

# Blood and ink! The common-interest-game between terrorists and the media

Dominic Rohner · Bruno S. Frey

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**Abstract** It has often been pointed out in the literature that a symbiotic relationship exists between terrorist groups and the media. As yet, however, no formal model has been built based on this issue and only very little empirical research has been done in this field. The present contribution builds a simple game theoretic model, focussing on the strategic interactions between terrorists and the media. The model has features of a common-interest-game and results in multiple equilibria. After a discussion of the policy implications of the model, an empirical analysis is performed. Using newspaper coverage, terror incidents and terror fatalities data, it is shown that media attention and terrorism do mutually Granger cause each other, as predicted by the model. Moreover, it is explained why terror attacks tend to be “bloodier” in developing countries than in Europe and the United States.

**Keywords** Terrorism · Media · Common-interest-game · Coordination · Conflict

**JEL Classification** C72 · D74 · H52 · H77 · J22

## 1 Terrorism and the media are symbiotic

Recent history has provided plenty of examples of mutually beneficial relationships between terrorist organisations and the media. The hostage taking by Palestinian terrorists at the 1972 Munich Olympics, the hijacking of TWA flight 847 by Lebanese terrorists in 1985, or the terrorist attack on New York’s twin towers on 9/11/2001 were all mediated mega-events, where terrorists deliberately wanted the attention of the public and where the media

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D. Rohner (✉)  
Faculty of Economics, University of Cambridge, Sidgwick Avenue, Cambridge CB3 9DD, UK  
e-mail: dr296@cam.ac.uk

B.S. Frey  
Institute for Empirical Research in Economics, University of Zurich, Blümlisalpstrasse 10, 8006  
Zurich, Switzerland  
e-mail: bsfrey@iew.unizh.ch

benefited from record sales and huge audiences. The more recent terrorist attacks on public transport services in Madrid in 2004 and in London in 2005 also follow the same pattern.

It appears that political extremists employ terror as a communication strategy, and that they deliberately choose their targets and their timing in order to maximise media attention. Most of the time, terror attacks take place in big cities with a high density of press agencies.<sup>1</sup> Similarly, terrorists tend to attack before or during big media events, such as elections, international summits<sup>2</sup> like the G8-summit or the Olympic Games. As once expressed by a leader of the terrorist organisation “United Red Army”: “There is no other way for us. Violent actions ... are shocking. We want to shock people, everywhere ... It is our way of communicating with the people” (see McKnight 1974: 168).

Obviously, the media also benefit from the public’s eagerness to obtain information about terrorist attacks. At least for sensationalist TV channels and tabloid-newspapers, the fear and fascination generated by terrorism and political extremism is a substantial part of their business.

Most of the literature on terrorism has linked terror to ethnic, religious or geographic factors (see for example, Rathbone and Rowley 2002; Shughart 2002), or has emphasised the economic incentive structure of the terrorists, and in particular bargaining and collective action problems (cf. Sandler et al. 1983; Azam 2005; Ferrero 2005). The relationship between terrorists and the media has received little attention. Among the scholars focussing on this issue, almost all agree that a symbiotic relationship exists between terrorists and the media. Several contributions have discussed this symbiotic relationship qualitatively with the help of case study evidence (Frey 1988; Hoffman 1998; Wilkinson 2000; Frey 2004).

Very few econometric studies have been performed specifically focussing on whether the media actually increase the risk of terrorism. An interesting article by Nelson and Scott (1992) assesses empirically whether media coverage causes terrorism for the time period 1968–1984, and arrives at the conclusion that this is not the case. In the empirical part of our contribution, we will test, using more recent data, whether this conclusion still holds in today’s more globalised and media-covered world. Another important empirical paper has been written by Schbley (2004), who analyses the impact of media on the propensity of Muslim zealots for terrorism. Analysing interviews with 2619 individuals, it is found that a lot of know-how on how to organise and execute a terrorist attack is transmitted by the media.

Some other articles put emphasis on related phenomena, such as the psychological impact of the media coverage of terrorism on the public (Slone 2000) and on the inaccuracy and non-representativity of the terrorism coverage of certain media (Delli Carpini and Williams 1987; Crelinsten 1997; Gentzkow and Shapiro 2004).

However, it is striking that, even though anecdotal and statistical evidence seem to suggest that there is a link between terrorism and the media, almost no theoretical research has been done on this issue. One exception is an article by Scott (2001). But he focuses on the competition amongst different terrorist groups and does not consider the explicit interaction between media and terrorists.

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<sup>1</sup>In big cities there is also a high density of targets. However, the difference in the number of targets between big cities such as London or Madrid and middle-sized cities such as Newcastle or Seville is not as great as the difference in the number of international press agencies.

<sup>2</sup>Of course, another aim of attacks during political summits is to influence the decision process of the politicians, although media attention is helpful for this purpose.

We intend to fill this gap in the theoretical literature by building a simple game-theoretic model, which will have the main features of a coordination-game, or, more exactly, a common-interest-game. As the symbiotic relationship between terrorists and media is a particular form of social interaction, a game-theoretic model is more appropriate than a traditional microeconomics model with independently maximising agents. In Sect. 2 of our paper, a simple model of the relationship between terrorism and the media is built. In Sect. 3 the issue of equilibrium selection is treated in a discrete choice model, while Sect. 4 focuses on intermediate equilibria. Section 5 is devoted to comparative statics, Sect. 6 performs an empirical analysis and Sect. 7 concludes.

## 2 A model of the interaction between terrorism and the media

We consider a two-player static game, where the players consist of terrorists and the media. Terrorists have the choice between committing terror acts and following productive activities. Their (normalised) time constraint is expressed in (1).

$$L + T = 1, \quad (1)$$

where  $T$  = time devoted to terrorist activities,  $L$  = time devoted to work.

The utility function of the terrorists, which are assumed to be an aggregate player, is displayed in (2). Their utility depends positively on the impact of the terrorist activity (first term on the right) and on the amount of productive work terrorists could alternatively engage in (second term on the right).

$$u_T = \alpha QST^\theta + \beta L, \quad (2)$$

where  $Q$  = share of the news of the media devoted to terrorism,  $S$  = level of sensationalism of the newspapers, with  $0 \leq S \leq 1$ ,  $\alpha, \theta, \beta$  are positive parameters,  $0 \leq \theta \leq 1$ .

The marginal productivity of terror incidents on terrorists' utility is assumed to be decreasing ( $U_T^T > 0, U_{TT}^T < 0$ ). Or, in other words, the higher the intensity of terror, the less impact and attention in the media an additional terrorist act receives.

The parameter  $\beta$  corresponds to the marginal benefits from engaging in productive activities.

