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By

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Abstract: The paper shows that in the absence of external sponsorship, strategic cooperation between two outfits has no impact on terror activity, if neither outfit is resource-constrained *a priori*. If only one outfit is resource-constrained *a priori*, inter-group cooperation increases terror activity if and only if there is sufficient resource-asymmetry between the outfits. Further, if both outfits are resource-constrained *a priori*, then cooperation may increase or decrease terror activity, depending on parametric asymmetries. Finally, it is demonstrated that while cooperation can neutralize the impact of strategic external sponsorship on terror activity and thereby remove the incentive for its provision, there is always some external sponsorship mechanism which can be utilized to enhance terror activity.

Key words: Terror outfit; Terror attacks; Non-cooperative competition; Outfit cooperation; Sponsorship fund; Counter terrorism

JEL Classifications: C71, C72, D74, H79.

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1. Introduction

Terrorists perpetrate violence to draw public attention to their objectives, and to pressurize ruling political dispensations into capitulating to their demands. Just as governments of different countries may coalesce to combat terrorism, terrorist groups may join forces to overwhelm the State machinery.[1] For instance, consider the merger in 2012 of the Somali terrorist group al-Shabaab, with the al Qaeda.[2] Alliances between terrorist groups however, are an exception rather than the rule, given that less than one percent (417 to be exact) of the 81,799 terror attacks conducted during 1970-2007 involved more than one terror outfit (Asal et al., 2016). This may be due to the inability of terror outfits, which are illegal organizations, to credibly overcome commitment issues in the absence of third-party enforcement (Bacon, 2017).[3] Further, a significant fraction of outfits does not exist for more than a year, thereby making it difficult for them to reliably pledge to certain behavioral patterns for the long term.[4]

In fact, a prominent reason proposed in the literature for inter-outfit cooperation, is the resultant enhancement of outfit longevity. Using data spanning 1987 to 2005, Phillips (2014) shows that terror outfits having one ally are 38 percent less likely to discontinue in a given year, compared to terror outfits without any ally. Further, the ability of terror outfits to address each other's organizational voids, forge a common discernibility and cultivate mutual trust are ubiquitous prerequisites for intergroup alliances (Bacon, 2018a). The notion that alliances are a measure of vulnerability, however, is not empirically validated.[5] On the other hand, Phillips (2019) finds that "*alliances are associated with territorial control, intermediate membership size, and religious motivation*".

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[1] See Sandler (2005) for a discussion on coordination problems which plague international cooperation against transnational terrorism, but do not hinder resolute effort against domestic terrorism; and Perliger and Milton (2018) for a data-driven identification of conditions under which countries may engage in counter-terrorism cooperation.
[2] See Thomas (2013) for a discussion on the counter-terrorism opportunities arising from vulnerabilities created as a result of this amalgamation.
[3] See Choi, Chowdhury and Kim (2016) for an insightful discussion on inter-group and intra-group dynamics, and possible feedback effects of inter-outfit rivalries. These can potentially negate any attempts at cooperation.
[4] Phillips (2019), based on eight most extensive global datasets on the longevity of terror outfits, obtains that 25-74 percent of outfits do not last beyond a year.
[5] See Phillips (2019), for instance.

In addition to understanding the causes of inter-group terrorist cooperation, it is also important to dwell on the nature of cooperation between terror outfits. Significant variation is observed in the scope and depth of cooperation between different terror outfits, from mergers and strategic cooperation at the upper end of the scale, to tactical and transactional cooperation at the lower end (Moghadam, 2015). In fact, mergers and strategic cooperation become equivalent if payoffs are freely transferable between the outfits, under the latter regime. When outfits merge, each outfit sacrifices its individual identity. Under transactional cooperation, at the other end of the spectrum, there is usually no noteworthy loss of independence for either outfit. Hence, the quality of cooperation holds salience for each outfit, and thereby for those seeking to counter them.

The present work is the first to formally model inter-outfit strategic cooperation in a manner which reveals that the cooperating outfits may conduct more, less or the same number of attacks as in the absence of cooperation; based on whether they are resource-constrained or not *a priori*; and on the extent to which cooperation can serve to ease such a constraint through inter-outfit resource-transfer. The alleged provision of training facilities by the Hezbollah in southern Lebanon, for thousands of Hamas fighters, is a case in point.[6] Bacon (2018b) discusses how cooperation between the al Qaeda and the Taliban, provided the former with a safe haven in Afghanistan, while benefitting the latter in terms of superior training of its fighters by al Qaeda operatives. She points out that al Qaeda operatives have, in fact, been known to carry out special operations on Taliban's behalf. Bacon (2018b) also mentions how it was the al Qaeda, during the 1990s, which provided funds to the Taliban. This typifies successful cooperation spanning over two decades, in which resources have been transferred in both directions during different periods of time, based on changing circumstances and evolving requirements. Also consider the alliance with the Popular Front for the Liberation of Palestine (PFLP), initiated by Fusako Shigenobu of the Japanese Red Army, in 1971. The cooperation, driven by resource requirements needed to implement its chosen strategy, resulted in the provision of guerilla training facilities to Red Army members, by PFLP operatives in Lebanon (Steinhoff, 1976; Bacon 2018a).

[6] See "Israel says Hamas working with Hezbollah to train 'thousands' in Lebanon", in Times of Israel (9 June, 2018), https://www.timesofisrael.com/israel-says-hamas-working-with-hezbollah-to-train-thousands-in-lebanon/.

Based on Bhan and Kabiraj (2020), our structure is able to illustrate clearly the distinction – if present - between the equilibria in the presence and absence of strategic cooperation, under different parametric restrictions. Further, the formulation demonstrates a natural barrier to the excessive use of any outfit channel for conducting attacks under cooperation, based on the diseconomies of scale associated with terror activity. This shows why such cost-convexities, by themselves, may provide a strong rationale for inter-outfit cooperation by providing the co-operating outfits multiple channels of terror activity.

Other benefits from strategic cooperation may flow from the internalization of operational externalities imposed by the activities of one group on the other, such as those discussed and modeled in Bhan and Kabiraj (2019). As a consequence of such cooperation, the total number of attacks conducted by the terrorists would tend to increase under positive externalities, and decrease under negative externalities. The present analysis, on the other hand, rationalizes strategic cooperation even in the absence of externalities, thereby indicating the possibility of inter-outfit cooperation in a wider range of real-world situations.

Refer to the afore-mentioned example of cooperation between the Japanese Red Army and the PFLP, the former originating in the East Asian country of Japan, and the latter operating in West Asia. Despite the traditional theatres of operation of these outfits being separated by thousands of kilometers of land and sea, their alliance led to the deadly attack conducted by Red Army terrorists on Lod Airport near the Israeli city of Tel Aviv in 1972, resulting in 28 deaths (including two attackers) and nearly 80 injuries (including the third attacker), thereby highlighting the potential for deadly cooperation between outfits imposing no operational externalities on each other *a priori*.

