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 contest between Hamas and Fatah, using newly collected data on Palestinian support for the two groups. Competition produces heterogeneous effects. 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 (Acosta 2014; Crenshaw 1981; Fortna 2015; Polo and González 2020). It is a particularly 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). This explanation is important as scholars are still debating the degree to which terrorism helps groups achieve their long-term political objectives.[1]

Because of this unique status, outbidding is often used to explain terrorism and intrastate violence. 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 encourage 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 economic 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 (Dechenaux, Kovenock and Sheremeta 2015; Stein 2002). The effect is particularly relevant in dynamic or multi-battled contests where players repeatedly compete over time (Konrad 2012). Overall rates of effort

[1] Abrahms (2006, 2012), Jones and Libicki (2008), Fortna (2015), and Getmansky and Zeitzoff (2014) argue that terrorism can be ineffective in this regard, but Gould and Klor (2010) find that fatalities from suicide terrorism in the Israeli-Palestinian conflict make Israelis more accommodating of Palestinian demands. For mixed effects see Beber, Roessler and Scacco (2014).

can therefore increase when one player becomes less competitive through handicapping the strong or providing head starts to the weak (Franke, Leininger and Wasser 2018; 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 an advantaged actor due to its status-quo leadership position and outside support from Israel and the U.S. 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.

If the deterrent effect exists, then it would fundamentally change how scholars test hypotheses derived from outbidding theories. Most frequently, studies regress measures of violence on measures of incentives to compete—e.g., the number of groups in a conflict—using time-series-cross-sectional data and look to see if a positive association emerges.[2] With 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 N.d.; Nemeth 2014). When both the deterrent and encouragement effects appear in the data, it is not clear how to evaluate evidence either for or against outbidding in these reduced-form regressions. Contests between potentially asymmetric terrorist groups can be consistent with either a positive or negative relationship between measures of competition and overall rates of violence.

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. 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 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 traditionally used in reduced-form regression. It fully embeds

[2] Of course, there are other research designs. Biberman and Zahid (2019), for example, use case studies of terrorist attacks on schools to show that outbidding among factions within an organization can increase the likelihood of violence. Vogt, Gleditsch and Cederman (2021) argue that competition creates incentives for groups to expand the scope of their demands, leading to more violence.

the intergroup strategic competition that defines outbidding into a unified theoretical and empirical framework.

We demonstrate competition's heterogeneous effects on violence using two types different counterfactual experiments. First, we compare the estimated equilibrium rates of terrorism to those in the counterfactual scenarios in which a 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 drives Fatah's use of violence, but not vice versa. Specifically, Fatah would use 25% less violence were it to expect no competition from Hamas. This illustrates the encouragement effect where violence from Hamas drives Fatah to use more violence. In contrast, Hamas would use only 7% less violence without competition from Fatah, but this average masks considerable heterogeneity. When Palestinian support sufficiently favors Hamas, moving from the estimated equilibrium to the counterfactual scenario with no competition from Fatah would decrease Hamas's use of violence by 27%, but when support favors Fatah, the effect is a 9% increase in violence. This latter result illustrates a deterrent effect in which Hamas would use more violence without competition from Fatah, which is unexpected in the outbidding literature.

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 type of counterfactuals fixed behavior of one group, these exercises illustrate how the behavior of both groups change as exogenous incentives to compete change. In our framework (as in other contest models), groups become more competitive 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. 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 Hamas 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 not only decrease violence among rival terrorist groups, but also that 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 two 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. The deterrence 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. We do this by adopting a structural approach as detailed below, although alternative strategies may be useful too. But, 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 of 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 quantify the effects of Israeli government and third-party policies 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 a finite set of $K \geq 3$ 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'

[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 groups competitors possess" (Gibilisco, Kenkel and Rueda 2019, 9).

if $s > s'$ and vice versa for Hamas. In other words, smaller states represent periods where Hamas is more popular and larger states periods where Fatah is more 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. 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. These shocks are drawn i.i.d. according to the type-1 extreme value distribution with density g.[4] As is customary in these dynamic games, the shocks account for the unobserved factors affecting the temporary costs and benefits of committing terrorism. The term $u_i(a_i^t, s^t; \theta)$ is the systematic component of group i's utility function, which is comprised 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.[5] 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. Group i simultaneously chooses whether or not 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 previously chosen actions and observed state. Given today's support 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.[6] We expect $\gamma_{H,1} < 0$ and $\gamma_{F,1} > 0$ so that attacks from group i pull popular

[4] Type-1 extreme value shocks are commonly used in random utility models to induce logit choice probabilities.

[5] By using value, cost, and effectiveness, we explicitly borrow phrasing from the contest literature as our model has similarities with multi-battle contests (e.g., Acharya et al. 2019; Konrad and Kovenock 2009). A key difference between our model and traditional multi-battle contests is that here the competition is never fully decisive.

[6] 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 or attract media attention.

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, e.g., that $\gamma_{F,2} > 0$. On the other hand, if its popularity is large, then there is less of the population to be won over, implying, e.g., that $\gamma_{F,2} < 0$. The model accommodates both possibilities, and we treat this as an empirical question to be answered below.

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 $\gamma = (\gamma_{H,1}, \gamma_{H,2}, \gamma_{F,1}, \gamma_{F,2}, \sigma)$ 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 and Markov random walks even though the model has a discrete state space so long as d is a small enough (Tauchen 1986).

Before proceeding, there are two important caveats to note with this model. First, we do not model the decision of individuals in the local population choosing a group to support.[7] Instead, their behavior is 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.[8] 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—observed in the data.

Second, the model deliberately focuses on outbidding at the expense of other explanations of terrorism. Spoiling, for example, is another theory of terrorism where one side in an intergroup dispute uses attacks to undermine a peace process that involves the other group. Within this conflict, Hamas is thought to have used attacks to spoil peace negotiations between Fatah and Israel in the 1990s (Kydd and Walter 2006). While spoiling is almost

[7] This is a common simplifying assumption in two-candidate dynamic models of elections as well (e.g., Acharya et al. 2019; Iaryczower, Lopez-Moctezuma and Meirowitz 2020).

