Outbidding as Deterrence: Endogenous Demands in the Shadow of Group Competition

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February 23, 2016

Abstract

The theory of outbidding states that terrorist, insurgent, and rebel groups use violence to capture a greater share of their audience's resources. I argue that opponents of these groups should endogenously anticipate this dynamic, which potentially alters their aims. Although a seemingly obvious implication of outbidding is that violence increases as the number of groups (and thus competition) increases, I show that this may or may not hold once we factor in the opponent's decision. This is because the target states—fearing group competition—might endogenously reduce their demands. The results help explain empirical inconsistencies regarding outbidding. Using comparative statics from the model, I then discuss the challenges to making valid inferences regarding outbidding.

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1 Introduction

The theory of outbidding states that terrorist, insurgent, and rebel groups using violence as a perverse form of marketing to attract and maintain recruits and donations to their organizations (Crenshaw 1985; Horowitz 1985; Oots 1989; Bloom 2004; Kydd and Walter 2006; McCauley and Moskalenko 2008).[1] Such organizations need labor and funding to operate. However, such resources are scarce, meaning the manpower and funds sent to one organization must also funnel away those assets from other groups. According to outbidding theory, this competition forces organizations to commit more attacks, signal their ability as a superior organization, and receive more of these resources (Bloom 2004; Chenoweth 2010).

Recognizing that terrorism affects coercive demands (Atkinson, Sandler, and Tschirhart 1987; Lapan and Sandler 1988; Bapat 2006; Bapat 2014), I explore the broader implications of such a mechanism. To wit, consider the the incentives a target state faces in the shadow of outbidding. Issuing bold policy declarations and expanding territorial demands risks increasing the supply of terrorists. Given incentives to outbid, that state may then suffer many violent attacks. Exceptionally violent outbidding may therefore have a pacifying effect by convincing the target to moderate its aims. Thus, more groups may lead to greater deterrence and ultimately less violence. As such, I investigate which way the effect actually cuts.

To answer this question, I develop a formal model of policy demands, violent attacks, and outbidding, featuring a target state, multiple competing organizations, and a pool of citizens. The target state begins by choosing the portion of a policy space it wishes to capture. This policy may represent the extent of Israeli encroachment into Palestinian-claimed territories, American expansion into the Middle East, or a government's draconian restrictions on a minority's freedom. The state prefers capturing a larger share of the policy for itself, but it must also worry that such an extreme demand will radicalize more citizens. Upon observing the state's demand, those citizens then choose whether to lend support to the resisting groups. Afterward, the violence-producing organizations select the level of intensity of attacks to "advertise"

[1] Throughout the paper, I often discuss these groups as terrorists because the literature tends to focus on such organizations. I do not mean to imply any normative judgments by using this term. Rather, the model covers any situation in which groups use costly violence on a target as a method to increase recruitment. As mentioned, this includes insurgent and rebel groups.

their "services" to the pool of recruits.

Whether more groups implies more violence depends on a seemingly unimportant detail. Indeed, *the shape of the distribution of citizen preferences determines how the number of groups relates to violence*. If citizens grow radicalized at a sufficiently increasingly rapid rate as the state demands a greater share of the policy, the straightforward effect holds—more terrorist groups imply more terrorist attacks. However, if citizens are especially sensitive to initial encroachments, the deterrence effect dominates—more terrorist groups can counterintuitively imply *fewer* terrorist attacks.

Why is the shape of the distribution of citizen preferences pivotal? In brief, when citizens are sensitive to initial encroachments, a target state's demand becomes an all-or-nothing affair. That is, if it is worth suffering the great pain to demand the first bit of the policy in dispute, then it is worth demanding *all* of the good. Thus, the pool of support the groups draw from is either large or non-existent. The outbidding logic means that group competition drives high levels of violence in the former case, and the violence grows worse as the number of groups increases. In turn, if the number of groups crosses a critical threshold, the target state switches from demanding everything to demanding nothing. The corresponding loss of potential support reduces violence.

The model has important implications for the empirical study of outbidding. Some scholars have assumed that outbidding implies a monotonic relationship between the number of groups and observed violence (Findley and Young 2012; Stanton 2013; Fortna 2015). They then fail to uncover this relationship with large-n analysis, drawing the conclusion that the historical record is not consistent with outbidding on a broad scale. Yet other scholars (Clauset et al 2010; Nemeth 2014; Jaeger et al 2015) recover the relationship.[2] For the outbidding literature to progress, scholars ought to address the discrepancy.

By bringing the target state back into the strategic discussion, my model offers an explanation for the inconsistent empirical results. I show that assuming a positive, monotonic relationship between the number of groups and violence is unjustified. Without controls for the shape of the market of support, my model shows virtually *any* empirical result—negative, positive, non-monotonic, or zero—is consistent with outbidding. In turn, it is unclear what theoretical purpose simple controls for groups serve in regressions.

[2] See also Lawrence 2010.

The model reveals two other important findings as well. First, violence is increasing in the number of individuals wishing to join the organizations, which is in turn increasing in the target's demands. Thus, violence is correlated with allocations unfavorable to the resistance organizations. Evidence suggests this is true empirically. Previously, scholars have argued that the connection indicated that terrorism does not help groups achieve their policy goals (Abrahms 2006). My model is neutral on the effectiveness of terrorism. It does, however, indicate that the observed connection between terrorism and lack of policy concessions may be an artifact of the target believing that such violence is merely the cost of doing business. Put differently, lack of policy concessions may cause violence, not the other way around.

Second, the model contributes to a growing literature on limited war aims (Ikenberry 2009; Schultz and Goemans 2014; Coe 2015). Even after achieving complete military victory, states often concede policy objectives to the vanquished. The causes of such restraint remain under-analyzed. If one interprets my model as the beginning of post-war policy implementation, expectations of future violence from resistance groups help explain some of the variation. In particular, the implementing state is more likely to exercise restraint when the number of competing groups is high and citizens are especially sensitive to initial encroachments.

This paper proceeds as follows. I begin by developing the aforementioned model. Partial equilibrium analysis then shows that outbidding occurs endogenously. Afterward, I show how market constraints impact the state's policy decision, which leads to the ambiguous relationship between the number of groups and quantity of attacks. A discussion section compares these formal results to existing empirical results, highlighting the necessity of correct controls for proper inference, and provides guidelines for future qualitative research on outbidding. A brief conclusion finishes the paper.

