INTER-FIRM NETWORKS IN NAPLES BEFORE AND AFTER ITALIAN POLITICAL UNIFICATION.
A NETWORK ANALYSIS PERSPECTIVE

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Abstract. *The study of economic relations, cultural ties and social groups in different historical periods by means of Social Network Analysis has been considered to be a very fruitful approach for improving the understanding of the relational structure underlying markets and financial and commercial networks. Moving away from rich literature results centred on the description of financial and business structures, this study aims to analyse the business structure in Naples, the most important city in Southern Italy, using new original data derived from economic archival sources. These data concern all business units operating before and after the Italian political unification (1861). More specifically, this study uses statistical network measures to investigate the role of the financial sector and its intercon- nections with the local business network to determine if and how it played a central role and if and how it evolved when the arena of power and economic relationships expanded, as Italy became a nation-state.*

Keywords: *Financial networks, International capital flow, Historical networks, Network measures*

1. INTRODUCTION

In the field of economic history (Casson and Hashimzade, 2013), how actors relate and interact within corporate networks has been a crucial factor in examining the

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interdependence among firms, economic elites, banking and financial systems and the structures of control and competition through which scholars explain power structures within different national varieties of capitalism. In this perspective, Italian scholars (Chiesi, 1982; Colli and Vasta, 2010; Giannetti and Vasta, 2006; Rinaldi and Vasta, 2012) have highlighted the structural characteristics of the Italian corporate system for the presence and importance of business groups in the 20th century and the central role of the financial sector – from a long run perspective – in the making of the Italian capitalism from the late 19th to the 20th century (Colli et al., 2016).

Dating the period of analysis from the early 19th century, this paper aims to address how the network of inter-firm relations in Naples, the most important city in Southern Italy, evolved before and after the Italian political unification (1861). The main goal is to use statistical network measures to investigate the role of the financial sector and its interconnections to the local business network in order to determine if and how it played a central role and if and how it evolved when the arena of power and economic relationships widened, as Italy became a nation-state.

In this framework, the methodological perspective of Social Network Analysis (SNA) offers several suitable tools to reconstruct the relational context in which Neapolitan business units were involved before and after the Italian unification. This method allows revisiting primary (archival) sources iteratively with new research questions. This methodological perspective has long been used as an analytical tool to explore actors or people networks (familial, religious, ethnic ties) as well as institutional networks (guilds) and, more recently organisational forms of business (business groups, multinationals, etc.).

In this paper, SNA is used to mainly identify the role played by the financial sector and its interconnections with other business actors. More specifically, visualisation tools and statistical network measures were devoted to: *i)* visually explore the relational patterns among business actors before and after the Italian political unification; *ii)* identify the core actors that played a central role (Freeman, 1978) and brokerage roles (Gould and Fernandez, 1989) during the two periods; *iii)* highlight the actors' homophily behaviours (Krackhardt and Stern, 1988) considering the sector as attribute data and the structural holes filled by those actors (Burt, 2009).

The reminder of the paper is organised as follows. Section 2 includes a brief review of historical networks and provides insights about the case study on business units in the Neapolitan area before and after the Italian political unification based on specific research questions. Section 3 describes the analytic strategy

used to analyse the business networks over time by means of statistical network measures. Section 4 describes the original archives used to derive the historical data under analysis and the data pre-treatment based on the temporal network definition. Section 5 presents the main results in terms of graph visualisations (graphs) and network measures at the network and individual levels. Section 6 concludes the paper and provides with some closing remarks and recommendations for future lines of research.

2. THE THEORETICAL FRAMEWORK

In the field of history, network analysis represents an important methodological development in an increasing interdisciplinary environment. A large body of research has revealed how both theories and network analysis methods can be effectively applied to historical data and to revisiting primary archival sources iteratively with new questions (Casson and Hashimzade, 2013). Even though the interest in the network analysis approach to history has increased over the last three decades, the use of formal network methods for historical research is relatively more recent (Baker and Jursa, 2014; Casson and Hashimzade, 2013; Lemercier, 2015; Wilson et al., 2017).

This methodology has become very popular in economic history, particularly in its main branches of financial and business history, with the emergence of some recurring topics, such as ownership relations, corporate control, interlocking directorships and the financial architecture of corporations in both national and global economies (Carroll and Sapinski, 2011; Chandler et al., 1997; Colpan et al., 2010; David and Westerhuis, 2014; Mizruchi and Schwartz, 1987; Wilkins and Schröter, 1998).

