The Determinants of the Decision to Join Terrorism.

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Abstract

What are the individual, social, economic and political causes of terrorism? In the last years there have been many empirical analysis of these questions, however we believe a general theoretic model is still missing and it would significantly help empirical research and data interpretations. This paper is just a first attempt towards this aim, the construction of a general model that consider individual education, government responsiveness and economic development as possible factors in a general model of why individual agents might decide to use terrorism as a political strategy to try to reach their political aim.The above important empirical works focus on new sources of data examined in new ways, however the conclusions drawn from the evidence are partially contradictory and not always convincing, e.g. because they often are overly confident that correlations in the data have causal interpretations. As a result, although these works make real contributions to our understanding of the empirical landscape of terrorism, we remain partially skeptical without a theoretical model. The aim of the model is to study the determinants of the citizens and government decisions. As possible determinants we consider citizens' human capital, citizens political preferences and the population political heterogeneity, labour productivity as a measure of economic development, government responsiveness to political activism and government instability. In particular, using these exogenous variables we determine the dynamic of citizens decisions and its interaction with the amount of government repression.

Keywords: terrorism, protest, repression.

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Contents

1 Introduction

What are the individual, social, economic and political causes of terrorism?

In the last years there have been many empirical analysis of these questions,[1] however we believe a general theoretic model is still missing and it would significantly help empirical research and data interpretations. This paper is just a first attempt towards this aim, the construction of a general model that consider individual education, government responsiveness and economic development as possible factors in a general model of why individual agents might decide to use terrorism as a political strategy to try to reach their political aim.

The above important empirical works focus on new sources of data examined in new ways, however the conclusions drawn from the evidence are partially contradictory and not always convincing, e.g. because they often are overly confident that correlations in the data have causal interpretations. As a result, although these works make real contributions to our understanding of the empirical landscape of terrorism, we remain partially skeptical without a theoretical model.

Our model posits that terrorists are rational actors who attack for political ends. In particular terrorists are utility maximizers that use terrorism when the expected political gains minus the expected costs outweigh the net expected benefits of alternative forms of protest. In particular we two class of players: a continuum of citizens who can join the terrorism or the political activism to change government or can support the status quo, and the government that has to decide how much of the fiscal revenue can be used to repress terrorism. A crucial point of our model is that we consider incomplete information on the effectiveness of terrorism activity: only the citizens joining terrorism in the first period will learn the true state that they may signal to the other players in a separating equilibrium or may conceal in a pooling equilibrium. The reason to consider an incomplete information game is to take seriously terrorism as "Propaganda of the Deed", i.e. that terrorism activity not only want to increase the government costs to refuse either requests, it also want to recruit new converts claiming that their choice is the most effective.

The aim of the model is to study the determinants of the citizens and government decisions. As possible determinants we consider

1. citizens' human capital,

2. citizens political preferences and the population political heterogeneity

3. labour productivity as a measure of economic development

[1] Abadie 2006, Benmelech and Berrebi 2007, Berrebi 2007, Krueger 2009, Freytag et al 2009, Krieger and Meierrieks 2011, Bandyopadhyaya and Younas 2011, Brockhoff, Krieger and Meierrieks 2012.

4. government responsiveness to political activism
5. government instability.

In particular, using these exogenous variables we determine the dynamic of citizens decisions and its interaction with the amount of government repression.

The paper proceeds as follows. Next section presents the structure of the model, then we present the results and their analysis, while the final section concludes explaining the relevance and the prospective of this approach. All the long calculations are in a online appendix.

2 The Model

2.1 The Structure of the Model

In the following notation the pedix denotes the role of the player while the apex denotes the time. The model we propose is sequential, where within each stage the agents play simultaneously and at the beginning of each stage all the players are informed of all the previous stage players' choices. The timing of the game is the following.

FIRST STAGE

Nature chooses the likelihood of a revolutionary outcome $\theta \in \{d, (1-d)\}$ with probability $\Pr\{\theta = d\}$;

SECOND STAGE

The citizens $i \in \{1, ..., P\}$ are uninformed on the likelihood of a revolutionary outcome $\theta \in \{d, (1-d)\}$ and they have to decide whether to join one of three different groups, terrorists, T^1, political activists, A^1, or conservative, C^1. Denote by N_T^1, N_A^1, and N_A^1 the number of, respectively, terrorists, activists and conservatives at stage 1 as a consequence of individual decisions;

THIRD STAGE

- each $i \in T^1$ learn the true θ and then chooses the terrorism effort $E_i^1 \in \{0, H_i\}$ and thus the labour supply $L_i^1 = H_i - E_i$, where $H_i \in [0,1]$ is the individual human capital equally affecting $i's$ productivity in both activities, terrorism and labour effort. W.l.g. the human capital is normalized. Finally, $i's$ income Y_i is determined by the production function $f(L) = \alpha L$, where $\alpha \in (0, +\infty)$ is the labour's productivity; hence from the usual budget constraint we get: $C_{i\in T}^1 = (1-t)\, Y_{i\in T}^1$, where $t \in [0,1]$ is the tax rate;
- each $i \in A^1$ does not learn the true θ and chooses political effort $E_i^1 = \frac{1}{2} H_i$ and labour supply $L_i^1 = \frac{1}{2} H_i$. Again, $i's$ income Y_i is determined by the production function $f(L) = \alpha L$, hence from the usual budget constraint we get: $C_{i\in A}^1 = \frac{1}{2}\alpha(1-t)H_i$;

- each $i \in C^1$ does not learn the true θ and then chooses political effort $E_i^1 = 0$ and labour supply $L_i^1 = H_i$. Again, $i's$ income Y_i is determined by the production function $f(L) = \alpha L$, hence from the usual budget constraint we get: $C_{i\in C}^1 = \alpha(1-t)H_i$;

FOURTH STAGE

The government G observes previous actions and then it chooses the amount of repression ρ or equivalently the tax rate t, subject to the public budget constraint: $t\sum_{i\in P} Y_i^1 = \rho$;

FIFTH STAGE

The Citizens $i \in \{1, ..., P\}$ decide whether to join T^2, A^2 *or* C^2;denote by N_T^2, N_A^2, and N_C^2 the number of, respectively, terrorists, activists and conservatives at stage 2 as a consequence of individual decisions;

SIXTH STAGE

- each $i \in T^2$ chooses terrorist effort $E_i^2 = H_i$ and labour supply $L_i^2 = 0$, hence from the usual budget constraint we get: $C_{i\in T}^2 = 0$;

- each $i \in A^2$ chooses political effort $E_i^2 = \frac{1}{2}H_i$ and labour supply $L_i^2 = \frac{1}{2}H_i$, hence from the usual budget constraint we get: $C_{i\in A}^2 = \frac{1}{2}\alpha H_i$;

- each $i \in C^2$ chooses political effort $E_i^2 = 0$ and labour supply $L_i^2 = H_i$, hence from the usual budget constraint we get: $C_{i\in C}^2 = \alpha H_i$.

FINAL OUTCOMES

The game ends with the final outcome: there are two possible final outcomes, Revolution or Status Quo with probability, respectively, R and $1 - R$.

The timing of the model is represented in figure 1:

The sequential structure of the game and the related players' information, i.e. the game form, is the most complex part of the model, while the players' payoff functions and the conflict technology are simplified to find a closed form solution.

PLAYERS' UTILITIES

The final outcome is associate to the following public payoff

$$\Pi = \begin{cases} 1 & \text{if Revolution} \\ 0 & \text{if status quo} \end{cases}$$

that in turn affect the players' payoffs linearly, as follows:

1. the government payoff is

$$U^G(\pi) = 1 - \Pi$$

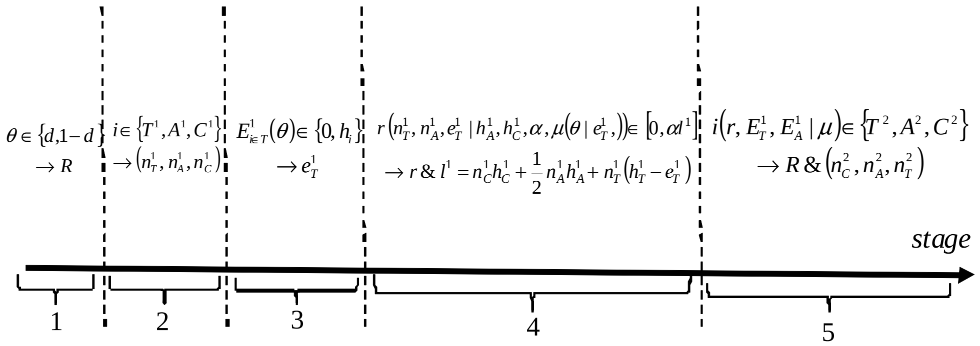

$\theta \in \{d, 1-d\}$
$\to R$
$i \in \{T^1, A^1, C^1\}$
$\to (n_T^1, n_A^1, n_C^1)$
$E_{i\in T}^1(\theta) \in \{0, h_i\}$
$\to e_T^1$
$r\left(n_T^1, n_A^1, e_T^1 \mid h_A^1, h_C^1, \alpha, \mu(\theta \mid e_T^1,)\right) \in [0, \alpha l^1]$
$\to r \,\&\, l^1 = n_C^1 h_C^1 + \frac{1}{2} n_A^1 h_A^1 + n_T^1 (h_T^1 - e_T^1)$
$i(r, E_T^1, E_A^1 \mid \mu) \in \{T^2, A^2, C^2\}$
$\to R \,\&\, (n_C^2, n_A^2, n_T^2)$
stage
1
2
3
4
5

Figure 1:

2. the citizens payoffs are

$$U_i(\pi) = C_i^1 + C_i^2 + \gamma_i \Pi.$$

where

$$\gamma_i \in \left[-\frac{m}{2}P, \frac{m}{2}P\right]$$

is an individual parameter that describes a citizen's position towards revolution: higher γ_i means a high propensity for revolution, while lower γ_i denotes a taste for status quo.

THE CONFLICT TECHNOLOGY

The final crucial aspect of this model is the specification of how the players' choices affect the probability of Revolution:

$$R = \min\left\{\theta\left[\left(1 - \frac{\rho}{\sum_{i\in P} Y_i^1}\right)\frac{E_T^1 + E_T^2}{P} + a\frac{E_A^1 + E_A^2}{P}\right], 1\right\}$$

This conflict technology is quite standard and it says in the simplest way that the probability of revolution increases linearly with the percentage of global terrorists' activity but its is reduced by governments repression. Also active participation to protests increases the likelihood of a revolution, however the effects of such protests is demoltiplicate by a parameter a. Finally this probability depends also on an unknown parameter θ : the higher θ, the greater is the probability of revolution for given terrorism effort, protest activity and government's repression.

Before deriving formally the game, we make the following hypotheses on the model's parameters.

Condition 1 *The parameters of the model satisfy the following conditions*

$$P \in \{1, ..., \infty\}, \ h_J^\tau \in [0,1], \ \theta \in \{d, (1-d)\}, \ d \in \left(0, \frac{1}{2}\right), \quad \Pr\{\theta = d\} = \frac{1}{2}$$

$$\alpha \in (0, +\infty), \ a \in (0; 1), \gamma_i \sim U\left[-\frac{m}{2}P, \frac{m}{2}P\right], \ m \in (0, +\infty)$$

where

1. $P \in \{1, ..., \infty\}$ *is the population size;*
2. $h_J^\tau := \frac{1}{N_J^\tau}\sum_{i\in J^\tau} H_i \in [0,1]$ *is the average human capital at period* $\tau = 1, 2$ *within group* $J \in \{T, A, C\}$, *and* N_J^τ *is the number of citizens* $i \in P$ *that join group* $J \in \{T, A, C\}$ *at period* $\tau = 1, 2$;
3. $\theta \in \{d, (1-d)\}$ *is the state of nature that measure the weakness of the government;*

4. $(1-d) \in \left(\frac{1}{2}, 1\right)$ *is a measure of the dispersion of opinions on the weakness of the government. Note that* $E(\theta) = \frac{1}{2}$ *since* $\Pr\{\theta = d\} = \frac{1}{2}$;

5. $\alpha \in (0, \infty)$ *is a measure of productivity which is correlated to the general economic situation;*

6. $a \in (0; 1)$ *is a measure of the effectiveness of activism to change the status quo;*

7. γ_i *is citizen's* i *marginal utility of the revolution;*

8. $U\left[-\frac{m}{2}P, \frac{m}{2}P\right]$ *is the uniform distribution on* $\left[-\frac{m}{2}P, \frac{m}{2}P\right]$, *thus* $G(\gamma_i) = \frac{1}{mP}\gamma_i + \frac{1}{2}$, *hence*

9. $m \in (0, +\infty)$ *is a measure of the political heterogeneity in the population.*

Some change in notation will help the following calculus. So let define

1.
$$n_J^\tau = \frac{N_J^\tau}{P}$$
as the proportion of citizens in group $J \in \{T, A, C\}$ at period $\tau \in \{1, 2\}$;

2.
$$e_J^\tau = \frac{\sum_{i \in J} E_i^\tau}{N_J^\tau}$$
as the average effort of citizens within group $J \in \{C, T, A\}$ at period $\tau \in \{1, 2\}$, so that
$$E_J^\tau = P n_J^\tau e_J^\tau.$$

Using this notation, we can rewrite the public budget constraint as follows:

$$t = \frac{\rho}{\sum_{i \in P} Y_i^1} = \frac{\rho}{\alpha P \left[\frac{1}{P} \sum\limits_{i \in C^1} H_i + \frac{1}{2}\frac{1}{P} \sum\limits_{i \in A^1} H_i + \frac{1}{P} \sum\limits_{i \in T^1} \left(H_i - E_i^1\right)\right]} = \frac{\rho}{\alpha P l^1}$$

where l^1 is the average labour supply at period $\tau = 1$ and thus αl^1 is the average income. Hence, we can rewrite the probability of successful revolution as follows

$$R = \min\left\{\theta\left[(1-t)\frac{E_T^1 + E_T^2}{P} + a\frac{E_A^1 + E_A^2}{P}\right], 1\right\} =$$

$$= \min\left\{\theta\left[(1-t)\left(n_T^1 e_T^1 + n_T^2 h_T^2\right) + \frac{1}{2}a\left(n_A^1 h_A^1 + n_A^2 h_A^2\right)\right], 1\right\};$$

remember that αl^1 is endogenous since

$$l^1 = n_C^1 h_C^1 + \frac{1}{2} n_A^1 h_A^1 + n_T^1\left(h_T^1 - e_T^1\right).$$

Finally, we rewrite the players payoffs as follows.

