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Predicting Organized Crime

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In the last decade, the use of social network analysis in the study of organized crime has seen significant developments. Since the beginning of the 2000s, academic interest in this specific field has strongly increased and contributed to opening new research directions in the study of criminal organizations (e.g. Natarajan 2006; Morselli, Giguère, and Petit 2007; Malm, Bichler, and Van De Walle 2009; Bouchard and Nguyen 2010; Bright, Hughes, and Chalmers 2012; Varese 2012; Calderoni 2012; Mancuso 2013). Among the most important contributions of these studies is the demonstrated importance of brokers within criminal organizations. Brokers are individuals that are capable of linking people, information and other resources. Brokering skills are extremely important for individuals to be successful in a number of illegal markets and activities (Burt 1992; Morselli 2005; Morselli 2009a; Morselli et al. 2013). In criminal networks, brokers are frequently identified through betweenness centrality, a measure capturing how often an individual is positioned between two other nodes (Morselli 2009a, 39). These subjects are often in the position to better exploit opportunities for a successful criminal career (e.g., Morselli 2005).

Despite this important development, criminal justice practitioners are still reticent to use social network analysis in organized crime cases. This methodology is not yet established as a standard instrument in tactical and strategic analyses. A possible cause of this skepticism may be that many of the prior studies applying SNA to organized crime analyzed data from phone wiretaps. To secure a wiretap, agencies must already have an understanding of the crime group, as such little investigative aid may be gained from analysis of intercepted com-

munications. From this perspective social network analysis may offer little insight to operators working daily on the case when the most strategically positioned individuals, those with highest brokering potential, wind up being the “usual suspects” already identified by law enforcement (Morselli et al. 2013). However, the social network analysis of other specific behaviors, instead of phone communications, may provide a different perspective to both scholars and the law enforcement in the analysis of organized crime. Using data other than phone wiretaps may uncover other relevant patterns who may have escaped the attention of the authorities.

The analysis of meeting attendance within organized crime organizations may be a relatively simple example of such new perspective. Meeting attendance data could be more easily accessible than wiretaps. For example, procedural requirements to shadow suspects or monitor public places (e.g. bars, restaurants, parks) are less constraining. The application of social network analysis to meeting data may provide insights into the functioning of a criminal network with a limited investment, not only in terms of procedural requirements but also in financial terms. At the same time, meeting participation may be an important element of the life of a criminal organization.

The analysis of meeting attendance may prove particularly informative when investigating traditional organized crime groups characterized by established hierarchies and “local” criminal activities (e.g. extortion, criminal protection, and corruption) (Kleemans 2007). Attendance to meetings may be indicative of an individual’s affiliation and role, or change in social status (Paoli 2002, 2003) Also, organized crime is often embedded in family, kinship and ethnic connections (van de Bunt and Kleemans 1999; Papachristos and Smith 2011). Therefore the analysis may also include social occasions such as religious ceremonies (e.g. baptisms, weddings, and funerals), family celebrations (e.g. birthday parties) and community events (town or neighborhood festivities).

Meeting attendance may also provide important information on the internal structure of a criminal group. In criminal networks, the most important players may take precautions against over exposition to phone communications to reduce the risk of interception. They may manage the criminal activities thanks to their status or more indirect forms of control.

Individuals more active on the phone may be middle level criminals which then report to the bosses (Morselli 2009b; Calderoni 2012). Similarly, Bright and colleagues, analyzing methamphetamine networks constructed from judges' sentencing comments, argued that network centrality does not always correspond to leadership (2012, 172). The analysis of meetings may penetrate these countermeasures and provide important information for the identification of the criminal leaders, which may be the target of specific crime prevention efforts.

Despite the possible advantages of the analysis of meetings, to date no study has applied network analysis methods on organized crime meeting patterns. This chapter aims to fill this gap, exploring individuals' participation in meetings in a large organized crime group, and verifying whether network analysis of meeting attendance can produce results relevant for both criminal investigations and crime prevention. This study addresses questions such "can social network analysis of meetings identify the importance of individuals within an organized group?", "if yes, what network measures better identify leaders from other participants?", "can social network analysis of meetings provide information before the end of the investigation, and, if so, when and how?", and "how can the prediction of criminal leadership contribute to prevent criminal networks to operate?"

To address these issues, this chapter analyzes a single case study, Operation Infinito. This investigation targeted a large organized crime group called the 'Ndrangheta, an Italian mafia from Calabria, Southern Italy. This case study has relevance outside Italy because a number of sources report that this criminal organization has already established formally structured groups outside its region of origin (Paoli 2003; Forgione 2009; KLPD 2011; Transcrime 2013; Campana 2013). Therefore, in addition to testing the utility of social network analysis of data other than phone wiretaps, the results of this study may provide insights on the functioning of a criminal organization which has expanded in a number of different countries.

Leadership roles in the ‘Ndrangheta

The ‘Ndrangheta is a mafia from Calabria, a Southern region at the tip of the Italian boot. It originated in the Nineteenth Century, or even before that period according to some sources (Ciconte 1992; Gratteri and Nicaso 2009, 25). Until recently, the ‘Ndrangheta received less attention than the Cosa Nostra, widely considered as the archetypical mafia organization (Paoli 1994). Some recent events have brought the Calabrian syndicate into the world media spotlight.ⁱ In particular, the ‘Ndrangheta has shown a remarkable capacity to establish its presence outside Calabria. A recent report estimated its yearly revenues from illegal activities at €3.5 bn, of which only 23% from original Calabria and nearly 60% from richer Northern regions (Piedmont, Lombardy, Emilia-Romagna, Lazio and Liguria) (Transcrime 2013, 80). Also, a number of sources report the presence of the ‘Ndrangheta in other nations (e.g. Australia, Canada, Germany and the Netherlands) (Ciconte and Macrì 2009; Forgione 2009; KLPD 2011; Campana 2013). As a consequence, law enforcement agencies and institutions have increasingly dedicated attention to this criminal organization.ⁱⁱ

