
# Organizational Structure and the Effects of Targeting Terrorist Leadership

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**Working Paper 09**
April 2011

**centre for security and defence studies**
**norman paterson school of international affairs**
**carleton university | ottawa, canada**

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# Organizational Structure and the Effects of Targeting Terrorist Leadership

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**Abstract**

Identifying policies to deal with the presence of terrorism is difficult, in part because the analysis of potential policies has often remained fairly underdeveloped. In this paper we use large-sample statistical techniques to examine the effects of targeting terrorist leadership (the "kingpin strategy") on certain measures of terrorist group activities and group termination. We also examine whether the effectiveness of this policy is related to the organizational structure of the groups.

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Preliminary draft prepared 26 October 2010 for presentation at the Defence and Security Economics Workshop 2010/Atelier en Économie de défense et sécurité 2010, Royal Military College of Canada/Collège militaire royal du Canada, Kingston, Ontario, 11 November 2010.

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## 1. INTRODUCTION

The so-called kingpin strategy has been used for decades as a strategy to break up illegal organizations such as drug cartels, the mafia and terrorist groups (Kenney, 2004). The logic behind this strategy is that targeting the leadership of an organization should disrupt operational and strategic functioning of the group. With the destabilization of these core elements of the group its capacity to conduct operations should diminish, and its cohesiveness should decline. With enough disruption it may even be possible to induce distrust, infighting and atomization of the group, which in turn may lead to the collapse of the organization.

In spite of its prevalence as a way for states to fight the scourge of terrorism (and other illegal organizations), there is little conclusive evidence that this strategy is successful in disrupting a terrorist campaign, or even of mitigating its destructive effects. There is also practically no work on identifying the conditions that may affect the effectiveness of the kingpin strategy, and whether its effectiveness can be generalized to all types of organizational structures. For example, Kenney (2007) writes that the United States' Drug Enforcement Agency (DEA):

> …crowed that they were winning the war on drugs and that the days of the cartels were over. These officials were right about one thing: the days of the cartels were over – because they had never really begun... the post-cartel drug industry in Colombia became more diffuse and decentralized, as smaller networks… (2007: 90)

Knowing when and against which organizations to deploy, and when to avoid, a targeted leadership strategy will be useful for policymakers facing a terrorist threat.

Despite the tremendous importance of this topic, there have been relatively few systematic empirical studies to investigate central questions of terrorist group activity.[1] This study contributes to this literature by using large sample quantitative analysis to examine the operational pace and group termination of more than one hundred terrorist organizations and the consequences of a interrupting or removing their leadership. Does leadership "decapitation" affect the number of attacks committed by a terrorist group or its propensity to end its operations?

An additional focus of the paper is to ask these questions in the context of a terrorist group's organizational structure. Like any organization, terrorist groups vary widely in terms of goals, strategies and their operational structure. In a decentralized organization the leadership has less control over the strategic and operational details. It is assumed that adopting a decapitation strategy here would prove relatively ineffective. Conversely, in a centralized organization, removing the leader or leaders could have catastrophic consequences for the group. However

[1] Two recent exceptions are Jordan (2009) and Mannes (2004).

there are many possible and subtle nuances to this sort of theorizing. For example, hierarchies are also more resilient, having procedures for promotion and replacement. In diffused organizations senior commanders may play more critical roles in determining group activity. Finally, capturing a leader may have quite different effects than killing them; in the first case they may order a reduction in activity to facilitate bargaining for their release, while killing personnel may induce more attacks as a symptom of competition amongst potential successors. We test these hypotheses as well.

## 2. LITERATURE REVIEW

There are three related literatures that are directly relevant to our analysis. These papers deal with terrorist group organizational behaviour, the termination of terrorist groups, and the effects of leadership decapitation on terrorist group activities. There is of course also an extensive literature on the theory of terrorism (for example Sandler, Tschirhart and Cauley, 1983; Ferrero, 2006) and counterterrorism (Arce and Sandler, 2005; Lapan and Sandler, 1988; Sandler, 2003), the psychology of terrorism (Victoroff, 2005), and some empirical analyses of counterterrorism policy (Li, 2005). Here we focus on the papers of immediate relevance to our analysis.

Crenshaw (1991, 2007) and Rapoport (2002) both observe that longevity of terrorist groups vary considerably. Rapoport argues that most groups do not last more than two years before they cease attacks. Those groups that do last beyond this time, he argues, are more deadly and more prolific. Crenshaw (1991) observes that after a period of time, which she fails to identify, terrorist groups gain enough support that they become more resilient and less affected by any leadership crises.[2]

While the longevity of a group seems to be an important determinant of its resilience to targeted leadership killing, so to, presumably, is the importance of leadership in terrorist groups. The literature on negotiating with terrorists emphasizes that while the leadership within a group must be clearly defined, it is difficult to understand the organizational dynamic of any clandestine group (Oots, 1990 in Jordan, 2009). Neumann (2007) similarly argues that when negotiating with terrorist groups, only those groups with a clear leader, who has control over a group's personnel, is a worthy negotiating partner. For these types of groups, it can be reasoned that a leadership decapitation would have a significant effect on the group.

However, decentralized and networked groups are quite the opposite. They are designed to function without leadership, and therefore, attacking any one leader will have little effect on the functioning of the group as a whole (See Kenney, 2007, Asal, 2006, Arquilla and Rondfeldt, 2004).

[2] This could also mean that they reach a critical mass large enough that a single leader is easily replaceable.

Hastening a terrorist group's demise is the purpose of a leadership decapitation strategy, but this strategy is by no means the only way that terrorist groups may end. Cronin (2006:19) describes six other main ways: unsuccessful generational transition, success, transition to legitimate political participation/negotiation, loss of popular support, repression and transition out of terrorism to either criminality or full insurgency (see Hutchinson and O'Malley, 2007). While comprehensive, the study is largely case-based and lacks large-sample quantitative analysis. In a similar work Crenshaw (1991) examines some forty groups and their reasons for ending. Again, the sample size is too small for the results to be anything but anecdotal.

