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Terrorist Spectaculars: Backlash Attacks and the Focus of Intelligence

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Abstract

This paper presents a signaling model of terrorist attacks, where the target government faces a trade-off from its counterterrorism responses and the backlash (counterreaction) that such responses incite. An endogenous characterization of terrorist spectaculars is specified, given a government's counterterrorism stance and the potential for backlash attacks. In particular, spectacular attacks are pooling, rather than separating, phenomena, whereby the government cannot discern, based on past attacks, the militancy of the terrorist group. Policy recommendations are specified for non-event-specific intelligence in relation to the avoidance of spectacular attacks or unnecessary concessions.

Keywords: Signaling games, Terrorist spectaculars, Value of intelligence, Backlash attacks

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Terrorist Spectaculars: Backlash Attacks and the Focus of Intelligence

1. Introduction

The unprecedented suicide skyjackings of September 11, 2001 (henceforth, 9/11) demonstrated that large-scale terrorist events – known as “spectaculars” – can result in huge human and monetary losses. Other spectacular terrorist incidents include the suicide truck bombing of the US Marine barracks in Beirut, Lebanon (October 23, 1983), the downing of Air India flight 182 over the Atlantic Ocean (June 23, 1985), the downing of Pan Am flight 103 over Lockerbie, Scotland (December 21, 1988), the simultaneous bombings of the US embassies in Kenya and Tanzania (August 7, 1998), and the bombing of a Bali nightclub (October 12, 2002). These spectacular attacks, and others not mentioned, may be perpetrated by terrorists whose demands may or may not be feasibly met by a target government. Hezbollah suspended its suicide bombings for a time after the United States and other participants in the multinational force (MNF) left Beirut in 1983. In contrast, al-Qaida, responsible for the African embassy bombings and 9/11, did not end its attacks after the United States partially conceded and closed its military bases in Saudi Arabia.

Counterterrorism requires a judicious mix of defensive and proactive measures, including the gathering of intelligence. Typically, the latter is understood to involve information to prevent specific terrorist events through the use of signal interception, group infiltration, or imagery (Derksen 2005; Marlo 1999). We, instead, view the value of intelligence in terms of a signaling game of incomplete information, in which a target government is ill-informed about the *nature* of the terrorist group. Since 9/11, there is an emphasis on “understanding the enemy” and the lengths to which it will go to achieve its objectives (Scheuer 2006; Wright 2006). For example, al-Qaida has not folded to tremendous proactive measures; instead, al-Qaida has further decentralized; particularly with a regional emphasis (Sheehan 2008). Moreover, attacks on the

Madrid commuter trains and stations on March 11, 2004 and on the London transport system on July 7, 2005 illustrate that offensive measures against al-Qaida may incite backlash attacks by sympathetic terrorists. In the recent *Iraq Study Group Report*, the authors state that: “The Defense Department and the intelligence community has not invested sufficient people and resources to understand the political and military threat...” (Baker and Hamilton 2006: 61).

The primary purpose of this article is to indicate how a target government should tailor its counterterrorism response to an unknown terrorist threat. This tailoring involves not only the amount, if any, of concessions, but also the level of counterterrorism actions. Unlike earlier signaling models of terrorism (Arce and Sandler 2007; Lapan and Sandler 1993; Overgaard 1994), government countermeasures may provoke a backlash attack. Another innovation here is to permit partial concessions in place of an all-or-nothing concessionary response. A secondary purpose is to offer an endogenous characterization of terrorist spectaculars, based on a government’s counterterrorism stance and the likelihood for backlash attacks. Spectacular incidents arise from a pooling equilibrium, whereby the government cannot distinguish the militant orientation of a terrorist group.

In the two earliest signaling models of terrorism (Lapan and Sandler 1993; Overgaard 1994), the government has incomplete information about the resources available to the terrorist group. At the same time, however, terrorists are initially endowed with sufficient resources to send a signal corresponding to a spectacular attack, with the definition of spectacular given exogenously (in terms of the resource requirements). The main difference between these two models is that in Lapan-Sandler terrorists directly benefit from violence, whereas in Overgaard violence is payoff-decreasing in that it takes away resources from nonviolent political activity. Subsequent to 9/11 a categorization of terrorist types has emerged in which incomplete information stems from the differences in preferences that differentiate the Lapan-Sander and

Overgaard models, rather than resource differences. For example, Hoffman and McCormick (2004) distinguish between groups that are absolute in that the terrorists would rather fight than compromise, as compared to political types that are prepared to reach a compromise that leaves something on the table for each player. Franck and Melese (2004) make a distinction between organizations that have chosen terrorism as a means to political ends and fanatics who have a predilection for violence. In their typology, political terrorists primarily intend to use violence to attract attention or communicate demands. By contrast, for fanatics the aim is more on inflicting damage than political communication. In Abrams' (2006) typology, terrorists with limited objectives employ violence to win political concessions, whereas maximalist terrorists have demands over beliefs, values, and ideology that are more difficult for the target government to compromise over and relinquish. Finally, Arce and Sandler (2007) and Sandler and Arce (2007) explicitly combine the terrorists types in Lapan-Sandler and Overgaard to create a signaling model in which the target government has incomplete information about whether terrorists are militantly motivated (*M*-types) or politically motivated (*P*-types). *M*-types will only accept full concessions, whereas *P*-types will accept partial concessions. *M*-types expend resources on attacks if concessions are not granted; *P*-types allocate their remaining resources to political purposes if no accommodations are made. *P*-types are also concerned about losing the high moral ground from a never-ending terrorist campaign. *M*-type terrorists, however, see violence as sanctified and not as a (temporary) necessary evil. Such terrorists have an incentive to create backlash attacks in reaction to their target's response and may even franchise new groups for this purpose.

