Predatory Behavior of Governments: The Case of Mass Killing

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ABSTRACT

In this paper we seek to answer the question: why governments engage in mass killing? Tullock (1974) gives gain or avoidance of loss as the motive. We construct a three-stage theoretic framework to explain the choice of a ruler of a country. The conditions that must be met for mass killing regime to win over alternative regimes are derived. Using the COW project data over the period 1816-1997, we estimate two models: negative binomial regression of number of battle related deaths and a probit model for the choice of mass killing. The paper concludes with suggestions for data collections and further research.

Keywords: Mass killing, Vertical differentiation.

JEL: C7

"In a predatory regime, nothing is done for public reasons. Indeed, the men in charge do not recognize that "public purposes" exist."

James K. Galbraith, The Predator State, Mother Jones, May/June 2006, p.31.

INTRODUCTION

The 20th century is replete with incidence of civilian killings by the state. Conflict related deaths in that century were put at 109.7 millions or 4.35 percent of world population. This contrasts with 19.4 million deaths in the 19th century, accounting for 1.65 percent of world population. Armed conflicts although declined in the late years of the 20th century, the geographical pattern of such conflicts seems to have shifted towards the poorest countries. Whereas in the period 1946-1989, 30 percent of all conflicts took place in low income developing countries, this percentage rose to 50 percent in the 1990-2003 period. Africa seems to have born the brunt of violent conflicts accounting for 38 percent of the world conflicts in that period (World Development Report 2005: 153).

Violent conflicts fall into three categories: interstate (military conflicts between states), extrastate (between states and non-state players) and intrastate (between fractions within a state). Although all violent conflicts have similar outcomes, death and destruction, the motivation for initiating a violent conflict may or may not be the same in all types of conflicts. In some conflicts such as civil wars, war provides the state or the instigating group with the opportunity to loot the opposing faction's resources (Azam and Hoeffler 2002), to undermine political support for the opposition parties and to deter future

challenges. In the case of interstate war, its purpose is to liberate the country from colonial power or alien culture[2].

In this paper we deal with intrastate conflict resulting into a civil war. Examples include Angola civil war lasting 27 years with more than one million deaths, repeated wars in Sri Lanka which caused over 500,000 deaths, Rwanda civil war which resulted in over one million deaths to name a few (Lacina and Gleditsch 2005). In a civil war, the government or the ruler participates either actively in the violence or passively through complicity with the instigating group.

The study of conflicts and their resolution have been for long a subject of inquiry by both political scientists and economists. The conflict literature, both theoretical and empirical, addresses issues ranging from an analysis of onset of war, negotiations of settlement, war and alliances, duration of conflicts and wars as well as the economic consequences of wars. A compilation of more than one hundred articles dealing with the economics of conflicts are embodied in three volumes edited by Sandler and Hartley (2003). In the first volume, seven out of 36 papers dealt with civil wars. Looting is given as a motivation of civil war (Azam 2002). Factors that motivate the onset of civil war such as ethnic diversity, poverty and natural resources are empirically evaluated by Sambanis (2004). The influences of civil wars on steady state income at home and in neighboring countries were empirically estimated by Murdoch and Sandler (2002).

With conflicts taking on a "genocide-type" dimension, mass killing of civilians by the state or by a dominant ethnic or a religious group leads to inquiry of those factors that would explain the onset of and duration of these episodes (Easterly et al.2006, Reynal-Querol

2002, Montalvo and Reynal-Querol 2005, Harff 2003, Fearon and Laitin 2003, Sambanis 2004, Collier et al 2006, and Eck and Hultman 2007).

The argument advanced in this paper is that killing is motivated by expectation of gain. This view has been expressed earlier by Gordon Tullock. In "The Social Dilemma: The Economics of War and Revolution" (1974), Tullock raises the question – "when can war be profitable?" We answer this question by characterizing the decision process of a ruler with heterogeneous types. A simple theoretic framework with three stages is constructed to explain the optimal behavior of a ruler of a country in which there are two distinct groups, A and B. We investigate the options open to the ruler of the country, assumed to belong to group A, as to whether to engage in mass killing (attack group B), to form a coalition government with group B, or to do nothing. In such a framework, we rather focus on the ex ante optimal decision of a ruler based on benefits and costs under different regimes departing from the previous literature analyzing the ex post relationship between the degree of mass killing and economic, ethnic, and institutional factors.

THE THEORETICAL MODEL

We construct a simple theoretic framework to explain the optimal behavior of a ruler of a country in which there exist two distinct groups [*A, B*]. Each group has a leader supported by his own group. Without loss of generality, the leader of group *A* is assumed to be the ruler of the nation (e.g., President). Let L_i be the leader of group *i (i=A, B)* and v_i the probability distribution of L_i to be the ruler. Another interpretation of v_i is the ruler's political power, which is similar to the indicator of the theoretical democracy-totalitarian continuum in Rummel (1995). Similar to Rummel's analysis, the ruler's political power

being close to zero means more democratic decision making in term of debate, toleration, negotiation of differences. On the other hand, the ruler has absolute power as v_i approaches one, which means the ruler has absolute power over all aspects of society. The distribution of ruler's power is given by the cumulative distribution function $F(v)$ with continuous density $F'(v) \geq 0$. For simplicity, we assume that the distribution of ruler's power in group A is uniformly distributed over the unit interval as $v_i \in U[0, 1]$. For example if $v_A = 0$ it means that L_A, the current ruler and leader of group A, has probability of 0 to remain in office. On the other hand, if $v_A = 1$ he has probability of 1 to remain in office. The objective of L_A is to maximize his expected utility which depends on his chance to remain in office and the wealth level of his own group. Three options are open to him: attack group B, form a coalition government with the leader of group B [L_B], or do nothing.

When the ruler of group A chooses to attack group B his expected utility is determined by three components: his political power, the expected wealth level of his own group and the cost of attack. θ_A^A denotes the expected wealth level of group A, which is determined by the sum of the group's own production activities and the appropriation of group B's wealth. To engage in hostile activities, the ruler of group A needs to allocate his group between productive activities and predatory activities. This model captures the essential trade-off that the ruler faces in that an increase in the number of his people allocated to predatory activities, rather than to productive activities, decreases the level of output of his own group but increases the probability of a successful attack and hence the appropriation of group B's wealth.

Violent conflict, henceforth referred to as mass killing, is costly. In this paper we distinguish between two different types of cost: a fixed explicit cost C_A^A, which is assumed to be constant across all political power (v_i) of the leader of group A. This constant fixed cost measures the additional military expenditure associated with mass killing. As a result, C_A^A is assumed to be the same across all different political power of the ruler or at least independently distributed with the political power of the ruler.

The second type of cost associated with attack is the opportunity cost of group A (the attacker) in diverting their members from economic production to war activities. It is the forgone marginal product of one unit of labor diverted from economic production. This opportunity cost, therefore, determines the expected wealth level, θ_A^A. The expected utility of the ruler of group A under a mass killing regime, $V_{L_A}^A$, can be written as:

$$V_{L_A}^A = \theta_A^A \cdot v_A - C_A^A \qquad (1).$$

Equation (1) is a trivial form of vertical-differentiation model. Each type of ruler, v_A, chooses his optimal choice of regime based on the expected wealth and the cost indexed by θ_A^A and C_A^A, respectively. All types of rulers prefer higher expected wealth for a given cost. However, a ruler with high v_A is more willing to pay to obtain a given expected wealth level.

