Popular Support, Denunciations and Territorial Control in Civil War*

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Abstract

I present a model of civilian cooperation with an armed group in an irregular war setting. Unlike previous models of interactions between civilians and combatants, in this model civilians consider the effect of their cooperation on territorial control in an incomplete information setting where they do not know others motivations or cooperation choices. I find that a superior military force that could ensure temporary territorial control by itself is not sufficient to achieve full civilian cooperation, and that full cooperation is attained only if this power comes with civilians' expectations of punishment for past defections. The model suggests that one reason why armed groups actively promote civilian displacement is to increase the levels of cooperation by those who stay in their land. The results also show that communities that have a highly centralized process of decision making are expected to give their support to only one of the groups of combatants.

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1 Introduction

In an irregular war the civilian population is under constant fear of being direct targets of violence from armed actors or other civilians. There are no good options for civilians when it comes to decide on their own participation in the conflict. If they opt to take sides and their group ends up being defeated, they face the possibility of reprisals. If they leave, they can expect to stay alive but they would often do so under conditions of extreme poverty without much hope of recovering their property or the jobs that they left behind. If they choose not to do anything, this could be interpreted as passive cooperation with the enemy by one of the armed actors. One alternative is to pretend to cooperate by giving false information to one armed group while perhaps gaining some additional benefit in the process. This option is not risk free either as it is possible that those receiving the information realize that it is of no military value, which could justify punishing the source of such bogus leads. Choosing among these alternatives is further complicated by the fact that others' civilians choices determine the effectiveness of pretending to cooperate, cooperating or becoming a displaced person at minimizing risks. How do civilians choose among those alternatives? What makes people more likely to cooperate with an armed group under the conditions of high uncertainty and high stakes present in irregular wars? This paper presents a model of civilian cooperation with an armed actor in an irregular war context in which civilians act under uncertainty about other civilians' actions and motivations and where territorial control is determined by the extent of civilian cooperation.

The formal literature in civil war has concentrated in the study of rebel recruitment focusing attention on its economic determinants (Grossman, 1991; Gates, 2002), but there has not been much work on other aspects of these conflicts like the transmission of information from civilians to combatants. This is surprising given the large literature on insurgency and counterinsurgency that highlights the importance of noncombatants in the outcomes of irregular warfare (Mao, 1937; Galula, 1964; Thompson, 1966). The work of Kalyvas (2006) is one of the few exceptions. He presents a game of denunciations in which two civilians with known preferences provide information to the armed group that they support taken as given the level of control exercised by each of the armed organizations. This paper builds on Kalyva's initial contribution and expands his analysis in several fronts. First, the model studies civilian cooperation in an incomplete information setting where personal motivations and actions of others civilians are not known by others. Second, civilian cooperation has an effect on the probability of one armed actor taking control over a territory; and third, the model's set up allows for the analysis of collective action problems present in the interactions of civilians and armed groups, showing how different community structures have different levels of cooperation and violence experienced by civilians.

Uncertainty about motivations and actions of civilians is prevalent in an irregular war, and a general sense of distrust among the population becomes a permanent characteristic of the communities involved in conflict. It is common to find that denunciations are used as a way to settle private disputes (Kalyvas, 2006). In these cases, people denounce their personal enemies as cooperators of one of the warring factions to the other hoping to gain some benefit derived from the consequences of those accusations. Since the denouncers' identities are generally kept secret by the armed organizations, people do not know who are denouncing others nor who will be the next victim. The uncertainty surrounding denunciations is compounded by the uncertainty about military outcomes. Civilians would like to support the group that is more likely to retain control over their territory to avoid being punished later for collaborating with the losers (or for failing to cooperate with the winner). They know that their cooperation affects the balance of military power and that if more civilians are supporting one group, that group will be (all else equal) more likely to prevail. But, what group are other civilians cooperating with? for the people facing that question, the information required to answer it is not available. Civilians are careful when possible to hide any action that they take to help one side or the other. The model captures two of the previous characteristics of the transmission of information from civilians to combatants: Territorial control is determined endogenously by denunciations, and all civilians take the decision on whether to cooperate or not without knowing what others' actions are, and without knowing what personal benefits (if any) others would obtain when they give any information to one of the warring factions.