Based on these considerations, we would classify Euskadi ta Askatasuna (ETA), the Provisional Irish Republic Army (PIRA), the African National Congress (ANC), the Stern Gang, Irgun, the Tamil Tigers, Hamas, Hezbollah, and most ethno-nationalist terrorist groups as *P*-

types. For example, ETA seeks regional autonomy and self-determination over social services, schooling, taxation, and law and order. At times, ETA has agreed to cease-fires – the most recent ending in June 2007 – when they saw progress with respect to their demands. ETA limits collateral damage and directs most of its violence against symbols of the government. When more general targets are chosen (e.g., tourists hotels), ETA provides advanced warnings of bombings to minimize casualties. A political party – Bastasuna – represents the political agenda of ETA. In the case of PIRA, the Irish Army Council ended its military campaign on July 28, 2005, at which time it resorted to democratic means to pursue political goals. The ANC, the Stern Gang, Irgun, and the Tamil Tigers all had or have clear political goals. Recently, the Tamil Tigers suspended its terrorist campaign when it perceived progress toward the autonomy that it seeks. Although formidable and violent, Hamas and Hezbollah provide social services so that attacks have a real opportunity cost in terms of their political objectives.

In contrast, *M*-type terrorists present demands that cannot be partially satisfied – e.g., al-Qaida's demands for fundamentalist governments and an end to Israel, or Jemaah Islamiyah's demand for a pan-Islamic state. The Egyptian Islamic Jihad (al-Jihad) is also an *M*-type group, now allied with al-Qaida. In the past, the Abu Nidal Organization (ANO) was bent on murder and presented ambiguous demands. In Uruguay, the Tupamaros (1968-1972) failed to win over a constituency owing to its brutality (Enders and Sandler 2006: 17-18).

One must wonder why a government may not be informed about the nature of the terrorist threat. Incomplete information may stem from myriad factors. First, the terrorist group may be new with no past track record – e.g., al-Qaida in the early 1990s. Second, the group may have just splintered off from an established group. Terrorist groups may have both militant and political factions vying for control. Governmental partial concessions may result in the genesis of a harder-line group – e.g., ANO and the Popular Front for the Liberation of Palestine (PFLP),

which broke off from Fatah (Sandler and Arce 2003). Third, terrorist groups may not claim responsibility for an attack so that the government is in the dark about the group's orientation – e.g., neither the “Black Hawk down” incident in Somalia (October 1993) nor the bombing of the Khobar Towers housing US Air Force personnel in Dhahran, Saudi Arabia (June 1996) were claimed. Fourth, multiple competing claims of responsibility may be made by groups for the same attack(s). Fifth, a terrorist group may acquire a new leader so that its orientation morphs. Sixth, terrorists may purposely exhibit uncharacteristic behavior in the short term to enhance their *bona fides* with their constituency or expand their base of political support (Hoffman and McCormick 2004, Abrams 2006).

Given this lack of information concerning a terrorist group's intentions, a target government may face two types of regret: *P*-regret from conceding to a group that would *not* have continued attacking, and *M*-regret from not responding with the proper counterterrorism measures that limit subsequent damage from attacks. *P*-types have an incentive to mimic *M*-types with a spectacular incident that might result in concessions. *M*-types have a rationale for holding back during their initial attack to curb the government's counterterrorism response. Such issues and the proper policy response are explored below, after the basic model is presented.

2. The model

Our study is based on a two-period signaling model of terrorism without discounting. We do not build further time dynamics into the model because 90% of terrorist organizations have a life span of less than one year; and of those that make it to a year, more than half disappear within a decade (Rapoport 1992). In democratic target nations, the government's time horizon is also short due to the turnover of policymakers.

We consider a situation where terrorists send a signal, $s \in [0,1]$, corresponding to their

first-period attacks, where terrorists have total resources at their disposal equal to 1. Governments react to this signal with counterterrorism policy $r \in [0,1]$, where non-intelligence action r decreases the effectiveness of a second-period attack on a one-to-one (1:1) basis. The upper limit of 1 implies that we are examining the relative tradeoff between counterterror activities, r , and concessions, $1 - r$. In contrast to prior signaling models, this relative policy tradeoff is now a continuous variable, rather than a discrete all-or-nothing choice. In keeping with prior signaling models, we are interested in this policy tradeoff, rather than a simultaneous increase in both concessions and counterterror activities. Similarly, we do not further decompose r into proactive and defensive components (nor does any other signaling model), because the different transnational externalities that these policies produce is not the subject of inquiry.¹

Furthermore, $(1 - r)S$ translates into the concessions made to terrorists when the government takes stance, S , against terrorism. The more hard-line the government, the greater is S . As a government's declared stance of toughness increases, any concessions become more costly since they indicate a greater compromise of the government's principles. By the same token, terrorists place a higher value on concessions gleaned from a tough government. As the degree of concession is given by the term $(1 - r)$, partial concessions represent a cost of $(1 - r)S$ to the government and a gain of $(1 - r)S$ to terrorists who accept these concessions.

We follow the unifying convention adopted in Arce and Sandler (2007) and Sandler and Arce (2007) in which two types of terrorists are considered – P -type (political) and M -type (militant) – as described above. This convention generalizes prior models in which terrorists vary in terms of the resources at their disposal, but always have sufficient first-period resources to mount a spectacular attack. When terrorist types were defined in terms of resources, they

¹ See Arce and Sandler (2005) for a discussion of the public benefits of proactive policy versus the public costs of defensive policies.

were either considered to be exclusively *M*-types (Lapan and Sandler 1993) or *P*-types (Overgaard 1994).