Introducing the time constraint (1), the utility function (2) becomes:

$$u_T = \alpha QST^\theta + \beta(1 - T). \quad (3)$$

As shown in (4), the value of the parameter  $\alpha$  depends on several factors related to intrinsic and extrinsic motivation. The benefits of a terrorist act are increasing with the value accorded to power  $p$ , monetary compensation  $m$  and ideological (missionary) gains  $i$ . This specification is consistent with findings in the literature (see Rathbone and Rowley 2002).

$$\alpha = \alpha(p, m, i) \quad (4)$$

with all first derivatives positive.

The media coverage of terrorism acts as a multiplier to the term representing the benefits from time devoted to terrorism in (3). With given preferences for power, money and ideology, an increase in media coverage increases the terrorists' motivation by making them more powerful, wealthy and ideologically influential. This "media multiplier" of terrorism benefits reflects on the one hand the amount of media coverage allocated to terrorist news  $Q$ ,

and on the other hand the extent of sensationalism  $S$ . The idea is that more sensationalist newspapers might focus more on catchy issues, such as terrorist leaders, rather than, for example, on a profound analysis of the underlying roots and problems in a given context. By assumption, terrorists are not only motivated by intrinsic factors, such as ideology, but also place considerable emphasis on extrinsic motivation factors, such as power or money. Sensationalist media coverage makes it easier for terrorist leaders to establish their terror organisation as a well-known “brand”, which facilitates fund-raising and increases their notoriety. As a result, sensationalist type news fit the aims of terrorists better than a nuanced analysis of terrorism.

The media, which for simplicity are again represented as an aggregate player, face the choice between reporting about terrorism and covering other topics. Their so-called “space” constraint is represented by (5).

$$Q + R = 1, \tag{5}$$

where  $R$  is the newspapers’ share of reports on subjects other than terrorism.

The media benefit from terrorist news and from reports about other topics (6). The gains from terrorist news are increasing in the level of sensationalism. The idea here is that terrorism is a catchy subject from which the sensationalist boulevard press can benefit more than the serious press. Further, the more terrorist acts that are committed, the greater is people’s interest in reports about terror. Thus, the benefits from terrorism coverage increase in  $T$ . The parameter  $\chi$  captures various factors that determine how lucrative reports about terrorism are for the media. These factors include the level of interest of the public in terrorism, the level of ease or danger associated with reporting about terrorism, etc. Similarly, the parameter  $\delta$  is related to the marginal benefits from reports about other topics than terrorism.

$$u_M = \chi TSQ^\rho + \delta R, \tag{6}$$

where  $\chi, \rho, \delta$  are positive parameters, with  $0 \leq \rho \leq 1$ .

Which level of sensationalism a given media company chooses depends on the preferred level of sensationalism of its target group of potential readers. In the present model, the media are represented as an aggregate player and the preferences of the public are not modelled explicitly. Thus, the level of sensationalism can, for the sake of simplicity, be taken as exogenous to the model. It can be assumed that the overall aggregate level of sensationalism of the media is determined by factors, such as the educational level of the population (where education increases the preference for nuanced journalism with a great information content).

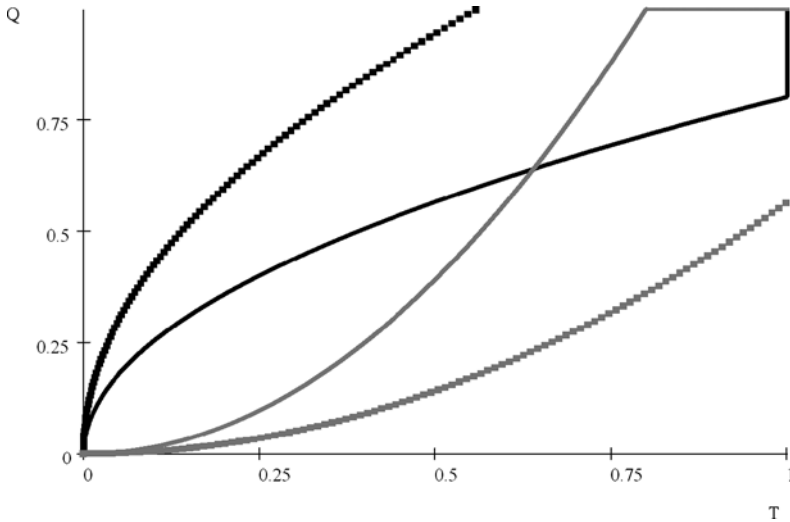
The share of news devoted to terrorism shows decreasing marginal returns ( $U_{QQ}^M > 0, U_{QQ}^M < 0$ ). In other words, if numerous articles have already focussed on a particular terrorist attack, subsequent supplementary articles receive less and less attention. This feature of the model is consistent with the “crowding”-result of Scott (2001).

Plugging the space constraint of the media (5) in their utility function (6), we obtain (7).

$$u_M = \chi TSQ^\rho + \delta(1 - Q). \tag{7}$$

The first-order conditions for terrorists and the media can be used to find the respective reaction functions. Setting  $\partial u_T / \partial T$  from (3) and  $\partial u_M / \partial Q$  from (7) equal to zero, we obtain the reaction function for the terrorists described by (8) and the reaction function for the media expressed by (9).

$$T = \left( \frac{\alpha \theta S Q}{\beta} \right)^{1/(1-\theta)}, \tag{8}$$



**Fig. 1** The reaction functions

$$Q = \left( \frac{\chi \rho S T}{\delta} \right)^{1/(1-\rho)} \tag{9}$$

$T$  and  $Q$  cannot exceed 1, as  $T$  is subject to the time constraint of the terrorists, and  $Q$  is subject to the space constraint of the media. Therefore, we have  $T = 1$  for  $(\frac{\alpha \theta S Q}{\beta})^{1/(1-\theta)} > 1$  and similarly  $Q = 1$  for  $(\frac{\chi \rho S T}{\delta})^{1/(1-\rho)} > 1$ .

The two reaction functions for particular parameter values<sup>3</sup> are displayed in Fig. 1 with the time spent on terrorist acts  $T$  on the horizontal axis, and the share of news devoted to terrorism on the vertical axis. The black lines represent the reaction function of the terrorists  $T = T(Q)$ , whereas the grey lines represent the reaction functions of the media  $Q = Q(T)$ .

The present framework corresponds to a common-interest-game with (potentially) multiple equilibria. The number of equilibria depends on the parameter values. In the case of the dotted reaction functions, there is only one stable “no attack” equilibrium, namely (0; 0): No terrorism occurs and newspapers do not write about terrorism. Another case (which is not displayed in Fig. 1) is when the reaction functions intersect twice at (0; 0) and at (1; 1).