The existence of individuals who would benefit by providing information that has no military value to a group involved in the conflict could give rise to collective action problems affecting the overall level of popular support for that group. As an example consider the case of a contested area where the balance of military power is even. If all civilians cooperate with the same faction they would increase significantly the chances of that group gaining control. This would shield them from violence from its adversary as long as the control was retained. However, if a person benefits by giving false information to a group that is not likely to identify or punish such practices, she could rely on others cooperation to ensure high chances of survival (by helping that group winning control) while still having the benefit product of his defection. The set up of the model allows to study how population size, relative military strengths and expectations of long term control determine the extent of these collective actions problems and how they affect the aggregate levels of civilians' cooperation.

A important element for the game to analyze the collective action problems that affect cooperation is modeling each civilian as an strategic player. Others models of irregular warfare either assume that civilians are one player in the game (e.g., Berman, Shapiro and Felter, 2008), or that they are not strategic actors as in (Fearon, 2008). Considering each civilian as a separate player in the game allows us to open the "black box" that hides the specific considerations of civilians in these situations where the consequences of their actions depend on others' choices. As the model shows, a direct consequence of the collective action problems is that there are major differences on the level of cooperation chosen by one agent that maximizes the welfare of the community and the decentralized solution. This result suggest that communities that are more centralized when it comes to define what group to support would be expected to suffer different patterns of violence exposure compared to those in which each civilian tries to maximize his own chances of survival.

Collective action problems have already been recognized as key elements in explanations of patterns of violence in irregular warfare. Weinstein and Humphreys (2006) presents a theory that links the structure of the warring factions with levels of abuse towards civilians. The authors argue that violent actions carried to gain some personal benefit by individual fighters can undermine the groups' overall objectives. This explains his empirical findings in which groups that have internal mechanisms that ensure higher control over their combatants are less likely to exert abusive extraction towards civilians. While in Weinstein and Humphreys (2006) collective action problems appear as determinants of violence through the internal organization of the armed groups, in this paper I study how the collective action problems within the communities affect their levels of cooperation and consequent levels of violence that they experience.

As a preview of the results, I find that a superior military force that could ensure temporary territorial control by itself is not sufficient to achieve full civilian cooperation, and that only if this power comes with civilians' expectations of certain punishment for past defections, full cooperation is attained. The model suggests that one reason why armed groups actively promote civilian displacement is to increase the levels of cooperation by those who stay in their towns. Communities that have a highly centralized process of decision making regarding cooperation with warring factions are expected to give their support to only one of them.

2 The model

Consider a village whose control is being disputed by two armed groups. One of them, *the counterinsurgents*, is trying to obtain information from the civilian population that is used to defeat the other group, *the rebels*. Neither the counterinsurgents nor the rebels are strategic actors.

There are $N > 2$ civilians all having an initial utility of one. Civilians simultaneously choose whether to cooperate with the counterinsurgents or not. Cooperation is interpreted as giving information that has military value to the counterinsurgents, like revealing the identities of rebels that live in the village. Not cooperating represents on the other hand, giving information to the counterinsurgents that does not increase their ability to take territorial control, but that nonetheless is used in military actions that affects civilians' safety. In armed conflicts when armed groups demand information from the population, the people can choose to lie, to provide it, or they can choose to remain silent. For now, the baseline model explores the case where remaining silent is not an option available to civilians. Cooperation will be denoted by c and giving false or useless information to the counterinsurgents by $-c$.

The benefits for civilian i of not cooperating with the counterinsurgents are captured by the term b_i, which is added to i's utility at the end of the game only if she chooses that option. The benefit could represent the value of a material or emotional reward that the punishment of a personal enemy brings when denunciations are used to settle private disputes. It can also represent the strength of ideological support for the rebels. This benefit is private information. No civilian knows how strong are others' incentives to give militarily useless information to the counterinsurgents. All civilians know however, that private benefits are distributed uniformly on the interval $\left[0, \bar{b}\right]$ and learn the value of their own at the beginning of the game.

When a civilian decides not to cooperate with the counterinsurgents this generates costs for all civilians. The costs are captured by a fraction $\frac{n^c}{N}$ that multiplies the initial unit of utility, where n^c denotes the number of civilians choosing c. These costs represent the damage on the civilian population caused by military actions taken by the counterinsurgents when given false information. Continuing with the example of false denunciations, if civilians do not reveal the identities of rebels but rather, point the finger to other civilians, this can inflict damage on those that were denounced but also on the original denouncer given the possibility of personal reprisals from the denounced person's relatives or friends. In this way, if everyone cooperates, all civilians are safe from harm caused by the counterinsurgents actions and they keep their unit of utility, but if only n^c of them do so, their utility is reduced to $\frac{n^c}{N}$.

