Strategic positioning in mafia networks

By Francesco Calderoni

Assistant Professor at Università Cattolica del Sacro Cuore
Researcher at TRANSCRIME, Joint Research Centre on Transnational Crime
Università Cattolica del Sacro Cuore di Milano - Università degli Studi di Trento

Abstract: This paper analyzes two criminal networks belonging to the 'Ndrangheta, a mafia-type criminal organization originating from Calabria, a Southern Italian Region.

The literature on criminal networks argues that differences in the degree and betweenness centrality measures may highlight strategic positioning patterns for criminals capable of reducing risk of detection and maintaining control over the criminal activities at the same time. However, the identification of this strategic pattern is difficult whenever, as frequently happens, centrality measures are highly correlated

The paper analyzes network positioning in two mafia-type organizations, where degree and betweenness centrality were highly correlated. The analysis focuses on specific characteristics of the individuals in the networks (task, hierarchy and social status within each group) and how these relate to network positioning (centrality scores and clustering coefficient) and the outcome of the criminal proceedings (accusation, arrest, conviction and sentence in months). Results show that task and hierarchy are highly associated with network centrality, but also with accusation, arrest and conviction. Contrarily, high social status within the networks shows limited association with network centrality and the outcome of criminal proceedings. This may reveal patterns of strategic positioning which could not be identified solely though network analysis measures.

1. Strategic positioning in criminal networks

The literature on drug trafficking has repeatedly highlighted that drug markets are particularly flexible and dynamic environments (Benson and Decker 2010; Bouchard and Ouellet 2011:70-71; Desroches 2003; Dorn, Levi, and King 2005:14-15; Dorn, Murji, and South 1992:ix; Paoli 2004:201; Pearson and Hobbs 2001:11-12; Reuter 2009; Reuter and Haaga 1989:54-55). The characteristics of drug (and other) criminal markets inevitably influence the type of criminal groups operating within them. (Reuter 1983; Paoli 2004:203) Several constraints related to the illegality of the product makes it difficult for large criminal enterprises to emerge and continue for longer periods. Contrarily, small, inconstant groups are formed with fast changing partnerships (Reuter 1983; Eck and Gersh 2000). Larger structured groups, such as mafia-type groups are exceptional (Reuter 2009:16). Whenever they participate in drug markets, mafia-type organizations do not seem to achieve monopoly positions (Becchi 1996:125-127; Paoli 2002a:145-147; Varese 2006a:433-438). On the contrary, they adapt to the dynamic environment with very limited relevance to the internal formal hierarchy (Paoli 2004:198-199).

In general, criminal groups, including mafia-type groups, appear constantly facing a trade-off between security (minimizing risk) and efficiency (maximizing opportunities/profits) (Bouchard and Nguyen 2010:132; Morselli, Giguère, and Petit 2007).

The particular nature of illegal markets has brought several scholars in the last decades to call for the application of social network analysis (hereinafter SNA) in this field. They advocated the usefulness

of SNA methods not only to analyze, but also to improve enforcement of, criminal networks and particularly organized crime (Lupsha 1980; Davis 1981; Lupsha 1983; Ianni and Reuss-Ianni 1990; Sparrow 1991b, 1991a). Most of these now "classic" contributions, albeit with some remarkable exceptions (e.g. Lupsha 1983; Baker and Faulkner 1993), did not engage in empirical analysis of criminal groups, possibly due to the limited availability of datasets and software.[1] Only ten years ago, Coles still complained about the "failure by criminologists to adopt Social Network Analysis techniques and concepts in the investigation of criminal networks, particularly of organized crime" (2001:58). The last decade has finally brought an increasing number of empirical studies on organized crime, and particularly drug trafficking, with social network methods (Natarajan 2000; Xu and Chen 2003; Natarajan 2006; Varese 2006b; Morselli and Giguere 2006; Morselli and Petit 2007; Morselli et al. 2007; Morselli and Roy 2008; Malm, Kinney, and Pollard 2008; Heber 2008; Morselli 2009a, 2009b; Bouchard and Nguyen 2010; Morselli 2010; Bouchard and Ouellet 2011). The application of SNA to criminal groups and particularly to drug trafficking groups has provided important contributions in achieving better knowledge about the structure of criminal organizations and markets. The positioning of specific criminals is among the most interesting topics studies by the mentioned contributions.

Since the beginning, the identification of the most important individuals in a criminal network has received particular attention (Ianni and Reuss-Ianni 1990:76-77; Davis 1981:18). This is hardly surprising, given the implications of such endeavors from both a research and policy perspective. The majority of SNA techniques revolve around the concept of centrality to identify the most important subjects in a network. Several measures of centrality have been developed for different purposes, the choice depending on the available data and research objectives (Hanneman and Riddle 2005:147; McGloin and Kirk 2010:219-220; Morselli 2009b:38; Scott 2000:82; Wasserman and Faust 1994:169). Increasingly, scholars have realized that the most straightforward measure of centrality, degree centrality, may be particularly misleading in identifying the most important nodes in criminal networks. In general, degree centrality reflects active involvement in the network activities, but in the case of criminal networks it was argued that "degree centrality makes a person vulnerable" (Baker and Faulkner 1993:854). Indeed, having a high number of direct contacts makes a node particularly visible and consequently an easy target for law enforcement. Alternatively, betweenness centrality was considered a more useful measure (Sparrow 1991b:264-265). Betweenness centrality calculates the number of times a node lies in the shortest paths between two other nodes in the same network. In the context of criminal networks, betweenness centrality may reveal more strategic positioning within a network, ensuring less visibility while allowing control to be maintained over the flow of information (Morselli 2009b:39-40, 2010). This interpretation has been supported by empirical evidence. Baker and Faulkner showed that degree centrality increased the chances of conviction and the penalties in price-fixing conspiracies (Baker and Faulkner 1993). In his studies on the Hells Angels in Quebec, Morselli found that subjects with higher status within the motorcycle group had higher betweenness centrality and lower degree centrality compared to middle and low status members (Morselli 2009a, 2009b). More recently, he also found that "the highest proportion of arrests was found in the high degree centrality/low-betweenness-centrality group (Morselli 2010:389). In another study, he found that members of the Bo-Gars gangs had lower direct, but higher indirect connectivity than other gangs and non-gang members. This was reflected in lower arrest rates (Morselli 2009b:156-157).

The reviewed literature argued that degree and betweenness centrality reflect different strategic positions within criminal networks. The first signals visibility and vulnerability, while the latter

---

[1] Recently, Mastrobuoni and Patacchini have demonstrated that, at least for the data issue, past law enforcement databases provided interesting opportunities for the application of SNA (2010).

provides a strategic brokering power. This strategic positioning pattern should provide a double advantage within criminal networks. Firstly, it should allow better control over criminal activities and therefore it should differentiate the criminal leaders from the other individuals. Secondly, it should grant better protection from detection and conviction along with lower sentencing. Unfortunately, this interpretation depends heavily from a specific distribution of the mentioned centrality measures in criminal networks. In the case of Hells Angels, the two centrality measures were significantly and positively correlated (Pearson's r=0.4) (Morselli 2010:388). This revealed that direct and indirect connectivity in the network followed different patterns.

In most criminal networks, however, it may be expected that centrality measures show higher correlation coefficients, to a point where the overlap between degree and betweenness centrality leaves little room to identify strategic positioning.[2] In such cases, SNA centrality measures alone may not allow to identify strategic positioning of individuals. However, application of multiple analyses may provide data allowing to identify patterns of strategic positioning not relying exclusively on centrality measures. Indeed, several studies have identified the main tasks, the status and other characteristics of individuals in criminal networks through a content analysis of intercepted conversations (Natarajan 2000, 2006; Varese 2006b; Campana 2011). Content analysis, in its various forms, is indeed compatible with SNA methods and its importance has been acknowledged by Morselli.[3]

In this perspective, this study aimed at identifying strategic positioning within two drug trafficking groups of the 'Ndrangheta, a mafia-type organization from Calabria, a Southern Italian region. The first objective was to identify strategic positioning within the criminal networks, which may distinguish strategically positioned individuals from the others. The second objective was to verify whether the identified strategic pattern reflects on the conviction and sentencing of individuals within the two 'Ndrangheta groups.