Inter-outfit cooperation may also have grave consequences in terms of the lethality of terror outfits. For instance, consider the symbiotic relationship that emerged between the Southeast Asian outfit Jemaah Islamiyah and the al Qaeda, which enabled the training of the former's manpower by the latter's operatives, resulting in the deadly Bali bombing in 2002 (Horowitz and Potter, 2014). Also, the then alleged and oft-ridiculed - and later proven - training of amateur Boko Haram personnel by al Qaeda in the Islamic Maghreb (AQIM) operatives beginning in 2009, resulted in suicide attacks conducted by the former in 2011 on the United Nations office in Abuja, Nigeria, using tactics similar to bombings conducted by the latter (Aronson, 2014). These examples serve to illustrate how cooperation can serve to increase the killing capacity of the outfits involved.

Finally, the circumstances associated with cooperation between symmetric and asymmetric entities, is critical in obtaining a holistic understanding of inter-group terrorist cooperation. Utilizing the UCDP/PRIO Armed Conflict Dataset, Bapat and Bond (2012) conclude that whereas outfits less at risk of State suppression tend to favour two-sided alliances, "*vulnerable militants are more likely to form asymmetric alliances*" such as those involving state or external sponsors. The present paper borrows from the formulation of Bhan and Kabiraj (2020) to illustrate not only the potential of strategic external sponsorship to augment violence, but also to demonstrate how strategic intergroup cooperation between terrorists can impede the effectiveness of such sponsorship, thereby decreasing the appeal for any potential sponsor to finance the cooperating outfits. This also provides a logical basis for a potential external sponsor, to hinder any inter-outfit strategic cooperation, in order to increase its own ability to induce additional terror attacks.

Consider for instance, the impact of the emergence of al-Badr in the Indian State of Jammu and Kashmir, towards the close of the 20th century. Earlier operating under the banner of Hizb-ul-Mujahideen (HM), Al-Badr was allegedly encouraged by Pakistan's Inter-Services Intelligence (ISI) to operate independently in the year 1998, as mentioned in an ANI report (dated 23 August, 2017) titled 'J-K: Al-Badr terrorist killed in Budgam encounter'.[7] Since then, the combined number of terror strikes conducted by both outfits dramatically increased, although HM still accounted for an overwhelming majority of the attacks. From 0 incidents in 1996 and 1997, the combined number of terror strikes jumped to 8 in 1999, 12 in 2000, and 11 in 2001. It is also noteworthy that Al-Badr was involved in only 1 terror incident (in 1999) out of the combined 31 in the period 1999-2001 (Global Terrorism Database). Hence, by engineering a split between HM and Al-Badr, the ISI was able to manipulate the former into conducting more attacks in order to maintain its (the HM's) pre-eminence.

[7] See https://www.aninews.in/news/national/politics/j-k-al-badr-terrorist-killed-in-budgam-encounter/.

The present work also provides a theoretical foundation for strategic external sponsorship, by internalizing the decision of terror outfits to cooperate strategically or not, and the external finance offered. Based on the *ex-ante* resources with the outfits and the quantum of finance made available by the sponsor, situations are illustrated where strategic external sponsorship can optimally induce outfits to operate non-cooperatively, and conduct attacks at the behest of the strategic sponsor.

Counter-terrorism (CT) implications of inter-group strategic cooperation must be viewed in light of the specificities of each instance in terms of *ex ante* resources with the outfits, availability of external sponsorship, etc., in order to determine whether such cooperation would increase or decrease terror strikes. Circumstances encouraging cooperation must be created in the latter situation, while measures inhibiting cooperation must be pursued in the former. For example, if the presence of a potential external sponsor is likely to increase attacks by discouraging cooperation, then CT efforts must be directed at enabling and encouraging alliance-formation, and thereby keeping the external sponsor at bay. Consider conversely, for instance, that cooperation is likely to ease the resource-constraint of an outfit such that overall violence is augmented. Then all efforts must be made to disrupt such an alliance by sowing distrust between the outfit leaders by raising suspicions of the potential partner being infiltrated by enemy intelligence, emphasizing ideological distinctions and operational autonomy, etc. via surveillance of inter-group communications and covert messaging for example, along the lines suggested by Bacon (2017).

The next section presents the baseline model, utilizing it to characterize and compare the equilibria under cooperation and non-cooperation. The third section analyzes the impact of strategic cooperation in the presence of a potential external sponsor. The fourth section extends the analysis by endogenizing the outfits' decision to cooperate or not, in the presence of strategic external sponsorship. Finally, the fifth section briefly discusses the implications of the results obtained, and concludes.

2. Model

Consider the interaction of two terror outfits, T_1 and T_2, operating in a target country. We assume that utility or payoff of T_i comes from two sources: consumption (over and above the subsistence level) (X_i), and the number of attacks it conducts (A_i).[8] Assume the utility function to be linear, specifically,[9]

$$U_i = X_i + \alpha_i A_i; \, i = 1, 2$$

where the parameter α_i (≥ 0) represents intrinsic propensity of violence of T_i. The associated cost of conducting A_i attacks for T_i is

$$C_i(A_i) = \frac{1}{2}\beta_i A_i^2$$

where β_i is a parameter representing cost-efficiency of terror outfit i, such that a higher β_i represents lower efficiency. The quadratic cost function reflects increasing difficulty in conducting successive attacks. Then, the budget constraint of T_i is given by:

$$X_i + \frac{1}{2}\beta_i A_i^2 = R_i$$

where R_i (> 0) is the resource-endowment available to T_i, net of subsistence consumption. We first note the equilibrium outcomes when the outfits interact independently or non-cooperatively, that is, when each outfit maximizes its payoff subject to its budget constraint. Following Bhan and Kabiraj (2020), we have the following results.

2.1 Non-cooperative (NC) equilibrium outcomes

(NC1): When $R_i \geq \frac{1}{2}\beta_i \left(\frac{\alpha_i}{\beta_i}\right)^2$ holds for each i, that is, no outfit is resource constrained, we call this interior equilibrium. Then in equilibrium:

$$A_i^{NC} = \frac{\alpha_i}{\beta_i}, \quad \text{and } X_i = R_i - \frac{1}{2}\frac{\alpha_i^2}{\beta_i} \equiv X_i^{NC} \geq 0 \qquad \forall\, i = 1, 2 \tag{1a}$$

Hence, total number of attacks is:

$$A^{NC} = A_1^{NC} + A_2^{NC} = \frac{\alpha_1}{\beta_1} + \frac{\alpha_2}{\beta_2} \tag{1b}$$

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[8] More generally, A_i can be considered to be an index of terror activity. We assume A_i to be a continuous variable.
[9] The formulation is based on Bhan and Kabiraj (2020).

