# Networks of Violence and Civilian Targeting During Civil War
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## Abstract

Increasingly in recent years, scholarship has reached a consensus that armed groups' decision to kill civilians is strategic in nature. However, most examinations of this choice (and its consequences) assume a simple, dyadic environment where the main conflict is between a government and a unified opposition. Yet, we know empirically that civil wars are more complicated than this, often involving three or more actors. We investigate the strategic incentives for civilian victimization in a complex multi-actor conflict environment using an innovative agent based model. We find that, irrespective of the overall intensity of conflict, more dense strategic environments – where conflict between any two actors is more likely – lead to a markedly higher tendency to target civilians by all groups. We empirically test this hypothesis in multi-actor civil wars using ACLED to generate conflict specific measures of both intensity and network density. Preliminary empirical analysis is supportive of our findings that a more dense strategic environment is associated with a higher level of violence against the civilian population.

☆Alphabetical order signifies equal authorship, all mistakes are our own. Replication material and instructions will be made available at `https://github.com/s7minhas/victimization`.

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## Introduction

Why do armed groups victimize civilians during civil war? For years, political scientists considered the violent targeting of non-combatants “irrational, random, or the result of hatreds between ethnic groups." (Valentino, 2014, p. 91). More recently, research has reached a new consensus as scholars now understand violence against civilians to be a highly rational, well-coordinated process used to gain more resources, more territory, or to achieve other militaristic goals. While agreement on the strategic nature of victimization might be increasing, the literature is splintered by different mechanisms seeking to explain the choice to victimize, demonstrating that armed actors are widely diverse in terms of characteristics like size, ideology, and doctrine (Oppenheim and Weintraub, 2017) as well as with respect to the complex array of intergroup competitive politics and fragmentation rebels face. (Kathman and Wood, 2015).[1]

Despite these advances, a majority of this scholarship assumes a dyadic conflict environment where the primary conflict is between a government and a unified opposition. Yet, it is well known that civil wars are more complicated than this–often involving three or more actors relevant to the broader conflict landscape. In addition, preexisting work tends to overlook civilian agency, and the role that civilians' own choices might play in affecting the strategic logic of armed groups. Modern day warfare is fought on battlegrounds diversified by civilian behavior and their willingness to support armed actors. This interactive nature of conflict, wherein civilians assess their likelihood of survival by balancing the risks and benefits of supporting armed groups, is prevalent across conflict cases. Unpacking the intricate relationship between civilians, their experience with violence, and armed actors has been a growing trend in conflict and peace

[1]For more on fragmentation and competition see (Bakke, Cunningham and Seymour, 2012; Fjelde and Nilsson, 2012; Nygård and Weintraub, 2015)

studies with an emphasis on rebel governance (Mampilly, 2011; Arjona, 2016), civilian victimization (Eck and Hultman, 2007; Bellows and Miguel, 2009; Wood, 2014; Dorff, 2017), civilian displacement (Steele, 2011), civilian organization and resistance (Kaplan, 2013; Arjona, 2017; Dorff and Braithwaite, 2018). This paper builds on recent scholarship to directly address the multi-actor, complex, nature of modern day conflict environments and its relationship to civilian victimization during war.

Our work expands current scholarship in two key ways. First, while we acknowledge the importance of multi-actor settings in terms of competition and the entry of new actors (Kathman and Wood, 2015; Gallop, Minhas and Dorff, Forthcoming), our study focuses both on the networked nature of the conflict environment and how civilians, through their support of armed groups, influences battle-field dynamics. In doing so, we incorporate civilians into the complex playing field of multi-actor civil wars. We investigate the strategic incentives for civilian victimization in a complex multi-actor conflict environment using an innovative agent based model. Our model's key finding is that a more dense conflict network–one in which any two actors are more likely to come into contact–leads to more civilian victimization *irrespective* of the overall level of violence or the number of groups. We investigate the relationship between network density and civilian victimization, and find empirical support for this prediction.

## Civilian Victimization During War

Previous explanations of civilian victimization have largely focused on key characteristics of armed groups, such as a group's fighting capability (Wood, 2010), resource base (Azam and Hoeffler, 2002*a*) and external support (Idean Salehyan and Wood, 2015). Yet these studies also acknowledge that an armed actor's decision to victimize civilians is conditional on the conflict landscape at large, wherein the decisions of armed groups are informed by the actions of both rival armed challengers and the civilian population.

As (Wood, 2010, p. 612) explains, “Unraveling these dynamics is particularly important if scholars wish to fully understand the dense web of interactions that guide insurgent’s decisions to use violence." Drawing on this intuition, that the networked dynamics of armed groups influence violence against civilians, we develop an agent-based model that incorporates insights about how the interdependent nature of multi-party intrastate conflicts influences armed groups’ decision to harm civilians.