As illustrated by the solid reaction functions in Fig. 1, for the parameter values  $\frac{\alpha \theta S}{\beta} > 1$  and  $\frac{\chi \rho S}{\delta} > 1$  there are three equilibria. In addition to the two stable equilibria, (0; 0) and (1; 1), there is a third, unstable<sup>4</sup> equilibrium for intermediate values of  $T$  and  $Q$ . For the particular parameter values chosen as an example, this unstable equilibrium is at (0.64; 0.64).<sup>5</sup>

It is important to note that the case displayed by the solid reaction functions in Fig. 1 can only occur if  $\alpha S > \beta$  and  $\chi S > \delta$ . This, however, implies that the equilibria of the

<sup>3</sup>The solid reaction functions in Fig. 1 correspond to the following parameter values:  $\theta = 0.5, \alpha = 1, \beta = 0.4, \rho = 0.5, \chi = 1, \delta = 0.4, S = 1$ . The dotted ones correspond to the following parameter values:  $\theta = 0.5, \alpha = 1, \beta = 0.66, \rho = 0.5, \chi = 1, \delta = 0.66, S = 1$ .

<sup>4</sup>In the Appendix it is shown why this equilibrium is unstable.

<sup>5</sup>Using (8) and (9), the values of  $T$  and  $Q$  of this unstable intermediate equilibrium can be computed. They are  $T = \left\{ \left[ \frac{\alpha \theta}{\beta} \right]^{1-\rho} S^{\frac{1}{1-\theta}} \left[ \frac{\chi \rho}{\delta} \right] \right\}^{(1-\theta)(1-\rho)-1}$  and  $Q = \left\{ \left[ \frac{\chi \rho}{\delta} \right]^{1-\theta} S^{\frac{1}{1-\rho}} \left[ \frac{\alpha \theta}{\beta} \right] \right\}^{(1-\theta)(1-\rho)-1}$ .

game are ranked and that from the perspective of the terrorists and the media the “attack” equilibrium (1; 1) is the “good” equilibrium, while the “no attack” equilibrium (0; 0) is the “bad” equilibrium. Obviously, from the point of view of the society this is just the other way around. In the remainder of the analysis we will refer to (1; 1) as the “attack” equilibrium and to (0; 0) as the “no attack” equilibrium.

In the dynamic model included in the [Appendix](#), which takes out of equilibrium movements into account, it is shown that already small perturbations away from the intermediate equilibrium lead to adjustments of the players that result in either the equilibrium (0; 0) or (1; 1). Thus, we will focus on only these two cases for the analysis of equilibrium selection.

### 3 Equilibrium selection in a discrete choice model

The model presented in Sect. 2 leaves one important question unanswered: What determines which stable equilibrium, (0; 0) or (1; 1), is chosen? In recent years the issue of equilibrium selection has become an important topic, and various tools have been developed for addressing this problem. In order to perform this analysis it simplifies matters to transform the game of Sect. 2, which had a continuous action space of  $T = [0, 1]$  and  $Q = [0, 1]$ , into a discrete choice game. Players face the discrete choice between the options “terrorism” and “non-terrorism”, respectively “media coverage on terrorism” and “no media coverage on terrorism”,  $T = \{0, 1\}$  and  $Q = \{0, 1\}$ . Given that in the continuous case of Sect. 2 the only stable equilibria were (0; 0) and (1; 1), much of the richness of the game can be captured in the simplified discrete choice version. Including the same utility functions (2) and (6) as before, the  $2 \times 2$  matrix of the discrete choice game is as displayed in Fig. 2.

In the continuous choice game of Sect. 2, for the case of  $\alpha S < \beta$  and  $\chi S < \delta$  the reaction functions intersected only once, and the only equilibrium of the game was (0; 0).<sup>6</sup> Also for the discrete choice version of the game the only equilibrium is (0; 0) if these conditions hold.

The case in which we are most interested is the one of multiple equilibria and strategic complementarities between the players, resulting in a common-interest-game. For the continuous action space in Sect. 2, we focussed on the case where  $\frac{\alpha\beta S}{\beta} > 1$  in the reaction function of the terrorists (8), and  $\frac{\chi\delta S}{\delta} > 1$  in the reaction function of the media. This constellation resulted in three equilibria, with (0; 0) and (1; 1) as stable equilibria, and corresponds to the solid reaction functions displayed in Fig. 1. This is equivalent to the condition of  $\alpha S > \beta$  and  $\chi S > \delta$  in the discrete choice model of the present section, displayed in Fig. 2. Under these conditions there are two pure strategy Nash equilibria in this game, (0; 0) and (1; 1). For the rest of this section we will focus on this case.

**Fig. 2** The payoff matrix in the discrete choice game

		<i>Media</i>	
		$Q = 1$	$Q = 0$
<i>Terrorists</i>	$T = 1$	$(\alpha S); (\chi S)$	$(0); (\delta)$
	$T = 0$	$(\beta); (0)$	$(\beta); (\delta)$

<sup>6</sup>This corresponds to the case of the dotted reaction functions in Fig. 1. It can easily be seen from (8) and (9) that for the conditions of  $\alpha S < \beta$  and  $\chi S < \delta$  the best reply to the action  $T = 1$  (respectively  $M = 1$ ) of the other player would be a level of  $M$  (respectively  $T$ ) smaller than 1.

In the present discrete choice model there exists also a mixed strategy Nash equilibrium where the terrorists mix with the probabilities  $(p, 1 - p) = (\frac{\delta}{\chi S}, 1 - \frac{\delta}{\chi S})$ , where  $p$  = probability of playing  $T = 1$ . The media mix with the probabilities  $(q, 1 - q) = (\frac{\beta}{\alpha S}, 1 - \frac{\beta}{\alpha S})$ , where  $q$  = probability of playing  $Q = 1$ .

As usually done in the equilibrium selection literature, we focus on the choice between pure equilibria. A powerful tool for predicting which equilibrium will be selected is the concept of “strategic dominance”, introduced by Harsanyi and Selten (1988). This selection criterion implies that the Nash equilibrium with the highest Nash-product (i.e. the product of losses from deviation) is chosen. The intuitive justification provided by Vega-Redondo (2003, p. 450) is that “heuristically, this notion simply reflects the fact that [the risk dominant choice] is the optimal (expected-payoff maximising) choice when a player has fully unbiased (i.e. uniform) subjective beliefs about the action to be played by the opponent”.

The Nash equilibrium (1; 1) is the risk dominant equilibrium if condition (10) holds:

$$(\alpha S - \beta)(\chi S - \delta) > \beta\delta \Leftrightarrow \alpha > \frac{\beta\chi}{\chi S - \delta}. \quad (10)$$

Given the assumption that  $\chi S > \delta$  we know that both sides of inequality (10) are positive. The greater the intrinsic and extrinsic motivation (higher  $\alpha$ ), and the smaller the marginal returns to productive activities (smaller  $\beta$ ), the more likely is condition (10) to hold. Similarly, the greater the returns from media coverage on terrorism (higher  $\chi$ ) and the smaller the returns from reports on other topics (smaller  $\delta$ ), the more likely is condition (10) to hold, which results in the equilibrium (1; 1) to be chosen.

If the heuristic justification of equilibrium selection through risk dominance is based on unbiased or *Laplacian* beliefs, another very powerful and more intuitively justifiable instrument of equilibrium selection has been developed more recently: Global games.<sup>7</sup> In this class of games some small uncertainty about the payoffs is introduced, and with the help of higher order beliefs and the “infection argument”, it is determined which of the multiple equilibria will be selected by the players.

