \begin{array}{c} w_1^P(x) = \alpha\widehat{w}_0^P(x)(d_0, s_0 = 0, \theta_0), \forall x \\ w_1^E = \alpha\widehat{w}_0^E(d_0, s_0 = 0, \theta_0) \\ 0, \text{ otherwise} \end{array} \end{array} & \text{if } \omega_0 = 1 \\ \begin{array}{cc} 1, \text{ if } & \begin{array}{c} w_1^P(x) = \alpha\widehat{w}_0^P(x)(d_0, s_0, \theta_0), \forall x \\ w_1^E = \alpha\widehat{w}_0^E(d_0, s_0, \theta_0) \\ 0, \text{ otherwise} \end{array} \end{array} & \text{if } \omega_0 = 0 \end{array}$$

is the conditional probability that the state at 1 *is* θ_1 *given that the set of moves and state at date* 0 *were respectively* d_0, s_0 *and* θ_0 *(note that* $\widehat{w}_0^i$ *is a function of* (d_0, s_0, θ_0)*).*

We now introduce several important simplifications to the analysis: we point out some equilibrium behavior properties of our game.

Something we can be sure of is that every member of the population will find optimal to bid, at the first step of the stage game in every period,

$$b_t^P(x) = \begin{array}{c} a^P(x), \text{ if } a^P(x) \leq w_t^P(x) \\ w_t^P(x), \text{ otherwise} \end{array}, \text{ for } x \in [0,1],$$

independently of what happens in the remaining game (a dominant strategy). This is because the gross gain in case of win is the ability level of this agent, $a^P(x)$, and because this agent's payment in the allocation mechanism, p_t, is independent of her bid. In what follows we assume that this is the equilibrium behavior of each member of P at her first step in the stage game of every period. We could support this as a strictly dominant strategy on the basis of a cost of getting to know the ability and wealth of the other members of the population, as well as the political elite's ability: only knowing this information a member of the population could identify another dominant strategy (as good as the first) at the analyzed node.

We then can focus our analysis on the decision of the level of corruption, λ_t^c, on the part of E, and on the decision of initiating or not the civil war by P, ω_t.

For this we specify some more notation provided the fact that we are going to focus on pure behavioral strategies:

- $\overline{\tau}^{(P,x)}(d_t^{(P,x)}|\theta_t)$ is defined as the above presented dominant (stationary) pure behavioral strategy for agent (P,x) at period t (given θ_t);
- $\overline{\tau}^E(\lambda_t^c|\theta_t, d_{t-1}^P) \equiv \tau^E(\lambda_t^c|\theta_t, d_t^{(P,x)} = (\tau^{(P,x)})^{-1}(1), d_{t-1}^P)$;
- $\overline{v}^i(\overline{\tau}^E, \tau^P; \theta_0) \equiv v^i(\overline{\tau}^E, \tau^P, \overline{\tau}^{(P,x)}; \theta_0)$, for $i = \{E, P\}$;
- $\lambda_t^c(\overline{\tau}^E|\theta_t, \omega_{t-1})$ and $\omega_t(\tau^P|\theta_t, \lambda_t^c)$ are defined as the pure strategies for E and P when the state is θ_t and the last moves by the opponent are ω_{t-1} and λ_t^c, corresponding to the stationary behavioral strategies by E and P, $\overline{\tau}^E(.|\theta_t, \omega_{t-1})$ and $\tau^P(.|\theta_t, \lambda_t^c)$, provided these have an action for which the assigned probability is one.

For clarity, we now present the expected payoff functions underlying the analysis that follows[5]. Looking at the decisions by E and P, we have that

[5]Notice that because we are restricting to pure strategies, there is no need to include in the the value function the past move of the opponent: this is implied in the stationary behavioral strategies.

when the E agent considers the stationary pure behavioral strategy $\overline{\tau}^E$ and when P uses the stationary pure behavioral strategy $\tau^P_{\tau^P(1|\theta_0,\lambda_0^c)=1}$ (where whenever θ_0 is the state and λ_0^c is the move by E, 1 is the decision with respect to initiating a civil war), the first will have the expected payoff

$$
\begin{aligned}
&\overline{v}^E(\overline{\tau}^E, \tau^P_{\tau^P(1|\theta_0,\lambda_0^c)=1}, \theta_0) = \\
&(1-\rho(\lambda_0^w))\,\{(1-\alpha)\widehat{w}_0^E\left[\lambda_0^c(\overline{\tau}^E|\theta_0), \omega_0(\tau^P|\theta_0,\lambda_0^c)=1, s_0=0, \theta_0\right] + \\
&\delta\overline{v}^E\left[\overline{\tau}^E, \tau^P_{\tau^P(1|\theta_0,\lambda_0^c)=1}, \theta_1(\alpha\widehat{w}_0(\lambda_0^c(\overline{\tau}^E|\theta_0), \omega_0(\tau^P|\theta_0,\lambda_0^c)=1, s_0=0, \theta_0))\right]\},
\end{aligned}
$$

