Tug of War: The Heterogeneous Effects of Outbidding between Terrorist Groups *

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Abstract

We introduce a dynamic game of outbidding where two groups use violence to compete for evolving public support in a tug-of-war fashion. We fit the model to the canonical outbidding rivalry between Hamas and Fatah, using newly collected data on Palestinian support for these groups. Competition produces heterogeneous effects, and we demonstrate that intergroup competition can deter violence. Competition from Hamas leads Fatah to use more terrorism than it would in a world where Hamas abstains from terrorism, but competition from Fatah can lead Hamas to attack less than it otherwise would. Likewise, making Hamas more capable or interested in competing increases overall violence, but making Fatah more capable or interested discourages violence on both sides. This deterrent effect of competition on violence is unexpected by current outbidding theories and emerges through the asymmetric contest: Fatah more effectively uses terrorism to boost its support although Hamas has smaller attack costs.

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1 Introduction

Outbidding is an explanation for terrorism where competing anti-government groups use violence to increase their share of popular support at the expense of their rivals. In this story, terrorism signals resolve or capacity to a population that is uncertain about which group best represents its interests. In turn, popularity and attention are critical for groups' recruitment numbers, financial resources, political influence, and day-to-day operations (Crenshaw 1981; Fortna 2015; Polo and González 2020). It is a unique theory of terrorism because "the enemy is only tangentially related to the strategic interaction," and therefore outbidding "provides a potential explanation for terrorist attacks that continue even when they seem unable to produce any real results" (Kydd and Walter 2006, 77).

Because scholars are still debating the degree to which terrorism helps groups achieve their long-term political objectives, outbidding provides an important explanation for the observed variation in terrorism and intrastate violence.[1] Following Bloom's (2004) seminal work, researchers generally expect greater violence when groups have stronger incentives to compete, although there is disagreement on how to identify competitive incentives or whether to measure the extent or intensity of terrorism. Conrad and Greene (2015, 547) concisely summarize a key theoretical mechanism underlying many of these studies: "Since competition directly and indirectly threatens the resource base necessary to sustain the organization and ensure its effectiveness, it follows that terrorist organizations should make tactical choices in an effort to increase their share of resources within a competitive environment."

This outbidding logic is incomplete, however. We still do not know how incentives to compete affect overall rates of violence because countervailing forces exist. On the one hand, if one group becomes more competitive, others may fight harder to keep up. This is the expected effect in the outbidding literature, where enhanced violence by and competition from one actor encourages others to use more violence. On the other hand, if one group becomes more competitive, others may recognize a lost cause and give up. This deterrent effect is overlooked in the outbidding literature. Furthermore, it can create an equilibrium feedback loop where even the most competitive group uses less violence as it expects little push back from its rivals.

The theoretical and experimental literature on contests demonstrates that the deterrent effect emerges when one participant is asymmetrically advantaged, e.g., has lower costs of effort or is favored in the contest success function (Chaudoin and Woon 2018; Dechenaux, Kovenock and Sheremeta 2015; Stein 2002). The effect also appears in dynamic contests where players repeatedly compete over time (Konrad and Kovenock 2005). Overall rates of

[1] Abrahms (2012), Fortna (2015), and Getmansky and Zeitzoff (2014) argue that terrorism can be ineffective in this regard. In contrast, Gould and Klor (2010) and Thomas (2014) find that terrorism can make governments or citizens more accommodating. For mixed effects see Beber, Roessler and Scacco (2014).

effort can therefore increase when one player becomes less competitive through handicapping the strong or providing head starts to the weak (Kirkegaard 2012; Siegel 2014).

The degree to which asymmetries and the deterrent effect appear in real-world competition among terrorist groups is not obvious, however. The rivalry between Hamas and Fatah is the most well-studied example of outbidding, but even here it is unclear which actor, if either, is advantaged. Fatah might be advantaged due to its status-quo leadership position, along with its support from and access to Israeli and U.S. policymakers. Nonetheless, the ease at which Hamas uses violence may indicate that it is the advantaged actor. Without a systematic analysis connecting theory to data, we do not know if these asymmetries are relevant or are strong enough to create deterrent effects.

Common empirical strategies in the outbidding literature are ill-suited to this task. Frequently, scholars regress measures of violence on proxies for incentives to compete—e.g., the number of groups in a conflict—using time-series-cross-sectional data and test for a positive association.[2] Within this framework, Findley and Young (2012) find no relationship between competition and violence, but Chenoweth (2010), Cunningham, Bakke and Seymour (2012), and Wood and Kathman (2015) find a positive relationship. Others highlight more limited or conditional findings (Conrad and Greene 2015; Conrad and Spaniel 2021; Nemeth 2014). This type of research design faces two challenges, however. First, it requires researchers to proxy for competitive incentives, but directly evaluating the strength of these proxies is difficult, especially when commonly used measures (e.g., number of terrorist groups) could be confounded by other aspects of the conflict (e.g., state strength). Second, it does not accommodate the potentially heterogeneous effects of competition on violence. Even when outbidding features prominently in the data generating process, regressions could find limited associations between competitive incentives and conflict because the encouragement and deterrent effects wash out in the aggregate.

In this paper, we systematically document the effect of competition on violence in the canonical example of outbidding, the rivalry between Hamas and Fatah. We find that competition has heterogeneous effects on violence. In particular, we provide strong evidence that the deterrent effect emerges in this conflict. To do this, we first construct a novel model of outbidding as a dynamic contest wherein each side uses terrorism to pull public opinion towards itself and away from its opponent in a tug-of-war fashion. Second, we compile monthly survey data that records aspects of Palestinian public opinion from 1994 to 2018. The collected data provide fine-grained details on how Palestinians view the conflict and the two groups, and we use it to measure the relative popularity of Hamas and Fatah. Third, we adopt the structural approach. We estimate the parameters of our model given data on

[2]Of course, there are other research designs. Biberman and Zahid (2019), for example, use case studies and examine competition among factions within a single group. Vogt, Gleditsch and Cederman (2021) argue that competition creates incentives for groups to expand the scope of their demands, leading to more violence.

public opinion and the groups' use of violence, and we then use the fitted model to quantify the substantive effects of competition on violence. Thus, our approach sidesteps the need for the indirect proxies of competition used in reduced-form regressions. It fully embeds the intergroup strategic competition that defines outbidding into a unified theoretical and empirical framework.

We demonstrate competition's heterogeneous effects on violence using two different types of counterfactual experiments. First, we compare the estimated equilibrium rates of terrorism to those in from counterfactual scenarios in which each group never anticipates violence from its rival. Comparing how a group behaves with and without violence from its rival is one way to compare group behavior in competitive and noncompetitive environments, respectively. We find that competition from Hamas has an encouragement effect on Fatah's use of violence, where Fatah is 34% more violent in equilibrium than when it expects Hamas to never attack. In contrast, we find that competition from Fatah can deter violence from Hamas. During the Oslo era between 1994 and 2001, Hamas is 4% less violent in equilibrium than when it expects Fatah to never use violence. That is, competition from Fatah depresses Hamas's use of violence even during the time when the two groups are publicly vying for support from the Palestinians. This illustrates the deterrent effect, which is unexpected in the outbidding literature. After the Oslo era, we find the encouragement effect emerges; Hamas uses about 37% more violence because of competition with Fatah.

Second, we conduct comparative statics exercises that quantify how equilibrium rates of violence change as a group becomes more or less competitive, i.e., has stronger or weaker incentives to compete. Whereas the first set of counterfactuals fixed the behavior of one group, this second set illustrates how the behavior of both groups change as incentives to compete change. In our framework (and in other contest models), groups have stronger competitive incentives when they place greater value on their popularity, have smaller costs of attacking, or become more effective at using terrorism to attract support. We find that making Hamas more competitive along any of these three dimensions increases the probability that either group uses terrorism. This is the expected encouragement effect in the outbidding literature where increasing the competitiveness of an actor leads to an increase in violence for not only the group in question but all groups involved. If Fatah becomes more competitive along any of these dimensions, however, both groups' propensities for terrorism decrease. This is the unexpected deterrent effect of outbidding.

Furthermore, our theoretical framework explains these results via asymmetric competition. Although we find that Hamas has both lower costs to terrorism and places higher value on its public support than Fatah, Fatah is more effective at increasing its support through terrorist attacks than Hamas. That is, attacks by Fatah result in larger pro-Fatah shifts in public opinion than the corresponding effects of Hamas attacks on pro-Hamas shifts. One reason for this disparity could be that because Fatah is a more establishment/pro-peace actor than Hamas, and as a result, attacks by it carry stronger signals to the public about its resolve. Even though attacks demonstrate the resolve of both groups, Fatah attacks are more surprising and thus more informative. Because Fatah is substantially more capable at moving public opinion with violence, if its incentives to compete increase, then the group is more willing to take on the immediate costs of violence to move popular opinion more quickly. Hamas cannot compete with Fatah's level of efficiency and reduces its use of terrorism. This creates an equilibrium feedback loop and decreases Fatah's propensity to attack as its rival becomes more nonviolent.