At the end of the game nature decides whether the counterinsurgents take control over the village or not. Aggregate provision of truthful information by the villagers has an effect on the probability of the counterinsurgents prevailing. Specifically, the probability that the counterinsurgents take control over the village is $1 - \beta(1 - \frac{n^c}{N})$ with β being in $[0, 1]$. The probability of the rebels holding control when there is no civilian cooperation is given by β that parameterizes the rebels' relative military power. The underlying assumption behind this functional form is that full civilian cooperation is sufficient for the counterinsurgents to gain territorial control regardless of the rebels' initial military strength.

Table 1: Ex-ante Civilians' Payoffs

	Counterinsurgents win	Counterinsurgents lose
c	$\frac{n^c_{-i}+1}{N}$	$\frac{n^c_{-i}+1}{N}\delta$
$-c$	$\frac{n^c_{-i}}{N}\delta + b_i$	$\frac{n^c_{-i}}{N} + b_i$

Once it is decided what group has control over the village there is a round of punishments carried out by that group. With probability δ a civilian that cooperated with the group that loses control is not punished. More specifically, if the rebels prevailed at the end of the game, the civilians that gave truthful information to the counterinsurgents remain unharmed with probability δ, and with probability $1-\delta$ they are punished by the rebels. If the ones gaining control over the village are the counterinsurgents, with probability $1-\delta$ those civilians that gave erroneous information to the counterinsurgents become the victims of reprisals and with probability δ they are able to avoid them. A civilian that is punished looses whatever utility she has left at that point.

The parameter δ captures factors that decrease the amount of local knowledge that the winner group has. One of those factors is the inability to hold control in the medium and long term. If villagers know that control will be firmly maintained by the winners of the military contest over the village, it is more likely that the group will eventually be able to identify past enemy informants, in which case δ would be low. In this way, the model separates expectations of short term and long term control. The villagers have the ability to affect short term control, but take as given the ability of the group that prevails in the short run to maintain that control later on. If a group of rebels is militarily strong in the area where the village is located, but there are expectations that even if they prevail, they will not be able to control the village for long, β and δ would be close to one.

Table 1 gives a civilian's payoffs at the beginning of the game conditional on the group that takes control and on the number of other civilians cooperating with the counterinsurgents (denoted by n^c_{-i}). The bottom row gives the payoffs of a civilian that chooses not to cooperate with the counterinsurgents. In this case, the harm inflicted by the false information given to the counterinsurgents reduces her initial utility to $\frac{n^c_{-i}}{N}$ regardless of what group wins. If the counterinsurgents take control, they leave the civilian unharmed with probability δ and with probability $1-\delta$ she looses all the utility that she has left at that point. Since she chose not to cooperate, the term b_i is added to both entries in that row. A similar logic applies to the first row of the table.

For the results that follow I assume that $\bar{b} = 1$. That way all civilians value being unharmed by any actor in the conflict by more of what they would gain by giving false information to the counterinsurgents. This is consistent with the observation made by case studies in which the desire to limit damage generally prevails over ideals or material benefits (e.g., Leites and Wolf, 1970).

The equilibrium concept used to solve this simultaneous game of incomplete information is Bayesian Nash Equilibrium. I concentrate in symmetric strategies represented by the function $s : [0, 1] \to \{c, -c\}$. The function $s(.)$ gives an action for a given private value of false denunciation b_i. That is, all civilian that have a value of providing false information to the counterinsurgents of b will take the same action $s(b)$ in equilibrium.

3 Results

A civilian takes the decision to cooperate with the counterinsurgents if her expected utility from doing so is greater than the utility she gets if she chooses to provide false information. The following expressions give us both of those utilities for civilian i.

$$\begin{aligned} U_i(c) &= E_{n^c|p^c}\left[\frac{n^c_{-i}+1}{N}\left(\beta\left(1-\frac{n^c_{-i}+1}{N}\right)\delta+\left(1-\beta\left(1-\frac{n^c_{-i}+1}{N}\right)\right)\right)\right], \\ U_i(-c) &= E_{n^c|p^c}\left[\frac{n^c_{-i}}{N}\left(\beta\left(1-\frac{n^c_{-i}}{N}\right)+\left(1-\beta\left(1-\frac{n^c_{-i}}{N}\right)\right)\delta\right)\right]+b_i. \end{aligned} \tag{1}$$