In specifying the payoff function for *M*-types, we assume that they expend all remaining resources in a second-period attack and receive a benefit from their first- and second-period attacks. Prior signaling models employ a dichotomous government strategy set defined as {concede, not concede}. When the government conceded, it was a full concession so that there was little doubt that *M*-types would accept it. By extension, we assume that *M*-types do not seek or accept *partial* concessions. This is consistent with the description of absolute (Hoffman and McCormick 2004), fanatical (Franck and Melese 2004), and maximalist terrorists (Abrams 2006), a collection of terms falling under our *M*-typology. For example, the radical Islamist movement has never had a clear idea of participation in governance, or even much interest in it. Purification is the goal (Wright 2006: 247), which corresponds to full concessions here. Our assumption is consistent with *M*-type's willingness to accept (*de facto*) full concessions in prior models, with the added implication that partial concessions imply that less funds are expended on counterterrorism. This then increases the potential damage of a second-period attack by *M*-types. Effectively, the benefits that *M*-types perceive from second-period attacks under reduced defenses are greater than those from partial concessions.

In addition, *M*-types receive an increase of resources stemming from the government response equal to br , where $0 \leq b < 1$. This backlash term is investigated in prior nonsignaling models by Rosendorff and Sandler (2004), Faria and Arce (2005), Jacobson and Kaplan (2007), and Siqueira and Sandler (2007). The upper bound on b is justified because a response is likely to include defensive and proactive components, and only the latter is likely to elicit a backlash.² Indeed, Kydd and Walter (2006) classify one possible motivation for terrorism as an attempt to

² In addition, $b < 1$ is consistent with the finiteness of the duration of terror groups documented in Rapoport (1992).

provoke targets into overreactions that turn public opinion into support for terrorists. Similarly, Wright (2006) finds that one of Osama bin Laden's goals in implementing the attacks of 9/11 was to draw al-Qaida's opponents into responses that turn out to be repressive blunders, thereby encouraging attacks by other Muslims (see also Sheehan 2008).

The M -type's payoff is given as:

$$M(s, r) = \begin{cases} 1 + br - r & \text{when } r \in (0, 1]; \text{ and} \\ S + s & \text{when } r = 0 \text{ (full concessions).} \end{cases}$$

The "1" term in $M(s, r) = 1 + br - r$ is the benefits that militant types receive from expending all of their resources over both periods by violent means. It is the sum of the damages done in the first-period attack, s , and the second-period attack, $1 - s$. These benefits are offset by the government's counterterrorism policy, r , and are augmented by the backlash effect, br , which is treated as an additional resource used in M -type's second-period attack. Furthermore, the government's response, r , depends on the initial level of terrorism, s . Partial concessions, $1 - r$, enter into $M(s, r) = 1 + br - r$ through two channels. First, as partial concessions increase, the government reduces its second-period countermeasures, thereby increasing M -types' benefits from a second-period attack. Second, increased concessions translate into a reduced r , which diminishes the backlash effect, br . The target population for concessions and backlash are often the same (Faria and Arce 2005; Frey and Luechinger 2003).

Under full concessions, M -types benefit from the first-period attack, s , plus the concession, S , and do not attack in the second period. With full concessions, the top term in $M(s, r)$ is 1. M -types are better off accepting full concessions when $1 < S + s$; i.e., the benefit from expending all their remaining resources in a second-period attack, $1 - s$, is less than what is received from full concessions, S . Furthermore, the following inequality holds: $S > 1 \geq s$. The upper bound on a first-

period attack in terms of terrorists' resources explains why $1 \geq s$. The fundamental notion of terrorism as asymmetric conflict justifies $S > 1$. Specifically, the consequences of fully conceding are greater for the government than are the amount of resources terrorists have on hand to mount attacks. An alternative interpretation of $S > 1$ stems from $r \in [0, 1]$. Since a second-period attack cannot exceed 1 and the government's response reduces the effectiveness of an attack on a 1:1 basis, the response need not exceed 1. Hence, $S > 1$ reflects reality because the government has more at stake when it fully concedes than what it budgets for counterterrorism.

In the absence of full concessions, M -types send signal s with anticipated response, $r > 0$, instead of signal s' with response $r' > 0$, whenever $1 + br - r \geq 1 + br' - r'$. That is,

$$M \text{ signals } s \text{ when } r' - r \geq 0. \text{ (Recall that } b < 1.) \tag{1}$$

P -types view their first-period signal as a pure cost and receive benefits for their remaining resources, $1 - s$, in the second period as they are applied to a political goal. With partial concessions, P -types receive payoff,

$$P(s, r) = (1 - s) + (1 - r)S.$$

The first term in $P(s, r)$ is the degree to which violence constitutes an opportunity cost relative to using resources for nonviolent political purposes. The second term is the concessions that the government grants in response to s . In comparing payoffs for signal s and response r with those of s' and r' , we find that

$$P \text{ signals } s \text{ when } r' - r \geq \frac{1}{S}(s - s'). \tag{2}$$

The terrorists' (senders') payoffs are non-increasing in the government's (receiver's) response, which is atypical for signaling models. When the government increases its response, this decreases the payoffs for either type of terrorist. By contrast, in the educational signaling

model, an increased wage (employer response) raises the payoff for both types of potential employees, regardless of their intrinsic level of productivity. In addition, terrorists do not all wish to be perceived as one type, as is generally the case in signaling models (e.g., to be perceived as a high-productivity worker).³ Instead, there are advantages for *P*-types to be perceived as *M*-types if this convinces the government to grant greater concessions to avoid a feared backlash. Furthermore, *M*-types can benefit from being perceived as *P*-types if the government's restrained response augments the prospects of second-period attacks.