2 The Model

I now turn to a stylized model to explore the interesting strategic tradeoffs between demanding greater policy concessions and provoking more violence.[3] The game has

[3] In that regard, it makes a number of simplifying assumptions to keep the substantive argument tractable. For assumptions that appear particularly problematic, I note how the results differ if they are relaxed.

complete information and consists of four phases with three groups of players: a state, a unit mass of citizens, and $n \geq 2$ competing groups. As a quick preview, the phases are:

1. The state makes a demand
2. Based on the demand, each citizen chooses whether to support a group
3. Each group chooses a level of violence
4. Based on the violence, the citizen individually chooses which group to support[4]

More thoroughly, the state begins by demanding $x \in [0, 1]$. This represents the portion of the good it consumes. One might conceptualize this as a government's extractive policy over an unrepresented group, American military coverage in the Middle East, or Israeli settlement expansion. Unlike models of crisis bargaining (Fearon 1995), an accept/reject phase does not follow the demand. Rather, I conceptualize the demand as the amount the state wishes to take after having dispatched traditional organized resistance. The only recourse individuals have is to use violence as a weapon of the weak to punish the state with costs (Pape 2003, 346). Even without a formal accept/reject phase, citizens can often deter excessive encroachment through the credible threat to commit violence.[5] All else equal, the state wishes to capture as much of the good as possible.

However, all else is not equal; larger demands increase grievances.[6] The second phase of the game features a unit mass of citizens. After the state selects its demand, each citizen decides whether to seek recruitment in an organization or remain a civilian. Citizens receive $w_i(x)$ for remaining civilians and (without loss of generality) 0 for joining a group. I conceptualize "joining a group" broadly; citizens may volunteer to become agents, donate to an organization, or provide material support. The key point

[4]The game's results are identical if the state makes a demand, the groups choose a level of violence, and the citizens conclude by deciding to support a group and selecting one at the end.

[5]Put differently, the power to hurt is a form of implicit bargaining power (Schelling 1966; Slantchev 2003).

[6]This argument is similar to the "provocation" literature (Laqueur 1987; Lake 2002; Bloom 2005, 107-110; Kydd and Walter 2006, 69-72) except that the state knowingly and willingly incites violence here as tradeoff for capturing more of the good.

is that a pool of resources becomes available that the organizations want to compete for.

The function $w_i(x)$ has many interpretations, but four seem particularly salient. First, it may represent a citizen's wage (Bueno de Mesquita 2005; Bueno de Mesquita and Dickson 2007) and general enjoyment of life; both decline as a target becomes more expansionary. Second, it captures an individual's extremist inclinations. Third, it factors in the revenge motive (Elster 2005, 241-242; Ricolfi 2005, 111), which should be increasing as the external actor entangles itself deeper into the civilians' affairs. Fourth, in the framework of terrorism-as-public-goods, the function represents the distribution of in-group altruistic preferences and willingness for self-sacrifice (Azam 2005; Pape 2005, 187-198; Elster 2005; Wintrobe 2006). While such individuals constitute a minority of any given population, a certain subset exhibits these traits (Iannaccone and Berman 2006; Berman and Laitin 2008, 1950).

The shape of $w_i(x)$ helps assist with these interpretations. Let $w_i'(x) < 0$ be strictly decreasing. In words, the more the state demands, the less attractive civilian life looks. This could be because encroachment into the population's domain risks hurting economic opportunities, killing friends and family members, and generally radicalizing citizens.[7] Note that some citizens have a particular value for x such that $w_i(x) = 0$. Put differently, a particular state demand exists that leaves citizen i indifferent between remaining a civilian and joining a group.[8]

Although these indifference points might not appear important for determining the relationship between the number of organizations and the prevalence of violence, they prove to be critical. Let $f(x)$ represent the probability density function of these indifference points. To permit greater analysis, suppose the explicit function is $f(x) = \lambda x^{\lambda-1}$, where $\lambda > 0$ is a parameter that determines its exact shape.[9] Known as a power distribution, this PDF form captures a surprisingly wide range of distributions. Figure 1

[7]Statistical evidence further indicates that more expansive foreign policy platforms (i.e., greater values of x) lead to more frequent transnational terrorism (Savun and Phillips 2009).

[8]The game treats the indifference points as complete information, though they are difficult to know in practice (Kuran 1991). Nevertheless, the complete information model is a critical first step in understanding the strategic tradeoffs between capturing more of the good and facing increased violence. Furthermore, as the propositions show later, the concavity of the distribution of these preferences drives all of the results. Thus, as long as the target state knows the concavity of the distribution, similar results would hold.

[9]Later, I discuss how these results generalize to other distribution functions.

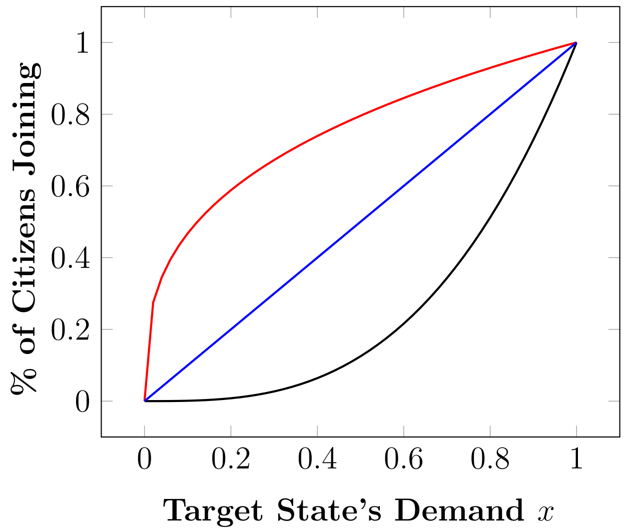

Figure 1: Example cumulative probability distributions for $\lambda < 1$ (concave), $\lambda = 1$ (linear), and $\lambda > 1$ (convex).

illustrates three such possibilities. When $\lambda = 1$, the CDF of the probability distribution is a uniform; each additional unit the state demands radicalizes the same portion of individuals. When $\lambda < 1$, the function is concave; each additional unit the state demands radicalizes decreasingly more citizens. Lastly, when $\lambda > 1$, the function is convex; each additional unit the state demands radicalizes increasingly more citizens.[10] Again, *ex ante*, the parameter λ may appear irrelevant to the research question. To the contrary, though, the results below demonstrate the presumed monotonic relationship between violence and groups requires a specific alignment of preferences.[11]

After the mass of citizens decide whether to join, the $n \geq 2$ groups compete for their membership.[12] Consistent with outbidding, each group j simultaneously selects an effort level v_j, representing an amount of violence. The individuals then choose which

[10]One interpretation of a highly concave function is that extremists feel "social solidarity" (Wintrobe 2006, 108-143), causing join decisions to accrue rapidly.