The organizational structure of the ‘Ndrangheta may be one of the possible factors of this successful expansion. Blood and community ties, rituals, affiliation ceremonies, mythology and a hierarchy comprising a number formal ranks (*doti*) and offices (*cariche*) strengthen the trust among the members, even at a great distance from the motherland (Paoli 2003; KLPD 2011).ⁱⁱⁱ

The ‘Ndrangheta is primarily based on the blood kinship (Paoli 2003; Varese 2006b). It is very common for men of the same family to join the organization, differently from Cosa Nostra where the “family” was actually a group of different individuals which rarely shared the same blood (there was even a rule against accepting more than two blood relatives in a Cosa Nostra family) (Arlacchi 1992; Paoli 2003, 31). One or several ‘Ndrangheta families in the same area, frequently connected also by marriages, godfathering and similar social ties, form a *ndrina*. The *ndrine* from the same area may form a *locale*, an autonomous criminal organization with control over a specific territory (Paoli 2007, 856).

The ‘Ndrangheta also has a formal structure made of ranks (*doti*) and offices (*cariche*) (Paoli 2003, 46). Competition for advancement in the hierarchy is fierce and concern over the

criminal career is a constant element of the life of a *'ndranghetista*. Affiliates frequently discuss matters relating to ranks and offices. Information on the formal organization is fragmented, despite the discovery of written “regulations” and informant descriptions of the rules of the organization (Gratteri and Nicaso 2009; Malafarina 1978; Paoli 2003). The *'Ndrangheta* keeps evolving and the number of ranks and offices have increased, possibly due to the internal pressure to climb the criminal career.

In general, every affiliate holds a specific rank (*dote*) within the organization. The ranks are a sort of internal career for the members. Indeed, the *dote* indicates each affiliate’s status within the *'Ndrangheta*.^{iv} While the lower levels have remained constant through the years, the last decades saw the creation of new higher ranks (Paoli 2003, 42–44). As a result, today there is a division of the members in two main tiers: the higher society (*società maggiore*) and lower society (*società minore*), with multiple ranks within each society (Paoli 2003).^v

Each locale has a number of formal offices (*cariche*), tasked with specific functions. Offices are assigned to higher ranked affiliates:

- The boss of the locale is the *capobastone* or *capolocale*.
- The *contabile* (accountant) is responsible for the common fund of the locale, the *crimine* (crime) oversees criminal, and particularly violent, actions.
- The *mastro di giornata* (literally “master of the day”) takes care of the communication flows within the *locale*.

Information is incomplete as to the offices, with investigations uncovering new offices and functions. In general, however, the number of offices is smaller, possibly to avoid overlaps in competences. For example, one internal rule requires every affiliate to state the names of the three main offices (the “copiata”) of his locale (capobastone, crimine and contabile) whenever he presents himself to members of other groups.

Case study

This study focused on one large judicial case, Operation *Infinito*, named after one of the new ranks in the *'Ndrangheta* discovered during the investigation. *Infinito* dates back to 2006,

with the start of different criminal investigations on the ‘*Ndrangheta* in Lombardy. These were subsequently joined and concluded on 13 July 2010, when the authorities arrested more than 160 individuals. To date, the trials are still ongoing.^{vi} The case concerned the establishment of several ‘*Ndrangheta locali* in the area around Milan, the capital city of the Lombardy region, Italy’s second largest city and economic capital. The data sources include a number of judicial documents-- law enforcement agencies reports, pretrial detention orders, and first and second grade judgments.

The main theme of *Infinito* was the vicissitudes of a special ‘*Ndrangheta* structure called *la Lombardia* (Lombardy in Italian) and of the person charged with its management, the *Mastro generale della Lombardia* (general master of Lombardy). Although the functioning of this body is still unclear, it seems that *la Lombardia* was a sort of coordination chamber among the *locali* based in Lombardy, but also with some role in the relations between these and the main *locali* in Calabria. At the beginning of the investigation, N161 was the leader of *la Lombardia*.^{vii} However, he showed excessive autonomy from the powerful Calabrian *locali*, by pressing for more independence for the Northern affiliates in the management of the criminal activities and in awarding of ranks and offices. As a reaction, the *locali* from Calabria ordered his murder, which took place on 15 July 2008, in a bar in San Vittore Olona, a town about 30 km from Milan. After N161’s murder, the dominant Calabrian families decided to suspend the office of *Mastro generale della Lombardia* and appointed a temporary manager, N099. Eventually, after several machinations concerning the vacant office, N157 was appointed as *Mastro generale* on 31 October 2009.

One of the salient characteristics of Operation *Infinito* is that the main offence charged is participation in a mafia-type association (Article 416-bis of the Italian Criminal Code). This offence criminalizes the participation in any association, whatever its origin, which uses the so-called mafia method. The key elements of the latter are:

- the intimidatory power deriving from the strength of the associative bond,
- the condition of subjection and
- of *omertà* or silence.

Due to this charge, the investigation aimed at demonstrating the stable presence of a mafia-type association in the area around Milan. The account of the struggle for the office of *Mastro generale della Lombardia* and the reconstruction of the offices of the *locali* in the area were crucial in proving the existence of a mafia-type association. Consequently, most of the investigative activities, from background checks to wiretaps and surveillance activities focused on describing the organizational structure of the ‘Ndrangheta with a particular concern in charting the hierarchy of la Lombardia and the different *locali* present in the region.^{viii}

Data Source

The primary data source for this study was the pretrial detention order issued by the preliminary investigation judge (*Giudice per le indagini preliminari*, henceforth GIP) of Milan upon request by the prosecution (Tribunale di Milano 2011). This judicial document containing more than 700 pages, petitions to restrict the suspects’ freedom, and in particular of remanding some of them in custody or pretrial detention. Since the law requires the judge to motivate her decision the document provides a wealth of information for the analysis of criminal groups and their criminal activities:

- It reports personal details of the suspects (e.g. name, birth date, residence, citizenship) and of the crimes (for every crime, e.g. extortion, they record the date, the place, the participants and the *modi operandi*).
- It provides details on the structure of the organization, the roles played by each member, and the evolution of the group during the investigation.
- It reports excerpts from intercepted telephone conversations and meetings observed or reconstructed by the investigators. Some of these meetings occurred in houses, private premises (e.g. warehouses) or cars, others in public places (e.g. bars, restaurants or public parks).