In this model, a country is composed of territories, filled with two types of actors: civilians and armed groups. Armed groups represent both rebel groups and governments. The main difference between the government and non-state actors is that the government controls more territory than non-state actors. In general, armed groups’ primary motivation is to hold territory containing resources that can be mobilized (Kalyvas, 2006). Failing this, actors prefer that territory is held by groups with similar preferences. The other main actors in this model are civilians. Civilians are primarily motivated by their personal safety; their secondary motivation is ideological. The inclusion of civilian preferences follows research on rebel-civilian relationships which underscores civilian agency in conflict areas (Mampilly, 2011; Kasfir, 2015; Arjona, 2017). Ceteris paribus, civilians would prefer that their territory is held by groups with similar political preferences. When political preferences align, even if weakly, all actors experience the benefits of political stability and resource sharing.

*Actor Overview*

In our model, we characterize armed groups using two variables, a measure of their ideal point ($x_i$) on a one-dimensional preference space (bounded between $0$ and $1$), and a measure of how ideological they are ($\phi_i$). Groups that are more ideological benefit (suffer) from having other groups with similar (dissimilar) preferences controlling territory, and thus have less (more) motivation to fight them.[2] Civilians are also characterized by their ideal point ($\eta_i$), but whereas the ideal points of armed groups are public, armed groups cannot directly observe the preferences of the civilian population. We define the distance between any two groups as:

$$D(a, b) = ||z_a - z_b|| \quad (1)$$

where $z_a = x_a$ if $a$ is an armed group, whereas $z_a = \eta_a$ if $a$ is a civilian. In particular, we define the ideological benefit that armed group $i$ gets from changes to group $j$'s utility as:

$$\alpha_{i,j} = 2\phi * (.5 - D(i, j)) \quad (2)$$

In this game, armed groups draw resources from civilian mobilization. This "instrumentalist" perspective follows from research conceptualizing victimization as a strategic choice shaped by the desire to control resources and territory while capturing civilian support and undermining support for opponent groups (Wood, 2014).[3] To extract resources, armed groups try to mobilize support from the civilian population and gain more resources as support increases. Furthermore, when the territory that civilians inhabit is under attack from another armed actor, civilians can choose to support the attacking group in order to increase the group's likelihood of victory.

Each actor makes two potential choices: (1) armed groups can choose to attack

[2]We treat the government actor as non-ideological, because in most cases a government will not allow a strong challenger to hold territory simply because they have politically congenial views.

[3]A modification of the game would be to allow for groups to have natural resources or foreign support which depends on territorial control but not civilian support) [add literature on different types of resources here]

other armed groups in order to conquer additional territory, and gain more resources; and (2) armed groups can victimize civilians in territory they control. Civilians choose whether to support an armed group in their territory, and which group to support. In addition, civilians can choose to move from one territory to another in search of a more congenial (or less indiscriminately violent) armed group.

When an armed actor attacks another territory, each group in the territory has a probability of winning based on their share of spatially weighted resources. To calculate resources, we need to understand the extent to which civilians support the armed groups. A supporter of the group gives the total possible resources (normalized to $1$). Conversely, because a non-supporter of the group requires effort to coerce into yielding resources, the armed group only captures $\psi$ resources (where $0 < \psi < 1$). Finally, if a civilian supporter is in one of the territories where the conflict is taking place, and they support one of the opposing armed groups, that civilian will actually reduce the resources available to the group that controls the territory by $k$ (where $1 > k > 0$). The nexus of civilian-armed group relations follows previous scholarship on the incentives for civilian abuse which argues that both governments and non-state actors target the population in order to gain support or shift support away from their opponent (Valentino, 2014; Azam and Hoeffler, 2002*b*; Kalyvas, 2006; Wood, 2010).

If the attacking group wins, they take control of the territory, and in any case, resources are lost and civilians causalities occur in all territories that are the source or target of an attack.[4] When a group decides which territory to attack, they compare all their neighboring territories, and choose to attack the one that gives the biggest dif-

[4]Because armed groups must mobilize resources from one territory in order to attack another, civilians that are killed during an attack in one location are necessarily civilians that have been mobilized from another location.

ference in utility between fighting in a battle, and the status quo if they were to refrain from attacking.

*Decision to Victimize*

Armed groups can also choose to victimize civilians in territories they control. These groups' ability to be selective relies on their access to resources and trustworthy information, as in Kalyvas (2006). The likelihood that they will victimize a non-supporter is based on how much information they are able to obtain from their supporters in the population (Lyall, Shiraito and Imai, 2015). Groups are more likely to accurately (selectively) victimize as the number of supporters in the territory increases.[5] We define this probability[6] as:

$$\zeta_q \equiv P(\text{selective victimization in territory } q) = 1 - \epsilon \left( \frac{||\text{nonsupporters}|| + 1}{||\text{civilians}||} \right) \tag{3}$$

where $\epsilon$ is the baseline rate of error in the case where all but one civilian supports the armed actor. In this model selective violence is effective at coercing civilians into giving support, whereas indiscriminate violence (targeting ones' own supporters) is counterproductive – when an actor targets a supporter, the range of ideologies that will provide support to the actor shrinks (since the safety provided by supporting the actor is illusory) and when they target a non-supporter, the range of ideologies grow.[7]

[5]An exception here is when they have either all supporters, or no supporters. In the first case, the decision rule prohibits them from victimizing. In the second case, there is no risk of unintentionally targeting a supporter since there are no supporters to target.