The work of Dugan *et. al* (2008) on the desistance of terrorism is relevant to the current study because it tracks the frequency of terrorist attacks before and after a key event to see if there is any affect. This attempt at developing a model for terrorist attack frequency is useful to the current study because it is based on what type of effect a single event may have on terrorist group activity. In this case, Dugan *et al* compare two Armenian terrorist groups and the effect that a botched attack (where many civilians died) had on the future of the group. Dugan *et al.* use a Cox proportional Hazard model to estimate the impact of specific terror attacks on the hazard of another attack. It uses continuous-time survival analysis with the dependent variable measured in the number of days until the next attack. Unlike most Cox models, this one is applied to estimate the hazard of many events, in this case terror attacks, using one observation – the group (Dugan *et. al.* 2008: 239). This model, while not ideally suited for our purposes, is promising in that it measures the effect of a single event on the group.

There are two key papers that attempt to study the effect of the leadership decapitation strategy on terrorist groups. Jenna Jordan (2009: 733) looks at 298 leadership decapitation events against 96 terrorist groups from 1945-2004. Jordan (2009: 734) finds, through a logit analysis, that age, size and group motivation are statistically significant in identifying "when an organization is susceptible to decapitation." She concludes that religious organizations are resistant to decapitation while left and right wing organizations are more likely to cease activity following a leadership event. This finding is intriguing since it implies that there exists a difference in how these types of groups operate. Her other key finding is that younger and smaller organizations are more susceptible to leadership attack than more established groups. In an earlier iteration of her work, Jordan (2004) asserts that in those rare cases where counterterrorism forces are able to remove both the leader and the senior commanders of an organization, the group falls apart every time.

Using the fate of the organization as the dependent variable, Jordan evaluates whether or not the organization remains active after the leadership decapitation. If the organization remained inactive for two years following the decapitation, decapitation was coded as a success, but if the organization continued attacks within

two years, the leadership decapitation was coded as a failure.[3] In terms of independent variables, Jordan uses several variables to capture leadership decapitation: if the event was an arrest or death, as well as the type of leader removed. A second set of independent variables measures organizational type: age, size and ideology.

While Jordan's analysis is an excellent starting point for investigating decapitation, the study does not take into account other mitigating factors such the type of attacks, the governance of the state in which the attacks take place or the size of the group, and the group's organizational structure. Our study does advance Jordan's work in one important aspect when she observes that: "…it would have been interesting to look at the relationship between typology and organizational structure.." (Jordan, 2004, p. 22). We also focus on terrorism after 1970.

Another attempt to empirically evaluate leadership decapitation is by Mannes (2008). Mannes builds a model predicting the frequency of attacks following a leadership decapitation and finds that there is some evidence that the number of attacks a group makes will decrease.[4] Mannes concludes that given the small sample size and inconsistent results it is difficult "to assess the utility of decapitation strategies" but that it may be useful under certain conditions.[5]

However by grouping together all terrorist groups, both of these studies overlook the crucial element played by the variance of organizational structure between groups. Without assessing how the leadership in a group functions, it is very difficult to understand under what circumstances leadership decapitation has been successful.

## 3. DATA

The first part of this research performs a quantitative analysis of terrorist groups using the Global Terrorism Database (GTD) - a clearinghouse of more than 80,000 terrorist incidents worldwide from 1970-2007. The GTD project was originally assembled by the Pinkerton Global Intelligence Services (PGIS) to identify and record terrorism incidents from wire services, government reports and major international newspapers from 1970-1997.[6] The purpose of the initial PGIS database was to assess the risk of terrorism worldwide for their clients but it has also served as the foundation for what is now known as the GTD. As described above, the definition used first by PGIS, then by the GTD is:

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[3] This two year demarcation is derived from the burden of proof required for organizations listed on the US Department of State Foreign Terrorist Organization list.

[4] Mannes (2008), p. 43

[5] Mannes (2008), p. 43

[6] See http://www.start.umd.edu/gtd/about/History.aspx.

> The threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion, or intimidation.[7]

Through funding from the US Department of Homeland Security, the database has been updated and harmonized for consistency through to the end of 2007 and is now managed by the University of Maryland. While efforts to maintain consistency have been made the original PGIS database was collected through real-time updates on a daily basis. From 1997- 2007, incidents have been coded retrospectively and because of this, differences in levels of attacks between these two periods may be due to the collection differences.

Like the GTD, other open-source terrorism databases exist. Notable are the RAND Corporation's database which contains international terrorism from 1972 to the present as well as domestic incidents from 1998 onward. The RAND database contains more than 36,000 incidents but is mostly focused on international incidents. The GTD has from the beginning logged both domestic and international incidents and contains more than 80,000 incidents. It is therefore the more comprehensive open-source database in existence.

For the purposes of this study, many of the 80,000 incidents contained in the GTD were quickly eliminated because there was not a terrorist group attributable to the event. The other selection criteria for this study was to only examine groups which had attempted at least ten attacks. While this threshold limited the number of groups included in the study, it served several purposes. A threshold of ten attacks was set to establish a basic level of competency and dedication by these groups. Generally speaking groups with less than ten attempted attacks do not possess the organizational capacity to sustain their activities.

A key innovation of this study is the coding for organizational structure. This variable uses structural typologies from Arquilla and Rondfeldt (2004) which are functionally similar to Kenney (2007). More than 300 terrorist groups were coded for structure on the basis of factors describing leadership type and functional differentiation. An example of a market structure is the Earth Liberation Front (ELF). The ELF lacks any formal leadership and is highly decentralized. A prominent all-channel group is the Weather Underground. These types of groups are highly inter-netted and maintain a largely flattened hierarchy. The two more hierarchical group structures are hub and spoke and bureaucracy. A typical example of the former is al-Qaeda – there is a clear leadership but it typically lacks centralized control and instead relies more on local commanders. Finally, bureaucratic groups are best compared to military organizations, highly structured and specialized. A classic bureaucratic group is the Palestine Liberation Organization (PLO) but this structure is typified by many other ethno-nationalist groups.