PLAYERS' PAYOFFS

1. Government:

$$U^G = 1 - R = 1 - \min\left\{ \mathbb{E}_G(\theta)\left[(1-t)\left(n_T^1 e_T^1 + n_T^2 h_T^2\right) + \frac{1}{2}a\left(n_A^1 h_A^1 + n_A^2 h_A^2\right)\right], 1\right\}$$

2. Citizens:

$$U_i = \gamma_i R + C_i^1 + C_i^2 =$$

$$= \gamma_i R_{-i}\left(t, \overline{n}_T^1 \overline{e}_T^1, \overline{n}_T^2 \overline{h}_T^2, \overline{n}_A^1 \overline{h}_A^1, \overline{n}_A^2 \overline{h}_A^2 | \mathbb{E}_i(\theta)\right) + B_i\left(i^1 \in J^1, i^2 \in J^2, E_i^1 | \mathbb{E}_i(\theta)\right)$$

where

$$R_{-i}\left(t, \overline{n}_T^1 \overline{e}_T^1, \overline{n}_T^2 \overline{h}_T^2, \overline{n}_A^1 \overline{h}_A^1, \overline{n}_A^2 \overline{h}_A^2 | \mathbb{E}_i(\theta)\right) =$$

$$= \min\left\{ \mathbb{E}_i(\theta)\left[(1-t)\left(\overline{n}_T^1 \overline{e}_T^1 + \overline{n}_T^2 \overline{h}_T^2\right) + \frac{1}{2}a\left(\overline{n}_A^1 \overline{h}_A^1 + \overline{n}_A^2 \overline{h}_A^2\right)\right], 1\right\}$$

and

$$B_i\left(i^1 \in J, i^2 \in J, E_i^1 | \mathbb{E}_i(\theta)\right) =$$

$$= \begin{cases} \frac{1}{P}\gamma_i \mathbb{E}_i(\theta)(1-t)E_i^1 + \alpha(1-t)\left(H_i - E_i^1\right) + \frac{1}{P}\gamma_i \mathbb{E}_i(\theta)(1-t)H_i & \text{if } i^1 \in T^1, i^2 \in T^2 \\ \frac{1}{P}\gamma_i \mathbb{E}_i(\theta)(1-t)E_i^1 + \alpha(1-t)\left(H_i - E_i^1\right) + \frac{1}{2P}\gamma_i \mathbb{E}_i(\theta)aH_i + \frac{1}{2}\alpha H_i & \text{if } i^1 \in T^1, i^2 \in A^2 \\ \frac{1}{P}\gamma_i \mathbb{E}_i(\theta)(1-t)E_i^1 + \alpha(1-t)\left(H_i - E_i^1\right) + \alpha H_i & \text{if } i^1 \in T^1, i^2 \in C^2 \\ \frac{1}{2P}\gamma_i \mathbb{E}_i(\theta)aH_i + \frac{1}{2}\alpha(1-t)H_i + \frac{1}{P}\gamma_i \mathbb{E}_i(\theta)(1-t)H_i & \text{if } i^1 \in A^1, i^2 \in T^2 \\ \frac{1}{2P}\gamma_i \mathbb{E}_i(\theta)aH_i + \frac{1}{2}\alpha(1-t)H_i + \frac{1}{2P}\gamma_i \mathbb{E}_i(\theta)aH_i + \frac{1}{2}\alpha H_i & \text{if } i^1 \in A^1, i^2 \in A^2 \\ \frac{1}{2P}\gamma_i \mathbb{E}_i(\theta)aH_i + \frac{1}{2}\alpha(1-t)H_i + \alpha H_i & \text{if } i^1 \in A^1, i^2 \in C^2 \\ \alpha(1-t)H_i + \frac{1}{P}\gamma_i \mathbb{E}_i(\theta)(1-t)H_i & \text{if } i^1 \in C^1, i^2 \in T^2 \\ \alpha(1-t)H_i + \frac{1}{2P}\gamma_i \mathbb{E}_i(\theta)aH_i + \frac{1}{2}\alpha H_i & \text{if } i^1 \in C^1, i^2 \in A^2 \\ \alpha(1-t)H_i + \alpha H_i & \text{if } i^1 \in C^1, i^2 \in C^2 \end{cases}$$

where $i^1 \in \left\{T^1, A^1, C^1\right\}$ and $i^2 \in \left\{T^2, A^2, C^2\right\}$ denotes $i's$ choice whether to join group $J^\tau = \{T^\tau, A^\tau, C^\tau\}$ in period $\tau \in \{1, 2\}$ and

$$\overline{n}_J^\tau = \frac{1}{P}\sum_{j \neq i, j=1}^{P} I_{\{j \in J\}} \text{ and } \overline{h}_J^\tau = \frac{1}{P}\sum_{j \neq i, j=1}^{P} I_{\{j \in J\}} H_j$$

where $I_{\{j \in J\}}$ is the indicator function for a citizen $j \in \{1, ..., P\}$ choice of group J, hence $\overline{n}_J^\tau$ and $\overline{h}_J^\tau$ denote, respectively, the percentage and the average human capital of citizens different from i that choose group $J^\tau = \{T^\tau, A^\tau, C^\tau\}$ in period $\tau \in \{1, 2\}$. In particular, it is important to consider the citizens' continuation payoff, which by definition is different at different stages:

Fifth stage: Citizen's i's continuation payoff is

$$EV_i^2\left(i^2 | \overline{n}_T^2 \overline{h}_T^2, \overline{n}_A^2 \overline{h}_A^2; t, n_T^1 e_T^1, n_A^1 h_A^1, \mathbb{E}_i(\theta)\right) = B_i\left(i^2 \in J^2 | i^1 \in J^1, E_i^1, t, \mathbb{E}_i(\theta)\right) =$$

$$= \begin{cases} \frac{1}{P}\gamma_i \mathbb{E}_i(\theta)(1-t)H_i & \text{if } i^2 \in T^2 \\ \frac{1}{2P}\gamma_i \mathbb{E}_i(\theta)aH_i + \frac{1}{2}\alpha H_i & \text{if } i^2 \in A^2 \\ \alpha H_i & \text{if } i^2 \in C^2 \end{cases}$$

Fourth stage: Government continuation payoff is

$$EV^{G}\left(t|n_T^1e_T^1, n_A^1h_A^1, \mathbb{E}_G(\theta)\right) = 1 - R =$$

$$= 1 - \min\left\{\mathbb{E}_G(\theta)\left[(1-t)\left(n_T^1e_T^1 + n_T^{2*}h_T^2\right) + \frac{1}{2}a\left(n_A^1h_A^1 + n_A^{2*}h_A^2\right)\right], 1\right\}$$

where n_J^{2*} is the sequential best reply at the fifth stage;

Third stage: Citizen's $i \in T^1$ continuation payoff is

$$EV^1_{i^1\in T^1}\left(E_i^1|n_T^1, n_A^1, \mathbb{E}_i(\theta)\right) =$$

$$= \gamma_i R_{-i}\left(t^*, \overline{n}_T^1\overline{e}_T^1, n_T^{2*}h_T^2, \overline{n}_A^1\overline{h}_A^1, n_A^{2*}h_A^2|\mathbb{E}_i(\theta)\right) + B_i\left(E_i^1|i^1 \in J^1, \mathbb{E}_i(\theta); t^*, i^{2*} \in J^2\right) =$$

$$= \gamma_i \min\left\{\mathbb{E}_i(\theta)\left[(1-t^*)\left(\overline{n}_T^1\overline{e}_T^1 + n_T^{2*}h_T^2\right) + \frac{1}{2}a\left(\overline{n}_A^1h_A^1 + n_A^{2*}h_A^2\right)\right], 1\right\} +$$

$$+\frac{1}{P}\gamma_i\mathbb{E}_i(\theta)(1-t^*)E_i^1 + \alpha(1-t^*)\left(H_i - E_i^1\right) + C_i^{2*} =$$

$$= \gamma_i \min\left\{\theta\left[(1-t^*)\left(\overline{n}_T^1\overline{e}_T^1 + n_T^{2*}h_T^2\right) + \frac{1}{2}a\left(\overline{n}_A^1h_A^1 + n_A^{2*}h_A^2\right)\right], 1\right\} +$$

$$+\frac{1}{P}\gamma_i(1-t^*)E_i^1 + \alpha(1-t^*)\left(H_i - E_i^1\right) + C_i^{2*}$$

where t^* and C_i^{2*} are, respectively, the sequential best reply at the fourth and fifth stages;

Second stage: Citizen's i's continuation payoff is

$$EV_i^1\left(i^1\right) = \gamma_i R_{-i}\left(t^*, \overline{n}_T^1e_T^{1*}, n_T^{2*}\overline{h}_T^2, \overline{n}_A^1h_A^{1*}, n_A^{2*}h_A^2\right) + B_i\left(i^1 \in J^1|i^{2*} \in J^2, t^*, E_i^{1*}\right) =$$

$$= \gamma_i \min\left\{\frac{1}{2}\left[(1-t^*)\left(\overline{n}_T^1e_T^{1*} + n_T^{2*}h_T^2\right) + \frac{1}{2}a\left(\overline{n}_A^1h_A^1 + n_A^{2*}h_A^2\right)\right], 1\right\} +$$

and

$$+\begin{cases}
\frac{1}{P}\gamma_i\frac{1}{2}(1-t^*)E_i^{1*} + \alpha(1-t^*)\left(H_i - E_i^1*\right) + \frac{1}{P}\gamma_i\frac{1}{2}(1-t^*)H_i & i^1 \in T^1, i^{2*} \in T^2 \\
\frac{1}{P}\gamma_i\frac{1}{2}(1-t^*)E_i^{1+} + \alpha(1-t^*)\left(H_i - E_i^{1*}\right) + \frac{1}{2P}\gamma_i\frac{1}{2}aH_i + \frac{1}{2}\alpha H_i & i^1 \in T^1, i^{2*} \in A^2 \\
\frac{1}{P}\gamma_i\frac{1}{2}(1-t^*)E_i^{1*} + \alpha(1-t^*)\left(H_i - E_i^{1*}\right) + \alpha H_i & i^1 \in T^1, i^{2*} \in C^2 \\
\frac{1}{2P}\gamma_i\frac{1}{2}aH_i + \frac{1}{2}\alpha(1-t^*)H_i + \frac{1}{P}\gamma_i\frac{1}{2}(1-t^*)H_i & i^1 \in A^1, i^{2*} \in T^2 \\
\frac{1}{2P}\gamma_i\frac{1}{2}aH_i + \frac{1}{2}\alpha(1-t^*)H_i + \frac{1}{2P}\gamma_i\frac{1}{2}aH_i + \frac{1}{2}\alpha H_i & i^1 \in A^1, i^{2*} \in A^2 \\
\frac{1}{2P}\gamma_i\frac{1}{2}aH_i + \frac{1}{2}\alpha(1-t^*)H_i + \alpha H_i & i^1 \in A^1, i^{2*} \in C^2 \\
\alpha(1-t^*)H_i + \frac{1}{P}\gamma_i\frac{1}{2}(1-t^*)H_i & i^1 \in C^1, i^{2*} \in T^2 \\
\alpha(1-t^*)H_i + \frac{1}{2P}\gamma_i\frac{1}{2}aH_i + \frac{1}{2}\alpha H_i & i^1 \in C^1, i^{2*} \in A^2 \\
\alpha(1-t^*)H_i + \alpha H_i & i^1 \in C^1, i^{2*} \in C^2.
\end{cases}$$

Before going to the results, let we sum up the exogenous and endogenous variable of the model, and their meaning

Exogenous variables	Meaning
$P \in \{0, ..., \infty\}$	population size
$m \in \mathbb{R}^{+}$	measure of political heterogeneity
$\alpha \in (0, \infty)$	measure of economic development
$a \in (0, 1)$	measure of regime's responsiveness
$\gamma_i \in \left[-\frac{m}{2}P, \frac{m}{2}P\right]$	citizens' political position
$1 - d \in \left(\frac{1}{2}, 1\right)$	measure of dispersion of opinions on regime instability
$\theta \in \{d, 1-d\}$	measure of regime instability
$h_J^{\tau} \in [0, 1]$	average human capital of citizens in group $J \in \{T, A, C\}$ in period $\tau = 1, 2$
Endogenous variables	**Meaning**
$n_J^{\tau} \in [0, 1]$	percentage of citizens in group $J \in \{T, A, C\}$ in period $\tau = 1, 2$
$t \in [0, 1]$	tax rate used for government repression
$e_i^1 \in \{0, h_i\}$	$i \in T^1$ decision on terrorist's activity

3 The Set of Equilibria

Denote by $EV_i^{\tau}(J|h_i^{\tau})$ the expected utility of agents $i \in P$ when she chooses of joining group J at stage τ given the choices of all the other agents and given previous choices h_i^{τ}.