[6]Except in the edge-case where there are no supporters or no non-supporters.

[7]Fjelde and Hultman (2014) show that that the number of civilians targeted by armed groups (government and non-state alike) is higher in areas populated by the enemy's ethnic constituency.

*Civilian Preferences*

When civilians choose whether or not to support an armed group, they do so fully cognizant of the risk of violence. In particular, if the territory is not the site of a battle, civilian's decision for who to support is based on their expectation of who other civilians will support. This is because if they believe other civilians will support the incumbent power in a region, it becomes more effective to "go along" with it in order to avoid the risk of violence. Civilians are assumed to support the incumbent with probability based on their inverse ideological distance (so civilians will support a maximally close group all of the time and never support the maximally distant group). Civilians will then support the group if their ideological distance, modified by the effect of past victimizations, is less than half of the expected number of other supporters of the armed group (so ceteris paribus, civilians will support a maximally close group regardless of the number of other supporters. If a civilian is half the preference space away, then she will only support the armed group if they are supported by the rest of the population, or if they have a history of very effective victimization). If a territory is the site of a battle, the calculations for civilians change. Now civilians seek to trade off between ideological distance and the chance a group will triumph. In particular, civilians choose to support the group that has the greatest product of inverse ideological distance and expected probability of victory. When civilians decide whether to remain in a territory they are not simply looking for the best armed actor controlling a territory, they are also relocating and often paying serious material costs. Thus, the decision to flee begins with a high threshold in the model and becomes more plausible over the course of the conflict.

*Sequential Order of Events*

We depict the main stages of the game in Figure 1 and Figure 2. In these graphics, territories are represented by rectangles, rectangle size is determined by its civilian population. Territories of the same color are held by the same armed group. The beginning stages of the game are shown in row 1, Figure refattackGraphic. In row 2 (left panel), we illustrate an armed groups' choice to attack in a given territory (if any). Civilians are arranged in the territory based on their ideological preferences (row 2, right panel); this graphic also shows the decisions of civilians to support the armed actor. The results of both armed actor and civilian decisions are shown in the final row. In figure 2 we depict how a third actor represented in this conflict environment would choose to victimize civilians. This actor's calculus depends on both whether an attack is likely, as well as the possible consequences of victimization. Below, we discuss the specific decision rules for each group in the graphic.

*(0) Generation of Country and Actors*

We begin by generating all of the relevant actors and territories. We first generate a number of territories that is at least as large as the number of armed actors in the game. The territories are connected via a random adjacency matrix that we define such that no territory is totally isolated. We then generate some number of armed actors, each with a random ideal point ($x_i$) and a level of ideology ($\phi_i$). Each armed actor is assigned a territory, and the remaining territories are given to the last group, the government.[8] We then generate a number of civilians in each territory, each with a random ideal point ($\eta_i$). With this foundation, we are ready to begin the game.

*(1) Armed groups choose which territories to invade*

[8] We also define the government as having an extreme ideal point $x_i = 0$, and being non-ideological $\phi_i = 0$.