The next section introduces some background information about the 'Ndrangheta. Section 3 presents the methodology, while section 4 discusses the results of the network positioning and the outcome of the investigations and trials. The last section contains the conclusions.

2. The 'Ndrangheta and network positioning

This study aims to contribute to the debate about strategic positioning in criminal networks. For this purpose, it applied multiple analyses to two drug trafficking groups of the 'Ndrangheta.

The historical origins of the 'Ndrangheta reach back to the nineteenth century, although some elements suggest that it may have had precursors even before that period (Ciconte 1992; Gratteri and Nicaso 2009:25). The 'Ndrangheta is composed of a number of different groups, called '*ndrine*, which exercise control over a specific territory. Unlike the Sicilian Cosa Nostra, the '*ndrine* mostly consist of members of the same family (Paoli 2003; Varese 2006a). This reinforces the cohesion of the criminal groups. The 'Ndrangheta further enhances the strength of the '*ndrine* by fostering a shared culture based on rituals, affiliation ceremonies, formal ranks and mythology.[4] The family, cultural and

---

[2] "More often than not, criminal network participants are balancing both forms of centrality" (Morselli 2010:386).

[3] "Content analysis is indeed the next step toward enriching the various analyses conducted throughout this book" (Morselli 2009b:164)

[4] Seizures have been made of written "regulations" which describe the rules of the organization and its secret oaths (Gratteri and Nicaso 2009; Malafarina 1978; Paoli 2003). The 'Ndrangheta has specific

hierarchical ties reinforce trust among the members and give the 'Ndrangheta exceptional solidity (Paoli 2003). As proof of this, very few *pentiti* (collaborators with justice) come from the 'Ndrangheta, as opposed to the Sicilian Mafia or the Neapolitan Camorra (Paoli 1994:216).

One of the main criminal activities of the 'Ndrangheta is the trafficking of cocaine. The 'Ndrangheta has exploited its organizational structure to establish solid partnerships with Colombian cocaine suppliers (Paoli 1994:222-223). Several official reports maintain that the 'Ndrangheta has achieved a primary role in the Italian cocaine market, outmatching other mafia-type organizations, such as the Sicilian Mafia and the Neapolitan Camorra (CPA 2008; Paoli 2004:201).

The analysis of the structure of two drug trafficking organizations linked to the 'Ndrangheta provides an interesting opportunity to identify strategic positioning patterns within two highly structured criminal groups. Indeed, the 'Ndrangheta normally operates with a clear division of tasks within the members of the organization. Furthermore, its mafia-type nature implies that different levels of leadership or social status may be identified, either through the formal ranks within the organization's hierarchy or the informal hierarchy that may be observed from the content analysis of the conversations.

3. Methodology

3.1. Case studies and data sources

This paper analyzed two case studies, relating to two investigations, called Chalonero and Stupor Mundi respectively, and coordinated by the Antimafia Prosecutor's Office of Reggio Calabria.[5] Information on the two cases came from multiple sources, including judicial files (e.g. arrest warrants, final judgments) and other sources (the literature, official reports by law enforcement agencies or prosecution offices and news reports).

Operation Chalonero was performed by the *Carabinieri* of the Provincial Command of Reggio Calabria. The investigation lasted several years and ended in January 2007 with the arrest of 16 people, ordered by the GIP of Reggio Calabria. The phone interceptions covered the period from August 2003 to June 2004. Operation Chalonero focused on criminal groups belonging to the 'Ndrangheta and trafficking cocaine from South America to Italy, through Spain. The drug was sold in Italy, particularly in the areas of Milan, Florence, Bologna, Rome and in Calabria (DIA 2007:106).

Operation Stupor Mundi was performed by the Antidrug Operational Group of the *Guardia di Finanza* of Reggio Calabria. The investigation lasted for years and ended in May 2007 with the arrest of 38 people by order of the Court of Reggio Calabria. The phone interceptions covered the period from June 2002 to April 2004. The operation focused on criminal groups belonging to the

---

ranks for its members, with an elaborate formal hierarchy consisting of two main layers: the higher society (*società maggiore*) and lower society (*società minore*). There are multiple ranks within each layer (Paoli 2003).

[5] The two investigations were identified in cooperation with the Antimafia Investigative Directorate (*Direzione Investigativa Antimafia* in Italian, hereinafter DIA). The DIA is a specialized unit, headquartered in Rome and with several offices across the Italian territory. Created in 1991, it is specialized in the investigation of mafia-type cases and tasked with performing both criminal investigations and strategic analysis. The DIA provided access to a number of judicial documents relating to approximately a dozen major investigations characterized by the involvement of the 'Ndrangheta in drug trafficking. The two operations were selected in order to be broadly comparable (in terms of the size and type of criminal activities).

'Ndrangheta and trafficking cocaine from South America to Italy, through Spain and the Netherlands. The drug was sold in Italy, particularly in the areas of Milan, Turin, Rome and in Calabria (CPA 2008:195 and 235).

The main analyses were conducted on the information contained in two court orders issued by the preliminary investigation judge (*Giudice per le indagini preliminari*, hereinafter GIP) upon request by the prosecution. The purpose of the court orders was to impose preventive measures (*misure cautelari*) upon suspects and particularly to remand them in custody. From a comparative perspective, these court orders are broadly similar to arrest warrants in other jurisdictions. To justify the decision to remand the suspects in custody, the court must provide detailed motivations. Consequently, the two documents provided a description of the accused individuals (e.g. name, birth date, residence, citizenship) and their activities. In particular, since both investigations were largely based on the interception of phone conversations and monitoring of suspects, they also reported data on the communication flows among the members of the two networks and a number of conversations were partly or entirely reported. The court orders provided different information about the individuals mentioned in the investigations (e.g. name and surname, gender, nationality). Further, these sources provided information on whether the individuals were accused of any crime (i.e. they were the targets of the investigations) and arrested at the end of the operations (Table 1).

Additional sources provided information about the outcome of the criminal proceedings. Several judgments were collected in cooperation with the Antimafia Prosecutor's Office of Reggio Calabria. Unfortunately, information about conviction and sentencing was available only for a limited number of individuals. This is because, in the Italian criminal justice system, once an investigation is closed, the development of the proceedings may take different paths for the accused persons and may last several years. Indeed, for Chalonero, two first degree judgments and one appeal decision were available. For Stupor Mundi, three first degree judgments were collected. Overall, the collected decisions provided information about acquittal or conviction for about 17 individuals out of 46 and for 40 out of 45 accused for Chalonero and Stupor Mundi respectively (Table 1).

Table 1. Information on the different stages of the criminal proceedings

	Accused	N/acc.	*Tot*	Arrested	N/arr.	*Tot*	Convicted	Acquitted	N/a	*Tot*
Stupor Mundi	45	28	*73*	38	7	*45*	26	14	5	*45*
Chalonero	46	15	*61*	11	35	*46*	12	5	29	*46*

The selected sources allowed to explore the social dynamics of the two 'Ndrangheta groups. The literature has frequently used similar judicial sources for analysis, including SNA methods (Heber 2008; Malm, Bichler, and Van De Walle 2009; Malm et al. 2008; Morselli 2010; Morselli and Giguere 2006; Morselli et al. 2007; Morselli and Petit 2007; Natarajan 2000, 2006; Natarajan and Belanger 1998; Natarajan, Zanella, and Yu 2010; Morselli 2009a; Campana 2011). This study followed different research methods, also considering previous studies on drug trafficking and other criminal groups (Natarajan 2000; Varese 2006b; Natarajan 2006; Morselli 2009b, 2010).