Entering this international wave of scientific discussion, Italian scholars have also provided important insights both into the peculiar structural characteristics of the Italian corporate system during the late 19th and the 20th centuries (Chiesi, 1982; Rinaldi and Vasta, 2005, 2012). Almost all of these studies generally focused on Italy as a nation-state, making use of statistical printed sources essentially compiled in the late 19th century. It is difficult to find similar studies addressing the business organisational heritage of the pre-unitarian states (Schisani and Caiazzo, 2016). Indeed, the lack of standardised historical data on pre-unitarian business systems has provided knowledge about those environments, essentially in the form of historical descriptive analyses generally focused on the social dynamics related to business and financial elites (Dawes, 1988; Finzi et al., 2003; Piluso, 1999).

Specifically, with regard to southern Italy, most of the literature describes the region's financial and business structure as being strongly dependent on the behaviour and interactions of interest groups formed by local and foreign businessmen and merchant bankers operating in Naples (mostly French, Swiss and German) (Caglioti, 2000, 2008; Davis, 1979; Demarco, 1963; Frascani, 1990; Schisani, 2001). These vested interests habitually aimed to take over as much of the lucrative businesses existing at a given moment as they could, at a grave cost to the rest of the community (Schisani, 2001).

2.1. BUSINESS INTERACTIONS IN NAPLES OVER ITALIAN UNIFICATION: RESEARCH QUESTIONS

Moving away from the literature results that are essentially centred on a socio-historical approach, the present study aims to analyse the Neapolitan business structure using new original data concerning the firms and companies (not including individual firms) created or operating in Naples during the 19th century. Relying on new original economic archival sources, this exploratory work investigated how Neapolitan entrepreneurial network structure developed and/or changed at the turn of the Italian political unification period. This study explains these changes by adapting widespread network theories by relying on common well known concepts, such as network centrality measures, brokerage roles, structural holes and homophily behaviours.

The main purpose is to provide new insights on the ownership structures and power geometries that characterised Neapolitan business organisations during the 19th century. Reconstructing and detecting the articulation of inter-firm links by identifying ownership, debt/credit and any kinds of relations documented in the sources, this paper describes the Neapolitan business sectoral structure and the inter-sectoral linkages; moreover it identifies the weight and influence of the relationships between economic sectors and the banking/financial system. Indeed, its main focus is to study the role of finance and its interconnections to the local business network to determine if and how it was central and, if and how it evolved when the arena of power and economic relationships expanded, as Italy became a nation-state.

Toward that end, the following research questions were addressed:

- *How central was the financial sector within the network during the examined period*?

- *What economic activity sectors had a stronger link to finance, over time*?

- *What was the nature of the sectoral connections; were the connections more inter-sectoral or intra-sectoral*?

- *How did the network structure of the financial sector linkages change during the Italian political unification*?

Finally, the general aim of this work is to utilise an interdisciplinary approach and reflect on the capacity of SNA to generate a more solid base for processing and interpreting data in economic history, thereby strengthening historical knowledge of financial-commercial networks encouraged by economic elites, such as bankers and merchants, at any given time.

3. NETWORK MEASURES IN HISTORICAL NETWORKS

One of the most important challenges for historical network researchers is their ability to maintain the methodological rigor of quantitative methods, typical of SNA, and more traditional qualitative approaches, consisting of heuristics, criticism and interpretation aimed at addressing sensitive information about the past (Düring et al., 2011). In most cases, in the historical framework the term network has only been used metaphorically, without reference to any, more or less, systematic information on precise ties between entities. Moreover, in general, it has not been accompanied by the use of any formal network method (Lemercier, 2015).

The latest scholars of the SNA approach in the field of history have also addressed the emergence and the evolution of network structures. Thinking about networks from an evolutionary perspective has become a key strategy for achieving a deeper understanding of both structural changes and the direction of those changes. In particular, in the network paradigm both the entities and the networks in which they are involved can evolve over time. In this context, the term dynamic means that at any fixed point in time, nodes and edges could be introduced or eliminated.

Hence, SNA could allow researchers to study the historical network evolution over time by comparing complete and ego-centred network measures, by revealing the presence of influential actors in terms of their central position and brokerage role, by studying their behaviours (i.e. homophily *vs.* heterophily based on some key-attribute data), and by recognising the presence of structural holes.

