

MODEL OF ECONOMIC ANTI-TERRORIST WAR

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Crises management, terrorism, terror, terrorists, fighting terrorism, manufacturing company, human resources, human resources management, human resources department, economic model of fighting terrorism.

Introduction

Already Drucker [1] has acknowledged that the current economic model and economic theory does not perfectly fit to the reality of contemporary world. The changes in basic management paradigms are so deep that the contemporary economic theory does not satisfactorily describe the reality and it has lead into the situation when management in itself is in fact the crises management. One of the biggest challenges of this management and one of the biggest threats of the 21st century has become terrorism. Terrorism means the premeditated use, or threat of use, of extra normal violence to obtain a political objective through intimidation or fear directed at a large audience [2]. An essential aspect of this definition concerns the presence of a political objective that the terrorist acts or campaigns are designed to achieve. Another crucial ingredient is the use of extra normal violence or brutality to capture news headlines and create a general atmosphere of fear.

1 Insight into terrorism

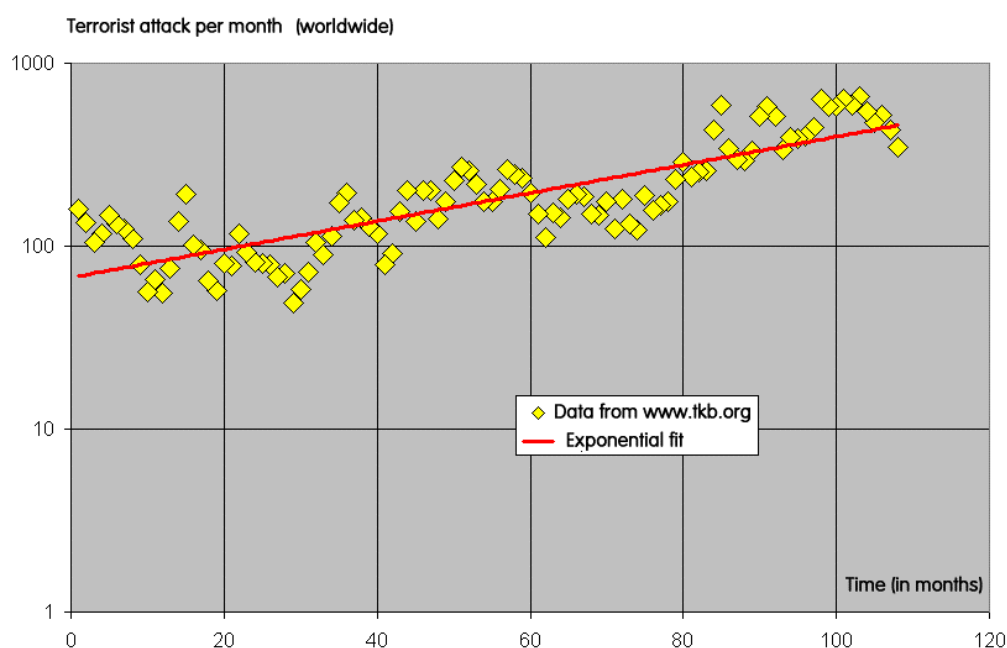
1.1 Basics for the model

One of the most important goals the terrorist want to achieve by their action (like in September 11th 2001) is visibility. Jain and Mukand [3] have acknowledged that the high visibility has an immediate and dramatic effect on the information sets and beliefs of all agents – potential victims, government, law enforcement agents, as well as terrorists. The authors use game-theoretic analysis in their work and as a starting point of their analysis is the fact that they do not see terrorists who are willing to commit suicide as irrational zealots, but rather as instruments

used by terrorist organizations to achieve their goals. (This point has been forcefully made by Sprinzak [4] who argues that “suicide terrorism has inherent tactical advantages to conventional terrorism; It is simple and low-cost operation – no escape routes or complicated rescue operations); it guarantees mass casualties and extensive damage – the suicide bomber can choose exact time, location and circumstances of the attack; there is no fear that interrogated terrorist will surrender important information – because their death is certain and it has an immense impact on the public and the media – due to the overwhelming sense of helplessness}. Once we treat terrorism as being conducted by rational actors, then we can start to try to describe it and fight it. One of such a possibility how to fight the terrorism is a model that I have developed. Economic methodology is particularly well-suited to provide insights in studying terrorism. Economic analysis can account for the strategic interactions among opposing interests e.g. the terrorists and the authorities, or between two targeted countries. Rational-choice models, based on microeconomic principles, can be applied to ascertain how terrorists are apt to respond to policy-induced changes to their constraints. But in my paper, I try to find a model that is valid not only for manufacturing companies, but generally and can be applied to all businesses. The model tries to describes the way how terrorism is being fought through finance that the human resources department owns in its budget.