3.2. Identification of the main individuals

For each individual in each document, this study identified the number of contacts (other individuals with whom he/she had talked or had met), conversations (the number of telephone conversations in which he or she had participated, independently from the number of contacts), and meetings (the

number of meetings in which he or she had participated, independently from the number of contacts).[6] Relational information (participation in phone calls and/or in meetings) was available for 92 and 128 individuals for Chalonero and Stupor Mundi, respectively. Considering the different time spans of the two operations, and the number of individuals involved, the ratios of communications per individual per month are broadly comparable.[7]

Analysis of the relational data in the two court orders highlighted that most individuals participated only marginally in the networks. A number of individuals were in contact with only one other subject and participated in a low number of communications. Contrarily, a limited number of individuals had a very high number of contacts and participated in a high number of communications. The results are consistent with the findings of previous research. Several studies have found that a small proportion of the individuals in a criminal group account for the majority of the communications (Natarajan 2000:277, 2006:179; Morselli 2009b:51).

Given the concentration of the contacts, it was decided to remove from the analysis the individuals with only one contact, to exclude people with very limited participation in the group activities. Consequently, the study concentrated on a subset of 61 and 73 individuals for Chalonero and Stupor Mundi respectively.[8]

3.3. The analyses on the two groups

The first analysis of this study aimed at identifying the main role of each individual within the two groups (Natarajan 2000, 2006; Morselli and Giguere 2006). As argued by previous studies, individuals charged with organizing smuggling operations and connecting producers/suppliers with buyers have key brokering roles in criminal networks. For this reason, the analysis identified those brokers and classified each individual as a trafficker. Other tasks (suppliers, buyers, couriers, support and retailer) were identified with interesting overlaps between the two organizations (Table 2).

The second analysis aimed at identifying the importance of each individual within the two criminal groups with methodologies different from SNA. For this purpose, two different strategies were followed.

The *first strategy* relied on information from the prosecution and the court. Indeed, both judicial documents provided information about the organizational structure of the two groups and namely about belonging to the mafia group and being a boss within each group (Table 2). This is because in both cases the most important charge was that of belonging to a drug trafficking organization. The court orders included the court's assessment of the evidence relating to this charge and therefore allowed to classify each individual in the two groups as either member of the 'Ndrangheta or non member. Furthermore, the prosecution and the court also identified the leaders (´´bosses) of each criminal organization. This is because the Italian criminal law attaches particular relevance to leadership roles within organized drug trafficking groups, providing higher penalties. In this way it was possible to classify 5 individuals as "bosses" in Chalonero and 6 in Stupor Mundi.

---

[6] For each operation, the analysis coded each individual as N1, N2, ... in order to prevent direct identification.

[7] The ratios total communications (phone calls + meetings) per individuals per months were 0.5 and 0.64 for Chalonero and Stupor Mundi respectively.

[8] Similar "trimming" operations are routinely conducted in criminal network studies (Natarajan 2000, 2006; Morselli 2009a:152)

The above mentioned classification had the advantage of selecting a restricted number of individuals as the criminal leaders. However, the main disadvantage was that it relied on information from the prosecution and the court, with very limited possibilities to verify its reliability and accuracy. To overcome this problem, the *second strategy* relied on the assessment of the relative status of the individuals drawing from previous literature (Natarajan 2000, 2006). The analysis applied a six-code scheme to the communications among the individuals in the groups.[9] The above coding scheme was applied to one conversation for every couple of individuals for which conversations were available in the court orders.[10] Each individual was attributed a status score resulting from application of the coding scheme (one point for the presence of each of the above listed codes).[11] In case of individuals with status scores from multiple conversations, the status score was the mean of the scores of the single conversations. Furthermore, the individuals in each group were divided into three status classes according to their status score (Table 2).[12]

---

[9] The coding scheme was as follows:
(a)　　　express (dis)satisfaction
(b)　　　request information
(c)　　　not provide information
(d)　　　give orders
(e)　　　not seek clarification of orders
(f)　　　not use the 3rd person singular or 2nd person plural when talking to others.

[10] The second conversation for every dyad was randomly selected. When a dyad was involved in a single conversation only, the analysis focused on that conversation.
For some individuals there were no conversations available. This was because these individuals had participated in meetings but not in conversations. For these individuals (n=17 and n=27 for Chalonero and Stupor Mundi, respectively), the status score was attributed on the basis of the detailed analysis of the overall context described in the court order. In particular, the study attributed the status score on the basis of the considerations of the court and of the prosecution and of the status of individuals performing the same task or with the same role within each criminal network. For example, in Chalonero, N1 was a fugitive, and he did not participate in telephone calls in order to avoid being tracked and arrested. At the same time, he was the boss of the organization, as evident both from the considerations of the court and the fact that his agreement was required for major decisions. For this reason, he received a status score of 4, equal to that of the highest-status individuals identified in the same operation.

[11] Two coders independently coded a sample of conversations to assess the reliability of the coding scheme. The mean correlation between the two coders was 0.85, in line with Natarajan's studies (2006, 182; 2000, 280).

[12] The medium status class included subjects with status scores within the mean +/- a half standard deviation; the low status class comprised status scores lower than the mean minus half standard deviation and the high status class included individuals with a status score higher than the mean plus half standard deviation. The classes ranges were very similar between the two networks. The thresholds were 2.5 and 3.1 for Chalonero and 2.2 and 2.9 for Stupor Mundi.

Table 2. Number of individuals per task, hierarchy and status

		Chalonero	Stupor Mundi
	Total individuals	**61**	**73**
General information	Foreigner	12	2
	Female	4	4
Task	Supplier	N/a	14
	Trafficker	16	9
	Buyer	19	15
	Courier	12	N/a
	Support	26	16
	Retailer	N/a	14
Hierarchy	Non member	44	37
	'Ndrangheta member	12	30
	Boss	5	6
Status class	High status	10	23
	Medium status	29	18
	Low status	22	32
Status score	Min score	2	1.7
	Max score	4	4.5
	Mean score	2.8	2.6
	St. dev.	0.6	0.6

Finally, the study applied SNA methods to the two criminal groups.[13] It extracted information about phone calls and meetings among from the two court orders and created two valued, square matrices, indicating whether any two individuals were in contact and how many communications occurred between them. Also, valued matrices were transformed in binary matrices to perform some routines.[14]

Consistently with the purpose of identifying strategic positioning patterns within the two groups, degree and betweenness centrality were calculated. Degree centrality was measured on both binary and valued networks, the latter indicating the number of contacts instead of the mere presence of a contact. In addition, the analysis calculated the clustering coefficient for each node, which measures the density of the neighborhood of each node (i.e. all the nodes directly connected to a given node) (Hanneman and Riddle 2005:124). The clustering coefficient measures the likelihood that two individuals connected to the same third individual are themselves connected (Morselli 2009b:40-41). Although Morselli suggested that it should be considered a measure of direct connectivity (such as degree or eigenvector centrality), this study used it in a different way (Morselli 2009b:136-137). Indeed, having a high coefficient means that a node's contacts are also in contact among them. Contrarily, a low score implies that the density of the neighborhood of a node is low. In the context of a criminal organization, having contacts scarcely connected may be an advantage, meaning that a node is bridging different individuals which are not in contact. Furthermore, higher clustering may imply low secrecy, since information may be shared among the other nodes.[15]

---

[13] The network analysis was performed using the Ucinet 6 (Borgatti, Everett, and Freeman 2002).