[8] 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.

certainly a factor in the rivalry between Hamas and Fatah, our focus is on the effects of group competition on violence via outbidding. Future work should consider the empirical strength of other explanations by developing and then estimating different models. Such a model can then be compared to ours using various 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 and welcome future comparisons to other models of terrorism.

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. Our results are nonetheless robust for $\delta \in [0.975, 0.999]$—see Appendix F.

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 for group i. Because ε_i is distributed type-1 extreme value, i chooses a_i in state s with probability $P(a_i, s; v_i)$, where

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

We can write group i's average 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 written as

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

An equilibrium is a profile v such that

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

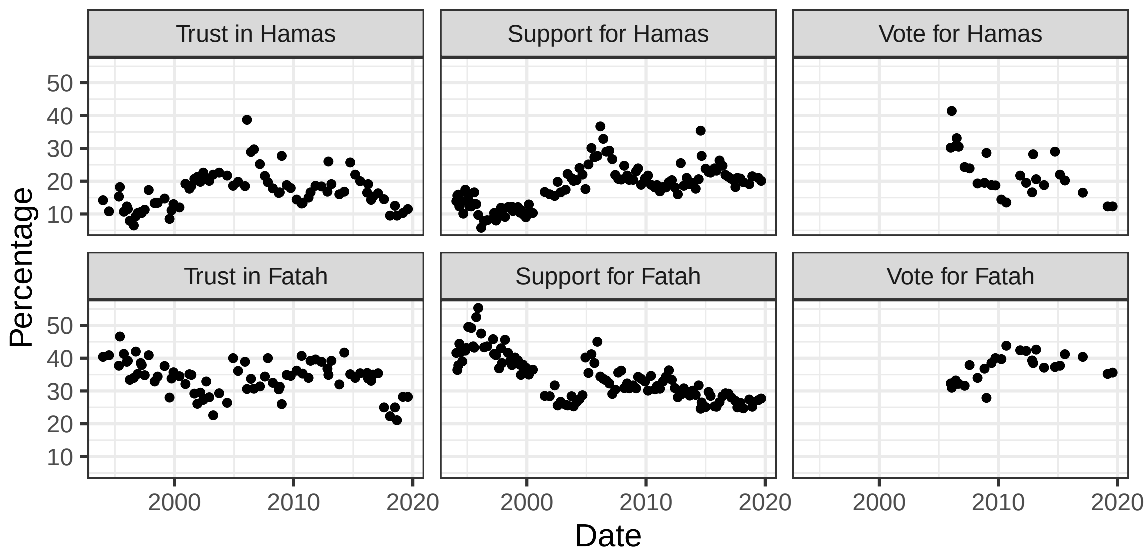
Notice Equations 4–7 characterize equilibria as a system of $4K$ equations, where K is the number of relative popularity levels. This is our starting point for estimation and analysis. Because the equations are not particularly informative for what types of strategic tensions arise in the model, we detail a numerical example in Appendix A. The example illustrates how dynamic competition creates strategic spillovers in the groups' use of violence, and it demonstrates that the relationship between competition and violence can exhibit either the encouragement or deterrent effect.

3 Data sources and measurement

Data on attacks are taken from the Global Terrorism Database (GTD) where we record all the terrorist attacks committed by Fatah/PLO and Hamas in every month from January 1994 to December 2018 (START 2019b). 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: occurring outside the confines of "legitimate warfare," designed to signal to a larger audience than the immediate victims, and helps to attain a political, religious, or social goal (START 2019a, 6). Hamas engages in roughly 1.5 attacks per month with a range of 0-36 attacks in any given month, while Fatah engages in an average of less than 1 attack per month with a range of 0-15. The median number of attacks for both actors is 0 and in only a small number of months does either side commit more than 2 attacks. In our data, a period is a calendar month. To measure group i's attack decision in month t, we record a dummy variable indicating whether the group engaged in 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 indicators of relative popularity. These six variables are created using surveys from the Jerusalem Media & Communication Centre (JMCC N.d.) and the Palestinian Center for Policy and Survey Research (PCPSR N.d.). 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 JMCC questions (asked 2-6 times a year) related to whether respondents trust Fatah or Hamas ("Which political or religious faction do you trust the most?"). The second records PCPSR questions (asked 2-9 times a year) related to how much political support each side has ("Which of the following political parties do you support?"). The third also relates to political support and it follows JMCC questions (asked 0-5 times a year starting in 2006) related to how individuals intend to vote in the next legislative election ("If Legislative Council elections were held today, which party would you vote for?").

Figure 1: Survey responses over time



Notes: First column tracks JMCC questions (asked 2-6 times a year) about trusting Fatah or Hamas ("Which political or religious faction do you trust the most?"). Second tracks PCPSR questions (asked 2-9 times a year) related to political support ("Which of the following political parties do you support?"). Third tracks JMCC questions (asked 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?").