As shown in the seminal article of Carlsson and van Damme (1993), for  $2 \times 2$  symmetric or asymmetric games with strategic complementarities, the solution selected by the global games approach (in the limit of the noise approaching zero) corresponds exactly to the one selected through Harsanyi and Selten (1988)’s risk dominance method. Thus, the condition for equilibrium (1; 1) to be selected, which was derived in (10), is equivalent to the condition obtained with the help of the “broader” concept of global games.

#### 4 Allowing for intermediate equilibria

In Sect. 2, we have analysed what equilibria can potentially emerge in the common-interest-game faced by the terrorists and the media. Further, in Sect. 3 it has been shown which of these multiple equilibria will be selected in a framework of risk dominance and global games.

In the present section we address the issue of intermediate equilibria. So far, above all the “extreme” cases (0; 0) and (1; 1) have been found to be potential equilibria. The only

<sup>7</sup>For the original treatment see Carlsson and van Damme (1993). Important generalisations of the results have been derived in Frankel et al. (2003). Good overview articles have been provided by Myatt et al. (2002) and Morris and Shin (2003).

equilibria with intermediate levels of terrorism and media coverage were a single unstable Nash equilibrium in the continuous choice version of the game in Sect. 2, and a single mixed equilibrium for the discrete choice case of Sect. 3. The intermediate equilibrium of the continuous choice case should be dismissed as it is unstable to the slightest trembles. Similarly, following common practise the focus for the equilibrium selection problem treated in Sect. 3 was on pure strategies. In a nutshell, so far we have mainly emphasised the extreme value equilibria (0; 0) and (1; 1), while in reality many countries have low, but not zero, or high, but not maximum levels of terror activity.

We tackle this issue by extending the discrete choice model of Sect. 3 to a number  $n$  of different terrorist groups and corresponding media outlets (newspapers, broadcasting stations). It is easiest to think of a given country  $C$  that is composed of  $n$  different regions or areas. In the case of Northern Ireland, for example,  $n$  could be the number of different cities, areas of Belfast, etc. In each of these zones there is a distinct terrorist organisation, or a cell of the same terror group. In Northern Ireland there have been different active groups such as the Irish Republican Army (IRA), Real IRA, Continuity IRA, Irish National Liberation Army, Ulster Freedom Fighters (UFF), Ulster Volunteer Force (UVF), Red Hand Commandos, Red Hand Defenders, Loyalist Volunteer Force, Red Branch Knights, Orange Volunteers, Ulster Resistance, Ulster Defence Association, etc.<sup>8</sup> Similarly, for the case of Al Qaida the  $n$  different groups could relate to several terror cells scattered around a given country or area. At the same time there are different newspapers and media companies in a given country, with some having a specific local audience and some targeting a specific population group.

This situation can be simplified as  $n$  pairs of terrorist groups and the corresponding media:  $t_1 =$  terrorist cell of town 1,  $m_1 =$  local newspaper of town 1,  $t_2 =$  terrorist cell of town 2,  $m_2 =$  local newspaper of town 2,  $\dots$ ,  $t_n =$  terrorist cell of town  $n$ ,  $m_n =$  local newspaper of town  $n$ .

Further, it makes sense to assume that some of the key variables  $\alpha$ ,  $\beta$ ,  $\chi$  and  $\delta$  vary between different terrorist organisations and media companies. Some terror cells might have a stronger motivation due to personal experiences (higher  $\alpha$ ) or a lower opportunity cost of terrorism (i.e. the forgone income of productive work) due to a lower level of education ( $\beta$ ). The incentive structure of different media companies might vary as well. Without loss of generality we consider the simplified case when terror groups vary only in  $\alpha$  and when all other parameters are constant for a given country, but vary between countries. For simplicity we can assume that  $\alpha$  is uniformly distributed between  $\alpha_{\min}$  and  $\alpha_{\max}$ .

For a given level of other parameters, there has to be a threshold level of  $\alpha^* = \beta\chi/(\chi S - \delta)$ , above which (10) holds, and where accordingly (1; 1) is the selected equilibrium. Below  $\alpha^*$ , (0; 0) is selected. Put differently, the terrorist cells with the strongest incentives attack, while the ones that have less to gain from terror do not attack. For the special case of a uniform distribution the proportion  $g$  of attacking cells corresponds to  $g = (\alpha_{\max} - \alpha^*)/(\alpha_{\max} - \alpha_{\min})$ . This could for example be  $g = 0.2$  or 20% of all terror cells engaging in attacks in a given country  $C1$ . In another country  $C2$  with different values of the other parameters, this level would be different. For example, if country  $C2$  has a higher level of education and offers better opportunities for productive activities (higher  $\beta$ ) than  $C1$ ,  $C2$  would accordingly have a higher threshold level  $\alpha^*$  for engaging in terrorism. This implies that for a same distribution of  $\alpha$  between  $\alpha_{\min}$  and  $\alpha_{\max}$  country  $C2$  would have a lower proportion of terrorist cells engaging in attacks.

<sup>8</sup>Some of these groups are or were very much intermeshed or overlapping and it is difficult to know exactly the frontiers between different groups. Information on this topic can be found on [www.mi5.gov.uk](http://www.mi5.gov.uk).



To sum up, even if any particular local terrorist organisation or cell faces a zero-one decision of engaging or not in terror attacks, we can find, if terror cells are heterogeneous with respect to parameter values, a whole range of intermediate levels of terrorism on the country level. For different parameter values in different countries, different thresholds for engaging in terrorism apply, leading to differences in the level of terrorism between countries.

## 5 Comparative statics

In this section, several policy options are discussed. As seen in (10), the values of the parameters  $\alpha$ ,  $\beta$ ,  $S$ ,  $\chi$ , and  $\delta$  determine which equilibrium will be selected. The greater  $\alpha$  is, the smaller  $\beta$  is, the greater  $S$  is, the greater  $\chi$  is, and the smaller  $\delta$  is, the more likely it is that condition (10) holds and that the high-terror equilibrium (1; 1) occurs.<sup>9</sup>

First of all, some policies directly related to the media are examined. One policy would be to not attribute terrorist acts to one specific group. This option has been discussed in Frey (1988, 2004) and in Frey and Lüchinger (2003). The refused recognition accorded to the terrorist incident would decrease the motivation of the terrorists by reducing their power. This policy option can therefore be represented by a decrease in  $\alpha$  in (4). A decrease in  $\alpha$  makes it more likely that condition (10) does not hold and that players end up in the equilibrium (0; 0), where no terrorism occurs and where the media do not write and broadcast about terrorism.

Another promising policy response to terrorism is represented by the legal or political support of quality media. Direct subsidies to particular newspapers may not be advisable, as measuring the quality of all national sources of media appears difficult and costly, and as direct subsidies could threaten the independence of the media. However, indirect policies, such as for example reduced charges for postal delivery of newspapers, would be conceivable. Such a measure is used in Switzerland, where above all “broadsheet”-newspapers are traditionally accepted and delivered by the post, and where “tabloids” are, in general, bought at a newspaper stand.