Under a coalition government regime, the expected utility of the ruler will depend on three components: his political power, the expected wealth level under the coalition regime and the cost of forming a coalition government. θ_A^C denotes the expected wealth level of group A obtained with full allocation of their members to economic production. An additional

assumption is made here that group A's expected wealth level under the coalition regime is proportional to the ruler's political power, v_A.

Forming coalition government is not without cost. It entails two types of costs: a fixed explicit cost of C_A^C, which is assumed to be constant across all political power of the leader of group A. This may be associated with the additional public spending in order to regain support from the ruler's own group for not initiating mass killing of the other group. Again, C_A^C is assumed the same across all different political power of the ruler or at least independently distributed from the political power of the ruler. The second type of cost associated with forming a coalition government is the reduction of the ruler's political power because of power sharing with group B leader. The loss of political power is assumed to be proportional to the ruler of group A's political power, which can be written as $(1-\tau)v_A$ where τ measures the degree of sharing the political power with group B. Thus, the ruler's expected utility under the coalition government regime, $V_{L_A}^C$, can be written as:

$$V_{L_A}^C = \theta_A^C (1-\tau) v_A - C_A^C \qquad (2).$$

Now we turn to the ruler's $[L_A]$ choice over different regimes where his payoff from no activity is normalized to zero. For a given set of $\{\theta_A^A, (1-\tau)\theta_A^C, C_A^A, C_A^C\}$, the expected net utility for the ruler $[L_A]$ with his political power v_A is

$$V_{L_A} = \begin{cases} V_{L_A}^A = \theta_A^A \cdot v_A - C_A^A & \text{if he decides to attack group B.} \\ V_{L_A}^C = \theta_A^C \cdot (1-\tau) v_A - C_A^C & \text{if he decides to form coalition with group B.} \\ 0 & \text{if he decides to do nothing.} \end{cases}$$

When the ruler makes his decision over different regimes, he chooses the one that yields the highest expected net utility. Assume for the moment that $\theta_A^A > (1-\tau)\theta_A^C$, that is the wealth of group A after attack (first option) exceeds the wealth acquired by group A under a coalition with group B. Under this assumption, the ruler's optimal choice will be determined by the net gain (or loss) associated with the two options. In order to have a meaningful discussion of the optimal choice over different regimes, we restrict our analysis to the parameter regions in which the coalition constraint is binding, that is,

$$\frac{\theta_A^A}{C_A^A} < \frac{(1-\tau)\theta_A^C}{C_A^C}\ ^{3} \qquad (3),$$

which means that the expected wealth per dollar spending is higher for the coalition regime. When the coalition constraint (3) is binding, we have the following lemma:

Lemma1. When the expected wealth under the mass killing regime is higher than that under the coalition regime ($\theta_A^A > (1-\tau)\theta_A^C$), there exists some type of ruler who would choose forming a coalition government as his optimal strategy if and only if the coalition constraint given by equation (3) is binding.

Proof. If the coalition constraint (3) is not binding, we have $\frac{\theta_A^A}{C_A^A} \geq \frac{(1-\tau)\theta_A^C}{C_A^C}$, then we have

$$(\theta_A^A v_A - C_A^A) - (\theta_A^C (1-\tau) v_A - C_A^C) = C_A^A \left(\frac{\theta_A^A v_A}{C_A^A} - 1 \right) - C_A^C \left(\frac{(1-\tau)\theta_A^C v_A}{C_A^C} - 1 \right)$$

$\geq (C_A^A - C_A^C)\left(\frac{(1-\tau)\theta_A^C v_A}{C_A^C} - 1 \right) \geq 0$ if $\theta_A^C (1-\tau) v_A \geq C_A^C$, which proves $V_{L_A}^A \geq V_{L_A}^C$ for any $V \in [0,1]$. As a result, no ruler chooses the coalition regime as his optimal choice since it

yields lower expected wealth level to the ruler at higher costs than under the mass killing regime.

■

When the condition in lemma 1 is satisfied, we have the more meaningful case where the coalition government regime is not "dominated." In this setup, the ruler whose political power exceeds a 'mass killing threshold', $\hat{v}$, where $\hat{v} \equiv \frac{C_A^A - C_A^C}{\theta_A^A - (1-\tau)\theta_A^C}$, chooses to attack group B. $\hat{v}$ denotes the type of the ruler whose net utility makes him indifferent between the mass killing and the coalition regimes:

$$\theta_A^A \hat{v} - C_A^A = \theta_A^C (1-\tau)\hat{v} - C_A^C \qquad (4).$$

Rulers with political power lower than $\hat{v}$ but exceeding 'coalition threshold', $\hat{\hat{v}}$, where $\hat{\hat{v}} \equiv \frac{C_A^C}{(1-\tau)\theta_A^C}$, choose to form a coalition government. $\hat{\hat{v}}$ denotes the type of the ruler whose net utility makes him indifferent between forming a coalition government and doing nothing:

$$\theta_A^C (1-\tau)\hat{\hat{v}} - C_A^C = 0 \qquad (5).$$

We denote the likelihood of mass killing as a probability of the ruler's type exceeds the mass killing threshold, $\hat{v}$, as $P(v_A > \hat{v}) = 1 - F(\hat{v}) = 1 - \hat{v}$. Similarly, the probability of forming a coalition government is $P(\hat{\hat{v}} < v_A < \hat{v}) = F(\hat{v}) - F(\hat{\hat{v}}) = \hat{v} - \hat{\hat{v}}$.

For the ruler of group A, L_A, the optimal choice among different regimes is [see Figure 1]:

$$\frac{C_A^A - C_A^C}{\theta_A^A - (1-\tau)\theta_A^C} \le v \qquad \text{Attack group B,}$$

$$\frac{C_A^C}{(1-\tau)\theta_A^C} \le v < \frac{C_A^A - C_A^C}{\theta_A^A - (1-\tau)\theta_A^C}$$ Form coalition with group B,

$$v < \frac{C_A^C}{(1-\tau)\theta_A^C}$$ Do nothing.

(Insert Figure 1)

There are three stages to this framework. In the first stage the political power of each leader v_i will be realized. Leader A's choice among attack, coalition or do nothing will take place in the second stage. If leader A decides to attack group B, he optimizes his decision over the allocation of his group members between economic production activities and military activities in the third stage. We proceed with backward induction.

Stage three with mass killing regime

To analyze the optimal behavior of the ruler in this model, we begin by considering the third-stage choice of the ruler under the mass killing regime. Again we assume that the country consists of two distinct groups A and B with population size N_A and N_B respectively. The overall size of the population is $N = N_A + N_B$. When leader A chooses to attack the other group in the third stage, he allocates his people among two types of activities: economic production and military activities. To be more precise he can channel his people into productive labor, which is denoted by E_A or into soldiering, which is denoted by F_A. Moreover, the ruler fully utilizes his population so that

$$N_A = E_A + F_A \quad (6).$$

For group B, F_B replaces F_A - where F_B is the level of resources devoted to ward off A's attack. Therefore, group B's economic production is constrained by the loss of their members to the war efforts so that group B's economic efforts is

$$E_B = N_B - F_B \quad (7).$$

The reduction in the economic product of group B in equation (7) associated with mass killing, means that group A will only acquire a fraction of the total wealth of group B ($E_B < N_B$). Let each group's production level, H_A and H_B be given by

$$H_A = \beta E_A \text{ and } H_B = \beta E_B \quad (8),$$

where the production level of each group depends on the number of members devoted to production and a parameter, β, denoting production technology, which is assumed to be the same for both groups[4].