(NC2): When $R_1 \geq \frac{1}{2}\beta_1\left(\frac{\alpha_1}{\beta_1}\right)^2$ but $R_2 < \frac{1}{2}\beta_2\left(\frac{\alpha_2}{\beta_2}\right)^2$, the equilibrium outcomes will be:

$$A_1^{NC} = \frac{\alpha_1}{\beta_1},\, X_1^{NC} = R_1 - \frac{1}{2}\frac{\alpha_1^2}{\beta_1} \geq 0 \text{ , but } A_2^{NC} = \sqrt{\frac{2R_2}{\beta_2}} \text{ and } X_2^{NC} = 0 \quad (2a)$$

$$A^{NC} = A_1^{NC} + A_2^{NC} = \frac{\alpha_1}{\beta_1} + \sqrt{\frac{2R_2}{\beta_2}} \quad (2b)$$

(NC3): When $R_i < \frac{1}{2}\beta_i\left(\frac{\alpha_i}{\beta_i}\right)^2$ holds $\forall\, i = 1, 2$, in equilibrium we have:

$$A_i^{NC} = \sqrt{\frac{2R_i}{\beta_i}}, \text{ and } X_i^{NC} = 0 \;\; \forall\, i = 1, 2 \quad (3a)$$

$$A^{NC} = A_1^{NC} + A_2^{NC} = \sqrt{\frac{2R_1}{\beta_1}} + \sqrt{\frac{2R_2}{\beta_2}} \quad (3b)$$

We call the equilibrium (NC2) and (NC3) corner solution -- this is the case when at least one outfit is resource constrained. Given the above equilibria, we shall now study whether under cooperation, the outfits together will enhance terror activity.

2.2 Co-operation between the terror outfits

We assume that under cooperation, payoffs are freely transferable between outfits. This means that under cooperation, the outfits are concerned with the maximization of the sum of their payoffs, subject to the overall resource constraint. Hence, strategic cooperation is equivalent to a merger of the outfits. The outfits will cooperatively decide the numbers of attacks to be conducted through each of the two outfit channels. After this allocation, any resources left over will be consumed by the outfits. Note that the channel of consumption is irrelevant.

As far as incentive for cooperation is concerned, it is true that in the present context there is no coordination or externality problem, nor is there an increase in cost efficiency though cooperation. Since the joint payoff under cooperation is always at least as large as the sum of their non-cooperative payoffs, this explains the incentive for cooperation. Moreover, if the ultimate objective of the terror activities is to overpower the targeted country and take a control, then the outfits are likely to promote increasing the number of total terror. We identify the situations when total number of attacks goes up under cooperation, and try to derive insights into the problem.

The optimization problem under cooperation is

$$Max_{X_1,X_2,A_1,A_2}(U_1 + U_2) = X + \alpha_1 A_1 + \alpha_2 A_2$$

subject to the following constraints:

Budget constraint: $R_1 + R_2 = X + \frac{1}{2}(\beta_1 A_1^2 + \beta_2 A_2^2)$

Non-negative constraints: $X \geq 0$, $A_1 \geq 0$ and $A_2 \geq 0$

where $X = X_1 + X_2;\ X_i \geq 0$. Then the Lagrangian to the problem is given by:

$$\max_{\{X, A_1, A_2, \lambda, \mu, \gamma_1, \gamma_2\}} L$$

where

$$L = X + \alpha_1 A_1 + \alpha_2 A_2 + \lambda\left[R_1 + R_2 - X - \frac{1}{2}(\beta_1 A_1^2 + \beta_2 A_2^2)\right] + \mu X + \gamma_1 A_1 + \gamma_2 A_2$$

By solving the Kuhn-Tucker conditions to the above problem, we shall get the following characterization of equilibrium under cooperation (C) (see *Appendix*):

(C1): If $R_1 + R_2 \geq \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$, the cooperative equilibrium outcome is

$$A_i^C = \frac{\alpha_i}{\beta_i},\ \text{i=1, 2, and } X^C = R_1 + R_2 - \frac{1}{2}\left(\frac{\alpha_1^2}{\beta_1} + \frac{\alpha_2^2}{\beta_2}\right) \geq 0 \quad (4a)$$

Then total number of attacks under this situation is

$$A^C = A_1^C + A_2^C = \frac{\alpha_1}{\beta_1} + \frac{\alpha_2}{\beta_2} \quad (4b)$$

(C2): If $R_1 + R_2 < \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$, the cooperative equilibrium outcome is:

$$A_i^C = \sqrt{\frac{2(R_i + R_j)\beta_i\beta_j}{\alpha_i^2\beta_j + \alpha_j^2\beta_i}}\left(\frac{\alpha_i}{\beta_i}\right),\ \ i \neq j,\ \text{ and } X^C = 0 \quad (5a)$$

$$A^C = A_1^C + A_2^C = \sqrt{\frac{2(R_1 + R_2)\beta_1\beta_2}{\alpha_1^2\beta_2 + \alpha_2^2\beta_1}}\ \left[\frac{\alpha_1}{\beta_1} + \frac{\alpha_2}{\beta_2}\right] \quad (5b)$$

2.3 Cooperative vs. Non-cooperative outcomes

We are now in a position to examine whether under cooperation total number of attacks will go up compared to non-cooperative situation. We study this issue under four possible assumptions.

Assumption (A1): $R_1 + R_2 \geq \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$ *along with* $R_1 \geq \frac{1}{2}\frac{\alpha_1^2}{\beta_1}$ *and* $R_2 \geq \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$

Given assumption (A1), under non-cooperative equilibrium none of the outfits are resource constrained, hence the equilibrium outcome is given by (NC1). The corresponding equilibrium under cooperation is given by (C1). Then comparing (1) and (4) we have:

$$A_i^C = A_i^{NC}; i = 1, 2, \text{ and } A^C = A^{NC}$$

Therefore, when none of the outfits are resource constrained, cooperation will have no effect on the number of attacks.

Proposition 1: *When neither outfit is resource constrained, cooperation will have no impact on terror activity.*

Assumption (A2): $R_1 + R_2 \geq \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$ *along with* $R_1 > \frac{1}{2}\frac{\alpha_1^2}{\beta_1}$ *and* $R_2 < \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$

Under this assumption, the equilibrium under non-cooperative situation is given by (NC2). This is the scenario when only one outfit (here T_2) is resource constrained under competition, but the outfit cooperation does not face any resource constraint, hence cooperative equilibrium continues to be given by (C1). So to see the effect of cooperation on the number of attacks, we compare (2) and (4). We have the results:

$$A_1^C = A_1^{NC}, A_2^C > A_2^{NC} \text{ and } A^C > A^{NC}$$

The inequality in the second term arises because $R_2 < \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$. Thus when only one outfit is resource constrained under non-cooperative competition, at least some surplus resource from the resource rich outfit (here T_1) is funneled to conduct more attacks through resource constrained outfit channel (T_2), hence total number of attacks also goes up under cooperation.