3.1 A possible separating equilibrium

We start assuming that there exists a possible separating equilibrium , i.e. such that in the second stage

$$\forall i \in T^1 \quad e_i^1 = \begin{cases} 0 & \text{if } \theta = d \\ h_i & \text{if } \theta = 1 - d. \end{cases}$$

This implies that in all subsequent stages, all the players can infer the true state of nature θ from the terrorists' first stage behavior.

3.1.1 Citizens' choices at the fifth stage

Condition 2 *From now on,* ***assume*** *that*

$$\frac{\alpha}{m\theta a}+\frac{1}{2}\leq 1\Leftrightarrow\frac{\alpha}{m\theta a}\leq\frac{1}{2}\Leftrightarrow m\geq\frac{2\alpha}{\theta a}.$$

This condition means that the ratio of political heterogeneity of the population over productivity is bounded from below so that their relative changes should be related. The condition is useful to simplify the actual calculus of the proportion of citizens in the different groups, however it is also plausible.

Then, we can conclude this analysis of players' strategic behavior with the following claims.

Proposition 1 *In the fifth stage, citizens will chase the organization according to the following inequalities*

$$i\in T^2\Leftrightarrow\begin{cases}\gamma_i\in\left[\dfrac{\alpha P}{\theta(1-t)},\dfrac{m}{2}P\right] & \text{if } t\in[0,1-a]\\ \gamma_i\in\left[\dfrac{\alpha P}{\theta(2-2t-a)},\dfrac{m}{2}P\right] & \text{if } t\in\left[1-a,1-\dfrac{a}{2}\right]\\ \text{never} & \text{if } t\in\left[1-\dfrac{a}{2},1\right].\end{cases}\qquad (T^2)$$

$$i\in A^2\Leftrightarrow\begin{cases}\text{never} & \text{if } t\in[0,1-a]\\ \gamma_i\in\left[\dfrac{\alpha P}{\theta a},\dfrac{\alpha P}{\theta(2-2t-a)}\right] & \text{if } t\in\left[1-a,1-\dfrac{a}{2}\right]\\ \gamma_i\in\left[\dfrac{\alpha P}{\theta a},\dfrac{m}{2}P\right] & \text{if } t\in\left[1-\dfrac{a}{2},1\right].\end{cases}\qquad (A^2)$$

$$i\in C^2\Leftrightarrow\begin{cases}\gamma_i\in\left[-\dfrac{m}{2}P,\dfrac{\alpha P}{\theta\,(1-t)}\right] & \text{if } t\in[0,1-a]\\ \gamma_i\in\left[-\dfrac{m}{2}P,\dfrac{\alpha P}{\theta a}\right] & \text{if } t\in[1-a,1].\end{cases}\qquad (C^2)$$

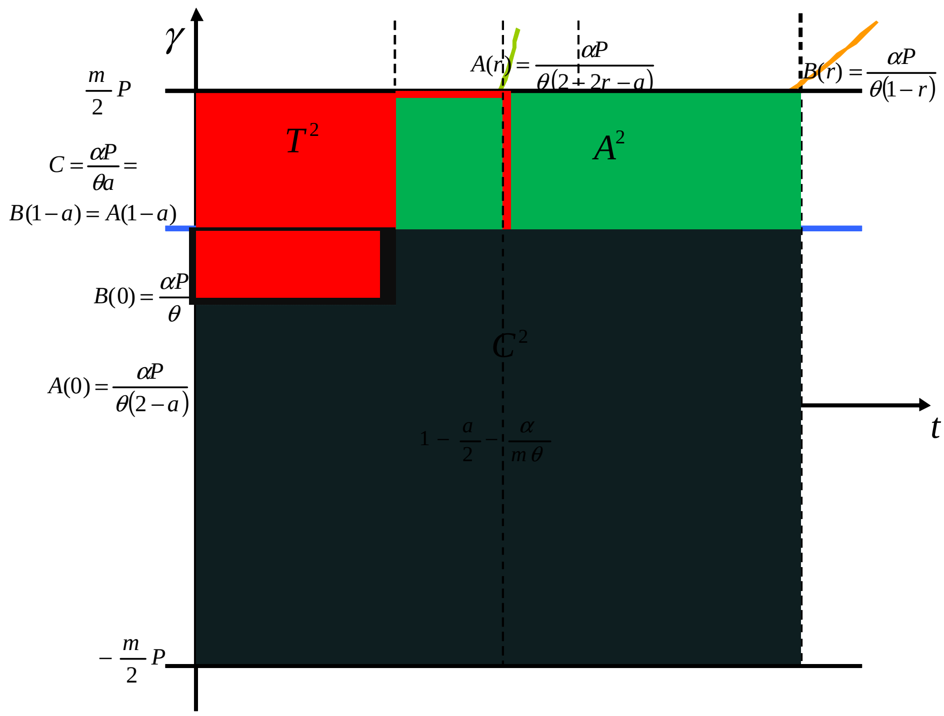
The situation is pictured in the following figure:

Hence, we can compute the average members of each organization in the last stage:

Corollary 1 *Proposition 1 can be rephrased as follows:*

$$n_C^{2*}\left(t|\alpha,a,m,\theta\right)=\begin{cases}\dfrac{\alpha}{m\theta(1-t)}+\dfrac{1}{2} & t\in[0,1-a]\\ \dfrac{\alpha}{am\theta}+\dfrac{1}{2} & t\in[1-a,1]\end{cases}$$

$$n_A^{2*}\left(t|\alpha,a,m,\theta\right)=\begin{cases}0 & t\in[0,1-a]\\ \dfrac{\alpha}{m\theta(2-2t-a)}-\dfrac{\alpha}{m\theta a} & t\in\left[1-a,1-\dfrac{a}{2}-\dfrac{\alpha}{m\theta}\right]\\ \dfrac{1}{2}-\dfrac{\alpha}{m\theta a} & t\in\left[1-\dfrac{a}{2}-\dfrac{\alpha}{m\theta},1\right]\end{cases}$$



γ
$\frac{m}{2}P$
$C = \frac{\alpha P}{\theta a} =$
$B(1-a) = A(1-a)$
$B(0) = \frac{\alpha P}{\theta}$
$A(0) = \frac{\alpha P}{\theta(2-a)}$
$-\frac{m}{2}P$
$A(r) = \frac{\alpha P}{\theta(2+2r-a)}$
$B(r) = \frac{\alpha P}{\theta(1-r)}$
T^2
A^2
C^2
$1-\frac{a}{2}-\frac{\alpha}{m\theta}$
t

Figure 2:

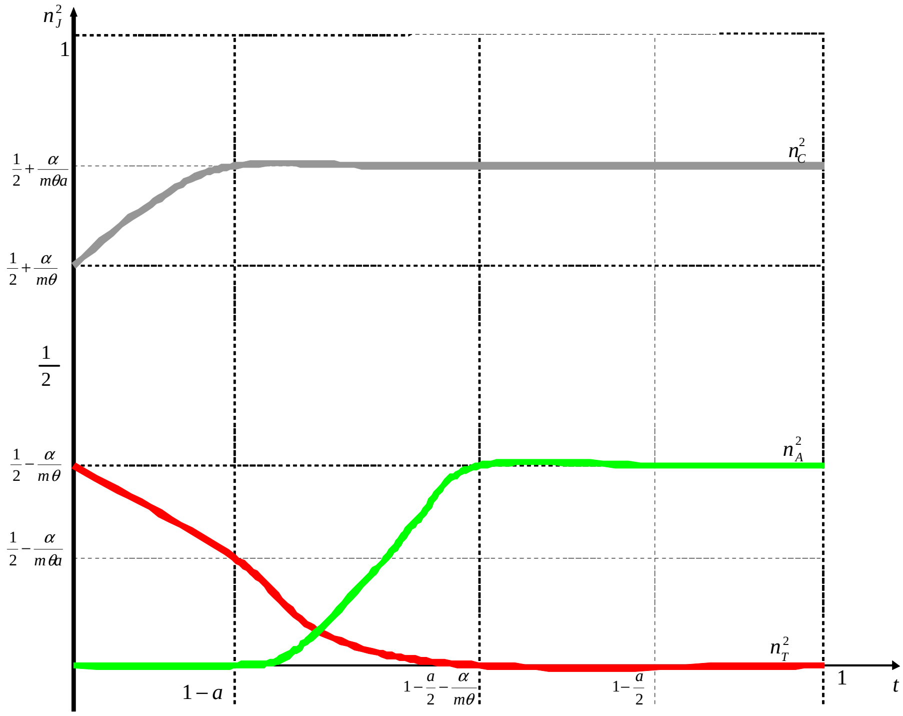


Figure 3:

$$n_T^{2*}(t|\alpha,a,m,\theta)=\begin{cases}\dfrac{1}{2}-\dfrac{\alpha}{m\theta(1-t)} & t\in[0,1-a]\\ \dfrac{1}{2}-\dfrac{\alpha}{m\theta(2-2t-a)} & t\in\left[1-a,1-\dfrac{a}{2}-\dfrac{\alpha}{m\theta}\right]\\ 0 & t\in\left[1-\dfrac{a}{2}-\dfrac{\alpha}{m\theta},1\right].\end{cases}$$

The following picture shows the connection between percentage of citizens in each group and government repression:

Comparative statics From proposition 1 and corollary 1, it is immediate to derive the following comparative static results.

Corollary 2 *From Corollary 1:*

1.

$$\frac{\partial n_C^{2*}}{\partial\alpha}>0;\quad \frac{\partial n_C^{2*}}{\partial a}=\begin{cases}0 & t\in\dfrac{\partial}{\partial a}[0,1-a]<0\\ <0 & t\in\dfrac{\partial}{\partial a}[1-a,1]>0\end{cases};\quad \frac{\partial n_C^{2*}}{\partial m}<0;\quad \frac{\partial n_C^{2*}}{\partial\theta}<0$$

i.e. the percentage of conservatives is increasing in economic development, weakly decreasing in regime responsiveness, decreasing in political heterogeneity and in regime stability. In particular note that $n_C^{2*}(t|\alpha,a,m,\theta)$

reaches its maximum at $t=1-a$ *at a value* $\frac{\alpha}{am\theta}+\frac{1}{2}$ *that it is decreasing in* a,m,θ *and increasing in* α*;*

2.

$$\frac{\partial n_A^{2*}}{\partial \alpha}=\begin{cases}0 & t\in[0,1-a]\\ >0 & t\in\frac{\partial}{\partial \alpha}\left[1-a,1-\frac{a}{2}-\frac{\alpha}{m\theta}\right]<0\\ <0 & t\in\frac{\partial}{\partial \alpha}\left[1-\frac{a}{2}-\frac{\alpha}{m\theta},1\right]>0\end{cases}$$

$$\frac{\partial n_A^{2*}}{\partial a}=\begin{cases}0 & t\in\frac{\partial}{\partial a}[0,1-a]<0\\ >0 & t\in\frac{\partial}{\partial a}\left[1-a,1-\frac{a}{2}-\frac{\alpha}{m\theta}\right]>0\\ >0 & t\in\frac{\partial}{\partial a}\left[1-\frac{a}{2}-\frac{\alpha}{m\theta},1\right]>0\end{cases}$$

$$\frac{\partial n_A^{2*}}{\partial m}=\begin{cases}0 & t\in[0,1-a]\\ <0 & t\in\frac{\partial}{\partial m}\left[1-a,1-\frac{a}{2}-\frac{\alpha}{m\theta}\right]>0\\ <0 & t\in\frac{\partial}{\partial m}\left[1-\frac{a}{2}-\frac{\alpha}{m\theta},1\right]>0\end{cases}$$

$$\frac{\partial n_A^{2*}}{\partial \theta}=\begin{cases}0 & t\in[0,1-a]\\ <0 & t\in\frac{\partial}{\partial \theta}\left[1-a,1-\frac{a}{2}-\frac{\alpha}{m\theta}\right]>0\\ <0 & t\in\frac{\partial}{\partial \theta}\left[1-\frac{a}{2}-\frac{\alpha}{m\theta},1\right]>0\end{cases}$$

i.e. the percentage of activists is non monotone in economic development, weakly increasing in regime responsiveness, decreasing in political heterogeneity and in regime stability. In particular note that $n_A^{2*}(t|\alpha,a,m,\theta)$ *reaches its maximum at* $t=1-\frac{a}{2}-\frac{\alpha}{m\theta}$ *at a value* $\frac{1}{2}-\frac{\alpha}{m\theta a}$ *that it is decreasing in* α *and increasing in* a,m,θ*;*

3.

$$\frac{\partial n_T^{2*}}{\partial \alpha}=\begin{cases}<0 & t\in[0,1-a]\\ <0 & t\in\frac{\partial}{\partial \alpha}\left[1-a,1-\frac{a}{2}-\frac{\alpha}{m\theta}\right]<0\\ 0 & t\in\frac{\partial}{\partial \alpha}\left[1-\frac{a}{2}-\frac{\alpha}{m\theta},1\right]>0\end{cases}$$

$$\frac{\partial n_T^{2*}}{\partial a}=\begin{cases}0 & t\in\frac{\partial}{\partial a}[0,1-a]<0\\ <0 & t\in\frac{\partial}{\partial a}\left[1-a,1-\frac{a}{2}-\frac{\alpha}{m\theta}\right]>0\\ 0 & t\in\frac{\partial}{\partial a}\left[1-\frac{a}{2}-\frac{\alpha}{m\theta},1\right]>0\end{cases}$$

$$\frac{\partial n_T^{2*}}{\partial m}=\begin{cases}>0 & t\in[0,1-a]\\ >0 & t\in\frac{\partial}{\partial m}\left[1-a,1-\frac{a}{2}-\frac{\alpha}{m\theta}\right]>0\\ 0 & t\in\frac{\partial}{\partial m}\left[1-\frac{a}{2}-\frac{\alpha}{m\theta},1\right]>0\end{cases}$$

$$\frac{\partial n_T^{2*}}{\partial\theta} = \begin{cases} >0 & t\in[0,1-a] \\ >0 & t\in\frac{\partial}{\partial\theta}\left[1-a, 1-\frac{a}{2}-\frac{\alpha}{m\theta}\right]>0 \\ 0 & t\in\frac{\partial}{\partial\theta}\left[1-\frac{a}{2}-\frac{\alpha}{m\theta}, 1\right]>0 \end{cases}$$

i.e. the percentage of terrorists is weakly decreasing in economic development, weakly decreasing in regime responsiveness, weakly increasing in political heterogeneity and in regime stability. In particular note that $n_T^{2*}(t|\alpha,a,m,\theta)$ *reaches its maximum at* $t=0$ *at a value* $\frac{1}{2}-\frac{\alpha}{m\theta}$ *that it is decreasing in* α *and increasing in* m,θ, *constant in* a.