The government's (*G*'s) payoffs are zero-sum in attacks and concessions. If μ is the government's belief that it faces an *M*-type when signal s is sent, then the government's expected payoff is:

$$G(s, r) = \begin{cases} -\mu[(1-s)-r+br] - (1-\mu)[(1-r)S] - s, & \text{for } r > 0; \text{ and} \\ -S - s, & \text{for } r = 0 \text{ (full concessions)}. \end{cases}$$

In the top expression, the first term in brackets is the expected loss from a second-period attack by *M*-types, $1 - s$, which is offset by counterterror policy, r , and augmented by the backlash that the response provokes, br . The second term is the expected loss for making concessions to *P*-types, while the third term is the damages from the first-period attack, s . In the bottom expression, the government makes full concessions and loses $-S$ along with the first-period attack, $-s$. Against demands that correspond to "purification" or the loss of the target's status as a political entity, we assume that full concessions are too costly for the government; i.e.,

$G(s, r) > G(s, 0)$ for all levels of terrorist signals $s \geq 0$.⁴ In an analysis of twenty-eight recent

³ Although they do not provide a formal signaling model, Hoffman and McCormick (2004: 246) also discuss the non-monotonicity of terrorist types similar to those examined here.

⁴ This reduces to $S > \mu[(1-s)-r-br] + (1-\mu)[(1-r)S]$, which is the prior probability of an *M*-type multiplied by the *M*-type's payoff from a second-period attack plus the prior probability of a *P*-type multiplied by the partial concessions received in the second period. In other words, the government has more at stake from fully conceding than the aggregate damage due to partial concessions.

terrorist campaigns, Abrams (2006) finds the instance of total success – in terms of terrorist’s expressed objectives – to be exceedingly rare, which is consistent with our assumption of prohibitively costly full concessions. In contrast to terrorists’ types, the government stance is known by the terrorists. There is little doubt as to the terrorism stance of Israel and the United States in light of the demands outlined above.

The government’s payoff function is essentially an expected loss function that is appended by the cost of the initial attack, s . Hence, the government’s objective is to select a policy mix, r , that limits its expected losses given the cost of first-period attack, $-s$; i.e., $G(s, r^*) = -s$. Another way to interpret this equality is that the game is zero-sum in attacks and concessions; hence, if we remove the $-s$ term from both sides of the equality, the government’s objective is to minimize the expected losses associated with a second-period attack and/or concessions given the damages done in the first-period attack. In this interpretation, the government’s truncated payoff function is a loss function whose minimum expected value is zero; i.e., the government selects r such that $-\mu[(1-s)-r+br]-(1-\mu)[(1-r)S]=0$. Solving for r in either equality yields the loss-minimizing government policy:

$$r^* = \frac{\mu(1-s) + (1-\mu)S}{\mu(1-b) + (1-\mu)S}. \quad (3)$$

This response, r^* , sets the government’s expected losses equal to zero exclusive of the initial attack, and the losses are equal to $-s$ inclusive of the initial attack, s . As the expected losses cannot be further reduced via a different response, r^* is the government’s best response given the terrorist’s strategy, s , and government beliefs, μ . Consequently, counterterrorism policy is a function of the incomplete information that the government has about the type of terrorists that it faces, as reflected by the μ term in (3). There is therefore a role for intelligence to better inform policy, a subject we investigate in detail in Section 4. Briefly, under complete

information, let r_M be the government's policy when it faces an M -type group and let r_P be its policy when it faces a P -type group. When the government knows that it confronts a P -type, $\mu = 0$, implying that $r_P = 1$ from (3). The government makes no concessions when knowingly facing a P -type. Similarly, when the government knowingly faces an M -type, so that $\mu = 1$, (3) implies that $r_M = (1-s)/(1-b)$. The government responds to the anticipated second-period attack by accounting for the backlash, b , that favors the terrorists. If $b = 0$, then the government expends counterterrorism resources to completely offset the effect of the second-period attack: $r_M = 1-s$. By definition, it must also be the case that $r_M \leq 1$; i.e., $b \leq s$, so that the second-period "multiplier" effect of a response is less than the damage done by the first-period attack.

3. Pooling equilibria

Intelligence is relevant in signaling games of terrorism when the target government cannot distinguish between terrorist types and appropriately tailors its counterterrorism response. We have already discussed that M - and P -types may have incentives to mimic one another's first-period attacks. When both types mount the same first-period attack, the government cannot use this as a signal to update its priors about the terrorist threat and adjust its response accordingly. Under the appropriate conditions (identified below), this game has a continuum of pooling equilibria in which both types select initial signal/attack level s , relative to out-of-equilibrium signal s' . The groups are pooling on s .

Pooling equilibria are often sensitive to the beliefs and strategies that support them off the equilibrium path. In perfect Bayesian equilibria beliefs, are unrestricted off the equilibrium path. Moreover, although defined for general signaling games, most signaling refinements are motivated by examples where the sender's payoff is monotonic in type; e.g., low versus high

productivity in educational signaling or weak versus strong in the beer-quiche game. In such cases, the motivation for refining the set of off-the-equilibrium-path beliefs is based on interpreting an out-of-equilibrium message as a higher-order signal. As we have discussed above, the game under study is non-monotonic in type, with each type having some incentive to be taken for the other type. The same holds true in Arce and Sandler's (2007) model with two potential signals and M - and P - terrorist types. Hoffman and McCormick (2004) make a similar observation, without specifying an explicit signaling model. When the sender's preferences are no longer monotonic, beliefs and responses to off-the-equilibrium-path deviations can no longer be nested by type (Banks 1991).

In particular, when s' is the out-of-equilibrium signal, μ' is the government's belief that an M -type sent this signal and r' is the government's off-the-equilibrium-path response. When $s > s'$, condition (2) on P -type's rationality is the binding constraint on terrorists' signals, and when $s' > s$, (1) is the binding constraint. We therefore make the following assumption based on the non-monotonic nature of our game.

ASSUMPTION: For any (perfect Bayesian) pooling equilibrium where (r, μ) is the government's strategy/belief assessment on the equilibrium path, s , the assessment for off-the-equilibrium-path signal $s' < s$ is $(r', \mu') = (1, 0)$; and $(r', \mu') = (r, \mu)$ is the government's assessment for off-the-equilibrium-path signal $s' > s$.