Our analysis leads to a rich set of substantive and policy implications. For the conflict literature, we show that intergroup competition can decrease violence among rival terrorist groups, and this unexpected deterrent effect emerges in the most well known and studied case of outbidding. We uncover the deterrent effect using a theory solely focused on outbidding and competition between rivals. In the model, there are no free-riding effects from ideologically similar groups or endogenous government interventions, which might be other explanations for a negative relationship between competition and violence (Conrad and Spaniel 2021; Nemeth 2014). The deterrent result is a new empirical finding within the outbidding literature, and scholars should account for the possibility that competition can encourage or discourage violence among groups in future studies that test outbidding hypotheses. Specifically, reduced-form correlations between competition and violence, like those reported in time-series cross-section regressions, cannot falsify outbidding hypotheses. Contests between potentially asymmetric terrorist groups can be consistent with either a positive or negative or null relationship between measures of competition and overall rates of violence. To disentangle encouragement and deterrent effects, we adopt the structural approach as detailed below, although alternative strategies may be useful too. It is clear that a close connection between formal theory and data is needed in future work.

For policy, many U.S. administrations provide direct and indirect support for Fatah, building the group's governing and coercive capacity to counterbalance Hamas (Kalman 2006). There is little research about the effectiveness of such policies, and our results suggest countervailing effects. If third-party support for Fatah increases the group's effectiveness at using terrorism to increase public opinion or decreases its cost of attacking, then violence should decrease, as increasing Fatah's incentives to compete decreases violence from both groups. If third-party support makes Fatah less reliant on local support, then violence by both Fatah and Hamas should increase, as decreasing the value Fatah places on support decreases its incentives to compete, therefore increasing violence. If both factors are at play, future work is needed to quantify the effects of the Israeli government and other third-party actors on competitive incentives.

2 Model

Hamas (H) and Fatah (F) compete over a countably infinite number of periods indexed by $t \in \{1, 2, \ldots\}$. In our data, a period corresponds to a calendar month. Period t's interaction explicitly depends on a publicly observed state variable $s^t \in \mathcal{S}$ measuring the relative popularity of Fatah over Hamas among the Palestinian public.[3] The set of states $\mathcal{S} = \{s_1, \ldots, s_K\} \subseteq \mathbb{R}$ is finite with $K \geq 3$ equally spaced popularity levels where $k > k'$ if and only if $s_k > s_{k'}$. We say Fatah is relatively more popular in state s than in state s' if $s > s'$ and vice versa for Hamas. In other words, smaller (larger) states represent periods where Hamas (Fatah) is more relatively popular.

Within each period t, Hamas and Fatah choose whether to commit a terrorist attack ($a_i^t = 1$) or not ($a_i^t = 0$), where $i = H, F$ indexes the group.[4] Given an action profile $a^t = (a_H^t, a_F^t)$, per-period payoffs are $u_i(a_i^t, s^t; \theta) + \varepsilon_i^t(a_i^t)$. The term ε_i^t is a vector of action-specific payoff shocks that is private information to group i. As is standard in these dynamic games, these shocks are drawn i.i.d. according to the type-one extreme value (T1EV) distribution with density g, and they account for unobserved factors temporarily affecting the costs and benefits of terrorism. The term $u_i(a_i^t, s^t; \theta)$ is the systematic component of group i's per-period payoff, which consists of popularity benefits and attack costs:

$$u_i(a_i^t, s^t; \theta) = \underbrace{\beta_i \cdot s^t}_{\text{popularity benefit}} + \underbrace{\kappa_i \cdot a_i^t}_{\text{attack cost}}. \tag{1}$$

Because $\beta_i \cdot s^t$ captures i's benefit from relative popularity level s^t, we expect $\beta_H < 0$ and $\beta_F > 0$. That is, groups want more favorable public support (smaller states for Hamas and larger for Fatah). Thus, the magnitude of β_i captures the group's *value* of support. In addition, κ_i denotes i's *cost* of attacking, so we expect $\kappa_i < 0$. The goal is to estimate $\theta = (\beta_H, \beta_F, \kappa_H, \kappa_F)$, which contains two (of three) competitive incentives for each group.

The sequence of the game in period t is as follows.

1. Group i observes s^t and ε_i^t.
2. Groups simultaneously choose whether to attack $a_i^t \in \{0, 1\}$.
3. Payoffs are accrued.
4. Transition to period $t + 1$.

As the game transitions from period t to $t + 1$, popularity evolves according to an AR-1 process with a mean that depends on the chosen actions and state. Given today's support

[3] We focus on relative popularity because several theories of outbidding maintain an underlying assumption that the benefits are "primarily relative or positional—i.e., the value of the resources gained depends on how much of that resource the group's competitors possess" (Gibilisco, Kenkel and Rueda 2022, 9).

[4] We model actions as binary for two reasons. Theoretically, these discrete-choice models have well-understood equilibrium and identification conditions, and estimation procedures. Empirically, these groups rarely attack more than once month: Fatah attacks more than once (twice) a month in 2.7% (0.7%) of observations, and Hamas more than once (twice) a month in 26% (16%) of observations—see Figure A.2 in Appendix A.

and attack decisions (a^t, s^t), we define the mean of tomorrow's support s^{t+1} as

$$\mu[a^t, s^t; \gamma] = \gamma_0 + \gamma_1 \cdot s^t + \sum_i (\gamma_{i,1} + \gamma_{i,2} \cdot s^t) \cdot a_i^t. \tag{2}$$

The term $(\gamma_{i,1} + \gamma_{i,2} \cdot s^t)$ represents group i's ability at using terrorist attacks to increase its support—what we call i's *effectiveness* of attacks, which is the third competitive incentive in the model.[5] We expect $\gamma_{H,1} < 0$ and $\gamma_{F,1} > 0$ so that attacks from group i pull popular support in i's preferred direction (smaller states for Hamas and larger ones for Fatah). Note that Equation 2 allows the effects of i's attacks to depend on the current popularity level s^t. *A priori*, it is not clear whether group i's attacks should be more or less effective as its popularity increases. On one hand, if its popularity is large, then its attacks may be more effective due to support from the local population, implying that, e.g., $\gamma_{F,2} > 0$. On the other hand, if its popularity is large, then there is less of the population to be won over, implying that, e.g., $\gamma_{F,2} < 0$. The model accommodates either possibility.

In period $t+1$, the probability $s^{t+1} = s' \in \mathcal{S}$ given action profile a^t and state s^t is $f(s'; a^t, s^t, \gamma)$. We specify f using a discretized normal distribution:

$$f(s'; a^t, s^t, \gamma) = \begin{cases} \Phi\left(\frac{s'+d-\mu[a^t,s^t;\gamma]}{\sigma}\right) - \Phi\left(\frac{s'-d-\mu[a^t,s^t;\gamma]}{\sigma}\right) & s' \in \{s_2, \ldots, s_{K-1}\} \\ \Phi\left(\frac{s_1+d-\mu[a^t,s^t;\gamma]}{\sigma}\right) & s' = s_1 \\ 1 - \Phi\left(\frac{s_K-d-\mu[a^t,s^t;\gamma]}{\sigma}\right) & s' = s_K \end{cases} \tag{3}$$

where Φ is the standard normal cumulative distribution function, σ is the standard deviation parameter, and $2d = s_2 - s_1$ is the distance between the equally spaced relative popularity levels. The parameters $\gamma = (\gamma_0, \gamma_1, \gamma_{H,1}, \gamma_{H,2}, \gamma_{F,1}, \gamma_{F,2}, \sigma)$ describe the transitions of the game, and we estimate them below. We choose this specification because γ can be estimated using standard techniques for continuous AR-1 models even though the model has a discrete state space (Tauchen 1986).

Before proceeding, three remarks are in order. First, because this is a model of outbidding, it explains variation in violence via intergroup competition and abstracts away from other motives for terrorism, such as spoiling, and from other nuances of conflict, such as government behavior. This spartan approach is critical for our argument: outbidding produces heterogeneous relationships between competition and violence, and one such relationship is a deterrent effect where competition decreases violence. Adding more moving pieces to the analysis only obfuscates this central result, which shows that outbidding is sufficient to produce a negative relationship between competition and violence; other strategic tensions are not necessary. Future work should consider the empirical strength of competing expla-

[5] We are using effectiveness in the context of outbidding. Of course, terrorism can have other dimensions of effectiveness in other environments, e.g., ability to hurt the government.

nations for terrorism by developing and then estimating different structural models, which can be compared to ours through model-fit exercises. A necessary first step in comparing theories of terrorism and their explanatory power is to provide models of each theory and fit them to the same data. We start this process with outbidding.