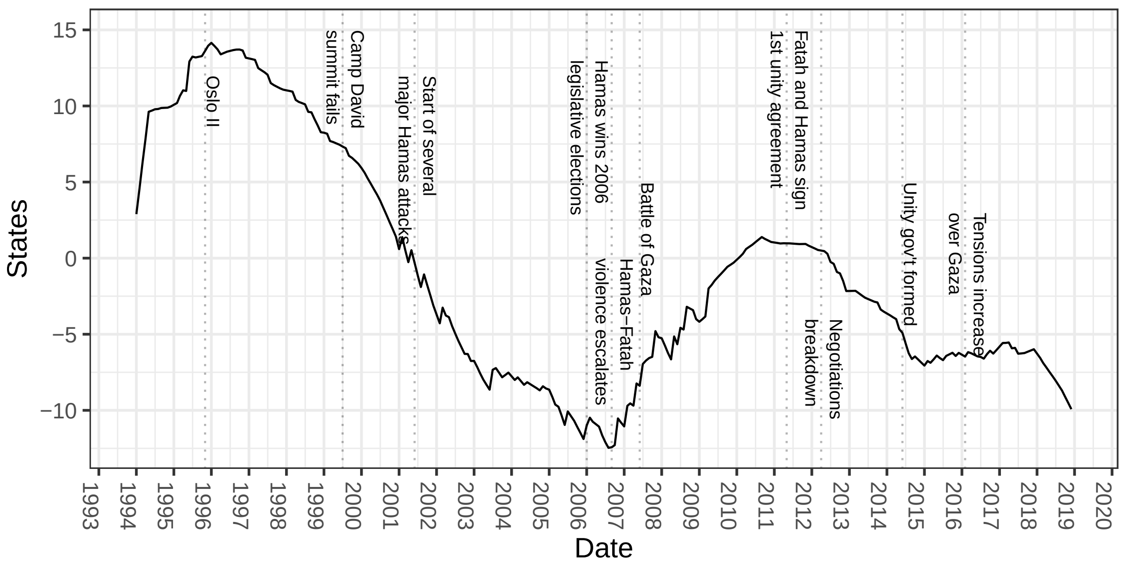
Figure 1 graphs responses to these six survey questions over time. These answers largely follow a basic trend where public attitudes towards Fatah and Hamas are inversely related. In general we see a decline in Fatah support during the 1990s and early 2000s, while Hamas's public support rises. These trends level out a bit in the later years, with Fatah maybe regaining some support here at the expense of Hamas. The surveys mostly correlate with each other in the expected directions, which suggests that they can be collapsed onto one dimension (see Table B.1 in Appendix B). To do this, we use a dynamic factor analysis to transform these polling questions into a continuous representation $\tilde{s}^t$ of the theoretical state variable s^t. Additional information on the survey questions and the dynamic factor model can be found in Appendix B.

Once we fit the model and produce the continuous state variable $\tilde{s}^t$, we want to check its validity and understand its distribution.[9] Figure 2 shows how the state variable evolves from 1994-2018. Fatah is favored in the earlier periods of the data, where they peak during the 1996 Oslo II process (Jan. 1996 = 14.15). Likewise, Hamas is at its most popular relative to Fatah in 2006 during the lead-up to the general election in which they took control of

[9] 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.2 in Appendix B.

the Gaza strip (Aug. 2006 = −12.46). The mean of this variable is −0.94 (median −3.02) with a standard deviation of 7.53 (IQR of −6.63 to 4.54).

Figure 2: Relative popularity of Fatah to Hamas over time.



Several important events in the conflict are listed in Figure 2, 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. Furthermore, our measure has a rich variation that exhibits substantial ups and downs that go undetected in existing measures of group popularity. For example, Tokdemir and Akcinaroglu (2016) do not find popularity differences between Fatah and Hamas after 1997.

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 $\tilde{s}^t$:

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

where a_F^{t-1} and a_H^{t-1} are binary indicators for whether Fatah and Hamas attacks, respectively, and $\nu^t \sim N(0, \sigma^2)$.

To fit the model in Equation 8, we will exploit the fact that $\tilde{s}^t$ and $\tilde{s}^{t-1}$ are cointegrated by construction. Cointegration means that we can directly fit the model in Equation 8 using ordinary least squares (OLS) to obtain superconsistent estimates of the parameters, but the sampling distribution of the parameters is unknown and possibly non-symmetric because of the unit root. However, we only need good point estimates to proceed with the second stage analysis, and so exploiting the cointegration here provides us with the best use of our limited number of observations. To test the hypotheses about each group's effectiveness, we also fit the model using the Engle-Granger error correction method (ECM).

The first-step estimates are then used to construct the Markov transition probabilities. First, we define the lowest (most Hamas friendly) state s_1 of the discrete state as the 5th percentile of the continuous state variable, $\tilde{s}^t$. Likewise, the largest state (most Fatah friendly) s_K is set to the 95th percentile. States between 1 and K are defined at equally spaced intervals of $2d = 0.1$ (i.e., $s_2 - s_1 = 0.1$). Let $\mu[a, s; \hat{\gamma}]$ be the fitted values from the first model in Table 1 for all possible combinations of action profiles with the discrete states. Plugging these fitted values and the estimate of σ into Equation 3 produces the transition probabilities. Finally, we discretize the observed states variable by mapping values of the continuous latent variable $\tilde{s}^t$ into the closest value of the discrete state space $\mathcal{S}$.

We use the constrained maximum likelihood estimator (CMLE) introduced by Su and Judd (2012). 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), and recall that $\theta = (\beta, \kappa)$. We fix the transition probabilities using the first stage estimates ($\hat{\gamma}$ from the OLS results in Step 1) 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 $v = \mathcal{V}(v; \theta, \hat{\gamma})$. Results from Silvey (1959) demonstrate that the CMLE is consistent in T and characterize its asymptotic distribution. Standard errors are computed using this characterization for constrained MLE and are corrected using the Murphy and Topel (1985) approach for two-step estimation.[10]

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 are generated from only one of these equilibria (Crisman-Cox and Gibilisco 2018, 2020; Su and Judd 2012). By treating the endogenous equilibrium expected utilities, v, as auxiliary parameters in the model, 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.

[10] We also conduct a sensitivity analysis in Appendix D to more fully assess how uncertainty associated with the transition probabilities influences the second stage estimates.

Table 1: Regressing the state space on terrorist attacks

	Dependent variable:	
	State	Δ State
	AR(1)	ECM
Hamas attack	-0.33	-0.33
		(0.05)
Fatah attacks	1.67	1.60
		(0.05)
Lag state	1.00	
Δ Lag state		0.17
		(0.04)
Hamas attacks $\times$ lag state	0.01	0.003
		(0.01)
Fatah attacks $\times$ lag state	0.02	0.01
		(0.01)
Constant	-0.01	-0.01
		(0.03)
T	299	298
adj. R^2	0.999	0.808
$\hat{\sigma}$	0.221	0.205

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

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.