This set of beliefs recognizes the non-monotonic nature of types in our game by specifying no concessions and maximum defenses for off-the-equilibrium-path signals (attacks)

that are less than the pooling signal.⁵ It recognizes the incentive for each type to look like the other – through an out-of-equilibrium signal – and, through (3), sets r accordingly. Further, it is consistent with a no negotiation/concession stance that often characterizes counterterror policies. Note that in a pooling equilibrium, the government's belief that it is facing an M -type on the equilibrium path, μ , is equal to the prior probability that terrorists are M -types. Hence, throughout the remainder of this section, we interpret $\mu \in (0,1)$ as this prior probability. The condition $(r', \mu') = (r, \mu)$ for $s' > s$ implies that the government does not further update from its pooling strategy if the off-the-equilibrium-path attack is greater than the pooling level. Again, non-monotonicity comes into play because M -types have an incentive to seek a greater response to provoke a backlash, and, given that no concessions occur for lower than pooling attacks, $s' < s$, this is the only path where concessions are a possibility (from the perspective of P -types). Hence, there is no rationale for the government to update any further. Finally, given that a pooling equilibrium must simultaneously satisfy conditions (1) and (2), our assumption gives the following intuitive characterization.

RESULT 1: pooling requires the government to believe that it is more likely (greater than .5) to be facing an M -type.

PROOF: applying the assumption about out-of-equilibrium beliefs to (2) yields:

$$1 - \underbrace{\frac{\mu(1-s) + (1-\mu)S}{\mu(1-b) + (1-\mu)S}}_{r^*} \geq \frac{s}{S}, \text{ which reduces to: } \frac{\mu(s-b)}{\mu(1-b) + (1-\mu)S} \geq \frac{s}{S}. \quad (4)$$

Cross-multiplying, we have

$$\mu s S - \mu b S \geq \mu s - \mu b s + s S - \mu s S. \quad (5)$$

⁵ This is equivalent to the off-the-equilibrium path belief structure in Arce and Sandler (2006) where only $s' < s$ is possible.

Equation (5) becomes $s[\mu(2S+b-1)-S] \geq \mu bS$. As the right side of this inequality is positive, it is necessary for the left-hand term in brackets to be positive for the inequality to hold (recall $s > 0$). The bracketed term is positive when

$$\mu > \frac{S}{2S+b-1} = .5 + \frac{.5(1-b)}{2S+b-1} = \mu^*. \blacksquare \quad (6)$$

Two implications follow from this result. First, the response, r^* , that satisfies (4) – characterized in term of μ, s, b and S – involves *partial* concessions ($r^* < 1$). In prior signaling models, pooling spectaculars occur under full concessions; yet, full concessions are rarely granted in practice. Moreover, for studies that call the rationality of terrorism into question, given the lack of evidence that terrorist groups successfully achieve their demands (e.g., Abrams 2006), we find an equilibrium rationale for terrorism that is based on pooling the goals of partial concessions for P -types and backlash effects for M -types. Furthermore, even though M -types do not accept partial concessions, target governments should understand the policy implication that partial concessions reduce the backlash effect that M -types seek to produce by placating the M -type's target constituency, rather than the M -types themselves.

Second, we can endogenously derive the first-period level of attack that allows for pooling. Under the above conditions, equilibrium condition (5) reduces to pooling on an attack, s , which meets or exceeds *spectacular* level, s^* , where:

$$s \geq \frac{\mu bS}{\mu(2S+b-1)-S} = s^*. \quad (7)$$

In prior signaling models of terrorism, s^* is exogenously defined as a large incident; whereas, s^* is now derived in terms of the equilibrium requirements for pooling. This is novel for two reasons. First, we have endogenously generated the lower bound on the pooling attack. Second, we can demonstrate that the spectacular interpretation is, indeed, correct. In a separating

equilibrium, P -types attack at level $s_p = 0$ and M -types attack at level $s_M \leq s_M^*$, where s_M^* is the upper bound on an M -type's separating attack. We later show in Result 5 that $s^* > s_M^*$, so that the pooling level of attack is greater than any level associated with a separating equilibrium, thereby making s^* the lower bound for spectacular attacks.

Comparative statics on s^* yield:

$$\frac{\partial s^*}{\partial \mu} = \frac{-bS^2}{[\mu(2S+b-1)-S]^2} < 0.$$

The greater the (prior) probability μ that the government believes that it is facing an M -type, the smaller the pooling spectacular attack. Effectively, P -types can free ride on the likelihood of M -types in terms of the resources necessary to mount a spectacular. P -types do engage in spectacular attacks to gain concession by appearing bent on even greater destruction if not appeased. Irgun Zvai Leumi bombed the local British military headquarters at the King David Hotel in Jerusalem on July 22, 1946 killing 91 (Enders and Sandler 2006: 250). This incident greatly contributed to the British decision to end its occupation. Hezbollah employed two large-scale suicide truck bombings against the US Marines and the French Paratroopers in Beirut on October 23, 1983. The multinational force departed Lebanon, as demanded, shortly after these incidents. Other P -types – e.g., Tamil Tigers – employ large-scale suicide attacks. Finally, the al Qaeda offshoot responsible for the Madrid train station bombings threatened to turn Spain into an inferno if Spain did not withdraw its troops from Iraq.