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[7] Global Terrorism Database.

## 4. LEADERSHIP INTERRUPTION, GROUP STRUCTURE AND TERMINATION

Our first question is whether leadership decapitation affects group termination, and whether any response is associated with group structure. We adopt two basic approaches to this analysis. First, we use a binary dependent variable estimation procedure to build a model of when a terrorist group would end. We use the rare events logit model when statistically possible due to the fact that the percentage of cases in which a group ended in our sample was only about four percent of the time (see Tomz, King and Zeng, 1999; King and Zeng, 1999a and 1999b). Out of the 249 groups in our sample, 170 did end their operations during the sample period of 1970-2007. After identifying a basic model we then include four distinct types of leadership interruption (captured, killed, accidental or natural death or exile) to see if there were any differentiated effects. Finally we test the model to see if terrorist organizations with different structures responded differently to leadership interruptions.

Our basic model for estimation is fairly simple. We hypothesize that the susceptibility of a group to termination is related inversely to its age, with older groups having demonstrated resilience. Similarly we expect that groups that are able to attain a larger peak size will have a larger base of support and hence also longevity. In terms of motivation, we separate groups into those motivated by left wing and right wing ideologies, nationalist groups and religious groups. The latter is the base case and hence is excluded from the model.

In terms of operational environment we include a variable to measure the economic and political conditions of the state that is the main base of operation. We expect that economically more advanced countries will be better able to suppress group activity and encourage its termination. The role of politics remains somewhat controversial, as repressive regimes are better able to suppress dissent than governments who must abide by moral and legal restrictions on their behaviour. At the same time the ability to channel dissent through the legal channels in a politically open government has been shown to be a powerful mechanism for avoiding terrorist activity.

We also attempt to control for pace of operations historically for each group. Specifically we use the ratio of the average annual number attacks in the previous three years to the historical average of the group. Groups with lower levels of activity relative to historical trends are presumed to be in decline and thus more susceptible to collapse. The final element of our base case estimation introduces the different types of organizational structures for the group. We included indicator variables for the three least centralized groups (market, all-channel and hub and spoke) and used the most centralized (hierarchical bureaucracy) as the base case. In the results reported in table 1, however, the hub and spoke groups appeared to have the same propensity to end as the base case hierarchical groups, and so it was removed from the equation.

The regular probit and rare events logit models produce fairly similar results for the full sample basic model without leadership events, which is helpful since in some instances statistical problems prevented the use of the latter. We also use the probit results to compute the (conditional) marginal effects of the variables on the probability that the group terminates.

The basic model does yield some insight into termination, though some do not conform to our prior expectations. As we can see in Table 1, the number of years of operation does not appear to affect a group's probability of ending its operation. Furthermore, and contrary to expectation, the peak size of the group is related positively to the probability of its termination. Specifically, increasing a group's size by one level (within its ranges) is associated with a 1.2 percent increase in the likelihood of termination in any given year. While this effect may seem small, it should be noted that the probability of termination in a given year is 4.5 percent overall. Unfortunately it is difficult to get group size data on an annual basis, so this variable will require further exploration.

**Table 1.** Basic Model: Logit

| Variable | Robust Coef. | Standard Error | p-value |
|---|---|---|---|
| Group age | -0.0045 | 0.0073 | 0.536 |
| Peak size | 0.2708 | 0.1259 | 0.031** |
| Right wing group | 1.6901 | 0.4586 | 0.000*** |
| Left wing group | 0.9267 | 0.3903 | 0.018** |
| Nationalist group | 0.4968 | 0.4028 | 0.217 |
| Country wealth | 0.0455 | 0.1492 | 0.760 |
| Level of democracy | -0.0201 | 0.0178 | 0.258 |
| Recent attacks | -0.1165 | 0.0513 | 0.023** |
| Market structure | 0.8679 | 0.3392 | 0.011** |
| All-channel structure | 0.8083 | 0.2315 | 0.000*** |
| Constant | -4.2559 | 0.6140 | 0.000*** |

Significance Levels: * $p < .1$; ** $p < .05$; *** $p < .01$

The results were far more dramatic for group motivation. Religiously motivated groups are the most durable, though the estimated coefficient for nationalist groups is not statistically significant at standard levels. Ideologically motivated groups, and especially right-wing groups, are both substantially more likely to end in a given year. For right-wing groups the marginal effect on the probability of termination is 0.144, while the equivalent value for left-wing groups is 0.047. By contrast neither the political nor the economic status of the main country of operation has any statistically significant relationship with terrorist group termination.

As expected, recent activity - relative to historical levels - is a good indicator of the likelihood of termination. A decline in the number of attacks is associated with a higher likelihood of imminent termination. As the number of attacks over the

previous three years as a ratio of the group's average to date increases by one (a one hundred percent increase) the probability of termination falls by 0.5 percent.

One of the innovations of this study is to examine the structure of terrorist organizations. In the estimation, the bureaucratic structure and the hub and spoke structure - the most centralized ones - were statistically the same and so both were left out as the base case. By comparison, the two more decentralized organizational structures (market or all-channel organization) both have nearly a five percent higher rate of termination. More centralized organizations, therefore, seem to have greater durability.

The next step of the analysis is to take this basic equation and include measures of leadership decapitation. Unfortunately, even with a stripped down model to reduce the likelihood of undesirable statistical dependence amongst the independent variables, there are few instances where sufficient observations exist to permit statistically valid results. In only one case was the termination of a group affected in a statistically significant way by a leadership event. This case was for organizations that had a senior member captured. In this case a group experiences a 32 percent higher chance of ending in the following year.