Proposition 2: *When only one outfit is resource constrained while the other outfit has sufficiently large resources, cooperation enhances terror activity.*

Assumption (A3): $R_1 + R_2 < \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$ *along with* $R_1 \geq \frac{1}{2}\frac{\alpha_1^2}{\beta_1}$ *and* $R_2 < \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$

Consider assumption (A3). This is the scenario when under non-cooperative competition outfit T_2 is resource constrained (T_1 not), but the merged outfit faces a resource constraint in the sense that it cannot conduct as many attacks it wants. Hence, non-cooperative equilibrium is given by (NC2) while the cooperative equilibrium is given by (C2). Then comparing (2) and (5) we have the following results: First, since under this scenario, $\sqrt{\frac{2(R_1+R_2)\beta_1\beta_2}{\alpha_1^2\beta_2+\alpha_2^2\beta_1}} < 1$, so we must have $A_1^C < A_1^{NC}$, that is, the number of attacks through unconstrained resource channel (T_1) will fall under cooperation. Further, under the given conditions we have $A_2^C > A_2^{NC}$. This follows from the fact that

$$\sqrt{\frac{2(R_1+R_2)\beta_1\beta_2}{\alpha_1^2\beta_2+\alpha_2^2\beta_1}}\,\frac{\alpha_2}{\beta_2} > \sqrt{\frac{2R_2}{\beta_2}} \Leftrightarrow R_1\alpha_2^2\beta_1 > R_2\alpha_1^2\beta_2 \Leftrightarrow \frac{R_1}{\frac{1\alpha_1^2}{2\beta_1}} > \frac{R_2}{\frac{1\alpha_2^2}{2\beta_2}}$$

which holds, given (A3). Finally, total number of attacks will go up (i.e., $A^C > A^{NC}$) if and only if the following holds, that is,

$$\sqrt{\frac{2(R_1+R_2)\beta_1\beta_2}{\alpha_1^2\beta_2+\alpha_2^2\beta_1}}\left[\frac{\alpha_1}{\beta_1}+\frac{\alpha_2}{\beta_2}\right] > \frac{\alpha_1}{\beta_1} + \sqrt{\frac{2R_2}{\beta_2}} \tag{6}$$

We can therefore write the following result:

Proposition 3: *Under assumption (A3), cooperation between two outfits will enhance the total number of attacks if and only if the outfit which is resource-constrained a priori, is sufficiently small compared to the other outfit in terms of resources.*

Proof: We prove the result in a special case, when both the outfits are equally efficient at conducing attacks, and have the same intrinsic propensity for violence. Suppose $\alpha_1 = \alpha_2 = \alpha$ and $\beta_1 = \beta_2 = \beta$. Then the condition (6) reduces to

$$2\sqrt{\frac{(R_1+R_2)}{\beta}} > \frac{\alpha}{\beta} + \sqrt{\frac{2R_2}{\beta}} \tag{7}$$

Then there always exists (R_1, R_2) satisfying $R_1 + R_2 < \frac{\alpha^2}{\beta}$ and $R_1 \geq \frac{1}{2}\frac{\alpha^2}{\beta} > R_2$ such that the above inequality holds.[10] This proves the result. QED

Proposition 3 must be understood in the context of transferring resources from the resource-abundant outfit (or channel of attack) to the resource-constrained outfit. In the vicinity of the initial equilibrium, this would leave the former's attacks unchanged, while easing the latter's resource-constraint and thereby enabling it to optimally conduct additional attacks. This would lead to higher overall attacks in the vicinity of the initial equilibrium. Further resource-transfer in the same direction, however, is optimal under cooperation, as demonstrated earlier.[11] Beyond a point, such a transfer would cause the former outfit's resource-constraint to bind, thereby causing its attacks to decline. However, this would be more (less) than proportionately compensated by the increase in the latter outfit's attacks, if and only if the latter outfit is sufficiently (insufficiently) small compared to the former, because of diseconomies in conducting attacks driven by the convex cost functions.

Assumption (A4): $R_1 + R_2 < \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$ *along with* $R_1 < \frac{1}{2}\frac{\alpha_1^2}{\beta_1}$ *and* $R_2 < \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$

Finally, consider assumption (A4). This is the scenario when not only is the outfit cooperation as a whole resource constrained, but also both outfits are individually resource constrained *a priori*. Therefore, non-cooperative equilibrium is given by (NC3) and cooperative equilibrium by (C2). Hence comparing (3) and (5) we can see

$$A_i^C \gtreqless A_i^{NC} \text{ according as } R_j \alpha_i^2 \beta_j \gtreqless R_i \alpha_j^2 \beta_i, \; i \neq j \tag{8}$$

and

$$A^C \gtreqless A^{NC} \text{ according as } \sqrt{\frac{2(R_1+R_2)\beta_1\beta_2}{\alpha_1^2\beta_2+\alpha_2^2\beta_1}}\left[\frac{\alpha_1}{\beta_1}+\frac{\alpha_2}{\beta_2}\right] \gtreqless \sqrt{\frac{2R_1}{\beta_1}} + \sqrt{\frac{2R_2}{\beta_2}} \tag{9}$$

Given the parametric restrictions under this case both the inequalities in (8) and (9) may go in either direction, this means in this case cooperation between the outfits may increase or decrease

[10] We can simply fix $R_1 + R_2$, then increase R_1 and decrease R_2 to satisfy the inequality (7).
[11] Refer to the resource-allocation derived earlier, under the cooperative equilibrium given by (C2).

the number of attacks in each outfit channel as well as the total number of attacks. We check the results in the following special cases:

Case (i): $\alpha_1 = \alpha_2$, $\beta_1 = \beta_2$ and $R_1 = R_2$. We expectedly obtain $A_i^C = A_i^{NC} \forall i = 1, 2$, and $A^C = A^N$, that is, if the outfits are identical in respect of all parameters, cooperation will have no effect. Since both the outfits are identical in every respect, there is nothing additional to share under cooperation.

Case (ii): $\alpha_1 = \alpha_2$, $\beta_1 = \beta_2$ but $R_1 \neq R_2$. Here, we get $A^C > A^N$.[12] Without any loss of generality, suppose $R_1 > R_2$. Then $A_1^C < A_1^{NC}$ and $A_2^C > A_2^{NC}$. So when the outfits differ only in respect of the size of their resources, cooperation will lead to a higher number of total attacks, such that the number of attacks through the outfit channel which has lesser resources will go up. The result is intuitive. Since $R_1 > R_2$, therefore under non-cooperation, $A_1^{NC} > A_2^{NC}$. Now given that the cost of conducting attacks is increasing and convex, the marginal cost of attacking through T_1 under non-cooperative competition is larger than T_2. Hence, under cooperation, reallocation of resources from channel T_i to channel T_j will be mutually rewarding, that is, A_i will fall and A_j will rise. Reducing one unit of A_i will release resources for conducting more than one unit of A_j. Therefore, the total number of attacks (A) will go up.