This study analyzed and coded each meeting mentioned in the court order.^{ix} In total, the document provides information about 308 individuals participating in 574 of such meetings between mid-2006 and the beginning of 2010. The number of participants per meeting varied

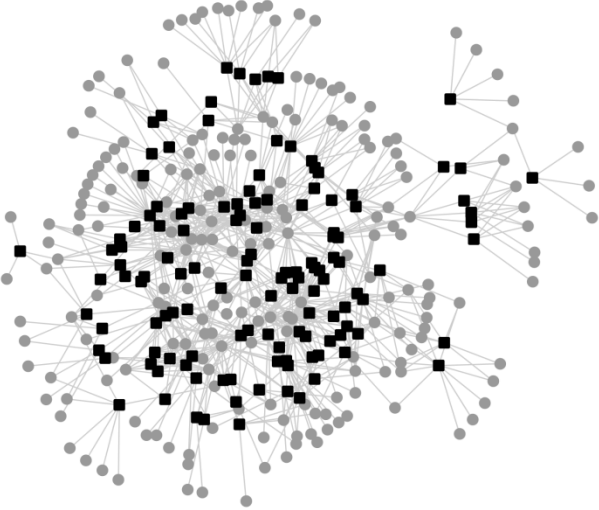
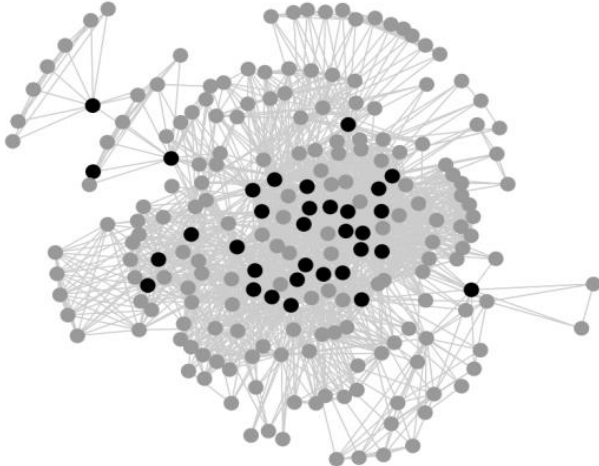
considerably, with a minimum of 2 and a maximum of 25 identified individuals. In most cases, the law enforcement agencies were able to identify all or most of the participants.

Given the specific focus of the investigation, most of the meetings reported in the court order were true organized crime meetings. These had the purpose of discussing criminal activities or matters relating to the life of the different *locali* (e.g. affiliations, attribution of ranks and offices) or of *la Lombardia* (including the vicissitudes of N161, his murder, the suspension of the office and the appointment of N157 as the new *Mastro generale della Lombardia*).^x

To be included in this study, the meeting had to involve at least four participants. The selection criterion serves to remove from the sample the smallest meetings and the most marginal actors. The inclusion of the latter may have biased the sample towards those individuals more intensely controlled by the law enforcement, e.g. because their cars were wiretapped (meetings in cars often involved only two or three participants).^{xi} Further, this kind of sampling procedure is frequent in studies applying a social network analysis methods to criminal groups (Natarajan 2000; Natarajan 2006; Morselli 2009b, 152).

The sample of selected meetings included a total of 215 individuals participating in 129 meetings. With only 22% of the 574 meetings recorded in judicial documents, the sample comprised nearly 70% of the total participants.. Most participants were made members of the ‘Ndrangheta, a further proof of the organized crime nature of the meetings. In some cases, however, the authorities could not verify the actual affiliation of some individuals. These subjects may have been actually affiliated to the organization, or associates not yet admitted in the ‘Ndrangheta, or external individuals who may participate or not in the criminal activities. Also, some individuals were not affiliated to the organization. In such cases, these individuals may have personal (e.g. family, friendship) or business (either legal or illegal) connections with the ‘Ndrangheta and for this they were included in the network.

Table 6.1 Actors-to-meetings and actor-to-actor networks

Network	Descriptive statistics
<p>a) Actors-to-meetings Network (2 mode)</p> 	<p>Meetings (black squares): 129</p> <p>Individuals (grey circles): 215</p> <p>Density (2-mode): 3.1%</p> <p>Avg. path length (2-mode): 4.6</p>
<p>b) Derived Actor-to-Actor network (1 mode)</p> 	<p>Leaders (black): 33</p> <p>Non-leaders (grey): 182</p> <p>Avg. degree: 34</p> <p>Density: 8.8%</p> <p>Avg. path length: 2.5</p>

Participants and meetings were entered into a two-mode, affiliation matrix (upper graph in Table 6.1). From this, a one-mode, valued and undirected adjacency matrix was computed, recording each individual's co-participation in meetings with any other individual in the net-

work (lower graph in Table 6.1). All network analysis operations were performed using the Ucinet 6 (Borgatti, Everett, and Freeman 2002).

The network was partitioned into four networks representing investigatory time periods of increasing duration (Figure 6.1 and Table 6.2). Since the meeting date was available for 118 out of the 129 meetings in the sample, the final time period includes all but 11 meetings. The 118 meetings took place between 25 June 2007 and 14 February 2010, although 110 (93%) events occurred between February 2008 and October 2009. These subdivisions help to assess the network measures' predictive capacity of the leadership in the criminal organization at different points throughout an investigation. Each period starts in June 2007 with the first meeting in the sample.