and the second the expected payoff

$$
\begin{aligned}
&\overline{v}^P(\overline{\tau}^E, \tau^P_{\tau^P(1|\theta_0,\lambda_0^c)=1}, \theta_0) = \\
&\rho(\lambda_0^w)(1-\alpha)\widehat{w}_0^P\left[\lambda_0^c(\overline{\tau}^E|\theta_0), \omega_0(\tau^P|\theta_0,\lambda_0^c)=1, s_0=1, \theta_0\right] + \\
&(1-\rho(\lambda_0^w))\,(1-\alpha)\widehat{w}_0^P\left[\lambda_0^c(\overline{\tau}^E|\theta_0), \omega_0(\tau^P|\theta_0,\lambda_0^c)=1, s_0=0, \theta_0\right] + \\
&\rho(\lambda_0^w)\delta\overline{v}^i\left[\overline{\tau}^E, \tau^P_{\tau^P(1|\theta_0)=1}, \theta_1\{\alpha\widehat{w}_0(\lambda_0^c(\overline{\tau}^E|\theta_0), \omega_0(\tau^P|\theta_0,\lambda_0^c)=1, s_0=1, \theta_0)\}\right] + \\
&(1-\rho(\lambda_0^w))\delta\overline{v}^i\left[\overline{\tau}^E, \tau^P_{\tau^P(1|\theta_0)=1}, \theta_1\{\alpha\widehat{w}_0(\lambda_0^c(\overline{\tau}^E|\theta_0), \omega_0(\tau^P|\theta_0,\lambda_0^c)=1, s_0=0, \theta_0)\}\right].
\end{aligned}
$$

When E sticks to the same strategy and when P uses the stationary pure behavioral strategy $\tau^P_{\tau^P(0|\theta_0)=1}$, these players will face the expected payoffs

$$
\begin{aligned}
&\overline{v}^i(\overline{\tau}^E, \tau^P_{\tau^P(0|\theta_0,\lambda_0^c)=1}, \theta_0) = \\
&(1-\alpha)\widehat{w}_0^i\left[\lambda_0^c(\overline{\tau}^E|\theta_0), \omega_0(\tau^P|\theta_0,\lambda_0^c)=1, \theta_0\right] + \\
&\delta\overline{v}^i\left[\overline{\tau}^E, \tau^P_{\tau^P(0|\theta_0)=1}, \theta_1\{\alpha\widehat{w}_0(\lambda_0^c(\overline{\tau}^E|\theta_0), \omega_0(\tau^P|\theta_0,\lambda_0^c)=0, \theta_0)\}\right],
\end{aligned}
$$

for $i \in \{E, P\}$.

We now present our main results on the characterization of equilibria.

We start by showing what we claim is our description of equilibrium behavior in the vast majority of Sub-Saharan countries. For this we need to define $\underleftarrow{\lambda}_t^c$ as the level of corruption corresponding to the intersection of E's ability function $a^E(.)$ and P's bid function $b_t^P(.)$ at date t, which is defined by the expression $b_t^P(1-\underleftarrow{\lambda}_t^c) = a^E(1-\underleftarrow{\lambda}_t^c)$.

Proposition 3 *(Sub-Saharan Country) If $a^E(.)$, w_0^E are sufficiently high, and $a^P(.)$, $w_0^P(.)$, δ, α sufficiently low, there is a stationary equilibrium where at the equilibrium path in the state variable it is dominant for E to play weakly above a level of corruption $\underleftarrow{\lambda}_0^c$ at every period where the economy works, and for which initiating civil wars is the best response on the part of P.*

Proof. We start by looking at E's decision.

For that we conjecture that there are initial parameter values θ_0 such that the optimal strategy $\overline{\tau}^E$ encompasses playing weakly above the amount of corruption $\underleftarrow{\lambda}_t^c$ (irrespectively of the strategy chosen by P) at every period t along every possible paths in the parameters θ_t consistent with that strategy by E and any strategy by P.

We now need to define the parameters for which this holds.

For that, we look at the decision by E (at date 0): E considers, for a fixed τ^P, the problem

$$\max_{\{\lambda_t^c\}_{t=0}^{\infty}} \overline{v}^E(\overline{\tau}^E_{\overline{\tau}^E(\lambda_t^c|\theta_t,\omega_{t-1})=1,\forall t}, \tau^P, \theta_0).$$

If $\tau^P(\omega_t|\theta_t) = \tau^P(\omega_t|\theta_t, \lambda_t^c), \forall t$, $\overset{*}{\underleftarrow{\lambda}}{}_t^c$, with $\overset{*}{\underleftarrow{\lambda}}{}_t^c \geq \underleftarrow{\lambda}_t^c$, solves this problem trivially, independently of the parameters, provided in the context of P being indifferent to E's moves in terms of behavior, E just wants to control at least the maximum portion of the economy she can with her ability, which is compatible with decreasing (increasing the difference in the wealths possessed by E and P) the probability of success of civil wars in case they are initiated. Note that E may want to control more than $\underleftarrow{\lambda}_t^c$ at a loss to decrease the probability of successful civil war at the next period - we could interpret this situation as one of *repression*. We then just have to consider another scenario: the one where P responds to E's moves. Let us restrict wlog (as we will see below) to a strategy where

$$\tau^P_{resp(\overrightarrow{\lambda}_t^c)}(\omega_t|\theta_t, \lambda_t^c) = \begin{array}{ll} \begin{array}{l} 1, \text{ if } \omega_t = 1, \\ 0, \text{ if } \omega_t = 0, \end{array} & \text{if } \lambda_t^c > \overrightarrow{\lambda}_t^c \\ \begin{array}{l} 0, \text{ if } \omega_t = 1, \\ 1, \text{ if } \omega_t = 0, \end{array} & \text{otherwise} \end{array}.$$

This implies an incentive on E to diminish the level of corruption to $\overrightarrow{\lambda}_t^c$ at every date t.