1.2 Data about terrorist attacks

Data, which are at disposal at internet, at one specialized page and database [5] show that graph showing all terrorist attacks have an exponential shape.



This shape of the graph underlines my model that is also based on the exponential equations and I believe in the model that the simplified reality can be described like that. Of course, that the model can not fully describe the complexity of the world, this is why it is a model. However, it was a starting point for my modeling and at the same time a confirmation of the applicability of my model.

2 Economic anti-terrorism model

2.1 Scenario

Economy of the counter-terrorism is characterized by the obvious imbalance between the two acting sides. On one hand, the crude weapons used by terrorists may be made with relatively small financial expenses. The terrorist has a free choice of where and when to strike. On the other hand, the measures introduced to counter the terrorist attack require deployment in large numbers across a large number of locations, which is extremely expensive. Moreover, the measures themselves are quite costly.

Even the relatively less expensive countermeasures associated with what may be done by an organization in the area of human resources have considerable negative economic impacts:

- a) The stringent screening required to protect organizations from employing potential terrorists lead to possible elimination of persons (perhaps because of religious faith) who could actually prove to be an asset to the organization.
- b) The screening and detection of terrorists and their sympathizants inevitable borders on freedom of the employees and has negative psychological consequences leading to decreased effectiveness of their work.
- c) To perform the strict screening requires an increased number of human resource personnel. The personnel has to be highly qualified and correspondingly rewarded, which results for the organization in spending additional money.
- d) An additional personnel is also needed to generate, maintain, and periodically test and upgrade the safety procedures for the terrorist attack situations.

However, regardless of the importance of the human resources department in the company, it is not only human resources that the manufacturing company can allow to concentrate on. Even though the tendency in the human resources development is to focus on the value added activities (like those described above – recruitment, training, developing corporate culture...), nevertheless is not the core activity of the company. This is and always has been production of a particular item(s) defined in the business plan and the production represents the reason why the company has been established and put into operation and of course, it has never been established just for the human resources sake. Whatever the production of the company is, it has always deal with money and financial resources and these are always scarce. It means that company has

to distribute its available resources among different activities and organization units and human resources can not get all the available resources or all the resources needed to fight against terrorism fully. There are another budgets for research and development, for construction and design, for buying equipment or another innovative stuff in the production, for buying of stock or another material needed for the production, for marketing etc. Obviously, there is always a shortage of these scarce resources and even in the richest companies there is always the need for financial planning and cost cutting. Therefore, I tried to elaborate on a model how the company can fight a terrorism and how to company and its management is willing to spend money on counter-terrorist activities. There is and will be an ongoing pressure from different groups and departments of the company how to spend the financial resources and in which amount. The pressure is the same on all levels within the company and is never-ending during the whole life-cycle of the company and its products. The pressure can be identified on the lowest levels e.g. what kind of paper we will buy in a copy machine, till the highest levels e.g. the owners/shareholders of the company can sometimes prefer to spend the generated financial resources on pay-out of dividends to shareholders instead of investing them back to the company and let the management of the company to use it further.

The truth is that the Czech manufacturing companies do not have that much experience with terrorism and terrorist attacks, but as the owners in the search for the cheapest production spread their production worldwide (one part of a machine being produced here, another in another country etc.), they become more and more terrorist aware and also willing to put the financial resources to counter-terrorist activities if there is an experience with them on the local market. Hence this willingness to spend money on counter-terrorist activities leads to changes in the model again.

As I have mentioned above, because human resources department is not the only point in the company that needs resources that are limited, an equation can be set that describes the way, in which the financial resources are being spent on that. Similarly, there exists an equation that describes the way how terrorists get and accumulate financial resources and how the amount company spends on counter-terrorist measures impacts the number and method of terrorist attacks. Thus a model based on two basic equations (correlation) can be elaborated that describes these phenomenon concluding that if the company follows certain strategy in this model (spends certain amount of money on different counter-terrorist activities) then it is possible to find a point of equilibrium in the model when no new terrorist attack should appear again. Hence my research question here is if it is possible to create such an economic model of fighting terrorism that would fit the reality and help us to prevent terrorist attacks from happening.

The present model operates with variables expressed in economic terms:

$X [\$]$ are the financial resources available to terrorists, while

$Y [\$]$ are the finance allocated by the organization to defend itself by deployment of counter-terrorist measures.

These variables are investigated as varying in the course of time. This variation is expressed by means of a system of ordinary differential equations.