In the expressions above, expectations are taken over the distribution of the number of civilians cooperating in equilibrium that do not include i. Given that in equilibrium others cooperate according to $s(.)$ at the time when i takes her decision, she would expect others to cooperate with probability $p^c \equiv \int_0^1 I_c(s(b))db$, where $I_c(.)$ takes the value of one whenever its argument is c and zero otherwise. After rearranging some of the terms in (1), we can deduce that a civilian i will cooperate with the counterinsurgents if and only if:

$$\begin{aligned} \Psi(p^c) \equiv & E_{n^c|p^c}\left[\frac{n^c_{-i}}{N}\left(\beta\left(1-\frac{n^c_{-i}}{N}\right)(\delta-1)+\left(1-\beta\left(1-\frac{n^c_{-i}}{N}\right)\right)(1-\delta)\right)\right] \\ & + E_{n^c|p^c}\left[\frac{n^c_{-i}}{N}\frac{\beta}{N}(1-\delta)\right]+\frac{1}{N}E_{n^c|p^c}\left[\beta\left(1-\frac{n^c_{-i}+1}{N}\right)\delta+\left(1-\beta\left(1-\frac{n^c_{-i}+1}{N}\right)\right)\right] \geq b_i \end{aligned} \tag{2}$$

The expression on the left hand side of inequality (2), $\Psi(p^c)$, is the expected gain in the likelihood of being unharmed that cooperation brings. The expression states that if by cooperating civilian i increases her chances of not being a victim of violence by more of what she gains by providing false information to the counterinsurgents, she would choose to cooperate. We can learn the effect of others' cooperation on the incentives to individual cooperation by studying the components of $\Psi(p^c)$. The first component of $\Psi(p^c)$ (from left to right) is the expected gain in utility if the actions of i had no direct repercussions on what group takes control over the village nor on the costs incurred by everyone when counterinsurgents act after denunciations. The second term, is the expected gain derived from increasing the chances of the counterinsurgents winning control and the third, the gain in utility from reducing the costs of violence that false information brings. We can immediately see that the second term is non decreasing in the expected number of other people cooperating with the counterinsurgents (equivalently, it is non decreasing in p^c). If i cooperates with the counterinsurgents and they win, she would not be punished once that group takes control and she would only have her personal safety utility reduced by others' non cooperation. After a quick inspection of (2), we can also see that the third term is not decreasing in the expected number of the counterinsurgents' informants. The intuition is simple. By cooperating, player i reduces the cost of violence that false information brings by $\frac{1}{N}$. Having sided with the counterinsurgents, she would be better off if they end up taking control over the village. This occurs with a higher probability if others cooperate with that group as well. We now only need to establish how the first term is affected by the ex-ante probability of cooperation. The next result shows that the first term is a quadratic function of p^c for most parameter combinations.

Lemma 1. *If $\beta > 0$ and $\delta < 1$, the expected gain of cooperating with the counterinsurgents when that action does not affect neither the probability of punishment after denunciation or which group gains control, is a quadratic function of p^c with a minimum at $p_{min} = \frac{2\beta\left(1-\frac{1}{N}\right)-1}{4\beta\left(1-\frac{1}{N}\right)}$.*

Proof. Notice that n^c_{-i} follows a binomial distribution with parameters $(N-1, p^c)$. Using the fact $E[n^c_{-i}] = (N-1)p^c$ and $E[(n^c_{-i})^2] = (N-1)p^c(1-p^c) + ((N-1)p^c)^2$, we can see that the first term of $\Psi(p^c)$ is

$$(1-\delta)\left(1-\frac{1}{N}\right)\left((p^c)^2 2\beta\left(1-\frac{2}{N}\right) + p^c\left(1-2\beta\left(1-\frac{1}{N}\right)\right)\right).$$

Since $\beta > 0$ and $\delta < 1$, this expression reaches a global minimum at $p_{\min}$.

□

The result tells us that if the rebels' military power is high enough (enough to make $p_{\min} > 0$), there is a range of values of p^c in which more cooperation by others *decreases* the incentives of individual cooperation (this range being $[0, p_{\min}]$). Given that the chances of the rebels winning in this range of cooperation is high enough, it is better to provide false information to the counterinsurgents while others cooperate. By doing this, others' cooperation reduces the cost of violence created by the counterinsurgents, as well as the probability of being punished by the likely winner (the rebels). On the other hand if $p^c > p_{\min}$, the incentives to cooperate increase with others' expected cooperation. For those levels of cooperation, there are enough people on the side of the counterinsurgents to make it worth collaborating with them as well.