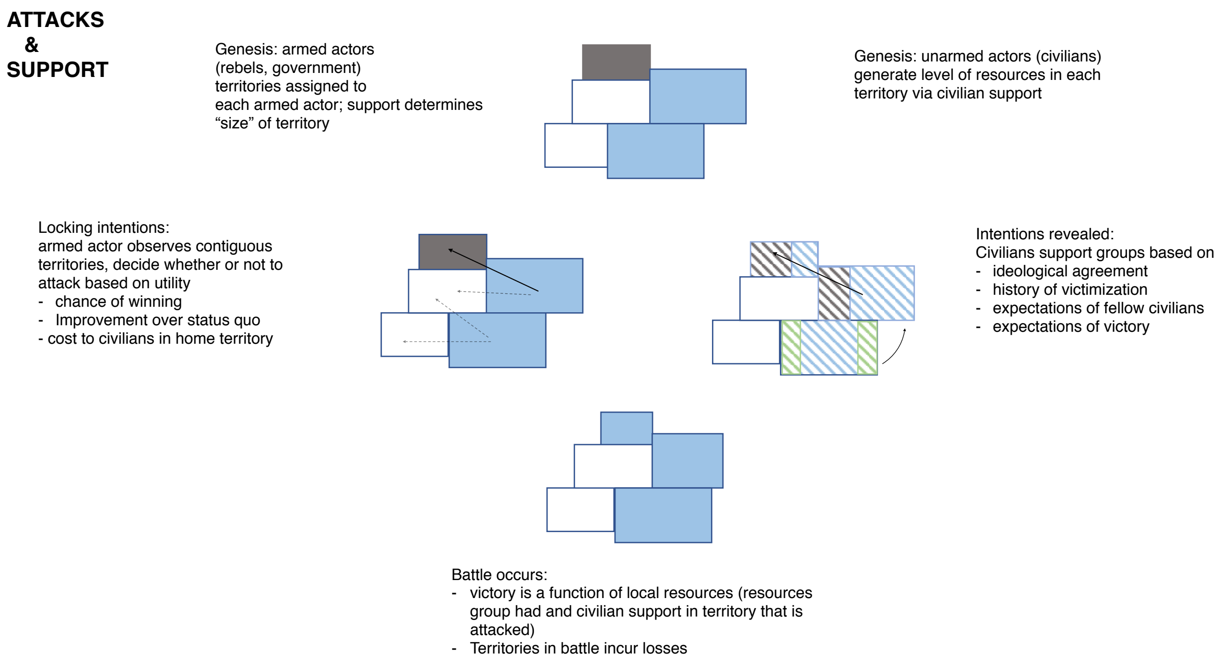


**Figure 1:** Graphic illustrating the choice of an armed actor to attack, and the choice of civilians to support the actor or not. Rectangles represent territory, with their size based on the size of the civilian population. For the solid colors, color represents the group controlling the territory. The arrows represent the potential territories this group can attack, with the solid arrow representing the actual choice. The diagonal lines represent the civilian population in each territory, ordered by ideology. In the two territories that are part of the battle, the civilians choose between the two combatants, in the other territory, the civilians choose between supporting the blue group or supporting no one. Based on the resources from civilian support, the battle concludes with the blue group winning.

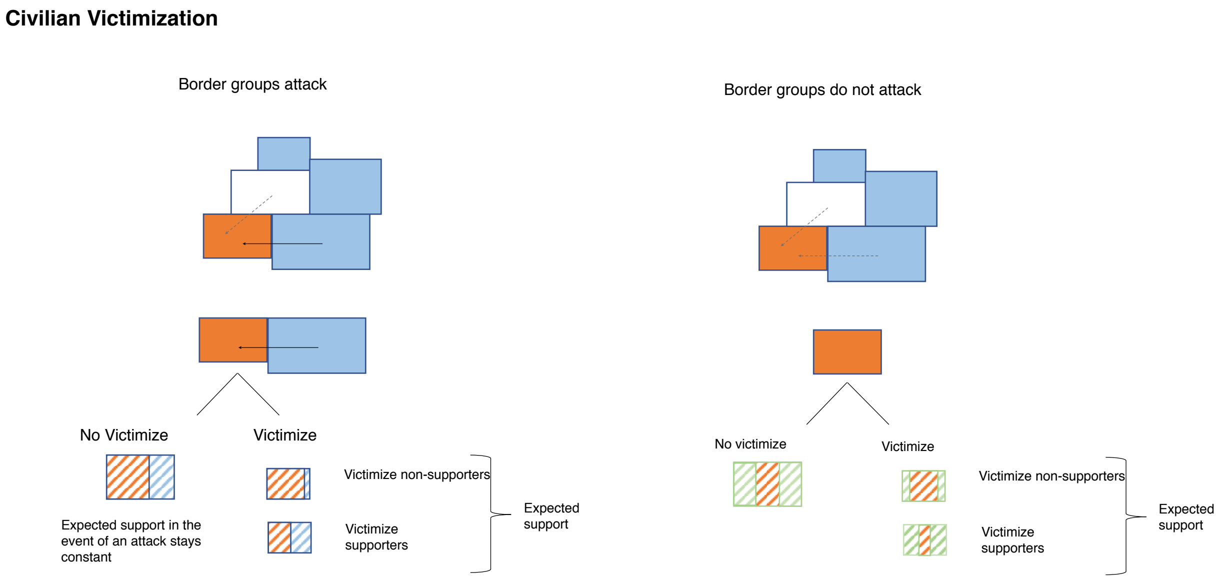


**Figure 2:** Graphic illustrating the choice of an armed actor to victimize civilians. The orange group first determines whether any of their neighbors are likely to attack. If they are, they decide whether to victimize to maximize their support and chance of winning in a battle, if not, they do so to maximize the resources they gain from the territory. Victimizing can either succeed (in killing a non-supporter) or fail (and indiscriminately kill a supporter) based on both levels of support in the territory and random chance. If it succeeds, the ideological range of support for the incumbent group increases, if it fails, the range contracts.

When an armed actor attacks another territory, each group involved in the territory has a probability of winning based on their share of spatially weighted resources. In particular, we call the local resources of group $i$ in territory $L$:

$$\Gamma_{i,L} = \sum_{l} \delta^{d_{l,L}}(n_{s,i,l} + \psi n_{ns,i,l} - k n_{o,i,l}) \tag{4}$$

where $\delta$ is the spatial discount factor – how much less useful distant resources are than proximate ones – $d_{l,L}$ is the distance from region $l$ to $L$, $n_{s,i,l}$ are the number of supporters of group $i$ in territory $l$, $n_{ns,i,l}$ are non-supporters of $i$ in $l$, and $n_{o,i,l}$ are the number of opponents of group $i$ in territory $l$ as long as territory $l$ is part of the "battlefield" – the set of territories that are either the source or the target of the battle in question. Finally, $\psi$ and $k$ are the resources you get from non supporters, and those you lose from supporters of your opponent respectively.