Such indirect support measures make it attractive for newspapers to decrease their focus on sensationalist news,  $S$ . The lower  $S$  is, the less likely condition (10) holds, leading to an outcome of (0; 0), i.e. “no attack”.

Another way of decreasing the amount of sensationalist media coverage would be to increase educational spending. If additional education sharpens the faculties of critical thought and knowledge of politics, the interest for boulevard-journalism is decreased. The media have fewer incentives to focus on sensationalist news (lower  $S$ ). Thus, educational spending increases the likelihood of achieving the “no attack” outcome (0; 0).

Other policies not directly linked to the media can also be discussed in the present framework. Decentralisation and federalism tend to increase the likelihood of a desirable outcome

<sup>9</sup>Another way of assessing the impact of parameter changes would be to focus on the rotations of the reaction functions in the continuous choice model of Sect. 2 (which correspond to the equilibrium lines in the Appendix). We can consider, say, the case of an increase in  $\alpha$  in (4). This parameter enters the numerator of the terrorists’ reaction function displayed in (8). The first derivative of  $T$  with respect to  $\alpha$  is positive,  $\frac{\partial T}{\partial \alpha} = \left(\frac{1}{1-\theta}\right) \left(\frac{Q\alpha\theta S}{\beta}\right)^{\theta/(1-\theta)} \left(\frac{Q\theta S}{\beta}\right) > 0$ , indicating that an increase in  $\alpha$  leads to an increase in the part of time spent on terror attacks, *ceteris paribus*. This leads to a rotation of the terrorists’ reaction function towards the southeast in Fig. 1. It follows that the basin of attraction of the (1; 1) equilibrium in the dynamic model of the Appendix increases, which leads also to a shift downwards of the “stable arm”, making that more starting points result in the final equilibrium (1; 1).

by decreasing the extrinsic motivation of the terrorists. As discussed in Frey (2004) and Frey and Lüchinger (2004), through decentralisation, the state can decrease its vulnerability with respect to terrorism. The lower vulnerability decreases the power  $p$  of the terrorists and decreases the parameter  $\alpha$ .

Last but not least, more perspectives for terrorists to lead a better life without resorting to violence can lead to less terrorism. A better outside option increases the opportunity cost of terrorism. In the present framework, better outside options lead to a higher  $\beta$ , which increases the likelihood of achieving (0; 0). Possible ways of improving opportunities in life are to rise educational spending, provide subsidises for start-up companies, and build up a fairer and more meritocratic public administration, etc.

## 6 Empirical results

In order to test the theoretical model, the relationships between monthly data of terrorist incidents and casualties on the one hand, and of media coverage of terrorist attacks on the other hand, are analysed.

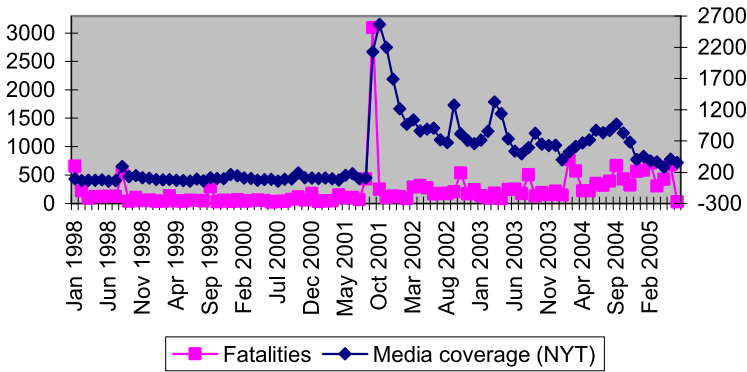
The data for the monthly number of terrorist incidents and victims are taken from the *National Memorial Institute for the Prevention of Terrorism (MIPT)*.

Terrorist acts are defined for the purpose of the MIPT statistics as follows (cf. www.mipt.org): “Terrorism is violence, or the threat of violence, calculated to create an atmosphere of fear and alarm”.

For the purpose of our study, it is important to include both domestic (i.e. “incidents perpetrated by local nationals against a purely domestic target”) and international terrorist acts. The time period is limited from January 1998 to June 2005, as prior to 1998, no data on domestic terrorism is available. Similarly, changes in definitions and coding policies of the MIPT after June 2005 make it preferable to limit our dataset to that date, assuring full comparability.

It is impossible to consider the media coverage of terrorism by all newspapers and television channels in every country. We therefore consider internationally recognised newspapers as a proxy for the huge number of newspapers and television stations available around the world. In journalism and communication studies, the concept “quality newspaper” has received considerable attention, even though a clear-cut definition and measurement is difficult (see Kim and Meyer 2005). A well-regarded journalism scholar, Merrill (1999), has performed opinion polls in 1968 and 1999 among leaders in business, politics, science and culture to rank the world’s highest-quality newspapers. For both waves of polls, the American *New York Times (NYT)* ranked first and the Swiss *Neue Zürcher Zeitung (NZZ)* ranked second. Our indicator of media coverage has been constructed, using editions of the NYT and the NZZ for the time period January 1998 to June 2005. We have simply counted the total number of times the expression “terrorism” or “Terrorismus” appeared during the month in question.

The NYT has also been chosen because it is one of the most influential high-quality newspapers in the United States, which has built a reputation for being as objective as possible. Moreover, the NYT is among the US-newspapers with a strong international orientation. It seems reasonable to assume that the NYT has a fairly unbiased focus. It is likely that it matters to terrorists what the citizens and politicians of the United States think. As the only remaining superpower of the world has a decisive impact on international and domestic politics in numerous countries, coverage by US-newspapers is likely to be one of the goals of terrorists in their quest to attract media attention.



**Fig. 3** Terrorist fatalities and media coverage (monthly data, 1998:01–2005:06). Source: MIPT, NYT. Remark: The scale to the left corresponds to the number of fatalities from terrorist attacks, whereas the scale to the right represents the media coverage of terrorism in the *New York Times*

The NZZ has been chosen to check the robustness of the results gained from the NYT because it is an internationally oriented high-quality newspaper, based in Continental Europe. Moreover, as it is edited in Switzerland, a neutral country without domestic terrorism, it is not biased towards certain kinds of particular terrorist incidents. It is reasonable to assume that the NZZ's coverage is quite unbiased and representative of the terrorism coverage of other internationally-oriented high-quality newspapers around the world.