Table 2: Payoff estimates

	Estimate	Std. Error
Hamas value of popularity (β_H)	-0.009	0.006
Fatah value popularity (β_F)	0.001	0.0003
Hamas attack cost (κ_H)	-0.952	0.284
Fatah attack cost (κ_F)	-2.572	0.349
T	300	
Log-Likelihood	-281.90	

Note: Two-step standard errors from Murphy and Topel (1985).

5 Parameter Estimates

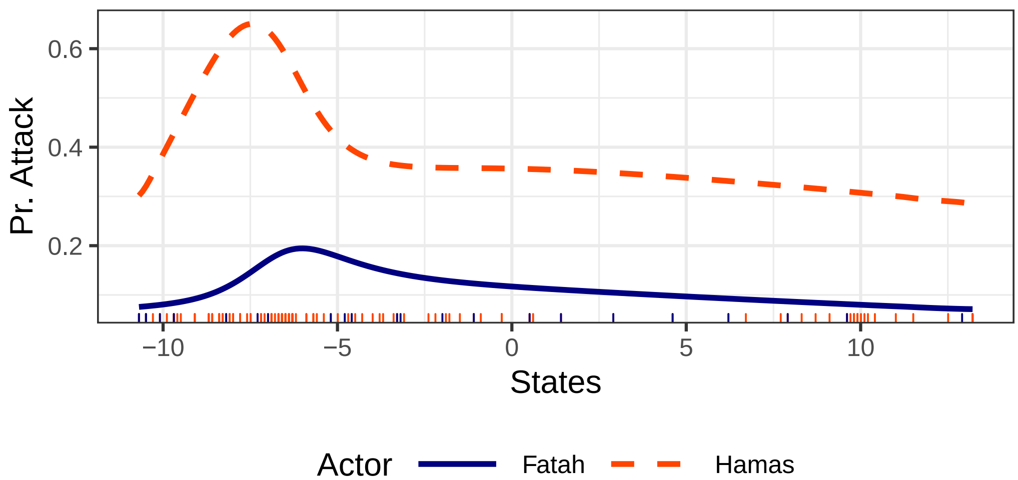
Table 1 presents the results of the first-stage estimation and shows that attacks by Fatah and Hamas move the state space in the expected direction. Recall that these are estimates of γ and reflect each group's effectiveness at using terrorism to shift public support towards itself and away from its rival. In months when Hamas attacks, their relative popularity improves by an average of about 0.3-0.4 in the following month depending on the current support $\tilde{s}^t$. Likewise, when Fatah attacks, they can expect the state space to improve in their direction by about 1.4-1.8 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 pubic 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, our estimates indicate that Fatah's use of terrorism more effectively increases public support of Fatah than Hamas's uses of terrorism increases support of Hamas.

In the Appendix C, we consider several additional control variables to ensure that these relationships are robust to economic and political factors, e.g., unemployment or the onset of the Second *Intifada*. Additionally, we also consider alternative measures of attacks (counts rather than indicators) and models with and without the interaction terms. Across these checks, the main relationship between attacks and shifts in public support are largely unchanged in either direction or magnitude.

Table 2 presents estimates for β (value of popularity) and κ (the 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. One explanation is that these costs reflect more than just the tactical cost of terrorism and also include the cost each actor pays for either continuing (Hamas) or deviating (Fatah) from their main posture. This result fits with the historical record of the conflict, which typically depicts Hamas as a strong, violent actor, while Fatah works hard to maintain a reputation as a more practical, political entity. Such differences reflect the "zealots and sellouts" logic from Kydd and Walter (2006) and presents the interesting problem faced by Fatah: they are more skilled at moving the state space than Hamas, but they face a much higher cost to doing so.

Figure 3: Estimated equilibrium probability of attacking



Notes: Estimated probability that each group attacks as a function of the popularity levels. Hamas (Fatah) prefers smaller (larger) states—see Table 2. The horizontal axis includes a rug plot of observed attacks.

Finally, Figure 3 illustrates the equilibrium rates of terrorist attacks. It graphs the probability that each group attacks as a function of their relative popularity, i.e., $P(a_i = 1; s, \hat{v}_i)$, where $\hat{v}_i$ is group i's equilibrium expected utilities estimated from the CMLE. Notice that Hamas has a higher probability of attacking than Fatah regardless of its relative popularity. This maps onto our estimates. Hamas cares more about its popularity than Fatah, and it has a comparatively smaller cost to commit terrorism although Fatah more effectively uses terrorism to increase its support. In addition, terrorism is particularly prevalent when Hamas is relatively popular. Hamas's probability of attacking is maximized at $s = -7.4$, and Fatah's is maximized at $s = -6$. These values are roughly one standard deviation below the mean of the observed relative popularity levels.