The rewards of mass killing (A attacking B) is measured by θ_A^A which has been defined earlier as the value of its own wealth plus the expected wealth resulting from A's attack on B and the appropriation of group B's wealth. θ_A^A then consists of two wealth components, group's A wealth and the addition to group A's wealth acquired from group B. Since the acquisition of B's wealth is uncertain, depending on the probability of success, θ_A^A may be written as:

$$\theta_A^A = P_A^A H_B + H_A \quad (9),$$

where P_A^A is defined as contest success function as specified in Hirshleifer (1988, 1995). The contest success function (CSF) summarizes the technology of conflict. P_i, each group

CSF, is a function of the difference between the two groups' resource commitments. Using Hirshleifer CSF (ratio form), we have $P_A/P_B = \left(\frac{F_A}{F_B}\right)$. Since $P_A + P_B = 1$, we have

$$P_A^A = \frac{\alpha_A F_A}{\alpha_A F_A + \alpha_B F_B} \qquad (10),$$

where α_A and α_B denote the efficiency of conflict effort of the two groups ($0 < \alpha_i < 1$)[5].

We now consider the optimal decision of leader L_A in the third stage when he decides to initiate the attack. Leader L_A maximizes his expected utility by choosing how many people to allocate to attack and how many to economic production, subject to the constraint $N_A = E_A + F_A$.

$$\underset{F_A}{Max}\ V_{L_A}^A = \theta_A^A v_A - C_A^A = \left[P_A^A \beta(N_B - F_B) + \beta(N_A - F_A)\right] v_A - C_A^A \qquad (11),$$

where P_A^A is given by equation (10).

After solving the utility maximization problem of L_A, we have either an interior maximum which satisfies the following condition:

$$\frac{dV_{L_A}^A}{dF_A} = \left[\frac{dP_A^A}{dF_A}\beta(N_B - F_B) - \beta\right] v_A = 0 \qquad (12a),$$

or a corner solution which satisfies the following condition:

$$\frac{dV_{L_A}^A}{dF_A} = \left[\frac{dP_A^A}{dF_A}\beta(N_B - F_B) - \beta\right] v_A \le 0 \qquad (12b).$$

The first term in the parenthesis in equations (12a) and (12b) represents the marginal benefit under the mass killing regime. The second term in the parenthesis shows the marginal cost associated with mass killing, which is measured by the reduction in economic output due to an additional increase in the war activities. Therefore, whenever the marginal

benefit equals the marginal cost, the ruler chooses the positive value for F_A as in equation (12a). The ruler chooses $F_A^* = 0$ as in equation (12b) if the marginal cost equals or exceeds the marginal benefit. From equations (12a) and (12b), the optimal level of F_A^* is as follows:

$$F_A^* = \begin{cases} \frac{1}{\alpha_A}\left[-\alpha_B F_B + \sqrt{\alpha_A \alpha_B (N_B - F_B) F_B}\right] > 0 & for\ 0 \le F_B < \tilde{F} \\ 0 & for\ F_B \ge \tilde{F} \end{cases} \quad (13),$$

where $\tilde{F} = \left(\frac{\alpha_A}{\alpha_A + \alpha_B}\right) N_B$.

$\tilde{F}$ is the minimum level of group B army, needed to deter leader A from attack. At the same time, it could be viewed as the maximum scale of mass killing which is still beneficial to leader A ($\tilde{F} < H_B$).

Substituting the optimal level of F_A^* in equation (13) into $V_{L_A}^A$ in equation (9), we obtain the expected wealth of group A under the mass killing regime as follows:

$$\theta_A^A = \begin{cases} \frac{\beta}{\alpha_A}\left[\alpha_A (N - F_B) + \alpha_B F_B - 2\sqrt{\alpha_A \alpha_B F_B E_B}\right] & \text{for } 0 \le \mathrm{F_B} < \tilde{F} \\ \beta N_A & \text{for } \tilde{F} \ge F_{\mathrm{B}} \end{cases} \quad (14).$$

The equilibrium expected utility level of leader A is obtained by substituting the equilibrium level of θ_A^A in equation (14) into equation (11):

$$V_{L_A}^A = \begin{cases} \frac{\beta}{\alpha_A}\left[\alpha_A (N - F_B) + \alpha_B F_B - 2\sqrt{\alpha_A \alpha_B F_B E_B}\right] v_A - C_A^A & \text{for } 0 \le \mathrm{F_B} < \tilde{F} \\ \beta N_A v_A & \text{for } \tilde{F} \ge F_{\mathrm{B}} \end{cases} \quad (15).$$

From (14), when $F_{\mathrm{B}} > \tilde{F}$ attack will cease, mass killing is deterred.

Stage three with coalition government regime

When leader A chooses to form a coalition government rather than attack group B, his expected utility is given by $V_{L_A}^C = \theta_A^C(1-\tau)v_A - C_A^C$. Under the coalition government regime, the leader of group A allocates his entire group members to economic production, so that A's wealth under the coalition regime, θ_A^C, equals to βN_A. Although all members of group A are engaged in economic production (no attack forces), there are two types of costs associated with forming a coalition government: a reduction in the ruler's political power $(1-\tau)v_A$, and a fixed cost C_A^C, representing additional spending to regain support from his own group (assuming some opposition to the coalition). The payoff of leader A under the coalition regime is given by:

$$V_{L_A}^C = \beta E_A(1-\tau)v_A - C_A^C = \beta N_A(1-\tau)v_A - C_A^C \qquad (16).$$

Stage two: A choice between attack and coalition

We consider next the second stage choice of leader A. At the second stage, leader A chooses between attack (mass killing) and forming a coalition government on the basis of the expected wealth level associated with the two options. Recall now that leader A engages his group in mass killing if the expected utility under the mass killing regime exceeds that under the coalition government regime, i.e. $V_{L_A}^A > V_{L_A}^C$. To verify the optimal choice of leader A, we need to insure that the assumption, $\theta_A^A > (1-\tau)\theta_A^C$, actually holds. For a given level of political power of leader A, we show that a comparison of two expected wealth levels under two regimes is as follows:

For $0 \le F_B < \tilde{F}$ we have

$$\theta_A^A - (1-\tau)\theta_A^C = \frac{\beta}{\alpha_A}\left[\alpha_B F_B + \alpha_A(\tau N_A + N_B - F_B) - 2\sqrt{\alpha_A \alpha_B (N_B - F_B) F_B}\right] \quad \text{(17a).}$$

$$= \frac{\beta}{\alpha_A}\left[\left(\sqrt{\alpha_B F_B} - \sqrt{\alpha_A (N_B - F_B)}\right)^2 + \alpha_A \tau N_A\right] \geq 0 .$$