[11]The positive support on the distribution function corresponds to cases where the some segment of the population will positively support terrorist violence. Per standard outbidding theory (Bloom 2004; Brym and Araj 2008), we would not expect groups to advertise in this manner otherwise.

[12]This number is exogenous, though theoretically identical results follow if group entry were endogenous. One could imagine that each organization faces different fixed costs of entry. Because more entrants lead to more overall violence, the value an organization gains by entering approaches 0 as the number of total entrants increases. Thus, groups with higher fixed costs would stay out. In turn, one might conceptualize the game presented here as a reduced-form interaction where those entry decisions have already taken place.

group to join. For this final part, a contest success function (Hirshleifer 1991) with n players captures the probability any given citizen chooses a particular organization. Thus, for effort v_j, organization j expects to recruit

$$\frac{v_j}{v_1 + ... + v_n}$$

portion of the pool of goods.

The contest success function models two important features of competition for scarce resources. First, the more effort an individual organization exerts, the larger the portion of goods it expects to receive.[13] Second, the more effort *other* organizations exerts, the smaller the portion of goods the original organization expects to receive.[14] Put differently, more effort is beneficial for any given organization but simultaneously hurts all other organizations. This also avoids modeling recruitment as an all-pay, winner-take-all auction that does not match the empirical record given that small organizations can persist over time.[15]

As for the remaining payoffs, the state receives x, the share it demands, and pays a cost for the total amount of violence the organizations commit and the portion of recruits it radicalizes. Let $\alpha > 0$ be a scalar measuring how much the state values the good versus the pain it suffers from violence and $F(x)$ be the cumulative distribution function of $f(x)$.[16] In turn, the formal utility expression is:

$$x - \alpha \left[\sum_{j=1}^{n} v_j + F(x) \right]$$

[13]That is, $\frac{v_j}{v_1+...+v_n}$ is increasing in v_j.

[14]That is, $\frac{v_j}{v_1+...+v_n}$ is decreasing in all v_{-j}.

[15]In this way, groups are perfectly substitutable. Thus, citizens condition support decisions entirely on violence. See Kaplan 2015 for a discussion of outbidding among groups with differing ideological orientation. Results would hold if certain groups received a larger share of the ratio per unit of violence created.

[16]Recall that the distribution function $F(x)$ mapped into a portion of individuals who lend support to an organization. Thus, the scalar α implicitly reflects the overall size of individuals willing to join organizations, which depends on citizen sympathy toward the enterprize. The outbidding literature sees this as necessary for the mechanism to apply (Bloom 2004; Kaplan 2015). One might imagine an alternative payoff specification in which the state weighs the cost of outbidding violence and total group membership differently. The results below are theoretically identical, so I use one scalar for the sake of parsimony.

For convenience, I assume that all the organizations are equal in their initial outlays.[17] They care about the amount of total recruits they receive and pay for their effort. This cost may arise due to the expenses necessary to commit an attack and the risk of retribution from the target.[18] As standard with contests success functions, assume that this cost equals the amount of violence committed v_j. As such, j's overall utility equals:

$$F(x)\frac{v_j}{v_1 + ... + v_n} - v_j$$

3 Partial Equilibrium Analysis: Outbidding between Groups

This is an extensive form game with complete information, so subgame perfect equilibrium is the appropriate solution concept. While the overall interaction involves the decisions of the state and individuals who choose to join the organization, the game featuring the n organizations is interesting in its own right. Since the solution to this portion of the game is necessary to solve for the overall subgame perfect equilibrium, I start at this point.

Proposition 1 gives the equilibrium strategies of the organizations:

Proposition 1. *In all SPE, each organization i selects violence level* $v_j^* = \frac{F(x)(n-1)}{n^2}$.

I provide full proofs of all formal claims in the appendix. Here, however, the following comparative static helps provide intuition for Proposition 1:

Remark 1. *The quantity of violence is increasing in the number of individuals seeking membership. Thus, the quantity of violence is increasing in the size of the state's demands.*

Organizations face a tradeoff between capturing larger recruitment shares and minimizing their operating costs. When the market for recruits is small (i.e., when $F(x)$ is

[17] Relaxing this assumption would not alter the theoretical insights I present here.

[18] Although groups may wish to commit violence for violence's sake, one may alternatively interpret these costs as the additional (unnecessary) risks groups incur in a rush to compete for resources. Berman (2009, 14) argues that these risks sometimes destroy an entire organization, helping explain why only 40 or so groups exist today despite low economic barriers to entry.

close to 0), any one organization has little incentive to invest heavily in advertising. In contrast, when the market for recruits is enormous (i.e., when $F(x)$ is close to 1), each unit of effort brings back a larger return, holding all other decisions constant. But all other organizations face the identical incentive. Consequently, they all increase their levels of violence, compounding the effect across all the groups.[19]

These market incentives give the state a troublesome tradeoff later—the state would like to capture more of the good, but doing so guarantees more attacks on it. Yet Remark 1 also demonstrates the challenges of inferring group success based on the amount of violence observed and the level of violence the target suffers. Abrahms (2006), for example, notes that foreign organizations achieve their policy objectives a remarkably low percentage of the time. He argues that this finding suggests that "the poor success rate is inherent to the tactic of terrorism itself" (Abrahms 2006, 43-44). That is, such violence *causes* policy outcomes unfavorable to the audiences of terrorist organizations.

Whether terrorism is a useful coercive tactic is beyond the scope of my model.[20] However, the model gives an alternative explanation for such an empirical correlation: policy outcomes extremely unfavorable to an audience result in greater levels of violence. That is, the causal relationship may flow in the opposite direction. If the optimal demand x is high—which I show below is sometimes the case—forward looking targets understand that onerous policy demands will result in such high levels of violence. They nevertheless take a large portion of the good because its marginal value exceeds the marginal increase in violence. Terrorist violence may prove expensive, but sometimes states are willing to suffer those costs to achieve policy goals.

The next remark shows that the outbidding mechanism arises endogenously in this model:

Remark 2. *(Endogenous Outbidding) Holding fixed the size of the market, the quantity of violence is increasing in the number of groups.*

In particular, the appendix shows that the groups in total commit $F(x)(1 - \frac{1}{n})$ quantity of violence, which is increasing in n.

[19]As a result, public support is partially endogenized in this model. Usually, outbidding scholars preface their theories by stating that they ought to only apply when the public is receptive to attacks (Bloom 2004). But note that whether the public is receptive of the attacks is itself a function of the initial demands made by the target state.