[14] The network analysis was performed on undirected matrixes. The use of directed matrices would have excluded a relevant set of information, namely the data concerning meetings, which could not be gathered in directed form.

[15] The clustering coefficient is highly influenced by the size of a node's neighbourhood. With a high number of direct contacts, it is less likely that they will be densely connected. For this reason, the

The three centrality measures (degree, valued degree and betweenness) were extremely correlated in both networks.[16] Given the very high level of overlap among the centrality measures, strategic positioning had to be explored through methods different from the analysis of the different distributions of betweenness and degree centrality.

The results of the mentioned analyses were used to identify patterns of strategic positioning within the two 'Ndrangheta groups.

3.4. Limitations

The analysis of this study had some limitations. Most of them regard the reliability of criminal justice sources for the proposed analyses. Recent contributions suggest that network properties and measures are strong even if randomly tested for missing data (Morselli 2009b:48; Xu and Chen 2008:63-64). Nevertheless, some caveats are necessary.

Obviously, as with most judicial documents, the data collection served mainly criminal procedural and evidentiary purposes. The sources were inevitably affected by the point of view of the police and the prosecution. Account for this influence has been given above, when presenting the analysis of the hierarchy of the two groups. However, law enforcement strategies may have further influenced the boundaries and characteristics of the groups investigated (Lampe 2009:95). Lastly, some parts of the criminal groups may have been omitted and/or overlooked, either because of the criminals' strategies to deflect attention or because of the limited resources available to law enforcement.

This study is inevitably exposed to the above problems. Unfortunately, these seem common to most studies on criminal networks, and the literature frequently highlights these issues (Malm and Bichler 2011:20-22; Morselli 2009b:41-50; Xu and Chen 2008:63; Lampe 2009). Some elements suggest that these problems were acceptably limited for the two groups studied. Firstly, Chalonero and Stupor Mundi were long-lasting investigations, so that the possibility that important individuals in the networks were missed should be relatively low (Morselli 2009b:49). Secondly, the direct analysis of conversations adopted for the identification of task and status scores allowed to focus directly on intercepted conversations. Although the selection of the conversations included in the court orders depended on the choices of the prosecution and the court, it seems unlikely that conversations containing particularly relevant information on the criminal activities may have been omitted. In any case, directed analysis of the conversations allowed to limit the influence of the criminal justice system on the results. Finally, the analysis of two broadly similar groups prevented the results from being influenced by particular features of one single criminal network.

Overall, although the study of criminal networks though the selected methods cannot be completely free from limitations, the growing literature applying similar judicial sources for similar analyses suggests that the methodology of the present study is reasonably fit for this purpose (Natarajan 2000; Varese 2006b; Natarajan 2006; Morselli 2009b; Campana 2011).

---

clustering coefficient is always presented along with the number of pairs (i.e. the number of possible combinations among a node's direct contacts).

[16] Pearson's r ranged from 0.946 to 0.978 in Chalonero and from 0.909 to 0.966 in Stupor Mundi. All correlations were statistically significant at 0.01 level.

4. Discussion

4.1. Strategic positioning in the 'Ndrangheta

Given the high correlation of centrality measures, the study focused at first on the relation among tasks, hierarchy and status. In both groups, traffickers and bosses had higher status scores than other individuals (Table 3). As for the traffickers, it appears that this specific task is of vital importance in drug trafficking organizations, including mafia-type ones. These individuals probably tend to be more experienced and skilled in comparison to other criminals and this may reflect on their higher status. This comes as no surprise. Traffickers are amenable to the concept of brokers in criminal networks, a function whose importance has been abundantly highlighted in the literature (Morselli 2009b:15; Coles 2001).[17] Similarly, the analysis of the status confirms that bosses have higher status than simple 'Ndrangheta members and non members (although the difference was not statistically significant in Chalonero, probably because of the limited number of 'Ndrangheta members and bosses). Interestingly, in both groups all bosses were traffickers.

Table 3. Mean status score by task and by hierarchy in both groups

		Chalonero		Stupor Mundi	
		N	Mean status sc.	N	Mean status sc.
Task	N/trafficker	52	2.70*	57	2.43**
	Trafficker	9	**3.16***	16	**2.98****
Hierarchy	N/member	49	2.71	43	2.50**
	Member	7	2.91	24	2.43**
	Boss	5	**3.2**	6	**3.38****

$**p < .01$, $*p < .05$

Note: in both criminal groups, the significance test refers to the differences of the mean status scores for each group of the task and hierarchy (ANOVA)

The introduction of network measures in the analysis provides a more complex picture (Table 4). In both groups traffickers, bosses and members of the 'Ndrangheta showed higher centrality measures. They had more contacts and also more frequent communications (valued degree). Furthermore, betweenness centrality scores are very high for traffickers, and even higher for bosses. Overall, a small set of traffickers/bosses is crucially central in the flow of information within the criminal networks. This signals that these individuals play a crucial role in connecting different nodes trough the drug trafficking chain. In part, the findings support the view that the specific activities within the drug trafficking chain account for the positioning of the individuals within the network. This may confirm that also mafia-type organizations adapt to the criminal markets they are operating in (Paoli 2002b, 2004).

---

[17] "Brokers are neither patrons nor clients. They play in between and what past research has demonstrated is that individuals who are capable of maintaining such a stance are generally well-respected, higher achievers, and strategic participants in the networks that surround them" (Morselli 2009b:17).

Table 4. Mean individual network measures by task, status class, hierarchy and traffickers-by-status class

		Chalonero						Stupor Mundi					
		N	Degree	Valued degree	Betweenness	Clus. coeff.	N.pairs	N	Degree	Valued degree	Betweenness	Clus. coeff.	N.pairs
Task	N/trafficker	52	0.050**	8.4**	0.014**	0.838**	3.8**	57	0.053**	17.6**	0.004**	0.814**	8**
	Trafficker	9	**0.198****	**66.6****	**0.138****	0.404**	112.6**	16	**0.191****	**177.0****	**0.071****	0.468**	165.6**
Hier.	N/member	49	0.047**	6.6**	0.003**	0.871**	3.3**	43	0.047**	10.3**	0.005**	0.838**	5.8**
	Member	7	0.102**	28.0**	0.040**	0.493**	19.7**	24	0.101**	64.0**	0.018**	0.649**	41.0**
	Boss	5	**0.274****	**103.2****	**0.222****	0.217**	183.0**	6	**0.278****	**309.2****	**0.118****	0.358**	312.7**
Status class	High st.	10	0.075	15.6	0.027	**0.717**	14.0	23	0.093	62.5	0.023	**0.643**	42.2
	Medium st.	29	**0.089**	**24.6**	**0.042**	0.720	34.4	18	**0.095**	**74.0**	**0.032**	0.780	80.7
	Low st.	22	0.048	7.4	0.003	0.870	3.4	32	0.070	33.3	0.008	0.782	21.5
Traff. *status	Traf*hi. st.	3	0.122	25.7	0.036	0.516	33.3	10	0.144	119.8	**0.046**	**0.466**	**87.1**
	Traf*med st.	6	**0.236**	**87.0**	**0.189**	0.349	152.2	1	0.708	947.0	**0.505**	0.094	1275.0
	Traf*low st.	0			N/a			5	**0.181**	**137.6**	0.034	0.549	100.6

**p< .01, *p< .05

Note: in both criminal groups, the significance test refers to the differences of the mean network measures for each group of the task, hierarchy, status class and traffickers*status (ANOVA). The differences for traffickers*status were not statistically significant probably due to the extremely low number of cases.