Case (iii): $\beta_1 = \beta_2$, $R_1 = R_2$ but $\alpha_1 \neq \alpha_2$. Here, we obtain $A^C < A^{NC}$.[13] If $\alpha_1 > \alpha_2$, then we get have $A_1^C > A_1^{NC}$ and $A_2^C < A_2^{NC}$, that is, the number of attacks through the outfit channel having a higher intrinsic propensity of violence goes up and that through the other channel falls. The total number of attacks also falls, given that the outfits differ in respect of their violence propensities. The intuition of this result also hinges on cost-convexities. Because the attacks conducted by each outfit in the non-cooperative equilibrium are equal and independent of the intrinsic propensity of violence, resource reallocation from one outfit to the other leads to efficiency loss at the margin, due to the increasing and strictly convex cost of conducting attacks. But given

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[12] Under Case (ii), $A^C = 2\sqrt{\frac{(R_1+R_2)}{\beta}}$ and $A^{NC} = \sqrt{\frac{2R_1}{\beta}} + \sqrt{\frac{2R_2}{\beta}}$. Therefore, $A^C > A^N$ because $\frac{(R_1+R_2)}{2} > \sqrt{R_1 R_2}$, that is, $A.M. > G.M.$

[13] Under Case (iii), $A^C = 2\sqrt{\frac{2R}{\beta}} \frac{(\alpha_1+\alpha_2)}{\sqrt{2(\alpha_1^2+\alpha_2^2)}}$ and $A^{NC} = 2\sqrt{\frac{2R}{\beta}}$. Hence, $A^C < A^{NC}$ because $\frac{(\alpha_1+\alpha_2)}{\sqrt{2(\alpha_1^2+\alpha_2^2)}} < 1$.

$\alpha_1 > \alpha_2$, since resources are drawn from outfit channel T_2 to conduct additional attack through T_1, payoff of the outfit cooperation will increase at the margin. This explains why the number of attacks through T_1 will go up, while that through T_2 will fall. But given the strictly convex cost function, the fall of attacks in equilibrium must dominate the increase, thereby leading to a lower total number of attacks under cooperation.

Case (iv): $\alpha_1 = \alpha_2$, $R_1 = R_2$ but $\beta_1 \neq \beta_2$. Here we unambiguously obtain $A^C > A^N$, that is, cooperation will enhance the total number of attacks.[14] Without any loss of generality when $\beta_1 > \beta_2$, we get $A_1^C < A_1^{NC}$ and $A_2^C > A_2^{NC}$, implying that the inefficient outfit channel will conduct less attacks under cooperation. Since more and more attacks are conducted through efficient channel, the total number of attacks will go up.

Summarizing the above results, we arrive at the following proposition:

Proposition 4: *When both outfits are resource constrained a priori, and the outfits differ in respect of at least one parameter, cooperation will affect the number of attacks to be conducted by each outfit as well as the total number of attacks. In particular, if the outfits have different levels of resources or if they differ in respect of their efficiency in conducting attacks, the total number of attacks under cooperation must increase. On the other hand, if the outfits have different intrinsic propensities of violence, cooperation will reduce the total number of attacks.*

3. Cooperation under Sponsorship

There are evidences to show that terror outfits sometimes receive funds from different agencies such as charities and NGOs.[15] A part of this sponsorship is provided strategically, to induce more attacks.

Consider the availability of external sponsorship $F > 0$ (measured in units of the consumption). Further, assume that the sponsor commits this fund to be distributed *ex post*

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[14] Here $A^C = \sqrt{\frac{2R}{\beta_i\beta_j}}\sqrt{2(\beta_i + \beta_j)}$ and $A^N = \sqrt{\frac{2R}{\beta_i\beta_j}}(\sqrt{\beta_i} + \sqrt{\beta_j})$, hence $A^C > A^{NC}$ because $A.M. > G.M.$

[15] See Chadha (2015) for a comprehensive discussion on the sources of terror finance.

between the outfits in proportion to the number of terror attacks conducted by each.[16] Thus, T_i receives $F_i = \frac{A_i}{A_i+A_j}F$. In the presence of such sponsorship, the payoff function of the i^{th} terrorist group ($i = 1, 2$) becomes

$$U_i = X_i + \alpha_i A_i + F_i \quad (10)$$

After incorporating the budget constraint, the payoff maximization problem of T_i ($i = 1, 2$) becomes

$$Max_{A_i} U_i = R_i - \frac{1}{2}\beta_i A_i^2 + \alpha_i A_i + F_i \quad (11)$$

Let the equilibrium solution of terror attacks to the problem under non-cooperation be (A_1^*, A_2^*). It is shown in Bhan and Kabiraj (2020), that the equilibrium is stable and unique. Further, when resources are sufficiently large (i.e., $R_i > \frac{1}{2}\frac{\alpha_i^2}{\beta_i}; i = 1, 2$), the reaction functions are initially upward sloping, intersect the 45^0-line, and then slope downwards.[17] It is hence possible that the number of attacks under sponsorship can be larger, compared to the case of no sponsorship. This illustrates the possibility that external sponsorship can induce more attacks when the outfits compete non-cooperatively.

Now suppose that given the commitment of the sponsors, the outfits decide to act cooperatively and hence maximize the sum of their payoffs. Hence the problem is:

$$Max_{X_1, X_2, A_1, A_2}(U_1 + U_2) = X_1 + X_2 + \alpha_1 A_1 + \alpha_2 A_2 + F \quad (12)$$

subject to the budget constraint,

$$X_1 + X_2 + \frac{1}{2}(\beta_1 A_1^2 + \beta_2 A_2^2) = R_1 + R_2$$

One can see that if $R_1 + R_2 \geq \frac{1}{2}\left(\frac{\alpha_1^2}{\beta_1} + \frac{\alpha_2^2}{\beta_2}\right)$, then an interior optimum exists. Otherwise, there is a corner solution. In either case, the solution to the above optimization problem is independent of F and is identical to the solution to the optimization problem of subsection 2.2 (absence of sponsorship). We therefore arrive at Proposition 5.

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[16] This is called the proportionate external sponsorship rule or mechanism (Bhan and Kabiraj, 2020).

[17] The slope of T_i's reaction function is $\frac{dA_i}{dA_j} = -\frac{\frac{\partial^2 U_i}{\partial A_i \partial A_j}}{\frac{\partial^2 U_i}{\partial A_i^2}} = \frac{(A_i - A_j)F}{\beta_i (A_i + A_j)^3 + 2A_j F}$ ($i \neq j = 1,2$), which is positive or negative according as $A_i > A_j$ or $A_i < A_j$.