Another comparative static result regarding spectacular attacks relates to the “toughness” of the government's no-concession stance, S :

$$\frac{\partial s^*}{\partial S} = \frac{\mu^2 b(b-1)}{[\mu(2S+b-1)-S]^2} < 0.$$

The lower bound on a spectacular attack is inversely related to S . When a government is hard-

line (high S), the threshold falls for classifying spectaculars. Thus, totalitarian governments view virtually any attack as spectacular, because any terrorism is a serious affront; hence, the tendency of these governments not to report terrorist events. Finally, we have

$$\frac{\partial s^*}{\partial b} = \frac{\mu S [\mu(2S-1) - S]}{[\mu(2S+b-1) - S]^2} > 0.$$

In a pooling equilibrium, $\mu \in (.5, 1)$ so that the effect of backlash attacks on what constitutes a spectacular is ambiguous. When the government is uncertain that it faces an M -type ($\mu \rightarrow .5$), greater backlash lowers s^* . When, conversely, the government is certain that it faces an M -type ($\mu \rightarrow 1$), greater backlash raises s^* . For the latter, the presence of backlash raises the stakes in terms of the required size of a pooling spectacular. The government realizes that first-period attacks are intended to provoke a large response resulting in more backlash, so government restraint is required.

RESULT 2: Spectacular attacks that meet or exceed the level of s^* given in (7) are consistent with a continuum of pooling equilibria. The defining level for spectaculars is inversely related to the government's stance against terrorism, S , and its (prior) belief that it is facing an M -type. In contrast, the influence of a backlash on the defining level of spectaculars is ambiguous.

Another important value is the lower bound on the government's prior that it is facing an M -type, consistent with the pooling equilibrium, μ^* . From (6), it is clear that $\partial \mu^* / \partial S < 0$ and $\partial \mu^* / \partial b < 0$. Thus, the greater is the government's stance against concessions, the less certain that government needs to be that terrorists are an M -type for a pooling equilibrium, in which the government does not fully concede. Moreover, the greater is the backlash, the less certain that

the government needs to be that terrorists are M -types for a pooling equilibrium.

RESULT 3: The (prior) belief that the government is facing an M -type, consistent with a pooling equilibrium, is inversely related to the government's stance against terrorists and the potential backlash.

4. The value of intelligence

In models with incomplete information about terrorists' resources or preferences, the value of intelligence stems from better informing the government on its choice of strategy. For example, Lapan and Sandler (1993) measure this value regarding whether it is optimal for a government to concede or not. Arce and Sandler (2007) instead identify a potential trade-off between conceding to an M -type versus decreasing the effectiveness of a second-period attack. In these models, the value of intelligence involves the avoidance of *ex post* regret. Given a pooling equilibrium, *ex post P*-regret occurs when the pooling payoff is compared to the "no-concede" payoff, which is the optimal strategy when the government faces a P -type. *Ex post M*-regret is measured as the difference between the pooling payoff and the government's optimal policy when it knows that it confronts an M -type. We also determine the value of intelligence by comparing the government's *ex post* payoff for a given type under its pooling response with its optimal complete information strategy. Because the policy response is a continuous variable in our model, intelligence not only tells the government whether to concede or not, but also how to tailor its response in anticipation of a second-period attack. Hoffman and McCormick (2004: 247) similarly observe that intelligence is not only needed to find, fix and destroy terrorist groups, but to also develop an accurate picture of the threat the group is likely to pose down the road. Specifically, in our model, intelligence guides the optimal counterterrorism response in recognition of the response's potential to create a backlash that fuels the terrorist campaign, as

given in (3). The potential for intelligence to inform counterterrorism policy distinguishes this study from prior signaling models and further illuminates intelligence's role as a complement to event-specific information.

We use (3) to ascertain the government's optimal payoff with complete information. For P -type terrorists, $G(s, r_p)$ equals $-s$, as $\mu = 0 \Rightarrow r_p = 1$; for M -type terrorists, $G(s, r_M)$ also equals $-s$ because $\mu = 1 \Rightarrow r_M = (1-s)/(1-b)$. In the latter case, the government's countermeasures completely offset the second-period attacks by accounting for any backlash. Given that the government's complete information payoff is $-s$, we now calculate the value of intelligence.

Case 1: Ex post the government faces a P -type. The government's *ex post* payoff is $-(1-r)S - s$, corresponding to the concession that it makes and its losses from the first-period attack. In the pooling equilibrium, the government's response is given by (3). Substituting this value for r into the *ex post* payoff yields:

$$-\left[\frac{\mu(s-b)}{\mu(1-b) + (1-\mu)S} \right] S - s.$$

Since the *value of intelligence* is the avoidance of *ex post* regret, it is the difference between the complete information payoff, $-s$, and the pooling payoff above. For a P -type, this value, v_p , is given by:

$$v_p = \left[\frac{\mu(s-b)}{\mu(1-b) + (1-\mu)S} \right] S. \quad (8)$$

Case 2: Ex post the government faces an M -type. The government's *ex post* payoff is $-\left[(1-s) - r + br \right] - s = -(1-r+br) - \left[(1-s) - r + br \right] - s = -(1-r+br)$. Substituting the pooling response, r , based on (3), we find that the government's *ex post* payoff for an M -type is:

$$-\left[\frac{\mu(s-b)}{\mu(1-b) + (1-\mu)S} \right] - b \left[\frac{\mu(1-s) + (1-\mu)S}{\mu(1-b) + (1-\mu)S} \right] - s.$$

The difference between the complete information payoff, $-s$, and this pooling payoff is the value of intelligence when facing an M -type's, in a pooling equilibrium, v_M :

$$v_M = \left[\frac{\mu(s-b)}{\mu(1-b) + (1-\mu)S} \right] + b \left[\frac{\mu(1-s) + (1-\mu)S}{\mu(1-b) + (1-\mu)S} \right]. \quad (9)$$