Second, we do not model the decision of individuals in the local population choosing a group to support, a simplifying assumption that appears in Conrad and Spaniel (2021).[6] Instead, individuals and their choices are captured by the functions $\mu[a^t, s^t; \gamma]$ and f, which describe how relative support evolves given the attack decisions of the two groups and their current popularity level. Rather than microfounding this behavior, we calibrate it to data by estimating the relevant parameters of interest, γ. Doing so allows us to sidestep additional assumptions detailing the decision of local individuals who may be myopic or adopt behavioral rules.[7] In other words, our groups best respond to the behavior of their rivals given the patterns of public support, explored in previous work and estimated below.

Third, by focusing on value, cost, and effectiveness, we explicitly borrow phrasing from the contest literature as our model has similarities with dynamic battles (e.g., Harris and Vickers 1985; Konrad and Kovenock 2005). Besides the structural approach, our key departure from this literature is that competition between our groups is never fully decisive. Even when a group reaches its most favorable state, outbidding continues. Conrad and Spaniel (2021) also use a contest model to study outbidding. Again besides the structural approach, our key departure is twofold. First, we consider a dynamic environment where popularity is a persistent and endogenous state variable, whereas Conrad and Spaniel (2021) consider a static model. Second, because we are interested in studying the effect of competition using the version of the model most closely tethered to observables, we consider a fully asymmetric contest where the value of popularity, effectiveness of attacks, and costs of terrorism are all group-specific parameters. In contrast, Conrad and Spaniel's (2021) main predictions require symmetry assumptions. As described above, both dynamic and asymmetric contests generate countervailing forces between competition and violence.

2.1 Equilibria

Given a sequence of states, actions, and payoff shocks $\{s^t, a_i^t, \varepsilon_i^t\}_{t=1}^{\infty}$, group i's total payoffs are $\sum_{t=1}^{\infty} \delta^{t-1} \left[u_i(a_i^t, s^t) + \varepsilon_i^t(a_i^t)\right]$ where $\delta \in (0,1)$ is a fixed, common discount factor. Generally, discount factors are not identified in dynamic discrete choice models (Magnac and Thesmar 2002). As such, we fix the discount factor to $\delta = 0.999$, which resulted in the highest log-likelihood when fitting the model given several fixed discount factors—see

[6]See also dynamic models of elections in Iaryczower, Lopez-Moctezuma and Meirowitz (2021) and Acharya et al. (2019).

[7]Polo and González (2020) discuss the microfoundations of how terrorism can mobilize support and improve group popularity. A key background condition is out-group antagonism or when terrorist groups recruit or receive support from a specific ethnic or religious faction, which is a feature of Hamas and Fatah.

Appendix G. This matches anecdotal descriptions of the groups that highlight their long time horizons.[8]

Markov equilibria in these discrete dynamic games have a straightforward characterization (Aguirregabiria and Mira 2007). Dropping references to time, let $v_i(a_i, s)$ denote i's net-of-shock expected utility from choosing action a_i in state s and continuing to play the game for an infinite number of periods. In other words, given a vector of expected utility values v_i and a vector of random shocks ε_i, group i chooses action a_i in state s if and essentially only if

$$a_i = \underset{a_i \in \{0,1\}}{\operatorname{argmax}} \{v_i(a_i, s) + \varepsilon_i(a_i)\}.$$

Thus, v_i is identical to a cut-off strategy. Because $\varepsilon_i(a_i)$ is distributed T1EV, i chooses a_i in state s with probability

$$P(a_i, s; v_i) = \frac{\exp\{v_i(a_i, s)\}}{\exp\{v_i(0, s)\} + \exp\{v_i(1, s)\}}\,. \tag{4}$$

We can write group i's expected utility in state s as

$$V_i(s, v_i) = \int \max_{a_i} \{v_i(a_i, s) + \varepsilon_i(a_i)\}\, g(\varepsilon_i) d\varepsilon_i. \tag{5}$$

Consider a profile $v = (v_i, v_j)$ of action-state expected utility values. Then group i's iterative expected utility of action a_i in state s, denoted $\mathcal{V}_i(a_i, s; v, \theta, \gamma)$, is

$$\mathcal{V}_i(a_i, s, v; \theta, \gamma) = u_i(a_i, s; \theta) + \delta\left[\sum_{a_j} P(a_j, s; v_j) \sum_{s' \in \mathcal{S}} f(s'; a_i, a_j, s, \gamma) V_i\left(s', v_i\right)\right]. \tag{6}$$

An equilibrium is a profile v such that

$$v = \mathcal{V}(v; \theta, \gamma) \equiv \times_i \times_{(a_i, s)} \mathcal{V}_i(a_i, s, v; \theta, \gamma). \tag{7}$$

Notice Equations 4–7 characterize equilibria as a system of $4K$ equations, where K is the number of relative popularity levels. We use these equations to derive a likelihood that allows us to estimate the model's parameters and equilibrium from observed data. We then study substantive features of the fitted model using comparative statics and other counterfactual exercises.

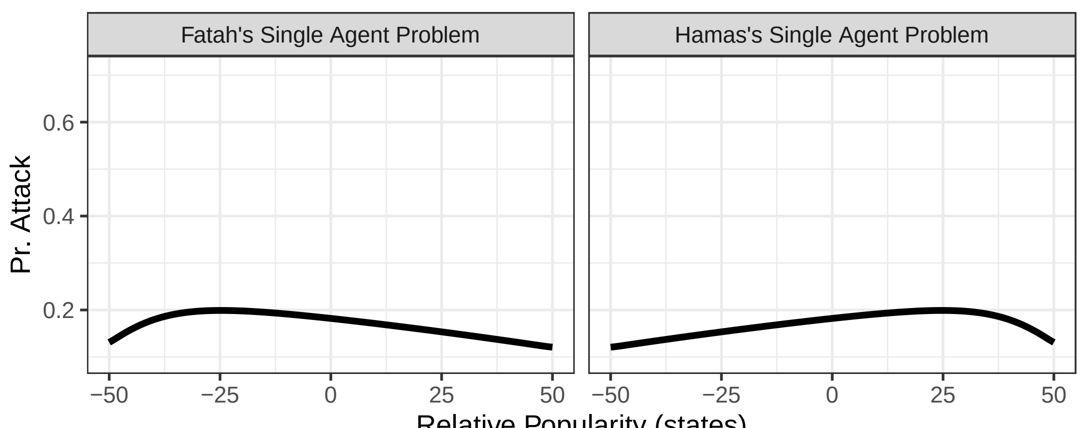
[8] A *New York Times* reporter describes it as follows: "It's sometimes shocking to sort of hear what their timeline is. And they'll say...well, we believe that justice is on our side and that we're doing the right thing. And if we're not able to do it, maybe our children will do it or maybe our grandchildren will do it. But they have this very long-term view of where this is going." ("Why Hamas Keeps Fighting and Losing", May 26 2021, `https://www.nytimes.com/2021/05/26/podcasts/the-daily/gaza-hamas-israel-war.html`).

2.2 Numerical example

To illustrate the strategic tensions in the model, we pick hypothetical values for the parameters and study the equilibria that arise. The specification is symmetric to aid in interpretation, but the model is more general. The popularity levels are $\mathcal{S} = \{-S, -S+1, \ldots, S-1, S\}$ where $S = 50$. For the payoff parameters, we set $\beta_F = \frac{1}{500} = -\beta_H$ and $\kappa_i = -2$. For the transitions, we assume $\mu[a^t, s^t; \gamma] = s^t - a^t_H + a^t_F$ and $\sigma = 2$. In other words, group i's attacks shift the mean of tomorrow's expected relative popularity by one in its preferred direction. The current popularity level does not change the effectiveness of attacks ($\gamma_{i,2} = 0$).

To build intuition, Figure 1 presents group i's optimal attack probabilities when its rival never attacks, i.e., when i is the only relevant group. The probabilities range from 0.1 to 0.2. Notice i is most likely to attack when its relative popularity is weak (small state s for Fatah and large state s for Hamas), although end-point effects emerge because the state space $\mathcal{S}$ is bounded. When the current state is at a boundary, one group's popularity cannot get worse, while the other's cannot get better tomorrow. This decreases the groups' incentives to attack. When a group is relatively unpopular, it has stronger dynamic benefits from using costly attacks to increase its popularity: attacking increases i's future payoffs for some time and decreases its need to use costly attacks in the future. Thus, comparing across the two single-agent problems, the groups generally attack in different states—the correlation coefficient of their attack probabilities is $\rho = -0.13$.