From the above this means the parameters for which $\overset{*}{\underleftarrow{\lambda}}{}_t^c, \forall t$ dominates any action strictly below $\underleftarrow{\lambda}_t^c$ are the ones satisfying, $\forall \lambda_t^c \leq \underleftarrow{\lambda}_t^c$,

$$\begin{aligned} &\overline{v}^E(\overline{\tau}^E_{\overline{\tau}^E(\underleftarrow{\lambda}_t^c|\theta_t,\omega_{t-1})=1,\forall t}, \tau^P_{resp(\overrightarrow{\lambda}_t^c),\forall t}, \theta_0) \geq \\ &\overline{v}^E(\overline{\tau}^E_{\overline{\tau}^E(\lambda_t^c|\theta_t,\omega_{t-1})=1,\forall t}, \tau^P_{resp(\overrightarrow{\lambda}_t^c),\forall t}, \theta_0) \end{aligned} \tag{1}$$

and for which every possible θ_1 coming out of the $(\underleftarrow{\lambda}_0^c, 1)$ moves at date 0, belongs to the same set of parameters (if this is true, then the same will be true from then on). We have then for E the cost of decreasing corruption being greater than the cost of bearing civil wars consistently over time. This is true for: $(w_0^P(.), w_0^E)$ such that λ_0^w is sufficiently high (so that the threat of civil wars is weak, i.e. $\rho(\lambda_0^w)$ is low); $(a^P(.), w_0^P(.), a^E, \alpha)$ such that $\underleftarrow{\lambda}_0^c$ is sufficiently high and the gain from corruption is high, and such that the implied possible λ_1^w are sufficiently high (so that at date 1 E faces $\lambda_1^w \geq \lambda_0^w$)[6]; δ sufficiently low (so that E is more willing to bear civil wars, i.e. E is not too worried about "being killed" in a future civil war).

This means that, under this set of initial parameters, $\underleftarrow{\lambda}_0^c$ is the minimal threshold of corruption arising along the equilibrium path: we have $\underleftarrow{\lambda}_0^c \leq \underleftarrow{\lambda}_1^c \leq ...$ The process of increasing thresholds stops at period t when $\underleftarrow{\lambda}_t^c$ corresponds to $a^E(1-\underleftarrow{\lambda}_t^c)=0$. However inequality in wealth continues increasing indefinitely.

Let us now turn to P.

We begin by defining $\overrightarrow{\lambda}_t^c$. We suppose that, $\forall t$, $\overrightarrow{\lambda}_t^c$ is defined by the condition

$$\overrightarrow{\lambda}_t^c = \arg\max_{\lambda_t^c} \lambda_t^c$$

subject to

$$\begin{aligned} &\overline{v}^P(\overline{\tau}^E_{\overline{\tau}^E(\lambda_t^c|\theta_t,\omega_{t-1})=1}, \tau^P_{resp(\lambda_t^c)}, \theta_t) \geq \\ &\overline{v}^P(\overline{\tau}^E_{\overline{\tau}^E(\underleftarrow{\lambda}_t^c|\theta_t,\omega_{t-1})=1}, \tau^P_{resp(\lambda_t^c)}, \theta_t), \end{aligned}$$

for given θ_t and ω_{t-1}, $(\overline{\tau}^E, \tau^P)$ defined otherwise. Note that the level $\overrightarrow{\lambda}_t^c$ is well defined provided, as we increase λ_t^c from 0 (where for a reasonable value of γ, sufficiently low - this is only necessary for the sake of real economies intuition -, no member of the population wants to initiate a civil war), a lower proportion of the population controls the economy, and therefore loses from stopping the economy and initiating a civil war in the hope for some redistribution (associated with the success of the civil war, i.e. pillage γ and substitution of political elite with the respective change in wealth): somewhere before 1 (where every member would be willing to begin the civil war), a level $\overrightarrow{\lambda}_t^c$ arises such that the above condition is satisfied. Naturally, a lower $\overrightarrow{\lambda}_t^c$ will arise when P has a lower $a^P(.)$, so that the members of the population that control the economy do not earn much income.

We now present the set of parameters such that it is a best response from P to initiate civil wars at every date. These parameters are the ones for which, on the equilibrium path,

$$\underleftarrow{\lambda}_t^c > \overrightarrow{\lambda}_t^c, \forall t, \tag{2}$$

i.e. sufficiently low $a^P(.)$ (so that P does not earn much from her winning portion of the economy when $\underleftarrow{\lambda}_t^c$ is implemented), and in addition to the first, sufficiently low $w_t^P(.)$ and high $a^E(.)$ (so that the intersection to P's bid function corresponds to a high $\underleftarrow{\lambda}_t^c$). Note that in this argument we can

[6]Note that in the unlikely event of a successful civil war, for these assumed parameters, the redistribution γ is not enough to make λ_1^w lower than λ_0^w.

leave relative wealth constant so that the probability of success in the civil war is constant.