Proposition 5: *If the terror outfits co-operate in the presence of proportionate external sponsorship, then the number of terror strikes conducted by each group will be identical to that in the absence of external sponsorship.*

The intuition for this result rests on the fact that external sponsorship loses its ability to induce terror strikes because, irrespective of the values of A_1 and A_2, the groups together would receive $F_1 + F_2 = F$. Hence, the number of terror strikes each outfit conducts will depend only on those factors which determine the equilibrium levels in the absence of external sponsorship, thereby ensuring a solution identical to that in the absence of external sponsorship. The following is, therefore, a straight-forward corollary:

Corollary: *If terror outfits strategically co-operate, there is no incentive for proportionate external sponsorship.*

It seems intuitive that in an environment characterized by the presence of multiple terror outfits and a common potential external sponsor, greater strategic cooperation between the terror outfits would impede the ability of the sponsor to manipulate the behavior of the outfits. This, in turn, would weaken the incentive for the external sponsor to provide sponsorship. The sponsor would therefore have an incentive to hinder strategic co-operation or engineer a split between the terror outfits, in order to increase its own influence on their actions. This is allegedly what happened in the case of Hizb-ul-Mujahideen (HM) in 1998, as discussed earlier.

4. Further Extension

Since the joint payoff of the outfits under cooperation is never less than the sum of their non-cooperative payoffs, the outfits may optimally cooperate if possible, irrespective of whether any sponsorship (under the proportional allocation rule) is available or not. Then, from the above analysis, it follows that the total number of terror attacks will equal that under non-cooperative competition. On the other hand, we have seen that when sponsorship is unavailable, cooperation can increase the total number of terror attacks compared to non-cooperation. This implies that there will be no incentive for providing proportionate external sponsorship, since cooperation is never less beneficial than non-cooperation, from the perspective of the outfits. Hence, our model thus far, fails to rationalize proportionate external sponsorship. In the analysis below, we slightly modify the structure of the game, and demonstrate how sponsorship money may strategically be chosen to increase the number of attacks.

Suppose that in the beginning, an external sponsor commits to pay $F > 0$ if and only if the outfits play a non-cooperative game to determine the levels of their terror activities. In the following analysis, we shall call this regime F. If they do not provide any sponsorship (i.e., $F = 0$) however, and then the outfits decide optimally whether to play the game cooperatively or non-cooperatively, we shall call this regime $\emptyset$. As we have shown earlier, under this situation the outfits will play cooperatively. Then $F > 0$ will be committed if and only if $A^{NC}(F) > A^{C}(\emptyset)$, that is, total number of terror attacks under F regime is larger than that under $\emptyset$ regime. But such an offer will be acceptable to the outfits if and only if $U^{NC}(F) \geq U^{C}(\emptyset)$, where $U^{(.)} = U_1^{(.)} + U_2^{(.)}$, that is, outfits are not worse off by accepting the F contract. We shall discuss the problem under different scenarios.

Scenario (1): First consider the case where $R_i > \frac{1}{2}\frac{\alpha_i^2}{\beta_i}$ $(i = 1, 2)$, so that $R_1 + R_2 > \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$. This is (part of) Assumption (A1). From sub-section 2.3, we have $A^{C}(\emptyset) = A^{NC}(\emptyset) = \frac{\alpha_1}{\beta_1} + \frac{\alpha_2}{\beta_2}$, i.e., when $F = 0$, while cooperation is weekly preferred to non-cooperation by the outfits, it does not increase the number of attacks. On the other hand, when $F > 0$ is offered, it will be accepted by the outfits because $U^{NC}(F) > U^{NC}(\emptyset) = U^{C}(\emptyset)$, and given the assumption we must have $A^{NC}(F) > A^{C}(\emptyset)$, because $A_i^{NC}(F) > A_i^{C}(\emptyset); i = 1, 2$. Therefore, under this case, sponsorship will occur and the number of attacks will go up. Since the maximum number of attacks that T_1 and T_2 can conduct cannot exceed $\sqrt{\frac{2R_1}{\beta_1}}$ and $\sqrt{\frac{2R_2}{\beta_2}}$ respectively, sponsors together can choose F strategically such that the outfits conduct these numbers of terror activities.[18]

[18] So long as $A_i \leq \sqrt{\frac{2R_i}{\beta_i}}$, $i = 1, 2$, for any $F > 0$, A_i's are solved from the FOCs of utility maximization problem under non-cooperative situation, i.e., $\alpha_i + \frac{A_j}{(A_i + A_j)^2}F - \beta_i A_i = 0$; $i = 1, 2$. Now setting $A_i = \sqrt{\frac{2R_i}{\beta_i}}$ for $i = 1, 2$, from

Scenario (2): Next, let us consider the case when $R_1 < \frac{1}{2}\frac{\alpha_1^2}{\beta_1}$ and $R_2 < \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$ so that $R_1 + R_2 < \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$. This is Assumption (A4). In this case under $\emptyset$ regime cooperation between the outfits will take place, and we have shown in subsection 2.3 that there are situations when cooperation will increase the number of attacks.[19] But given the assumption, sponsorship money cannot increase the number of total attacks, because under F, total number of attacks under non-cooperative situation will be stuck at $\sqrt{\frac{2R_1}{\beta_1}} + \sqrt{\frac{2R_2}{\beta_2}}$. Hence sponsorship money in this case will not induce more attacks.[20]

Scenario (3): Now consider assumption (A2), i.e., $R_1 > \frac{1}{2}\frac{\alpha_1^2}{\beta_2}$ and $R_2 < \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$ but $R_1 + R_2 \geq \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$. This appears to be the most interesting case. We have already derived (in Subsection 2.1 and 2.2) that $[A_1^{NC}(\emptyset) = \frac{\alpha_1}{\beta_1},\ A_2^{NC}(\emptyset) = \sqrt{\frac{2R_2}{\beta_2}} < \frac{\alpha_2}{\beta_2}]$ and $[A_1^{C}(\emptyset) = \frac{\alpha_1}{\beta_1},\ A_2^{C}(\emptyset) = \frac{\alpha_2}{\beta_2}]$ so that $A^C(\emptyset) > A^N(\emptyset)$. Therefore, when no sponsorship is available, the outfits will choose their terror activities cooperatively, and the number of attacks is larger than that under non-cooperative situation. Hence under $\emptyset$, $A^C(\emptyset) = \frac{\alpha_1}{\beta_1} + \frac{\alpha_2}{\beta_2}$. Correspondingly, the joint profits of the outfits are,

$$U^C(\emptyset) = \alpha_1\left(\frac{\alpha_1}{\beta_1}\right) + \alpha_2\left(\frac{\alpha_2}{\beta_2}\right) + R_1 + R_2 - \frac{1}{2}\left(\frac{\alpha_1^2}{\beta_1} + \frac{\alpha_2^2}{\beta_2}\right) = \frac{1}{2}\left[\frac{\alpha_1^2}{\beta_1} + \frac{\alpha_2^2}{\beta_2}\right] + R_1 + R_2 \qquad (13)$$

Then question is whether by committing an appropriate amount of funding, conditional on the terror outfits playing the game non-cooperatively, the sponsor can induce the outfits to further increase the total number of attacks. We show that if R_1 is sufficiently large, the sponsors can appropriately choose an $F > 0$ to maximize the number of total attacks.