3.1.2 Government choice at the fourth stage

Then, we might conclude with the following proposition.

Proposition 2 *At stage 4, the government sequential best reply depends on the parameters as follows:*

1. ***FIRST*** $h_T^2-h_A^2$ ***REGION*** $R_G^1\left(\alpha,a,m,\theta,n_T^1h_T^1\right)$

$$h_A^2\in\left[0,\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2+\frac{4\alpha n_T^1h_T^1}{a(1-d)m}\right]\cup$$
$$h_A^2\in\left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2+\frac{4\alpha n_T^1h_T^1}{a(1-d)m},\left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2+\frac{a(1-d)mn_T^1h_T^1}{\alpha}\right]\cap$$
$$\cup\qquad\cap\left[h_T^2,\left(\frac{2\alpha}{adm}+1\right)h_T^2\right]\&$$
$$\&\tfrac{1}{2}a(1-d)n_T^1h_T^1+\sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1h_T^1+h_T^2\right)}{2m}}\geq\tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

then

$$t_1^*\left(e_T^1|n_T^1,n_A^1;\mathbb{E}_G(\theta)\right)=\begin{cases}1 & e_T^1=0\\ 1 & e_T^1=h_T^1\end{cases}$$

2. ***SECOND*** $h_T^2-h_A^2$ ***REGION*** $R_G^2\left(\alpha,a,m,\theta,n_T^1h_T^1\right)$

$$h_A^2\in\left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2+\frac{4\alpha n_T^1h_T^1}{a(1-d)m},\left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2+\frac{a(1-d)mn_T^1h_T^1}{\alpha}\right]\cap$$
$$\cap h_A^2\in\left[\left(\frac{2\alpha}{adm}+1\right)h_T^2,\left(\frac{adm}{2\alpha}+1\right)h_T^2\right]\&$$
$$\&\tfrac{1}{2}a(1-d)n_T^1h_T^1+\sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1h_T^1+h_T^2\right)}{2m}}\geq\tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

then

$$t_2^*\left(e_T^1|n_T^1,n_A^1;\mathbb{E}_G(\theta)\right)=\begin{cases}1-\frac{a}{2}-\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}} & e_T^1=0\\ 1 & e_T^1=h_T^1\end{cases}$$

3. ***THIRD*** $h_T^2 - h_A^2$ ***REGION*** $R_G^3\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$

$$h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2+\frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2+\frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$
$$\cap h_A^2 \in \left[\left(\frac{adm}{2\alpha}+1\right)h_T^2, 1\right] \&$$
$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1+\sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1+h_T^2\right)}{2m}} \geq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

then

$$t_3^*\left(e_T^1|n_T^1, n_A^1; \mathbb{E}_G(\theta)\right)=\begin{cases} 1-a & e_T^1=0 \\ 1 & e_T^1=h_T^1 \end{cases}$$

4. ***FOURTH*** $h_T^2 - h_A^2$ ***REGION*** $R_G^4\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$

$$h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2+\frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2+\frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$
$$\cap h_A^2 \in \left[h_T^2, \left(\frac{2\alpha}{adm}+1\right)h_T^2\right] \&$$
$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1+\sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1+h_T^2\right)}{2m}} \leq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

then

$$t_4^*\left(e_T^1|n_T^1, n_A^1; \mathbb{E}_G(\theta)\right)=\begin{cases} 1 & e_T^1=0 \\ 1-\dfrac{a}{2}-\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)m\left(2n_T^1 h_T^1+h_T^2\right)}} & e_T^1=h_T^1 \end{cases}$$

5. ***FIFTH*** $h_T^2 - h_A^2$ ***REGION*** $R_G^5\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$

$$h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2+\frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2+\frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$
$$\cap h_A^2 \in \left[\left(\frac{2\alpha}{adm}+1\right)h_T^2, \left(\frac{adm}{2\alpha}+1\right)h_T^2\right] \&$$
$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1+\sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1+h_T^2\right)}{2m}} \leq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

then

$$t_5^*\left(e_T^1|n_T^1, n_A^1; \mathbb{E}_G(\theta)\right)=\begin{cases} 1-\dfrac{a}{2}-\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}} & e_T^1=0 \\ 1-\dfrac{a}{2}-\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)m\left(2n_T^1 h_T^1+h_T^2\right)}} & e_T^1=h_T^1 \end{cases}$$

6. ***SIXTH*** $h_T^2 - h_A^2$ ***REGION*** $R_G^6\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$

$$h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2+\frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2+\frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$
$$\cap h_A^2 \in \left[\left(\frac{adm}{2\alpha}+1\right)h_T^2, 1\right] \&$$
$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1+\sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1+h_T^2\right)}{2m}} \leq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

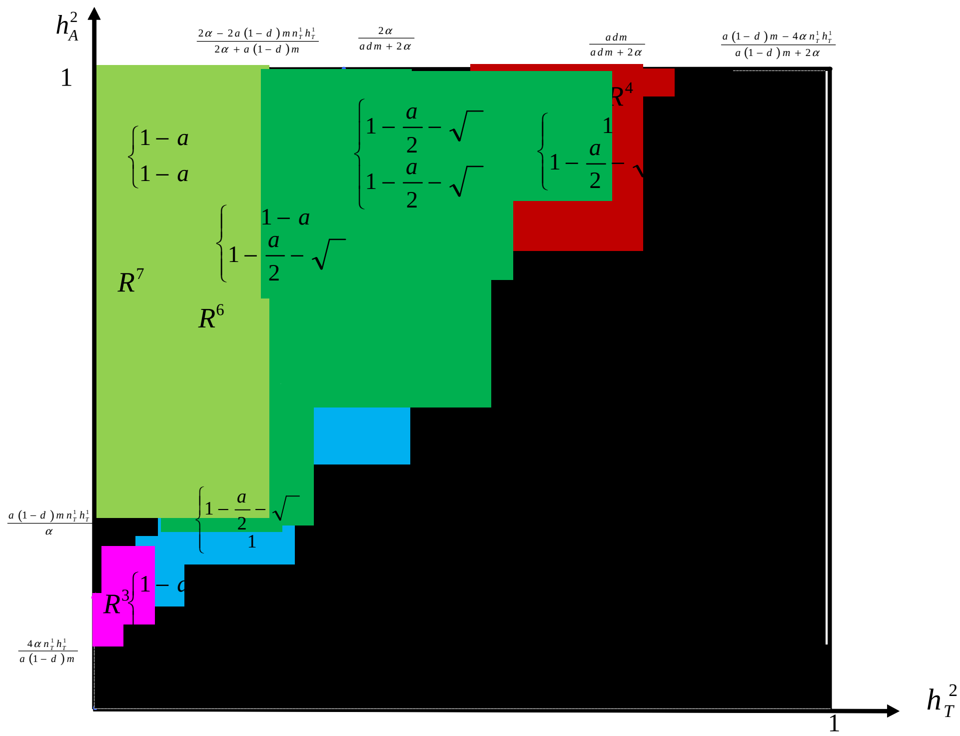


Figure 4:

then

$$t_6^*\left(e_T^1|n_T^1, n_A^1; \mathbb{E}_G(\theta)\right) = \begin{cases} 1-a & e_T^1 = 0 \\ 1 - \frac{a}{2} - \sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)}{2(1-d)\,m\left(2n_T^1 h_T^1 + h_T^2\right)}} & e_T^1 = h_T^1 \end{cases}$$

7. ***SEVENTH*** $h_T^2 - h_A^2$ ***REGION*** $R_G^7\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$

$$h_A^2 \in \left[\left(\frac{adm}{2\alpha}+1\right)h_T^2, 1\right] \cap \left[\left(\frac{a(1-d)\,m}{2\alpha}+1\right)h_T^2 + \frac{a(1-d)\,m n_T^1 h_T^1}{\alpha}, 1\right]$$

then

$$t_7^*\left(e_T^1|n_T^1, n_A^1; \mathbb{E}_G(\theta)\right) = \begin{cases} 1-a & e_T^1 = 0 \\ 1-a & e_T^1 = h_T^1 \end{cases}$$

The following picture shows the seven regions:

Remark 3 *From proposition 2, we see two interesting characteristics of government policy*

1. *repression is decreasing when activists' human capital is comparatively high wrt terrorists' human capital*

2. *repression is not responsive to previous period terrorism activity in region 1, in region 5 and in region 7 $R_G^7\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$, i.e. when there is maximum repression because activists' human capital is comparatively low wrt terrorists' human capital or when there is lower repression because activists' human capital is comparatively high wrt terrorists' human capital.*

Comparative statics The following corollary is not immediate since the regions' areas are not always nice polygon, however geometric simulations help the derivation of the following result.

Corollary 3 *Let consider the seven political relevant regions, then their dimension depends on the parameters as follows:*

Proposition 3 1. ***FIRST*** $h_T^2 - h_A^2$ ***REGION*** $R_G^1\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$

$$h_A^2 \in \left[0, \left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}\right] \cup$$

$$\cup \quad h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2 + \frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$

$$\cap \left[h_T^2, \left(\frac{2\alpha}{adm}+1\right)h_T^2\right] \&$$

$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1 + \sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1 + h_T^2\right)}{2m}} \geq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right) + \frac{\alpha h_T^2}{2m}$$

then

$$t_1^*\left(e_T^1 | n_T^1, n_A^1; \mathbb{E}_G(\theta)\right) = \begin{cases} 1 & e_T^1 = 0 \\ 1 & e_T^1 = h_T^1 \end{cases}$$

2. ***SECOND*** $h_T^2 - h_A^2$ ***REGION*** $R_G^2\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$

$$h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2 + \frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$

$$\cap h_A^2 \in \left[\left(\frac{2\alpha}{adm}+1\right)h_T^2, \left(\frac{adm}{2\alpha}+1\right)h_T^2\right] \&$$

$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1 + \sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1 + h_T^2\right)}{2m}} \geq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right) + \frac{\alpha h_T^2}{2m}$$

then

$$t_2^*\left(e_T^1 | n_T^1, n_A^1; \mathbb{E}_G(\theta)\right) = \begin{cases} 1 - \frac{a}{2} - \sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}} & e_T^1 = 0 \\ 1 & e_T^1 = h_T^1 \end{cases}$$

3. ***THIRD*** $h_T^2 - h_A^2$ ***REGION*** $R_G^3\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$

$$h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2 + \frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$

$$\cap h_A^2 \in \left[\left(\frac{adm}{2\alpha}+1\right)h_T^2, 1\right] \&$$

$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1 + \sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1 + h_T^2\right)}{2m}} \geq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right) + \frac{\alpha h_T^2}{2m}$$

then

$$t_3^*\left(e_T^1|n_T^1,n_A^1;\mathbb{E}_G(\theta)\right)=\begin{cases}1-a & e_T^1=0\\ 1 & e_T^1=h_T^1\end{cases}$$

4. ***FOURTH*** $h_T^2-h_A^2$ ***REGION*** $R_G^4\left(\alpha,a,m,\theta,n_T^1h_T^1\right)$

$$h_A^2\in\left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2+\frac{4\alpha n_T^1h_T^1}{a(1-d)m},\left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2+\frac{a(1-d)mn_T^1h_T^1}{\alpha}\right]\cap$$
$$\cap h_A^2\in\left[h_T^2,\left(\frac{2\alpha}{adm}+1\right)h_T^2\right]\&$$
$$\&\tfrac{1}{2}a(1-d)n_T^1h_T^1+\sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1h_T^1+h_T^2\right)}{2m}}\leq\tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

then

$$t_4^*\left(e_T^1|n_T^1,n_A^1;\mathbb{E}_G(\theta)\right)=\begin{cases}1 & e_T^1=0\\ 1-\dfrac{a}{2}-\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)m\left(2n_T^1h_T^1+h_T^2\right)}} & e_T^1=h_T^1\end{cases}$$