Figure 3 plots both the number of terrorist fatalities and the media coverage of terrorism by the New York Times. There is an important structural break at the time of the terrorist attack aimed at the New York twin towers on 9/11/2001. After this event, both terrorist activity and media coverage remain significantly higher. Initially (1998–2001), there was a low terror equilibrium with a parsimonious media coverage of terrorist acts. The attacks of 9/11 massively increased the media interest in terrorism and the level of media coverage has remained high, even though 9/11 could have been considered an exceptional catastrophe rather than the beginning of a new trend. Over time, however, the increased media coverage of terrorism has encouraged terrorists, and a trend of increasing terrorist activity has emerged. As a result, media coverage remained high. In 2004 and 2005, both the level of media coverage and terrorism were significantly higher than before 9/11. In a nutshell, before 9/11 there was an equilibrium where both terrorism and media attention were low, whereas afterwards (especially in 2004 and 2005) both the level of terrorism and the media coverage were higher.

Granger causality tests are used to assess whether terrorist attacks Granger cause media attention and whether media coverage encourages terror, as suggested in our theoretical model. It is realistic to assume that the impact time of terror attacks and media coverage is relatively short. An impact time of a quarter of a year seems reasonable. Therefore, we perform Granger causality tests with 3 lags.

The Granger causality test between fatalities and the media coverage of terrorism by the NYT is displayed in Table 1. The null hypothesis of fatalities not causing (in the Granger sense) media coverage of terror by the NYT is rejected at a level of confidence of 99%. In other words, at a level of confidence of 99%, terror fatalities cause the media coverage of terrorism by the NYT, according to the definition of Granger causality. Similarly, the media attention of the NYT causes terrorist fatalities at a level of confidence of 95%.

**Table 1** Granger causality tests for worldwide terror fatalities and media coverage of terrorism by the NYT

Null hypothesis	Obs.	F-Statistic	Probability
NYT coverage does not Granger Cause FATALITIES	87	3.557	0.018
FATALITIES does not Granger Cause NYT coverage		27.441	2.651 e-12

Pairwise Granger Causality tests. Sample: 1998:01–2005:06. Lags: 3

This clear result for terrorism and media attention causing each other is robust with respect to different lag lengths for the coverage by the NYT. The bilateral causality is also supported using data from the NZZ media coverage of terrorism.<sup>10</sup>

Our findings for data from 1998–2005 contrast with the results of Nelson and Scott (1992)'s study, which used data on terrorism and media coverage from 1968 to 1984. They focus as well on coverage by the NYT as proxy for media coverage. One potential explanation for differences would be that, in their study, terrorism data was provided by ITER-ATE2, whereas our data was provided by the *National Memorial Institute for the Prevention of Terrorism*. However, in our view, it is much more likely that the underlying reason for the different results is that the world has changed in the last two decades. Our world has become increasingly globalised and so has international terrorism. In today's world, the media play an extremely important role and the world's leading newspapers are read all over the planet, both as the printed edition and the online edition. Therefore, the possibility of gaining media attention can trigger terrorism more than ever.

We have tested whether fatalities in Western Europe and the United States matter more for the attention of the NYT than fatalities in other parts of the world, such as for example Africa. We find that the *F*-statistics for both directions of Granger causality are even higher for fatalities in Western Europe and the United States than for fatalities worldwide. The Granger causality relation is significant in both directions at a level of confidence of 99%. Each terror victim in Western democracies receives more media attention from the NYT than a similar death in a developing country. Thus, media coverage of terrorism by the NYT has more appeal for terrorist groups operating in Western Europe and the USA rather than in developing countries. This bias in the media coverage towards terror attacks in Western democracies is also found for the NZZ.

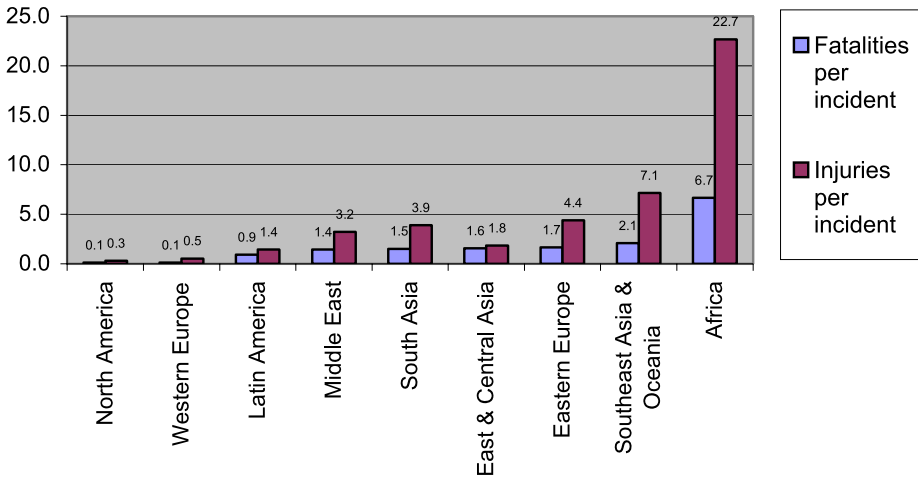
It would be interesting to know whether this result also holds for terror incidents (rather than fatalities) and media coverage by the NYT. There seems to be only a weak bilateral causality relationship between the number of terror incidents and media coverage. However, this relationship is stronger for terrorist incidents in Western Europe and the United States. As shown in Table 2, terror incidents in Western Europe and the United States cause (in the Granger sense) media coverage by the NYT at a level of confidence of 95%. Similarly, media coverage of terrorism by the NYT causes terrorist incidents in Western Europe and the USA at a level of confidence of 95%. Again, this result is robust with respect to taking different lag lengths, or to using media coverage in the NZZ rather than in the NYT. In the case of the NZZ, the bilateral Granger causality result is also stronger for terror incidents in Western Europe and the USA than for worldwide terrorist incidents, and the Granger causality is also statistically significant in both directions and for different lag lengths.

<sup>10</sup>In order to limit the number of tables and to make the present article as reader-friendly as possible, we have renounced the idea of displaying and discussing the empirical results for the NZZ coverage on terrorism and for the NYT coverage on terrorism in Western Europe and the United States in detail. However, we would be happy to share our data and results with other scholars after publication.

**Table 2** Granger causality tests for terror incidents in Western Europe and the United States and media coverage of terrorism by the NYT

Null hypothesis	Obs.	F-Statistic	Probability
NYT coverage does not Granger Cause INCEUUS	87	2.78595	0.04604
INCEUUS does not Granger Cause NYT coverage		3.20924	0.0274

Pairwise Granger Causality tests. Sample: 1998:01–2005:06. Lags: 3



**Fig. 4** Ratio between fatalities, injuries and incidents for different regions. Source: MIPT. Remark: As an outlier, the terror attack on the USA on 9/11 has been excluded

These results suggest that even high-quality newspapers like the NYT and the NZZ focus more on Western countries and under-report terrorist acts in developing countries. For the number of fatalities, the media's focus on Western Europe and the USA is less pronounced than for the number of incidents, where the NYT and the NZZ appear to be mostly interested in terrorist attacks in Western countries. In other words, to make it into the news, terrorists operating in Western countries can commit some minor terror incident with few fatalities, whereas terrorists in developing countries need to "produce" a lot of blood to attract the attention of the Western media.