While there are a number of leadership event combinations and time lags that could be investigated, none of the ones we examined led to statistically significant changes in the probability that a group would end. However it is also difficult to generate insights from the regression models due to the relatively low frequency of leadership events and the presence of linearly dependent variables. In many cases key independent variables are omitted from the estimation by the program due to their perfect collinearity with the outcome.

Therefore we also examine simple (unpaired) t-tests of the probability of a group ending when there is a leadership event, and when there is not. The basic data on termination and leadership removal are presented in table 2. As is clear, there is generally no strong indication of a link between these events and the group ending. In fact, for leader decapitations alone, the probability of group termination in the next two years is lower than when there is no such decapitation, with the (unexpected) exception of groups with the most decentralized (market) structure. So leadership removal does not seem to be a sufficient condition for group termination.

More detailed investigation of the conditional probabilities also reveals that for group endings there is a lower probability of leader or senior commander disruptions in the previous two years than for the full sample; leadership removal is thus also not a necessary condition for group termination. Only in the case of both a senior and leader decapitation happening jointly in the previous two years is there an increase in the associated rate of termination, almost doubling from 4.5 percent to 8.3 percent. However not even this change is statistically significant due to the small sample. For several other detailed cases there are insufficient data to conduct

even the simple t-tests. The results that do emerge essentially replicate those from the estimations: the only case of a significant difference is that of a senior leader being captured from a terrorist group that has a relatively diffused all-channel structure. However further investigation indicated that this result is entirely due to one case, the United Self Defense units of Colombia (AUC), which ended its activities in 2006.

Table 2. Group ending probability

| Structure | Prob. group ends when leadership event | Prob. group ends w/o leadership event |
|---|---|---|
| All structures | 0.037 | 0.045 |
| Market | 0.091 | 0.057 |
| All-channel | 0.045 | 0.059 |
| Hub & Spoke | 0.019 | 0.024 |
| Bureaucracy | 0.036 | 0.043 |

These results are consistent with the findings of Jordan (2009), who found no strong relationship between leadership removal and group termination. However, Jordan uses terrorist groups as opposed to individual incidents of decapitation as the unit of analysis.

Our preliminary conclusions, therefore, is that decapitation strategies are not particularly effective in causing terrorist groups to cease operation and disappear. The absence of any effect also does not seem to be related to the type of organization adopted by the group.

## 5. LEADERSHIP INTERRUPTION, STRUCTURE AND ACTIVITY

While the preceding analysis does not provide any compelling evidence that targeting leadership has any significant effect on the ending of a group, it may still be a valuable tool in altering the pace or nature of operations conducted by terrorist groups. We examine this hypothesis by examining the basic data trends, and then present a more formal estimation of the number of attacks.

### *REVIEW OF THE DATA*

As described in Table 3, the incidence of leaders captured or dying has a statistically significant association with reduced multiple attacks for the decentralized (market) structure. For these groups, there is a net decrease in the number of multiple attacks over the one, two and three year period after a leadership interruption event (leader either is captured or dies) compared to before the event. The market structure also shows a statistically significant decrease in multiple attacks after a leader or senior commander is killed, specifically for the three year period after the event compared to the three years before. For bureaucratic organizations, results suggest that a captured leader has a statistically

significant effect on reducing multiple attacks within a one year period before and after the leadership interruption. A similar effect is found for hub and spoke organizations but applies to both leaders and senior commanders killed. Finally, captured leaders of both market and hub and spoke organizations result in a decrease in multiple attacks for two and three years after the event relative to the same periods beforehand.

**Table 3.** Cases where number of multiple attacks affected

| Variable | # of cases | Year | Structure | Mean (Before) | Mean (After) |
|---|---|---|---|---|---|
| Leader captured or dies | 7 | 1 | Market (1) | 0.7142 | 0.0000** |
| Leader captured or dies | 7 | 2 | Market (1) | 0.7142 | 0.2857** |
| Leader captured or dies | 7 | 3 | Market (1) | 0.7142 | 0.2857* |
| Leader captured | 42 | 1 | Bureaucratic (4) | 0.6190 | 0.0476** |
| Lead/command killed | 23 | 1 | Hub/Spoke (3) | 0.8696 | 0.1739* |
| Only those killed | 22 | 3 | Market (1) | 2.9545 | 0.9091* |
| Leader captured | 45 | 2 | MK (1) & HS (3) | 10.0889 | 1.2889* |
| Leader captured | 41 | 3 | MK (1) & HS (3) | 16.1463 | 2.0244* |

Significance Levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

A group capable of launching multiple attacks indicates a higher level of sophistication in the strategic and operational planning of the group. That there were no statistically significant results for the all-channel structure requires further investigation but it can be posited that in this structure, more than any other, the interconnections between actors mitigates the effect of the loss of any one person.

**Table 4.** Cases where number of hard target attacks affected

| Variable | # of cases | Year | Structure | Mean (Before) | Mean (After) |
|---|---|---|---|---|---|
| Leader captured/killed | 26 | 1 | Hub/Spoke (3) | 6.0384 | 0.5769** |
| Leader captured/killed | 24 | 2 | Hub/Spoke (3) | 5.8958 | 1.1042* |
| Leader captured/killed | 24 | 3 | Hub/Spoke (3) | 6.5 | 1.1806** |
| Commander killed | 10 | 1 | Hub/Spoke (3) | 6.1 | 2.2* |
| Commander killed | 10 | 2 | Hub/Spoke (3) | 4.1 | 1.75* |
| Commander killed | 10 | 3 | Hub/Spoke (3) | 3.6 | 1.8333* |

Significance Levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 4 shows that leadership interruptions had a statistically significant association with reduced attacks against hard targets, but only for terrorist organizations with hub and spoke structures. The ability to successfully attack a hard target presumably indicates a level of organizational complexity. The loss of a leader reduces the organizational capacity of a group. It is posited that groups losing their leadership will result in a decreased ability to attack hard targets. The results show that for leaders captured or killed, and for senior commanders killed, the result is the same – hub and spoke organizations seem to have greater difficulty mounting attacks against hard targets.[8] The explanation for this finding is likely

[8] While not statistically significant, the result that hard target attacks decrease following a leadership interruption are consistent across all other organizational structures.

found in the structural attributes of a hub and spoke group. While a resilient structure in many circumstances, hub and spoke groups place more decision-making power in the hands of senior commanders; the loss of whom indicates a short-term loss in higher-order attack capability. Further investigation is required to determine the duration of this effect.