I now shift attention to finding the equilibrium probability of cooperation. As indicated by (2), $s(b_i)$ must be a threshold strategy, and the ex-ante probability of any civilian cooperating must be the probability of that civilian having a private benefit b_i being less than $\Psi(p^c)$. Therefore, the equilibrium probability of cooperation satisfies

$$F(\Psi(p^c)) = p^c, \tag{3}$$

where $F(.)$ denotes the c.d.f of a uniform random variable with support in $[0,1]$. The following result shows that there is in fact a fixed point of $F(\Psi(.))$ in $(0,1]$.

Proposition 1. *There is a unique symmetric Bayesian equilibrium in which the ex-ante probability of cooperation is strictly positive.*

Proof. Notice that for a finite population $F(\Psi(0)) = \frac{1}{N}\left(1-\beta(1-\delta)\left(1-\frac{1}{N}\right)\right) > 0$. Also $F(\Psi(1)) = (1-\delta)\left(1-\frac{1}{N}\right)\left(1-\frac{\beta}{N}\right) + \frac{1}{N} \leq 1$. By continuity of $\Psi(p^c)$ we know that there is at least one fixed point of $F(\Psi(p^c))$ in $(0,1]$. Now I show uniqueness. First, I look at the case where $\beta > 0$ and $\delta < 1$. By Lemma 1 and by the fact that the second and third terms in the left hand side of inequality (2) are linear in p^c, $\Psi(p^c)$ is quadratic in p^c and has a global minimum. Let the global minimum of

$\Psi(p^c)$ be reached at $p'_{\min}$. If $p'_{\min} < 0$, $\Psi(p^c)$ is monotonically increasing with no inflection points in [0,1], so there is only one point where $\Psi(p^c)$ and p^c intersect. If $p'_{\min} > 0$ and $\Psi(p'_{\min}) > p'_{\min}$, $\Psi(p^c)$ and p^c can not intersect in $[0, p'_{\min}]$ but by the same argument as in the previous case, they intersect at one point in $(p'_{\min}, 1]$. If $\Psi(p'_{\min}) \leq p'_{\min}$, $\Psi(p^c)$ is monotonically decreasing in $[0, p'_{\min}]$ and therefore $\Psi(p^c)$ and p^c intersect at one point. There can not be any other intersection between those two functions in $(p'_{\min}, 1]$. If $\beta = 0$ or $\delta = 1$, $\Psi(p^c)$ is linear in p^c and given the values of $\Psi(0)$ and $\Psi(1)$ there will be just one intersection with p^c. □

3.1 Size of the population, relative military power, and expectations of long term control

Proposition 1 shows that under no circumstances all civilians choose not to cooperate. The intuition is straightforward. If all civilians are lying to the counterinsurgents, the risk of being harmed by the actions that this information produce is so high that a civilian with small private value of not cooperating would prefer to reduce the cost of violence by giving truthful information. The opposite extreme situation would be one where everyone decides to give truthful information to the counterinsurgents. Proposition 2 gives necessary and sufficient conditions to observe that outcome.

Proposition 2. *The ex-ante equilibrium probability of cooperating with the counterinsurgents is* 1 *if and only if* $\delta = 0$ *and* $\beta = 0$

Proof. If in equilibrium $p^c = 1$, this implies $F(\Psi(1)) = 1$ which is equivalent to $(1-\delta)\left(1 - \frac{\beta}{N}\right) = 1$. Since both δ and β are in $[0, 1]$, they have to be both zero. If δ and β are 0, using (2) we get $\Psi(p^c) = p^c\left(1 - \frac{1}{N}\right) + \frac{1}{N}$. Using (3) $p^c = 1$. □

The result suggests that a superior military advantage on the part of the counterinsurgents is not enough to make civilians cooperate with them with certainty. Civilians need to believe that after taking control, the counterinsurgents will be able to find out who were those that did not cooperate with them, which as mentioned earlier, can be achieved with long lasting strong presence in the village. Similarly, it is not sufficient for civilians to know that they will be caught with certainty if they lied to induce cooperation. If there is even small chance that the rebels would prevail in the absence of civilians' help, that would be enough to deter cooperation for those that have a strong interest in deceiving the counterinsurgents.