6 Substantive effects of competition

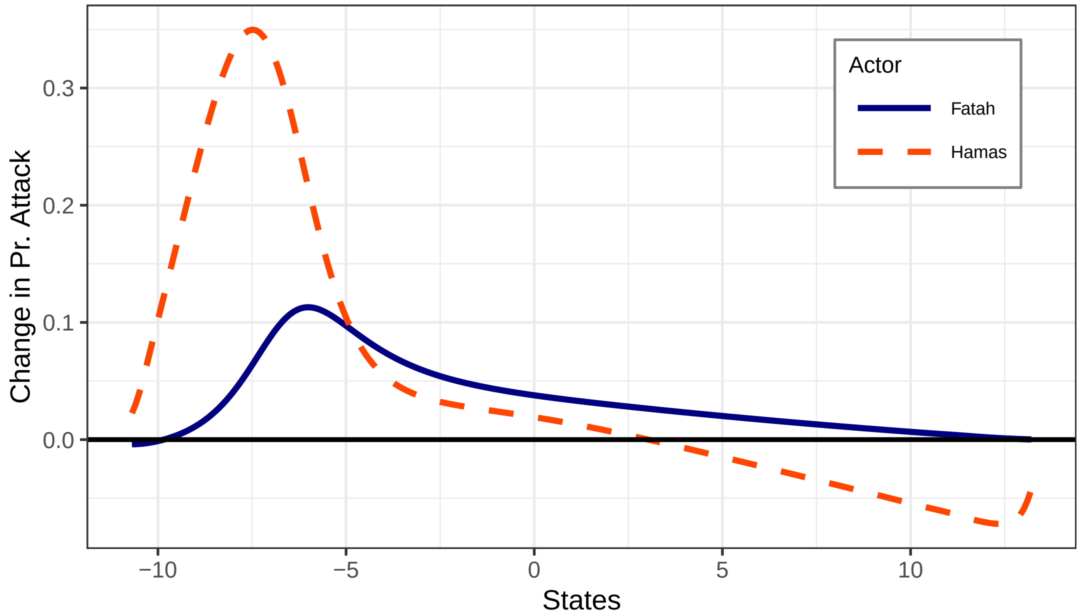
We now quantify the substantive effects of competition on violence. As discussed above, outbidding studies generally expect an encouragement effect in which enhanced competition leads to more violence. Nonetheless, our point estimates uncover substantial asymmetries between Hamas and Fatah, where Fatah is the more effective at using terrorism to boost its popularity ($|\gamma_{F,1}| > |\gamma_{H,1}|$; Table 1) but Hamas has smaller attack costs ($|\kappa_H| > |\kappa_F|$; Table 2). If these asymmetries are sufficiently strong, outbidding can exhibit a deterrent effect in which enhanced competition depresses violence. To see which effect dominates, we conduct a series of counterfactual exercises on the estimated model. In each exercise, we increase or decrease different aspects of competition from the baseline model and determine how overall violence would respond.

Given the informal nature of most theory in the outbidding literature, it is not obvious how to operationalize changes in competition levels in a formal model. As such, we explore this relationship using two different types of counterfactual experiments. In the first set of counterfactuals, we focus on how the competitive behavior of one group affects its rivals use violence. That is, would Fatah use more or less violence if Hamas did not engage in terrorism and vice versa? Here, we fix violence from one group to zero and examine how behavior of the other group changes from the estimated model.[11] In the second set of counterfactuals, we focus on how one group's exogenous incentives to compete affect the propensity of either group to use violence. For example, how would overall violence levels change if one group began to value its public support to a greater degree (i.e., if β_i increases in magnitude)? Such a change could occur after a third-party supporter stops backing one group, then the group might become more reliant on support from local Palestinians (therefore increasing β_i for that group). Likewise, democratic reforms in the Palestinian territories could make groups more reliant on public support (therefore increasing β_i for both groups).

In the first set of counterfactuals, we compare group i's equilibrium probabilities of attacking (in Figure 3) to the probabilities of attacking in group i's single-agent problem, that is, 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 effects of the competition between Hamas and Fatah on their use of violence as a group never expects to compete with its rival in its single-agent problem. Figure 4 graphs these differences as functions of the relatively popularity levels s. Positive values indicate that a group's equilibrium probability of attacking is larger than its probability of attacking without competition (i.e., in its single-agent problem). Negative values indicate that group i is more likely to attack without competition than in the estimated equilibrium.

[11] This approach is similar to Conrad and Spaniel (N.d., Proposition 2.1) who examine how violence (effort) levels in a one-shot, symmetric outbidding contest change as the number of groups increases or decreases. In a static game, Gibilisco, Kenkel and Rueda (2019) quantify how groups in the Colombia civil war would use less violence against civilians if they expect rival groups to not use such violence.

Figure 4: Effects of competition on violence



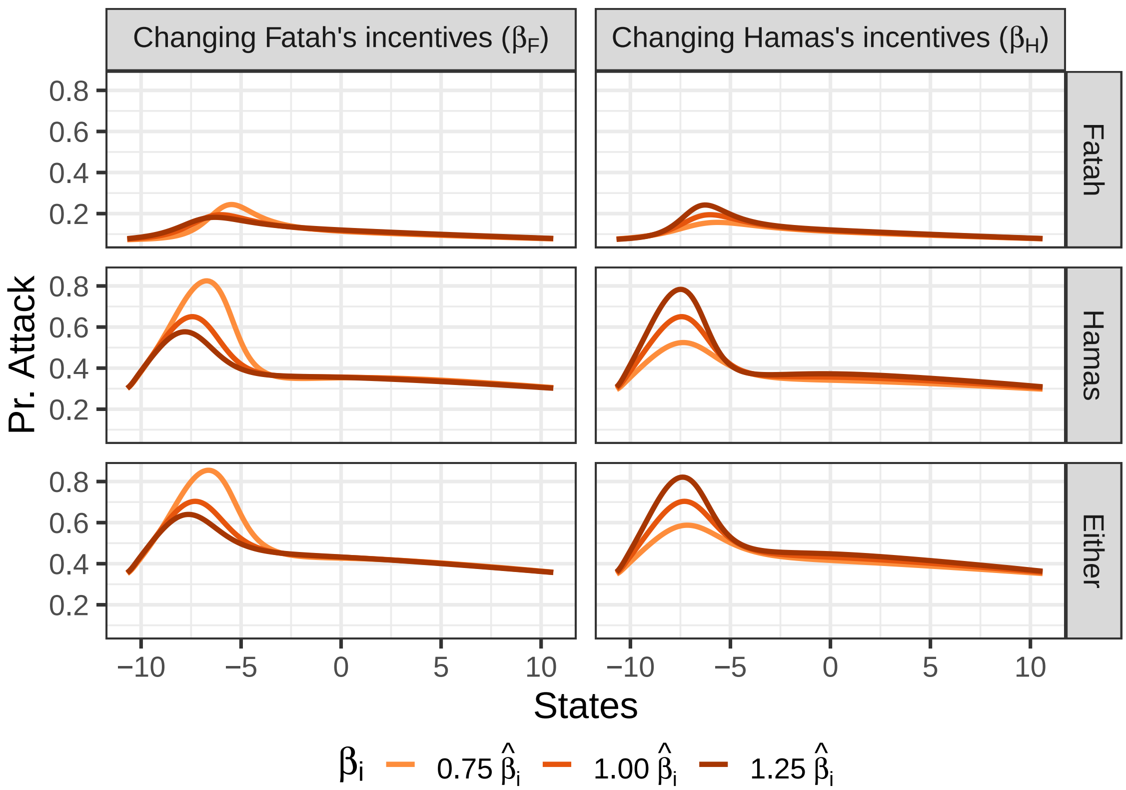
Notes: We compare group i's equilibrium probability of terrorism in state s (Figure 3) to the probability that would arise if i expects its rival to never use violence, by subtracting the latter from the former. Positive values indicate that competition increases violence by group i in state s; negative values indicate that competition decreases violence by group i in state s.