As predicted by our model, terrorists may be assumed to adapt their terror strategy with respect to media behaviour. The terrorists' main goal is to obtain media attention to expose their ideology. As Western media might only cover terrorism in developing countries if a high number of fatalities are involved, terrorist attacks in developing countries should tend to be bloodier. Figure 4 shows that this is indeed the case. The attacks of 9/11, being a so far unique event with a large number of deaths, are excluded as outlier from the data used in Fig. 4. This figure clearly reveals that, in North America and in Western Europe, terror attacks tend to involve less fatalities and injuries, whereas in developing countries the number of injuries and deaths per terror incident is much higher. Especially in Africa, the most ignored continent in terms of media coverage, terrorism shows a worrying tendency towards brutality and bloodiness. More than five people die and over twenty are injured in an average terror incident.

The empirical analysis presented implies a strong symbiotic relationship between the media and terrorists. The Granger causality analysis supports the notion that the causality goes in both directions. Analysing this issue in a game theory framework, as done in the previous sections, rather than by traditional microeconomic models with independently maximising agents, is therefore desirable. Models ignoring social interaction would bear the risk of only capturing one direction of causality and not emphasising the strategic complementarities between the players.

## 7 Conclusion

The present contribution emphasises the symbiotic relationship between terrorism and the media. Terrorist attacks are a particular form of communication by terrorist groups. The media are used as a platform for securing a broad dissemination of the terrorists' ideology. The media benefit from terrorism, as reports of terror attacks increase newspaper sales and the number of television viewers. There is a common-interest-game, whereby both the media and terrorists benefit from terrorist incidents and where both parties adjust their actions according to the actions of the other player.

The first part of the paper formalises this intuition with the help of a simple common-interest-game. Terrorists have the choice of how much of their time they want to dedicate to terrorist activities. The media can choose how much of their news space they want to use for reporting on terrorism. Following the parameter values, one, two or three equilibria were found. The extreme cases of very high and very low levels of terrorism and media coverage were both stable, whereas the intermediate equilibrium was unstable. In Sects. 3 and 4 it was then assessed which of the multiple equilibria will take place and how intermediate levels of terrorism can be explained.

The analysis allows us to draw policy recommendations. Avoiding, as far as possible, to attribute terrorist attacks to particular groups and subsidise (indirectly) high quality journalism have been found to increase the likelihood of a low terrorism outcome. Further policy options, such as increased educational spending, more decentralisation and better perspectives for living a satisfying, law-abiding life could also decrease the risk of terrorism.

The empirical analysis of the media coverage of terrorism, terror incidents and fatalities in the *New York Times* and in the *Neue Zürcher Zeitung* suggests that terrorism and media coverage of terrorism cause each other in the Granger sense of the word. This result is consistent with the predictions of our game theoretic model. It remains remarkably robust to various changes, such as different lag lengths, different newspapers or different regions. The lower interest of Western media for terrorism in developing countries, rather than in North America and Western Europe, leads terrorists in developing countries to commit bloodier terror attacks. Increasing the number of fatalities and injuries is their only possibility of obtaining the desired media coverage.

The present contribution uses, and empirically tests, a simple game theoretic model of the relationship between the media and terrorist groups. To our knowledge, this is the first formal explanation of the symbiotic relationship between the two groups of actors. There is still much research to be done in the present field of study. Above all, collecting data on the percentage of people reading quality newspapers per country, and about the attribution policy of terror attacks in different countries, would be important.

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### Appendix Out of equilibrium dynamics for the continuous choice model

The continuous choice model derived in Sect. 2 provides multiple equilibria for the common-interest-game between the terrorists and the media. It is able to predict which stable equilibria are sustainable in the long run. What it, however, does not show are the out of equilibria dynamics and how players end up in a given equilibrium.

To address these issues, an explicit dynamic version of the model is required. In order to keep things as simple as possible, we assume that changes in the level of terrorism are a linear function of the difference between the marginal returns from terrorism,  $\alpha QST^{\theta-1}$ , and non-terrorism,  $\beta$ . Similarly, changes in the level of media coverage on terrorism are modelled as a linear function of the difference between the marginal returns from terrorism coverage,  $\chi TS\rho Q^{\rho-1}$ , and reports on other topics,  $\delta$ . Baker and Bulte (2006) have chosen a similar approach for introducing dynamics in their static model.

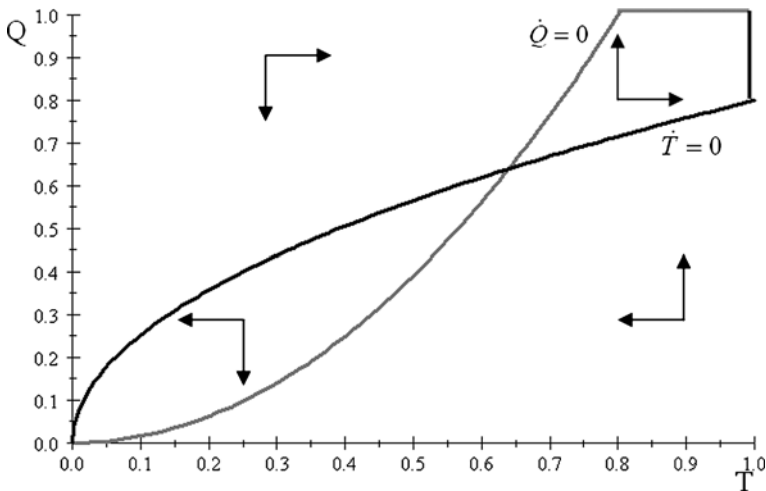
Given these assumptions, the differential equations of the level of terrorism and of the media coverage on terrorism become as displayed in (11) and (12) below:

$$\dot{T} = \phi(\alpha QST^{\theta-1} - \beta), \tag{11}$$

$$\dot{Q} = \psi(\chi TS\rho Q^{\rho-1} - \delta), \tag{12}$$

where  $\phi$  = parameter relative to the speed of adjustment of the level of terrorism,  $\psi$  = parameter relative to the speed of adjustment of the level of media coverage on terrorism.

