

## ROLE OF GAME THEORY IN ELIMINATING TERRORISM

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[Received-29/12/2012, Accepted-15/01/2013]

### ABSTRACT

In keeping with a rational actor depiction, economists and later political scientists have applied game theory to study terrorism. Game theory is an appropriate methodology for examining terrorism for a number of reasons. First, game theory captures the strategic interactions between terrorists and targeted governments, where actions are independent and, thus cannot be analyzed as though one side were passive. Second, strategic interactions among rational beings, who are trying to act according to how they think their counterparts will act and react, characterize the interfaces among terrorists or among alternative targets. Third, game theory permits adversaries to issue threats and promises to gain strategic advantage – for example, a no-negotiation declaration intended to keep terrorists from taking hostages, or a terrorists group's pledge to engage in suicide bombings in order to gain concessions. Fourth, game theoretic notions of bargaining are applicable to hostage negotiations and terrorist campaign induced negotiations over demands. Fifth, uncertainty and learning in a strategic environment are relevant to all aspects of terrorism in which the terrorists or government or both are not completely informed. Game theory concerns the knowledge possessed by the players and allows earlier actions to inform players over time. This research investigates in detail the role of game theory in eliminating terrorism.

**Index Terms:** Game theory, terrorism, Game theory and hostage taking, game theory and governmental responses and game theoretical issues

### INTRODUCTION

The purpose of this paper is to investigate and evaluate the two primary categories of counterterrorism policies – proactive and defensive. Proactive or offensive measures attack the terrorists, their resource base, or those who support them. By contrast, defensive or passive policies may erect a protective barrier around potential targets – physical or human. Such measures dissuade terrorists by decreasing their anticipated gains from attacks. This can occur if their costs are raised or their anticipated benefits are reduced. Defensive actions may also limit attacks if alternatives non terrorist actions are made more attractive. Defensive measures may involve limiting damage following a terrorist attack – for instance, enhanced first responder

capabilities or stockpiles of antidotes against chemical agents. Stiffer penalties and greater certainty of apprehension can dissuade would be terrorists.

This paper casts light on two puzzles. First, we explain why there appears to be a proclivity for most countries to rely on defensive rather than proactive policies when addressing transitional terrorism, and why this tendency does not appear to characterize actions with respect to domestic terrorism. Nations are quite proactive in pursuing domestic groups when they harm interests at home, either directly or indirectly through collateral damage. European action to dismantle many of the fighting communist organizations, such as the Combatant Communist Cells and the

Italian Red Brigades in the 1980s is testimony to this proactive stance with respect to domestic terrorism, we explain the tendency for the world community to rely on one or two nations proactive responses. To accomplish these goals, we employ some elementary game theory to identify strategic interaction among targeted governments which may actually work at cross purposes as they independently make policy choices.

**I. Game theory and Hostage taking:**

Despite the events of 9/11, hostage taking may still have negotiations, because most such missions involve kidnappings, where the terrorists are not suicidal. Recent skyjackings in Turkey and Cuba during March 2003 demonstrate that not all skyjackings include terrorists bent on mass destruction. Nevertheless, suicide skyjackings and the reactions of desperate passengers to fight back must be analysed in the future along with a government's decision to destroy a hijacked plane. To date, there have been six economic analyses of hostage-taking events – i.e Atkinson et al. [1], Lapan and Sandler [2]. The first three studies stress game-theoretic aspects, while the latter three studies do not. We focus our remarks around the Lapan and Sandler [2] study, the most general of these three games-theoretic studies. The question posed by their investigation is whether or not stated policy by which a government precommits never to negotiate with hostage takers will have the intended consequence of keeping terrorist from ever taking hostages. The conventional wisdom states that if terrorists know ahead of time that they have nothing to gain that they will never abduct hostages. This belief has become one of the four pillars of US policy with respect to addressing transitional terrorism – i.e ‘make no concessions to terrorists and strike no deals’.

According to Selten [3] the conventional wisdom for the never-to-capitulate policy hinges on at least four implicit assumptions:

1. The government's deterrence is sufficient to stop all attacks;
2. The government's pledge is fully credible to all would be hostage takers;

3. The terrorists gains from hostage taking only derives from the fulfillment of their demands; and
4. There is no uncertainty concerning the payoffs.