In particular, the central position of firms is assessed using degree centrality indices (Freeman, 1978). With directed network data, an actors centrality position is to be either *in-degree* and *out-degree*. Generally speaking, actors that have many links play a prominent role or have high prestige. Thus, many other actors seek

to establish direct links to that prominent actor, and this may indicate the actors importance in the network structure. Actors who have high out-degree centrality are able to exchange links with many others actors. Given the data under analysis, in this paper the high in-degree and/or out-degree centrality of business units is mainly related to links received by actors from other actors related to the purchase of company shares or money transfers or, conversely, actors who purchase other company shares.

The actor betweenness position is assessed by presenting the five brokerage measures (Gould and Fernandez, 1989) in a graph with directional links that consider the sector categories. More specifically, given a triad of units *a*, *b* and *c*, and assuming the path *a*–>*b*–>*c*, where *a* is the source, *b* is the broker and *c* is the destination, the five brokerage roles are: *i) coordinator*, the number of times *b* is a broker and all business units belong to the same sector; *ii) consultant*, the number of times *b* is a broker and the broker belongs to one sector, and the other two business units belong to a different sector; *iii) gatekeeper*, the number of times *b* is a broker and *a* belongs to a different group; *iv) representative*, the number of times *b* is a broker and *c* belongs to a different sector; and *v) liaison*, the number of times *b* is a broker and *a* and *c* belong to a different sector.

Taking into account that utility varies based on an actor's position in the network, some structural holes measures (Burt, 2009) must be considered in order to highlight the ego's brokerage opportunities in an open ego-centred network structure in the absence of relationships among ego's alteri: *i)* the *effective size*, that is the number of alteri that the ego has minus the average number of links that each alter has to the other alteri; *ii)* the *efficiency*, obtained by dividing the effective size by the network size ranging from a minimum of 0, when all ties are redundant, to a maximum of 1 if there are no redundant ties; and *iii)* the *constraint*, that is the extent to which the ego's contacts are redundant.

Furthermore, the propensity of business units to interact with other actors in the same sector (i.e. homophily) is evaluated by computing the $E - I$ index (Krackhardt and Stern, 1988), a measure of group embeddedness at the whole, group and individual levels. Given that I is the number of links within sectors (internal) and E is the number of links between sectors (external), the normalised $E - I$ index is equal to the ratio: $(E - I)/(E + I)$.

4. HISTORICAL DATA SOURCES AND THE IFESMEZ DATASET

The present case study offers wider possibilities for network analysis thanks to original archival sources that are particularly suited to the data requirements of

network analysis thanks to a deeply studied methodology of data collection. Indeed the present paper is based on completely original data related to the economic, business and financial structure of Naples (and its province) between 1812 and 1913. Data were extracted from the IFESMez database[2], a large multi-source relational database that gathers interrelated datasets on economic and socio-political individual and collective actors operating in Southern Italy between 1808 and the 1st post-World War I period (1919).

The structure of the IFESMez database enables users to meet the specific needs of a wider and long-term research project for an in-depth study of Southern Italy's economic system. Created in 2012, and continuously populated by adding new data, this database aims to reconstruct reliable historical information on southern Italy's business structure by providing data obtained from over the course of more than a century, in a period when official printed sources were lacking.

The main source is the Mercantile Courts archival funds (after the 1883 Civil Court), which are available at the Naples State Archive. This primary source allows researchers to collect data from official documents (including memoranda of associations, balance sheets, appointments of directors, etc.) provided to the courts by any types of legal firms (general partnerships, limited partnerships and companies, cooperative firms, etc.) created or/and operating in Naples and its province. Additional data coded from other sources (local, national and international archives, grey literature, publications, etc.) progressively contribute to enlarge and enrich the information contained in the database. These different kinds of sources offer wide possibilities for network analysis in order to explain the patterns of ties, considering their origins (e.g. dependent on legal constraints or on kinship ties, strategically or freely established), their effects, their changes in response to exogenous shocks (like the change of a political regime) and their consequences.