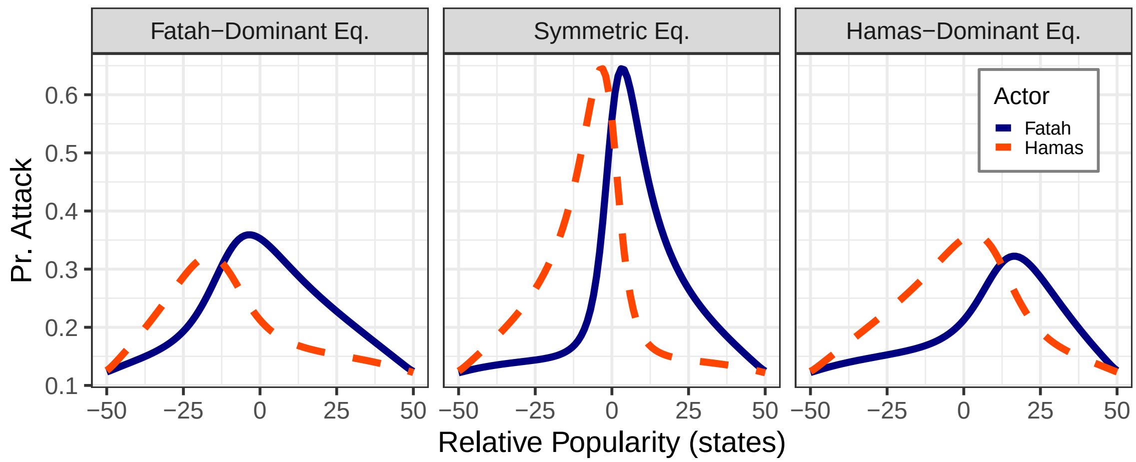
Figure 1: Attack probabilities without competition in the numerical example.



Note: Left panel graphs the probability that Fatah attacks (y-axis) as a function of the states (x-axis) in its single-agent dynamic programming problem, i.e., when Hamas never attacks. The right panel graphs the attack probabilities for Hamas's single-agent dynamic programming problem.

Turning to the strategic setting, we investigate equilibrium probabilities of attacking. Three equilibria exist in this numerical example; Figure 2 graphs the attack probabilities for each equilibrium. In the symmetric equilibrium, terrorism is most fierce when the groups are equally popular, and group i attacks with the highest probability once it begins to be slightly less popular than its rival. The other two equilibria are asymmetric but are essentially the same with the actors and states flipped. In these equilibria, one actor (labeled dominant) is using violence with higher probability than the remaining actor for the majority of the state space.[9]

Figure 2: Computed equilibria in the numerical example.



The example illustrates three features. First, violence between groups exhibits some strategic complementarities: attack probabilities are positively correlated across states. In the asymmetric equilibria, the correlation coefficient is $\rho = 0.41$, and in the symmetric equilibrium it is $\rho = 0.28$. These complementarities do not arise through the group's per-period payoffs in Equation 1, because i's per-period payoff does not depend on its opponent's action. In addition, the groups do not become more effective in certain states as $\gamma_{i,2} = 0$. Instead, the complementarities arise endogenously through tug-of-war dynamics in which competition can increase violence. Indeed, group i's attack probabilities in any of the three equilibria are larger than those in its single-agent problem. Thus, our dynamic model can endogenize the strategic complementarities for violence found in previous analyses using static games (Gibilisco, Kenkel and Rueda 2022).

Second, these complementarities are moderate, i.e., the attack probabilities are not perfectly correlated. In all equilibria, the state in which Hamas is most likely to attack is strictly less than the state in which Fatah is most likely to attack. This arises because, all else equal, Hamas wants to exert costly effort to attack at popularity levels where becoming more popular reduces Fatah's likelihood to attack and vice versa. These incentives temper the potential strategic complimentarities in the model.

Third, equilibrium rates of attacks are not perfect measures of competitive incentives. Consider the Fatah-dominant equilibrium. At the majority of popularity levels, Fatah is attacking with greater probability than Hamas, so one might conclude that Fatah has

[9]Figure A.1 in Appendix A graphs the invariant distribution for each of the three equilibria.

smaller attack costs or a greater value of popularity. The example is symmetric, however, and both groups have identical competitive incentives. Thus, incentives to compete do not directly map onto observed rates of violence as the relationship is mediated by a strategic interaction. As a result, reduced-form regressions using observed terrorism as the dependent variable may obscure some aspects of the outbidding process. Directly estimating the model's parameters and equilibrium allows for a deeper exploration of how competition affects violence.

In the online appendix, we consider some comparative statics to illustrate how changes in competitive incentives can affect violence. In this symmetric example, we find that increasing Hamas's value for public support can increase, decrease, or have mixed effects on each actor's willingness depending on the equilibrium. These mixed comparative statics motivate fitting this model to data as it is not clear what parameter values or equilibrium are empirically relevant. Overall, the example illustrates that enhanced incentives to compete can either increase or decrease overall violence levels, raising two questions: Which effect dominates in the data? Do these effects vary when competition is asymmetric?

3 Data sources and measurement

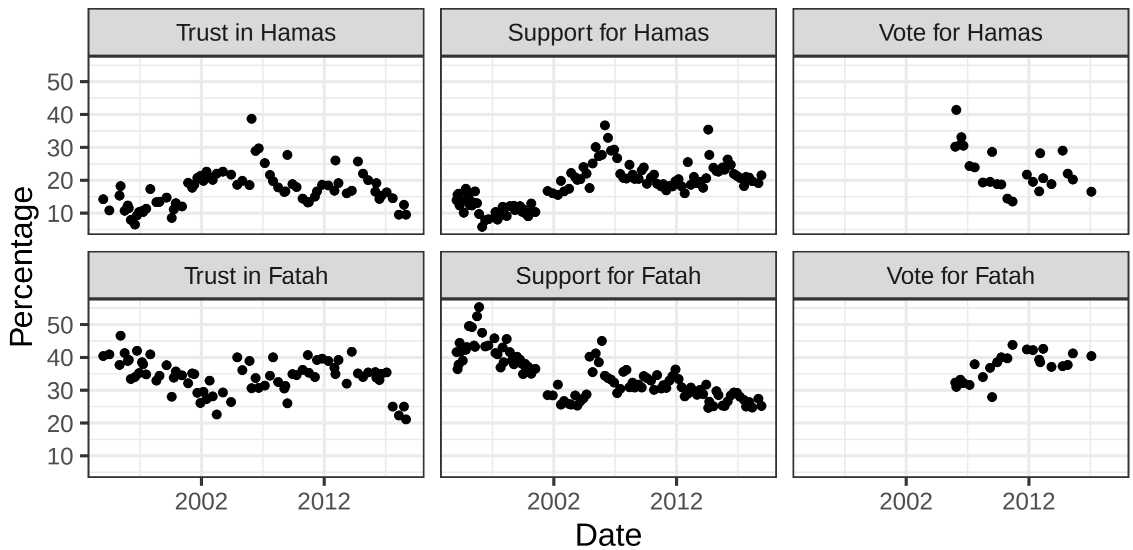
Data on attacks are taken from the Global Terrorism Database (GTD) where we record all terrorist attacks committed by Fatah/PLO and Hamas in every month from January 1994 to December 2018.[10] The GTD is a standard source for recording terrorist acts, which are defined as either a threat or an attack that meets two of the following conditions: occurs outside the confines of legitimate warfare; is designed to signal to a larger audience than the immediate victims; and helps to attain a political, religious, or social goal (START 2019, 6). Not only does the GTD record suicide bombings, which were the focus of Bloom (2004) and Findley and Young (2012), but it also records other types of attacks with and without fatalities, e.g., rocket attacks have become a greater part of violence against Israelis in recent years (Haushofer, Biletzki and Kanwisher 2010). Hamas engages in roughly 1.5 attacks per month, while Fatah engages in an average of less than 1 attack per month—see Figure A.2 in Appendix A for details. To measure group i's attack decision in month t, we record a dummy variable indicating whether the group committed any terrorist attacks in that month.

The state variable in the model is the relative popularity for the two groups among the Palestinian population. To measure it, we treat relative popularity as a latent variable in a dynamic factor model that uses six public-opinion variables as its indicators. These six variables are created using surveys from the Jerusalem Media & Communication Centre

[10] In Appendix F, we reestimate the model using different time frames; our results are stable across specifications.

(JMCC N.d.) and the Palestinian Center for Policy and Survey Research (PCPSR N.d.).[11] We search through every survey published by these centers between 1994 and 2018 to track Palestinian public opinion for both actors using three dimensions. The first tracks which political or religious group respondents trust most. The second asks which political party each respondent supports. The third is similar and asks which party they intend to vote for in the upcoming legislative elections. For each of these three questions we track the proportion of respondents who answer Hamas or Fatah.