Each of these assumptions may not hold in practice. Deterrence will not stop all attacks if the terrorists perceive that there is a positive expected payoff from taking hostages. Past concessions limit the credibility of the government's no-concession pledge. Moreover, a fanatical terrorist group may gain positive benefits from failure in terms of heavenly rewards or media exposure. Given that the costs to the government's pledge may be time inconsistent, so that the government reneges for the ‘right’ hostages if the costs of capitulating is less than holding firm. Thus, the pitfalls to this policy are easily laid bare by game theory.

Lapan and Sandler [2] make their analysis more realistic by allowing multiple periods and reputation costs. Concessions result in a loss in reputation that is costly in terms of more hostage taking in the future. As reputation costs increase, the no-negotiation policy is less apt to be time inconsistent. This outcome can be fostered through rules – e.g a constitutional amendment that imposes sufficiently severe punishments to eliminate any discretion of government negotiators.

The game can be made still more realistic by including additional sources of uncertainty in terms of the terrorist payoffs. Hostage-taking incidents involve asymmetric information and uncertainty on the part of both terrorists and governments. The beauty of game theory is that it permits the evaluation of policies while accounting for uncertainty and strategic interactions of opposing interests, so that easy fixes may not be so straightforward.

**II. Game theory and governmental responses:**

Enders, W and Sandler T [6] have described that external costs are present when deterrence at home displaces the attack abroad, while external benefits are relevant when deterrence at home either protects foreigners or reduces the level of attacks

globally. Depending on the opposing external effects, and there may be others not listed, there may result too much or too little differences. The overdeterrence/undeterrence problem is heightened when a terrorist network operates in upwards of 60 countries and stages their attacks worldwide. Underdeterrence is particularly acute in countries sympathetic to a group grievance when the group focuses their attack on foreigners. As the amount of potential targets increase, transference efforts may be especially large. By forming a global network, terrorists limit the effectiveness of countries' efforts to thwart terrorism as externalities are maximized through countries uncoordinated decisions. Terrorists will naturally seek out the weakest link – i.e the country with the least security – for the venue for their next attack and will dispatch their best team. To address these weaknesses, prime targets, such as the United States, have instituted programs to assist such weakest link countries in bolstering their counterterrorists capabilities. In fact, this assistance is another of the four pillars of US antiterrorism policy. Ironically, US efforts to induce other countries to secure their airports and public places make the United States a more attractive target, as 9/11 sadly demonstrated.

Islam and Shahin [7] have described that if the terrorists networking advantage is to be countered, then targeted nations must learn to coordinate their own efforts at counterterrorism. This poses a special problem because nations resist sacrificing their autonomy over security matters to a supranational collective. With this in mind, terrorist experts have often called for piecemeal policy where intelligence is shared but not deterrence decisions. Such piecemeal responses may be inadvisable when the strategic incentives are taken into account. Suppose that a terrorist network targets three countries, each of which are engaged in overdeterrence to transfer the attack abroad. Further suppose that intelligence allows the targeted countries to better judge the marginal effectiveness of diverting attacks by revealing the terrorists preference for alternative targets. As

these nations acquire this information, they become better adapted at diverting attacks, thereby augmenting the negative transference externality. Similarly Shahin and Islam [8] have described that the net impact of this information sharing may be to heighten the “transference race” without providing more security against a group bent on attacking, so that the added deterrence costs simply make the three countries worse off. This results in a second best outcome where the change in one policy parameter, which would under full cooperation, improve efficiency, may worsen in efficiency when a second policy is not chosen optimally. A similar second best scenario may characterize other partial responses – e.g greater actions apprehend terrorists without coordinating efforts to increase punishments. Thus, the application of game theory again raises policy concerns previously ignored in the terrorism literature.

### III. GAME-THEORITICAL ISSUES:

We begin with an explanation, using some elementary game theory, of why the short and fixed time horizon of government officials hampers international cooperation among governments. We purposely construct the example to minimize computational complications. Suppose that two governments confronting the same terrorist threat must decide whether to preempt the terrorists through an attack on their base or sponsors. Unlike the analysis, we further suppose that the two governments in our example can interact for only two periods owing to the election-term considerations [4].

According to Sandler and Scott [4] the procedure for solving such a game is to examine the Nash equilibrium for the second period and then to condition the Nash equilibrium solution for the first period on the solution value found for the second period. In technical parlance, this gives a sub game perfect equilibrium in which the players would not unilaterally change their strategies during the current or future period. This solution strategy is found by solving the game backward, starting at the last period. We assume that the

preemption game is a Prisoner's Dilemma. In fig 6.4, we display the 2 x 2 game matrix for the two players – nation 1 ( the row player) and nation 2 (the column player) – viewed from the standpoint of the second and the last period of the two period game. Recall that the left hand payoff in each cell is that nation 1, and the right hand payoff is that of nation 2.

		nation 2	
		Preempt	Status quo
nation 1	Preempt	6, 6	-2, 8
	Status quo	8, -2	<b>0, 0</b>

Figure 6.4. Prisoners' Dilemma viewed from period two of two-period game.