[20]Others (Dershowitz 2002; Pape 2003) argue for its effectiveness.

A simple intuition makes sense of this result. If a single organization exists, it need not commit costly violence to compete for resources. Consequently, it can reap all the profits without paying any advertising costs. With two groups, the organizations must compete for resources. Nevertheless, some profits still remain, as the marginal value of a group's advertisements is decreasing. Maintaining these levels of profits with three groups proves impossible, though, as the third group would want to exert some effort and capture some of the remaining surplus. Thus, while each group's individual effort decreases, the total effort increases. These principles hold true as n increases, as Remark 2 claimed.

Remark 2's result is critical for the discussion moving forward. It shows that competition matters in this model in the manner that the outbidding literature has previously expressed. That is, it takes theory seriously. Yet the results below show that more groups might not ultimately imply more violence despite the incentives for competition.

4 Why the Shape of Aggregate Citizen Preferences Matters

Now consider the state's demand. As previewed above, the state wishes to capture as much of the good as it can, subject to the costs it suffers from attacks and radicalization from the population. The decision for the mass of citizens is trivial—those for whom $w_i(x) > 0$ join and those for whom $w_i(x) < 0$ do not.[21] From there, because the game has complete information and occurs sequentially, the state also anticipates suffering $F(x)\left(1 - \frac{1}{n}\right)$ in violence. Conveniently, the state can calculate this for each possible value x it could choose. Combining this with the value it receives for capturing the good, the cost of increased membership, and a scalar differentiating the value of the two, the state's objective function is:

$$x - \alpha \left[F(x) \left(1 - \frac{1}{n}\right) + F(x) \right]$$

Let $x^* = \left(\frac{1}{\alpha\lambda\left(2 - \frac{1}{n}\right)} \right)^{\frac{1}{\lambda - 1}}$. This is sufficient for the next proposition:

[21] Because the citizens are a continuum and $f(x)$ is atomless, the case where $w_i(x) = 0$ is immaterial.

Proposition 2. *Suppose $\lambda > 1$. The game has a unique SPE. In it, the state demands the minimum of x^* and 1.*

Here, the intuition is straightforward. Recall the concave PDF in Figure 1, which corresponds to the case where $\lambda > 1$. Capturing small values of x induces few individuals to join the organization. Thus, organizations have little incentive to advertise through attacks. Facing only minor resistance initially, the state should demand *something*. However, the rate of radicalization eventually becomes large, yielding more recruitment and greater advertisement. This effect decreases the marginal value of demanding more. Note that if α is sufficiently small—that is, the state cares about violence relatively little compared to the good—the marginal value for demanding more may never turn negative. In that case, the state demands everything. Otherwise, it cuts off its demand at the point where the marginal value turns negative.

Perhaps unexpectedly, these results do not carry over to situations in which $\lambda < 1$:

Proposition 3. *Suppose $\lambda < 1$. The game has a unique SPE. If $\alpha < \frac{1}{2-\frac{1}{n}}$, the state demands 1. If $\alpha > \frac{1}{2-\frac{1}{n}}$, the state demands 0.*

Put differently, the state makes the demand an all-or-nothing affair when $\lambda < 1$; it will never capture a middling amount as it might when $\lambda > 1$.

Why is there such a stark contrast between Propositions 2 and 3? Consider the state's decision to increase its demand from none of the good to an arbitrarily small portion. Doing so induces more citizens to join a group and in turn increases the outbidding violence. Recalling back to Figure 1, the marginal difference between 0 and that arbitrarily small portion is also vanishingly small when $\lambda > 1$. Only later in the distribution does taking an additional fixed unit substantially alter the recruitment patterns. Thus, the state keeps demanding more until it reaches the point where the marginal recruitment and outbidding violence costs exceed the marginal value of the amount captured.

In contrast, when $\lambda < 1$, increasing the state's demand from 0 to an arbitrarily small amount has a disproportionately significant effect on recruitment; demanding each additional unit of the good results in less radicalization than taking the first portion does. As such, if demanding that first amount proves worthwhile, demanding *all* additional units of the good must be worthwhile as well. In turn, the state merely needs to check whether taking nothing is better than demanding everything and suffering the consequences. The cutpoint $\alpha < \frac{1}{2-\frac{1}{n}}$ determines which is optimal.

5 Deterrence, Violence, and Group Size

Having solved the model, I now turn to its comparative statics. To begin, consider how the state's demand changes as a function of the number of groups:

Remark 3. *(Credible Deterrence) The state's demand is weakly decreasing in the number of competing groups. In turn, group surplus is weakly decreasing in the number of organizations but citizen welfare is weakly increasing.*

Given that this is a model of competitive organizational advertising, it might not be surprising that the overall group surplus decreases as the number of organizations increase. Similar to competitive Cournot markets where additional firms push equilibrium quantities below the monopoly quantity, Remark 1 says that adding another group forces the overall violence to increase. In turn, increasing the number of organizations slowly eradicates all of the surplus.

However, competition is only part of the story. Organizations also suffer due to the state's endogenous response to potential outbidding. Internalizing additional attacks with more organizations present, the state reduces its demands. In turn, fewer individuals wish to provide resistance, leaving organizations with a smaller pool of potential recruits and less funding. Many scholars have noted terrorists' desire to provoke an overreaction from their targets, thereby polarizing moderates and convincing them to lend their support (Mishal and Sela 2000; Zirakzadeh 2000; Rosendorff and Sandler 2004; Bueno de Mesquita and Dickson 2007). Given that the deterrence effect would ordinarily lead to less support for terrorism, the model suggests that the incentives to provoke are the strongest when more groups exist.

Although the groups collectively lose out as they become more numerous, citizens who choose not to join a group collectively benefit. Recall that conditional on remaining a civilian, each strictly prefers the state demand a smaller amount of the good. But having more groups creates a deterrent effect on the target state, leading it to temper its demands. Thus, all civilians benefit from the credible threat to use violence—even if outbidding is ultimately costly to the organizations.[22]

It is worth emphasizing that the state's limited aims are not the result of some bargaining process.[23] In the standard bargaining model of war setup (Fearon 1995), states with all of the proposal power ask for less than their ideal policy outcome because the opponent can implement a less favorable outcome via war. Here, the state faces no such rejection constraint; if the state wants to capture the entire policy good, it may. But the model illustrates that states sometimes wish to limit their share in the dictator game, recognizing that the cost of violence may exceed the marginal value of an additional portion of the policy good. In practice, this effect may reverberate; Schultz and Goemans (2014) demonstrate that these ultimate goals affect crisis bargaining decisions. Future research could exploit variation in competing groups to explore these theories empirically.