Figure 3: Survey responses over time.



Note: First column tracks JMCC questions (2-6 times a year) about trusting Fatah or Hamas ("Which political or religious faction do you trust the most?"). Second tracks PCPSR questions (2-9 times a year) related to political support ("Which of the following political parties do you support?"). Third tracks JMCC questions (0-5 times a year starting in 2006) about voting in elections ("If Legislative Council elections were held today, which party would you vote for?").

Figure 3 graphs responses to these six survey questions over time. These answers largely follow a basic trend where public attitudes towards Fatah and Hamas are inversely related. In general, we see a decline in Fatah support during the 1990s and early 2000s, while Hamas's public support rises. These trends level out a bit in the later years, with Fatah maybe regaining some support at the expense of Hamas. To transform these polling questions into a continuous representation $\tilde{s}^t$ of the theoretical state variable s^t we fit a one-dimensional dynamic factor model to these surveys (see Appendix B for details).

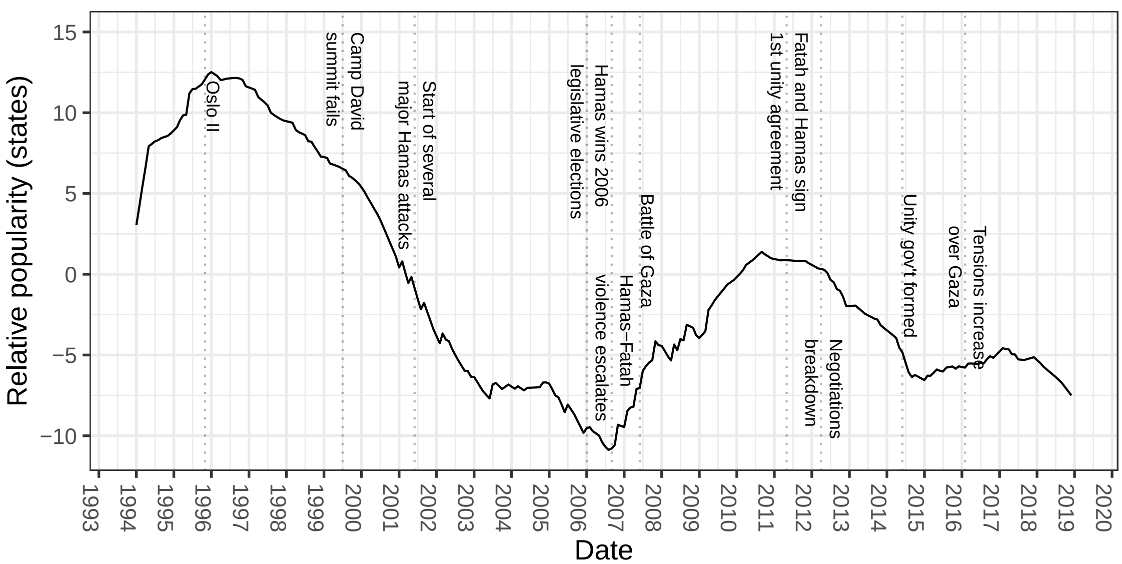
Once we fit the model and produce the continuous state variable $\tilde{s}^t$, we want to check its validity.[12] Figure 4 shows how the state variable evolves from 1994-2018. Fatah is favored

[11] Appendix B contains more details on question wording and survey frequency.

[12] All survey responses load onto the factor in the expected directions: pro-Hamas responses are more likely when the state variable is small, and pro-Fatah responses are more likely when the state variable is large. See Table B.3 in Appendix B.

in the earlier periods of the data, where they peak during the 1996 Oslo II process (Jan. 1996 = 12.5). Likewise, Hamas is at its most popular relative to Fatah in 2006 during the aftermath of the general election in which they took control of the Gaza strip (Aug. 2006 = −10.9). The mean of this variable is −0.84 (median of −2.99) with a standard deviation of 6.57 (IQR of −5.98 to 4.13).

Figure 4: Relative popularity of Fatah to Hamas over time.



Several important events in the conflict are listed in Figure 4, providing context and face validity to the idea that this latent variable captures the relative ups and downs between the two groups. Notably, the 1990s are typically regarded as an important period for the rise of Hamas and that is clearly reflected here, where Fatah struggles in popular support as the peace process unravels. Finally, in Appendix B, we demonstrate that our latent measure of relative popularity is robust to several specification choices (e.g., heteroskedasticity).

4 Estimation and identification

Following Rust (1994), we adopt a two-step estimation procedure where we first estimate how popular support evolves given the group's use of terrorism (γ) and then estimate the groups' payoff parameters (β, κ). To build the transition model, we first rewrite the AR(1) model in Equation 2 in terms of the continuous state variable $\tilde{s}^t$:

$$\tilde{s}^t = \gamma_0 + \gamma_1 \tilde{s}^{t-1} + \gamma_{H1} a_H^{t-1} + \gamma_{H2}(\tilde{s}^{t-1} \times a_H^{t-1}) + \gamma_{F1} a_F^{t-1} + \gamma_{F2}(\tilde{s}^{t-1} \times a_F^{t-1}) + \nu^t, \quad (8)$$

where a_F^{t-1} and a_H^{t-1} are binary indicators for whether Fatah and Hamas attack, respectively, and $\nu^t \sim N(0, \sigma^2)$.[13] The first-step estimates are then used to construct the Markov transition probabilities as described in Appendix C.

Following Crisman-Cox and Gibilisco (2018) and Su and Judd (2012), we use constrained maximum likelihood estimation (CMLE) to estimate the payoff parameters $\theta = (\beta, \kappa)$. Specifically, let $Y = \left(s^t, a_H^t, a_F^t\right)_{t=1}^T$ denote the time series of observed data (relative popularity levels and attacks). We fix the transition probabilities using the first stage estimates, $\hat{\gamma}$. and the definition of f in Equation 3. The CMLE estimates $(\hat{\theta}, \hat{v})$ maximize the log-likelihood

$$L(v|Y) = \sum_{t=1}^{T} \left[\log P(a_H^t; s^t, v_H) + \log P(a_F^t; s^t, v_F)\right]$$

subject to the equilibrium constraint equations $v = \mathcal{V}(v; \theta, \hat{\gamma})$. Standard errors are computed using two-step estimation results—see Appendix D.

The game between Hamas and Fatah can have multiple equilibria. The CMLE allows for this multiplicity with its main identification assumption being that the data Y are generated from only one of these equilibria (Crisman-Cox and Gibilisco 2018; Su and Judd 2012). By treating the endogenous equilibrium expected utilities, v, as auxiliary parameters, the CMLE selects the values of v that best describe the data while still being an equilibrium of the model. In other words, the CMLE selects the equilibrium that produces the highest likelihood value while avoiding the need to repeatedly enumerate the set of equilibria.

Along with the assumption that one equilibrium is generating the data, three empirical moments pin down our parameters of interest. We estimate γ through observed variation in the state variable over time. We know that each action profile has a positive probability of being played at each relative popularity level given the distributional assumptions on ε_i^t, and the probability of transitioning from level s to level s' is positive for all s and s'. As such, f can be estimated non-parametrically from frequency estimators with a sufficiently long time frame because, eventually, the equilibrium path will visit all states and all action profiles will be played in every state. When the transition probabilities are known, the payoff parameters are identified by their relationship to the equilibrium constraint $\mathcal{V}$ in Equation 6. A group's attack costs are identified through its baseline propensity to attack regardless of the state, and a group's value of public support is identified by the variation in its propensity to attack across states. To see why, note that when $\beta_i = 0$ (or $\delta = 0$), then Equations 1 and 6 imply i's probability of attacking is constant across states and only depends on its attack costs κ_i.

[13] Unit root tests suggest that the state variable $\tilde{s}_t$ is not stationary. However, because $\tilde{s}^t$ and $\tilde{s}^{t-1}$ are cointegrated, OLS will produce superconsistent estimates. We also fit the model using the Engle-Granger error correction method (ECM) for hypothesis testing.

5 Parameter estimates

Table 1: Regressing relative popularity (state variable) on terrorist attacks.

	Dependent variable:	
	State	Δ State
	AR(1)	ECM
Hamas attack, $\gamma_{H,1}$	−0.21	−0.21
		(0.04)
Fatah attacks, $\gamma_{F,1}$	1.12	1.03
		(0.05)
Lag state, γ_1	1.00	
Δ Lag state		0.33
		(0.04)
Hamas attacks × lag state, $\gamma_{H,2}$	0.01	0.002
		(0.01)
Fatah attacks × lag state, $\gamma_{F,2}$	0.03	0.01
		(0.01)
Constant, γ_0	−0.02	−0.01
		(0.02)
T	299	298
adj. R^2	0.999	0.720
σ	0.216	0.183

Note: Newey-West standard errors in parentheses. No standard errors are reported for the AR(1) model due to unit root.