2.2 Differential equations under the no-attack conditions

A) Terrorists

The terrorists increase their available financial means by collecting money from their supporters and sympathizants – in the case of the militant fundamental Muslim groups they increase the value $X [\$]$ mainly by donations received from the countries with Muslim governments. There is a positive feedback effect: the more money a terrorist organization possesses, the more it can acquire because it can make itself more widely known and also its members can travel more worldwide to propagate their ideas and obtain the financial support.

The dependence between the rate of increase of their financial resources with time,

$$\frac{dX}{dt} \quad [\$ / \text{year}] \quad \dots (1)$$

and the already available cumulative value X is in general the function

$$\frac{dX}{dt} = f(X) \quad \dots (2)$$

Exact character of this function is not known. In the model, the function is represented by the simplest functional dependence exhibiting the proper character in eq. (2). This is the linear homogeneous function

$$\frac{dX}{dt} = E \cdot X \quad \dots (3)$$

Where $E [1 / \text{year}]$ is the proportionality constant.

B) The defending organization

Even under the conditions of there being no terrorist attack, the organization has to allocate certain money for the purposes of suppress the eventuality of any disaster that may happen. At the lowest level the money may be e.g. needed for the above mentioned generation, testing and upgrading of safety procedures. The allocation of money to this purpose is inevitably done in the environment of there being other also quite important necessary expenses to be considered. The other requirements are competing for the attention of the decision makers within the

organization. There is, as a result, a general tendency to decrease gradually the value Y [\$] allocated specifically for the purposes of anti-terrorist warfare. The time rate of change of the sum is

$$\frac{dY}{dt} \quad [\$/\text{year}] \quad \dots (4)$$

If the amount Y is large, the tendency to subtract something from it for other purposes is also large. The sum is, of course, never sufficient to adopt measures that would ensure a 100 % safety. If the available value Y is small, then its inadequacy and the resultant perspective of

vulnerability becomes more apparent. The function $\frac{dY}{dt} = f(Y)$ is in the present model also simply modeled by the linear homogeneous dependence, of course with the minus sign:

$$\frac{dY}{dt} = -B \cdot Y \quad \dots (5)$$

with introduced proportionality constant B [1/year], again – like E above - to be evaluated from existing statistical data.

2.2 Differential equations adapted in the situation of the terrorist attacks taking place

The responses to the attack by are dependent on the frequency of the attack taking place. The frequency is proportional to the ratio

$$\frac{X}{Y} \quad [-] \quad \dots (6)$$

- more money X the terrorists possess, the more opportunities they have for deploying the attack. They can afford buying more sophisticated weapons and supporting technology (such as e.g. satellite telephones to communicate between themselves). They also can travel more extensively to locations where the attack can cause a higher economic losses to the attacked organization. On the other hand, the effect of the monetary sum Y available for the anti-terrorist actions is the very opposite. It higher value decreases the probability of an attack. It is therefore considered appropriate to model its effect on the frequency of the attacks by the inverse proportionality.

A) Terrorists

The time rate of change of the economic effects on the terrorists' side may be modeled by adapted equation (3), containing an additional term on the right-hand side

$$\frac{dX}{dt} = E \cdot X - A \cdot X/Y \quad \dots (7)$$

The new term, the second one on the right-hand side, represents the expenses associated with performing an attack. Its sign is negative (minus), because the higher is the attack frequency $\frac{X}{Y}$ according to eq. (6), the less money the terrorists have. The proportionality constant A [\$/year] in the new term cannot be simply compared with the growth constant E [1/year] because of the difference in the dimensions. Nevertheless, for the terrorist organization continuing to exist, it is obvious that the new additional term (expenses) should be higher than the growth term. It may be useful, for the ease of handling, to re-normalize the terms. This leads to use of the relative value,

$$a = A / E \text{ [\$]} \quad \dots (8)$$

For which it may be safely assumed that a is numerically a small but positive quantity. The equation for the terrorists' financial means after the renormalization is

$$\frac{dX}{d\tau} = X - a \cdot X/Y \quad \dots (9)$$

- where $\tau = E \cdot t$ is dimensionless time.

B) The defending organization

The anti-terrorist expenses of the defending organization are still essentially the equation (5) again supplemented with an additional term dependent on the frequency of the attacks:

$$\frac{dY}{dt} = -B \cdot Y + C X/Y \quad \dots (10)$$

Here, the positive value of the coefficient C [\$/year] reflects the generally expected willingness of the decision making executive officers of the organization to spend more money on the counter-measures. The importance of the counter-measures is likely to become obvious by the reports about more frequently occurring conflicts.