Two-mode affiliation matrixes were calculated for each time period. This enabled derivation of one-mode adjacency matrixes recording individuals' co-participation in meetings. The affiliation matrixes (both the first one for the whole investigation and the four period matrixes) enabled the calculation of a number of social network measures (all based on a binary matrix, except for valued degree centrality).

Figure 6.1 Number of Meetings per Month and Period

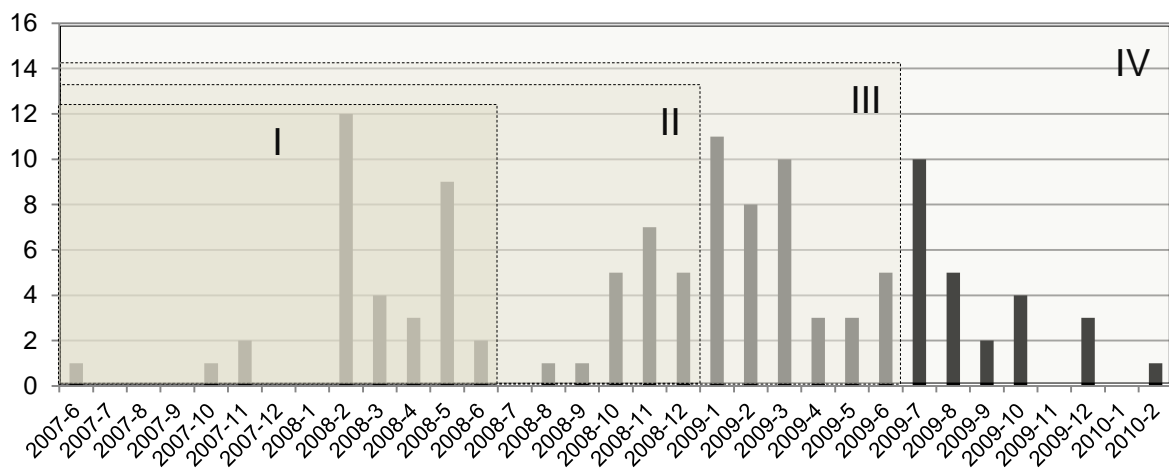


Table 6.2 Descriptive Statistics of the Four Time Periods

	I	II	III	IV
End date (from 25 Jun 2007)	30 Jun 2008	31 Dec 2008	30 Jun 2009	28 Feb 2010
No. months	13	19	25	33
No. meetings	34	53	93	118
No. nodes	82	126	183	205
<i>Of which leaders</i>	27	31	33	33

Measures

Independent Variables. Given the lack of previous studies on meeting attendance in criminal networks, the analysis opted for an exploratory approach, calculating the centrality measures most frequently used in the literature. These include degree (on both binary and valued matrixes), betweenness and closeness centrality, three classic measures of centrality developed by Freeman and frequently used in the literature on criminal network (Freeman 1979; Baker and Faulkner 1993; Morselli 2009a).^{xii} Other measures are eigenvector centrality, an adaptation of degree taking into account the degree of the a node's contacts (i.e. neighborhood) (Bonacich 1972; Morselli 2009a) and the clustering coefficient, a measure of the level of interconnection among a node's neighborhood (Watts 1992; Morselli 2009a; Calderoni 2011).^{xiii} Table 6.3 reports the minimum, maximum, mean, and standard deviation for each variable.

Leadership Role. A dichotomous *dependent* variable "leadership," was created from information provided in the court documents.^{xiv} This variable records whether each subject held one of the main offices within the *locali* or the *Lombardia* or not (leader=1 and other=0). Among the 215 individuals in the sample of meetings for the whole investigation, 33 subjects had a leadership office and 182 are simple members of the 'Ndrangheta (n=135), unidentified (n=43) or not formally affiliated (n=4). Leaders included in the four time periods are reported in Table 6.2.

Analytic Process

The statistical analysis consisted of two modeling procedures. First, a logistic regression was conducted using network information developed from all meetings. As previously noted, the dependent dichotomous variable was leadership. Independent variables included the above mentioned individual network measures and two controls (Table 6.3). The first is the number of meetings attended for each individual. Second, to control for a possible prosecution bias, a dummy was included (mafia charge), assessing whether each node was investigated for the offence of mafia-type association (data extracted from the court order). Given the exploratory nature of the analysis, the model used a forward stepwise selection method among all the variables.

Table 6.3 Descriptive Statistics and Pearson's Correlation Coefficients of the Variables for the Network Generated from All Meetings*

Variable	Min	Max	Mean	StDev.	2	3	4	5	6	7	8	9
1 Leadership	0.0	1.0	0.2	0.4								
2 Meetings Attended	1.0	38.0	4.0	5.0	-	.822	.940	.789	.487	.681	-.742	.862
3 Degree (Normalised)	1.4	38.8	8.8	7.5		-	.940	.635	.541	.946	-.725	.940
4 Valued Degree	3.0	221.0	31.1	38.4			-	.699	.531	.854	-.710	.951
5 Betweenness (Normalised)	0.0	15.2	0.7	2.0				-	.370	.480	-.624	.714
6 Closeness (raw scores)	55.1	144.6	95.0	17.9					-	.506	-.470	.511
7 Eigenvector (Normalised)	0.0	32.0	6.6	7.1						-	-.570	.863
8 Clustering Coefficient	0.3	1.0	0.8	0.2							-	-.642
9 Number of Pairs	3.0	3403.0	294.3	520.8								-
10 Mafia Charge	0.0	1.0	0.5	0.5								

*all correlations are statistically significant at $p < .01$ level

The second step involved running four logistic regression models, one for each time periods, using the leadership as dependent variable. The independent variables were calculated on the network partitions for each time period and their selection and were selected on the basis of the results of the regression for the whole investigation (all meetings). The two controls were also included (no. of meetings attended and mafia charges). Several attempts with all the above mentioned centrality measures provided similar results, ensuring the robustness of the models.