For $F_B \geq \tilde{F}$ we have

$$\theta_A^A - (1-\tau)\theta_A^C = \beta N_A - \beta(1-\tau)N_A = \beta\tau N_A \geq 0 . \quad \text{(17b).}$$

Stage one: Realization of the ruler's political power

We now turn to the optimal choice of L_A according to his political power after verifying $\theta_A^A > (1-\tau)\theta_A^C$ with equations (17a) and (17b). Substituting from equations (4) and (5) into $\hat{v}$ and $\hat{\hat{v}}$, we calculate the equilibrium configuration of regimes as follows:

$$\hat{v} = \frac{C_A^A - C_A^C}{\theta_A^A - (1-\tau)\theta_A^C} = \begin{cases} \dfrac{C_A^A - C_A^C}{\dfrac{\beta}{\alpha_A}\left(\sqrt{\alpha_B F_B} - \sqrt{\alpha_A (N_B - F_B)}\right)^2 + \beta\tau N_A} & \text{if } 0 \leq F_B < \tilde{F} \\ \dfrac{C_A^A - C_A^C}{\beta\tau N_A} & \text{if } F_B \geq \tilde{F} \end{cases} \quad \text{(18),}$$

$$\hat{\hat{v}} = \frac{C_A^C}{\beta(1-\tau)N_A} \quad \text{(19).}$$

From equations (18) and (19) respectively, we can construct the equilibrium configuration of the regime in the space of (v_A, F_B) as in Figure 2. Also, we can demonstrate the relationship between the scale of defense forces and the likelihood of mass killing.

Proposition 1. Under the mass killing regime an increase in the scale of defense forces [F_B] lowers the likelihood of mass killing [$1-\hat{v}$].

Proof. To address the effect of an increase in the scale of defense forces on the likelihood of mass killing we need to determine the sign of $\frac{\partial(1-\hat{v})}{\partial F_B}$ under the mass killing regime:

$$\frac{\partial(1-\hat{v})}{\partial F_B}=\frac{\alpha_A(C_A^A-C_A^C)\left(\frac{\alpha_B}{\sqrt{\alpha_B F_B}}+\frac{\alpha_A}{\sqrt{\alpha_A(N_B-F_B)}}\right)\left(\sqrt{\alpha_B F_B}-\sqrt{\alpha_A(N_B-F_B)}\right)}{\beta\left(\left(\sqrt{\alpha_B F_B}-\sqrt{\alpha_A(N_B-F_B)}\right)^2+\beta\tau N_A\right)^2} \quad (20),$$

for $0\le F_B<\tilde{F}$.

Therefore, we obtain sign $\left(\frac{\partial(1-\hat{v})}{\partial F_B}\right)$=sign $\left(\sqrt{\alpha_B F_B}-\sqrt{\alpha_A(N_B-F_B)}\right)$ in equation (20).

Since we have $0\le F_B<\tilde{F}$, we assume that

$$F_B=\lambda\tilde{F}=\lambda\frac{\alpha_A N_B}{\alpha_A+\alpha_B} \quad (21),$$

where $\lambda\in[0,1)$.

By substituting equation (21) into $\left(\sqrt{\alpha_B F_B}-\sqrt{\alpha_A(N_B-F_B)}\right)$, we have

$$\left(\sqrt{\alpha_B F_B}-\sqrt{\alpha_A(N_B-F_B)}\right)=\sqrt{\frac{\alpha_A N_B}{\alpha_A+\alpha_B}}\left(\sqrt{\lambda\alpha_B}-\sqrt{\alpha_B+(1-\lambda)\alpha_A}\right)<0 \quad (22).$$

As a result, we have $\frac{\partial(1-\hat{v})}{\partial F_B}<0$. Also, since $\hat{\hat{v}}$ in equation (19) is not affected by an increase in F_B, we have $\frac{\partial(\hat{v}-\hat{v})}{\partial F_B}=\frac{\partial v}{\partial F_B}>0$.

(Insert Figure 2)

COMPARATIVE STATICS

We now examine the effect of marginal increases in parameters values on the optimal behavior of the leader of group A. The focus is on those parameters that affect the two critical values $\hat{v}$ and $\hat{\hat{v}}$, which determine the likelihood of engaging in mass killing or forming a coalition government. We divide the parameters into three subgroups according to their attributes. The first subgroup of parameters is $\{C_A^A, C_A^C\}$ *which shift the expected utility curve in a parallel fashion*. For example, with higher fixed cost, C_A^A, leaders with different political power face the same increase in fixed cost, which is equivalent to an inward parallel shift in the expected utility curve in the mass killing case. With a decreased utility, fewer rulers would choose the mass killing regime as their optimal choice. Therefore, we observe less likelihood of mass killing in equilibrium. The second subgroup of parameters $\{\alpha_A, N_B, \tau\}$ affects the slope of the utility curve. The first two parameters only affect the expected wealth level of group A in the mass killing case, whereas τ only affects the expected wealth level in the coalition government case. In the comparative static exercise with the second group of parameters, we observe a pivot change in one of the expected utility curves that affects the slope of the specific utility curve. The last subgroup of parameters $\{N_A\}$ affects the slopes of both utility curves. Therefore, the effect of variation in $\{N_A\}$ depends on the relative magnitude of the slope of both utility curves.

Subgroup 1: Variation in parameters which shift the expected utility curve in a parallel fashion

Variation in C_A^A and C_A^C

We conduct comparative static exercise by calculating the following equations:

$$\frac{\partial(1-\hat{v})}{\partial C_A^A} = -\frac{1}{\Delta} < 0 \qquad \text{and} \qquad \frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial C_A^A} = \frac{1}{\Delta} > 0 \qquad (23a),$$

$$\frac{\partial(1-\hat{v})}{\partial C_A^C} = \frac{1}{\Delta} > 0 \qquad \text{and} \qquad \frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial C_A^C} = -\left(\frac{1}{\Delta} + \frac{1}{\beta(1-\tau)N_A}\right) < 0 \qquad (23b),$$

where $\Delta \equiv \frac{\beta}{\alpha_A}\left(\sqrt{\alpha_B F_B} - \sqrt{\alpha_A(N_B - F_B)}\right)^2 + \beta\tau N_A$. Increases in C_A^A have the same effect as declines in C_A^C in the mass killing case since the ruler's optimal choice rests on the net utility under different regimes. However, in terms of the likelihood of forming a coalition government the effects are substantially different. Due to the constant increases in the fixed cost of forming a coalition government, a leader with lower probability is more adversely affected by an increase in C_A^C. Hence, the probability for forming a coalition government falls further with an increase in C_A^C. The effect of an increase in the fixed cost is shown in Figure 3 for the two cases.