Again, it may be useful to re-normalize the coefficients by relating them to the terrorists' growth potential coefficient E . The relative factors are:

- the dimensionless

$$b = B / E \quad [-] \quad \dots (11)$$

- and

$$c = C/E \quad [\text{Hz}] \quad \dots (12)$$

2.3 The complete model

As a result, the differential equations of the investigated problem are eq. (9)

$$\frac{dX}{d\tau} = X - a \cdot X/Y$$

and

$$\frac{dY}{d\tau} = -b \cdot Y + c X/Y \quad \dots (13)$$

The problem is fully specified by evaluating, for example from statistical data or estimates, the numerical values of the three coefficients a , b , and c and then by selecting the two boundary conditions

$$X_0 = X \quad \text{at } t=0$$

$$Y_0 = Y \quad \text{at } t=0$$

3 Solution

The problem of the economic warfare model, consisting of the two ordinary differential equations (9) and (13) some standard mathematic/statistic models can be used like MatLab. After entering some sample coefficients in the model and letting the system to compute them, I was surprised how good results I got. We can have a look together at one example, which has been calculated.

3.1 Example of the solution

As one example, I have gained the following results for one set of data. This results confirm that the model works fine and that it would be possible to use it. This example was chosen for quantitative analysis of the dependence in time of the financial means accumulated (and partly spend) by terrorists and by the organization defending itself by deploying the expensive counter-terrorist programs and technological means (such as e.g. explosives detectors). The initial conditions chosen, $X = 0.8$ and $Y = 0.55$ were chosen to correspond to typical situation at the time of the first strike against the organization. At this time, the terrorists have already accumulated from donations considerable available financial means, while the means available for the anti-terrorist warfare in the organization are less than sufficient.

The numerical values of the three coefficients a , b , and c are as follows:

a – is quite small. This means the terrorists use rather primitive and relatively cheaply obtainable weapons and keep also low their other expenses associated with performing the attacks (local attacks, no expensive travel of the terrorists' teams).

b – rather low, corresponding to a situation where the threat is recognized and the competing requirements on the finance for other purposes are not high.

c - large, the impact of the attack leads to generous spending of money on the anti-terrorist war by the organization.

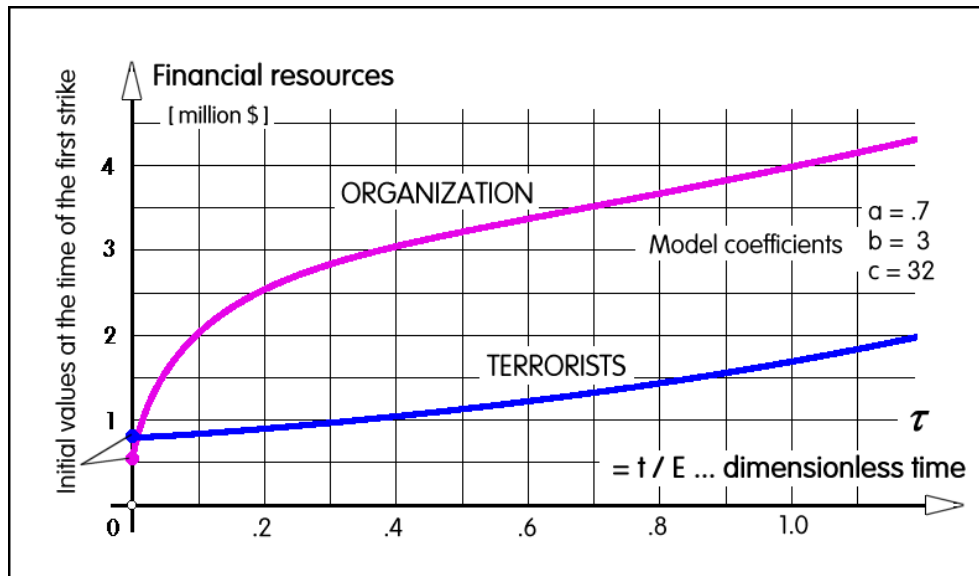


Figure 1 Development in time of economic means available to the terrorists and those allocated by the organization for the counter-terrorist activities, computed by the present computer models.

The immediate response by the rather lavish expenditure on the counter-terrorism (note the fast initial rise of the purple line in Figure 1) results in immediate decrease of the incidence of attacks, Figure 2.