5. ***FIFTH*** $h_T^2-h_A^2$ ***REGION*** $R_G^5\left(\alpha,a,m,\theta,n_T^1h_T^1\right)$

$$h_A^2\in\left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2+\frac{4\alpha n_T^1h_T^1}{a(1-d)m},\left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2+\frac{a(1-d)mn_T^1h_T^1}{\alpha}\right]\cap$$
$$\cap h_A^2\in\left[\left(\frac{2\alpha}{adm}+1\right)h_T^2,\left(\frac{adm}{2\alpha}+1\right)h_T^2\right]\&$$
$$\&\tfrac{1}{2}a(1-d)n_T^1h_T^1+\sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1h_T^1+h_T^2\right)}{2m}}\leq\tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

then

$$t_5^*\left(e_T^1|n_T^1,n_A^1;\mathbb{E}_G(\theta)\right)=\begin{cases}1-\dfrac{a}{2}-\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}} & e_T^1=0\\ 1-\dfrac{a}{2}-\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)m\left(2n_T^1h_T^1+h_T^2\right)}} & e_T^1=h_T^1\end{cases}$$

6. ***SIXTH*** $h_T^2-h_A^2$ ***REGION*** $R_G^6\left(\alpha,a,m,\theta,n_T^1h_T^1\right)$

$$h_A^2\in\left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2+\frac{4\alpha n_T^1h_T^1}{a(1-d)m},\left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2+\frac{a(1-d)mn_T^1h_T^1}{\alpha}\right]\cap$$
$$\cap h_A^2\in\left[\left(\frac{adm}{2\alpha}+1\right)h_T^2,1\right]\&$$
$$\&\tfrac{1}{2}a(1-d)n_T^1h_T^1+\sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1h_T^1+h_T^2\right)}{2m}}\leq\tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

then

$$t_6^*\left(e_T^1|n_T^1,n_A^1;\mathbb{E}_G(\theta)\right)=\begin{cases}1-a & e_T^1=0\\ 1-\dfrac{a}{2}-\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)m\left(2n_T^1h_T^1+h_T^2\right)}} & e_T^1=h_T^1\end{cases}$$

7. ***SEVENTH*** $h_T^2 - h_A^2$ ***REGION*** $R_G^7\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$

$$h_A^2 \in \left[\left(\frac{adm}{2\alpha}+1\right)h_T^2, 1\right] \cap \left[\left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2 + \frac{a(1-d)mn_T^1h_T^1}{\alpha}, 1\right]$$

then

$$t_7^*\left(e_T^1|n_T^1, n_A^1; \mathbb{E}_G(\theta)\right) = \begin{cases} 1-a & e_T^1 = 0 \\ 1-a & e_T^1 = h_T^1 \end{cases}$$

Now, consider the effects of the usual parameters on the repression policies, distinguishing the six $h_A^2 - h_T^2$ regions, which are immediate to derive.

Corollary 4 *Let consider the six political relevant regions and the associate government's policies:*

1. *In region* $R_G^1\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$ *where*

$$t_1^*\left(e_T^1|n_T^1, n_A^1; \mathbb{E}_G(\theta)\right) = \begin{cases} 1 & e_T^1 = 0 \\ 1 & e_T^1 = h_T^1 \end{cases}$$

then

$$\frac{\partial t_1^*\left(e_T^1|\alpha, a, m, \theta\right)}{\partial \alpha} = \frac{\partial t_1^*\left(e_T^1|\alpha, a, m, \theta\right)}{\partial a} = \\ = \frac{\partial t_1^*\left(e_T^1|\alpha, a, m, \theta\right)}{\partial m} = \frac{\partial t_1^*\left(e_T^1|\alpha, a, m, \theta\right)}{\partial \theta} = 0$$

which means that the political parameters have no effect;

2. *In region* $R_G^2\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$ *where*

$$t_2^*\left(e_T^1|n_T^1, n_A^1; \mathbb{E}_G(\theta)\right) = \begin{cases} 1 - \frac{a}{2} - \sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)}{2mdh_T^2}} & e_T^1 = 0 \\ 1 & e_T^1 = h_T^1 \end{cases}$$

then

$$\frac{\partial t_2^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial \alpha} = \frac{\partial t_2^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial a} = \\ = \frac{\partial t_2^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial m} = \frac{\partial t_2^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial \theta} = 0$$

and

$$\frac{\partial t_2^*(0|\alpha, a, m, \theta)}{\partial \alpha} < 0; \frac{\partial t_2^*(0|\alpha, a, m, \theta)}{\partial a} < 0; \\ \frac{\partial t_2^*(0|\alpha, a, m, \theta)}{\partial m} = \frac{\partial t_2^*(0|\alpha, a, m, \theta)}{\partial \theta} > 0$$

which means that repression is affected by political parameters only if there was no terrorism in the first period, and that in this case repression is decreasing in economic development and in regime responsiveness, while is increasing in political heterogeneity and in regime fragility;

3. *In region* $R_G^3\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$ *where*

$$t_3^*\left(e_T^1 | n_T^1, n_A^1; \mathbb{E}_G(\theta)\right) = \begin{cases} 1-a & e_T^1 = 0 \\ 1 & e_T^1 = h_T^1 \end{cases}$$

then

$$\begin{aligned} \frac{\partial t_3^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial \alpha} &= \frac{\partial t_3^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial a} = \\ = \frac{\partial t_3^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial m} &= \frac{\partial t_3^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial \theta} = 0 \end{aligned}$$

and

$$\begin{aligned} \frac{\partial t_3^*\left(0|\alpha, a, m, \theta\right)}{\partial \alpha} &= 0; \frac{\partial t_3^*\left(0|\alpha, a, m, \theta\right)}{\partial a} < 0; \\ \frac{\partial t_3^*\left(0|\alpha, a, m, \theta\right)}{\partial m} &= \frac{\partial t_3^*\left(0|\alpha, a, m, \theta\right)}{\partial \theta} = 0 \end{aligned}$$

which means that repression is affected by political parameters only if there was no terrorism in the first period, and that in this case repression is decreasing in regime responsiveness;

4. *In region* $R_G^4\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$ *where*

$$t_4^*\left(e_T^1 | n_T^1, n_A^1; \mathbb{E}_G(\theta)\right) = \begin{cases} 1 & e_T^1 = 0 \\ 1 - \dfrac{a}{2} - \sqrt{\dfrac{\alpha a\left(h_A^2 - h_T^2\right)}{2(1-d)\, m\left(2n_T^1 h_T^1 + h_T^2\right)}} & e_T^1 = h_T^1 \end{cases}$$

then

$$\begin{aligned} \frac{\partial t_4^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial \alpha} &< 0; \frac{\partial t_4^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial a} < 0; \\ \frac{\partial t_4^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial m} &= \frac{\partial t_4^*\left(h_T^1|\alpha, a, m, \theta\right)}{\partial \theta} > 0 \end{aligned}$$

and

$$\begin{aligned} \frac{\partial t_4^*\left(0|\alpha, a, m, \theta\right)}{\partial \alpha} &= \frac{\partial t_4^*\left(0|\alpha, a, m, \theta\right)}{\partial m} = \\ = \frac{\partial t_4^*\left(0|\alpha, a, m, \theta\right)}{\partial \theta} &= \frac{\partial t_4^*\left(0|\alpha, a, m, \theta\right)}{\partial a} = 0 \end{aligned}$$

which means that when there was no terrorism in the first period, repressions not affected by political parameters, while when there was terrorism in the first period then repression is decreasing in economic development and in regime responsiveness, while is increasing in political heterogeneity and in regime fragility;

5. *In region* $R_G^5\left(\alpha, a, m, \theta, n_T^1 h_T^1\right)$ *where*

$$t_5^*\left(e_T^1 | n_T^1, n_A^1; \mathbb{E}_G(\theta)\right) = \begin{cases} 1 - \dfrac{a}{2} - \sqrt{\dfrac{\alpha a\left(h_A^2 - h_T^2\right)}{2mdh_T^2}} & e_T^1 = 0 \\ 1 - \dfrac{a}{2} - \sqrt{\dfrac{\alpha a\left(h_A^2 - h_T^2\right)}{2(1-d)\, m\left(2n_T^1 h_T^1 + h_T^2\right)}} & e_T^1 = h_T^1 \end{cases}$$

then

$$\begin{aligned}\frac{\partial t_5^*\left(h_T^1|\alpha,a,m,\theta\right)}{\partial\alpha} &< 0; \frac{\partial t_5^*\left(h_T^1|\alpha,a,m,\theta\right)}{\partial a}<0;\\ \frac{\partial t_4^*\left(h_T^1|\alpha,a,m,\theta\right)}{\partial m} &= \frac{\partial t_4^*\left(h_T^1|\alpha,a,m,\theta\right)}{\partial\theta}>0\end{aligned}$$

and

$$\begin{aligned}\frac{\partial t_5^*\left(0|\alpha,a,m,\theta\right)}{\partial\alpha} &< 0; \frac{\partial t_5^*\left(0|\alpha,a,m,\theta\right)}{\partial a}<0;\\ \frac{\partial t_5^*\left(0|\alpha,a,m,\theta\right)}{\partial m} &= \frac{\partial t_5^*\left(0|\alpha,a,m,\theta\right)}{\partial\theta}>0\end{aligned}$$

which means that whether there was terrorism or not in the first period, repression is decreasing in economic development and in regime responsiveness, while is increasing in political heterogeneity and in regime fragility;

6. *In region* $R_G^6\left(\alpha,a,m,\theta,n_T^1h_T^1\right)$ *where*

$$t_6^*\left(e_T^1|n_T^1,n_A^1;\mathbb{E}_G(\theta)\right)=\begin{cases}1-a & e_T^1=0\\ 1-\dfrac{a}{2}-\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)\,m\,(2n_T^1h_T^1+h_T^2)}} & e_T^1=h_T^1\end{cases}$$

then

$$\begin{aligned}\frac{\partial t_6^*\left(0|\alpha,a,m,\theta\right)}{\partial\alpha}&=\frac{\partial t_6^*\left(0|\alpha,a,m,\theta\right)}{\partial m}=\\ =\frac{\partial t_6^*\left(0|\alpha,a,m,\theta\right)}{\partial\theta}&=0;\frac{\partial t_6^*\left(0|\alpha,a,m,\theta\right)}{\partial a}<0\end{aligned}$$

and

$$\begin{aligned}\frac{\partial t_6^*\left(h_T^1|\alpha,a,m,\theta\right)}{\partial\alpha} &< 0; \frac{\partial t_6^*\left(h_T^1|\alpha,a,m,\theta\right)}{\partial a}<0;\\ \frac{\partial t_6^*\left(h_T^1|\alpha,a,m,\theta\right)}{\partial m} &= \frac{\partial t_6^*\left(h_T^1|\alpha,a,m,\theta\right)}{\partial\theta}>0\end{aligned}$$

which means that when there is terrorism in the first period, repression is decreasing in economic development and in regime responsiveness, while is increasing in political heterogeneity and in regime fragility, while when there was no terrorism in the first period, then repression is not affected by political parameters apart from regime responsiveness that reduces government's repression.

7. *In region* $R_G^7\left(\alpha,a,m,\theta,n_T^1h_T^1\right)$ *where*

$$t_7^*\left(e_T^1|n_T^1,n_A^1;\mathbb{E}_G(\theta)\right)=\begin{cases}1-a & e_T^1=0\\ 1-a & e_T^1=h_T^1\end{cases}$$

then

$$\frac{\partial t_7^*\left(e_T^1|\alpha,a,m,\theta\right)}{\partial\alpha}=\frac{\partial t_7^*\left(e_T^1|\alpha,a,m,\theta\right)}{\partial m}=$$

$$= \frac{\partial t_7^*\left(e_T^1|\alpha, a, m, \theta\right)}{\partial \theta} = 0; \frac{\partial t_7^*\left(e_T^1|\alpha, a, m, \theta\right)}{\partial a} < 0$$

which means that previous terrorism activity notwithstanding, repression is not affected by political parameters apart from regime responsiveness that reduces government's repression.

3.1.3 Terrorists' choices at the third stage

This is probably the stage where calculations are most complex, and the interpretation is less meaningful. To slightly simplify calculations, we assume that population is big enough

Condition 4 *Let assume that*

$$P \geq \max\left\{\frac{\alpha\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}}\right)H_i}{\sqrt{\frac{\alpha admh_T^2\left(h_A^2-h_T^2\right)}{32}}+\sqrt{\frac{\left(\alpha h_T^2\right)^3}{8adm\left(h_A^2-h_T^2\right)}}-\frac{\alpha h_T^2}{2}}, \frac{2adm\left(1-2\alpha a\right)H_i}{\alpha\left(2h_T^2-h_A^2\right)\left(adm-2\alpha\right)}\right\}$$

so that

$$\min\left\{P\sqrt{\frac{\alpha m h_T^2}{2da\left(h_A^2-h_T^2\right)}}, \frac{\alpha\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}}\right)H_i}{\left(\frac{1}{4}ad\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}-\sqrt{\frac{\alpha adh_T^2\left(h_A^2-h_T^2\right)}{2m}}\right)}\right\} =$$

$$= \frac{\alpha\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}}\right)H_i}{\left(\frac{1}{4}ad\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}-\sqrt{\frac{\alpha adh_T^2\left(h_A^2-h_T^2\right)}{2m}}\right)}$$

and

$$\max\left\{\frac{\alpha P}{ad}, \frac{2\left(1-2\alpha a\right)mH_i}{\left(2h_T^2-h_A^2\right)\left(adm-2\alpha\right)}\right\} = \frac{\alpha P}{ad}.$$

Now, we are able to derive first period individual terrorist's behavior, which will depends on government's repression and thus on different $h_A^2 - h_T^2$ regions.