The above welfare analysis does not yet answer how the levels of violence—an important comparative static and often a key dependent variable in empirical work—changes with the number of groups. The following two remarks address this question, separating the parameter space by λ:

Remark 4. *If λ is sufficiently high (i.e., $\lambda > 2 - \frac{1}{n}$), equilibrium violence is weakly increasing in n. If λ falls in a middle range (i.e., $\lambda \in (1, 2 - \frac{1}{n})$), equilibrium violence has a nonmonotonic relationship with n.*

Put differently, the first part of Remark 4 says when the cumulative distribution function of citizen turning points has a strong convex shape (like the black line in Figure 1), outbidding works as commonly understood: more groups imply more violence. The intuition is as follows. Per Proposition 2, when $1 < x^*$, the state simply demands the entire good. Thus, the outbidding subgame entirely determines the level of violence. Because more groups creates more competition and less surplus, the amount of violence is increasing in that case. As Figure 2 illustrates, though, the marginal effect of each

[22] This reveals a deeper credibility issue that the citizens face. Citizens would collectively benefit if they could threaten to join an organization regardless of whether their demands are met. If the target state believed those threats, it would further recede its demands, as violence is increasing in the number of citizens providing support (Remark 1). All citizens would benefit. However, such threats are not inherently credible—the only citizens that join are those for which $w_i(x) < 0$.

[23] Cunningham (2011), for example, finds that states are more likely to grant self-determination when facing divided movements than united fronts because concessions can strengthen the target's preferred faction. My model highlights an alternative mechanism, namely that increased competition disincentivizes larger claims.

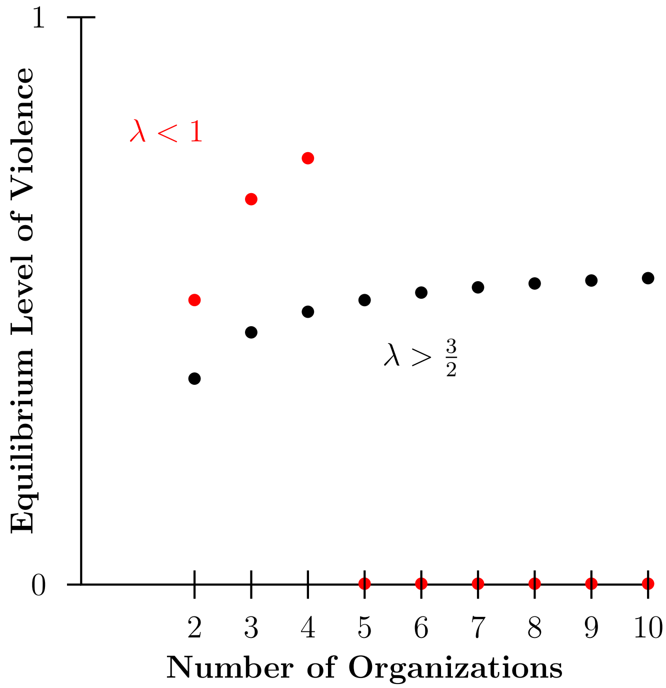

Figure 2: Equilibrium levels of violence as a function of the number of groups and the shape of the ideological distribution of the citizens. Note violence is strictly increasing in n for $\lambda > \frac{3}{2}$. However, a critical threshold exists when $\lambda < 1$. Below that threshold, violence increases in n; after that threshold, equilibrium violence drops precipitously.

additional organization is decreasing. This is worth noting because the typical "group" variable in empirical research is a simple count. Conditional on the monotonic effect, the model indicates that the count variable requires a transformation; a logarithm or square root more closely resembles the proper shape.

On the other hand, suppose $x^* < 1$. As explained in the discussion of Remark 3, the state decreases its demand as n increases here, leading to fewer individuals wishing to join the group. Nevertheless—and perhaps surprisingly—violence still increases in n. Although the outbidding threat deters the state from taking more of the good, the additional violence in the competition subgame overwhelms the pacifying effect of the smaller demand. The black dots in Figure 2 illustrate this relationship.

The results are not as straightforward when λ is not as convex, i.e., when $\lambda \in (1, 2-\frac{1}{n})$. In this case, the slight convexity means that the first few groups lead the state to reduce its demands, but not by much. In turn, the outbidding effect predominates initially, causing equilibrium violence to increase. Eventually, however, increasing the number of groups makes the state trop its demands more precipitously, leading to declining violence and a nonmonotonic effect overall. Because the lowest value n can take is 2, note that $\lambda > \frac{3}{2}$ ensures that the relationship is monotonic throughout.

Interestingly, the results grow further complicated when $\lambda < 1$:

Remark 5. *For $\lambda < 1$, if the state is sufficiently sensitive to violence, equilibrium violence drops to 0 for sufficiently large n.*

Put differently, when the cumulative distribution function of citizen turning points is concave (like the function of the red line in Figure 1), the conventional wisdom on outbidding no longer holds; violence only increases in the number of groups to a point, at which it drops off precipitously. The key is understanding the two cases from Proposition 3. Recall that when $\lambda < 1$, the state adopts a "go big or go home" strategy—it either demands everything or it demands nothing. This is because a demand slightly greater than 0 corresponds to a high jump in individuals volunteering. However, any demand slightly greater than that increases the number of volunteers at a smaller rate. Thus, if the state is willing to demand any positive amount, it ought to go all the way to 1.

The costs incurred through violence determines the state's choice between 0 and 1. When the cost is low, demanding 1 is optimal; when the cost is high, sticking to the safe 0 amount is preferable. Of course, the number of organizations determines the extent of violence. In turn, increasing the number of organizations convinces the state to switch from 1 to 0, leading to a decrease in violence.

Figure 2 illustrates these results. The red dots correspond to the equilibrium violence when $\lambda < 1$ as a function of the number of organizations. Below the critical threshold, the state demands all of the good. Equilibrium violence is therefore increasing in the number of groups, as the total demanded remains constant but the outbidding incentives magnify. However, once n exceeds the threshold, the state switches to demanding none of the good at all. The organizations have no incentive to outbid, and thus equilibrium violence drops off entirely.

Before moving on, a couple of notes are in order about the generality of the results in Figure 2. First, the concavity of the cumulative distribution function drives the drop off. If a segment of a cumulative distribution function is concave and the state optimally chooses a demand within that range, it will select one of the end points. Thus, the drop off is not a consequence of this particular family of probability distributions I analyze.