At present, IFESMez contains complete information for approximately 2700 firms – created and/or operating in Naples and its province – and more than 25000 people. The dataset utilised in the present exploratory study was obtained through specific queries enabling the retrieval of the selected records linking business units through all forms of documented relations: shareholding, cross-shareholding, other kinds of ownership ties (mergers and acquisitions), financial relations (debt/credit) and trade relations (business flows). It includes records

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[2]   Enterprises, Finance, Economy and Society in the Mezzogiorno. For more details see: https://www.ifesmez.unina.it

linking 753 business units of any legal type operating in Naples (and its province) between 1812 and 1913.

Different from the usual studies found in the Italian literature, which have mainly collected information from firms' boards and analysed the networks of interlocking directorates, the present study includes data on shareholding from which the direct ownership structure in business sectors can be readily obtained in order to show the importance of primary affiliations in the link between two or more firms/corporations within the Neapolitan business structure.

As in any network study, the starting point has been to carefully define the relationships among actors. In light of this, all inter-firm relations have been coded in terms of active roles: who is doing something to whom (which firm/company is a shareholder in other firms/companies); which firm/company is a creditor of other firms/companies; which firm/company incorporates other firms/companies; and which firm/company is a commercial or financial representative of other firms/companies.

Additional attribute data, relative to specific actors' fields of activity, supplement the relational data in order to analyse the composition of the Neapolitan business sectoral structure, to detect inter-sectoral linkages and to identify areas in the network that are more densely connected. To achieve this, the business units have been uniformed and then coded into seven categories, the boundaries of which have involved implicit decisions on the basis of evidence reported in the literature:

- *Bank,* small private deposit banks whose purpose is unknown, commercial banks, cooperative banks, saving banks, saving and loan associations, mutual savings banks;

- *Finance,* financial companies, insurances, merchant-bankers mostly operating in financial markets and as financial advisors, 'haute banque', financial agents and brokers, commodity contracts dealers, financial intermediaries, financial representatives, mixed banks;

- *Industry,* craftworks, manufacturing, heavy and light industry, mines, transport companies, construction; investment banks, land credit banks, real estate credit, real estate companies, portfolio management, miscellaneous financial activities;

- *Public utilities,* gas, electricity and water suppliers, railways, tramways, navigation, telecommunications and other minor services;

- *Trade,* retail and wholesale firms for domestic and foreign goods trading, trade agencies;

- *Other sectors,* various credit associations;

- *Information not available – Not available,* generally, partnerships for which

documents do not specify any information and which are generally identified under the partners' names.

Table 1 shows the frequency distribution of the business units based on these sector categories before and after the Italian political unification.

Tab. 1: Number of business units involved by the actors' sector and kinds of network links before (< 1861) and after (≥ 1861) the Italian political unification

	< 1861	≥ 1861
Actors' sector	# Units	# Units
Bank	6	69
Finance	115	255
Industry	39	97
Public Utilities	7	43
Trade	31	67
Other Sectors	0	7
Not available	25	65
Type of link	# Edges	# Edges
All	147	647
Anagraphical	35	50
Commercial	5	31
Financial	8	60
Property	99	484

4.1 DATA PRE-TREATMENT AND NETWORK DEFINITION

As previously mentioned, the study's working dataset includes a total of 753 business units operating in Naples between 1812 and 1913. Demographic and network data were collected for each business unit in the dataset. For the demographic data, the dataset includes the business start and end date, the first reading date found in the archives, the firms' sector (Table 1) and the location of the firms' headquarters. The business start-of-activity and end-of-activity date are aggregated in two classes: before and after Italian political unification. The same approach was used for the variable date of link creation. For the definition of network data, the dataset includes information about the firm names of the senders and recipients, the date of the link creation and the kind of link activated between two units. The relationships among units were aggregated based on the following four categories:
• *Anagraphical* activities, including changes in the corporate structure, such as a

company name change, resumption of business activities, etc.;

- *Commercial* activities, including acquisition of new agencies, representation activities, acquisition of new concessions and contracts (supplier, manager, contractor, subcontractor);
- *Financial* activities, including banking and financial services in general, such as credit opening, debt settlement and bonding;
- *Ownership* activities, including subsidiary companies, firms' shares or social assets, new acquisitions or mergers of companies.