Table 1 shows the first-stage estimates and demonstrates that attacks by Fatah and Hamas move the state space in the expected direction. Recall that estimates of $\gamma_{i,1}$ reflect each group's effectiveness at using terrorism to shift public support towards itself and away from its rival. In months when Hamas attacks, their relative popularity improves by an average of about 0.11–0.29 in the following month depending on the current support $\tilde{s}^t$. Likewise, when Fatah attacks, they can expect their relative popularity to improve by about 0.86–1.4 on average. Both of these effects are statistically significant in the ECM model, and we reject the hypothesis that the groups are equally effective at moving public opinion at every level of relative popularity. These results provide evidence that groups are capable of outbidding and that acts of terrorism carry popularity benefits to the group, which supports results from Jaeger et al. (2015). Likewise, these results support findings from Polo and González (2020) who find that terrorism can be used to build support among a civilian audience, particularly when the audience is well-defined along ethnic or religious lines (as is the case here).

In addition, we find that Fatah's use of terrorism more effectively increases pro-Fatah support than Hamas's use of terrorism increases pro-Hamas support. This asymmetry is not obvious before fitting the model to data. One explanation for this asymmetry is that, as the more pro-peace actor, attacks by Fatah provide more information to the public. To put this another way, attacks from Hamas are expected and do little to adjust public opinion as a result. For Fatah, attacks are more surprising, and thus the public's beliefs about how committed Fatah is to the Palestinian cause adjust more dramatically after an attack. As such, even though attacks demonstrate the resolve of both groups, Fatah receives a larger boost in public opinion because its attacks are more informative in the public's eyes.

In Appendix C, we consider additional control variables to ensure that these relationships are robust to economic and political factors, e.g., unemployment, attitudes toward violence, the onset of the Second Intifada, or Palestinian fatalities from Israeli forces (which is one proxy for government actions). Additionally, we consider alternative measures of attacks (e.g., counts) and models with and without the interaction terms. Overall, the relationships between attacks and shifts in public support are largely unchanged in either direction or magnitude. Even when we measure violence using fatalities or fatalities per attack, we find Fatah's violence more effectively increases its support than Hamas's violence increases its support—see models 3 and 4 in Table C.4.

Table 2: Payoff estimates.

	Estimate	Std. Error
Hamas value for outbidding, β_H	-0.0071	0.0055
Fatah value for outbidding, β_F	0.0005	0.0004
Hamas attack cost, κ_H	-0.95	0.28
Fatah attack cost, κ_F	-2.45	0.39
Log-Likelihood	-278.09	
T	300	

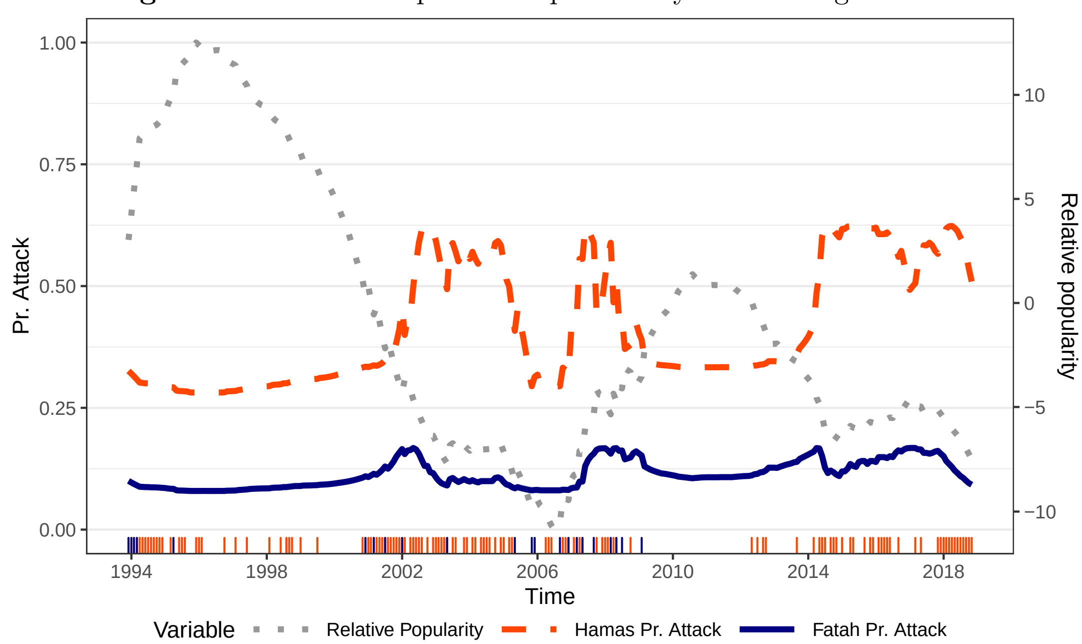
Note: All values rounded to two significant digits; two-step standard errors from Murphy and Topel (1985)

Table 2 presents estimates for β (value of popularity) and κ (costs of terrorist attacks). The sign on each estimate is in the expected direction. Both actors like being relatively more popular than their opponent, which is to say that Hamas's most preferred state is s_1 and Fatah most prefers s_K. Interestingly, Hamas values its public opinion more than Fatah with $|\hat{\beta}_H|$ being an order of magnitude larger than $|\hat{\beta}_F|$. One explanation for this difference is that Fatah derives more support from non-Palestinian actors like the Israeli government or the U.S. than Hamas. As such, Fatah might be less reliant on the local population for its day to day activities.

Intuitively, we find that terrorism is less costly for Hamas than Fatah, a finding which likely has several potential explanations. First, it could reflect different preferences for violence across the two groups, where members of Hamas have stronger preferences for terrorism than members of Fatah. Second, Hamas has made a concerted effort to build up its capacity for violence by developing infrastructure to acquire weapons and better train its members. As such, the group would find it less costly to engage in violence than Fatah which has devoted more resources to governance and engagement with the Israeli and U.S. governments. Both explanations fit with the historical record, which typically depicts Hamas as a strong violent actor while Fatah is a more practical political entity.

Beyond the face validity of the point estimates, we conduct a sensitivity analysis in Appendix D and demonstrate that our second-stage estimates in Table 2 are stable across a range of plausible γ estimates. Appendix E describes more formal model-fit exercises in which we compare our outbidding model to a baseline model where outbidding cannot occur (i.e., terrorism only emerges for reasons other than outbidding). Overall, we find that the outbidding model better fits the data. In Appendix F, we check the robustness of these estimates by using four different and smaller time frames that end at plausible change points in the Fatah-Hamas relationship: the 2014 agreement, 2011 agreement, 2006 election, and start of the Second Intifada. These cutoffs reflect points where the groups' preferences (β and κ) may change in response to changes in the relationship between the groups; our estimates are largely stable regardless of time frame.

Figure 5: Estimated equilibrium probability of attacking over time.



Note: Horizontal axis denotes sample months/periods. Left vertical axis is the estimated probability that i attacks in month t, i.e., $P(a_i = 1; s^t, \hat{v}_i)$ where s^t is the observed relative popularity level in period t and $\hat{v}_i$ is estimated from the CMLE. For reference, s^t is also plotted on right vertical axis. The rug plot indicates observed attacks.

Finally, Figure 5 graphs the estimated attack probabilities for each group over time, that is, $P(a_i = 1; s^t, \hat{v}_i)$, where $\hat{v}_i$ is group i's equilibrium expected utilities estimated from the CMLE and s^t is the observed state.[14] In addition, we also graph the relative popularity level s^t over time on the second horizontal axis for reference. Notice that Hamas has a higher probability of attacking than Fatah regardless of its relative popularity. Averaging over the observed states, Hamas attacks with probability 0.42 and Fatah with probability 0.11. This maps onto our estimates. Hamas cares more about its popularity than Fatah, and it has a comparatively smaller attack cost although Fatah more effectively uses terrorism to increase its support. In addition, terrorism is particularly prevalent when Hamas is relatively popular, specifically during the Second Intifada and after the group wins legislative elections in 2006.