Results

The logistic regression model using data from all meetings successfully predicts the leadership positions of 92.6% of individuals (66.7% for leaders and 97.3% for others). The Hosmer-Lemeshow test for goodness of fit indicates that model fits the data acceptably (χ^2 15.344, $p < .53$, $df = 8$).^{xv} Nagelkerke's R^2 is of .641, which reveals a good capacity of the predictors to identify the role of the participants.

The stepwise selection retained only valued degree (at first step) and betweenness (included at the second step) as independent variables (Table 6.4). The controls and the other variables were not included by the selection method. Betweenness centrality has an odds ratio of 2.565 (95% confidence interval 1.482-4.439) with $p < .001$, indicating that higher value of this measure increases the probability of identifying a leader (approximately +156% per unit increase of betweenness, keeping the variable valued degree constant). Valued degree has also a positive association with being in a position of leadership (OR 1.037, 95% CI 1.018-1.056, equal to an increased probability to be a leader of approximately +4% per unit of valued degree, irrespective of the value of betweenness).

Table 6.4 Results of the Logistic Regression on Leadership for the All Meetings

Predictor	B	SE	OR
Valued degree	.036	.009	1.037***
Betweenness (normalised)	.942	.280	2.565**
Constant	-4.261	.544	.014***

* $p < .05$, ** $p < .01$, *** $p < .001$

The logistic regressions for the four time periods demonstrate a significant capacity to predict the leadership role even at early stages of the investigation. The share of successful predictions is always above the one of a constant-only model (Table 6.5).

Table 6.5 Percent of Successful Predictions from the Logistic Regressions on Leadership for the Four Time Periods

	I	II	III	IV
Constant only	67.1	75.4	82	83.9
Full model	75.6	84.9	90.7	92.2
Others	90.9	94.7	98	97.7
Leaders	44.4	54.8	57.6	63.6

The first time period (until mid-2008) provides successful identification for 75.6% the nodes, with only 34 meetings and 82 individuals in the network. Analysis of the meetings until the end of 2008 further increases the success rate (approximately 85%), with a significant increase in the identification of the leaders (54.8%). The third and fourth periods provide successful predictions (90.7% and 92.2% respectively) very close to the whole investigation model (92.6%).

The Hosmer-Lemeshow tests show that all the four models fit the data. Nagelkerke's R^2 increases in time, indicating that the regressions' predictive capacities grow with the number of meetings and nodes in the sample. Significantly, the fourth period's model has a Nagelkerke's R^2 of .657, slightly above the whole investigation model (Table 6.6).

Table 6.6 Results of the Logistic Regressions on Leadership for the Four Time Periods

Time period	Variables	B	SE	OR
I (June 2007 to 30 June 2008)	Valued Degree	.001	.025	1.001
	Betweenness (normalised)	.614	.359	1.848!
	No. Meetings	.116	.238	1.123
	Mafia Charge	1.735	1.092	5.671
	Constant	-3.105	1.058	.045**
	H-L Test $\chi^2= 3.498$ p=.899 Nagelkerke's $R^2=.387$			
II (June 2007 to 31 Dec. 2008)	Valued Degree	.008	.024	1.008
	Betweenness (normalised)	.833	.359	2.300*
	No. Meetings	.077	.217	1.080
	Mafia Charge	1.820	1.084	6.170!
	Constant	-3.866	1.026	.021***
	H-L Test $\chi^2= 7.747$ p=.459 Nagelkerke's $R^2=.515$			
III (June 2007 to 30 June 2009)	Valued Degree	.024	.018	1.024
	Betweenness (normalised)	.691	.264	1.996**
	No. Meetings	-.068	.168	.934
	Mafia Charge	2.173	1.080	8.787*
	Constant	-4.638	1.016	.010***
	H-L Test $\chi^2= 3.861$ p=.896 Nagelkerke's $R^2=.559$			
IV (June 2007 to 28 Feb. 2010)	Valued Degree	.044	.019	1.044*
	Betweenness (normalised)	.898	.309	2.454**
	No. Meetings	-.132	.155	.876
	Mafia Charge	1.731	1.108	5.648
	Constant	-5.180	1.033	.006***
	H-L Test $\chi^2= 6.066$ p=.640 Nagelkerke's $R^2=.657$			

!p<.1,*p<.05, ** p<.01, *** p<.001;

Betweenness centrality is the main predictor of the nodes' leadership position, showing a statistically significant strong positive effect on the probability of being a leader (Table 6.6). In the first period it shows an odds ratio of 1.8. However, its statistical significance is very low (p<.1), probably due to the low number of observations (n=82) and to an overall low predictive power of the model (Nagelkerke's $R^2=.387$). In the three following periods

betweenness is always statistically significant and its odds ratios high (2.3, 2 and 2.4, respectively). This implies that a unit increase of betweenness, all other variables equal, increases the probability of being a leader by 130%, 100% and 140% respectively. Valued degree is statistically significant only in the fourth period with an OR of 1.04, in line with the whole investigation model. Among the control variables, the number of meetings is never significant, while mafia charge is significant and strongly positive only in the third and fourth period. Nevertheless, this does not affect the statistical significance and the sign of the effect of betweenness centrality.

Discussion

The results show that the analysis of the meetings within an organized crime group can correctly identify the leadership positions of the participants. These findings demonstrate that the meeting attendance may provide insight into the internal organization of a criminal network, overcoming the limitations associated with the analysis of telephone communications. Also, the regression for the different time periods indicate that successful prediction may be possible also during the course of an investigation. These results may enable the adoption of preventive measures with the aim of hindering the activities of criminal organizations.