More formally, let $\mathcal{N} = \{1,2,\ldots,n\}$ be the set of n business actors, $\mathcal{L}$ is the links between pairs of actors showing all kinds of relationships and $\mathbf{G}(n \times n)$ is the valued network graph describing the directed adjacency matrix, with elements a_{ij} = 1 if $i \in \mathcal{N}$ send a link to $j \in \mathcal{N}$, 0 otherwise. In order to highlight the structural changes that occurred over time, two separate adjacency matrices were derived from $\mathbf{G}$, considering the threshold year of 1861. Each of the two temporal slides can be described as a graph $G_T(N,L,T)$, in which t $in \mathcal{T}$ is the set of ordered time points, $n \in \mathcal{N}$ is the set of actors, and $l \in \mathcal{L}$ is the set of links changing over time.

The whole network is comprised of a total of 772 links (weighted arcs) describing a valued direct one-mode network. Specifically, the network before the Italian political unification is comprised of 223 units and 147 weighted arcs, while the network after unification includes 603 units and 647 weighted arcs (Table 2). Only 22 arcs were found among the 73 units present in both time periods. Thus, 150 firms ended their business activity before 1861. The other 530 units that were involved in the network after 1861 are different from those of the previous period. Moving from the first temporal network to the second temporal network, the rate of substitution of business units is 253.3%.[3] As seen in Table 1, most of the links among business units involved in the two temporal networks are related to property activities.

5. NETWORK RESULTS

In this paper, the analytical strategy that was adopted to analyse the two temporal networks is mainly based on graphs' visualisation using the IGRAPH package of R software (Csardi and Nepusz, 2006) and statistical network measures computed by Ucinet software (Borgatti et al., 2002) to explore and identify the temporal

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[3] This rate was computed by considering the number of units after 1861 (530) out of the number of units before 1861 (150), excluding the number of units present in both periods (73).

changes in the actor-level position in the two network structures before and after the Italian political unification period.

Figures 1a, b displays the valued networks showing the relationships among business units in the two periods considered. The graphs are enriched by weighting the actor's size through the betweenness centrality index of each business unit.

Some whole network measures are provided for each temporal network considering the dichotomised version of G_T by all link values greater than 1 to be equal to 1 (Table 2). The number of business units involved in the two historical periods and the links among units notably increased over time, increasing from 223 units and 146 binary arcs before 1861 to 603 units and 606 binary arcs after 1861. The density values are low in both periods, and the network's centralisation values are around 0, showing the absence of actors playing a very strong central role. For the network before the 1861, the cohesive subgroup analysis shows the presence of 51 components of at least two actors, a giant component with 28.70% of units and two weak cliques of three actors (disregarding the direction of links).

For the network after the 1861, the analysis shows 81 components of at least two actors, a giant component with 60.20% of units and 42 weak cliques.

Tab. 2: Network measures of business and financial network in Naples before (< 1861) and after the Italian political unification ≥ 1861.

|	< 1861	≥ 1861
# units	223	603
# arcs (binary)	146	606
# arcs (weighted)	147	647
Density	0.003	0.002
Average degree	0.66	1.05
$E – I$ index	-0.32	0.26
Centralization (In)	0.065	0.005
Centralization (Out)	0.024	0.002
# components (weak)	51	81
Giant component (%)	28.70%	60.20%
Cliques (weak)	2	42
$E – I$ index by actor sector		
Bank	0.43	0.65
Finance	-0.52	-0.08
Industry	-0.30	0.48
Public utilities	0.67	0.45
Trade	-0.20	0.44
Other sector		1.00
Not available	0.20	0.88

[a]

