

The 3rd International Conference on Economics and Social Sciences
Innovative models to revive the global economy
October 15-16, 2020
Bucharest University of Economic Studies, Romania

Terrorist Networks as Social Networks

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DOI: 10.2478/9788395815072-091

Abstract

Terrorism remains one of the most stringent socio-economical threats these days, which is why efforts to detect and contain these types of manifestations should not be speared. At the same time, resources have to be allocated efficiently, thus a deeper knowledge on how terrorist networks form and function may be very beneficial in destabilizing those networks and thus preventing terrorist acts. In this paper, we will use the concept of social network analysis and analyse the March 11th bombings in Madrid. Conclusions show that even though the current situation points to mostly separatist terrorism taking place, some of the bloodiest episodes in the recent history of Spain rooted in jihadist terrorism. Efforts should be made in closely surveilling places that are known to be of interest for already known terrorists, as well as monitoring the ties of each individual and mapping potential terrorist networks.

Keywords: Game Theory, Social Network Analysis, Terrorism, Madrid bombings.

JEL Classification: C71, F51, F52

1. Introduction

Although terrorism has become a worldwide phenomenon, no consensus has been reached as to how exactly terrorism can be defined. One of the reasons for this variety of definitions may be explained by the fact that terrorism itself can be split into more than one category. When looking at the motivation that lies behind the actual attack and what is hoped to be obtained by carrying it out, in the literature we found these four most common types of terrorism: jihadist terrorism, ethno-nationalist and separatist terrorism, right-wing terrorism as well as left-wing and anarchist terrorism.

Considering Spain with its March 11th bombings in Madrid as a case study, we look how starting from the predominance of a certain type of terrorism in a country

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and the analysis of known terrorist cells can terrorism be predicted and eventually prevented from taking place.

In the following, section 2 is a short review of the literature on game theory and its use with respect to terrorism, with special focus on terrorist networks and social network analysis. In the next section, we present the methodology on which the case study presented in section 4 is based. Conclusions are presented in section 5.

2. Problem Statement

Studies on terrorism are to be found since the early 80s, but the subject has become significantly more discussed and addressed in the scholarly literature after the attacks from September 11th. Since then, the number of studies regarding terrorism and its consequences has considerably increased.

There are plenty of directions for studies in the literature, from which we recall only some: theoretical and empirical articles on the most suitable methodology for analysing terrorism: game theory or statistical analysis; the types of antiterrorist countermeasures a state can take: proactive measure or reactive ones; the structure of terrorist networks combined with the theory of social network analysis and the theory of graphs; and last, but probably the most offering field is that of researches on the economic consequences of different types of terrorism.

When talking about literature on terrorism, we cannot but mention Todd Sandler and Daniel Arce. They are authors with most contributions in this field of study, their focus being mostly on the game theoretical approach of terrorism. Most of their articles are oriented on the game theoretical approach of terrorism. In the paper called “Counterterrorism. A Game-Theoretic Analysis” (2005), they tackle the subject of which type of measures a government should take against terrorism: proactive or reactive. In order to establish this, they evaluate the costs and benefits of each of the alternatives. In his paper from 2004, Sandler describes deterrence races. In order to overthrow the actions of terrorists, each country makes deterrence effort. The results point to the fact that if the efforts of the players are not coordinated, it might lead to too high costs, whereas if they decide to cooperate instead of trying to deflect terrorism for themselves, the results are better for all nations.

Zimmerman (2011) puts terrorism in the context of globalization. His paper emphasizes on the potential for growing terrorism in the context of globalization as well as the relation between it and immigration. The assumption the study is based upon is that globalization can change opportunity costs. In the article, globalization is defined as an increase in exchanges of goods, persons as well as ideas. Considering that terrorism is based on asymmetric information, we might have to wonder if terrorism has increased by growing international commerce, by the movement of people or by the large scale dissemination of ideas. The author concluded that even though globalization may have contributed to international terrorism, but it is not a determining factor of it.

Another direction of study relates to modelling terrorist networks as social networks. This implies the use of social network analysis. The method is useful in

order to determine the most important individual inside a social network. Since the importance of a person inside a group is relative, more than one variation of centrality measures should be used.

Lindelauf, Hamers and Huslage (2013) model terrorist networks as social networks and apply a network game. In the article, it is pointed out that identifying key players inside a network enables for an easier destabilization of the network. In this way, resources can be allocated more efficiently in the battle against terrorism, only towards the most important terrorist players. As a measure of a player's power inside a network, Shapley value is used. Their model allows also for assessing non-network related factors. The methodology used allows for a hierarchy of terrorists inside the network, and two case studies are used: Bali bombings from 2002, as well as the September 11th Al Qaeda attack.