Betweenness centrality is the measure which better predicts the leadership roles. In this case, the variable reveals that the leaders participate in the network with a specific strategy. Betweenness measures the capacity of leaders to meet individuals who do not meet each other in other occasions. This is consistent with the specific role that individuals holding important offices within the 'Ndrangheta may fulfill. Mafia leaders are both tasked with important decisions about the activities of their *locale*, or the organization as a whole, and with a number of formal or “ceremonial” activities, including attendance at special events. For example, leaders may participate in high-level meetings reserved for leaders or visit other *locali* as a sign of respect. The inclusion of valued degree centrality in the whole investigation model is more intuitive. Leaders tend to meet other participants more frequently. Also, the variable is strongly correlated with other direct connectivity variables (number of meet-

ings attended, binary degree centrality and the number of pairs). This is a natural consequence of the fact that the leaders were participating in more meetings.^{xvi}

The importance of betweenness is consistent with existing literature on criminal networks. Betweenness centrality reflects a broker role within a criminal network, i.e. the capacity to bring different resources together. Brokering skills are crucial to the success of criminal careers in a number of illegal markets and activities, including organized crime (Burt 1992; Morselli 2003; Morselli 2005; Morselli 2009a). In a number of criminal networks, high betweenness centrality was typical of the leaders of the criminal groups (Morselli 2009b; Varese 2013; Morselli and Roy 2008). However, while brokering is frequently a crucial element for success, it does not always mirror actual leadership within a criminal group. In larger and more structured criminal groups, there may be multiple organizational layers. For example, a study on two mafia groups involved in drug trafficking demonstrated that high betweenness centrality was associated with individuals directly managing smuggling operations, but not with the highest criminal status in the organizations. High status actors remained distant from everyday trafficking activity to reduce the risk of detection (Calderoni 2012). This may be due to the fact that mafias adapt to the rules of drug markets, adopting flexible organizational structures (Paoli 2002). The formal roles are less relevant and the management of trafficking is delegated to middle status members, who may see this as a career opportunity within the group. This pattern does not show up in the present case study.

In *Infinito*, the meeting network mirrors the “institutional” life of a mafia, where offices are an important issue, object of frequent discussions and occasional disputes. The leaders cannot delegate to others some of the most important tasks relating to the functioning of the organization, which includes attending certain meetings. For this reason, the meetings in *Infinito* may reflect the political maneuvering of leaders more closely than studies analyzing phone communications and drug trafficking.

The findings of this study may point out a specific social structure within organized crime groups. Active participation in meetings appears as a crucial requirement for leaders of organized crime groups. On the one side, attendance at specific meetings may grant leader a strategic position, providing access to precious resources and placing them in ideal brokerage

positions. For the leaders of large criminal groups, this is an important opportunity to maintain control over the illicit activities. On the other side, opportunities may turn into vulnerabilities, since meeting participation can hardly be dissimulated, enabling the identification of leaders through network analysis methods.

The results of the regressions for the four time periods point out that it is possible to successfully identify the leadership roles even in the early stage of an investigation, with acceptable rates of success even from the first stages of a case. Despite the low number of observations, betweenness centrality scores improve the correct classification of individuals' leadership roles from the first observed meetings. The regression for the first time period correctly classified more than 75% individuals based on only 34 meetings (28% of the total). Analysis of the meetings until the end of 2008 (45%) yielded even better results, with nearly 85% of success. With the third (mid-2009) and fourth (beginning of 2010) periods, the probability already reaches the one of the whole investigation model. The four models are more effective in the identification of non-leaders. Only from the second period the success rate for the leaders exceeds 50%, reaching a maximum of approximately 64% in the fourth period. This may be probably influenced by the low number of leaders in the sample (33 out of 205 in the fourth period).

These outcomes may be relevant from a law enforcement perspective. The analysis of meeting attendance may suggest on which suspects concentrate law enforcement resources, which are frequently limited by definition; it may prompt increased surveillance, background checks and other actions to verify and improve the prediction. Also, since phone interceptions are often restricted by legal requirements and resources availability, the analysis of meetings may provide a more accessible alternative or complementary strategy. As an alternative tactic, it may help in the reconstruction of the internal structure of a group. As a complementary strategy, since wiretaps require judicial authorization and courts may be particularly demanding whenever the suspects' freedoms are at stake, the analysis of meetings may assist in the selection of the best targets for interceptions, so that the law enforcement may prioritize evidence to authorize wiretaps of the possible leaders.

The identification of criminal leaders may also enable the adoption of crime prevention measures in line with the techniques of situational crime prevention (Clarke 1983). Although most frequently applied to volume/conventional crimes, situational crime prevention measures are increasingly considered for the preventing organized crime (van de Bunt and van der Schoot 2003; Bullock, Clarke, and Tilley 2010). In this field a number of strategies fall within the administrative approach to organized crime, which dates back to the non-criminal tactics adopted in New York City to remove Cosa Nostra's control of different industries (Jacobs, Friel, and Raddick 1999). The possible preventive measures aim at making it more difficult for criminal leaders to participate in the activities of the mafias and particularly to meet other members. Given the nature local nature of the activities of some organized crime groups, administrative approach may prove particularly effective in preventing their functioning (Kleemans 2007).

The Italian legislation (Legislative Decree 6 settembre 2011, n. 159, also known as Antimafia Code) currently provides for non-criminal preventive measures against individuals suspected of a number of criminal activities and who may be dangerous for public order and security. Preventive measures are applied either by the head of the State Police of a province (*Questore*) or by a judicial authority upon request by law enforcement or prosecution agencies. The procedure is administrative and aims at the imposition of personal or patrimonial restrictions, but not of criminal penalties. Individuals suspected of belonging to a mafia-type association are among the most typical target of these measures.