Second, the reason levels of violence remain constant at 0 for high values of n when $\lambda < 1$ is because $F(0) = 0$ for the probability distributions I analyze. One may alternatively suppose that a fixed portion of individuals prefer to join an organization regardless of the state's demand. Here, even if the state optimally chooses 0, the organizations have incentive to outbid one another. In turn, the function would maintain the precipitous drop off but would rise once more immediately afterward.

6 Implications and Challenges for Empirical Outbidding Research

Although the higher-order strategic effects of outbidding are interesting from a theoretical perspective alone, the model's results also have important empirical implications. In particular, a commonly-held implication of outbidding is that increasing competition leads to more violence. For example, Findley and Young (2012, 708) state that "The greater the number of opposition groups, the more likely any terrorist acts will occur during armed conflict." Stanton (2013, 1014) claims that "outbidding arguments predict that terrorism is more likely in conflicts involving multiple rebel groups." Nemeth (2014, 3453) argues that "Groups in competitive and favorable environments will commit more terrorist acts than groups in noncompetitive and nonfavorable environments." And Fortna (2015, 15) posits that "The outbidding argument suggests that terrorism is more likely when there are several rebel groups active as part of the same struggle."

Each of these scholars then operationalizes group competition and tests whether the presumed outbidding effect holds.[24] Their results are mixed. Nemeth finds evidence to support the hypothesis, though the connection intuitively hinges on whether the audience will respond favorably to violence. Stanton and Fortna find no results. Findley and Young make a stronger claim, centering their argument on the null hypothesis, ultimately concluding that their results "clearly suggest that the outbidding argument may not be generalizable to a wide variety of countries and conflicts" (719).

[24] The operationalization varies from paper to paper. Stanton and Fortna both use dummy variables. Nemeth uses a firm concentration index from Herfindahl 1950 and Hirschman 1945. Findley and Young use a variety of measures, a necessary task to persuasively argue for a null hypothesis.

More than a decade has passed since Bloom's work revitalized interest in outbidding. For the literature to mature and for knowledge to accumulate, we need to reconcile the discrepancies in these empirical results. The model provides an explanation: the relationship between the number of groups and levels of violence can go either way depending on the shape of the distribution function determining recruitment. In that light, it is unsurprising to see different empirical results depending on the research design. Consequently, Findley and Young's claim that their empirical results fail to support the outbidding hypothesis overlooks how the initial demands complicate the association. Indeed, *any* relationship—positive, negative, nonmonotonic, or none—is consistent with the theory.[25]

If simple counts of competing groups is insufficient to recover the correct relationship, then what is? Unfortunately, finding a solution is a challenging task. But Findley and Young provide some insight. They note that "It may also be the case that there are heterogeneous dynamics at work in which the number of groups increases terrorism in some countries such as Israel, but decreases it in others" (719). The model supports this assertion. In *some* cases, violence increases in group size. True to that, they find that the predicted relationship holds with attacks on Israel.

More specifically, per Remark 4, the model shows that the straightforward relationship holds when $\lambda > \frac{3}{2}$. Thus, to properly test the above hypotheses, one could gather data on the shape of the recruitment curves. Following that, a model that subsets the data exclusively on cases where $\lambda > \frac{3}{2}$ would recover the appropriate relationship between the number of groups and violence. Of course, the devil is in the details—developing measures of supply curves requires a significant effort even with vast amounts of data.

One temptation may therefore be to use state fixed effects. Fixed effects are useful when unobservable characteristics of a unit remain unchanging over time and correlate with the dependent variable at hand. Thus, if the recruitment supply curves remain constant over time, fixed effects may appear to provide a solution to test the relationship between the number of groups and violence, even if they cannot test whether λ holds in the expected manner.

[25] In this light, it is unclear exactly what the number of groups controls. Without any additional manipulation, the only monotonic relationship n has is with demand sizes—larger values for n imply weakly smaller demands from the state no matter the value of λ.

Again, though, the solution is not that simple. Fixed effects only add (or subtract) an amount to the estimates for all observations of their respective countries. Thus, a fixed effect is the portion of the dependent variable attributable to being a part of that unit—which might include latent conflict, wealth, opportunity, and a supply curve. However, the model demonstrates that the supply curve matters insofar as it relates to the number of groups. As such, the appropriate statistical solution is to subset the data or use an interaction term. This is infeasible with fixed effects for two reasons. First, the large quantity of interaction terms would prevent cross-country analysis, which is a key motivator for the large-n empirical studies in the first place (Findley and Young 2012). Second, the interaction would also absorb any country-specific characteristics that remain constant over time. We would therefore be unable to adequately differentiate whether the estimates are the result of the supply curve's interactive effect with violence or some other unobserved characteristic.

One alternative approach Findley and Young take is to subset on instances with violence. At first, this strategy appears to recover the data generating process. After all, in Figure 2, all sections of the parameter space that result in violence see the quantity increase in the number of groups. This relationship fails then violence discontinuously drops, but it would appear that those cases would not enter into the data due to the subsetting.

Unfortunately, as previewed above, the apparent insight is an artifact of the cumulative distribution function I used here. Specifically, $F(0) = 0$ in the model, meaning that a complete concession from the state would lead to no supply of recruits. In turn, no violence occurs because the organizations have nothing to outbid each other over. Nevertheless, one might alternatively assume that $F(0)$ equals some positive amount, meaning that a certain segment will always wish to join an organization no matter how the state behaves. The precipitous drop off can still happen in this case. However, because some citizens still join, the groups have something to outbid each other over. In turn, the amount of violence begins increasing again after the heavy drop. But this means that the discontinuous drop would occur in data subsetted on observed violence, again meaning that such an empirical model would be unable to recover the correct relationship.

Ultimately, this may be a direction for future qualitative research in outbidding theory. Now that the model has revealed that the shape of distribution matters, qualitative scholars may wish to reinvestigate cases where the outbidding mechanism came into play to then back out what caused the curve to take a particular shape. Building on that theory, quantitative scholars may then find the appropriate proxy variables to demonstrate the relationship at a larger level.

One promising possible determinant of λ is foreign intervention. For example, consider the origins of discontent in Lebanon prior to the 1983 Beirut barrack bombings. Colin Powell, who was as assistant to Defense Secretary Caspar Weinberger at the time, wrote in retrospect that U.S. operations against Shiite targets led that audience to "assume...the American 'referee' had taken sides" (Powell and Perscio 1996, 291). In effect, by taking one step into the fray, Washington had mobilized a large segment of the population against it. This is like having a recruitment curve with concave shape, like red curve from Figure 1. That is, the initial incursion leads to a sharp increase in initial recruitment.