Proposition 4 *At stage 3, the first period terrorists will separate according to the agents' human capital and to their preferences:*

1. ***FIRST*** h_A^2***-REGION*** *when*

$$h_A^2 \in \left[0, \left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}\right] \cup$$

$$\cup \quad h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2 + \frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$

$$\cap \left[h_T^2, \left(\frac{2\alpha}{adm}+1\right)h_T^2\right] \&$$

$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1 + \sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1 + h_T^2\right)}{2m}} \geq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right) + \frac{\alpha h_T^2}{2m}$$

then we get a separating equilibrium if and only if

$$\forall i \in T^1 \quad \gamma_i \in \left[-\frac{m}{2}P, \frac{m}{2}P\right]$$

2. ***SECOND*** h_A^2***-REGION*** *when*

$$h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2 + \frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$

$$\cap h_A^2 \in \left[\left(\frac{2\alpha}{adm}+1\right)h_T^2, \left(\frac{adm}{2\alpha}+1\right)h_T^2\right] \&$$

$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1 + \sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1 + h_T^2\right)}{2m}} \geq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right) + \frac{\alpha h_T^2}{2m}$$

then we get a separating equilibrium if and only if

$$\forall i \in T^1: \quad \gamma_i \in \left[-\frac{m}{2}P, \min\left\{P\sqrt{\frac{\alpha m h_T^2}{2da\left(h_A^2-h_T^2\right)}}, \frac{\alpha\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}}\right)H_i}{\left(\frac{1}{4}ad\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}-\sqrt{\frac{\alpha a d h_T^2\left(h_A^2-h_T^2\right)}{2m}}\right)}\right\}\right]$$

3. ***THIRD*** h_A^2***-REGION*** *when*

$$h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2 + \frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$

$$\cap h_A^2 \in \left[\left(\frac{adm}{2\alpha}+1\right)h_T^2, 1\right] \&$$

$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1 + \sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1 + h_T^2\right)}{2m}} \geq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right) + \frac{\alpha h_T^2}{2m}$$

then we get a separating equilibrium if and only if

$$\forall i \in T^1: \quad \gamma_i \in \left[-\frac{m}{2}P, \min\left\{\frac{\alpha P}{ad}, \frac{4\alpha a m H_i}{\left(h_A^2-2h_T^2\right)(adm-2\alpha)}\right\}\right].$$

4. ***FOURTH*** h_A^2***-REGION*** *when*

$$h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2 + \frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$

$$\cap h_A^2 \in \left[h_T^2, \left(\frac{2\alpha}{adm}+1\right)h_T^2\right] \&$$

$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1 + \sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1 + h_T^2\right)}{2m}} \leq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right) + \frac{\alpha h_T^2}{2m}$$

then we get a separating equilibrium if and only if

$$\forall i \in T^1 : \quad \gamma_i \in \left[-\frac{m}{2} P, \frac{m}{2} P \right].$$

5. ***FIFTH*** h_A^2***-REGION*** *when*

$$h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m} + 1 \right) h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha} + 1 \right) h_T^2 + \frac{a(1-d)mn_T^1 h_T^1}{\alpha} \right] \cap$$
$$\cap h_A^2 \in \left[\left(\frac{2\alpha}{adm} + 1 \right) h_T^2, \left(\frac{adm}{2\alpha} + 1 \right) h_T^2 \right] \&$$
$$\& \tfrac{1}{2} a(1-d) n_T^1 h_T^1 + \sqrt{\frac{\alpha a(1-d)\left(h_A^2 - h_T^2\right)\left(2n_T^1 h_T^1 + h_T^2\right)}{2m}} \leq \tfrac{1}{4} a(1-d)\left(h_A^2 - h_T^2\right) + \frac{\alpha h_T^2}{2m}$$

then we get a separating equilibrium if and only if

$$\forall i \in T^1 : \gamma_i \in$$

$$\in \left[\frac{\alpha}{1-d} [A]^{-1} \left(\frac{a}{2} + \sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)}{2m(1-d)\left(2n_T^1 h_T^1 - \frac{2}{P} H_i + h_T^2\right)}} \right) H_i, \frac{\alpha}{d} [B]^{-1} \left(\frac{a}{2} + \sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)}{2mdh_T^2}} \right) H_i \right]$$
$$\subset \left[-\frac{m}{2} P, \frac{\alpha}{a(1-d)} P \right].$$

where

$$A :=$$
$$:= \sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)\left(2n_T^1 h_T^1 + h_T^2\right)}{2m(1-d)}} + \sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)}{2m(1-d)\left(2n_T^1 h_T^1 - \frac{2}{P} H_i + h_T^2\right)}} \frac{1}{P} H_i +$$
$$: -\sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)}{2m(1-d)(2n_T^1 h_T^1 + h_T^2)}} \frac{1}{P} H_i - \frac{a}{2P} H_i$$

and

$$B := \sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)}{2m}} \left(\frac{\frac{2}{P}(1-d) H_i + h_T^2}{2d\sqrt{(1-d)\left(\frac{2}{P} H_i + h_T^2\right)}} + \frac{\frac{1}{P} H_i}{\sqrt{d\left(\frac{2}{P} H_i + h_T^2\right)}} - \sqrt{\frac{h_T^2}{d}} \right) + \frac{a}{2P} H_i$$

6. ***SIXTH*** h_A^2***-REGION*** *when*

$$h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m} + 1 \right) h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha} + 1 \right) h_T^2 + \frac{a(1-d)mn_T^1 h_T^1}{\alpha} \right] \cap$$
$$\cap h_A^2 \in \left[\left(\frac{adm}{2\alpha} + 1 \right) h_T^2, 1 \right] \&$$
$$\& \tfrac{1}{2} a(1-d) n_T^1 h_T^1 + \sqrt{\frac{\alpha a(1-d)\left(h_A^2 - h_T^2\right)\left(2n_T^1 h_T^1 + h_T^2\right)}{2m}} \leq \tfrac{1}{4} a(1-d)\left(h_A^2 - h_T^2\right) + \frac{\alpha h_T^2}{2m}$$

then we get a separating equilibrium if and only if

$$\forall i \in T^1 : \quad \gamma_i \in$$

$$\in \left[\frac{\alpha}{1-d}\left[A\right]^{-1}\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2m\left(1-d\right)\left(2n_T^1h_T^1-\frac{2}{P}H_i+h_T^2\right)}}\right)H_i, \frac{\alpha a}{d}\left[C\right]^{-1}H_i\right] \subset$$

$$\subset \left[-\frac{m}{2}P, \frac{\alpha}{a\left(1-d\right)}P\right].$$

where

$$A := \sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)\left(2n_T^1h_T^1+h_T^2\right)}{2m\left(1-d\right)}}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2m\left(1-d\right)\left(2n_T^1h_T^1-\frac{2}{P}H_i+h_T^2\right)}}\frac{1}{P}H_i+$$

$$-\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2m\left(1-d\right)\left(2n_T^1h_T^1+h_T^2\right)}}\frac{1}{P}H_i-\frac{a}{2P}H_i$$

and

$$C := \frac{a}{2P}H_i+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{8\left(1-d\right)d^2m\left(\frac{2}{P}H_i+h_T^2\right)}}\left(\frac{4}{P}H_i+h_T^2\right)-\frac{1}{4}ah_T^2-\frac{\alpha h_A^2}{2m}-\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{8\left(1-d\right)m\left(\frac{2}{P}H_i+h_T^2\right)}}\frac{2}{P}H$$

7. ***SEVENTH*** h_A^2***-REGION*** *when*

$$h_A^2 \in \left[\left(\frac{adm}{2\alpha}+1\right)h_T^2, 1\right] \cap \left[\left(\frac{a\left(1-d\right)m}{2\alpha}+1\right)h_T^2+\frac{a\left(1-d\right)mn_T^1h_T^1}{\alpha}, 1\right]$$

then we get a separating equilibrium if and only if

$$\forall i \in T^1 : \quad \gamma_i \in \left[\frac{\alpha P}{a\left(1-d\right)}, \frac{\alpha P}{ad}\right]$$

3.1.4 Citizens' choices at the second stage

Proposition 5 *1. in the **FIRST** h_A^2**-REGION** when*

$$h_A^2 \in \left[0, \left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}\right] \cup$$

$$\cup \quad h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_T^1 h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2 + \frac{a(1-d)mn_T^1 h_T^1}{\alpha}\right] \cap$$
$$\cap \left[h_T^2, \left(\frac{2\alpha}{adm}+1\right)h_T^2\right] \&$$

$$\& \tfrac{1}{2}a(1-d)n_T^1 h_T^1 + \sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1 h_T^1 + h_T^2\right)}{2m}} \geq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right) + \frac{\alpha h_T^2}{2m}$$

then we get a separating equilibrium such that

$$i_{1R}^{1*} \in T^1 \cup C^1 \Leftrightarrow \gamma_i \in \left[-\frac{m}{2}P, 0\right] \text{ and } i_{1R}^{1*} \in A^1 \Leftrightarrow \gamma_i \in \left[0, \frac{m}{2}P\right]$$

$$\forall i^1 \in T^1 \quad E_{i,1R}^{1*}(\theta) = \begin{cases} 0 & \theta = d \\ H_i & \theta = 1-d \end{cases}$$

$$t_{1R}^*\left(e_T^1|n_T^1, n_A^1;\theta\right) = \begin{cases} 1 & e_T^1 = 0 \\ 1 & e_T^1 = h_T^1 \end{cases}$$

$$i_{1R}^{2*} \in T^2 \Leftrightarrow \begin{cases} \gamma_i \geq \dfrac{\alpha P}{\theta(1-t)} & \text{if } t \in [0, 1-a] \\ \gamma_i \geq \dfrac{\alpha P}{\theta(2-2t-a)} & \text{if } t \in \left[0, 1-\frac{a}{2}\right] \\ \text{never} & \text{if } t \in \left[1-\frac{a}{2}, 1\right] \end{cases} \qquad (T^2)$$

$$i_{1R}^{2*} \in A^2 \Leftrightarrow \begin{cases} \text{never} & \text{if } t \in [0, 1-a] \\ \gamma_i \in \left[\dfrac{\alpha P}{\theta a}, \dfrac{\alpha P}{\theta(2-2t-a)}\right] & \text{if } t \in \left[1-a, 1-\frac{a}{2}\right] \\ \gamma_i \geq \dfrac{\alpha P}{\theta a} & \text{if } t \in \left[1-\frac{a}{2}, 1\right] \end{cases} \qquad (A^2)$$

$$i_{1R}^{2*} \in C^2 \Leftrightarrow \begin{cases} \gamma_i \leq \dfrac{\alpha P}{\theta(1-t)} & \text{if } t \in [0, 1-a] \\ \gamma_i \leq \dfrac{\alpha P}{\theta a} & \text{if } t \in [1-a, 1] \end{cases} \qquad (C^2)$$

hence when

$$h_A^2 \in \left[0, \left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_{T,1R}^{1*} h_T^1}{a(1-d)m}\right] \cup$$

$$\cup \quad h_A^2 \in \left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2 + \frac{4\alpha n_{T,1R}^{1*} h_T^1}{a(1-d)m}, \left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2 + \frac{a(1-d)mn_{T,1R}^{1*} h_T^1}{\alpha}\right] \cap$$
$$\cap \left[h_T^2, \left(\frac{2\alpha}{adm}+1\right)h_T^2\right] \&$$

$$\& \tfrac{1}{2}a(1-d)n_{T,1R}^{1*} h_T^1 + \sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_{T,1R}^{1*} h_T^1 + h_T^2\right)}{2m}} \geq \tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right) + \frac{\alpha h_T^2}{2m}$$

$$\frac{1}{2}a\left(1-d\right)n_{T,1R}^{1*}h_T^1+\sqrt{\frac{\alpha a\left(1-d\right)\left(h_A^2-h_T^2\right)\left(2n_{T,1R}^{1*}h_T^1+h_T^2\right)}{2m}}\geq\frac{1}{4}a\left(1-d\right)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

the equilibrium outcome is

$$n_{T,1}^{1*}+n_{C,1}^{1*}=n_{A,1}^{1*}=\frac{1}{2}$$

$$e_{T,1R}^{1*}(\theta)=\begin{cases}0 & \theta=d\\ h_T^1 & \theta=1-d\end{cases}$$

$$t_{1R}^{*}=1$$

$$n_{T,1}^{2*}=0,\quad n_{A,1}^{2*}=\begin{cases}\dfrac{1}{2}-\dfrac{\alpha}{adm} & prob\ \dfrac{1}{2}\\ \dfrac{1}{2}-\dfrac{\alpha}{a\left(1-d\right)m} & prob\ \dfrac{1}{2}\end{cases},\quad n_{C,1}^{2*}=\begin{cases}\dfrac{1}{2}+\dfrac{\alpha}{adm} & prob\ \dfrac{1}{2}\\ \dfrac{1}{2}+\dfrac{\alpha}{a\left(1-d\right)m} & prob\ \dfrac{1}{2}\end{cases}$$