(Insert Figure 3)

Subgroup 2: Variation in parameters which rotate only one of the expected utility curves

Variation in α_A and N_B

The comparative statics effect of conflict efficiency and the size of group B is given by

$$\frac{\partial(1-\hat{v})}{\partial \alpha_A} = -\frac{(C_A^A - C_A^C)\sqrt{\alpha_B F_B}\left(\sqrt{\alpha_B F_B} - \sqrt{\alpha_A(N_B - F_B)}\right)}{\beta\left(-\alpha_B F_B + 2\sqrt{\alpha_B F_B}\sqrt{\alpha_A(N_B - F_B)} + \alpha_A(N_B + \tau N_A)\right)^2} \qquad (24)$$

$$\frac{\partial(1-\hat{v})}{\partial N_B} = -\frac{\beta(C_A^A - C_A^C)\left(\sqrt{\alpha_B F_B} - \sqrt{\alpha_A(N_B - F_B)}\right)}{\sqrt{\alpha_A(N_B - F_B)}\Delta^2} \qquad (25).$$

Equation (24) and (25) imply that sign $\left(\frac{\partial(1-\hat{v})}{\partial \alpha_A}\right)$=sign $\left(\sqrt{\alpha_B F_B} - \sqrt{\alpha_A(N_B - F_B)}\right)$, and with the aid of equation (22), we have $\frac{\partial(1-\hat{v})}{\partial \alpha_A} > 0$ and $\frac{\partial(1-\hat{v})}{\partial N_B} > 0$. Also, since an increase in α_A and N_B only affects the utility curve in the mass killing case, we have $\frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial \alpha_A} = \frac{\partial \hat{v}}{\partial \alpha_A} < 0$ and $\frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial N_B} = \frac{\partial \hat{v}}{\partial N_B} < 0$. Therefore, α_A and N_B have very similar effects on the wealth level of group A in the mass killing case so that the leader of group A would be indifferent between a higher chance to win due to higher α_A and the increased wealth of group B due to bigger N_B with given F_B.

Variation in τ

An increase in τ has two effects: it reduces the mass killing threshold as the coalition regime becomes less attractive and, at the same time, it increases the coalition threshold. Thus, it entails a moderate increase in the likelihood of mass killing but a substantial decrease in the likelihood of forming a coalition government, as follows:

$$\frac{\partial(1-\hat{v})}{\partial \tau} = \frac{1}{\Delta^2}\left[\beta(C_A^A - C_A^C)N_A\right] > 0 \qquad (25),$$

$$\frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial \tau} = -\left[\frac{C_A^C}{\beta(1-\tau)^2 N_A} + \frac{1}{\Delta^2}\left(\beta(C_A^A - C_A^C)N_A\right)\right] < 0 \qquad (26).$$

The effects of variations in α_A and τ are depicted in Figure 4.

(Insert Figure 4)

Subgroup 3: Variation in parameters which rotate both the expected utility curves

Variation in N_A

The response of the two types of rulers to increases in the size of N_A is not clear. From Figure 5, the intersection of the two utility curves produces lower value of $\hat{v}$. Thus, we observe a definite increase in the likelihood of mass killing. As to the effect on the likelihood of forming a coalition government, an increase in N_A gives incentives for rulers to adopt either regime. Therefore, the effect on the likelihood of choosing a coalition government regime is ambiguous and depends on the relative magnitude of the two countervailing effects. These effects are shown as:

$$\frac{\partial(1-\hat{v})}{\partial N_A} = \frac{1}{\Delta^2}\left[\beta(C_A^A - C_A^C)\tau\right] > 0 \qquad (27),$$

$$\frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial N_A} = -\frac{1}{\Delta^2}\left(\beta(C_A^A - C_A^C)\tau\right) + \frac{C_A^C}{\beta(1-\tau)N_A^2} \gtrless 0 \qquad (28).$$

(Insert Figure 5)

Table 1 gives a summary of comparative statics.

(Insert Table 1)

To summarize: The three-stage framework developed above sets the conditions for the ruler's optimal choice in a country where there are two distinct groups of the population (A

and B). It is an ex-ante model used to explain the behavior of the ruler. The choices before the ruler, assumed to be from group A, are: to attack group B (mass killing regime), form a coalition government sharing power with the leader of group B, or do nothing. The optimization equation identifies the conditions that have to be met for the mass killing regime to be selected.

EMPIRICAL SPECIFICATION AND DATA

Two regression models are estimated. Two dependent variables are used: one count variable for the number of battle related deaths (1,000 or more per year), the second a binary variable for the probability of mass killing (10,000 or more battle deaths per year). For the count variable, Model 1, we use a negative binomial regression model[6], and for the binary variable, Model 2, we use the Probit. The independent variables are those highlighted in the theoretical model with additional variables as control variables. Before presenting the findings, it is useful to provide a brief discussion of civil wars data.

Civil wars data

The empirical literature on civil wars relies heavily on one data source: The Correlates of War (COW) project[7]. Other data sets are available to users, other only by subscription. Almost all of the data sets suffer from systematic problems (Gleditsch 2004), definitional problems (Gleditsch et al. 2002; Sambanis 2001; Doyle and Sambanis 2000), and coding of onset of war problems (Sambanis 2004). A more serious problem is the lack of data on variables such as the size of the military of the two (or more) war factions, the battle deaths

of each of the groups separately and in cases where this information is provided most of the data points are usually missing.

Drawing on insights offered in the literature regarding data bases, definition of civil war and coding rules, the selection favored COW data set (1816-1997) for the following reasons: it meets the requirement of a relatively large sample (213 observations); it defines a major armed conflict in a civil war as resulting in at least 1,000 annual battle related deaths; it identifies war initiator (government or another group) and the onset and termination of war. COW defines civil war by the internality of the war to the territory of a sovereign state and the participation of the government as a combatant.

A listing of the variables used in the estimation and the sources are given in Table 2.

Findings

The estimation results are presented in Tables 3 and 4. In both models, the independent variables are those suggested by the theoretical model: gross domestic product, military expenditure, military personnel, power of the ruler (measured by the length of executive tenure) and ethnicity (measured by the fractionalization index). Two other variables, population and duration of the war are included as control variables.

In Model 1 the dependent variable is the number of battle related deaths (≥ 1,000 annually). Except for ethnicity and the length of the executive, the independent variables are in logs. From the regression we find the length of executive tenure and duration to be significant factors for civil wars killing. Population is positive and significant; GDP negative but not significant; ethnicity was positive but not significant. The latter findings are similar to those reported in the literature (Gleditsch et al. 2002; Fearon and Laitin 2003; Sambanis 2004).

From the estimated incidence rate ratio, a one year increase in the length of executive tenure, the number of battle related deaths would be expected to decrease by a factor of 0.956, holding all other variables in the model constant. As to war duration, a one percentage increase in duration leads to an increase of the rate ratio for battle related deaths by a factor of 1.58, ceteris paribus. Population also increases the death rate – a one percent increase in population leads to an increase of the rate ratio by a factor of 1.72, ceteris paribus[8].

In Model 2, the main independent variables: log of GDP, log of military expenditure, log of war duration, log of population, and ethnicity, have the correct sign and are all significant. The likelihood of mass killing (≥ 10,000 battle-related deaths annually) increases the greater the resources the government devotes to the war, the larger the duration of the conflict and the larger the population. The negative sign for ethnicity, measured by the fractionalization index, suggests that the more fragmented the population – many ethnic groups, the less likely is mass killing. With respect to GDP, again the finding is consistent with the literature – the higher the income of the country, the less likely the ruler would engage into predatory behavior.