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the FOCs we shall get the optimal level of sponsorship fund maximizing the total number of attacks to be $F = (\beta_1 A_1 + \beta_2 A_2) - (\beta_1 + \beta_2)$.

[19] $A^C(\emptyset) > A^{NC}(\emptyset)$ iff $\sqrt{\frac{2(R_1+R_2)\beta_1\beta_2}{\alpha_1^2\beta_2+\alpha_2^2\beta_1}}\left[\frac{\alpha_1}{\beta_1} + \frac{\alpha_2}{\beta_2}\right] > \sqrt{\frac{2R_1}{\beta_1}} + \sqrt{\frac{2R_2}{\beta_2}}$.

[20] In this situation we may, however, think that sponsors pay each outfit some money to supplement its initial resource before any attack takes place. For example, T_i will increase its terror attacks from $\sqrt{\frac{2R_i}{\beta_i}}$ to $\frac{\alpha_i}{\beta_i}$ if it gets an amount of fund F_i where $\sqrt{\frac{2R_i+F_i}{\beta_i}} = \frac{\alpha_i}{\beta_i}$.

If any $F > 0$ is offered by the sponsors and accepted by the terror outfits, then given Assumption (A2), the optimal number of terror attacks chosen by T_2 will be $A_2^{NC}(R_2) = \sqrt{\frac{2R_2}{\beta_2}}$, and the optimal number of terror attacks to be chosen by T_1 will be

$$A_1^{NC}(F; R_1, R_2) = \min\{A_1\left(F; A_2^{NC}(R_2)\right), \sqrt{\frac{2R_1}{\beta_1}}\} \quad (14)$$

where $A_1\left(F; A_2^{NC}(R_2)\right)$ is the solution obtained from the FOC of the problem: $Max_{A_1} U_1 = R_1 - \frac{1}{2}\beta_1 A_1^2 + \alpha_1 A_1 + F_1$, where $F_1 = \frac{A_2}{A_1 + A_2} F$ and $A_2 = A_2^{NC}(R_2)$. The FOC is:

$$\alpha_1 + \frac{A_2}{(A_1 + A_2)^2} F - \beta_1 A_1 = 0 \quad (15)$$

Given that the SOC is satisfied, $A_1\left(F; A_2^{NC}(R_2)\right)$ is solved from the above. Now, as long as $A_1\left(F; A_2^{NC}(R_2)\right) < \sqrt{\frac{2R_1}{\beta_1}}$, F can be increased to increase $A_1^{NC}(.)$ up to $\sqrt{\frac{2R_1}{\beta_1}}$. Hence, the optimal F maximizing the total number of attacks under this situation is given by $F^* = F(R_1;\ R_2)$, solved from $A_1^{NC}(F; R_1, R_2) = \sqrt{\frac{2R_1}{\beta_1}}$.[21] Therefore, $F(R_1;\ R_2)$ will be offered by the sponsors provided the total number of terror attacks under $F > 0$ (non-cooperative competition) is larger than that under $F = 0$ (cooperative situation), i.e., $A^{NC}(F) > A^C(\emptyset)$, or, $\sqrt{\frac{2R_1}{\beta_1}} + \sqrt{\frac{2R_2}{\beta_2}} \geq \frac{\alpha_1}{\beta_1} + \frac{\alpha_2}{\beta_2}$, and hence

$$R_1 > \frac{\beta_1}{2}\left[\frac{\alpha_1}{\beta_1} + \frac{\alpha_2}{\beta_2} - \sqrt{\frac{2R_2}{\beta_2}}\right]^2 \equiv R_1^* \quad (16)$$

Now given $R_1 > R_1^*$, thus when sponsors want to induce terror attacks (A_1^{NC}, A_2^{NC}), the optimal sponsor money $F(R_1;\ R_2)$ is solved from the FOC $\alpha_1 + \frac{A_2}{(A_1 + A_2)^2} F - \beta_1 A_1 = 0$, i.e.,

$$F(R_1;\ R_2) = (\beta_1 A_1 - \alpha_1)\frac{(A_1 + A_2)^2}{A_2} \quad (17)$$

Finally, given $R_1 > R_1^*$, offer $F(R_1;\ R_2)$ will be acceptable to the outfits if and only if $U^{NC}(F) \geq U^C(\emptyset)$, we have

$$U^{NC}(F) = \alpha_1(A_1^{NC}) + \alpha_2(A_2^{NC}) + R_1 + R_2 - \frac{1}{2}\beta_1(A_1^{NC})^2 - \frac{1}{2}\beta_2(A_2^{NC})^2 + F$$

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[21] For all $F \geq F(R_1, R_2)$, A_1^{NC} will remain fixed at $\sqrt{\frac{2R_1}{\beta_1}}$.

$$= \alpha_1 \left(\sqrt{\frac{2R_1}{\beta_1}}\right) + \alpha_2 \left(\sqrt{\frac{2R_2}{\beta_2}}\right) + R_1 + R_2 - \frac{1}{2}[\beta_1 \left(\sqrt{\frac{2R_1}{\beta_1}}\right)^2 + \beta_2 \left(\sqrt{\frac{2R_2}{\beta_2}}\right)^2 + F(R_1;\ R_2)$$

Hence,

$$U^{NC}(F) = \alpha_1 \left(\sqrt{\frac{2R_1}{\beta_1}}\right) + \alpha_2 \left(\sqrt{\frac{2R_2}{\beta_2}}\right) + F(R_1;\ R_2) \tag{18}$$

Therefore, $U^{NC}(F)) \geq U^C(\emptyset)$ if and only if (comparing (13) and (18)),

$$\alpha_1 \left[\left(\sqrt{\frac{2R_1}{\beta_1}}\right) - \frac{1}{2}\left(\frac{\alpha_1}{\beta_1}\right)\right] + F(R_1;\ R_2) \geq \alpha_2[\frac{1}{2}\left(\frac{\alpha_2}{\beta_2}\right) - \sqrt{\frac{2R_2}{\beta_2}}] \tag{19}$$

The LHS is strictly positive, but the RHS can be positive or negative or zero. Hence the sufficient condition that the above condition will always be satisfied is $\frac{\alpha_2}{\beta_2} \leq 2\sqrt{\frac{2R_2}{\beta_2}}$, that is, R_2 is sufficiently small. In general, condition (19) will be satisfied if R_1 is sufficiently large.

Scenario (4): Now consider scenario where $R_1 > \frac{1}{2}\frac{\alpha_1^2}{\beta_1}$ and $R_2 < \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$, but $R_1 + R_2 < \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}$. In this case $A^C(\emptyset) = \sqrt{\frac{2(R_1+R_2)\beta_1\beta_2}{\alpha_1^2\beta_2+\alpha_2^2\beta_1}}\left[\frac{\alpha_1}{\beta_1} + \frac{\alpha_2}{\beta_2}\right] < \frac{\alpha_1}{\beta_1} + \frac{\alpha_2}{\beta_2}$ because $\sqrt{\frac{2(R_1+R_2)\beta_1\beta_2}{\alpha_1^2\beta_2+\alpha_2^2\beta_1}} < 1$. The analysis in this case will be similar to the previous case. Here however we have the limited flexibility to increase R_1 to satisfy the similar condition like (16).[22]

To summarize this subsection, we see that there are scenarios where the sponsors can choose the sponsorship money and contracts appropriately such that sponsorship will lead to a higher terrorist activity. All that matters in this case is the amount of resources the outfits have access to, initially. Hence we can write the following proposition.