Table 5 shows that in a hub and spoke organizational structure the effect of a leader being captured results in a statistically significant reduction of casualties for the two year period afterwards, compared to the two year period before. No other tests with casualties (or simple killed or wounded variables) yielded statistically significant results. Future work should focus on examining the deadliness of attacks as a possible measure of a group's behaviour following a leadership interruption.

**Table 6.** Cases where number of casualties* affected

| Variable | # of cases | Year | Structure | Mean (Before) | Mean (After) |
|---|---|---|---|---|---|
| Leader captured (# kill) | 6 | 2 | Hub/Spoke (3) | 7.0833 | 0.41667** |
| Leader captured (# kill + # wound) | 6 | 2 | Hub/Spoke (3) | 27.4167 | 4.6667* |

Significance Levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Finally, when the number of attacks is examined before and after a leadership interruption, the results show that for bureaucratic, hub-and-spoke and market structures there is a decline in the number of incidents (see Table 6). In bureaucratic structures, a captured leader results in a statistically significant decrease in the number of attacks for the one and two year periods before such an event, relative to the same period beforehand.

**Table 5.** Cases where number of attacks affected

| Variable | # of cases | Year | Structure | Mean (Before) | Mean (After) |
|---|---|---|---|---|---|
| Leader captured | 16 | 1 | Bureaucratic (4) | 5.25 | 2.25* |
| Leader captured | 13 | 2 | Bureaucratic (4) | 7.8462 | 2.8846* |
| Leader captured | 12 | 3 | Hub/Spoke (3) | 53.2222 | 7.5833* |
| Leader killed | 12 | 3 | Hub/Spoke (3) | 7.5556 | 1.3889* |
| Commander captured | 11 | 1 | Hub/Spoke (3) | 9.0909 | 6.5454** |
| Commander captured | 10 | 2 | Hub/Spoke (3) | 8.05 | 5.7** |
| Commander captured | 10 | 3 | Hub/Spoke (3) | 8.3667 | 5.3333* |
| Commander captured | 8 | 2 | Market (1) | 5.375 | 2.75* |
| Commander captured | 8 | 3 | Market (1) | 5.2083 | 1.9167** |

Significance Levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

A similar effect is found with the hub and spoke structure.[9] Hub and spoke structures are also susceptible to killed leaders and captured commanders. As Table 6 shows, for these cases, there is a statistically significant reduction in the mean number of attacks before and after. Finally, terrorist organizations with a market structure exhibit similar declines in attack frequency when senior commanders are captured (for both the two and three years after the capture takes place).

[9] It should be noted here that the high divergence between means before (53.222) and after (7.5833) is driven by *Sendero Luminoso* (Shining Path) of Peru. However, when this outlier was removed, the results remained robust and consistent. It was decided to include this outlier in the results.

While a relatively simple measure of a terrorist group behaviour, the number of attacks can be a key indicator to policy-makers for groups upon which to focus their counter-terror efforts. This is further explored below in the model of attack frequency.

### *A MODEL OF ATTACK FREQUENCY*

The preceding analysis indicates that there are strong reasons to suspect that the successful removal of leaders and senior commanders of a terrorist group do affect both the frequency and nature of its operations. We conclude our analysis by presenting an estimation of the annual number of attacks by a terrorist group. This more formal approach allows us to ensure that the previous results are not driven by cross-correlations of leadership decapitation and other key factors that influence the pace of operations. While this is not a perfect correction for the possible endogeniety of leadership targeting by counter-terrorist operations, the lagged structure and logic of the model should allow us to examine the interruption of activities.

We have modeled the number of attacks in any given year primarily as a function of the pattern over the previous three years. The lagged dependent variables capture the pattern of recent activity levels. In addition we have included variables to indicate whether the primary country of operation is a colony or an occupied territory, indicators of economic wealth and political freedom, the age of the group, and the group's organizational structure. Our expectation for this basic model is that the recent attack levels will be positively related to the current period's number of attacks, though with diminishing effects over time. While we expect that economically wealthier states will be able to suppress terrorist operations through the deployment of more resources, as noted earlier it is not clear whether operating in a freer country, or one that is a not a colony or is not occupied, will allow authorities greater flexibility in using force against a group, or whether it allow groups to express dissent through legitimate channels and hence reduce the incentives to mount attacks. The age of the terrorist group should presumably be related to capacity to attack, and hence should is expected to have a positive relationship with the number of current attacks. However these are preliminary hypotheses, and the impact of many of these explanatory variables may already be reflected in the level of attacks in previous years.

We also include group motivations. We include the two ideological groups (left wing and right wing) but exclude religious and nationalist groups as the base case, as the estimated coefficient on nationalism was statistically indistinguishable from one (i.e. not distinct from the base group with religious mmotivations) when included in the model. We have no priors about attack frequency related to the nature of the group's motivation.

Finally, the core innovations for this paper are the inclusion of dummy variables to capture the different organizational structures of terrorist groups, and the inclusion of variables indicating different leadership events resulting (typically) from counter-terrorist activities. We expect that more institutionalized and hierarchical terrorist groups will likely be able to mount more (and also more sophisticated) attacks than decentralized organizations.