For each group in the battle, the probability of winning is:

$$p_{i,L} \equiv P(i \text{ wins in territory L}) = \frac{\Gamma_{i,L}}{\sum_j \Gamma_{j,L}} \tag{5}$$

where a group's probability of winning in territory ($L$) is determined by the group's local resources within the territory relative to the sum of all combatant's local resources in the same territory. Next, a group decides which territory to attack by looking at all territories they border, and compares their utility for attacking that territory compared to doing nothing. In particular, for each territory $q$, they look at:

$$U_i(q|G) = \sum_{g \in G} E(p_{g,L}|G))\alpha_{i,j}(R_q - c) \tag{6}$$

where $G$ are the groups already committed to battle within a territory, $R$ is the number of civilians within a territory, $c$ is the cost of war. We include the expectation here because at the time of the decision, civilian support is unknown[9] and so armed groups estimate their likelihood of victory using either their prior beliefs about the distribution of civilian preferences, or the past actions taken by civilians in a territory towards a particular armed group. Specifically, the potential attacker assesses how much utility they will gain from attacking a territory compared to how satisfied they will be if they do nothing. For comparison, the utility for group $i$ of the status quo in territory $q$, held by group $j$ is:

$$U_i(j \text{ controls } q) = \alpha_{j,i} R_q \tag{7}$$

The difference between these two factors is the payoff for attacking a given territory. Groups choose to attack in a territory where there will be the biggest payoff from attacking compared to the status quo (or if none of these are positive, they attack nowhere). This decision is illustrated in Figure 1.

*(2) Civilians choose whether to support armed groups*

Civilians' decisions are conditioned not just on the characteristics of armed actors, but on the behavior of other civilians. When civilians choose who to support, they assume that other civilians will make support decisions probabilistically based on their proximity to armed groups, such that:

$$E(P(\text{Civilian l supports Group } i)) \equiv \text{max}(\text{min}(1 - D(i,l) + v * \chi_j, 1), 0) \tag{8}$$

Civilians that are highly ideologically close to the armed group are assumed to be highly likely to support them and groups that are very far from the armed group will be much less likely to support them. Here $\chi_i$ is the net discriminacy of victimization

[9] We will determine this in equations 9 and 10 in the next stage.

by group $i$, which decreases when they victimize a supporter and $v$ is the penalty for indiscriminately victimizing civilians. If a group has a history of killing supporters, all civilians are perceived as less likely to support the group.

Civilians behavior is also conditioned on the actions of armed groups in the territory and battle occurrence, as determined in the previous stage. If no battle is taking place in territory $q$, civilian $l$ will support an armed group $i$ if:

$$\frac{E(n_{s,i,q}^{-})}{2} > D(i,l) + v * \chi_i \tag{9}$$

where the expected number of supporters is calculated as discussed in equation 8.

On the other hand when a battle is taking place in a territory $q$, civilian $h$ will support group $g$ such that:

$$\text{argmax}_{(g \in G)} E(p_{g,q}) * (1 - D(g,h) + v * \chi_g) \tag{10}$$

It is worth highlighting here that $E(p_{g,q})$ is determined by using beliefs from equation 8 to calculate the values in 4 and 5. Civilians try to meet both their goals by choosing the group that gives them the best combination of plausibly winning the battle and ideological congruence.

*(3) Battles take place and winners are determined*

This occurs as discussed above in equation 5, in each territory, $c$ civilians at random are removed.

*(4) Armed groups choose in which territories to victimize.*

Armed groups first determine if each territory is at risk of an attack next period. This means a group $i$ will evaluate, for each neighbor $j$ and territory they control $q$, whether:

$$\alpha_{j,i}R_q < E(p_{i,q})\alpha_{j,i}(R_q - c) + E(p_{j,q})(R_q - c) \tag{11}$$

Note that these are the same utilities from equation 6 and 7. In any territory where this is true for all neighbors $j$, the armed group will victimize to maximize their potential of winning in a future period. If it is not true, they will victimize in order to maximize resources in a future period.

Armed groups believe that the proportion of the preference space made by their supporters is $s \equiv \frac{x_{s,i,q}}{n_{ns_i,q}+n_{s,i,q}} + v * \chi_i$. The proportion believed to be composed by non-supporters is of course $1 - s$. If the territory is not at risk of attack, the group will victimize if:

$$\zeta_q * (\frac{v * (1-c) * n_{ns,i,q-1}}{(1-s)} - c) - (1-\zeta_q) * (\frac{v * (1-c) * n_{s,i,q-1}}{s} - 1) > 0 \tag{12}$$

Here $\frac{(v * n_{ns,i,q-1})}{1-s}$ is the expected number of non-supporters coerced to support the armed group in the event of selective victimization, $(1-c)$ is the benefit of coercing non-supporters into support, and $\frac{(v * n_{s,i,q-1})}{s}$ are the number of supporters pushed to non-support in the event of indiscriminate victimization. In addition, victimization has a direct effect of either killing a supporter or a non-supporter.