Besides scientific researchers, there are also regulated authorities that oversee the phenomenon of terrorism. Their object of activity is to study in order to prevent terrorist acts from happening. At European level, Europol is the organism in charge with supervising the prevention and evolution of criminal activities. Its purpose is fighting against European criminality, by taking over the responsibilities of the national police of each member state, in case a crime expands outside the borders of one country. Each year, this organization publishes The EU Terrorism Situation and Trend Report (TE-SAT). Its content is based on information supplied by EU Member States, some non-EU countries and the partner organization Eurojust, alongside information gained from open sources.

The main categories of terrorism analysed in the above mentioned report are jihadist terrorism, ethno-nationalist and separatist terrorism, left-wing and anarchist terrorism, as well as right-wing terrorism.

Jihadist terrorism is associated to military movements "rooted in Islam". Ethno-nationalist and separatist terrorism, as the name suggests, is that form of terrorism motivated by nationalism. Nationalist terrorists seek to form self-determination in some form that may vary from gaining greater autonomy to establishing a completely independent, sovereign state. This can be related to a national, religious ethnic or other form of group that has a feeling of oppression or denial of rights, especially rights accorded to others, or it might even manifest in acts of violence against immigrants in a country. The Irish Republican Army (IRA), the Euskadi Ta Askatasuna (ETA) and the Kosovo Liberation Army are such examples. In Europe, the countries that report most terrorist attacks linked to separatist terrorism are the UK (88), France (42) and Spain (7). Right-wing terrorism is a form of terrorism that originates in different right-wing ideologies, most prominently neo-fascism, this being the rarest form of terrorism encountered. Left-wing terrorism is a form of terrorism meant to overthrow conservative or capitalist systems and replace them with progressive, anarchist societies.

Although most of the literature about Spanish terrorism is focused mostly on ETA, after the Madrid Bombings concerns have also raised in connection with the existence and development of the Spanish Al Qaeda Cell, which is sometimes also referred as the network of Syrian origin or Abu Dahdah network. Such papers

include F Reinales' work "Al-Qaeda's Revenge: The 2004 Madrid Train Bombings". This book has two parts: one focusing on the attack's origins, components and formation and the second one on the fact that it was revenge, the strategy for carrying out the attack as well as the opportunity for it taking place. The book presents how it went from the forming of the Spanish AL Qaeda Cell in 1994 to the events from March 11th. Besides the connections to Osama Bin Laden, The Moroccan Islamic Combatant Group was also involved, alongside some common Spanish delinquents that turned into Jihadists on the occasion of the Madrid bombings.

3. Research Questions / Aims of the Research

The terrorist attack from March 11th in Madrid was a series of coordinated bombings targeting the commuter train system. The attack resulted in 191 people dead and around 2000 injured.

The attacks took place 3 days before Spain's general elections. This, combined with the fact that in Spain the most encountered form of terrorism is the ethno-nationalist and separatist, as pictured in Figure 1, led to the immediate first conclusion that responsible for the attack was the terrorist group active in Spain commonly known as ETA. The figures presented in Figure 1 were obtained from 2017 Europol report The EU Terrorism Situation and Trend Report (TE-SAT).

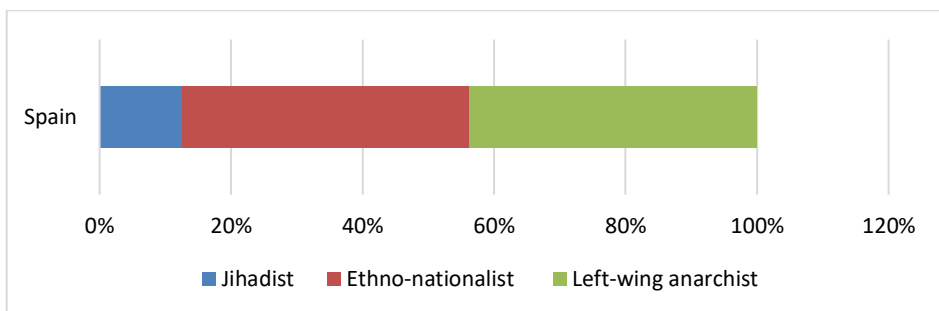


Figure 1. Distribution of types of terrorism inside Spain

Source: Based on 2018 European Union Terrorism and Situation and Trend Report

Nevertheless, after more investigations took place and arrests were made, the situation revealed that the terrorist attack should be classified as jihadist. This will become clearer once we look at how the terrorist network behind the attack was structured.