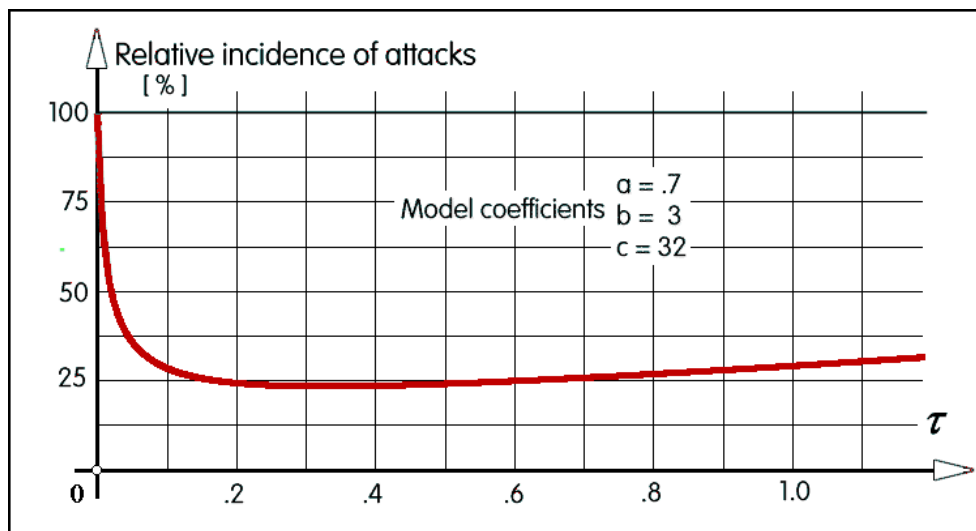


Figure 2 Computed example of the time development of the relative frequency of the terrorist attacks, evaluated for the same conditions as the financial strengths of the two opponents in Figure 1.

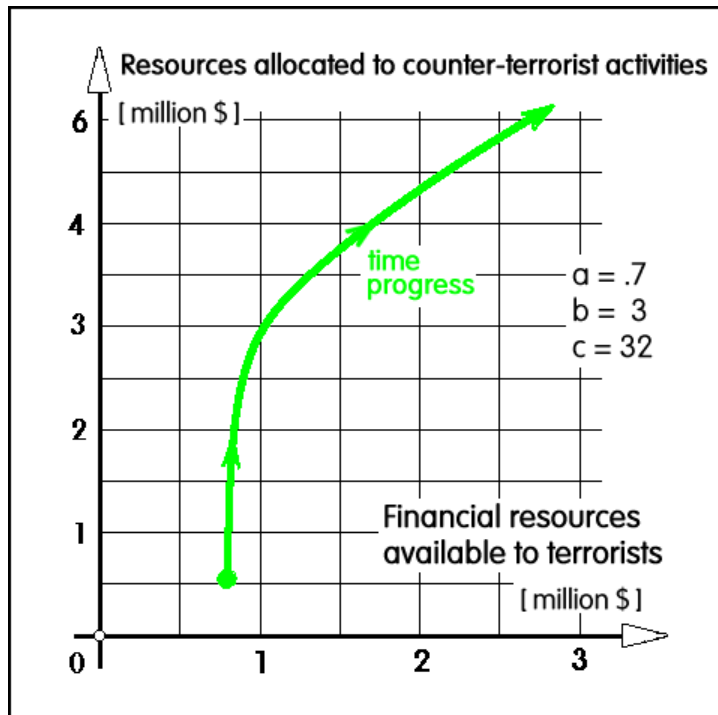


Figure 3 The phase plane trajectory of the two developments: mutual dependence between the two financial strengths in Figure 1: this is actually the plot of Y vs. X values computed by the program.

There are two distinct phases in the solution, best seen in the phase-plane presentation in Figure 3. In the first phase, the money available to the terrorists for their activities remain practically constant, all financial sources are directed to maintaining the activity. Even then, the effectiveness of terrorism sharply decreases. Then, however, comes the next phase, in which terrorists recover. Their finance exhibit a steady growth and despite the corresponding growth on the organization's side, this results in the incidence of the attack gradually increasing at the later stages of the dimensionless time (Figure 2). Even though the numerical values of the coefficients as well as initial values could be considerable improved upon, this first example roughly is in qualitative correspondence with the current developments after the 11th September 2001.

Conclusion

I have elaborated on a model how organization can fights terrorists. I have proven by one example that this model is valid and that it reflects reality well. I would like to play with the model further on as there is the possibility to test on the model different strategies of a company or of terrorist and they mutual fight. I believe it is also possible to find kind of an equilibrium point i.e. right coefficients a,b and c when the company will fight the terrorism effectively and no more terrorist actions will it threaten. I believe that another big advantage of this models is the fact that it is not only valid for manufacturing companies. This model is general and could be

used also in another industrial sphere, even though the activities to which the company spends the financial resources is different. Hence the model is generally valid for all companies operating in today's turbulent world.

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