Although straightforward, this picture seems to contrast with the model of a hierarchical organization as hypothesized in the literature and as could be expected given the characteristics of the 'Ndrangheta. In hierarchical networks, it may be expected that leaders are only in contact with a limited number of lieutenants or collaborators, allowing them to maintain strict control over the criminal activities minimizing their visibility (Jackson, Herbrink, and Jansen 1996). Contrarily, in the two ´Ndrangheta groups, the bosses were directly involved in the criminal activities. Further, no strategic positioning could be identified, as in previous studies where the leading individuals had higher betweenness but lower degree centrality than other nodes (Baker and Faulkner 1993; Morselli 2010, 2009a, 2009b:chap. 9). These results confirm that "covert networks are not generally capable of trading efficiency for security"(Morselli et al. 2007:151). This applies also to mafia-type organizations. Although traffickers, bosses and members of the 'Ndrangheta were remarkably higher in betweenness centrality than other individuals, they also had higher degree centrality.

Multiple interpretations, not necessarily mutually exclusive, may explain this picture.

Firstly, the theoretical hypothesis formulated by Jackson and colleagues (1996) may have overlooked the specific features of criminal activities and markets. Here, the illicit nature of the activities implies that security (direct control by bosses of the activities) prevails over efficiency (indirect control and delegation). Delegation may increase the risks of information diffusion and detection and therefore it is a luxury that criminal organizations can rarely afford.

Furthermore, the observed networks may be influence by law enforcement perception. In part, this is no surprise, since the data were drawn from law enforcement sources and collected with purposes different from the analysis of the structure of the groups from a network perspective. Police surveillance may have focused on the most visible players and this may further explain why all bosses were also traffickers. Indeed, the content analysis of the conversations revealed that individuals identified as bosses frequently did not enjoy particular respect from other individuals. For example, they frequently received orders and treated other individuals with deference. In particular, bosses may have been identified by law enforcement agencies depending on particular investigative strategies and their sheer visibility in the criminal trades.

A last interpretation provides more interesting insight and is based on the inclusion of the status scores in the analysis (Table 4). Indeed, in both groups, individuals in the high status class were not the most central nodes. Contrarily, individuals with medium status had higher centrality scores (although the differences of the means were not statistically different).

These findings highlight a specific structure of the two 'Ndrangheta networks. High status individuals remained more detached from the core of the criminal activities, leaving medium status individuals in central positions. As a further element supporting this interpretation, in both 'Ndrangheta networks high status individuals had lower clustering coefficients, although they generally had smaller neighborhoods. This is counterintuitive, since the clustering coefficient is generally indirectly correlated to the size of a node's neighborhood. Conversely, medium status individuals had larger neighborhoods, but also higher clustering coefficients. This may reveal that such nodes are largely redundant and they actual brokering power is more limited than high status nodes. These were connecting subjects who are less connected among themselves and this pattern highlights their strategic position within the two criminal networks.

Closer analysis of traffickers within different status classes provides further confirmation to this picture (Table 4). In Chalonero, medium status traffickers have higher centrality scores than the high status individuals (there were no low status traffickers). In Stupor Mundi, high status traffickers have centrality scores lower than the only medium status trafficker and even lower than low status traffickers. Further, their clustering coefficient is lower, despite having smaller neighborhoods than the other traffickers.

The strategic positioning pattern is recognizable in Figure 1 and

Figure 2 where the nodes were plotted against their status score and task. In both networks, traffickers were strongly connected among them and communicated very frequently (solid black and solid grey lines). High status individuals maintained less frequent contacts, remaining in a more detached position.

The network structure emerging from these data suggests that a specific pattern of network positioning was in place in the 'Ndrangheta groups. However, this could not be identified solely through the analysis of degree and betweenness centrality as suggested by the previous literature (Baker and Faulkner 1993; Morselli 2010, 2009a, 2009b:chap. 9). In the two 'Ndrangheta networks, medium status individuals had both direct and indirect connectivity higher than high status individuals. High status individuals were less central, but frequently had more strategic (less redundant) connections, as highlighted by lower clustering coefficient This pattern appears consistent with the hypothesis that more important individuals may prefer to remain more detached from the operational core of the criminal activities, in order to reduce the risk of detection (Morselli 2010). High status individuals did not maintain control over the criminal activities through a better control of indirect connectivity (this would have resulted in higher betweenness centrality), but relying on their higher social status within the mafia-type organizations. This is consistent with Paoli (2002b), who argued that the roots of mafia-type organizations lie in particularly strong relations based on shared culture and kinship.

The structure observed in the two groups provided particular strength to the 'Ndrangheta organizations. Medium status individuals were more central, but also more easily replaceable with other, readily available, affiliates, to restore the criminal trade (Carley, Krackhardt, and Lee 2002). For example, in Stupor Mundi, N24 was arrested by the police during a smuggling operation. Other traffickers, such as N25 (N24's brother) and N28, quickly mobilized and replaced the arrested node in the trafficking of cocaine.

Figure 1. Chalonero. Status score by task[a]