We now ascertain whether a ranking exists between the value of intelligence to avoid P -regret versus M -regret. We have assumed that $S > 1 \geq r$, so that the cost of fully conceding to terrorists (S) exceeds the budgeted response to terrorist attacks ($1 \geq r$).⁶ When comparing the two values of intelligence, we have

$$v_P > v_M \Leftrightarrow (\mu s - b)S > \mu s(1-b).$$

Since $b < 1$, the right hand of this inequality is positive. Given that S is also positive, a necessary condition for this inequality is $\mu > b/s$. As we earlier derived that $r_M \leq 1$ implies $s \geq b$, the necessary condition holds when the prior probability of an M -type takes an extreme value; specifically, $\mu \in (b/s, 1)$. If $s = b$ this condition cannot be met and $v_P < v_M$. Further, when μ falls within this range, the government is relatively certain that it is facing an M -type. There is very little need for intelligence in such circumstances. By contrast, when μ takes an intermediate value, $\mu \in (\mu^*, b/s)$, this is consistent with the notion of a pooling equilibrium in that the government is relatively uncertain about the type of terrorist it is facing.⁷ In other words, the value of intelligence is an issue when μ takes an intermediate value rather than an extreme one. This implies that M -regret is the overriding issue; i.e., $v_P < v_M$. We can thus conclude that, *in the presence of backlash attacks* ($b \neq$

⁶ If, however, $S \leq 1$, then clearly $v_M > v_P$.

⁷ The interval $(\mu^*, b/s)$ is well-defined when $b/s > \mu^*$ or $b > s\mu^*$. In other words, the backlash effect must have sufficient potential; otherwise, there is no incentive for M -types to provoke a response with a spectacular.

0), the value of intelligence is defined by the avoidance of *M*-regret.

This observation calls into question the focus on *P*-regret in prior signaling models where the government either fully conceded or held firm. Arce and Sandler (2007) introduce the possibility of *M*-regret when, *ex post*, the government would have preferred a counterterrorism response to (full) concession. However, they do not allow for mollified reactions that include both partial concession and a measured response, nor do they allow for *M*-type attacks designed to provoke a backlash to the government's response.⁸ In our analysis, the value of intelligence is almost always defined by the avoidance of *M*-regret. The identification of the nature of intelligence comes from our generalized framework that allows for a continuous response strategy that weighs defensive benefits and counterproductive backlash reactions.

Because v_M is the likely measure of the value of intelligence, we are interested in the comparative statics of v_M relative to the government's stance and backlash. To begin, we have $\partial v_M / \partial S \leq 0$ (see appendix). In Arce and Sandler (2007), the relation between the value of intelligence and the government's stance is ambiguous due to the discrete nature of the policy response, which allows for both forms of regret. Our unambiguous comparative static finding means that a tough stance to weather attacks is best served by investing resources in strong counterterrorism measures, which includes event-preventing intelligence. With a tougher stance, there is less to gain from knowing the nature of the threat since concession is less of an option.

Moreover, the ways in which s^* and v_M are related to the backlash term have important policy implications. First, it is unclear whether the potential for backlash increases or decreases the magnitude of spectacles (s^*) required for pooling equilibria (Result 2); yet in a pooling equilibrium, intelligence is required to avoid *M*-regret. Second, the value of information to avoid

⁸ *P*-regret is relevant in their study because, effectively, $b = 0$ so that $\mu s > b$ holds trivially.

M -regret is inversely related to the size of the backlash to the government's response:

$\partial v_M / \partial b < 0$ (see appendix). This follows because knowledge of b is effectively a substitute for intelligence regarding terrorist types, given that only M -types seek to create a backlash to the government response. If, consequently, the government determines the potential for a backlash, it then knows whether M -types have a greater incentive to mount a spectacular attack in a pooling equilibrium. In other words, *intelligence should be focused on the propensity for counterterrorism to result in a backlash.*

5. Separating equilibrium

We now consider the case where $s_M \neq s_P (= 0)$. In such a separating equilibrium, the government has perfect information about which type of terrorist it is facing at the information sets following signals s_M and s_P , respectively. The government's responses are r_M and r_P , respectively. The best response characterization in (1) for an M -type's signal is: $r_P - r_M \geq 0$; while the best response characterization in (2) for a P -type signal is: $r_M - r_P \geq -\frac{s_M}{S}$, or

$r_P - r_M \leq \frac{s_M}{S}$. Combined, these inequalities indicate that:

$$\frac{s_M}{S} \geq r_P - r_M \geq 0.$$

Further, $\mu = 1$ at the information set corresponding to s_M and $\mu = 0$ at the information set corresponding to s_P . From (3), this results in $r_M = (1 - s_M) / (1 - b)$ and $r_P = 1$. The government adjusts its response, r_M , according to the anticipated second-period attack and potential backlash, and it does not concede to P -types. Combining these values with the above inequality produces:

$$\frac{s_M}{S} \geq 1 - (1 - s_M) / (1 - b) \geq 0 \text{ or } \frac{s_M}{S} \geq (s_M - b) / (1 - b) \geq 0.$$

Cross-multiplying and solving for s_M gives an upper bound for the separating equilibrium, s_M^* :

$$s_M \leq \frac{bS}{S + b - 1} = s_M^*. \quad (10)$$

RESULT 4: A separating equilibrium (s_M, s_P) exists in which P -types do not attack and receive no concessions ($s_P = 0$ and $1 - r_P = 0$) and M -types initially attack at or below s_M^* . The government's optimal response to the attack is $r_M = (1 - s_M) / (1 - b)$.

The comparative statics on upper bound s_M^* are as follows:

$$\frac{\partial s_M^*}{\partial S} = \frac{b(b-1)}{(S+b-1)^2} < 0, \text{ and}$$

$$\frac{\partial s_M^*}{\partial b} = \frac{S(S-1)}{(S+b-1)^2} > 0.$$

In a separating equilibrium, M -types must attack below the level, s_M^* , which is an inverse function of the government's hard-line stance, S . When facing a tough government, militant terrorists are better off by not provoking an immediate response and, instead, intertemporally substituting into second-period attacks. If, however, the resulting backlash to the government's response is expected to be high, then militants should instead move their plans forward to promote recruitment. The intertemporal nature of attacks is therefore characterized by a fundamental trade-off between the effectiveness of government counterterrorism policy and the backlash that the policy provokes.