[b]
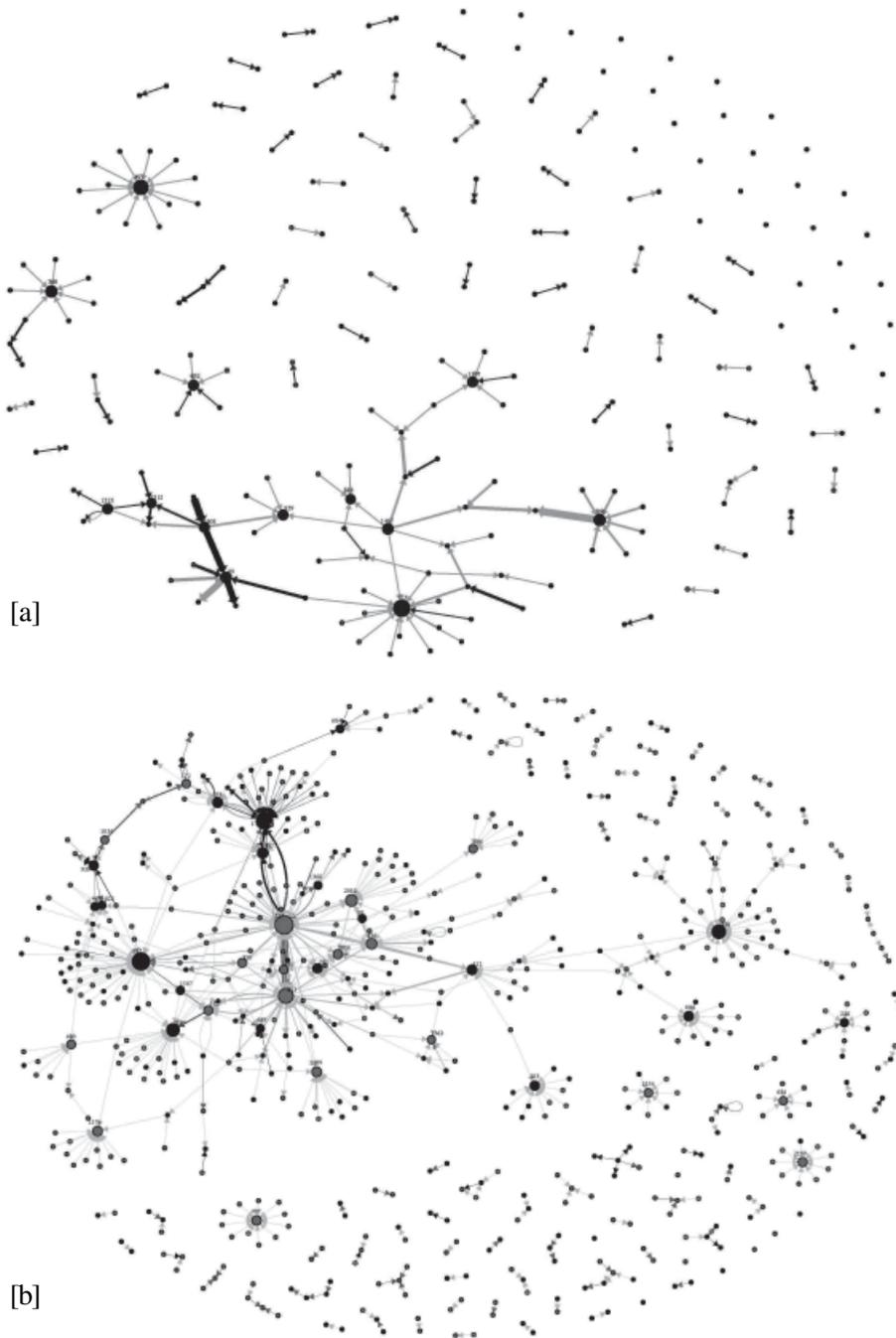
Fig. 1: Business and financial network in Naples a) before and b) after the Italian political unification. Actor's size = Betweenness centrality index

5.1 THE BUSINESS UNITS WITH CENTRAL ROLES

The business units with high in-degree and/or out-degree values are primarily involved in financial and property activities (Table 3). In particular, before 1861, the one insurance company, the local *Società Napoletana di Assicurazioni,* has the highest in-degree; this means that several business units purchased this company's shares. Among the firms involved in the network before Italian political unification, other companies with a high in-degree value are the public utility local companies *Compagnia di illuminazione a gas della città di Napoli, Banca Fruttuaria nel Regno delle due Sicilie,* and *Società Anonima di Assicurazioni marittime.*

 After 1861, four local units of different sectors *(Società Italiana per le Strade Ferrate del Mediterraneo, Banca Meridionale, Società per il Risanamento di Napoli,* and *Società generale Napoletana di credito e costruzioni)* show a high in-degree based on the property activities; one public utilities company, *Compagnie Napolitaine d'Éclairage et de Chauffage par le gaz,* received links from other units in terms of financial activities, including banking and financial services, such as credit opening, debt settlement and bonding.