6 Substantive effects of competition on violence

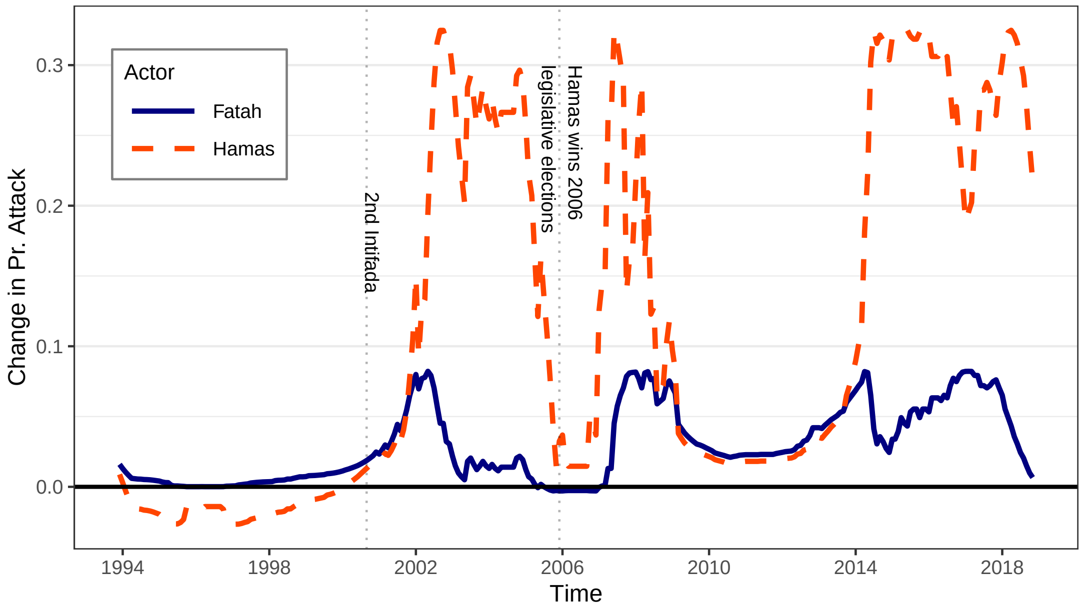
Outbidding studies generally expect an encouragement effect in which enhanced competition leads to more violence. Nonetheless, our point estimates uncover substantial asymmetries between Hamas and Fatah, where Fatah is more effective at using terrorism to boost its popularity but Hamas has smaller attack costs and cares more about its popularity. If these asymmetries are sufficiently strong, outbidding could exhibit a deterrent effect in which enhanced competition depresses violence. To see which effect dominates, we conduct a series counterfactual exercises on the estimated model. The goal is to modify different aspects of competition and then track how the groups' use of violence changes in response.

First, we compare how a group behaves with and without violence from its rival. That is, would Fatah use more or less violence if Hamas did not engage in terrorism and vice versa? Specially, we compare group i's estimated equilibrium probability of attacking (in Figure 5) to the probability of attacking in group i's single-agent problem, i.e., i's predicted use of violence if it expects its rival to never attack. Subtracting the latter from the former is one way to quantify the effect of competition on violence where the equilibrium attack probabilities represent violence in a competitive environment and the single-agent attack probabilities are from a noncompetitive environment. Figure 6 graphs these differences over time given the observed relative popularity s^t. Positive values indicate a positive effect of competition on violence, i.e., a group's equilibrium probability of attacking is larger than its probability of attacking in its single-agent problem. Negative values indicate a negative effect.[15]

[14] Figure A.4 in Appendix A, graphs the estimated attack probabilities as a function of the state, rather than the observed state as in Figure 5.

[15] Whereas Figure 6 graphs the difference between equilibrium and single-agent attack probabilities over time conditional on the observed relative popularity s^t, Figure A.5 in Appendix A graphs the difference as a function of all potential relative popularity levels.

Figure 6: Effects of competition on violence given observed states.



Note: For each month t (horizontal axis), we compare group i's equilibrium probability of terrorism to the probability that would arise if i expects its rival to never use violence, by subtracting the latter from the former given the observed state s^t. Positive values indicate that competition increases violence by group i in period t with state s^t; negative values indicate that competition decreases violence by group i. Vertical dashed lines indicate the start of the Second Intifada and Hamas winning legislative elections.

For Fatah, the values are entirely positive indicating that Hamas encourages Fatah to use more violence than it would use absent competition. Averaging over time, competition from Hamas increases Fatah's use of violence by 34% from the baseline noncompetitive environment (i.e., Fatah's single-agent problem). This is the expected encouragement effect of competition on violence from the outbidding literature. Table 3 decomposes the effect over three time periods. It shows that Fatah's propensity for terrorism increases by about 3 percentage points due to competition from Hamas, especially after the start of the Second Intifada. For Hamas, however, the story is different as heterogeneous effects exist. Competition from Fatah depresses Hamas's use of violence during the Oslo era, although we find a positive effect after the Second Intifada. Table 3 indicates that, during this initial period, Hamas's propensity for terrorism would increase by 1-2 percentage points in the absence of competition from Fatah. More specifically, the estimates indicate that, in equilibrium, Hamas used 4–5% less violence during Oslo lull than if it thought Fatah would never attack, i.e., in its single-agent problem. This is the deterrent effect of competition on violence where a group uses less violence in the competitive environment than in a noncompetitive one.

Thus, the presence of a rival terrorist group can depress violence. With a rival that is an effective outbidder (Fatah), a group (Hamas) may use less violence than it normally would because it sees the competition as a lost cause. As Figure 6 illustrates, this deterrent effect emerges in the Oslo era where Fatah was relatively more popular than Hamas. Although

Table 3: Average Effect of Competition on Violence in Three Time Periods

	Jan. 1994 to Sep. 2000 Oslo era	Oct. 2000 to Jan. 2006 2nd Intifada	Feb. 2006 to Dec. 2018 post-2006 election
Hamas	−0.014	0.177	0.148
	(0.001)	(0.010)	(0.007)
Fatah	0.005	0.027	0.043
	(0.0003)	(0.002)	(0.001)

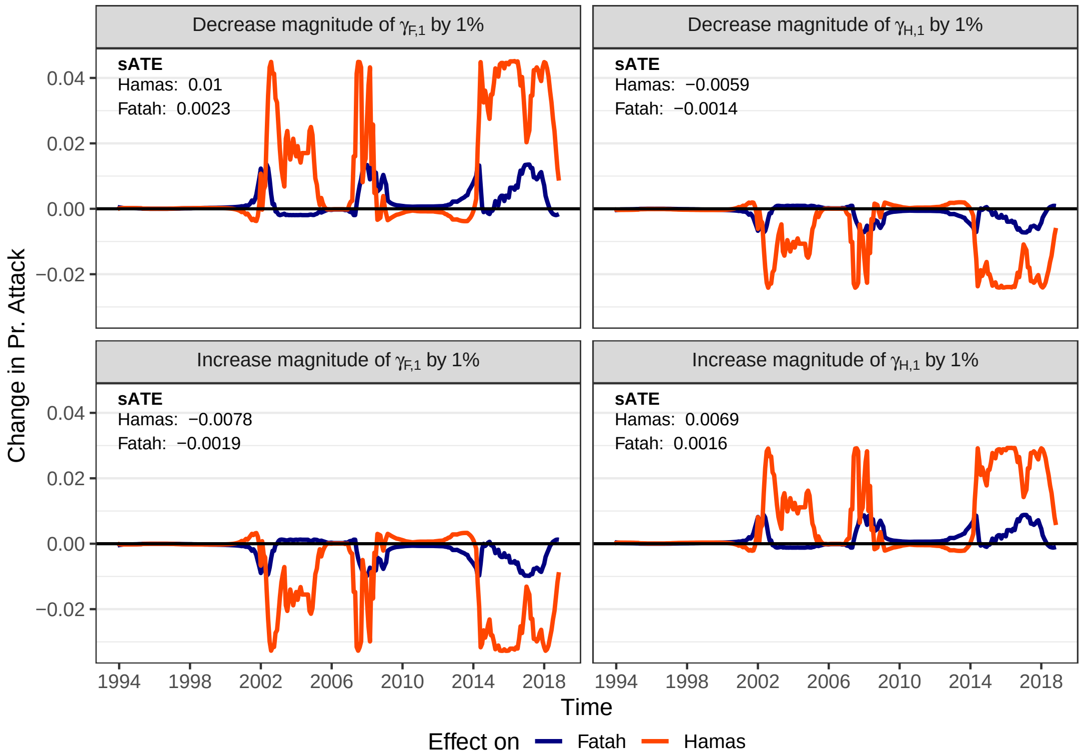
Note: Average difference between equilibrium and single-agent attack probabilities from three time periods with standard errors in parentheses. Positive values indicate the former are larger than the latter, i.e., more violence in the competitive (equilibrium) environment than the noncompetitive (single-agent) environment. Oslo era is Jan. 1994–Sep. 2000, 2nd Intifada is Oct. 2000–Dec. 2005, and post-2006 election is Jan. 2006–Dec. 2018.

some outbidding studies argue that increasing the number of terrorist groups—a common proxy for competitiveness—can decrease violence, their underlying mechanisms do not appear in this setting. For example, Nemeth (2014) argues that increasing the number of ideologically similar groups should decrease violence through free-riding dynamics. Hamas and Fatah are generally seen as ideologically opposed, however, and there are no free-riding incentives in the model. Another example is Conrad and Spaniel (2021) who argue that the government may change its demands in response to a large number of groups, leading to a negative correlation between terrorist group numbers and violence. As Figure 6 and Table 3 demonstrate, endogenous government demands are not necessary for competition to have a negative effect on violence.