While having a completely superior military advantage does not guarantee that civilians will cooperate with the counterinsurgents, a stronger military force will in most cases, generate more cooperation.

Proposition 3. *In equilibrium* p^c *is not increasing in* β *and it is strictly decreasing when* $\delta < 1$.

Proof. I first show that the partial derivative of $\Psi(p^c)$ with respect to β is less than or equal to zero with equality reached only when δ is one. A simple calculation gives

$$\frac{\partial \Psi(p^c)}{\partial \beta} = 2\beta(1-\delta)\left(1 - \frac{1}{N}\right)\left(1 - \frac{2}{N}\right)(p^c - 1) - (1-\delta)\left(1 - \frac{1}{N}\right)\frac{1}{N}.$$

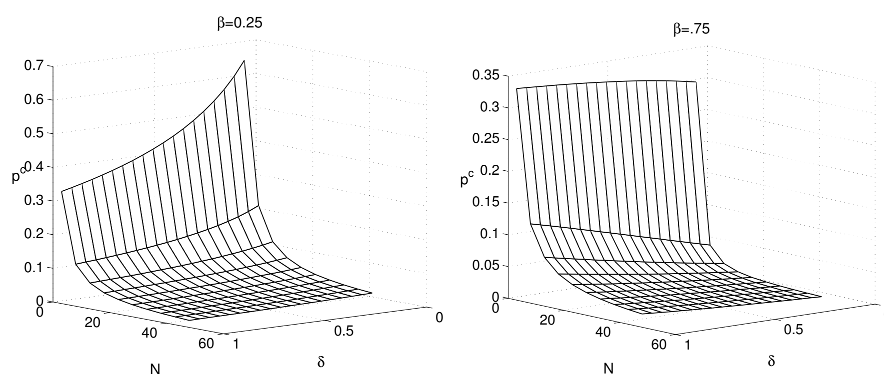
Consider the plane where the horizontal axis takes the values for probabilities of cooperation and the vertical axis takes the values of $\Psi(p^c)$. Given that the equilibrium probability of cooperation is the unique positive intersection of the graph of the Ψ function and the 45 degree line in this plane, we can see that a downward shift in Ψ implies a decrease in the equilibrium probability. $\square$

The positive relationship between the counterinsurgents' military power and cooperation does not hold when δ is one. If civilians know that counterinsurgents are not capable, or willing, or are not legally allowed to punish those that gave them false information once they get control, more military power will not make more people cooperate with them. When δ is one, what group gains control becomes irrelevant for civilians, as they know that no one will be punished by previous cooperation choices. It is easy to show that when δ is one, the ex ante equilibrium probability of cooperation is $\frac{1}{N}$. This captures the fact that for that particular case all that matters for a civilian when deciding whether to cooperate is by how much she can reduce the cost of counterinsurgent caused violence, which is exactly $\frac{1}{N}$.

For the particular case where δ is one, we see that the probability of cooperation is decreasing in the size of the population. In a large population the effect of one civilian's choice on reducing the cost of counterinsurgency violence is small. The argument however could be applied more generally for other cases. For a village with a large population, the action of one civilian is less important at affecting both the costs generated by violence after false denunciations and the outcome of the military contest between counterinsurgents and rebels. Therefore, we expect to observe levels of cooperation decreasing in the size of the population for values of δ different than one.

How does the relationship between cooperation, an population size change when there are positive chances of being punished by the group that takes control? Figure 1 shows us the main patterns.

Figure 1: Probability of cooperating with challenger: Comparative statics



The first observation confirms the basic intuition regarding the size of the population. We see that for the values of δ different than one and for the two levels of the rebels' military cooperation shown, the probability of cooperation decreases in the size of the population. The model then provides a mechanism that accounts for why armed groups that are trying to gain territorial control often put pressure on civilians to leave the places where they live. The more civilians are displaced, the more likely is that the ones that stay will cooperate with the incoming group.[1]

The graphs also shows that there is less cooperation with the counterinsurgents with higher δ's if the rebels are militarily weak, but that the opposite occurs if the rebels are strong. Intuitively what this says is that it becomes a more attractive option to help the likely loser if it is harder for the winner to punish enemy cooperators.