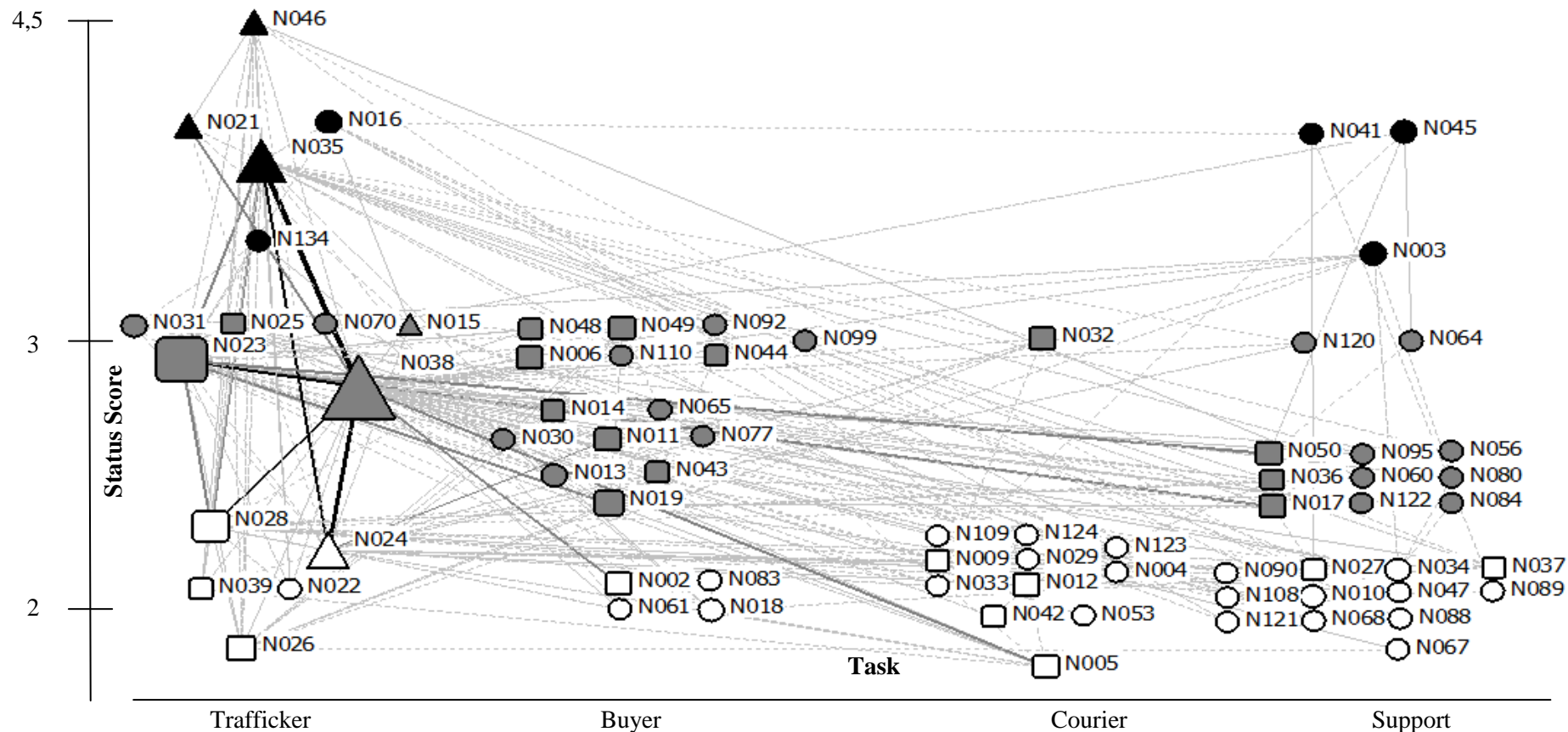**Figure 1. Chalonero. Status score by task[a]**
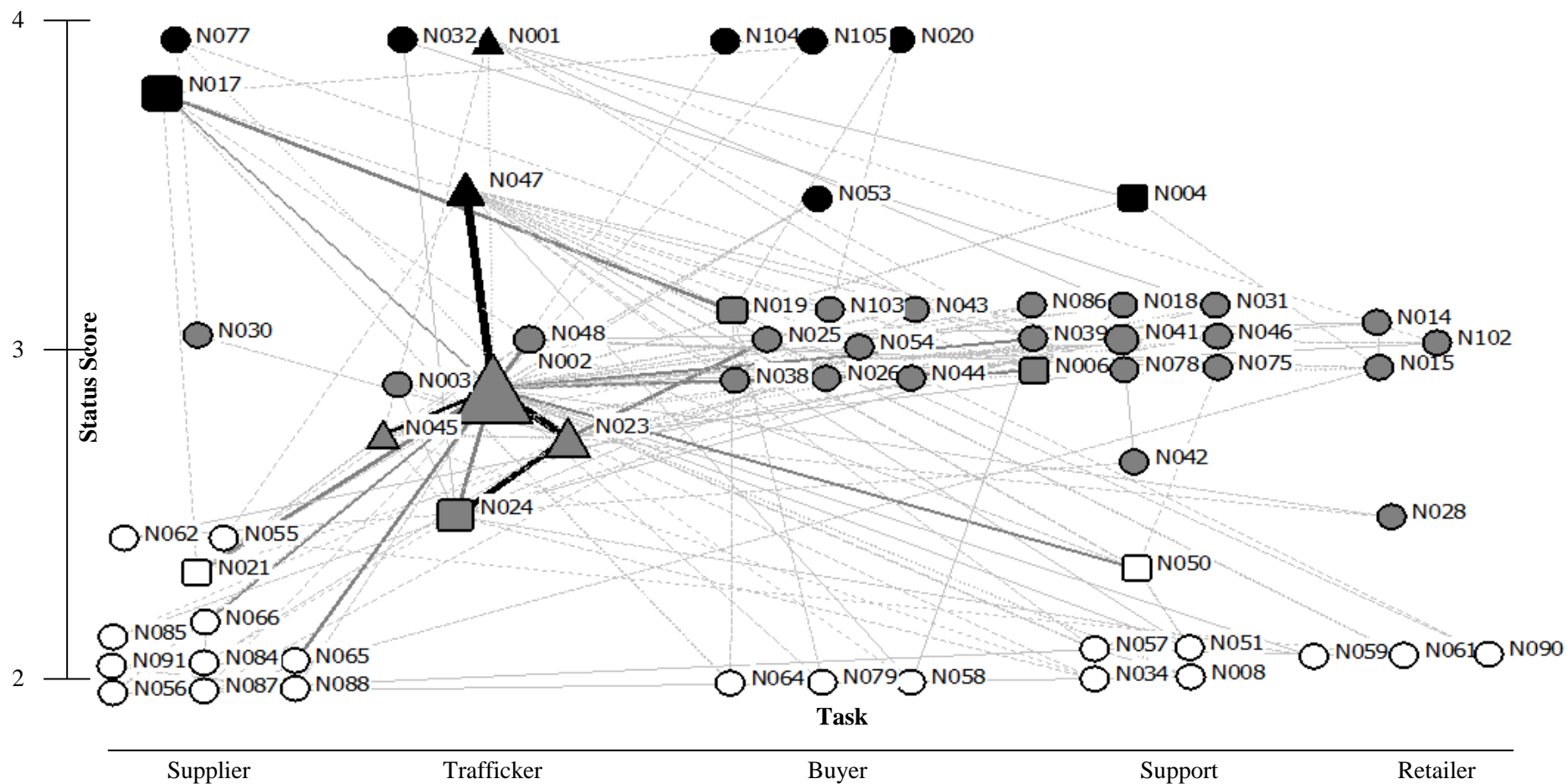
[a]*Node colours: black= high status class, grey= medium status class, white=low status class*

Node shapes: up triangle: boss, rounded square=member of the 'Ndrangheta, circle: non member

Node size: betweenness centrality

Lines: solid black lines: ties with value > average valued degree (17), solid grey lines: ties with value > ½ valued degree (8), dotted grey lines: other ties

Figure 2. Stupor Mundi. Status score by task[a]

[a]Node colors: black= high status class, grey= medium status class, white=low status class
Node shapes: up triangle: boss, rounded square=member of the 'Ndrangheta, circle: non member
Node size: betweenness centrality
Lines: solid black lines: ties with value > average valued degree (53), solid grey lines: ties with value > ½ valued degree (27), dotted grey lines: other ties

4.2. Strategic positioning and outcome of the investigations and trials

In the light of the previous results, it is possible to explore the relation between the network structure and the outcome of the investigations (accusation and arrest) and the trials (acquittal, conviction and sentencing).

Concerning the outcome of the investigations, individuals in both groups were classified as non accused, accused-not-arrested, and arrested.[18] Table 5 shows that that traffickers, members of the 'Ndrangheta and bosses were always accused (except for 2 out of 16 traffickers in Stupor Mundi). As for arrests, all bosses and members of the 'Ndrangheta were arrested (except for one member in Chalonero). Traffickers were arrested much more frequently than non traffickers. Data on status appear less straightforward. Overall, the bivariate analysis of the status classes and the outcome of the investigation provided statistically significant, but weaker Chi square than task and hierarchy for Chalonero and non statistically significant results for Stupor Mundi. This may suggest that the status was less relevant in the determination of the outcome of the investigations. While law enforcement focused on traffickers and members/bosses of the 'Ndrangheta, the status of individuals was less associated with accusation and arrest.

Table 5. Task, hierarchy and status class per accused, accused (not arrested) and arrested individuals

		Chalonero				Stupor Mundi			
		N/accused	Accused	Arrested	χ^2(p)	N/accused	Accused	Arrested	χ^2(p)
Task	Non trafficker	15	32	5	17.5**	26	6	25	7.2*
	Trafficker	0	3	6		2	1	13	
Hierarchy	Non Member	15	34	0		28	7	8	
	Member	0	1	6	55.8**	0	0	24	46.9**
	Boss	0	0	5		0	0	6	
Status	High st.	3	3	4		7	2	14	
	Medium st.	5	18	6	7.8**	8	1	9	1.7
	Low st.	7	14	1		13	4	15	
Total		**15**	**35**	**11**		**28**	**7**	**38**	

**p< .01, *p< .05

A focus on the outcome of the trials provides further insight. As already mentioned, information about the acquittal/conviction was available only for a limited number of individuals in the two groups. For this reason, the analysis of the judicial outcome concentrated only on Stupor Mundi, where information on convictions was available for 40 out of 46 accused individuals.