As $\underleftarrow{\lambda}_t^c$ is dominant relative to lower values on the part of E, we have, given the parameters satisfying (2),

$$\begin{aligned}
&\overline{v}^P(\overline{\tau}^E_{\overline{\tau}^E(\overset{*}{\underleftarrow{\lambda}}{}_t^c|\theta_t,\omega_{t-1})=1,\forall t}, \tau^P_{\tau^P(1|\theta_t,\underleftarrow{\lambda}_t^c)=1,\forall t}, \theta_0) = \\
&\overline{v}^P(\overline{\tau}^E_{\overline{\tau}^E(\overset{*}{\underleftarrow{\lambda}}{}_t^c|\theta_t,\omega_{t-1})=1,\forall t}, \tau^P_{resp(\overrightarrow{\lambda}_t^c),\forall t}, \theta_0) > \\
&\overline{v}^P(\overline{\tau}^E_{\overline{\tau}^E(\overset{*}{\underleftarrow{\lambda}}{}_t^c|\theta_t,\omega_{t-1})=1,\forall t}, \tau^P_{\exists t,\text{ s.t. } \tau^P(0|\theta_t,\underleftarrow{\lambda}_t^c)=1}, \theta_0)
\end{aligned}$$

on the part of P. The inequality comes from the fact that, under the described conditions, P prefers to engage in an attempt to diminish the speed at which the process of increasing inequality and decreasing control of the economy by P happens.

We therefore have that the set of parameters for which this proposition is valid is the one satisfying (1) and (2), which are compatible conditions. Namely we can fix the parameters from the first condition and, if these are not enough to satisfy the second, we change the ones related with the second in the way described above (leaving relative wealth constant) which does not conflict with the first condition. We define this set of parameters as S (for Sub-Saharan countries).

We finally argue about considering τ^P_{resp} wlog. This is the most benevolent to E strategy agent P can consider. Indeed this corresponds to the maximum corruption P can bear without preferring to initiate a civil war provided she has that alternative. We therefore do not need to consider any other strategy in this proposition where civil wars are optimally initiated. ■

Following this is our characterization of equilibrium behavior in what we argue is the most of the Western World.

Proposition 4 *(Western Country) If $a^E(.)$, w_0^E are sufficiently low, and $a^P(.)$, $w_0^P(.)$, δ, $\overline{\lambda}^w$ sufficiently high, there is a continuum of stationary equilibria where E plays weakly below the level of corruption* $\min\{\overrightarrow{\lambda}_t^c, \widetilde{\lambda}_t^c\}$ *and above the level $\underrightarrow{\lambda}_t^c$ at every period t, and for which not initiating civil wars is the best response on the part of P.*

Proof. We first define, $\forall t$, $\underrightarrow{\lambda}_t^c$ as the level of corruption satisfying recursively the following condition:

$$\underrightarrow{\lambda}_t^c = \arg\min_{\lambda_t^c} \lambda_t^c$$

subject to

$$\begin{aligned}
&\overline{v}^E(\overline{\tau}^E_{\overline{\tau}^E(\lambda_t^c|\theta_t,\omega_{t-1})}, \tau^P_{resp(\lambda_t^c)}, \theta_t) \geq \\
&\overline{v}^E(\overline{\tau}^E_{\overline{\tau}^E(\overset{*}{\underleftarrow{\lambda}}{}_t^c|\theta_t,\omega_{t-1})}, \tau^P_{resp(\lambda_t^c)}, \theta_t),
\end{aligned}$$

for given θ_t and ω_{t-1}, $(\overline{\tau}^E, \tau^P)$ defined otherwise. In addition, we define

$$\tau^E_{resp(\widehat{\lambda}^c_t)}(\lambda^c_t|\theta_t, \omega_{t-1}) = \begin{array}{ll} \begin{array}{c} 1, \text{ if } \lambda^c_t = \overset{*}{\underleftarrow{\lambda}}{}^c_t, \\ 0, \text{ otherwise,} \end{array} & \text{if } \omega_{t-1} = 1 \\ \begin{array}{c} 1, \text{ if } \lambda^c_t = \widehat{\lambda}^c_t, \\ 0, \text{ otherwise,} \end{array} & \text{otherwise} \end{array} .$$

We then argue that for $\widehat{\lambda}^c_t$ such that $\min\{\overrightarrow{\lambda}^c_t, \widetilde{\lambda}^c_t\} \geq \widehat{\lambda}^c_t \geq \underrightarrow{\lambda}^c_t$ and for some parameters θ_0, E faces

$$\begin{array}{l} \overline{v}^E(\overline{\tau}^E_{resp(\widehat{\lambda}^c_t),\forall t}, \tau^P_{resp(\widehat{\lambda}^c_t),\forall t}, \theta_0) \geq \\ \overline{v}^E(\overline{\tau}^E, \tau^P_{resp(\widehat{\lambda}^c_t),\forall t}, \theta_0), \end{array}$$

and P faces

$$\begin{array}{l} \overline{v}^P(\overline{\tau}^E_{resp(\widehat{\lambda}^c_t),\forall t}, \tau^P_{resp(\widehat{\lambda}^c_t),\forall t}, \theta_0) \geq \\ \overline{v}^P(\overline{\tau}^E_{resp(\widehat{\lambda}^c_t),\forall t}, \tau^P, \theta_0); \end{array}$$

$\widetilde{\lambda}^c_t$ is defined next.

We now present the set of parameters, defined as W (for Western country), for which the above is true and for which every possible θ_1 coming out of the $(\lambda^c_0, 0)$ moves at date 0, belongs to the same set of parameters (if this is true, then the same will be true from then on); $\widetilde{\lambda}^c_t$ is defined as the lowest λ^c_t such that this second condition holds. $\underrightarrow{\lambda}^c_t$ is sufficiently low for us to have the above order if we assume a sufficiently high $\overline{\lambda}^w$.