When considering whether to victimize in a territory at risk of an attack, the armed group needs to separate civilians into potential supporters of the attacker and non-supporters. Their belief is that the division for support for groups $i$ and $j$, defined such that $x_i > x_j$ is that a civilian, $f$, will support group $i$ if:

$$\eta_f > x_i E(p_{i,q}) + x_j E(p_{j,q}) \equiv \lambda_q \tag{13}$$

this, combined with their beliefs about the distribution of supporters and non-supporters, allow an armed group to estimate the number of supporters both for themselves and the attacking group, as well as the range of preferences occupied by each group, which, are of length $\lambda_q$ and $1-\lambda_q$ respectively. They then victimize if:

$$\zeta_q * \frac{v*(1+k)*E(n_{o,i,q})}{\lambda_k} + k) - (1-\zeta_q)*(\frac{v*(1+k)*E(n_{s,i,q})}{(1-\lambda_k)} + 1) > 0 \quad (14)$$

Similar to the case where there is no risk of battle, this is the net effect of victimization on local resources, which is the probability of gaining new supporters and the negative effect of civilian death on resources. The tradeoffs for the armed group in each of these cases is illustrated in 2.

*(5) Civilians Choose to Flee*

After victimization civilians choose whether or not to flee from a territory into an adjacent territory. Civilian $k$ will choose to flee a territory controlled by group $i$ for a territory controlled by group $j$ if these territories are contiguous and:

$$D(i,l) + v*\chi_i < e^{3-t*3/T} D(j,l) + v*\chi_j) \quad (15)$$

The exponential decay function is such that in the first turn of a game ($t$) another group needs to be at least $e^3$ times better than the incumbent in a civilians territory for the civilian to move, but by the final turn of the game ($T$) the group will move to whichever territory has a more congenial incumbent.

*(6) Territories Experience Growth*

Second, in each territory, there will be new civilians added to the game based on the global growth rate parameter $G$ (rounded down to the nearest integer.

Stages 1-6 will continue until one of three end conditions are met: a) the government controls all the territories, b) the government controls no territories, c) the game reaches the predetermined turn limit and ends in a stalemate.

## Hypotheses

As we model it, the decision for armed groups to victimize civilians is a strategic action. Armed groups target civilians to help extract resources from the population and to increase their likelihood of prevailing in expected conflicts with other groups. Civilians likewise act strategically to minimize their personal likelihood of being killed by armed groups. Thus, to understand when and where civilian victimization is likely to take place, we need to evaluate the strategic environment.

To do this, we conceptualize the overall strategic environment as a social network, wherein the nodes in this network are armed groups, and the edges are battles between these groups. To understand the strategic environment, consider three ideal types of conflict networks.

The first type of conflict network is the empty network. Here, while there are a number of groups that have the capacity to attack, no actual conflict takes place. In this network, territorial control is fixed, and the strategic decision to victimize civilians is simple – victimization takes place if the coercive effect (causing more non-supporters to begrudgingly support the group in charge) outweighs the resources that could be mobilized from non-supporters. In this environment, while there may be some initial victimization, we will pretty quickly approach an equilibrium where most civilians support the groups in control of their territory, and no victimization occurs.

A second stylized network we could see is a polarized network. In this type of network, we have (usually) two groups of actors who are clustered so that all of their interactions are with the groups in the other cluster. For example, in many civil conflicts, we see this dynamic where a number of different separatist groups are all fighting the central government and are not fighting each-other. In this game, this will be especially likely if we see ideologically oriented groups that cluster at two points on the spectrum. Here, some territories groups control will be at risk of attack, and so these groups will have incentive to victimize civilians not just to coerce them into support, but also to avoid the risk of civilians supporting an attacking group. This will lead to a rise in the likelihood of victimization in these border territories. Similarly, there will be territories that trade back and forth between groups, and when control of a territory changes hands, we can expect to see increased victimization because supporters of the old controlling group were likely in the majority. That being said, victimization due to both causes should only be moderate, because many territories will not be at risk of attack, and when territory changes hands, it will usually alternate between two groups.

The final stylized network is the full network. This conflict network functions as a Hobbesian war of all against all, where each armed group is ready to attack each other armed group. In these cases, the dynamics that led to victimization int he polarized network are intensified. Almost all territories are at risk of an attack, and they are at risk of an attack from multiple sources leading to even stronger incentives towards victimization, since even if victimization is counterproductive against some opponents, it will be beneficial against others. There will also likely be a fluid control of territory and frequent changes in the ruling groups leading to even more incentives for violence against civilians.

To determine the macro-level effects of the strategic environment in this game, we ran 10000 simulations of this game, with parameters chosen at random, and recorded 3 main network statistics – the number of armed groups in the network, the overall level of violence in the network, and the density of the conflict network. Returning to our three stylized networks, the empty network would have both a low density and a low level of conflict, and the full network would be more dense, but not necessarily have a higher level of conflict than the polarized network.

As you can see in figure 3, even when controlling for the level of violence between armed groups and the number of actors, more dense conflict networks had both a higher likelihood and a higher frequency of civilian victimization. This leads to our main hypothesis for the empirical investigation.