For leadership events we include the capturing, killing, death or exile of either a leader or senior commander in either of the previous two years. Our expectations regarding leadership events are more exploratory. While it is tempting to think that the removal of a leader may disrupt an organization, it may also be true that it will launch a leadership struggle that has different potential replacements competing (through the intensity of their terrorist activities) to be promoted as a replacement. In addition, an organization's response to a leadership event is likely conditioned on its structure. A hierarchical organization may well be highly dependent on the presence of a key charismatic leader. However such an organization will also have a well-identified chain of command, and the removal of one person – even at the top of the organization – may simply be dealt with by a routine process of promotion. After all, corporations and other organizations also experience leadership events (though typically less violent than the ones considered in this paper) without collapsing or changing operations; this is one of the strengths of a hierarchical structure.

At the same time less centralized organizations may not suffer much at all from the removal of a central leader, and in some instances may be disrupted more by the removal of a particularly active senior commander. While it may be possible to model these nuances more formally, the absence of detailed information would likely make it difficult to gather the data to test the model. Here we focus simply on exploring the general empirical pattern to ask whether leadership events affect the number of attacks a terrorist group might be otherwise expected to carry out.

The equations are estimated using a Poisson regression since the dependent variable is a "count variable". In addition it was necessary to correct for group-specific heteroscedasticity (using the cluster option in Stata); without the correction some of the individual coefficient estimates had unreasonably high normal statistics. For interpretation, the marginal effect of a one unit change in independent variable "i" is given by $e^{\beta i}$ where $\beta i$ is the coefficient estimate for variable i. The tables have done this conversion, so the number reported in place of the coefficient estimate is the incidence-rate ratio (IRR) associated with a one-unit change in the variable.

**Table 7.** Basic Model: Poisson Regression (2663 obs.)

| Variable | Robust IRR | Standard Error | p-value |
|---|---|---|---|
| # of attacks | 1.0065 | 0.0009 | 0.000 |
| # of attacks (lag 1) | 1.0018 | 0.0007 | 0.009*** |
| # of attacks (lag 2) | 1.0012 | 0.0005 | 0.017** |
| Occupied or colony | 0.6353 | 0.1775 | 0.104 |
| Country wealth | 0.6437 | 0.1262 | 0.025** |
| Level of freedom | 0.6769 | 0.1309 | 0.044** |
| Group age | 1.0206 | 0.0059 | 0.000*** |
| Left wing group | 1.5627 | 0.3362 | 0.038** |
| Right wing group | 0.5959 | 0.2045 | 0.131 |
| Market structure | 0.3174 | 0.1153 | 0.002*** |
| All-channel structure | 0.6371 | 0.1862 | 0.124 |
| Leader interruption | 0.6218 | 0.1575 | 0.061* |

Significance Levels: * $p < .1$; ** $p < .05$; *** $p < .01$
Dependent variable is # of attacks the following year

The basic results of the estimation are presented in Table 7. The addition of the leadership removal indicators did not change substantially any of the other results, so we present only the results of this estimation. To give a sense of the explanatory power of the model, a simple OLS regression on the same equation was run, yielding a reasonably high R-squared value of 0.64. As the table shows, the introduction of the leadership event variables does not affect the main results of the basic model, so we focus on this second, expanded, model.

The core results generally conform to our expectations. The number of attacks in a given year is related positively and significantly (statistically) to the number of attacks in the previous three years, and with a diminishing strength to the lag. The effects are fairly small, however. Each attack in the previous year, for example, increases the expected number of attacks in the current year by only 1.007 times. Being occupied or a colony had a negative effect on future attacks, but the estimated coefficient was not statistically significant by standard criteria. Wealthier countries and those identified as free experienced roughly 63 percent of the attacks they might otherwise expect, while being in operation for one additional year was associated with 1.02 times more attacks in a given year. Groups with a leftist ideology tended to be more than 50 percent more active than groups with other motivations, while right wing groups had lower attack rates (though the coefficient estimate is not statistically significant).

Decentralized terrorist groups mount far fewer attacks than hierarchical ones, though the effect is only statistically significant (and very large) for the most decentralized (market) group. For the most decentralized groups attacks were only 64 percent as frequent as for the two more hierarchical groups. The evidence that all-channel groups also had fewer attacks was less clear.

Finally, leadership events in the previous two years had a negative effect on attack frequency in the subsequent year. The effect is fairly significant (only 62 percent of the number of attacks of groups without such removals), though the level of statistical significance for the estimated coefficient for this variable is marginal. There is no effect for events that removed a senior commander. It should be noted that the removal of a leader or senior commander in the more distant past has no significant effect. At best, these events seem to interrupt only briefly the tempo of terrorist group operations.

However these estimations are performed using indicators of leadership removal in the previous two years, and senior commander removals over the previous two years. It is possible that the effects of a leader or senior commander being removed depends on how they are removed. To investigate this possibility we run an additional estimation (not reported here for space reasons) to examine recent and past events disaggregated by the four different types (capture, killing, death, and exile). While several of these events have to be dropped from the estimation due to problems of collinearity, the significant results in the main estimation are associated with leaders being captured, dying and (though only weakly) being exiled. The actual killing of a leader has no statistically significant effect on subsequent attack frequency, and indeed the estimated coefficient is positive (though very small and very insignificant). In the disaggregated estimation the death (but not capture or killing) of a senior commander is associated with an increase in attacks in the following year.

Finally, we perform the most disaggregated estimation. Each equation is run separately on the sample corresponding to each of the four group organizational types. Second, each leadership or senior commander event is entered separately by the manner of removal. Finally, these events are entered separately for each of the one year and two year lagged periods. The smaller samples introduce greater problems of collinearity and several of the specific leader or senior commander event variables have to be left out of the equations. So while this estimation runs the risk of being driven by relatively few events and being fairly inefficient, it affords the most detailed examination of the different ways of targeting leaders and senior commanders.

Tables 8-11 show the results of these more detailed estimations. The first observation is that the equation performs relatively poorly for the market group (Table 8): the R-squared for the associated OLS regression is only 0.11. The R-squareds for the other three groups are 0.49, 0.72 and 0.43 respectively, from least to most hierarchical. The core results for the general (non-disaggregated) model are often not present in any of the individual estimations on separate organizational types. However it is perhaps interesting that the least centrally directed group has the least predictable attack frequency.