4. Research Methods

In order to determine the key nodes inside a terrorist network, we will use the theoretical model proposed by Lindelauf, Hamers and Husslage (2013). We will use three centrality measures: degree centrality, betweenness centrality and closeness centrality. These measures will bring important information related to the

hierarchy inside an organization, even though they do not count for non-network related information.

A social network is mathematically presented as a graph $G = (N, E)$, where $N = \{1, \dots, n\}$ denotes the set of players. The set of unordered pairs of players $\{i, j\}$ denotes a network g . Each pair denotes a link between the two players. The set of all links defined on N determines the set of edges E .

The *normalized degree centrality* stands to argue that the more connected a person is, the more important that person is likely to be. The normalized degree centrality of the person i is expressed as the fraction of the network with which the person i is directly related:

$$C_{degree}(i) = \frac{d(i)}{|N|-1} \quad (1)$$

where:

$d(i)$ is the number of direct relations of the person i ;

$|N|$ is the total number of persons in the network.

The following inequality should verify: $0 < C_{degree}(i) < 1$

Betweenness centrality is based on the idea that a person is more important when it enables connections between other persons in the network. It is measured by counting the number of shortest paths (short path equal to minimum number of links) between two persons that pass through another person. Let s_{kj} denote the total number of shortest paths between the person k and j and let s_{kij} denote the number of shortest paths between k and j that pass through person i . The normalized betweenness centrality of person i can be defined as:

$$C_{between}(i) = \frac{2}{(|N|-1)(|N|-2)} * \sum_{k,j \in N\{i\}, k < j} \frac{s_{kij}}{s_{kj}} \quad (2)$$

The following inequality should verify: $0 < C_{between}(i) < 1$

Closeness centrality measures the distance from a certain person to all other persons in the network, where l_{ij} is the shortest distance between persons i and j . The normalized closeness centrality of person i is defined as:

$$C_{close}(i) = \frac{|N|-1}{\sum_{j \in N} l_{ij}} \quad (3)$$

The following inequality should verify: $0 < C_{close}(i) < 1$

Results obtained by applying the above described indicators are not relevant as standalone values, but for the rankings they allow inside a given network.

An enhancement to the centrality measures above can be brought by using networks where either links or certain nodes are assigned weights, namely weighted networks. Nevertheless, through this approach, only the structure of the

network is taken into consideration, not allowing for additional information to be embedded.

$$v(S) = \begin{cases} 1 & \text{if } S_G \text{ is connected} \\ 0 & \text{otherwise} \end{cases} \quad (4)$$

When we have relevant information regarding certain relationships between players, then the focus can be shifted on the most relevant connections inside the group, making a weighted connectivity game most appropriate.

On the other hand, when we have relevant information regarding certain persons inside the network, as will be the case with our case study, a weighted connectivity game using information about individuals should be applied. In this case equation (4) becomes:

$$v^{individual}(S) = \begin{cases} \sum_{i \in S} w_i & \text{if } S_G \text{ is connected} \\ 0 & \text{otherwise} \end{cases} \quad (5)$$

where w_i is the weight assigned to person i inside the network.

In order to allocate the power inside coalitions, the Shapley value is used. This allocation rule is based on the marginal contribution of a player inside a certain coalition. The Shapley value of player i is defined as per below:

$$\varphi_i(v) = \sum_{S \subseteq N, i \in S} \frac{|S|! (|N| - 1 - |S|)!}{|N|!} * [v(S \cup \{i\}) - v(S)] \quad (6)$$

5. Findings

In order to apply the methodology described in the previous section, for the Madrid bombings some steps are necessary.

We need to obtain the network to be analysed, this being the input in our model. In order to obtain a graphic visualization of the terrorist network involved in the March 11th bombings in Madrid, we used information from Memon et al. (2008) combined with information from the article Jihadist Radicalization and the 2004 Madrid Bombing Network published by the Combating Terrorism Centre.

According to data obtained during the investigation, the terrorist network behind the attack was formed between March 2002 and November 2003 by the decision to coalesce of four relatively small groups. Two of the groups were interconnected because they evolved from the remnants of an Al Qaeda cell established in Spain around 1994. This cell was led by the Syrian-born Imad Eddin Barakat Yarkas, better known as Abu Dahdah, network that was partially dismantled after the 9/11 incident. A third cluster of individuals who eventually became part of the network was linked to the Moroccan Islamic Combatant Group (GICM), which established structures across Western Europe in the 1990s, particularly in France and Belgium. The fourth cluster was initially composed of a criminal gang active throughout Spain and specialized in illicit trafficking of drugs and stolen vehicles.