*Hypothesis: Even when controlling for the overall level of violence, a more dense conflict network will lead to a higher level of civilian victimization.*

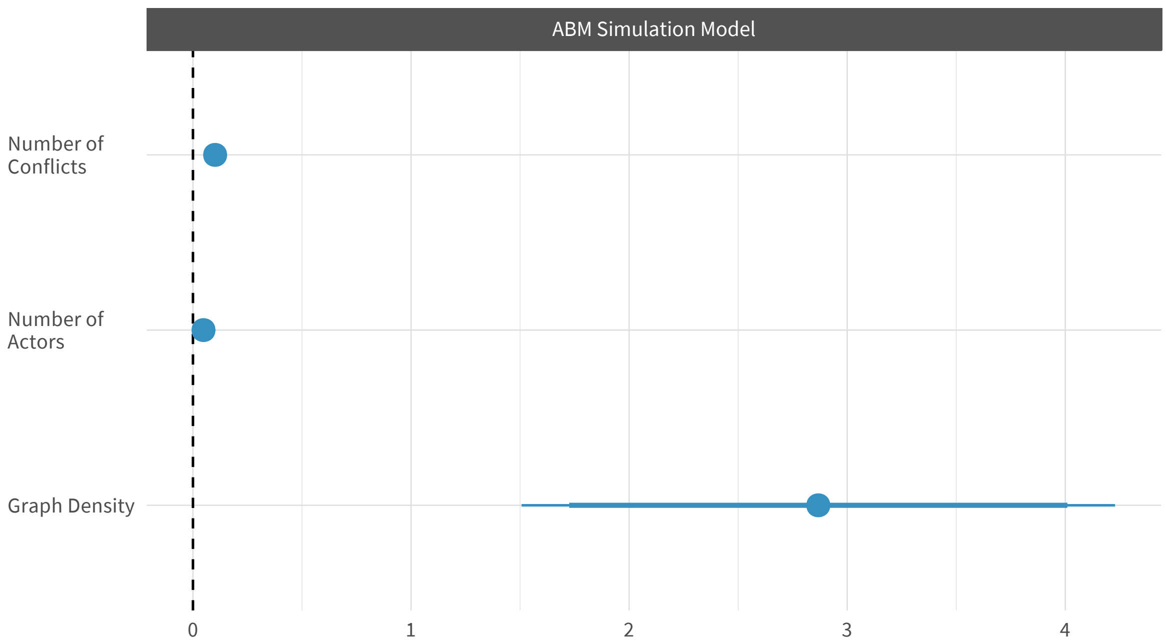


**Figure 3:** Analysis of determinants of victimization in computational model.

## Empirical setup

To investigate the implications of our computational model empirically, we rely on the Armed Conflict Location and Event Dataset (ACLED) dataset developed by Raleigh et al. (2010). Our first step is to calculate conflict network densities for countries experiencing intrastate conflict according to the *battles* data provided by ACLED. Our sample of countries range from 1997 to 2016 and include 39 countries. For each of these countries we construct a conflict adjacency matrix in which a value of one is recorded if there was a battle between armed groups.[10] Given that untangling who initiated a particular battle can be difficult from, the conflict adjacency matrices we construct are symmetric. The set of actors in these adjacency matrices include both rebel groups and government forces.[11] Once we have generated our set of adjacency matrices for every country-year we then calculate the number of actors, number of conflictual events, and the graph density of the conflict networks.

We also control for a number of factors that have been argued to affect the level of civilian victimization at the country-year:

- Graph Density (Raleigh et al., 2010)
- Number of Conflicts (Raleigh et al., 2010)
- Number of Actors (Raleigh et al., 2010)
- Polity (Marshall, Jaggers and Gurr, 2009)
- Log(Population) (World Bank Group, 2016)
- Log(GDP per Capita) (World Bank Group, 2016)
- Ethnic Fractionalization (Vogt et al., 2015)
- Presence of Peacekeepers (Kathman, 2013)

[10] The criterion we use for battles includes: "Battle-No change of territory", "Battle-Government regains territory", "Battle-Non-state actor overtakes territory".

[11] We exclude international actors from our analysis.

- Rebel(s) Stronger than Govt. (Cunningham, Gleditsch and Salehyan, 2013)
- Rebel(s) Supported by Foreign Govt. (Cunningham, Gleditsch and Salehyan, 2013)
- Govt. Supported by Foreign Govt. (Cunningham, Gleditsch and Salehyan, 2013)

Our dependent variable is a count of the number of civilians killed during a country-year. We retrieve this information from the "Violence against civilians" event type in the ACLED dataset. To model this, we utilize a negative binomial model with fixed effects for countries.[12]

## Empirical Results

We report the results for our models of civilian victimization in Figure 4 below. In the left panel, we show results without using any of the controls. Within this fixed effects framework, graph density has a notable effect on the level of civilian victimization observed in a country-year. Whereas simple counts of the number of actors involved in a conflict or the number of conflicts seem to be less meaningful in explaining levels of civilian victimization. In the right panel, we show that our findings are robust to a number of controls.[13]

[12] Results are similar when using a random effects framework.

[13] To deal with missingness in our sample, we employ a multiple imputation method developed by Hoff (2007) and shown to have comparable performance to alternatives such as AMELIA and MICE by Hollenbach (2014).