The marginal effects on the probability of mass killing from a change in an independent variable, we note that one unit increase in military expenditure increases the likelihood of mass killing by 8.4 percent; a one unit increase of population by 14.3 percent; a one unit increase in duration by 19 percent. The strongest effect is for ethnicity, where a one unit increase in the index reduces the probability by 44 percent, for GDP the reduction is 15.5 percent.

A further insight into the ruler's choice of the mass killing regime may be gained from data reported in Table 5. In the Table the contest success functions (CSF) are compared with the actual outcomes for 24 civil war conflicts.

In the theoretical model it is argued that the ruler of group A in initiating the attack on group B expects to enhance his group's wealth (θ_A^A). Since θ_A^A depends on his group's wealth and the expected wealth appropriated from group B, the likelihood of this appropriation can be inferred from the scores of the CSF. A value between 0.5 and 1.0 predicts a winning outcome for the party initiating the conflict (the government). This turned out to be the case for eleven (11) cases. In four (4) cases, the opposition won even though the CES scores for the government were above 0.5. For the remaining nine (9) cases, the CSF scores did not predict the outcome. Of these cases the government won four (4), the opposition won two (2) and for three (3) wars the outcome for each war was a stalemate or no win.

Several factors may explain the "limited success" of the CSF. Because of missing information on the relative size of the two armies in the COW data set, the small sample size (24 out of 213 observations) may have biased the result. Also, factors not captured in the estimation, such as the efficiency of the conflict technology, information that could have been gained from prior war episodes and/or support from outside sources by either party to the conflict, may have played a more significant role in determining the outcome.

CONCLUSIONS

The statistical analysis provides insights into the factors that induce a government, a leader of a country to engage in mass killing of own people.

The findings presented in the paper differ from those reported in the literature in two major respects: the threshold for mass killing is defined at ≥ 10,000 battle-related deaths annually, whereas the literature uses either ≥ 1,000 per year or some number between 25 and 1,000[9]. Secondly, two of the independent variables, the power of the leader measured by the length of executive tenure, and military expenditure turned out to be significant, but were not investigated in the civil war studies.

As is the case in most empirical research, the test of hypotheses is held hostage to data availability and its quality. There lies avenue for future data collection and research. Researchers undoubtedly will continue to use COW data sets. There is room for improvement there. For one thing some efforts should be made to fill in missing values especially for two critical variables: pre-war armies of the two factions in the war and battle-related deaths separately for the state and the other group challenging the state. The suggested improvements in data collection will enable researchers to shed light on the motivation as well as the capabilities of the opposing groups. Moreover, factors that would induce the government and the opposition parties to resolve the conflict through the formation of a coalition government rather than engaging in mass killing need to be filtered out of the data. Another avenue of research is to examine the role played by outsiders in initiating or concluding a violent intrastate conflict.

ENDNOTES:

[‡] Acknowledgement: The authors are grateful for comments and suggestions from two anonymous referees and the editor. We thank participants to the African Outreach Program of The Institute for Economic Policy Studies for useful comments. Chyanda Querido provided valuable research assistance.

[2] For a list of mass killing episodes see Easterly et al. (2006), Appendix 2. For a listing of civil wars 1816-2002 see Gleditsch (2004), Table A-2.

[3] This is trivial assumption in vertical differentiation model in industrial organization where consumers have unanimous ranking of vertically differentiated products, which means everyone prefers the high quality product. Equation (3), therefore, rules out the case where a choice gives inferior outcome at a higher cost than the high value, which induces no demand for the inferior one.

[4] Further, we make the assumption that H_A and H_B are fixed. This is clearly a simplifying assumption, given that war affects the size of the economy (Bellany 1999), but is needed for the mathematical derivation.

[5] Hirshleifer's formula does not contain the efficiency parameter α_i, although he has suggested that it should be included.

[6] The negative binomial model as compared to other count model (i.e. Poisson) is assured to be the correct model – the dependent variable is over-dispersed and does not have an excessive number of zeros.

[7] For a complete listing of data sets, see Eck (2005).

[8] We estimated another variant of the model where the number of battle related deaths was set at ≥ 10,000 annually. For this sample, none of the coefficients changed sign, but the significance of some of the independent variables.

[9] The choice of ≥ 10,000 battle-related deaths per year, although arbitrary, conveys the scale of mass killing in a civil war more than the practice of using ≥ 25 or ≥ 1,000 battle-related deaths. The higher number used in this paper was in response to anonymous referees suggestion.

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TABLES:

Table 1. Comparative statics results.

Parameters	**The likelihood of mass killing**	**The likelihood of forming coalition government**
C_A^A	$\frac{\partial(1-\hat{v})}{\partial C_A^A} < 0$	$\frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial C_A^A} > 0$
C_A^C	$\frac{\partial(1-\hat{v})}{\partial C_A^C} > 0$	$\frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial C_A^C} \ll 0$
α_A	$\frac{\partial(1-\hat{v})}{\partial \alpha_A} > 0$	$\frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial \alpha_A} < 0$
τ	$\frac{\partial(1-\hat{v})}{\partial \tau} > 0$	$\frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial \tau} \ll 0$
N_A	$\frac{\partial(1-\hat{v})}{\partial N_A} > 0$	$\frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial N_A} \lesseqgtr 0$
N_B	$\frac{\partial(1-\hat{v})}{\partial N_B} > 0$	$\frac{\partial(\hat{v}-\hat{\hat{v}})}{\partial N_B} < 0$

Table 2. List of variables and sources

Variable name	**Source**
lgdp: Log GDP	Angus Maddison (2007), from year 1 to 2003.
lmilexp: Log Military Expenditure	Correlates of War (COW).
lpop: Log Population	Angus Maddison (2007).
lmilper: Log military personnel	Correlates of War (COW).
lmindur: Log war duration	Correlates of War (COW).
ethnic: Ethnic fractionalization	Alesina et al. (2003).
lengexec: Length executive (in years)	Cross-National Time-Series (CNTS) Data Archive (launched in 1968 by Arthur S. Banks), 1815-1999.
masskill: Dependent variable in Probit model: Dummy variable, =1 if number of deaths >=10,000; 0, otherwise	Correlates of War (COW).
battledeath: Dependent variable in Negative binomial model: Number of battle deaths	Correlates of War (COW).

Table 3. Negative binomial regression of civil wars battle-related deaths, 1816-1997.

Variable	**Negative binomial model Coef/t-stat**	**IRR**
lgdp	-0.256 (-1.44)	0.7740
lmilexp	0.041 (0.54)	1.0423
lpop	0.546** (2.84)	1.7266
lmilper	0.071 (0.53)	1.0740
lmindur	0.457*** (9.45)	1.5799
ethnic	0.085 (0.14)	1.0881
lengexec	-0.045*** (-3.48)	0.9560
constant	1.904 (1.33)	
constant	0.773*** (9.38)	
N. of obs.	198	89

* p<0.05, ** p<0.01, *** p<0.001

Table 4. Probit model estimates, civil wars 1816-1997.