The equilibrium lines can be computed, setting  $\dot{T} = 0$  in (11) and  $\dot{Q} = 0$  in (12). The shape of these equilibrium lines corresponds exactly to the reaction functions of the static model in Sect. 2. The stable equilibria (fixed points) are given by the intersection of the

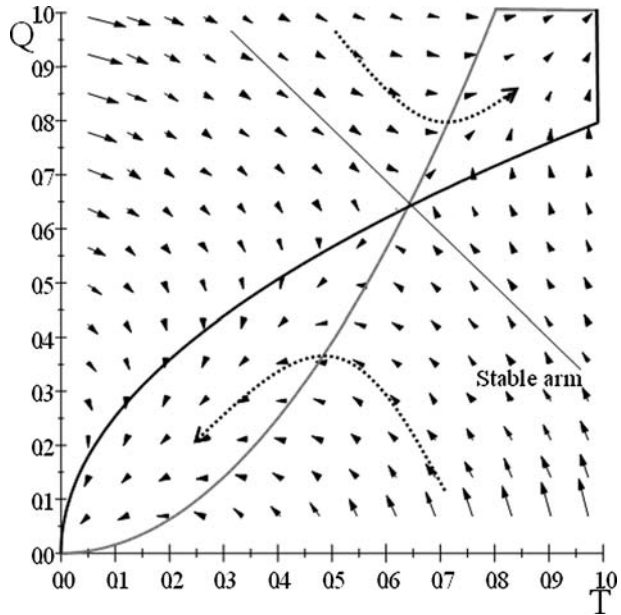


**Fig. 5** Phase diagram of the dynamic continuous choice model

<sup>11</sup>In (2) the total returns from terrorist activities are given by  $\alpha QST^{\theta}$ . The marginal returns from terrorism correspond to the first derivative of these total returns with respect to  $T$ . Similarly, the total returns from production are given by  $\beta L$ . Again, the marginal returns from production are obtained by taking the first derivative of the total returns with respect to  $L$ . An analogous approach is used for computing the marginal returns from media coverage on terrorism and on other topics.



**Fig. 6** Vector field of the dynamic continuous choice model



equilibrium lines, where simultaneously  $\dot{T} = 0$  and  $\dot{Q} = 0$  hold. The equilibria are exactly the same as in the static model, namely  $(0; 0)$ ,  $(1; 1)$  and the same intermediate equilibrium.

Figure 5<sup>12</sup> displays the phase diagram of the dynamic model. The plane  $(T, Q)$  is divided in four zones. The zone in the southwest (between the two equilibrium lines) corresponds to the basin of attraction of the equilibrium  $(0; 0)$  (in this zone both  $\dot{T}$  in (11) and  $\dot{Q}$  in (12) become negative). The zone in the northeast is the basin of attraction of  $(1; 1)$ . From the starting points in the zone in the northwest players initially move to the southeast, whereas from starting points in the southeast players initially move towards the northwest.

In Fig. 6<sup>13</sup> it is shown in what direction players move from each point in the plane. The length of the vectors corresponds to the speed of movement. Two examples of paths are displayed by the dotted curves.

The intermediate equilibrium is unstable. Small trembles to the southwest result in adjustments leading to the stable equilibrium  $(0; 0)$ , while following small trembles to the northeast the players end up in the stable equilibrium  $(1; 1)$ . Put differently, if players are to the north of the “stable arm” (i.e. the thin negatively sloped line in Fig. 6), they will end up in  $(1; 1)$ , otherwise in  $(0; 0)$ .

## References

- Azam, J.-P. (2005). Suicide-bombing as inter-generational investment. *Public Choice*, 122, 177–198.
- Baker, M., & Bulte, E. (2006). Kings and vikings: On the dynamics of competitive agglomeration. Mimeo, United States Naval Academy and Tilburg University.

<sup>12</sup>The parameter values used for Figs. 5 and 6 are the same as the ones for Fig. 1. They are listed in footnote 3.

<sup>13</sup>The equilibrium lines and four zones in Fig. 6 are exactly the same as in Fig. 5. The vector field of Fig. 6 has been computed using the software *Mathematica*.



- Carlsson, H., & van Damme, E. (1993). Global games and equilibrium selection. *Econometrica*, *61*, 989–1018.
- Crelinsten, R. (1997). Television and terrorism: Implications for crisis management and policy-making. *Terrorism and Political Violence*, *9*, 8–32.
- Delli Carpini, M., & Williams, B. (1987). Television and terrorism: Patterns of presentation and occurrence, 1969–1980. *Western Political Quarterly*, *40*, 45–64.
- Ferrero, M. (2005). Radicalization as a reaction to failure: An economic model of Islamic extremism. *Public Choice*, *122*, 199–220.
- Frankel, D., Morris, S., & Pauzner, A. (2003). Equilibrium selection in global games with strategic complementarities. *Journal of Economic Theory*, *108*, 1–44.
- Frey, B. S. (1988). Fighting political terrorism by refusing recognition. *Journal of Public Policy*, *7*, 179–188.
- Frey, B. S. (2004). *Dealing with terrorism – Stick or carrot?* Cheltenham: Edward Elgar.
- Frey, B. S., & Lüchinger, S. (2003). How to fight terrorism: alternatives to deterrence. *Defence and Peace Economics*, *14*, 237–249.
- Frey, B. S., & Lüchinger, S. (2004). Decentralization as a disincentive for terror. *European Journal of Political Economy*, *20*, 509–515.
- Gentzkow, M., & Shapiro, J. (2004). Media, education and anti-Americanism in the Muslim world. *Journal of Economic Perspectives*, *18*, 117–133.
- Harsanyi, J., & Selten, R. (1988). *A general theory of equilibrium selection in games*. Cambridge: MIT.
- Hoffman, B. (1998). *Inside terrorism*. New York: Columbia University Press.
- Kim, K.-H., & Meyer, P. (2005). Survey yields factors of newspaper quality. *Newspaper Research Journal*, *26*, 6–15.
- McKnight, G. (1974). *The mind of the terrorist*. London: Michael Joseph.
- Merrill, J. (1999). The global elite: World's best newspapers reflect political changes. *IPI Report 1999*, 13–15.
- Morris, S., & Shin, H. S. (2003). Global games: theory and applications. In M. Dewatripont, L. P. Hansen, & S. Turnovski (Eds.), *Advances in economics and econometrics* (pp. 56–114). Cambridge: Cambridge University Press.
- Myatt, D., Shin, H. S., & Wallace, C. (2002). The assessment: games and coordination. *Oxford Review of Economic Policy*, *18*, 397–417.
- Nelson, P., & Scott, J. (1992). Terrorism and the media: An empirical analysis. *Defence Economics*, *3*, 329–339.
- Rathbone, A., & Rowley, C. (2002). Terrorism. *Public Choice*, *112*, 215–224.
- Sandler, T., Tschirhart, J., & Cauley, J. (1983). A theoretical analysis of transnational terrorism. *American Political Science Review*, *77*, 36–54.
- Schbley, A. (2004). Religious terrorism, the media, and international islamization terrorism: Justifying the unjustifiable. *Studies in Conflict and Terrorism*, *27*, 207–233.
- Scott, J. (2001). Media congestion limits media terrorism. *Defence and Peace Economics*, *12*, 215–227.
- Shughart, W. (2002). September 11, 2001. *Public Choice*, *112*, 225–232.
- Slone, M. (2000). Responses to media coverage of terrorism. *Journal of Conflict Resolution*, *44*, 508–522.
- Vega-Redondo, F. (2003). *Economics and the theory of games*. Cambridge: Cambridge University Press.
- Wilkinson, P. (2000). *Terrorism versus democracy: The liberal state response*. London: Frank Cass.