Second, we examine how one group's incentives to compete affect the propensity of both groups to use violence. For example, how would overall violence levels change if group i became a more effective outbidder, i.e., $\gamma_{H,1}$ becomes more negative or $\gamma_{F,1}$ becomes more positive? Whereas the first counterfactual fixes the behavior of one group, this exercise illustrates how the behavior of both groups changes as a function of competitive incentives. To do this, we fix the transition parameters estimated from Table 1, the payoff parameters in Table 2, and the equilibrium expected utilities from the CMLE. For each group i, we then change how effectively i can boost its popularity through terrorism by increasing and decreasing the magnitude of $\gamma_{i,1}$ by 1%. As the effectiveness of attacks changes, the equilibrium probabilities of attacks will change as well. Figure 7 graphs theses differences given the change in $\gamma_{i,1}$ and observed state s^t. Positive values indicate that violence from group i in observed state s^t increases in the counterfactual scenario, whereas negative values indicate that violence decreases.

Focusing on the effects of Hamas's competitive incentives, we find evidence of outbidding's expected encouragement effect: when Hamas has greater incentives to compete, violence by both groups increases. We estimate that a 1% increase in Hamas's effectiveness results in a 1 percentage point increase in the frequency of terrorism by Hamas and a 0.1

Figure 7: Relationship between terrorism and effectiveness of attacks in observed states.



Note: In each panel, we increase and decrease the magnitude of $\gamma_{i,1}$ for $i = H, F$ from its estimated value by 1%; all other parameters are held constant at their estimated values. Incentives to compete are greater when $\gamma_{i,1}$ is larger in magnitude. The horizontal axis denotes the period/month t. The vertical axis is the difference between equilibrium attack probabilities (Figure 5) and counterfactual attack probabilities given the change in $\gamma_{i,1}$ and observed state s^t. Positive (negative) values indicate that violence by group i increases (decreases) in the counterfactual.

percentage point increase in the frequency of terrorism by Fatah. On average, this implies Hamas would increase its use of violence by 2% and Fatah by 1%. Likewise, a 1% decrease in Hamas's effectiveness results in a 1 percentage point decrease in the frequency of terrorism by Hamas and a 0.1 percentage point decrease in the frequency of terrorism by Fatah. These encouragement effects are even stronger when focusing on more recent observations after the Oslo era.

Focusing on the effects of Fatah's competitive incentives, we find evidence of outbidding's unexpected deterrent effect: when Fatah has greater incentives to compete, violence by both groups decreases. We estimate that a 1% increase in Fatah's effectiveness results in a 1 percentage point decrease in the frequency of terrorism by Hamas and a 0.2 percentage point decrease in the frequency of terrorism by Fatah. On average, this implies both groups would decrease their violence by 2% if Fatah were to have greater incentives to compete via becoming 1% more effective at outbidding. Similarly, a 1% decrease in Fatah's effectiveness results in a 1 percentage point increase in the frequency of terrorism by Hamas and a 0.2 percentage point increase in the frequency of terrorism by Fatah. Again, these deterrent effects are even stronger after the Oslo era.

In Appendix A, we repeat the same exercise for the value of support, β_i, and the costs of attacking, κ_i—see Figures A.6 and A.7, respectively. The main takeaways are similar: when Hamas becomes more competitive, both sides attack more frequently (as expected by the outbidding literature), but when Fatah becomes more competitive, both sides tend to attack less frequently (in contrast to expectations in the outbidding literature).

These deterrent effects arise from asymmetric competition. Fatah is a relatively advantaged player due to its effectiveness at using terrorism to increase public support, that is, $|\gamma_{F,1}|$ is substantially larger than $|\gamma_{H,1}|$. When Fatah's incentive to compete increase, it more readily absorbs the up-front costs of terrorist attacks in order to more quickly increase public opinion levels in the future. This affects Hamas's equilibrium strategy. When Fatah becomes more aggressive, Hamas generally attacks less as it cannot efficiently compete against the more aggressive and more capable Fatah. In equilibrium, this creates a feedback loop where Fatah uses less violence as Hamas becomes more nonviolent. Thus, stronger incentives to compete against a rival for one group can deter terrorism from all groups.

7 Conclusion

We show that the relationship between intergroup competition and terrorism is not as clear as the current outbidding literature suggests. Although previous studies focus on an encouragement effect where enhanced competition leads to more violence, we document a deterrent effect in which competition can depress violence. This effect emerges in the rivalry between Hamas and Fatah, the canonical outbidding example. To do this, we construct and estimate a new model of outbidding. The exercise involves compiling monthly-level survey data and estimating Palestinian support for the two groups between 1994–2018.

Through a series of counterfactual exercises, we highlight two different types of deterrent effects. First, we find that when Fatah is relatively popular like during the Oslo era between 1993 and 2000, competition from Fatah deters Hamas from using violence. That is, Hamas would use more violence if it expected no violence from Fatah. Second, we find that were Fatah's competitive incentives to increase, equilibrium rates of violence from either group would decrease.

Our theoretical framework explains these results through the logic of asymmetric contests. We find that, although Hamas has smaller attack costs, Fatah is a more effective outbidder than Hamas in the sense that Fatah attacks lead to larger pro-Fatah swings in public opinion than Hamas attacks lead to pro-Hamas swings. This asymmetry leads to the two deterrent effects. When Fatah is overwhelmingly popular, it is very difficult for Hamas to win back public opinion in the face of competition from Fatah. As such, Hamas tempers its use of violence in the presence of competition with a popular Fatah. Likewise, when

Fatah's incentives to compete increase, it more readily absorbs its high, up-front costs of attacking to quickly increase its popularity. Hamas cannot compete with a more aggressive and capable Fatah, so the group would become less violent, leading to an equilibrium feedback loop where both groups use less violence.

More substantively, these results highlight an uncomfortable tension surrounding Fatah. As the actor most invested in the peace process, Fatah has to appeal to not only Palestinians but also Israel and an international audience. These outside concerns provide one explanation for why we find that Fatah cares less about its popularity among Palestinians and is a more effective outbidder than Hamas. Thus, one policy implication from this analysis is that efforts to make Fatah more accountable to the Palestinian people, e.g., further promotion of democratic institutions and political competition within the Palestinian territories, may lead Fatah to care more for its relative popularity and result in an overall decrease in violence. Although care needs to be taken here, because if these policies also make Hamas care about its support then violence may increase.

The paper leaves open several important avenues for future research. First, Israeli defense policy only enters the analysis indirectly and non-strategically through its effect on the exogenous parameters of interest. Theoretically, this omission was following the outbidding literature, so our model focuses on the competition between two terrorist groups; however, it is perhaps clear that this competition should unfold in the shadow of government intervention. Empirically, this omission reflects the lack of data on actions taken in response to or anticipation of terrorist attacks. Future work will focus on collecting this data and using it to fit an expanded three actor model. We can then test for whether military responses are effective at attenuating competitive incentives or not. Government attacks may raise a group's cost of committing terrorism, but they may also make the population more sympathetic to the group's cause, thereby increasing the group's ability to win over public support. Disentangling the effects of competition in this situation presents a challenging, but fundamentally important, next step in the study of outbidding.

Second, one recurrent point of skepticism surrounding structural estimation in conflict studies and international relations has been a lack of high-quality and high-frequency data. This concern reflects the use of structural estimation to study the strategy behind international crisis escalation (e.g., Crisman-Cox and Gibilisco 2018; Kenkel and Ramsay 2021; Signorino 1999). Militarized interstate disputes are relatively rare, and historical disputes may be subject to measurement error. We therefore hope our analysis highlights the natural complementarities between events data and structural estimation. Structural exercises often demand many observed moments in the data to pin down the parameters of interest, so the prevalence of high-frequency events data is promising. Likewise, events data often record endogenous actions of strategic actors, e.g., when governments repress, where protesters meet, or when terrorists attack. Explicitly accounting for these strategic interactions in a structural model can help scholars answer a greater variety of questions.

Additionally, this model can easily be applied to other cases of intergroup competition. For example, competition among republican groups in Northern Ireland, leftist groups in Colombia, or Tamil groups in Sri Lanka are natural places to study outbidding. Our model provides a framework for considering these cases and identifying the competitive incentives of all the relevant actors. The formal and statistical model can easily be expanded to any number of groups. The main limitation to studying alternative conflicts is the need for public support data, but as intrastate conflict data becomes more available and fine-grained, we anticipate being able to fit these kinds of models to any number of relevant contests.

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