The data show that traffickers, members of the 'Ndrangheta and bosses were frequently convicted (but for both groups the differences were not statistically significant) (Table 6). Indeed, also non traffickers and non members of the 'Ndrangheta had high conviction rates (both above 50%). For traffickers, members and bossed of the 'Ndrangheta, the mean sentence in months was statistically much higher than other individuals (Table 7). Interestingly, a different pattern emerges when looking at the status classes. Here, low status individuals were more frequently convicted. Low status individuals appear extremely vulnerable as to their conviction rate (14 out of 19). Indeed, this may

---

[18] In the Italian criminal justice system, criminal investigations actually finish some time after the arrest of the the most dangerous suspects, once the prosecution has wrapped up the evidence and formulated the indictment (*richiesta di rinvio a giudizio*). In practice, however, much evidence is gathered to request the arrest warrant. Therefore, this study focused on the part of criminal investigation ending with the arrest warrants.

relate to limited skills in reducing the risks associated with drug trafficking. Conversely, they received lower sentences (on average approximately 7 years and 9 months of imprisonment). As for sentencing, medium status individuals received the highest penalties (on average approximately 12 years and 3 months), but with a conviction rate lower than the low status class (5 out of 10). This is consistent with the more central position in the criminal network, which in case of conviction may result in very serious punishment. High status individuals, have been convicted slightly more frequently than medium status ones (7 out of 11). However, their mean sentence was significantly lower (approx. 9 years and 3 months), with a difference of nearly 36 months.

Table 6. Conviction per task, hierarchy and status class in Stupor Mundi network

		Acquitted	Convicted	χ^2(p)
N		**14**	**26**	
Task	Non Trafficker	13	17	3.6
	Trafficker	1	**9**	
Hierarchy	Non member	6	7	1.1
	Member	7	**16**	
	Boss	1	**3**	
Status class	High status	4	7	1.6
	Medium Status	5	5	
	Low Status	5	**14**	

**p< .01, *p< .05

Table 7. Mean sentence (in months) per task, hierarchy and status class in Stupor Mundi network

		Mean sentence (months)
Task	Non Trafficker	92.9**
	Trafficker	**138.1****
Hierarchy	Non member	86.1**
	Member	96.5**
	Boss	**225.3****
Status class	High status	111.7
	Medium Status	**147.2**
	Low Status	93.2

**p< .01, *p< .05
Note: the significance test refers to the differences of the mean sentence in months for each group of the task, hierarchy, status class (ANOVA).

Overall, the results concerning the outcome of the investigations and of the trials shows that the strategic patterns identified in the previous section also reflect on the judicial outcome of the two operations. In particular, high status individuals, maintaining a more detached position within the network of Stupor Mundi, received lower sentences than medium status individuals (the most active players in the network) and lower conviction rates than low status individuals (the subjects usually carrying out the most risky activities, such as couriers).

5. Conclusions

This study analyzed two drug trafficking networks belonging to the 'Ndrangheta and their internal structure. Differently from previous research, in the observed networks centrality measures were strongly correlated. This made it difficult to identify strategic positions within the criminal groups only through the analysis of centrality measures as in previous studies. For this reason, the study adopted multiple methodologies to identify the tasks and importance of the individuals in the criminal

groups. Not surprisingly, individuals classified as traffickers, members of the 'Ndrangheta and bosses were more directly involved in the criminal activities and had higher centrality scores than other members. Although of interest, these findings did not show any trace of strategic positioning. Contrarily, the analysis of the status of the individuals, based on the content analysis of the conversations, allowed to identify a different pattern of network positioning. In both networks, individuals with high status remained more detached from the core of the criminal activities, leaving medium status individuals in central, and more vulnerable, positions. The identified strategic positioning patterns provided particular strength to the 'Ndrangheta networks. Indeed, medium status individuals could be (and in one occasion actually were) more easily replaceable with other affiliates, quickly resuming criminal activities at the previous levels. High status individuals showed to have particularly strategic connections (lower clustering coefficients despite the smaller size of their neighborhood). Further research may explore whether these connections could function as weak ties, providing more opportunities and resources than the stronger ties of medium status individuals (Granovetter 1973, 1983).

The study further compared the structure of the two groups with the outcome of the investigations (accusation and arrest) and of the trial (acquittal or conviction). While in both groups task and hierarchy were strongly associated with higher accusation and arrest rates, this was not the same for the status of individuals. This suggests that individuals with higher status were not more frequently accused and arrested compared to traffickers and bosses. Furthermore, in Stupor Mundi, high status individuals were not more frequently convicted than others. In particular, they received lower mean sentences than medium status individuals. This analysis suggests that the strategic positioning pattern identified in the 'Ndrangheta networks actually reflects on the outcome of the criminal proceedings.

In conclusion, this study identified the particular network structure in two mafia-type organizations. Results also show that when degree and betweenness centrality substantially overlap, which is likely to be the most frequent situation as with most social networks, alternative methods may be used to uncover the strategies of some criminal leaders to reduce the risk of detection and punishment.

References

Baker, Wayne E., and Robert R. Faulkner. 1993. "The Social Organization of Conspiracy: Illegal Networks in the Heavy Electrical Equipment Industry." *American Sociological Review* 58(6):837-860.

Becchi, Ada. 1996. "Italy: 'Mafia-dominated Drug Market'?"Pp. 119-130 in *European Drug Policies and Enforcement*, edited by Nicholas Dorn, Jorgen Jepsen, and Ernesto U. Savona. Basingstoke and London: Macmillan.

Benson, Jana S., and Scott H. Decker. 2010. "The organizational structure of international drug smuggling." *Journal of Criminal Justice* 38(2):130-138. Retrieved March 5, 2011.

Borgatti, Steve P., Martin G. Everett, and Linton C. Freeman. 2002. *Ucinet 6 for Windows: Software for Social Netwok Analysis*. Harvard: Analytic Technologies.

Bouchard, Martin, and Holly Nguyen. 2010. "Is It Who You Know, or How Many That Counts? Criminal Networks and Cost Avoidance in a Sample of Young Offenders." *Justice Quarterly* 27(1):130-158. Retrieved July 28, 2011.

Bouchard, Martin, and Frederic Ouellet. 2011. "Is small beautiful? The link between risks and size in illegal drug markets." *Global Crime* 12(1):70-86.

Campana, Paolo. 2011. "Eavesdropping on the Mob: the functional diversification of Mafia activities across territories." *European Journal of Criminology* 8(3):213 -228.

Carley, Kathleen M, David Krackhardt, and Ju-Sung Lee. 2002. "Destabilizing networks." *Connections* 24(3):79-92.

Ciconte, Enzo. 1992. *"Ndrangheta Dall''unità a Oggi*. Roma Bari: Laterza.

Coles, Nigel. 2001. "It's Not What You Know—It's Who You Know That Counts. Analysing Serious Crime Groups as Social Networks." *British Journal of Criminology* 41(4):580 -594.

CPA. 2008. *Relazione annuale sulla 'ndrangheta - Relatore On. Francesco Forgione*. Roma: Commissione Parlamentare di inchiesta sul fenomeno della criminalità organizzata mafiosa o similare.

Davis, Roger H. 1981. "Social Network Analysis: An Aid in Conspiracy Investigations." *FBI Law Enforcement Bulletin* 50(12):11-19.

Desroches, Frederick J. 2003. "Drug Trafficking and Organized Crime in Canada: A Study of High-Level Drug Networks." Pp. 237-255 in *Critical reflections on transnational organized crime, money laundering and corruption*, edited by Margaret E. Beare. Toronto: University of Toronto Press.

DIA. 2007. *Relazione del Ministro dell'Interno al Parlamento sull'attività svolta e sui risultati conseguiti dalla Direzione Investigativa Antimafia - I semestre 2007*. Rome: Ministry of Interior.

Dorn, Nicholas, Michael Levi, and Leslie King. 2005. *Literature review on upper level drug trafficking*. London: Home Office Research, Development and Statistics Directorate.