That said, a complete understanding of this phenomenon requires solving the-dog-that-didn't-bark problem. Due to the attention that 305 casualties brings, there is a wealth of information that scholars can use to trace the Reagan administration's decision making process following the barrack bombings. However, when the deterrent effect is at its strongest, potential targets of terrorist attacks withdraw from the situation before any violence can take place. In turn, historians and political scientists have had less incentive to focus on such cases. Of course, even if they had, primary source materials would be lacking because it takes less time and fewer meetings to decide *not* to engage then to plan and strategize once violence is ongoing. This all indicates that researchers ought to think about outbidding more holistically.

7 Conclusion

Does outbidding deter aggressive demands? This paper investigated a target state's demand decision in the shadow of intergroup competition for scarce terrorist resources. Fearing that especially large demands will lead to a greater supply of terrorist recruits and greater competition for them, target states endogenously limit their aims. Further, they demand less as the number of groups—and thus the incentives to compete—grows.

The deterrence effect leads to unexpected results regarding the overall relationship between the number of groups and violence. Whereas researchers have traditionally assumed that outbidding implies that more groups yield more violence, the deterrence effect sometimes dominates. Increasing groups can therefore lead to a sharp drop off in the quantity of violence. Formal analysis indicates that the convexity of terrorist supply curves entirely determines whether the expected effect holds. These results help illustrate the utility of formal theory, as it is unclear *ex ante* why the convexity of that function would matter for empirical implications of the outbidding theory.

This model was also the first step in thinking about second-order effects of outbidding. The literature on outbidding is maturing. Future research then ought to slowly move beyond providing microfoundational or empirical support and advance to asking how states, terrorist groups, and other actors strategically respond to the outbidding incentives. The contest model introduced in the paper—which endogenously supports the notion of outbidding—provides a useful baseline to expand on. Such research would yield new testable hypotheses, which could provide further empirical support outbidding from another angle.

8 Appendix

This section gives full proofs for claims not previously shown.

8.1 Proof of Proposition 1

Previous moves from the external actor and individuals have determined that $F(x)$ of those individuals comprise the market. Each organization j therefore has an objective function of:

$$F(x)\frac{v_j}{v_1 + ... + v_n} - v_j$$

In words, group j earns a share of the $F(x)$ number of individuals equal to the percentage of all effort $\frac{v_j}{v_1+...+v_n}$ it exerts. It must also pay for its own effort.

Taking the first order condition of this objective function yields:

$$F(x)\frac{v_1 + ... + v_n - v_j}{(v_1 + ... + v_n)^2} - 1 = 0$$

Since the interaction contains n organizations, there are n such first order conditions.

Substituting $v_j = v_{-j}$ into the above first order condition yields:

$$F(x)\frac{(n-1)v_j}{(nv_j)^2} - 1 = 0$$

$$v_j^* = \frac{F(x)(n-1)}{n^2}$$

The second order condition is fulfilled because the second derivative of the objective function is:

$$\frac{-(v_1 + ... + v_n - v_j) * 2(v_1 + ... + v_n)}{(v_1 + ... + v_n)^4}$$

Thus, each organization commits to $\frac{F(x)(n-1)}{n^2}$ quantity of violence. □

8.2 Proof of Remark 1

Proof. For the first sentence of Remark 1, per Proposition 1, each group commits to $\frac{F(x)(n-1)}{n^2}$ violence. The derivative of this with respect to x equals $\frac{f(x)(n-1)}{n^2}$. This is strictly positive, so increasing the number of citizens supporting the competing groups (i.e., increasing $F(x)$) increases violence. The second sentence of the remark is a simple extension of the first, noting that $F(x)$ is increasing in x. □

8.3 Proof of Remark 2

Proof. Per Proposition 1, each group commits to $\frac{F(x)(n-1)}{n^2}$ violence. There are n such groups. Therefore, the total amount of violence across all groups equals:

$$\frac{nF(x)(n-1)}{n^2}$$

$$F(x)\left(1 - \frac{1}{n}\right)$$

The first derivative of this with respect to n is positive. Therefore, the equilibrium level of violence is increasing in n holding fixed the size of the market. □

8.4 Proof of Proposition 2

Proof. The derivative of the state's above objective function is:

$$1 - f(x)(\alpha)\left(2 - \frac{1}{n}\right)$$

Setting this equal to 0, substituting the functional form of $f(x)$, and solving for x yields x^*.[26] Because $x \in [0, 1]$, the most the state can possibly take is 1. Thus, the state demands the minimum of x^* and 1. □

8.5 Proof of Proposition 3

The proof follows from the same setup as Proposition 2. The state's objective function remains the same. Thus, the objective function's critical point is identical. However, because $\lambda < 1$, the second derivative is positive, meaning that the critical point is now a *minimum*. In turn, the state's optimal demand must be on a corner. Using the objective function, demanding 1 is better than demanding 0 if:

$$1 - \alpha\left[(1)\left(1 - \frac{1}{n} + 1\right)\right] > 0$$

$$\alpha < \frac{1}{2 - \frac{1}{n}}$$

This generates the cutpoints in Proposition 3. □

8.6 Proof of Remark 3

For clarity, I split this proof into three parts.

8.6.1 Demands are weakly decreasing in the number of terrorist organizations.

First, consider the case when $\lambda < 1$. The state demands either 0 or 1 here, so proving the claim only requires showing that increasing n cannot lead to a switch from demanding 0 to demanding 1. Recall from Proposition 3 that the state demands 0 if $\alpha > \frac{1}{2-\frac{1}{n}}$.

[26] This is a maximizer because second derivative equals $-\alpha\lambda(\lambda - 1)\left(2 - \frac{1}{n}\right)x^{\lambda-2}$, which is strictly negative for $\lambda > 1$.

Increasing n monotonically increases the right side of the inequality. Since α must be greater than the right side to lead to an increase in demands, increasing n cannot cause this to happen. It can, however, cause the state to switch from demanding 1 to demanding 0.