The main personal preventive measure is the *sorveglianza speciale di pubblica sicurezza* (special surveillance of public security), which can last from one up to five years. When applying the special surveillance, the court can impose a number of prescription to the targeted person. These include the duty to communicate to the authorities the residence and domicile and any changes to these; to live honestly, abiding the law, and not to leave home without informing the police; not to associate with people convicted or targeted by similar preventive measures; not to carry weapons. The court can also impose any other prescription considered useful for preventing criminal activities by the targeted person. If other preventive measures are not sufficient to ensure public security, the court can also impose the obligation

to live in the municipality of residence or domicile. The imposition of special surveillance entails that the targeted individuals cannot participate in public procurement contracts, cannot receive authorization or subsidies from the state. Also, the prosecution can request the interception of telephone or electronic communications to ensure that the individual is fulfilling with the imposed obligations and is not protracting the suspect behaviors. Violation of the prescriptions imposed by the court is punishable as a misdemeanor, with deprivation of liberty from three months to one year. If the violation concerns the obligation of residence or domicile, it is a felony punishable with imprisonment from one up to five years. If the targeted person commits an offence (including the participation in, or the direction of, a mafia-type association) the penalties for the offence are increased from one third up to an half.

The analysis of meeting participation may provide the competent authorities with relevant information about potential optimal targets for applying for special surveillance orders. Once possible leaders are identified, it may be possible to collect evidence to satisfy the court that an individual suspected of belonging to the mafia should be imposed special surveillance.

The special surveillance regime may make it harder for the targeted subjects to successfully manage a criminal organization. The effects of special surveillance are indeed amenable to the different situational crime prevention approaches and particularly to increasing the effort, increasing the risk and removing excuses. These include:

- Increased awareness of the authorities' attention and of the risk of detection and arrest. This is likely to remove excuses for continuing illegal activities.
- Individuals are obliged to inform the authorities of their residence and domicile, making them more vulnerable in case of arrest and search.
- The prohibition to meet with other affiliates would make it more difficult and riskier for the targets of special surveillance to meet with their associates. Given the considerations above on the vital importance of meeting attendance for organized crime leaders, the restriction may significantly increase the efforts and risks for effectively managing criminal groups.

- The possibility to intercept telephone or electronic communications of the targeted subjects will increase the efforts and the risks for devising alternative methods for the management of the criminal groups.
- The penalties for the violations of the obligations imposed by the court and the significant aggravation of penalties in case of conviction for a number of offences may increase the risks for the targeted individuals.

Limitations

It is often argued that studies based on judicial sources are inevitably biased by the strategies of the law enforcement. Judicial investigations may have a partial coverage of criminal groups and this may affect the reliability of the network measures. For example, for a few *locali* the authorities identified a limited number of ‘Ndrangheta members. This problem is common to most network studies of criminal organizations and requires particular care in the handling of data. Nevertheless, there are reasons to believe that this should not affect the results of this study. Some studies found that criminal network measures are strong even if randomly tested for missing data (Xu and Chen 2008, 63–64; Morselli 2009a, 48). Furthermore, *Infinito* was a long investigation, specifically aiming to identify the most important individuals in the ‘Ndrangheta in Lombardy. The risk that possible missed or excluded individuals may have radically changed the structure of the network appears low. For two reasons: (1) first and second grade judgments have confirmed the charges against the suspects, indicating that important actors were identified; and, (2) Berlusconi tested the robustness of degree and betweenness centrality across different phases of the judicial process (wiretap records, arrest warrant and judgment) and argued that “arrest warrants and judgments seem to be reliable data sources to identify key players regardless of whether a large proportion of peripheral nodes is missing” (Berlusconi 2013, 78).

Another possible issue for the analysis is the correct identification of leaders. However, in *Infinito*, the identification of the leaders was based on direct evidence about the structure of the ‘Ndrangheta. The assessment was independent from the observation of meeting attend-

ance and individuals' activities. No individual was classified as leader due to the attendance at a specific meeting, since the court would have dismissed any such argument for lack of evidence. The evaluation therefore appears as the most reliable depiction of the actual leadership roles within the criminal organization. In other studies, the reconstruction of the internal structure relied on the evaluation of the law enforcement or the court, or on individuals tasks or role in the criminal activities or on the content analysis of the conversations (Natarajan 2000; Varese 2006a; Natarajan 2006; Morselli 2009a; Calderoni 2011; Calderoni 2012). Contrarily, this case study provides a valuable opportunity, enabling to explore how social network measures may contribute to the identification of leadership positions, due to the independence of the identification of the leaders by the authorities and their meeting attendance patterns.

Conclusions

This chapter demonstrates that the analysis of meetings attendance can provide insights on the internal structure of organized crime. Betweenness centrality can predict the leadership role of the participants and who the leaders of the group are. The prediction is quite robust even in the first stages of the investigation. With only a few initial meetings, the analysis enables to correctly assess the leadership of more than 3 out of four individuals. The model reaches increasingly high success rates as the case evolves in time with a peak of 92% of successful predictions.

These results have implications for the study of organized crime as well as network analysis. First, they show that specific behaviors may reveal the criminal status of the members of organized crime. In a meeting network, and independently from the number of meetings attended, the leaders have brokering positions, which give them access to criminal opportunities. Increasing or decreasing betweenness centrality in meetings may reveal a possible change in the opportunities available to an individual. This may help in identifying ascending or decaying criminals. Second, further studies may verify whether other criminal organizations, from terrorist groups to drug trafficking networks, show similar patterns when meeting attendance is concerned. For example, the relevance of such patterns may depend on the presence of any internal hierarchy. Conversely, they may be due to the characteristics of

the crimes. Local activities such as extortion, loan sharing, provision of criminal protection, and corruption may require active meeting participation, while transit crime, such as international drug trafficking may necessarily rely more on telephone communications than on meetings (Kleemans 2007). Third, the results point out the importance of the formal offices within organized criminal groups, even when they establish a presence far from the motherland. Given the international expansion of the ‘Ndrangheta, other studies may verify whether its relatively recent growth in other areas of the world also corresponds to the internal organization observed in *Infinito*.