The previous observations highlight the importance of long and medium term expectations when civilians decide to cooperate. In this type of conflict for an armed group it is crucial to convince civilians that their side will win and that they will sustain control over the area if they gain it. As Oliver Crawford noted about Malaya "If we could make it clear to even the most ignorant villager that we were winning, then information would begin to flow the other way- out to us, instead of back into the jungle."[2] In terms of the model, the counterinsurgents should induce civilians to believe that they are militarily stronger (lowering β) and simultaneously, they should make clear that they will find out who cooperated with the enemy, possibly by creating expectations long term control (reducing δ).

The negative effect of the size of the population on cooperation comes as a straightforward consequence of the collective action problems faced by the civilians in this environments. When some civilians do not cooperate aiming to gain a private benefit, they are eliminating the outcome in which no one in the village gets harmed. Defection is more likely if people perceive that their actions are less important at determining outcomes, which is what happens in large populations. This suggest that if there is only one agent in charge of deciding the level of cooperation with the counterinsurgents, she would choose complete cooperation. The next result shows that this is indeed the case.

Proposition 4. *The centralized cooperation decision involves all civilians cooperating with the counterinsurgents.*

Proof. The objective function of an agent concerned with the aggregate welfare of the villagers is:

$$\sum_{i\in C}\frac{n^c}{N}\left(\beta\left(1-\frac{n^c}{N}\right)\delta+\left(1-\beta\left(1-\frac{n^c}{N}\right)\right)\right)+\sum_{i\in -C}\left(\frac{n^c}{N}\left(\beta\left(1-\frac{n^c}{N}\right)+\left(1-\beta\left(1-\frac{n^c}{N}\right)\right)\delta\right)+E[b_i]\right)$$

Where C and $-C$ denote the set of individuals that cooperate with the counterinsurgents and the set of the ones that do not respectively. The problem of this agent is to maximize her utility by choosing an optimal level on cooperation n^c. Since $E[b_i]=\frac{1}{2}$ and all other terms in the summations are equal for all i and less than or equal than 1, we get the following:

$$\frac{n^c}{N}\left(n^c\left(\beta\left(1-\frac{n^c}{N}\right)\delta+\left(1-\beta\left(1-\frac{n^c}{N}\right)\right)\right)\right)+\frac{(N-n^c)}{N}\left(n^c\left(\beta\left(1-\frac{n^c}{N}\right)+\left(1-\beta\left(1-\frac{n^c}{N}\right)\right)\delta\right)\right)+\frac{(N-n^c)}{2}$$
$$\leq\frac{n^c}{N}N+\frac{(N-n^c)}{2}=\frac{N+n^c}{2}$$

[1]An alternative mechanisms that explains that same observation is that the incoming group wants to take possession of the villagers' land.

[2]Crawford (1958), as cited in Kalyvas (2006).

If we evaluate the objective function at $n^c = N$, we get N, which is the the maximum of the function $\frac{N+n^c}{2}$. Also, since $\frac{N+n^c}{2} < N$ for all $n^c \neq N$, the objective function will be strictly less than N for all those values of n^c. We conclude that the unique maximizer of the objective function is $n^c = N$. $\square$

The centralized optimal benchmark could give us an idea of how communities in which by culture or tradition centralize their political decisions in few or one individual decide on whether to give or not their support to an armed group. In light of this interpretation what the previous result suggests is that with that type of community we should observe a more consistent support for one of the armed actors. Moreover, if there is any violence exerted toward members of those communities it should come from only one of the armed groups.

3.2 The option of neutrality

The baseline model studies the case where civilians are forced to provide information to the counterinsurgents. In this section I study the case where civilians are allowed to remain neutral.

Let n^0 denote the number of civilians that choose not to give any information to the counterinsurgents. It is assumed that those civilians do not affect the chances of any group taking control and that because of this, they will not be punished by the winners. Therefore, the expected utility at the beginning of the game of remaining silent is

$$U_i(0) = E_{n^c,n^0|p^c,p^0}\left[\frac{n^c_{-i} + n^0_{-i} + 1}{N}\right]. \tag{4}$$

Now the expectation is taken over the distribution of the number of civilians that cooperate with the counterinsurgents and the number of those that remain neutral (other than i). These numbers and the number of civilians that give false information to the counterinsurgents follow a multinomial distribution with parameters $(p^c, p^0, 1 - p^c - p^0, N - 1)$.

Allowing people to remain silent will dramatically change the levels of cooperation that the counterinsurgents receive as the next result shows.