**Table 8.** Market Group (1): Poisson Regression (464 obs.)

| Variable | Robust IRR | Standard Error | p-value |
|---|---|---|---|
| # of attacks | 1.0276 | 0.0042 | 0.000*** |
| # of attacks (lag 1) | 0.9869 | 0.0221 | 0.557 |
| # of attacks (lag 2) | 1.0131 | 0.0109 | 0.228 |
| Occupied or colony | 0.5825 | 0.1876 | 0.093* |
| Country wealth | 1.2539 | 0.2826 | 0.315 |
| Level of freedom | 0.6275 | 0.1973 | 0.138 |
| Group age | 0.9561 | 0.0128 | 0.001*** |
| Left wing group | 1.1611 | 0.2798 | 0.535 |
| Right wing group | 0.9828 | 0.2878 | 0.953 |
| Leader capture | 0.6538 | 0.3668 | 0.449 |
| Leader death | 0.0001 | 0.0002 | 0.000*** |
| Commander capture | 1.3519 | 0.7225 | 0.573 |
| Commander kill | 0.4345 | 0.3360 | 0.281 |
| Leader capture (lag) | 1.2018 | 0.4704 | 0.639 |
| Leader die (lag) | 0.6201 | 0.1255 | 0.018** |
| Commander capture (lag) | 0.7179 | 0.4948 | 0.631 |
| Commander kill (lag) | 1.4913 | 0.6652 | 0.370 |

Significance Levels: * $p < .1$; ** $p < .05$; *** $p < .01$
Dependent variable is # of attacks the following year

**Table 9.** All-Channel Group (2): Poisson Regression (730 obs.)

| Variable | Robust IRR | Standard Error | p-value |
|---|---|---|---|
| # of attacks | 1.0155 | 0.0027 | 0.000 |
| # of attacks (lag 1) | 1.0091 | 0.0031 | 0.004*** |
| # of attacks (lag 2) | 0.9986 | 0.0019 | 0.458 |
| Occupied or colony | 2.2248 | 0.8365 | 0.033** |
| Country wealth | 0.8360 | 0.1173 | 0.202 |
| Level of freedom | 0.6318 | 0.1443 | 0.044** |
| Group age | 0.9766 | 0.0137 | 0.092* |
| Left wing group | 3.3576 | 1.0339 | 0.000*** |
| Right wing group | 0.7681 | 0.2624 | 0.440 |
| Leader capture | 0.5827 | 0.4629 | 0.497 |
| Leader kill | 2.7935 | 1.0811 | 0.008*** |
| Leader exile | 5.33e-10 | 5.11e-10 | 0.000*** |
| Commander capture | 0.4140 | 0.1371 | 0.008*** |
| Commander kill | 1.9467 | 0.5273 | 0.014** |
| Leader capture (lag) | 0.3881 | 0.2321 | 0.114 |
| Leader kill (lag) | 1.1517 | 0.2535 | 0.521 |
| Leader exile (lag) | 5.45e-10 | 5.24e-10 | 0.000*** |
| Commander capture (lag) | 0.7806 | 0.5756 | 0.737 |
| Commander kill (lag) | 2.3948 | 0.5424 | 0.000*** |

Significance Levels: * $p < .1$; ** $p < .05$; *** $p < .01$
Dependent variable is # of attacks the following year

**Table 10.** Hub and Spoke Group (3): Poisson Regression (843 obs.)

| Variable | Robust IRR | Standard Error | p-value |
|---|---|---|---|
| # of attacks | 1.0053 | 0.0013 | 0.000 |
| # of attacks (lag 1) | 1.0009 | 0.0005 | 0.054* |
| # of attacks (lag 2) | 1.0012 | 0.0005 | 0.023** |
| Occupied or colony | 0.3958 | 0.2565 | 0.153 |
| Country wealth | 0.4868 | 0.2057 | 0.088* |
| Level of freedom | 0.7214 | 0.2058 | 0.252 |
| Group age | 0.9819 | 0.0187 | 0.340 |
| Left wing group | 1.6109 | 0.7736 | 0.321 |
| Right wing group | 0.4979 | 0.2924 | 0.235 |
| Leader capture | 0.1224 | 0.0882 | 0.004*** |
| Leader kill | 0.1281 | 0.0539 | 0.000*** |
| Leader death | 1.1449 | 0.4981 | 0.756 |
| Leader exile | 0.1655 | 0.0617 | 0.000*** |
| Commander capture | 0.7239 | 0.2622 | 0.372 |
| Commander kill | 1.5178 | 0.8547 | 0.459 |
| Leader capture (lag) | 0.9502 | 0.2438 | 0.842 |
| Leader kill (lag) | 0.1346 | 0.0722 | 0.000*** |
| Leader death (lag) | 1.7011 | 0.7354 | 0.219 |
| Leader exile (lag) | 0.0885 | 0.0334 | 0.000*** |
| Commander capture (lag) | 0.4718 | 0.2113 | 0.093* |
| Commander kill (lag) | 0.8449 | 0.4305 | 0.741 |