We have then for E the cost of decreasing corruption being smaller than the cost of bearing civil wars consistently over time. This is true for: $(w^P_0(.), w^E_0)$ such that λ^w_0 is sufficiently low (so that the threat of civil wars is very strong, i.e. $\rho(\lambda^w_0)$ near 1); $(a^P(.), w^P_0(.), a^E)$ such that $\underleftarrow{\lambda}^c_0$ is sufficiently low and the gain from corruption is low, and such that the implied possible λ^w_1 are sufficiently low (so that at date 1 E faces $\lambda^w_1 \leq \lambda^w_0$); δ sufficiently high (so that E is less willing to bear civil wars).

Note that inequality in wealth continues increasing indefinitely under these equilibrium moves. ■

The next Figure graphically illustrates two cases relative to the two propositions (at date 0).

We have then characterized two quite appealing sets of stationary equilibrium moves of this model (for different initial parameters).

One is described by the situation where high corruption is a dominant behavioral strategy at each date for the political elite, and where the population initiates civil wars at all dates. This is the description of the majority of the Sub-Saharan countries, where we assume the parameters are: low

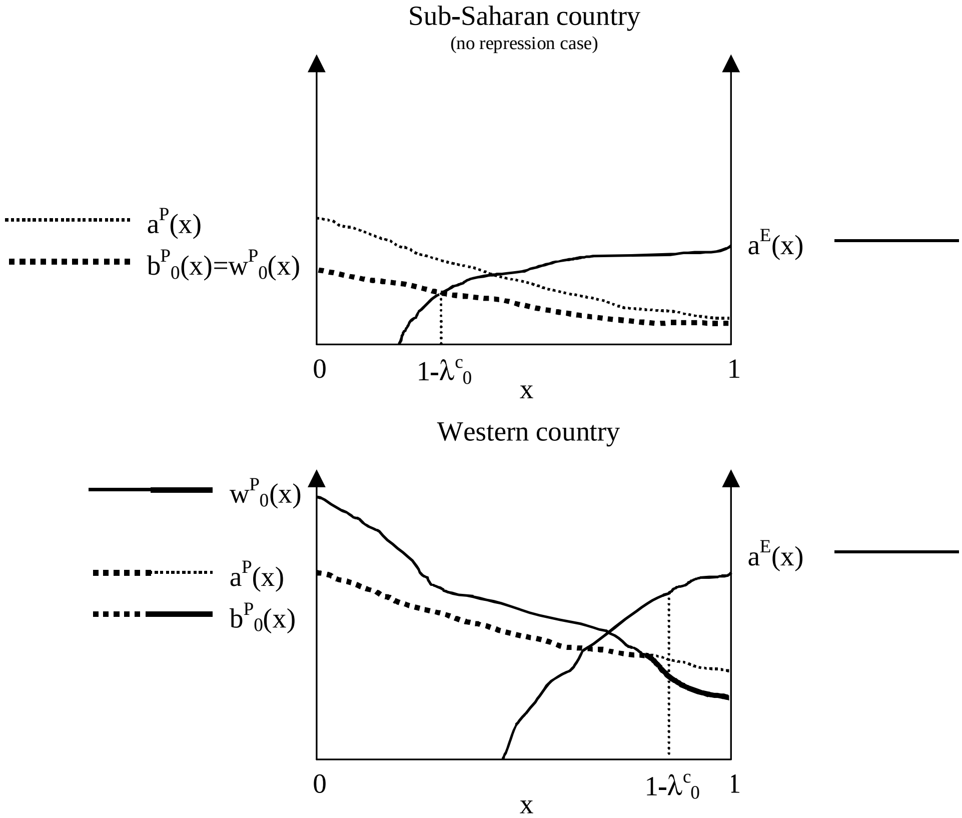


Figure 4: An illustration of the above Propositions at the initial date.

ability and wealth in the population, high ability (large state sectors, exploring rich natural resources) and wealth of the political elite, low discount factor.

The other is characterized by the situation where the political elite decides for low corruption levels in exchange for the guarantee that the population does not initiate civil wars. We take this as a description of Western developed countries by assuming these countries have: high levels of ability and wealth in the population, low ability and wealth in the political elite, high discount factor.

The next Figure summarizes our findings in terms of equilibrium corruption.

3.1 Empirical Counterpart

We now present more specific data (than the one presented at the beginning of the paper) regarding our findings.