Variable	Probit model coef/t-stat	Marginal change coef/t-stat
lgdp	-0.399*	-0.155*
	(-2.11)	(-2.11)
lmilexp	0.215*	0.084*
	(2.49)	(2.47)
lpop	0.367*	0.143*
	(2.44)	(2.44)
lmindur	0.491***	0.191***
	(7.11)	(7.25)
ethnic	-1.130*	-0.440*
	(-2.18)	(-2.17)
lengexec	-0.025	-0.010
	(-1.45)	(-1.45)
constant	-5.647***	
	(-4.30)	
N. of obs.	198	198

* p<0.05, ** p<0.01, *** p<0.001

Table 5. A comparison of CSF and civil war outcome

Name of war	F_A/F_B	CSF	War Outcome (winner)
Two Sicilies vs. Anti-Monarchists	6.5	0.866	Opposition
Sardinia vs. Sardinian Rebels	6.3	0.864	Government
Portugal vs. Conservatives	3.6	0.781	Government
Ottoman Empire vs. Mehmet Ali	1.3	0.566	Government
Austria-Hungary vs. Magyars	0.6	0.369	Government
China vs. Taipings	0.3	0.234	Government
Morocco vs. Fez Caids of 1907	103.2	0.990	Government
Morocco vs. Fez Caids of 1911	106.3	0.990	Government
China vs. Kuomintang	0.2	0.139	Opposition
Greece vs. Communists	326.6	0.997	Government
Lebanon vs. Leftists of 1958	267.8	0.996	Government
Republic of Vietnam vs. NLF	14.4	0.935	Opposition
Zaire vs. Katanga & Leftists	4.4	0.815	Government
Yemen Arab Republic vs. Royalists	55.0	0.982	Government
Dominican Republic vs. Leftists	129.6	0.992	Government
Jordan vs. Palestinians	0.9	0.462	Government
Ethiopia vs. Eritrean Rebels	2.7	0.735	Opposition
Iraq vs. Kurds of 1974	0.5	0.314	Government
Afghanistan vs. Mujahedin	33.3	0.971	Opposition
Cambodia vs. Khmer Rouge of 1978	102.0	0.990	Stalemate
Sri Lanka vs. Tamils	70.1	0.986	No winner
Iraq vs. Kurds & Shiites	1.7	0.630	Government

Liberia vs. Anti-Doe Rebels	0.05	0.05	Opposition
Liberia vs. NPFL & ULIMO	15.2	0.938	Stalemate

Source: Correlates of War Project, 1816-1997

FIGURES:

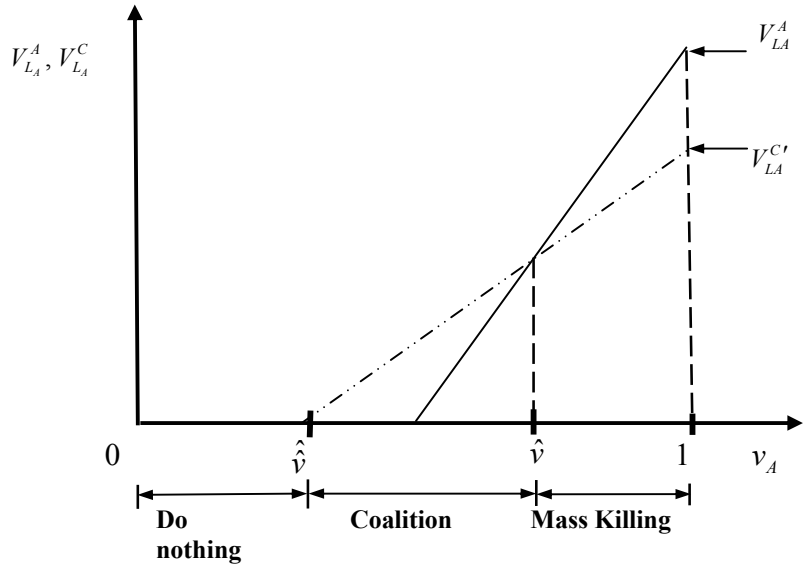


Figure 1. Leader A's choice

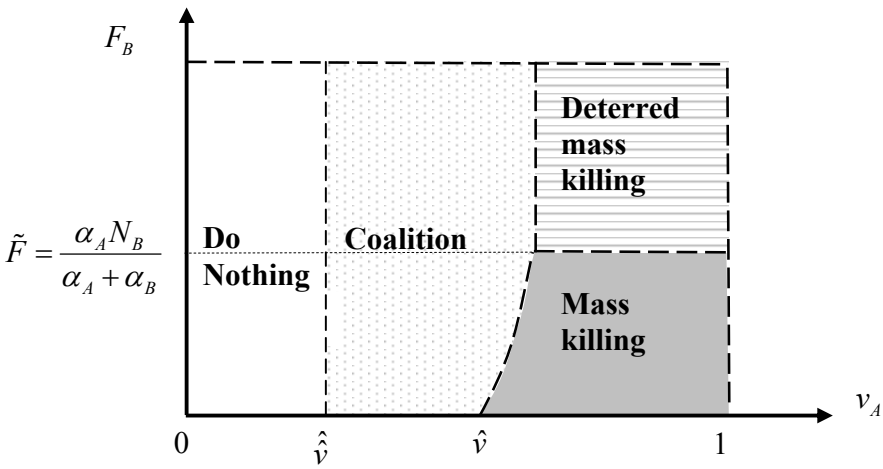
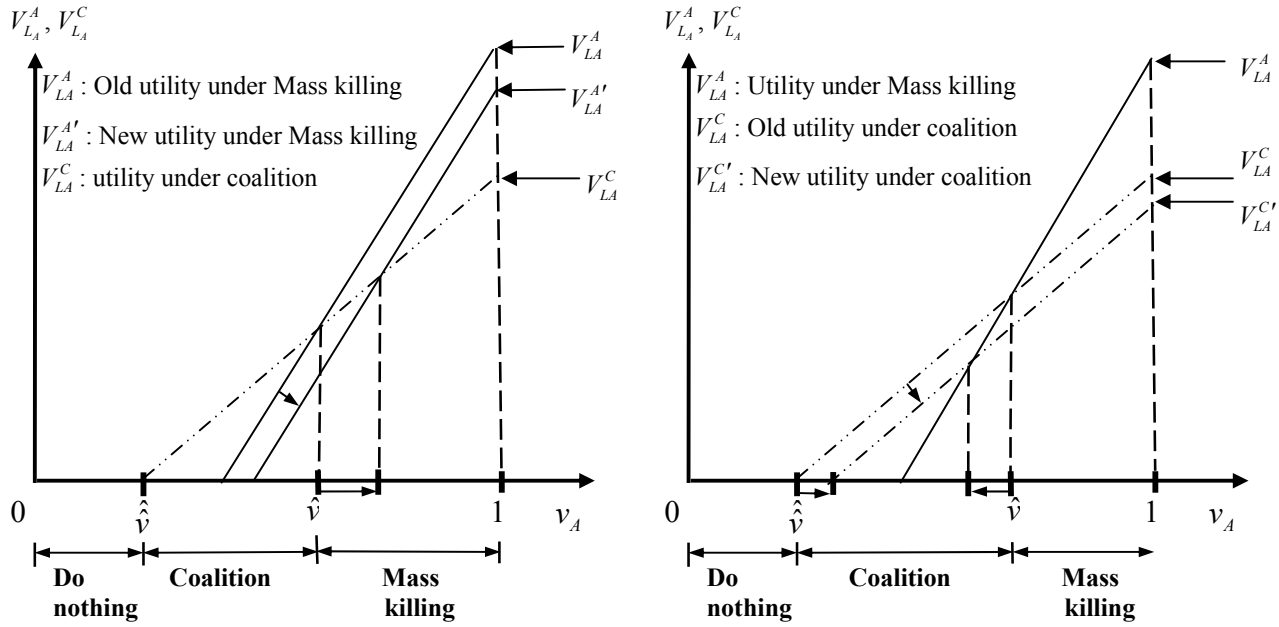
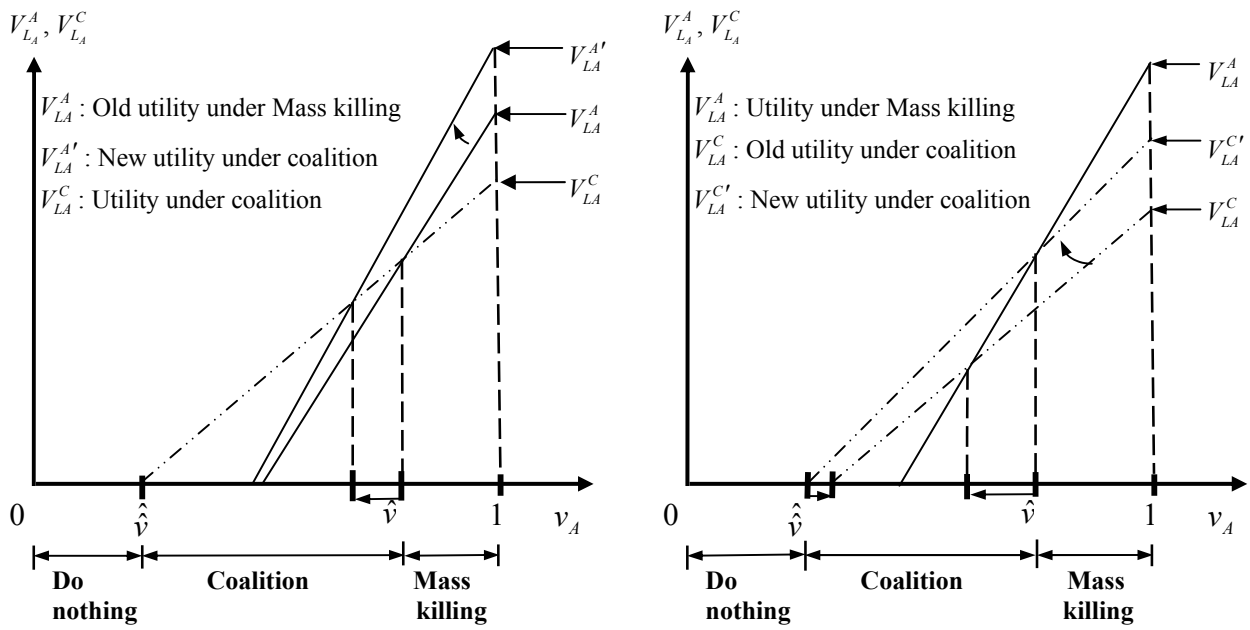