Significance Levels: * $p < .1$; ** $p < .05$; *** $p < .01$

Dependent variable is # of attacks the following year

**Table 11.** Bureaucracy Group (4): Poisson Regression (1553 obs.)

| Variable | Robust IRR | Standard Error | p-value |
|---|---|---|---|
| # of attacks | 1.0079 | 0.0020 | 0.000*** |
| # of attacks (lag 1) | 1.0032 | 0.0014 | 0.022** |
| # of attacks (lag 2) | 1.0062 | 0.0008 | 0.000*** |
| Occupied or colony | 0.9971 | 0.2851 | 0.992 |
| Country wealth | 0.6412 | 0.1457 | 0.051* |
| Level of freedom | 0.7156 | 0.1749 | 0.171 |
| Group age | 1.0095 | 0.3135 | 0.145 |
| Left wing group | 1.3895 | 0.3135 | 0.145 |
| Right wing group | 0.5296 | 0.2342 | 0.151 |
| Leader capture | 0.7391 | 0.2277 | 0.327 |
| Leader kill | 1.4459 | 0.5668 | 0.347 |
| Leader death | 0.0569 | 0.0467 | 0.000*** |
| Leader exile | 0.8739 | 0.3601 | 0.744 |
| Commander capture | 1.8064 | 0.3211 | 0.001*** |
| Commander kill | 0.4741 | 0.1447 | 0.015** |
| Commander death | 1.9198 | 0.5210 | 0.016** |
| Leader capture (lag) | 0.7859 | 0.4275 | 0.658 |
| Leader kill (lag) | 1.7500 | 0.7911 | 0.216 |
| Leader death (lag) | 0.3949 | 0.1634 | 0.025** |
| Leader exile (lag) | 0.8594 | 0.3456 | 0.706 |
| Commander capture (lag) | 1.8996 | 0.5592 | 0.029** |
| Commander kill (lag) | 1.4089 | 0.2744 | 0.078* |
| Commander death (lag) | 0.7285 | 0.1863 | 0.216 |

Significance Levels: * $p < .1$; ** $p < .05$; *** $p < .01$

Dependent variable is # of attacks the following year

Focusing on the different leadership events, the results show wide variation across the organizational structures. For the most decentralized group only the relatively rare event of a leader's death has any statistically significant effect. In the first year after such an event the decline in activity is extreme: effectively no attacks would occur. After one year the number of attacks remains at only 62 percent of what it would otherwise have been. Even if this result is not driven by exceptional outliers, the accidental or natural death of a leader is not something that counter-terrorist operations would easily be able to replicate; as a policy tool this is not a particularly helpful finding.

For all-channel organizations (Table 9) the results are highly variable. The killing of a leader is associated with a dramatic increase in the attack frequency the year after (by 2.8 times), though there is no statistically significant residual effect the year after. The rare event of a leader being sent into exile dramatically is also associated with a reduction in attack frequency, an effect does not diminish the following year. The capture of a leader is generally followed by a lower attack frequency, but the effect is not statistically significant. These organizations are also affected by the removal of senior commanders, but in complex ways. Capturing a senior commander is associated with a reduction in attacks in the following year by almost 60 percent, though the effect does not appear to persist. By contrast the killing of a senior commander is followed by an increase in attack frequency by almost two times in the next year, and almost 2.4 times the year after. So the general lesson seems to be that killing leaders or senior commanders in these organizations does not appear to dramatically degrade their capacity to mount attacks because they are less reliant on centralized command structures. At the same time, however, these events appear to provoke reprisals. Capturing or exiling these leaders or senior commanders appears to be a far more effective way of reducing the activity of groups organized in this manner.

For hub-and-spoke organizations leaders play a much more important role. As shown in Table 10 the capture, killing or exile of a leader is associated with a decline in attack frequency in the subsequent year (by almost 90 percent in some cases) and (for killing and exile) in the following year as well. Capturing a senior commander is also associated with a reduction in activity two years later, but the effect is only marginally significant. Again, the results are plausible: leaders play an important coordinating role in these organizations, but there is not a resilient hierarchical structure to provide continuity should the leader be removed. Targeting the leadership of these organizations, therefore, seems to be a reasonable counter-terrorist policy.

Finally, for hierarchically structures terrorist groups the results are somewhat mixed (Table 11). The rare event of a leader dying is generally followed by a reduction in activity of almost 95 percent in the first year and 40 percent in the second year. However the capture, death, or exile of a leader has no significant association with subsequent attack frequency. It is tempting to conclude that hierarchical terrorist groups are simply organizationally sophisticated enough to

deal with the removal of its leader. After all, other bureaucratic organizations (governments, militaries, corporations) routinely lose and replace leaders (usually, though not always, with less blood being shed). However why such groups would be unable to cope with the natural or accidental death of a leader is unclear.

The apparent reaction of these organizations to the removal of a senior commander is even more unclear. The capture or death of a senior commander is followed by almost a doubling of the number of attacks in the subsequent year and, in the case of capture, the year after that as well. Killing a senior commander, by contrast, is initially associated with a reduction in attack frequency (the following year) of almost 50 percent. The effect seems to be reversed two years after the killing, with attack frequencies increasing by over 40 percent (though the statistical significance of the association is marginal). The data are too crude and the results too complex to tell a simple story in this case. Undoubtedly bureaucratic organizations are more complex than those with a less hierarchical structure, and the multiple and possibly contradictory effects of internal competition for promotion, incentives for reprisal, and operational capacity might be intermingling at this important (but less critical) level of leadership.

The interpretations of these varied results are necessarily post hoc and speculative. More work is needed to determine how consistent these results are across the cases, and to what extent the inferences are being drawn on the basis of one or two extreme events. However the results do hold out some promise for a more structured approach to looking at the effects of targeting the senior leadership of terrorist organizations. In addition, it appears that there is considerable nuance in terms of the determinants of terrorist group activity, and how different terrorist groups respond to interruptions in their hierarchies.

## 6. CONCLUSIONS

The kingpin strategy focuses on eliminating known leaders in the hopes this will disrupt the organization. While an intuitively appealing counter-terrorism strategy, the effectiveness of targeting terrorist group leadership, as our analysis suggests, is complex and occasionally undesirable. Reliance on a kingpin strategy, therefore is inadequate for managing terrorist groups. Other tools, such as negotiation (however unpalatable to a government) or opening avenues for conversion into legitimate political participation, may be far more effective, especially over the longer term. However the relative effectiveness of different policies is itself hard to determine, and may well be linked to the terrorist group's organizational structure.

Further research is required to understand better the effects of leadership targeting. Filling out our dataset with more information about the quality of the government and the method and weapons of the terrorist groups will yield more precision in building a working model.

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