We argue that Sub-Saharan countries are the ones for which ability and

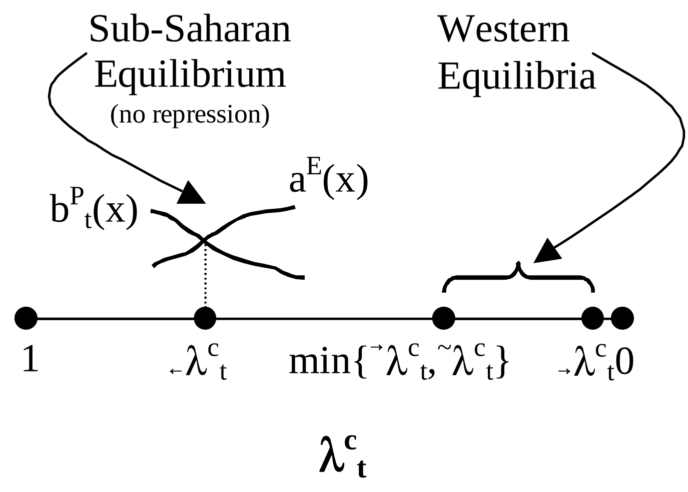
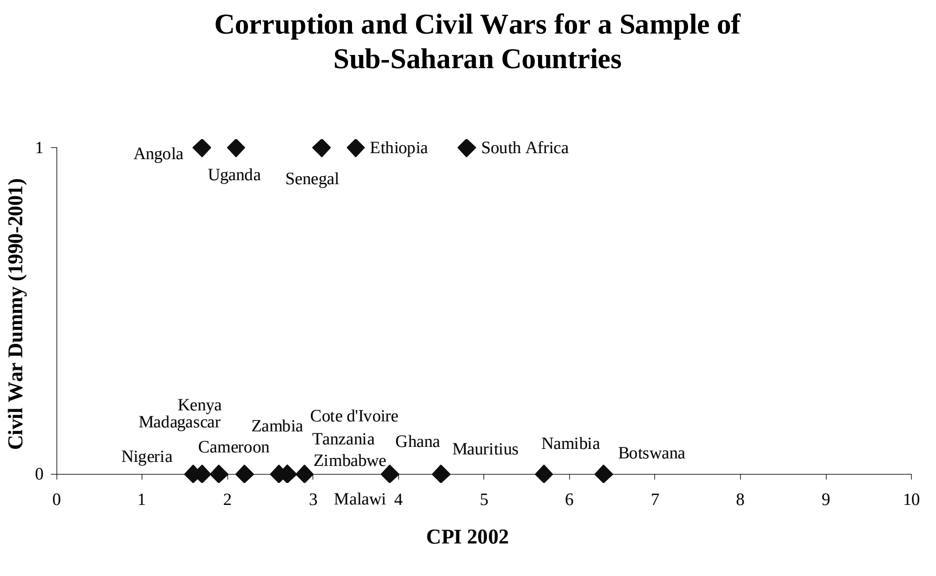


Figure 5: Equilibrium moves characterization in terms of corruption.

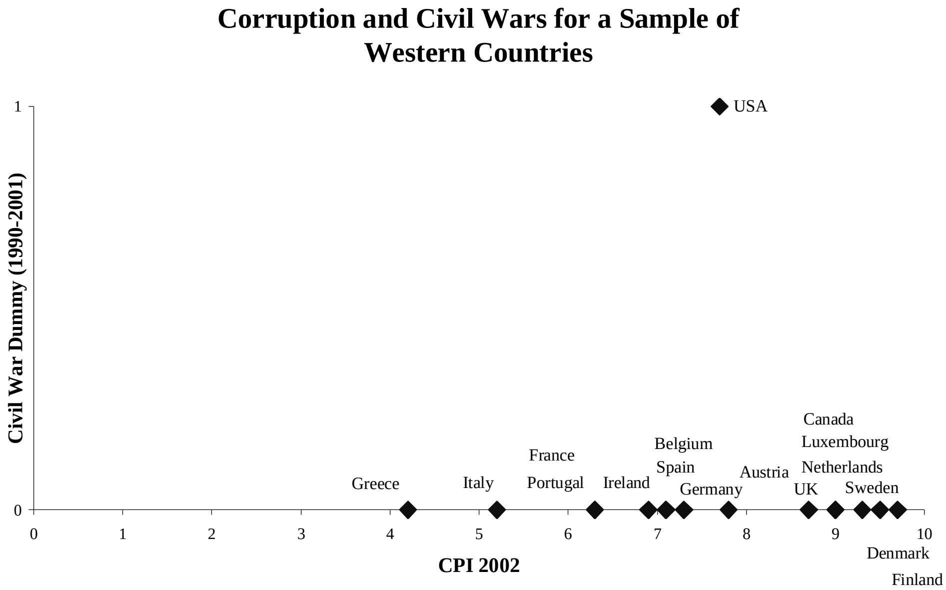
wealth are more extremely low, so that we should find in the data high corruption and frequent civil wars. The data is presented in the next graph.



Source: Corruption Perception Index by Transparency International; Civil War Dummy corresponds to own calculations based on Gleditsch et al. (2002). 'Armed Conflict 1946–2001: A New Dataset', Journal of Peace Research 39(5): 615–637.

Note that not many civil wars are reported in the graph provided 15 Sub-Saharan countries, which had civil wars in the years 1990-2001, had no data for corruption.

Taking Western countries as the ones where ability and wealth in the population are most extremely high, we should find relatively low corruption and no civil wars. The data is depicted in the following graph.



Source: Corruption Perception Index by Transparency International; Civil War Dummy corresponds to own calculations based on Gleditsch et al. (2002). 'Armed Conflict 1946–2001: A New Dataset', Journal of Peace Research 39(5): 615–637.

A note regarding data used: for corruption we used the most recent indicator published by Transparency International; for civil wars, we used the survey by Glecitsch et al. (2002) which reports all conflicts in the years 1946-2001. From those we computed a dummy variable taking value 1 if there was any intrastate war in the years 1990-2001 with government as the main motive of incompatibility, according to source - i.e. no territorial motives

4 Is There Hope? A Comparison of Policy Instruments

In this section we aim at analyzing the problem of a third party T endowed with wealth, whose objective is to minimize costs (discounted at rate δ) associated with helping the economy enter the set W of parameters. We naturally focus in the case where the economy departs from the situation described in Proposition 3; additionally, we assume the economy begins with $a^P(x) > w_0^P(x), \forall x$, i.e. every member of the population is credit constrained.