Proposition 6: *The provision of external sponsorship, utilizing an appropriate sponsorship mechanism, always enhances terror activity.*

5. Conclusion

[22] Here, $R_1 > \frac{\beta_1}{2}\left[\frac{2(R_1+R_2)\beta_1\beta_2}{\alpha_1^2\beta_2+\alpha_2^2\beta_1}(\frac{\alpha_1}{\beta_1} + \frac{\alpha_2}{\beta_2}) - \sqrt{\frac{2R_2}{\beta_2}}\right]^2 \equiv R_1^{**}$.

In the present paper we have shown that when the terror outfits differ in respect of one or the other characteristic, there are situations when the outfits might gain by cooperating by means of resource relocation between themselves, and thereby increasing the number of total attacks. Generally, outfits prefer to work independently so as to preserve their identities and autonomy. But there are evidences to show that sometimes the outfits go for strategic cooperation to achieve their broader goal. Particularly, when outfits are not too distant ideologically, they may be willing to coordinate their activities, appropriately transfer resources and terror technology, enhance the number of attacks, and thereby reap benefits by exploiting loopholes in the state's security apparatus.

We have shown in the paper that benefits of strategic cooperation accrue to the cooperating outfits, when at least one outfit is resource constrained. Through cooperation, the outfits can reallocate resources to conduct attacks more efficiently, or in favor of more aggressive outlet. Inter-outfit cooperation can also derive benefits from cost-convexities. Contrarily, if there are sponsors who commit to provide fund to the outfits in proportion to their attacks, then cooperation will reduce total number of attacks compared to the non-cooperative situation. This implies that in such a situation, no strategic external sponsor will commit any funds to the outfits. We have, however, subsequently modified the game and demonstrated situations justifying the existence of external sponsorship.

The purpose of this paper is to provide insights to policy makers, to enable better designing the counter-terrorism (CT) policies. Defensive CT policies generally increase the cost of terrorist operations. The present work underscores the importance of preventing the transfer of resources and other terror materials, from one outfit to the other. In such scenarios, offensive policies that target to destroy infrastructure or confiscate terror resources, may appear very effective. However, such a policy may sometimes be very expensive to implement, both in pecuniary and non-pecuniary terms. Confidence building measures, that target one or the other outfit to restore normalcy, may not be very effective in view of the possible funneling of resources from one outfit to the other.

Finally, and more generally, our analysis demonstrates that inter-outfit strategic cooperation can serve to increase terror attacks in certain circumstances, while serving to inhibit terror activity under other situations. An example of the former is when a resource-constrained outfit cooperates with a resource-abundant outfit having sufficiently large resources, in the absence of external funding. On the other hand, we have discussed multiple situations where external sponsorship can be offered strategically to enhance terror activity by inhibiting intergroup cooperation. Therefore, CT efforts targeted at disrupting cooperation under the former set of circumstances, while those aimed at curbing the leverage of the external sponsor over the terrorists by encouraging intergroup cooperation under the latter, would serve to decrease terror attacks. The present work, therefore, calls for reviewing the existing CT policy framework in view of the implications of strategic cooperation between terror outfits.

Appendix

The Lagrangian problem is given by:

$$\max_{\{X, A_1, A_2, \lambda, \mu, \gamma_1, \gamma_2\}} L$$

where

$$L = X + \alpha_1 A_1 + \alpha_2 A_2 + \lambda \left[R_1 + R_2 - X - \frac{1}{2}(\beta_1 A_1^2 + \beta_2 A_2^2) \right] + \mu X + \gamma_1 A_1 + \gamma_2 A_2$$

The relevant K-T conditions for solving the above problem are:

(i) $\frac{\partial L}{\partial X} = 1 - \lambda + \mu = 0$

(ii) $\frac{\partial L}{\partial A_i} = \alpha_i - \lambda \beta_i A_i + \gamma_i = 0; i = 1, 2$

(iii) $\lambda \geq 0, \mu \geq 0, \gamma_i \geq 0 \, (i = 1, 2)$

(iv) $X \geq 0, \; A_i \geq 0 \, (i = 1, 2), \quad R_1 + R_2 \geq X + \frac{1}{2}(\beta_1 A_1^2 + \beta_2 A_2^2)$

(v) $\mu X = 0, \gamma_i A_i = 0 \; (i = 1, 2)$ and $\lambda \left[R_i + R_j - X - \frac{1}{2}\left(\beta_i A_i^2 + \beta_j A_j^2\right) \right] = 0$

In our formulation, $A_i > 0$, and so $\gamma_i = 0 \; \forall \, i = 1, 2$ (from (v)). Now consider the following cases:

Case (a): Consider equilibrium with $X > 0$; this means $\mu = 0$ (see (v)), hence $\lambda = 1$ (from (i)). This leads to cooperative equilibrium (from (ii)):

$$A_i = \frac{\alpha_i}{\beta_i} \equiv A_i^C \; \forall \, i = 1, 2 \text{ with } R_1 + R_2 > \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}.$$

Case (b): Consider equilibrium with $X = 0$. This means $\mu \geq 0$, and hence $\lambda = 1 + \mu \geq 1$ (see (v) and (i)). When $\mu = 0$, $\lambda = 1$, and the cooperative equilibrium is given by

$$A_i^C = \frac{\alpha_i}{\beta_i} \; \forall \, i = 1, 2 \text{ and } R_1 + R_2 = \frac{1}{2}\frac{\alpha_1^2}{\beta_1} + \frac{1}{2}\frac{\alpha_2^2}{\beta_2}.$$

If $\mu > 0$, then $\lambda > 1$. Hence, $A_i = \frac{\alpha_i}{\lambda \beta_i} < \frac{\alpha_i}{\beta_i} \; \forall \, i = 1, 2$ from (ii), and

$R_1 + R_2 = \frac{1}{2}(\beta_1 A_1^2 + \beta_2 A_2^2)$ (from (iv)). Then plugging the values of A_1 and A_2 into this expression, we get:

$$\frac{1}{\lambda^2} = \frac{2(R_i + R_j)\beta_i \beta_j}{\alpha_i^2 \beta_j + \alpha_j^2 \beta_i}$$

Therefore, we get the cooperative solution

$$A_i^C = \sqrt{\frac{2(R_i + R_j)\beta_i \beta_j}{\alpha_i^2 \beta_j + \alpha_j^2 \beta_i}} . \frac{\alpha_i}{\beta_i} \text{ for } i \neq j$$

This solves the cooperative game.

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