Proposition 5. *When civilians are allowed to remain silent, if $\delta < 1$ and $\beta > 0$ then in equilibrium $p^c = 0$. For all other parameter combinations, the maximum probability of cooperation that can be achieved in any equilibrium is $\frac{1}{1+\delta(N-1)}$.*

Proof. The expected utility of cooperating for civilian i is now

$$U_i(c) = E_{n^c,n^0|p^c,p^0}\left[\frac{n^c_{-i} + n^0_{-i} + 1}{N}\left(\beta\left(1 - \frac{n^c_{-i}+1}{N}\right)\delta + \left(1 - \beta\left(1 - \frac{n^c_{-i}+1}{N}\right)\right)\right)\right]. \tag{5}$$

Civilian i will choose to remain silent rather than cooperate if and only if

$$E_{n^c,n^0|p^c,p^0}\left[\frac{n^c_{-i} + n^0_{-i} + 1}{N}\beta(1-\delta)\left(1 - \frac{n^c_{-i}+1}{N}\right)\right] \geq 0 \tag{6}$$

We can see that the inequality is strict whenever δ is not one and β is positive, which proves the first statement of the proposition.

In any equilibrium, a civilian cooperates if and only if

$$E_{n^c,n^0|p^c,p^0}\left[\frac{n^c_{-i}+n^0_{-i}+1}{N}(1-\delta)\left(1-\beta\left(1-\frac{n^c_{-i}+1}{N}\right)\right)\right]+\frac{1}{N}\geq b_i. \tag{7}$$

If β is zero and all the civilians that are indifferent between staying silent and cooperating cooperate the previous expression reduces to

$$p^c(1-\delta)\left(1-\frac{1}{N}\right)+\frac{1}{N}\geq b_i, \tag{8}$$

and therefore the probability of cooperation is $\frac{1}{1+\delta(N-1)}$. Other possible symmetric equilibria where some of the civilians that are indifferent do stay silent would reduce the probability of cooperation to less than $\frac{1}{1+\delta(N-1)}$.

If δ is one, a similar analysis shows that the maximum probability of cooperation is $\frac{1}{N}$. □

As a corollary of proposition 5, we can see that when civilians are allowed to remain silent the level of cooperation is less than or equal than when they are forced to give any kind of information. Moreover, it can be proved that the same conclusion holds when we compare the centralized solutions. An agent that maximizes all civilians welfare when they are allowed to remain silent would not have anyone giving false information, but could have either all civilians remaining silent or all of them cooperating as before. What the model suggests then is that counterinsurgents forces have high incentives in forcing civilians to reveal information, even when some of them end up lying. Whether forcing civilians to speak is the most convenient choice for the counterinsurgents depends on how costly it is for them to execute actions based on false leads. Such cost are not limited to the actual resources spent in the military operations carried under useless information, they can also include the damage done to innocent civilians while executing those operations. The baseline model captures a conflict environment where these costs are low, as it is the case when paramilitary forces, or non-democratic governments are searching for rebel units.

References

Berman, E., J. Shapiro and J. Felter. 2008. "Can Hearts and Minds be Bought? The Economics of Counterinsurgency in Irak." *National Bureau of Economic Research, Working Paper* 14606.

Crawford, O. 1958. *The Door Marked Malaya.* New Press, New York.

Fearon, J. 2008. Economic Development, Insurgency and Civil War. In *Institutions and Economic Performance*, ed. E. Helpman. Harvard University Press pp. 292–.

Galula, D. 1964. *Counterinsurgency Warfare; Theory and Practice.* Praeger, New York.

Gates, S. 2002. "Recruitment and Allegiance: The Microfoundations of Rebellion." *The Journal of Conflict Resolution* 46(1):111–130.

Grossman, H. 1991. "A General Equilibrium Model of Insurrections." *The American Economic Review* 81(4):912–921.

Kalyvas, S. 2006. *The Logic of Violence in Civil War.* Cambridge University Press, New York.

Leites, N. and C. Wolf. 1970. *Rebellion and Authority, An Analytic Essay on Insurgent Conflicts.* Markham Publishing Company.

Mao, Tsetung. 1937. *On Guerrilla Warfare. Translated by S. Griffith.* University of Illinois Press, Urbana and Chicago.

Thompson, R. 1966. *Defeating Communist insurgency; the lessons of Malaya and Vietnam.* Praeger, New York.

Weinstein, J. and M. Humphreys. 2006. "Handling and Manhandling Civilians in Civil War." *American Political Science Review* 100(3):429–447.