We now present a comparison of different policy instruments. These are:

1. giving credit to the population before the allocation mechanism (so that their credit constraint is alleviated) to be paid back after production and before consumption; we assume however that for each unit of credit a percentage μ is lost to the political elite; perfect commitment is assumed on the part of the population, as well as the inability by T to distinguish among the members of the population who ask for credit;

2. giving direct incentives to the political elite depending on the level of corruption at each date.

Note that while the first instrument is abundantly used by IMF (at the macro level) or World Bank (at the micro level, trying to take care of high μ's, namely with the recently popular microcredit programs), the second is apparently not used (though the World Bank is increasing its attention to corruption issues, these are more aimed at decreasing μ in the "old" policies, and not at taking care of the fundamental problem of corruption by the ruling elites).

We now provide some statements yielding the aimed comparison. We start by arguing that when ability is sufficiently low in the population, the first instrument is completely ineffective in terms of achieving the desired change to W parameters (the long run implied equilibrium).

Proposition 5 *If $a^P(.)$ is sufficiently low and the parameters θ_0 are such that the economy is engaged in the Sub-Saharan equilibrium (characterized in Proposition 3), then giving credit to P (Instrument 1) will result in no change in the characterized equilibrium path.*

Proof. Suppose T is willing to cover the needs of the population in terms of the lag between their wealth and their ability, so that they can bid their ability. For sufficiently low $a^P(.)$, the argument will follow intact in the proof of Proposition 3, so that the equilibrium will still be characterized by the same properties. ■

However, comparing to the credit constrained equilibrium, the share of the population winning the control of land will be larger for the same date, which means a slower increase in the levels of corruption.

We now add some more notation concerning the introduction of this third party T. Namely, we define i^k as corresponding to the pure strategy regarding incentives using instrument k ($k = 1, 2$). We define a stationary behavioral strategy equilibrium analogously to the definition considered above, but now with the extra player T, who announces a contract at date 0 before the other players' moves. Because the contracts we consider are functions of histories of moves, we need to add a dimension to the state θ_t, relative to $\{(\lambda_j^c, \omega_j)\}_{j=0}^{t-1}$. We then restrict to contracts of the form:

$$i^1(\theta_t) = \begin{array}{c} \widehat{i}^1(\theta_t), \text{ if } \theta_t \notin W \\ 0, \text{ otherwise} \end{array}$$

$$\begin{array}{l} i_t^2(\theta_t, \{\lambda_j^c, \omega_j\}_{j=0}^t) = \\ \begin{array}{c} \widehat{i}_t^2(\theta_t), \text{ if } \{(\lambda_j^c, \omega_j) = (\widehat{\lambda}_j^c, 0)\}_{j=0}^t,\ \theta_t \notin W,\ \theta_{t+1} \in W \\ 0, \text{ otherwise} \end{array} \end{array},$$

where $\widehat{i}^1(\theta_t)$ refers to the maximum (positive) amount of credit T has available to a member of the population when θ_t happens; $\widehat{i}_t^2(\theta_t)$ concerns the amount of wage given to E in case the contract (recommending $\{(\lambda_j^c, \omega_j) = (\widehat{\lambda}_j^c, 0)\}_{j=0}^t$) is respected by everyone until t and t corresponds to the last period before the economy turns to parameters included in the set W; $\widehat{\lambda}_j^c$ is a certain level of corruption belonging to $\left[\underrightarrow{\lambda}_j^c, \min\{\overrightarrow{\lambda}_j^c, \widetilde{\lambda}_j^c\}\right]$. We also denote by t^1 and t^2 the dates where W parameters are reached under instruments 1 and 2 respectively. Notice that the total expenditure by agent T under instrument 1 at a given date is, for i^1,

$$e(i^1, \theta_t, \mu) \equiv (\frac{1}{1-\mu}) \int_0^1 \left[\begin{array}{c} 1(x, i^1, a^P(.), w_t^P(.))(a^P(x) - w_t^P(x)) + \\ (1 - 1(x, i^1, a^P(.), w_t^P(.))i^1 \end{array} \right] dx$$

(where $1(x, i^1, a^P(.), w_t^P(.)) = \begin{array}{c} 1, \text{ if } a^P(x) - w_t^P(x) \leq i^1 \\ 0, \text{ otherwise} \end{array}$); for instrument 2 it is just i^2.

We can then see that under instrument 1 T aims at, through the weakening of the credit constraint, make the working of the economy redistribute wealth towards the population across time so that parameters W can be reached (after that there is no reason, as assumed on the objective of T, to continue intervening).

Under instrument 2, T aims at compensating E for a certain path of low corruption (for which it is optimal for P to engage in no civil war): that is, T presents a contract which corresponds to advising a certain stationary equilibrium (described under Proposition 4). More specifically, we consider for instrument 2

$$\widehat{i}_t^2(\theta_t(\theta_0)) = (\frac{1}{\delta})^t \left[\begin{array}{c} \overline{v}^E(\overline{\tau}^E_{resp(\widehat{\lambda}_j^c),\forall j}, \tau^P_{resp(\widehat{\lambda}_j^c),\forall j}, \theta_0) - \\ \overline{v}^E(\overline{\tau}^E_{\overline{\tau}^E(\overset{*}{\leftarrow}\lambda_t^c|\theta_j, \omega_{j-1})=1,\forall j}, \tau^P_{resp(\widehat{\lambda}_j^c),\forall j}, \theta_0) \end{array} \right]$$

i.e. the incentives that make E indifferent between, at date 0, the advised equilibrium path and the high corruption/civil wars equilibrium path[7][8].