2. *In the* ***SECOND*** h_A^2***-REGION*** *when*

$$h_A^2\in\left[\left(\frac{2\alpha}{a\left(1-d\right)m}+1\right)h_T^2+\frac{4\alpha n_T^1h_T^1}{a\left(1-d\right)m},\left(\frac{a\left(1-d\right)m}{2\alpha}+1\right)h_T^2+\frac{a\left(1-d\right)mn_T^1h_T^1}{\alpha}\right]\cap$$
$$\cap h_A^2\in\left[\left(\frac{2\alpha}{adm}+1\right)h_T^2,\left(\frac{adm}{2\alpha}+1\right)h_T^2\right]\&$$
$$\&\tfrac{1}{2}a\left(1-d\right)n_T^1h_T^1+\sqrt{\frac{\alpha a\left(1-d\right)\left(h_A^2-h_T^2\right)\left(2n_T^1h_T^1+h_T^2\right)}{2m}}\geq\tfrac{1}{4}a\left(1-d\right)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

then we get a separating equilibrium such that

$$i_2^{1*}\in T^1\cup C^1\Leftrightarrow\gamma_i\in\left[-\frac{m}{2}P,\frac{\alpha\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}}\right)H_i}{\left(\frac{1}{4}ad\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}-\sqrt{\frac{\alpha adh_T^2\left(h_A^2-h_T^2\right)}{2m}}\right)}\right]$$

$$i_2^{1*}\in C^1\Leftrightarrow\gamma_i\in\left[\frac{\alpha\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}}\right)H_i}{\left(\frac{1}{4}ad\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}-\sqrt{\frac{\alpha adh_T^2\left(h_A^2-h_T^2\right)}{2m}}\right)},\frac{\alpha}{a}\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}}\right)P\right]$$

$$i_2^{1*}\in A^1\Leftrightarrow\gamma_i\in\left[\frac{\alpha}{a}\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2mdh_T^2}}\right)P,\frac{m}{2}P\right]$$

$$\forall i^1\in T^1\quad E_{i,2R}^{1*}(\theta)=\begin{cases}0 & \theta=d\\ H_i & \theta=1-d\end{cases}$$

$$t_2^*\left(e_T^1|n_T^1,n_A^1;\mathbb{E}_G\left(\theta\right)\right)=t_{4R}^*\left(e_T^1|n_T^1,n_A^1;\mathbb{E}_G\left(\theta\right)\right)=\begin{cases}1-\dfrac{a}{2}-\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2m\mathbb{E}_G\left(\theta\right)h_T^2}} & e_T^1=0\\ 1 & e_T^1=h_T^1\end{cases}$$

$$R_2^* = \begin{cases} \frac{1}{4}a\mathbb{E}_G(\theta)h_T^2 + \sqrt{\frac{\alpha a\mathbb{E}_G(\theta)\left(h_A^2 - h_T^2\right)h_T^2}{2m}} + \frac{1}{2}a\mathbb{E}_G(\theta)n_A^1h_A^1 - \frac{\alpha\left(h_A^2 + h_T^2\right)}{2m} & e_T^1 = 0 \\ \frac{1}{2}a\mathbb{E}_G(\theta)n_A^1h_A^1 + \frac{1}{4}a\mathbb{E}_G(\theta)h_A^2 - \frac{\alpha h_A^2}{2m} & e_T^1 = h_T^1 \end{cases}$$

$$i_2^{2*} \in T^2 \Leftrightarrow \begin{cases} \gamma_i \geq \frac{\alpha P}{\theta(1-t)} & \textit{if } t \in [0, 1-a] \\ \gamma_i \geq \frac{\alpha P}{\theta(2-2t-a)} & \textit{if } t \in \left[0, 1-\frac{a}{2}\right] \\ \textit{never} & \textit{if } t \in \left[1-\frac{a}{2}, 1\right] \end{cases} \qquad (T^2)$$

$$i_2^{2*} \in A^2 \Leftrightarrow \begin{cases} \textit{never} & \textit{if } t \in [0, 1-a] \\ \gamma_i \in \left[\frac{\alpha P}{\theta a}, \frac{\alpha P}{\theta(2-2t-a)}\right] & \textit{if } t \in \left[1-a, 1-\frac{a}{2}\right] \\ \gamma_i \geq \frac{\alpha P}{\theta a} & \textit{if } t \in \left[1-\frac{a}{2}, 1\right] \end{cases} \qquad (A^2)$$

$$i_2^{2*} \in C^2 \Leftrightarrow \begin{cases} \gamma_i \leq \frac{\alpha P}{\theta(1-t)} & \textit{if } t \in [0, 1-a] \\ \gamma_i \leq \frac{\alpha P}{\theta a} & \textit{if } t \in [1-a, 1] \end{cases} \qquad (C^2)$$

hence the equilibrium outcome is

$$n_{T,2}^{1*} + n_{C,2}^{1*} = \frac{1}{2} + \frac{\alpha}{am}\left(\frac{a}{2} + \sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)}{2mdh_T^2}}\right)$$

$$\max n_{T,2}^{1*} = \frac{1}{2} + \frac{\alpha\left(\frac{a}{2} + \sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)}{2mdh_T^2}}\right)H_i}{\left(\frac{1}{4}ad\left(h_A^2 - h_T^2\right) + \frac{\alpha h_T^2}{2m} - \sqrt{\frac{\alpha adh_T^2\left(h_A^2 - h_T^2\right)}{2m}}\right)mP}$$

$$n_{A,2}^{1*} = \frac{1}{2} - \frac{\alpha}{am}\left(\frac{a}{2} + \sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)}{2mdh_T^2}}\right)$$

$$e_{T,2}^{1*}(\theta) = \begin{cases} 0 & \theta = d \\ h_T^1 & \theta = 1-d \end{cases}$$

$$t_2^* = \begin{cases} 1 - \frac{a}{2} - \sqrt{\frac{\alpha a\left(h_A^2 - h_T^2\right)}{2dmh_T^2}} & \textit{prob } \frac{1}{2} \\ 1 & \textit{prob } \frac{1}{2} \end{cases}$$

$$n_{T2}^{2*}\left(t, n^1, e_T^1 | \mathbb{E}_i(\theta)\right) = \begin{cases} \frac{1}{2} - \sqrt{\frac{\alpha h_T^2}{2adm\left(h_A^2 - h_T^2\right)}} & \textit{prob } \frac{1}{2} \\ 0 & \textit{prob } \frac{1}{2} \end{cases}$$

$$n_{A2}^{2*}\left(t, n^1, e_T^1 | \mathbb{E}_i(\theta)\right) = \begin{cases} \sqrt{\frac{\alpha h_T^2}{2adm\left(h_A^2 - h_T^2\right)}} - \frac{\alpha}{adm} & \textit{prob } \frac{1}{2} \\ \frac{1}{2} - \frac{\alpha}{a(1-d)m} & \textit{prob } \frac{1}{2} \end{cases}$$

$$n_{C2}^{2*}\left(t,n^{1},e_{T}^{1}|\mathbb{E}_{i}\left(\theta\right)\right)=\left\{\begin{array}{cc}\frac{1}{2}+\frac{\alpha}{adm} & prob\ \frac{1}{2}\\ \frac{1}{2}+\frac{\alpha}{a\left(1-d\right)m} & prob\ \frac{1}{2}\end{array}\right.$$

3. *In the* ***THIRD*** h_A^2***-REGION*** *when*

$$h_{A}^{2}\in\left[\left(\frac{2\alpha}{a\left(1-d\right)m}+1\right)h_{T}^{2}+\frac{4\alpha n_{T}^{1}h_{T}^{1}}{a\left(1-d\right)m},\left(\frac{a\left(1-d\right)m}{2\alpha}+1\right)h_{T}^{2}+\frac{a\left(1-d\right)mn_{T}^{1}h_{T}^{1}}{\alpha}\right]\cap$$
$$\cap h_{A}^{2}\in\left[\left(\frac{adm}{2\alpha}+1\right)h_{T}^{2},1\right]\&$$
$$\&\tfrac{1}{2}a\left(1-d\right)n_{T}^{1}h_{T}^{1}+\sqrt{\frac{\alpha a\left(1-d\right)\left(h_{A}^{2}-h_{T}^{2}\right)\left(2n_{T}^{1}h_{T}^{1}+h_{T}^{2}\right)}{2m}}\geq\tfrac{1}{4}a\left(1-d\right)\left(h_{A}^{2}-h_{T}^{2}\right)+\frac{\alpha h_{T}^{2}}{2m}$$

then we get a separating equilibrium such that

$$i_{3R}^{1*}\in T^{1}\cup C^{1}\Leftrightarrow\gamma_{i}\in\left[-\frac{m}{2}P,\frac{4\alpha amH_{i}}{\left(h_{A}^{2}-2h_{T}^{2}\right)\left(adm-2\alpha\right)}\right]$$

$$i_{3R}^{1*}\in C^{1}\Leftrightarrow\gamma_{i}\in\left[\frac{4\alpha amH_{i}}{\left(h_{A}^{2}-2h_{T}^{2}\right)\left(adm-2\alpha\right)},\alpha P\right]$$

$$i_{3R}^{1*}\in A^{1}\Leftrightarrow\gamma_{i}\in\left[\alpha P,\frac{m}{2}P\right]$$

$$\forall i^{1}\in T^{1}\quad E_{i,3R}^{1*}(\theta)=\left\{\begin{array}{ll}0 & \theta=d\\ H_{i} & \theta=1-d\end{array}\right.$$

$$t_{3}^{*}\left(e_{T}^{1}|n_{T}^{1},n_{A}^{1};\mathbb{E}_{G}\left(\theta\right)\right)=\left\{\begin{array}{ll}1-a & e_{T}^{1}=0\\ 1 & e_{T}^{1}=h_{T}^{1}\end{array}\right.$$

$$i_{3}^{*}\in T^{2}\Leftrightarrow\left\{\begin{array}{cc}\gamma_{i}\in\left[\frac{\alpha P}{\theta(1-t)},\frac{m}{2}P\right] & if\ t\in\left[0,1-a\right]\\ \gamma_{i}\in\left[\frac{\alpha P}{\theta(2-2t-a)},\frac{m}{2}P\right] & if\ t\in\left[1-a,1-\frac{a}{2}\right]\\ never & if\ t\in\left[1-\frac{a}{2},1\right].\end{array}\right.\qquad(T^{2})$$

$$i_{3}^{*}\in A^{2}\Leftrightarrow\left\{\begin{array}{cc}never & if\ t\in\left[0,1-a\right]\\ \gamma_{i}\in\left[\frac{\alpha P}{\theta a},\frac{\alpha P}{\theta(2-2t-a)}\right] & if\ t\in\left[1-a,1-\frac{a}{2}\right]\\ \gamma_{i}\in\left[\frac{\alpha P}{\theta a},\frac{m}{2}P\right] & if\ t\in\left[1-\frac{a}{2},1\right].\end{array}\right.\qquad(A^{2})$$

$$i_{3}^{*}\in C^{2}\Leftrightarrow\left\{\begin{array}{cc}\gamma_{i}\in\left[-\frac{m}{2}P,\frac{\alpha P}{\theta\left(1-t\right)}\right] & if\ t\in\left[0,1-a\right]\\ \gamma_{i}\in\left[-\frac{m}{2}P,\frac{\alpha P}{\theta a}\right] & if\ t\in\left[1-a,1\right].\end{array}\right.\qquad(C^{2})$$

hence the equilibrium outcome is

$$n_{T,3}^{1*}+n_{C,3}^{1*}=\frac{1}{2}+\frac{\alpha}{m}$$

$$\max n_{T,3}^{1*}=\frac{1}{2}+\frac{4\alpha aH_{i}}{\left(h_{A}^{2}-2h_{T}^{2}\right)\left(adm-2\alpha\right)P}$$

$$n_{A,3}^{1*}=\frac{1}{2}-\frac{\alpha}{m}$$

$$e_{T,3}^{1*}(\theta)=\begin{cases}0 & \theta=d\\ h_T^1 & \theta=1-d\end{cases}$$

$$t_3^*=\begin{cases}1-a & prob\ \ \frac{1}{2}\\ 1 & prob\ \ \frac{1}{2}\end{cases}$$

$$n_{T3}^{2*}\left(t,n^1,e_T^1|\mathbb{E}_i(\theta)\right)=\begin{cases}\frac{1}{2}-\frac{\alpha}{adm} & prob\ \ \frac{1}{2}\\ 0 & prob\ \ \frac{1}{2}\end{cases}$$

$$n_{A3}^{2*}\left(t,n^1,e_T^1|\mathbb{E}_i(\theta)\right)=\begin{cases}0 & prob\ \ \frac{1}{2}\\ \frac{1}{2}-\frac{\alpha}{a(1-d)m} & prob\ \ \frac{1}{2}\end{cases}$$

$$n_{C3}^{2*}\left(t,n^1,e_T^1|\mathbb{E}_i(\theta)\right)=\begin{cases}\frac{1}{2}+\frac{\alpha}{adm} & prob\ \ \frac{1}{2}\\ \frac{1}{2}+\frac{\alpha}{a(1-d)m} & prob\ \ \frac{1}{2}\end{cases}$$