For Fatah, the values are entirely positive indicating that Hamas's use of violence encourages Fatah to use more violence than it would use absent competition. Averaging over states, 25% of Fatah's use of violence can be attributed to competition with Hamas. The story is slightly more complicated for Hamas, however. On average, 7% of Hamas's use of violence can be attributed to competition with Fatah, but this masks nontrivial heterogeneity. In more pro-Hamas states ($s < 0$), the probability of a Hamas attack is on average 27% smaller in Hamas's single-agent problem than in the estimated equilibrium. In more pro-Fatah states ($s > 0$), the probability of a Hamas attack is on average 9% larger in Hamas's single-agent problem than in the estimated equilibrium.

This latter finding in which Hamas can use more violence in the non-competitive environment (its single-agent problem) than in the competitive environment (the estimated equilibrium) is unexpected from previous studies on outbidding. Although some argue that increasing the number of terrorist groups (which is a common proxy for the level of competition in a conflict) 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 (N.d.) 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. In contrast to these previous arguments, the presence of a rival can depress violence in our model due to asymmetric strengths in the contest for public opinion. In the presence of 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 4 helps to illustrate, this deterrent effect emerges in the states where Fatah mostly dominates public opinion.

Second, we explore the relationship between a group's competitive incentives and violence. To do this, we engage in a comparative statics analysis. We fix the transition probabilities estimated in Table 1, the payoff parameters in Table 2, and the equilibrium expected utilities from the CMLE. For each group i we then change how much they value public support, β_i, by increasing and decreasing the estimated value by 25%. As the value of support changes, the equilibrium probabilities of attacks will change as well.[12]

Figure 5: Value of popular support and its effects on terrorism



Notes: We increase and decrease β_i by 25% from its estimated value in Table 2 for each group. The horizontal axis is the relative popularity levels (smaller values are more favorable to Hamas) and the vertical axis is the probability of an attack. Columns correspond to which group's incentives are changing in the counterfactuals, and rows denote which group's probability of attacking is graphed. Darker lines denote stronger incentives to compete ($|\beta_i|$ increases). All other parameters are held constant at their estimated values.

[12] Multiple equilibria may exist under the estimated parameters, so we cannot just vary β_i, compute a new equilibrium, and compare choice probabilities under the old and new parameter values. Doing so would not guarantee that the new equilibrium bears any resemblance to the estimated one. That is, we want to ensure that equilibrium selection is fixed in the counterfactuals. To address this problem, we implement a version of the homotopy method from Aguirregabiria (2012) that maps equilibria as locally continuous functions of the relevant parameters.

Figure 5 presents the results, where the horizontal axis corresponds to the popularity levels and the vertical axis is the probability of an attack. The columns in the figure correspond to which actor's incentives are changing in the counterfactuals, and the rows denote which actor's equilibrium attack probability is graphed. In the Figure, β_i takes on three values representing a 25% decrease, no change, and a 25% increase in magnitude from its estimated value in Table 2. So darker lines in the figure represent stronger incentives to compete (β_i larger in magnitude), and lighter lines represent weaker incentives (β_i smaller in magnitude).

The main thing to note is that changing the value of public support has competing effects on the incidence of terrorism, and the direction of these effects depends on the identity of the group whose preferences are changing. Specifically, as Hamas values its public support more (β_H moves towards $-\infty$), both groups become more violent. This is the encouragement effect, which is expected in the outbidding literature. Groups with enhanced incentives to compete adopt a higher propensity for terrorism, thereby encouraging others to do the same to keep up in the competition.

In contrast, as Fatah's desire to outbid increases (β_F moves toward $+\infty$), both groups become *less* violent. This is the deterrent effect, which is unexpected in the outbidding literature. It arises 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 cares more about its public support, it more readily absorbs the up-front costs of terrorist attacks in order to more quickly increase public opinion levels in the future. This effects Hamas's 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.

We also repeat the same exercise for the effectiveness parameter, $\gamma_{i,1}$ and the cost of attacking, κ_i. The cost of attacking, for example, might increase or decrease as the Israeli Defense Force changes its counterterrorism polices and how much it retaliates against attacks. For each group, we increase or decrease these values by 10% from its estimated baseline while fixing the other parameters. In Appendix G, Figure G.1 presents the results for the effectiveness counterfactuals and Figure G.2 does the same for attack costs. The main takeaways match those previously discussed: 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).

Finally, one might argue that unexpected surges in public support make a group stronger in the contest of public opinion. And these swings in public support are the relevant changes in competition in the outbidding literature. We consider this approach with another set of counterfactuals in Appendix H that quantify how short- and long-term violence levels change after shocks to public opinion. We find similar results as those detailed here. When Hamas becomes more competitive in the sense that they have relatively large public support, violence increases although only Hamas becomes more likely to attack. When Fatah becomes more popular, however, violence from both groups decreases. We find that these effects persist even after several years.

7 Robustness

Measurement model. To measure the state variable, we aggregate six public opinion measures using a dynamic factor analysis. In Appendix B, we demonstrate that our latent measure of relative popularity is robust to model specification. For example, we allow for heteroskedastic variances in our indicator variables or drop the questions about vote choice in legislative elections. Across the measurement models, the state variables are highly correlated, demonstrating that our relative popularity levels are picking up meaningful variation over time.