As compared to the one presented by Memom et al. (2008), Figure 2 presents the simplified version of the network, focusing mainly on the four clusters that were identified as involved in the attack. The main nodes are the ones represented by each cluster and a weight is assigned to each cluster based on how many of the known terrorists mentioned also by Memom were belonging to each cluster and how well connected they were to the other participants. Given this information, we will apply (5) in the following.

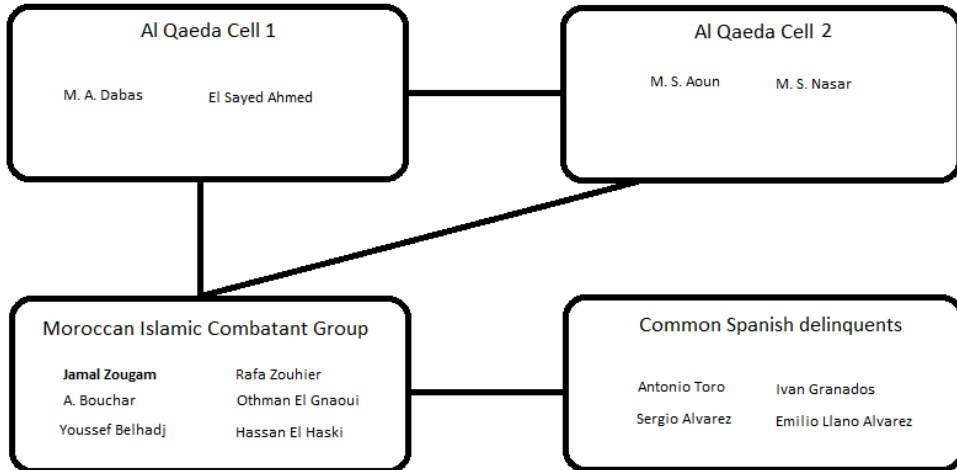


Figure 2. Simplified Terrorist Network for March 11th bombings in Madrid

As a last step, we analyse the rankings obtained by each cluster, which represent the output of the applied model. A comparison between standard centrality measures and game theoretical centrality measures should be performed.

Table 1. Weights assigned to clusters

Cluster	Weight
Old Al Qaeda faction 1	2
Old Al Qaeda faction 2	2
Moroccan Islamic Combatant Group	4
Common Spanish delinquents	1

Centrality measures presented in Table 2 were obtained using the theoretical model described in the previous section.

Table 2. Centrality measures

Cluster	Degree	Betweenness	Closeness	Individual Weight
Old Al Qaeda faction 1	0.667	0.333	0.750	5.097
Old Al Qaeda faction 2	0.667	0.333	0.750	5.097
Moroccan Islamic Combatant Group	1.000	1.000	1.000	10.195
Common Spanish delinquents	0.333	0.000	0.600	2.549

Given the results for all three indicators, it is obvious that the determining factor in the attack from Madrid was the involvement of the persons from the Moroccan Islamic Combatant Group and that the contribution of Spanish men was only minimal and it was only related to supplying some of the materials from which the bombs were made.

Most of the men involved were of Moroccan origin, being economic immigrants with both legal and illegal residence documents. Even though the incident was considered one of home-grown terrorist, the involvement of the two minor al Qaeda remnant cells proves that there were also international ties to terrorism, so the statement cannot be considered entirely true.

A general fact about terrorism that proves to be also the case in this situation is that the people attracted into these kinds of acts are recruited through many channels. For the case of Spain, it happened mostly in mosques, worship sites, countryside gatherings and private residences where most of the members of the Madrid bombing network adopted extremist views but few also adopted a violent conception of Islam while in prison.

6. Conclusions

Even though analysing data from 2017 it seems that Spain is mostly affected by ethno-nationalist incidents or by left-wing anarchism, one of the bloodiest incidents in the history of the countries seems to be mostly tied to jihadism. This proves once more the volatile nature of terrorism occurrence.

By applying a theoretical model, we confirmed the results of the investigations. Unfortunately, most of such analysis can be done for now only after the event occurs, but in time, with the use of newer models and permanent training of those models, we could get even predictions of terrorist behaviour.

This is why it is important for more effort to be directed towards the study of the terrorist cells, because if the formation of such groups can be prevented, the chance of emerging attacks that have high impact on the population decreases.

Moreover, places known to spread such beliefs, as well as the already known connections of terrorism, suspects should be mapped and closely followed, since any knowledge into this type of terrorist network might help preventing an attack.

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