This is wlog because it represents the minimum T can spend to get to W parameters.

Proposition 6 *For sufficiently small γ, the above presented shape for the instrument 2,*

$$i_t^2(\theta_t, \{\widehat{\lambda}_j^c\}_{j=0}^t),$$

is the optimal shape for a wage contract (cost minimizing for T) aimed at making the transition to parameters W.

Proof. After the parameters reach the set W, the assumed objective for T implies that the players should be left alone at that set of parameters: this means that after t, such that $\theta_t \notin W$ and $\theta_{t+1} \in W$, incentives should be zero.

Consider now the incentives at periods before $t+1$. At period 0, T must induce E to lower corruption below the maximum $\overset{*}{\underset{\leftarrow}{\lambda}}{}_t^c$ at the first $t^2 + 1$ dates. The way we are proposing T does so is through the promise (kept for sure, though time inconsistent) of a future transfer at t^2 just compensating for that.

We now argue that it is efficiency that leads us to fundament the equilibrium prescribed along the way to W with respect to the prescription of no civil wars initiated: we lose opportunities for redistribution of wealth (the allocation of land taking place) if we allow for civil wars - this is where the assumption of sufficiently small γ enters.

This means that along the equilibrium, the path for θ_t is known with certainty which makes (given the fact that δ is the discount rate for T) the above schedule to be cost minimizing. ∎

Following this is the statement that the best policy instrument (in a context where both can be effective and the speed of convergence to W parameters is irrelevant) is crucially dependent on the parameter μ.

Proposition 7 *If the parameters $\theta_0 \in S$, i.e. are such that the economy is engaged in the Sub-Saharan equilibrium (characterized in Proposition 3), and $a^P(.)$ is sufficiently high so that we are not in the case of Proposition 5, then, for fixed μ, instrument 2 ex-ante dominates instrument 1 if*

$$\min_{i^1} \sum\nolimits_{\theta_1, \theta_2, ..., \theta_{t^1(i^1)}} \Pr(\theta_1, \theta_2, ..., \theta_{t^1(i^1)}) \sum\nolimits_{j=0}^{t^1(i^1)} \delta^j e(i^1, \theta_j, \mu) \leq$$
$$\min_{i^2} \delta^{t^2(i^2)} i^2(\theta_{t^2}, \{\widehat{\lambda}_j^c\}_{j=0}^{t^2(i^2)}).$$

[7] Note that while instrument 2 depends on the period of time, instrument 1 does not. This is due to the fact that with respect to instrument 2, T has to stick to her promise, which was made at the precise date 0; instrument 1 is forward looking.

[8] Note that $\theta_t(.)$ is a deterministic function of θ_0 under the conditions for $\widehat{i}_t^2$.

5 Concluding Remarks and Ways Forward

In this paper we presented a theory of the dynamics of corruption and civil wars as determined by the ability and wealth distributions over time in the economy. We found two sets of equilibrium moves as a function of the initial state (in terms of ability and wealth): one where high possible corruption is a dominant move (relative to lower levels than the efficient one) by the political elite at all dates, for which initiating civil wars is the best response from the population (this is for low relative wealth and ability in the population); the other is characterized by low corruption and peace (this is for high relative wealth and ability in the population). These correspond to the empirical facts found with respect to Sub-Saharan economies and Western countries, respectively. The dynamics of the distribution of wealth in our model are also consistent with the twin peaks distribution of income reported.

In the second part of the paper we analyzed two instruments, credit offered to the population and incentive contracts directed to the political elite. We found that the first can be useless in terms of leading an economy trapped in the bad equilibrium moves to the good set of equilibrium moves described above. Also, their relative cost when used to change the equilibrium path is a function of the parameters of the economy (ability and wealth) as well as of the inefficiency parameter of the first instrument.

We now add a note on democracy and institutional issues. This paper, when discussing corruption, is obviously implying a level of *institutional quality*. This concept is therefore at the heart of the message this work. We just do not think democracy or lack of democratic institutions are *the* issue. These are a consequence of the balance of power, and just *generally* correspond to lower and higher (respectively) levels of corruption. With this in mind we can also conclude for one policy implication of our model concerning the idea that democracy should not be seen as the magic solution for development: it can only be time consistent (low corruption) if a steady increase in the wealth levels of the population is anticipated by the parties.

We also feel there is a comment to be made with respect to the relation between how we modelize and how we see a dramatic equilibrium arising for certain parameters: we use components of the usual efficiency of a market (we use an allocation mechanism which, in the no repression case of Sub-Saharan equilibrium moves, gives the control of land to the highest bidders - with the interpretation of bid corresponding to that of ability in the case of the political elite) to get to the referred result. The cause for the possible fundamental inefficiencies (we usually argue exist in developing countries), in a no repression case, is isolated in the assumptions of credit constrained population and more importantly of a richly endowed (with a considerable amount of initial ability) state political power.

We now add some remarks on possible ways forward for this paper:

- there are several more precise policy instruments we could consider with respect to credit (we assumed that the third party could not discriminate between members of the population); there are questions to be asked regarding the speed of convergence to the low corruption/peace parameters induced by the different instruments;

- there is naturally an empirical counterpart for this paper (which was slightly broached at the end of Section 3) that would be of great value; for that we would need to be very precise with respect to the empirical interpretations of ability and wealth of the players in the model; the aim would be testing it in a panel of countries.

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