First-stage results. The first-stage models presented in Table 1 show how effective attacks by Fatah and Hamas are at shifting relative popularity between the two groups. However, these relationship are modeled without additional control variables, which may raise concerns about spurious relationships. In Appendix C, we consider alternative specifications that include different measures of attacks along with controls for economic conditions, underlying attitudes about violence towards Israel, and an indicator for the Second *Intifada*. None of these additional controls changes the estimated effects reported in Table 1 in a meaningful way.

Sensitivity analysis. Although we incorporate first-stage uncertainty in our second-stage standard errors via Murphy and Topel (1985), our second stage results (and hence our substantive conclusions about outbidding) are sensitive to our first-stage estimates. Appendix D investigates this sensitivity by bootstrapping our first-stage analysis and then re-estimating the second-stage CMLE. The sensitivity analysis illustrates the variation in the second stage estimates under a range of plausible values of γ. The signs on the second-stage estimates never change over the course of this experiment and are always in the expected direction. Some distributions of parameter estimates have long tails, but it is always in the direction away from zero.

Time frame. It could be the case that outbidding is less relevant as Fatah moves away from violence over the last decade. Our baseline analysis considers the 1994–2018 time frame to maximize the number of observations. Appendix E presents robustness checks with three different time frames potentially representing plausible change points in the Fatah-Hamas relationship: 1994–2015, 1994–2011, and 1994–2006. These cutoffs reflect points where the groups' preferences (β and κ) may change in response to changes in the relationship between the groups. Overall the estimates are fairly constant across the different time frames. The only notable change is in Hamas's cost of terrorism, where it is half as costly if we only consider the period before the 2006 election. This reflects the fact that their use of terrorism is particularly prominent earlier in the time frame.

Discount factor. In dynamic discrete choice models, discount factors are not generally identified (Magnac and Thesmar 2002). Even with suitable exclusion restrictions, the discount factor is not guaranteed to be point-identified (Abbring and Daljord 2020). In the baseline analysis, we set $\delta = 0.999$ and estimate the remaining parameters. In Appendix F, we present the log-likelihood when we re-estimate the payoff parameters setting δ as one of 16 values in the interval $[0, 1)$. The results indicate that $\delta = 0.999$ maximizes the likelihood of the observed data. Furthermore, the estimated payoff parameters and equilibrium attack probabilities are essentially identical for $\delta \in [0.975, 0.999]$.

8 Conclusion

We argue that the relationship between intergroup competition and terrorism is not as clear cut 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 example of outbidding. To do this, we construct and estimate a new model of outbidding among the two groups. 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, 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 incentives to compete increase, equilibrium rates of violence from either group would decrease.

Our theoretical framework explains these deterrent effects through the logic of asymmetric contests. Namely, 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. 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 than Hamas. While Fatah's outside focus may be part of its peace effort, it is also associated with increased violence. 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 two 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 done to keep the model focused on the competition among 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 groups 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 initial 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.

References

Abbring, Jaap H and Øystein Daljord. 2020. "Identifying the Discount Factor in Dynamic Discrete Choice Models." *Quantitative Economics* 11(2):471–501.

Abrahms, Max. 2006. "Why Terrorism Does Not Work." *International Security* 31(2):42–78.

Abrahms, Max. 2012. "The Political Effectiveness of Terrorism Revisited." *Comparative Political Studies* 45(3):366–393.

Acharya, Avidit, Edoardo Grillo, Takuo Sugaya and Eray Turkel. 2019. "Dynamic Campaign Spending.". Unpublished manuscript. erayturkel.github.io/files/campaigns-printcopy.pdf.

Acosta, Benjamin. 2014. "Live to Win Another Day: Why Militant Organizations Survive Yet Few Succeed." *Studies in Conflict & Terrorism* 37(2):135–161.

Aguirregabiria, Victor. 2012. "A Method for Implementing Counterfactual Experiments in Models with Multiple Equilibria." *Economics Letters* 114(2):190–194.

Aguirregabiria, Victor and Pedro Mira. 2007. "Sequential Estimation of Dynamic Discrete Games." *Econometrica* 75(1):1–53.

Beber, Bernd, Philip Roessler and Alexandra Scacco. 2014. "Intergroup Violence and Political Attitudes: Evidence from a Dividing Sudan." *The Journal of Politics* 76(3):649–665.

Biberman, Yelena and Farhan Zahid. 2019. "Why Terrorists Target Children: Outbidding, Desperation, and Extremism in the Peshawar and Beslan School Massacres." *Terrorism and political violence* 31(2):169–184.

Bloom, Mia M. 2004. "Palestinian Suicide Bombing: Public Support, Market Share, and Outbidding." *Political Science Quarterly* 119(1):61–88.

Chenoweth, Erica. 2010. "Democratic Competition and Terrorist Activity." *Journal of Politics* 72(1):16–30.

Conrad, Justin and Kevin Greene. 2015. "Competition, Differentiation, and the Severity of Terrorist Attacks." *Journal of Politics* 77(2):546–561.

Conrad, Justin and William Spaniel. N.d. *Militant Competition: How Terrorists and Insurgents Advertise with Violence and How They Can Be Stopped*. Cambridge University Press.

Crenshaw, Martha. 1981. "The Causes of Terrorism." *Comparative Politics* 13(4):379–399.

Crisman-Cox, Casey and Michael Gibilisco. 2018. "Audience Costs and the Dynamics of War and Peace." *American Journal of Political Science* 62(3):566–580.

Crisman-Cox, Casey and Michael Gibilisco. 2020. "Estimating Crisis Signaling Games in International Relations: Problems and Solutions." Forthcoming at *Political Science Research and Methods*.

Cunningham, Kathleen Gallagher, Kristin M. Bakke and Lee J.M. Seymour. 2012. "Shirts Today, Skins Tomorrow: Dual Contests and the Effects of Fragmentation in Self-Determination Disputes." *Journal of Conflict Resolution* 56(1):67–93.

Dechenaux, Emmanuel, Dan Kovenock and Roman M. Sheremeta. 2015. "A Survey of Experimental Research on Contests, All-pay Auctions and Tournaments." *Experimental Economics* 18(4):609–669.