6. Spectacular attacks are pooling phenomena

The trade-off between the additional benefit that M -types seek by restraining carnage in the first period versus the potential for provoking a backlash raises the issue of whether the upper bound on M -types' separating attack, s_M^* , crosses the lower bound on the pooling equilibrium spectacular, s^* . Formally, we have:

RESULT 5: (Spectacular) pooling attacks cannot be considered militant attacks, consistent with a separating equilibrium; i.e., $s_M^* < s^*$.

Proof: see appendix.

The fact that the pooling attack, s^* , *exceeds* the level of an M -type attack associated with a separating equilibrium, s_M^* , is what allows us to label s^* as a spectacular. Results 2 and 5 allow us to endogenously derive and characterize the value of a spectacular, in contrast to its exogeneity in other signaling models of terrorism. Instead of the conventional wisdom that M -types seek to distinguish themselves through spectacular attacks, we have the novel result that spectaculars are pooling phenomena. In a separating equilibrium, the government does not concede to P -types and it knows to tailor its response to M -types based upon the expected magnitude of the second-period attack and the potential backlash that the government response may elicit. Partial concessions are made in the pooling equilibrium to reduce the backlash effect of a government's response. This implies a benefit for M -type's because the presence of incomplete information means that the government's response does not fully anticipate M -type's second-period attack. Further, P -types directly benefit from the partial concessions. Consequently, both M - and P -types have an incentive to create a pooling equilibrium through a spectacular attack, thereby preserving a situation of incomplete information.

7. Concluding remarks

This paper presents a signaling model of terrorist attacks where the government is uninformed about whether the terrorists are politically or militarily motivated. The former view attacks as a pure cost and will accept partial concessions, while the latter derives fulfillment from the attack itself and will only accept full capitulation. We derive a characterization of spectacular terrorist incidents as a function of the country's declared stance of toughness and the terrorists' goal of inciting a counterterrorism-induced backlash recruitment. Although *M*-types do not accept partial concessions, a target government offers such concessions to limit backlash, thereby reducing militants' payoffs. We associate spectacular incidents with a pooling equilibrium, where the government cannot distinguish the nature of the terrorist threat. That is, *M*-types engage in large-scale incidents to prod the government into a response that provokes a backlash. *P*-types also resort to large-scale incidents in the hopes of receiving partial concession, given by governments to limit a backlash. In a pooling equilibrium, the value of intelligence derives from the proper policy mix of countermeasures and concessions to combat just *M*-types. Thus, intelligence on the potential for a backlash serves as an effective substitute for identifying the nature of the terrorist type. This insight is not available from prior signaling models.

Appendix

Proof that $\partial v_M / \partial S \leq 0$: From (9), $v_M = \left[\frac{\mu(s-b)}{\mu(1-b) + (1-\mu)S} \right] + b \left[\frac{\mu(1-s) + (1-\mu)S}{\mu(1-b) + (1-\mu)S} \right]$.

$$\frac{\partial v_M}{\partial S} = \left[\frac{-\mu(1-\mu)(s-b)}{(\mu(1-b) + (1-\mu)S)^2} \right] + b \left[\frac{(1-\mu)(\mu(1-b) + (1-\mu)S) - (1-\mu)(\mu(1-s) + (1-\mu)S)}{(\mu(1-b) + (1-\mu)S)^2} \right].$$

The denominators are common and positive, so that they can be eliminated. By dividing through by $(1-\mu) > 0$ and aggregating terms, we have:

$$\text{sign} \left\{ \frac{\partial v_M}{\partial S} \right\} = \text{sign} \{ -\mu(s-b) + b\mu(s-b) \} = \text{sign} \{ (b-1)\mu(s-b) \}.$$

Since $b < 1$ and $s \geq b$, $\partial v_M / \partial S \leq 0$. ■

Proof that $\partial v_M / \partial b \leq 0$: Using the value of v_M given in (9), we have

$$\frac{\partial v_M}{\partial b} = \left[\frac{-\mu(\mu(1-b) + (1-\mu)S) + \mu^2(s-b)}{(\mu(1-b) + (1-\mu)S)^2} \right] + b \left[\frac{\mu(\mu(1-s) + (1-\mu)S)}{(\mu(1-b) + (1-\mu)S)^2} \right].$$

We again eliminate the common positive denominator. Next, we divide the numerator by $\mu > 0$,

which leaves:

$$\text{sign} \left\{ \frac{\partial v_M}{\partial b} \right\} = \text{sign} \{ -(\mu(1-b) + (1-\mu)S) + \mu(s-b) + b(\mu(1-s) + (1-\mu)S) \}.$$

Aggregating terms, we get

$$\text{sign} \left\{ \frac{\partial v_M}{\partial b} \right\} = \text{sign} \{ (b-1)[(1-\mu)S + \mu(1-s)] \}.$$

Since $\mu, b < 1$; $s \leq 1$; and $S > 1$, this implies $\partial v_M / \partial b < 0$. ■

Proof of Result 5: The result holds when $s_M^* = \frac{bS}{S+b-1} < \frac{\mu bS}{\mu(2S+b-1)-S} = s^*$, because then

any pooling spectacular that exceeds s^* will not be chosen by M -types in a separating equilibrium. As shown in Section 3, the denominator on the right side of this inequality is positive; otherwise, no pooling equilibrium exists. The denominator of the left-hand side is positive because $S > 1$. Cross-multiplying, $2\mu bS^2 + \mu b^2S - \mu bS - bS^2 < \mu bS^2 + \mu b^2S - \mu bS$.

Aggregating terms, $\mu bS^2 < bS^2$ or $\mu < 1$, which holds by definition. ■

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