4. *In the* ***FOURTH*** h_A^2***-REGION*** *when*

$$h_A^2\in\left[\left(\frac{2\alpha}{a(1-d)m}+1\right)h_T^2+\frac{4\alpha n_T^1h_T^1}{a(1-d)m},\left(\frac{a(1-d)m}{2\alpha}+1\right)h_T^2+\frac{a(1-d)mn_T^1h_T^1}{\alpha}\right]\cap$$
$$\cap h_A^2\in\left[h_T^2,\left(\frac{2\alpha}{adm}+1\right)h_T^2\right]\ \&$$
$$\&\tfrac{1}{2}a(1-d)n_T^1h_T^1+\sqrt{\frac{\alpha a(1-d)\left(h_A^2-h_T^2\right)\left(2n_T^1h_T^1+h_T^2\right)}{2m}}\leq\tfrac{1}{4}a(1-d)\left(h_A^2-h_T^2\right)+\frac{\alpha h_T^2}{2m}$$

then we get a separating equilibrium such that

$$i_4^{1*}\in T^1\Leftrightarrow\gamma_i\in$$
$$\in\left[\min\left\{\alpha\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)m\left(2n_T^1h_T^1+h_T^2\right)}}\right)\left(\sqrt{\frac{2\alpha a(1-d)\left(h_A^2-h_T^2\right)}{m\left(2n_T^1h_T^1+h_T^2\right)}}-ad\right)^{-1}P,\frac{\alpha P}{a(1-d)}\right\},\frac{m}{2}\right.$$

$$i_4^{1*}\in A^1\Leftrightarrow\gamma_i\in$$
$$\in\left[\begin{array}{c}2\alpha\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)m\left(2n_T^1h_T^1+h_T^2\right)}}\right)\left(a+\sqrt{\frac{2\alpha a(1-d)\left(h_A^2-h_T^2\right)}{m\left(2n_T^1h_T^1+h_T^2\right)}}-ad\right)^{-1}P,\\ \min\left\{\alpha\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)m\left(2n_T^1h_T^1+h_T^2\right)}}\right)\left(\sqrt{\frac{2\alpha a(1-d)\left(h_A^2-h_T^2\right)}{m\left(2n_T^1h_T^1+h_T^2\right)}}-ad\right)^{-1}P,\frac{\alpha P}{a(1-d)}\right\}\end{array}\right]$$

$$i_4^{1*}\in C^1\Leftrightarrow\gamma_i\in\left[-\frac{m}{2}P,2\alpha\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)m\left(2n_T^1h_T^1+h_T^2\right)}}\right)\left(a+\sqrt{\frac{2\alpha a(1-d)\left(h_A^2-h_T^2\right)}{m\left(2n_T^1h_T^1+h_T^2\right)}}-ad\right)\right.$$

$$t_4^*\left(e_T^1|n_T^1,n_A^1;\mathbb{E}_G(\theta)\right)=\begin{cases}1 & e_T^1=0\\ 1-\dfrac{a}{2}-\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)\,m\left(2n_T^1h_T^1+h_T^2\right)}} & e_T^1=h_T^1\end{cases}$$

$$i\in T^2\Leftrightarrow\begin{cases}\gamma_i\in\left[\dfrac{\alpha P}{\theta(1-t)},\dfrac{m}{2}P\right] & \mathit{if}\ t\in[0,1-a]\\ \gamma_i\in\left[\dfrac{\alpha P}{\theta(2-2t-a)},\dfrac{m}{2}P\right] & \mathit{if}\ t\in\left[1-a,1-\dfrac{a}{2}\right]\\ \mathit{never} & \mathit{if}\ t\in\left[1-\dfrac{a}{2},1\right].\end{cases}\qquad (T^2)$$

$$i\in A^2\Leftrightarrow\begin{cases}\mathit{never} & \mathit{if}\ t\in[0,1-a]\\ \gamma_i\in\left[\dfrac{\alpha P}{\theta a},\dfrac{\alpha P}{\theta(2-2t-a)}\right] & \mathit{if}\ t\in\left[1-a,1-\dfrac{a}{2}\right]\\ \gamma_i\in\left[\dfrac{\alpha P}{\theta a},\dfrac{m}{2}P\right] & \mathit{if}\ t\in\left[1-\dfrac{a}{2},1\right].\end{cases}\qquad (A^2)$$

$$i\in C^2\Leftrightarrow\begin{cases}\gamma_i\in\left[-\dfrac{m}{2}P,\dfrac{\alpha P}{\theta(1-t)}\right] & \mathit{if}\ t\in[0,1-a]\\ \gamma_i\in\left[-\dfrac{m}{2}P,\dfrac{\alpha P}{\theta a}\right] & \mathit{if}\ t\in[1-a,1].\end{cases}\qquad (C^2)$$

hence the equilibrium outcome is

$$n_{T,4}^{1*}=\frac{1}{2}-\frac{\alpha}{m}\min\left\{\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)\,m\left(2n_T^1h_T^1+h_T^2\right)}}\right)\left(\sqrt{\frac{2\alpha a(1-d)\left(h_A^2-h_T^2\right)}{m\left(2n_T^1h_T^1+h_T^2\right)}}-ad\right)^{-1},\frac{1}{a(1-a}\right.$$

$$n_{A,2R}^{1*}=\frac{\alpha}{m}\left[\begin{array}{l}\min\left\{\left(\dfrac{a}{2}+\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)\,m\left(2n_T^1h_T^1+h_T^2\right)}}\right)\left(\sqrt{\dfrac{2\alpha a(1-d)\left(h_A^2-h_T^2\right)}{m\left(2n_T^1h_T^1+h_T^2\right)}}-ad\right)^{-1},\dfrac{1}{a(1-a}\right.\\ \qquad -2\left(\dfrac{a}{2}+\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)\,m\left(2n_T^1h_T^1+h_T^2\right)}}\right)\left(a+\sqrt{\dfrac{2\alpha a(1-d)\left(h_A^2-h_T^2\right)}{m\left(2n_T^1h_T^1+h_T^2\right)}}-ad\right)^{-1}\end{array}\right.$$

$$n_{C,4}^{1*}=\frac{1}{2}+\frac{2\alpha}{m}\left(\frac{a}{2}+\sqrt{\frac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)\,m\left(2n_T^1h_T^1+h_T^2\right)}}\right)\left(a+\sqrt{\frac{2\alpha a(1-d)\left(h_A^2-h_T^2\right)}{m\left(2n_T^1h_T^1+h_T^2\right)}}-ad\right)^{-1}$$

$$e_{T,4}^{1*}(\theta)=\begin{cases}0 & \theta=d\\ h_T^1 & \theta=1-d\end{cases}$$

$$t_4^*=\begin{cases}1 & \mathit{prob}\ \dfrac{1}{2}\\ 1-\dfrac{a}{2}-\sqrt{\dfrac{\alpha a\left(h_A^2-h_T^2\right)}{2(1-d)\,m\left(2n_T^1h_T^1+h_T^2\right)}} & \mathit{prob}\ \dfrac{1}{2}\end{cases}$$

$$n_{T4}^{2*}\left(t,n^1,e_T^1|\mathbb{E}_i(\theta)\right)=\begin{cases}0 & \mathit{prob}\ \dfrac{1}{2}\\ \dfrac{1}{2}-\sqrt{\dfrac{\alpha\left(2n_T^1h_T^1+h_T^2\right)}{2a(1-d)\,m\left(h_A^2-h_T^2\right)}} & \mathit{prob}\ \dfrac{1}{2}\end{cases}$$

$$n_{A4}^{2*}\left(t,n^{1},e_{T}^{1}|\mathbb{E}_{i}\left(\theta\right)\right)=\begin{cases}\frac{1}{2}-\frac{\alpha}{adm} & prob\ \frac{1}{2}\\ \sqrt{\frac{\alpha\left(2n_{T}^{1}h_{T}^{1}+h_{T}^{2}\right)}{2a\left(1-d\right)m\left(h_{A}^{2}-h_{T}^{2}\right)}}-\frac{\alpha}{a\left(1-d\right)m} & prob\ \frac{1}{2}\end{cases}$$

$$n_{C4}^{2*}\left(t,n^{1},e_{T}^{1}|\mathbb{E}_{i}\left(\theta\right)\right)=\begin{cases}\frac{1}{2}+\frac{\alpha}{adm} & prob\ \frac{1}{2}\\ \frac{1}{2}+\frac{\alpha}{a\left(1-d\right)m} & prob\ \frac{1}{2}\end{cases}$$

5. *In the* ***FIFTH*** h_A^2***-REGION*** *when*

$$h_{A}^{2}\in\left[\left(\frac{2\alpha}{a\left(1-d\right)m}+1\right)h_{T}^{2}+\frac{4\alpha n_{T}^{1}h_{T}^{1}}{a\left(1-d\right)m},\left(\frac{a\left(1-d\right)m}{2\alpha}+1\right)h_{T}^{2}+\frac{a\left(1-d\right)mn_{T}^{1}h_{T}^{1}}{\alpha}\right]\cap$$
$$\cap h_{A}^{2}\in\left[\left(\frac{2\alpha}{adm}+1\right)h_{T}^{2},\left(\frac{adm}{2\alpha}+1\right)h_{T}^{2}\right]\&$$
$$\&\tfrac{1}{2}a\left(1-d\right)n_{T}^{1}h_{T}^{1}+\sqrt{\frac{\alpha a\left(1-d\right)\left(h_{A}^{2}-h_{T}^{2}\right)\left(2n_{T}^{1}h_{T}^{1}+h_{T}^{2}\right)}{2m}}\leq\tfrac{1}{4}a\left(1-d\right)\left(h_{A}^{2}-h_{T}^{2}\right)+\frac{\alpha h_{T}^{2}}{2m}$$

there is no separating equilibrium.

6. *In the* ***SIXTH*** h_A^2***-REGION*** *when*

$$h_{A}^{2}\in\left[\left(\frac{2\alpha}{a\left(1-d\right)m}+1\right)h_{T}^{2}+\frac{4\alpha n_{T}^{1}h_{T}^{1}}{a\left(1-d\right)m},\left(\frac{a\left(1-d\right)m}{2\alpha}+1\right)h_{T}^{2}+\frac{a\left(1-d\right)mn_{T}^{1}h_{T}^{1}}{\alpha}\right]\cap$$
$$\cap h_{A}^{2}\in\left[\left(\frac{adm}{2\alpha}+1\right)h_{T}^{2},1\right]\&$$
$$\&\tfrac{1}{2}a\left(1-d\right)n_{T}^{1}h_{T}^{1}+\sqrt{\frac{\alpha a\left(1-d\right)\left(h_{A}^{2}-h_{T}^{2}\right)\left(2n_{T}^{1}h_{T}^{1}+h_{T}^{2}\right)}{2m}}\leq\tfrac{1}{4}a\left(1-d\right)\left(h_{A}^{2}-h_{T}^{2}\right)+\frac{\alpha h_{T}^{2}}{2m}$$

then there is no separating equilibrium.

7. *In the* ***SEVENTH*** h_A^2***-REGION*** *when*

$$h_{A}^{2}\in\left[\left(\frac{adm}{2\alpha}+1\right)h_{T}^{2},1\right]\cap\left[\left(\frac{a\left(1-d\right)m}{2\alpha}+1\right)h_{T}^{2}+\frac{a\left(1-d\right)mn_{T}^{1}h_{T}^{1}}{\alpha},1\right]$$

then there is no separating equilibrium

4 Remarks on the results and conclusion

The final proposition shows many interesting properties of the endogenous variables. The first thing to stress is that the existence of a separating equilibrium requires two conditions: high political heterogeneity of the population and that the ratio between activists' and terrorists human capital is not to high. Note that even if the citizens' human capital enters multiplicatively in their productivity and therefore it seems irrelevant for the individual choices between engagement or labour, actually it is crucially important both for the existence of a separating equilibrium and for its properties.

When there is a separating equilibrium, we have shown that terrorists' affiliates are decreasing through time, while the temporal behavior of activists' affiliates is indeterminate. Note that the first period terrorists activity is not an indicator of the number of terrorists, because they might be silent when the regime is strong.

The effects of our political and economic variables on the consistency of the terrorists depends on the h_A^2-regions, however usually:

1. in both periods, it is increasing in the political heterogeneity of the population, in the regime responsiveness and in the activists' human capital

2. in both periods is often decreasing in the level of economic development (there is an exception in the third region first period), in the dispersion of opinions on the weakness of the government and in terrorists' human capital

Government repression responsiveness to terrorists' activity depends on the ration of the terrorists' and activists' human capita: when the activists' human capital is increasing wrt terrorists, then the government policy becomes responsive. More generally

1. it is decreasing in the level of economic development, in the dispersion of opinions on the weakness of the government and in the regime responsiveness and in the activists' human capital

2. It is increasing in the terrorists' human capital and in the political heterogeneity of the population.

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[7] unified approach to studying political violence with roots in poverty, natural resources rents and weak political institutions

[8] Incumbent or opposition can use violence to maintain or to acquire power

[9] model that links incidence of T and economic circumstances

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[17] 1. the larger the set of economic opportunities the lower the likelihood to be involved in T; 2. expected future growth is associated to increase in current T; 3 T brutality (N. of people killed) is associated with real GDP per capita

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[24] interaction among G, dissidents and public. Concessions may signal weakness & publci trust more D when there is high repression

[25] general equilibrium frame to study insurrection

[26] theory of endogenous determination of the equilibrium distribution of property

[27] tentaive to expand rational choice theory

[28] distinction between discriminate and indiscriminate violence, stressing that the second is much cheaper and usually is more likely at early stages

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[34] Review of Dataset

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