Findley, Michael G. and Joseph K. Young. 2012. "More Combatant Groups, More Terror? Empirical Tests of an Outbidding Logic." *Terrorism and Political Violence* 24(5):706–721.

Fortna, Virginia Page. 2015. "Do Terrorists Win? Rebels' Use of Terrorism and Civil War Outcomes." *International Organization* 69(3):519556.

Franke, Jörg, Wolfgang Leininger and Cédric Wasser. 2018. "Optimal Favoritism in All-pay Auctions and Lottery Contests." *European Economic Review* 104:22–37.

Getmansky, Anna and Thomas Zeitzoff. 2014. "Terrorism and Voting: The Effect of Rockets in Israeli Elections." *American Political Science Review* 108(3):588–604.

Gibilisco, Michael, Brenton Kenkel and Miguel R. Rueda. 2019. "Competition and Civilian Victimization." Unpublished manuscript. http://michaelgibilisco.com/papers/competitionVictimization.pdf.

Gould, Eric D. and Esteban F. Klor. 2010. "Does Terrorism Work?" *The Quarterly Journal of Economics* 125(4):1459–1510.

Iaryczower, Matias, Gabriel Lopez-Moctezuma and Adam Meirowitz. 2020. "Career Concerns and the Dynamics of Electoral Accountability." Unpublished manuscript. www.dropbox.com/s/4pn131nw2prnfbm/careerdynamics_may20_post.pdf.

Jaeger, David A., Esteban F. Klor, Sami H. Miaari and M. Daniele Paserman. 2015. "Can Militants Use Violence to Win Public Support? Evidence from the Second Intifada." *Journal of Conflict Resolution* 59(3):528–549.

Jerusalem Media and Communication Centre (JMCC). N.d. "Polls." Accessed November 2019 from http://www.jmcc.org/polls.aspx.

Jones, Seth G. and Martin C. Libicki. 2008. *How Terrorist Groups End: Lessons for Countering Al Qa'ida*. Santa Monica, CA: Rand.

Kalman, Matthew. 2006. "U.S. training Fatah in anti-terror tactics." *San Francisco Chronicle*. Published 14 December 2006. Accessed 22 July 2020 from https://www.sfgate.com/news/article/U-S-training-Fatah-in-anti-terror-tactics-2465370.php.

Kenkel, Brenton and Kristopher W. Ramsay. 2021. "The Effective Power of Military Coalitions: A Unified Theoretical and Empirical Model." Unpublished manuscript. https://bkenkel.com/files/structwar.pdf.

Kirkegaard, René. 2012. "Favoritism in Asymmetric contests: Head Starts and Handicaps." *Games and Economic Behavior* 76(1):226–248.

Konrad, Kai A. 2012. "Dynamic Contests and the Discouragement Effect." *Revue d'économie politique* 122(2):233–256.

Konrad, Kai A. and Dan Kovenock. 2009. "Multi-battle contests." *Games and Economic Behavior* 66(1):256–274.

Kydd, Andrew H. and Barbara F. Walter. 2006. "The Strategies of Terrorism." *International Security* .

Magnac, Thierry and David Thesmar. 2002. "Identifying Dynamic Discrete Decision Processes." *Econometrica* 70(2):801–816.

Murphy, Kevin M. and Robert H. Topel. 1985. "Estimation and Inference in Two-Step Econometric Models." *Journal of Business & Economic Statistics* 3(4):370–379.

National Consortium for the Study of Terrorism and Responses to Terrorism (START). 2019*a*. "Codebook: Inclusion Criteria and Variables." Global Terrorism Database. Accessed December 2019.

National Consortium for the Study of Terrorism and Responses to Terrorism (START). 2019*b*. "Global Terrorism Database.". Accessed December 2019 from https://www.start.umd.edu/gtd/.

Nemeth, Stephen. 2014. "The Effect of Competition on Terrorist Group Operations." *Journal of Conflict Resolution* 58(2):336–362.

Palestinian Center for Policy and Survey Research (PCPSR). N.d. "Index Survey Research." Accessed November 2019 from https://www.pcpsr.org/en/node/105.

Polo, Sara MT and Belén González. 2020. "The Power to Resist: Mobilization and the Logic of Terrorist Attacks in Civil War." *Comparative Political Studies* 53(13):2029–2060.

Rust, John. 1994. Structural Estimation of Markov Decision Processes. In *Handbook of Econometrics*, ed. Robert F Engle and Daniel L McFadden. Oxford: Elsevier pp. 3081–3143.

Siegel, Ron. 2014. "Asymmetric Contests with Head Starts and Nonmonotonic Costs." *American Economic Journal: Microeconomics* 6(3):59–105.

Signorino, Curtis. 1999. "Strategic Interaction and the Statistical Analysis of International Conflict." *American Political Science Review* 93(2).

Silvey, S. D. 1959. "The Lagrangian Multiplier Test." *The Annals of Mathematical Statistics* 30(2):389–407.

Stein, William E. 2002. "Asymmetric Rent-seeking with More than Two Contestants." *Public Choice* 113(3):325–336.

Su, Che-Lin and Kenneth L. Judd. 2012. "Constrained Optimization Approaches to Estimation of Structural Models." *Econometrica* 80(5):2213–2230.

Tauchen, George. 1986. "Finite State Markov-Chain Approximations to Univariate and Vector Autoregressions." *Economics letters* 20(2):177–181.

Tokdemir, Efe and Seden Akcinaroglu. 2016. "Reputation of Terror Groups Dataset: Measuring popularity of terror groups." *Journal of Peace Research* 53(2):268–277.

Vogt, Manuel, Kristian Skrede Gleditsch and Lars-Erik Cederman. 2021. "From Claims to Violence: Signaling, Outbidding, and Escalation." *Journal of Conflict Resolution* p. forthcoming.

Wood, Reed M. and Jacob D. Kathman. 2015. "Competing for the crown: Inter-rebel competition and civilian targeting in civil war." *Political Research Quarterly* 68(1):167–179.