Now suppose $\lambda > 1$. Here, the optimal demand is 0 if $x^* < 0$ the minimum of x^* and 1 otherwise. Recall that $x^* = \left(\frac{1}{\alpha\lambda\frac{1}{n}}\right)^{\frac{1}{\lambda-1}}$. This is also decreasing in n. Thus, if $x^* > 1$, increasing n has no effect on the demand. That said, increasing n enough can push x^* below 1. If $x^* \in (0, 1)$, the demand is trivially decreasing because x^* is decreasing in n. Once more, increasing n enough can push x^* below 0. In this case, increasing n further has no effect on the state's demand. □

8.6.2 Terrorist organizational surplus is weakly decreasing in the number of organizations.

Recall that an individual organization j's objective function is $F(x)\frac{v_j}{v_1+...+v_n} - v_j$. Thus, the sum of all groups utilities equals:

$$F(x) - \sum_{j=1}^{n} v_j$$

Substituting x^* and v^* gives:

$$F(x^*)\left(\frac{v_1 + ... + v_n}{v_1 + ... + v_n}\right) - F(x^*)\left(1 - \frac{1}{n}\right)$$

$$\frac{F(x^*)}{n}$$

We have two cases to consider: $\lambda > 1$ and $\lambda < 1$. First, suppose $\lambda > 1$. Proposition 2 says that the state demands the minimum of $x^* = \left(\frac{1}{\alpha\lambda\left(2-\frac{1}{n}\right)}\right)^{\frac{1}{\lambda-1}}$ and 1 if $x^* > 0$ and 0 otherwise.

Per the above, increasing n can move the optimal demand from 1 to x^* to 0. So suppose the optimal demand equals 1. Then the sum of utilities is simply $\frac{1}{n}$, which is decreasing in n.

Now suppose that increasing n shifts the optimal demand to x^*. Because $F(x)$ is decreasing in x, $\frac{F(x^*)}{n}$ is less than $\frac{1}{n}$.

To see whether the surplus is decreasing within the interval, first note that x^* is itself a function of n. Thus, the surplus function equals:

$$\frac{\left(\left(\frac{1}{\alpha\lambda\left(2-\frac{1}{n}\right)}\right)^{\frac{1}{\lambda-1}}\right)^{\lambda}}{n}$$

Taking the derivative of this value with respect to n yields:

$$-\frac{\left(\frac{1}{\alpha\lambda\left(2-\frac{1}{n}\right)}\right)^{\frac{\lambda}{\lambda-1}-1}}{\alpha n^3(\lambda-1)\left(2-\frac{1}{n}\right)^2}-\frac{\left(\frac{1}{\alpha\lambda\left(2-\frac{1}{n}\right)}\right)^{\frac{\lambda}{\lambda-1}}}{n^2}$$

Because $\lambda > 1$ in this case, each of the segments is negative. Thus, the derivative overall is always negative. In turn, increasing the number of terrorist groups decreases collective terrorist surplus on this interval.

Finally, decreasing n further can shift the optimal demand to 0. Now the surplus equals 0 because no one recruits wish to join the organizations. This is less than the positive amount it was for x^* and is unchanging as n increases further.

The remaining case is when $\lambda < 1$. This is simple, however. The optimal demand is either 1 or 0. If it is 1, the surplus equals $\frac{1}{n}$ like before. Increasing n decreases the surplus and also potentially shifts the optimal demand to 0. When that demand is 0, the surplus equals 0 and is unchanging. □

8.6.3 Citizen welfare is weakly increasing in the number of organizations.

Recall that citizens' welfare depends on the demand. From above, that demand is decreasing in n. The shape of citizen preferences $w_i(x)$ dictates that a decrease in the demand will convince all citizens who preferred remaining civilians to continue remaining civilians. Some portion, however, switch from civilians to recruits. Those who remain recruits receive a flat 0 and find their welfare unchanging. Those that switch do so because the utility for becoming civilians has exceeded the value for becoming recruits, so their welfare increases. Lastly, those who remain civilians regardless receive a payoff of $w_i(x)$. Recalling that $w_i(x)$ is strictly decreasing in x, their payoffs necessarily improve. □

8.7 Proof of Remark 4

From above, increasing n shrinks the state's demand from 1 to x^* to 0. Further, because equilibrium violence is continuous at 0 and 1, we only need to investigate how the relationship changes within the intervals. In the 1 region, equilibrium violence simply equals $1 - \frac{1}{n}$, which is clearly increasing in n.

In the x^* region, recall that equilibrium violence is:

$$F(x^*)\left(1 - \frac{1}{n}\right)$$

$$\left(\frac{1}{\alpha\lambda\left(2 - \frac{1}{n}\right)}\right)^{\frac{\lambda}{\lambda-1}}\left(1 - \frac{1}{n}\right)$$

Taking the derivative with respect to n yields:

$$-\frac{\left(\frac{1}{\alpha\lambda\left(2-\frac{1}{n}\right)}\right)^{\frac{\lambda}{\lambda-1}-1}}{\alpha n^2(\lambda-1)\left(2-\frac{1}{n}\right)^2} + \frac{\left(\frac{1}{\alpha\lambda\left(2-\frac{1}{n}\right)}\right)^{\frac{\lambda}{\lambda-1}-1}}{\alpha n^3(\lambda-1)\left(2-\frac{1}{n}\right)^2} + \frac{\left(\frac{1}{\alpha\lambda\left(2-\frac{1}{n}\right)}\right)^{\frac{\lambda}{\lambda-1}}}{n^2}$$

By what can only be described as a miracle of algebraic manipulation, this value is positive if $\lambda > 2 - \frac{1}{n}$ and negative if $\lambda < 2 - \frac{1}{n}$. Thus, violence is increasing in n when $\lambda > 2 - \frac{1}{n}$ and decreasing in n when $\lambda < 2 - \frac{1}{n}$. Further, note that sufficiently large values of λ guarantee that the function is decreasing in n over the entire domain. Yet when λ is small, violence increases for the initial groups before eventually switching to decreasing.

Lastly, when the state demands 0, equilibrium violence remains constant at 0, explaining why the relationship is weak. $\square$

8.8 Proof of Remark 5

Recall that if $\lambda < 1$, the state demands 1 if $\alpha < \frac{1}{2-\frac{1}{n}}$ and 0 otherwise. Note that even as n approaches infinity, the right side never exceeds $\frac{1}{2}$. Thus, the cutpoint holds regardless of the specific value of n if $\alpha < \frac{1}{2}$. Under these conditions, the state demands 1 regardless of n, and so violence is increasing in n. This is why Remark 5 requires the state to be sufficiently sensitive to terrorism.

Now suppose $\alpha > \frac{1}{2}$. Rewriting the cutpoint as a function of n yields:

Note that $\frac{1}{2-\frac{1}{n}}$ is increasing in n. Therefore, there exists

$$n < \frac{\alpha}{2\alpha - 1}$$

Consequently, there exists a critical value for which the state demands 0 for n greater than that value.[27] At those values, equilibrium violence equals 0. $\square$

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[27] Note that if $\alpha > \frac{2}{3}$, the state demands 0 for all values of n.

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