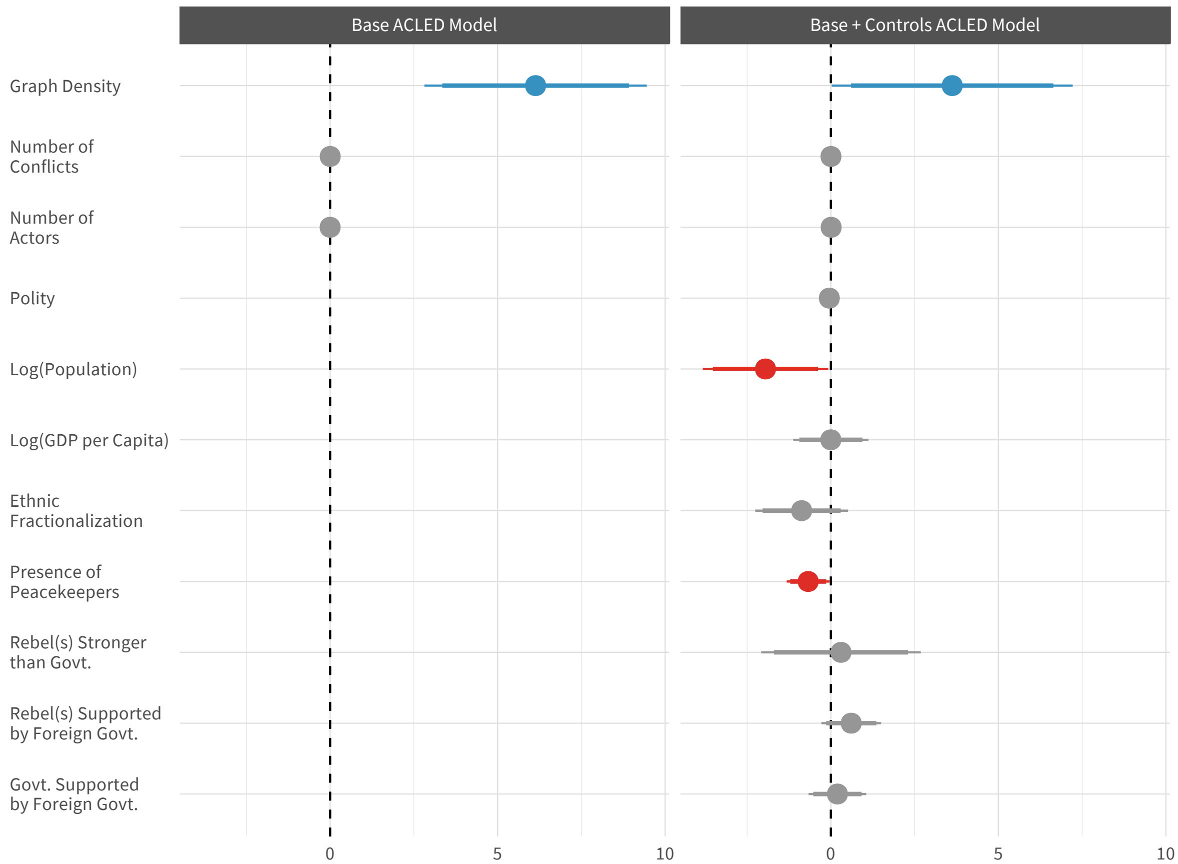


**Figure 4:** Analysis of determinants of victimization based on ACLED data.

## Discussion

We model the choice for armed groups to victimize civilians as a strategic one. Armed groups choose to victimize civilians to improve their ability to mobilize resources and to maximize their chances to defend themselves if their territory is attacked. Civilians can to provide or withhold support, as well as to flee, out of self-preservation and to achieve ideological goals.

Thus, the frequency of civilian victimization depends, in large part, on the strategic environment. If conflict between armed groups is rare, civilian victimization will similarly be rare; if conflict is polarized between two groups (for example a government and different opposition groups, or armed groups of two opposing religions or ethnicities) then there will be a moderate level of civilian victimization; if we have a conflict where any two conflict groups are likely to fight, then civilian victimization will be at its highest. This result holds even when accounting for the number of belligerents and the total volume of fighting. There are two primary reasons for this pattern of victimization. First, groups are more likely to victimize civilians in a territory if that territory is at risk of an attack. Second, victimization is most common when groups are newly in control of territory, since a combination of past victimization, and the civilians' choice to flee make territories more ideological homogeneous and congruent with the ruling group over time. Both of these factors are at their most intense in dense conflict networks.

We test these dynamics in a cross-national analysis of multi-actor civil wars using ACLED data to construct conflict networks. We find a consistent positive effect of network density on civilian victimization even when controlling for other characteristics of the conflict network. Further, including these network characteristics helps us to better predict the level of civilian victimization out of sample.

Going forward, we hope to make a number of advances on both the empirical and theoretical side. On the empirical side, we would like to investigate whether these results hold when using event data from other sources such as UCDP's GED data. Theoretically, we would like to see whether other empirical regularities concerning civilian victimization, like the tendency for more violent battles to increase the risk of victimization, are borne out in our model. We would also like to incorporate other important factors into our model, such as the possibility of groups relying on foreign support or lootable goods, and the ability for armed groups to endogeneously enter and leave the model.

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