This chapter may also have some interest for its law enforcement implications. It suggests that it may be possible to successfully assess the leadership roles of the participants of a criminal organization through the analysis of the meetings. Leaders may be the target of specific preventive measures (such as the special surveillance provided by the Italian legislation), enabling the application of administrative approaches to prevent organized crime. Also, the prediction of leaders may support law enforcement agencies in developing intelligence for better action against criminal networks. While its operational effectiveness remains to be verified, it points out that network analysis of organized crime may still offer interesting developments for the law enforcement activity both from the crime prevention and the crime control perspective.

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ⁱ The first event was the so-called ‘Duisburg massacre’ of 15 August 2007, when six people of Calabrian origin were murdered in Duisburg, Germany, in connection with a decade-long blood feud between two ‘ndrine (D’Emilio 2007; Landler and Fisher 2007; Spiegel Online International 2007; Williamson and Bompard 2007). Investigators found evidence of an affiliation ritual in the pocket of one of the victims (the remnants of a burned holy image), which further confirmed the tight relation between the massacre and the ‘Ndrangheta (McKenna 2001). Second, on 30 May 2008 the President of the United States designated the ‘Ndrangheta as a significant foreign narcotics trafficker (to date, the only Italian mafia) and inserted it in a special list prompting a number of sanctions by U.S. authorities (OFAC 2012; U.S. Department of State 2011)..

ⁱⁱ For example, in 2011, the Dutch Police issued a report on the ‘Ndrangheta, arguing that “no reliable statements can be made about the organizational structure in the Netherlands. It is likely that the ‘Ndrangheta also applies the structure it uses in Calabria and elsewhere in the world in the Netherlands, which means that there are one or more *locales* that organize criminal activities” (KLPD 2011, 45).

ⁱⁱⁱ Indeed, neither Cosa Nostra nor the Camorra established a stable organized presence outside their regions and rather adopted more flexible structures. During the golden years of the 20th century, only a few Cosa Nostra families were based outside Sicily (Arlacchi 1992). A study on the Camorra clan *La Torre* highlighted that its presence in the Netherlands and Scotland was associated with money-laundering and participation in illegal markets. However, the core business of the group (criminal protection) remained in the region of origin (Campana 2011).

^{iv} The award of a new rank is a very important moment for each ‘ndranghetista, usually celebrated with a dinner or a party with the closest affiliates. Higher ranks can only be awarded by top ranked individuals, with the agreement of the most prominent figures in Calabria.

^v Before formally joining the ‘Ndrangheta, associates are called *contrasto onorato*. After their initiation, they start within the lower society which includes affiliates with lower ranks (*picciotto, camorrista, sgarrista*). The higher society comprises members who have reached higher ranks (*santa, vangelo, quartino, tre quartino, quintino, associazione* and other ranks discovered in recent investigations).

^{vi} The Court of Milan issued two first grade judgments on 11 November 2011 and 6 December 2012, convicting most of the suspects. On 23 April 2013 the Court of Appeal of Milan confirmed the convictions of the first judgment. Further appeals and the third grade trials at the Cassation Court of Rome will follow in the next months.

^{vii} The study coded each individual in the court order as N001, N002, ... to prevent identification.

^{viii} The investigation also uncovered a number of other crimes, ranging from extortion to usury, from corruption to the infiltration into public procurement.

^{ix} The study coded each meeting as E001, E002, etc., recording the meeting’s time, place and participants.

^x For example, on 31 October 2009, the law enforcement managed to film a ‘Ndrangheta meeting in Paderno Dugnano, a town approximately 10 Km from the centre of Milan. The meeting took place in a social club for elderly people entitled to Giovanni Falcone and Paolo Borsellino, two judges killed by Cosa Nostra in 1992.

The meeting had the goal of appointing N157 as the new *Mastro generale*. 23 men sat at a horseshoe-shaped table, having dinner and discussing among them. The temporary manager N099 gave a speech and proposed N157. Afterwards, all the leaders of the *locali* approved the candidate, whose appointment was celebrated with a toast.

^{xi} Exploration of the full meeting dataset showed that, on average, leaders and non-leaders met with a similar number of individuals, although the frequency distribution of non-leaders was more skewed to the left (avg. 5.91 st.dev. 2.68 for leaders and avg. 6.07 and st. dev. 5.68 for non leaders).

^{xii} Closeness was measured as the sum of the reciprocal of the geodesic distances so that the most central nodes have the highest score.

^{xiii} The clustering coefficient is strongly influenced by the size of a node's neighborhood. With a high number of direct contacts, it is less likely that they will be densely connected. For this reason, the clustering coefficient is always presented along with the number of pairs (i.e. the number of possible combinations among a node's direct contacts).

^{xiv} The court order provided detailed information about the leadership positions among the 'Ndrangheta groups in Lombardy. First, the investigation identified the individuals who led the coordination chamber *la Lombardia*, with the special office of *Mastro generale della Lombardia*. Second, the law enforcement also carefully charted the hierarchy of each *locale*. The court order reports detailed information about 17 *locali* in Lombardy and the membership of each of them. The investigation identified the leader of each *locale* (*capolocale* or *capobastone*) and, in the majority of cases, also the other main offices (*caposocietà*, *contabile*, *crimine*). The law enforcement and the prosecution based their assessment of the offices in each locale on different sources. These include evidence from previous investigations and trials, but also, and more frequently, on the wiretaps of conversations among members of the 'Ndrangheta. The offices within each locale were a frequent topic in the discussion of the suspects, also due to the particular period of stress which followed the murder of N161 and the competition for the appointment as new *Mastro generale della Lombardia*.

^{xv} The Hosmer and Lemeshow's (H-L) goodness of fit test divides subjects into deciles based on predicted probabilities, then computes a X^2 from observed and expected frequencies. Differently from the standard X^2 test, the null hypothesis for the H-L test is that the two distributions are equal. Non-significant results accept the null hypothesis and suggest that the model correctly fit the data, since the predicted and observed frequency are statistically similar.

^{xvi} Test logistic regressions including betweenness centrality and the other direct connectivity measures provided results very similar to the model presented above