Figure 2 Equilibrium configurations of regimes



(a) Variation in C_A^A (b) Variation in C_A^C

Figure 3. The effect of an increase in fixed cost



(a) Variation in α_A (b) Variation in τ

Figure 4. The effect of an increase in α_A and τ

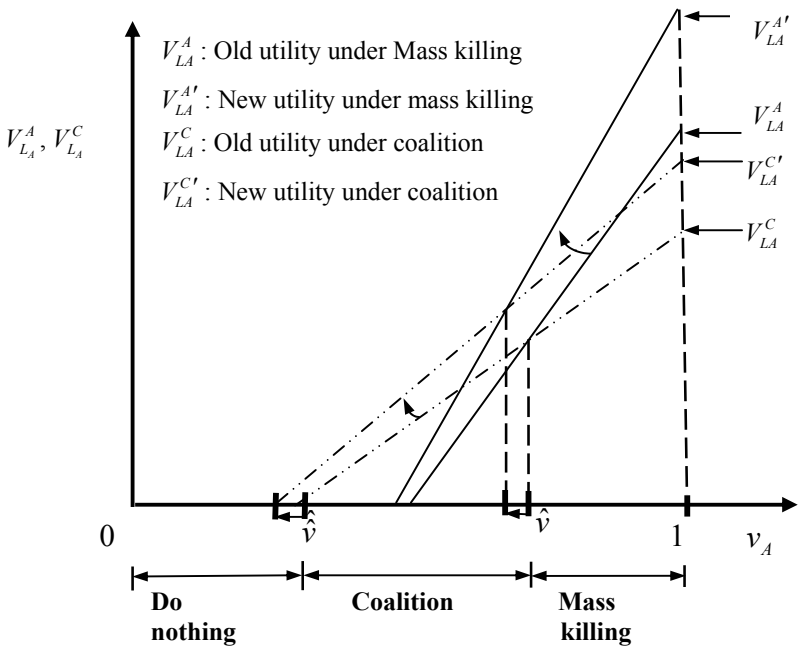


Figure 5. The effect of an increase in N_A

FIGURES CAPTIONS LIST:

FIGURE 1:

v_A : Ruler's political power;

$\hat{v}$: Mass killing threshold;

$\hat{\hat{v}}$: Coalition threshold;

$V_{L_A}^{A}$: The group A ruler's expected utility under a mass killing regime;

$V_{L_A}^{C}$: The ruler's expected utility under a coalition government regime.

FIGURE 2:

v_A : Ruler's political power;

$\hat{v}$: Mass killing threshold;

$\hat{\hat{v}}$: Coalition threshold;

$\tilde{F}$: The minimum level of group B army, needed to deter leader A from attack;

F_A : Size of group A's military forces.

FIGURE 3:

v_A : Ruler's political power;

$\hat{v}$: Mass killing threshold;

$\hat{\hat{v}}$: Coalition threshold;

$V_{L_A}^{A}$: The group A ruler's expected utility under a mass killing regime;

$V_{L_A}^{C}$: The ruler's expected utility under a coalition government regime;

$V_{L_A}^{A\prime}$: New ruler's expected utility under a mass killing regime;

$V_{L_A}^{C\prime}$: New ruler's expected utility under a coalition government regime.

FIGURE 4:

v_A : Ruler's political power;

$\hat{v}$: Mass killing threshold;

$\hat{\hat{v}}$: Coalition threshold;

$V_{L_A}^{A}$: The group A ruler's expected utility under a mass killing regime;

$V_{L_A}^{C}$: The ruler's expected utility under a coalition government regime;

$V_{L_A}^{A\prime}$: New ruler's expected utility under a mass killing regime;

$V_{L_A}^{C\prime}$: New ruler's expected utility under a coalition government regime.

FIGURE 5:

v_A : Ruler's political power;

$\hat{v}$: Mass killing threshold;

$\hat{\hat{v}}$: Coalition threshold;

$V_{L_A}^{A}$: The group A ruler's expected utility under a mass killing regime;

$V_{L_A}^{C}$: The ruler's expected utility under a coalition government regime;

$V_{L_A}^{A'}$: New ruler's expected utility under a mass killing regime;

$V_{L_A}^{C'}$: New ruler's expected utility under a coalition government regime.