Dorn, Nicholas, Karim Murji, and Nigel South, eds. 1992. *Traffickers: Drug Markets and Law Enforcement*. London: Routledge.

Eck, John E., and Jeffrey S. Gersh. 2000. "Drug Trafficking as a Cottage Industry." Pp. 241-271 in *Illegal drug markets: from research to prevention policy*, *Crime Prevention Studies*, edited by Mangai Natarajan and Mike Hough. Boulder, CO: Lynne Rienner Publishers.

Granovetter, Mark S. 1983. "The Strength of Weak Ties: A Network Theory Revisited." *Sociological Theory* 1(1):201.

Granovetter, Mark S. 1973. "The Strength of Weak Ties." *American Journal of Sociology* 78(6):1360-1380.

Gratteri, Nicola, and Antonio Nicaso. 2009. *Fratelli di sangue*. 2nd ed. Milano: Mondadori.

Hanneman, Robert A., and Mark Riddle. 2005. *Introduction to Social Networks Methods*. Riverside, CA: University of California, Riverside Retrieved (http://www.faculty.ucr.edu/~hanneman/nettext/).

Heber, Anita. 2008. "The networks of drug offenders." *Trends in Organized Crime* 12(1):1-20.

Ianni, Francis A. J, and Elizabeth Reuss-Ianni. 1990. "Network analysis." Pp. 67-84 in *Criminal intelligence analysis*, edited by Paul P. Andrews and Marilyn B. Peterson. Loomis, CA: Palmer Enterprises.

Jackson, Janet L., Janet C.M. Herbrink, and Robert W.J. Jansen. 1996. "Examining criminal organizations: Possible methodologies." *Transnational Organized Crime* 2(4):83-105.

Lampe, Klaus. 2009. "Human capital and social capital in criminal networks: introduction to the special issue on the 7th Blankensee Colloquium." *Trends in Organized Crime* 12(2):93-100. Retrieved July 28, 2011.

Lupsha, Peter. 1983. "Networks vs. networking: Analysis of an organized crime group." in *Career Criminals*, edited by Gordon P. Waldo. Beverly Hills, CA: Sage.

Lupsha, Peter. 1980. "Steps Toward A Strategic Analysis Of Organized Crime." *The Police Chief*.

Malafarina, Luigi. 1978. *Il codice della ndrangheta*. Reggio Calabria: Parallelo 38.

Malm, Aili E., and Gisela Bichler. 2011. "Networks of Collaborating Criminals: Assessing the Structural Vulnerability of Drug Markets." *Journal of Research in Crime and Delinquency* Online first.

Malm, Aili E., Gisela Bichler, and Stephanie Van De Walle. 2009. "Comparing the ties that bind criminal networks: Is blood thicker than water?" *Security Journal* 23(1):52-74.

Malm, Aili E., J. Bryan Kinney, and Nahanni R. Pollard. 2008. "Social Network and Distance Correlates of Criminal Associates Involved in Illicit Drug Production." *Security Journal* 21(1-2):77-94.

Mastrobuoni, Giovanni, and Eleonora Patacchini. 2010. *Understanding Organized Crime Networks: Evidence Based on Federal Bureau of Narcotics Secret Files on American Mafia*. Collegio Carlo Alberto Retrieved January 17, 2011.

Morselli, Carlo. 2010. "Assessing Vulnerable and Strategic Positions in a Criminal Network." *Journal of Contemporary Criminal Justice* 26(4):382 -392.

Morselli, Carlo. 2009a. "Hells Angels in Springtime." *Trends in Organized Crime* 12(2):145-158.

Morselli, Carlo. 2009b. *Inside Criminal Networks*. New York, NY: Springer.

Morselli, Carlo, and Cynthia Giguere. 2006. "Legitimate Strengths in Criminal Networks." *Crime, Law and Social Change* 43(3):185-200.

Morselli, Carlo, and Katia Petit. 2007. "Law-Enforcement Disruption of a Drug Importation Network." *Global Crime* 8(2):109-130.

Morselli, Carlo, and Julie Roy. 2008. "Brokerage Qualifications in Ringing Operations." *Criminology* 46(1):71-98.

Morselli, Carlo, Cynthia Giguère, and Katia Petit. 2007. "The efficiency/security trade-off in criminal networks." *Social Networks* 29(1):143-153.

Natarajan, Mangai. 2000. "Understanding the Structure of a Drug Trafficking Organization: A Conversational Analysis." Pp. 273-298 in *Illegal Drug Markets: From Research to Prevention Policy*, vol. 11, *Crime Prevention Studies*, edited by Mangai Natarajan and Mike Hough. Monsey, NY: Criminal Justice Press/Willow Tree Press.

Natarajan, Mangai. 2006. "Understanding the Structure of a Large Heroin Distribution Network: A Quantitative Analysis of Qualitative Data." *Journal of Quantitative Criminology* 22(2):171-192.

Natarajan, Mangai, and Mathieu Belanger. 1998. "Varieties of drug trafficking organizations: A typology of cases prosecuted in New York City." *Journal of Drug Issues* 28(4):1005-1026.

Natarajan, Mangai, Marco Zanella, and Christopher Yu. 2010. "'How organized is dug trafficking?'"Brisbane, Australia.

Paoli, Letizia. 1994. "An Underestimated Criminal Phenomenon: The Calabrian 'Ndrangheta." *European Journal of Crime, Criminal Law and Criminal Justice* 2(3):212-238.

Paoli, Letizia. 2002a. "'Flexible Hierarchies and Dynamic Disorder': the drug distribution system in Frankfurt and Milan." *Drugs: Education, Prevention, and Policy* 9(2):143-151.

Paoli, Letizia. 2003. *Mafia brotherhoods: organized crime, Italian style*. Oxford: Oxford University Press.

Paoli, Letizia. 2004. "The illegal drugs market." *Journal of Modern Italian Studies* 9(2):186.

Paoli, Letizia. 2002b. "The paradoxes of organized crime." *Crime, Law & Social Change* 37:51-97.

Pearson, Geoffrey, and Dick Hobbs. 2001. *Middle Market Drug Distribution*. London: Home Office Research, Development and Statistics Directorate.

Raab, Jörg, and H. Brinton Milward. 2003. "Dark Networks as Problems." *Journal of Public Administration Research and Theory* 13(4):413 -439.

Reuter, Peter. 2009. *Assessing the Operation of the Global Drug Market Report 1*. Cambdirge, UK: RAND Europe.

Reuter, Peter. 1983. *Disorganized crime: the economics of the visible hand*. Cambridge, MA: MIT Press.

Reuter, Peter, and Kohn Haaga. 1989. *The Organization of High-Level Drug Markets: An Exploratory Study*. Santa Monica, CA: RAND.

Sparrow, Malcolm K. 1991a. "Network vulnerabilities and strategic intelligence in law enforcement." *International Journal of Intelligence and CounterIntelligence* 5(3):255-274.

Sparrow, Malcolm K. 1991b. "The application of network analysis to criminal intelligence: An assessment of the prospects." *Social Networks* 13(3):251-274.

Varese, Federico. 2006a. "How Mafias Migrate: The Case of the 'Ndrangheta in Northern Italy." *Law & Society Review* 40(2):411-444.

Varese, Federico. 2006b. "The Structure of a Criminal Network Examined: The Russian Mafia in Rome."

Xu, Jennifer, and Hsinchun Chen. 2008. "The topology of dark networks." *Communications of the ACM*, October, 58–65.

Xu, Jennifer, and Hsinchun Chen. 2003. "Untangling Criminal Networks: A Case Study." Pp. 232-248 in *Intelligence and Security Informatics*, vol. 2665, edited by Hsinchun Chen et al. Berlin, Heidelberg: Springer Berlin Heidelberg Retrieved February 8, 2011.