Lapan and Sandler [9] have described that the payoffs are based on the following assumptions. During each period, a preemptor confers a benefit of 8 each of the two players at a cost of 10 to itself. If, therefore only one country preempts, then the preemptor nets -2, while the free rider gains 8. If, however, both countries take action, then each receives 6 as cumulative benefits. This is a classic Prisoner's Dilemma with a dominant strategy of the status quo, where the payoffs are greater than the corresponding payoffs of preempting. As each nation exercises its dominant strategy, the second period Nash equilibrium, whose payoffs are boldfaced in fig 6.4, is achieved with no nation taking measures against the terrorists.

We now use the second period solution's payoffs to view the first period game. This is done by adding the Nash equilibrium payoffs of 0 to each player's first period matrix, whose payoff array is identical to fig 6.4 prior to this addition. Because we are adding 0 to each payoff, the first period matrix augmented by the second period Nash payoffs stays identical to that in fig 6.4 and so is not displayed. If, say, the Nash payoffs in the second period had been 2 for each player, then every payoff in the first period matrix would be

greater by 2 than those in the second period matrix. Whether 0 or some other constant is added to every payoff of the first period matrix, the dominant strategy will not change and remains for each nation to maintain the status quo. Thus, the sub game perfect equilibrium for the two period repeated interaction is for each government to maintain the status quo during each period – hence, the absence of action or cooperation against a common terrorist threat [10].

Lee and Sandler [11] have described that the government officials in two countries have any number of known periods to interact. The game is solved in the same way, starting at the last period as in fig 6.4 and finding the Nash equilibrium at mutual inactivity with payoffs of 0. These zero payoffs are then added to every payoff in the 2 x 2 matrix for the next-to-last period. The Nash equilibrium of the augmented next-to-last period matrix is again mutual inactivity, as it is for the next earlier period, and so on. In short, the game is “folded back” period by period to show that the sub game perfect strategy is to maintain the status quo during each and every period. The same result follows if there are more than two interacting governments.

Sandler [12] has mentioned that limited office terms inhibit cooperative arrangements among governments when addressing a threat of transitional terrorism. There are only two instances where cooperation develops: when the officials number of terms in office is unknown or when the officials are tenured for life. In either instance, the officials know that reneging on a cooperative arrangement may have repercussions as their counterpart punishes their misbehavior. Because the last office period is not known with certainty, there is no point at which cheating would necessarily go unpunished during the ensuing period. The presence of future periods is precisely what motivates a terrorist group with tenured leaders to honor its commitments to their groups. Quite simply, terrorists are interested in the future because failure to abide by understandings has consequences for future interactions.

#### IV. Conclusion

Actions to coordinate retaliation against either a terrorist organization or a state sponsor of terrorism has typically been characterized as a Prisoners Dilemma with all countries playing their dominant strategy to sit back and do nothing. The forging of an alliance to wage war on terrorism in Afghanistan after 9/11 appears to abide by a different underlying game form than the Prisoners Dilemma for select countries that have participated in the retaliatory response against the Taliban and Osama bin Laden. We shall focus on the two most ardent participants – the United States and the United Kingdom. We represent an underlying retaliation game in ordinal form, where payoffs are rank ordered from highest to lowest. The payoffs for the row player – the US – are listed first, followed by those of the column player – the UK – in each of the four strategic combinations. The ordinal payoffs displayed indicate that the highest payoffs come from these two countries jointly retaliating, followed by the next-largest payoff for free riding when the other country retaliates. The worst payoff corresponds to retaliating on one's own, followed by the second-worst payoff when neither country retaliates. This game differs from the standard prisoners Dilemma by having the ordinal payoffs of the 3s and 4s switched. That is, the heinous nature of 9/11 attacks and its human toll on American and British citizens at the World Trade Center increased the ordinal payoff for joint retaliation and decrease this payoff from free riding, as compared with earlier terrorist incidents, including the downing of Pan Am Flight 103 over Lockerbie, Scotland on 21 December 1988. This research will therefore help greatly in eliminating terrorism across the globe and minimizing the consequences and terrible losses it causes to human lives.

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