 The sector categories were considered to examine the brokerage roles of the business units in the two periods (Table 4). By counting the number of times that each actor plays each of the five roles in the whole directed graphs, it is important to note that, before 1861, only three actors in the finance sector lie on the directed path between two others actors as a representative *(Società di Assicurazioni Diverse,* and *Banca Fruttuaria nel Regno delle due Sicilie)* or a coordinator (*Meuricoffre, Sorvillo e Compagni*) or a liason (*Società di Assicurazioni Diverse*). From 1861 onward, the broker roles are mainly covered as a coordinator, representative, and liaison by the *Banca Napoletana* (*Società di Credito Meridionale since 1885*)[4], as a coordinator by the *Società generale Napoletana di credito e costruzioni,* as a gatekeeper by the *Compagnie Napolitaine d'Éclairage et de Chauffage par le gaz,* and as a representative by the *Cassa Marittima di Napoli.*

 The units occupying structurally different positions within the two networks and having the potential to bridge structural holes changed in the two periods (Table 5). Before 1861, one actor from the finance sector (*Società Napolitana di Assi-*

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[4] Note that the two nodes Banca Napoletana –code 211 – and *Società di Credito Meridionale* –code 227 – are related to the same entity. However, for historical reasons, they have been treated separately in the network analysis. In fact, the *Banca Napoletana* changed its name in *Società di Credito Meridionale* in 1885, and at the same time strongly increasing its equity capital. In this way, it became a very different entity by attracting very large subscribers and, in turn, by establishing ownership relationships with many of the biggest companies of the time, formed thanks to the *Risanamento Law (*1885).

Tab. 3: In-degree and out-degree (absolute and normalised values) of the more relevant business units before and after the Italian unification period

CODE	LABEL	SECTOR	Outdegree	Indegree	nOutdegree	nIndegree
<1861						
772	Società Napolitana di Assicurazioni	FINANCE	0	15	0.00	0.07
≥1861						
985	Società Italiana per le Strade Ferrate del Mediterraneo	PUBLIC_UTILITIES	0	45	0.00	0.07
227	Banca Napoletana (Società di Credito Meridionale)	FINANCE	11	33	0.02	0.05
310	Banca Meridionale	BANK	0	28	0.00	0.05
2129	Società per il Risanamento di Napoli	INDUSTRY	0	25	0.00	0.04
179	Compagnie Napolitaine d'Éclairage et de Chauffage par le gaz	PUBLIC_UTILITIES	3	23	0.00	0.04
2012	Società generale Napoletana di credito e costruzioni	FINANCE	2	18	0.00	0.03
211	Società di Credito Meridionale	FINANCE	15	15	0.02	0.02

Tab. 4: Brokerage roles of the more relevant business units before and after the Italian unification period

CODE	LABEL	SECTOR	Coordinator	Gatekeeper	Representative	Consultant	Liaison	Total
<1861								
99	Società di Assicurazioni Diverse	FINANCE	0	0	4	0	4	8
896	Banca Fruttuaria nel Regno delle due Sicilie	FINANCE	0	0	6	0	0	6
1308	Meuricoffre, Sorvillo e Compagni (1817)	FINANCE	4	0	0	0	0	4
≥1861								
227	Banca Napoletana (Società di Credito Meridionale)	FINANCE	91	28	167	10	46	342
211	Società di Credito Meridionale	FINANCE	21	20	90	22	62	215
179	Compagnie Napolitaine d'Éclairage et de Chauffage par le gaz	PUBLIC_UTILITIES	3	41	2	3	18	67
436	Cassa Marittima di Napoli	FINANCE	8	1	21	2	2	34
2012	Società generale Napoletana di credito e costruzioni	FINANCE	29	2	0	0	0	31

Tab. 5: Structural roles measures of the more relevant business units before and after the Italian unification period

CODE	LABEL	SECTOR	Effective size	Efficiency	Constraint
< 1861					
772	Società Napolitana di Assicurazioni	FINANCE	15.00	1.00	0.07
896	Banca Fruttuaria nel Regno delle due Sicilie	FINANCE	7.00	1.00	0.14
360	Compagnia di illuminazione a gas della città di Napoli (detta Compagnie Pouchain)	PUBLIC_UTILITIES	7.00	1.00	0.14
99	Società di Assicurazioni Diverse	FINANCE	6.00	1.00	0.17
1467	Gennaro Giuseppe Volpicelli q.m Costantino	FINANCE	6.00	1.00	0.17
1167	Società Anonima di Assicurazioni marittime	FINANCE	5.00	1.00	0.20
959	Compagnia Commerciale di Assicurazioni	FINANCE	5.00	1.00	0.20
832	Binet e Compagni	FINANCE	5.00	1.00	0.20
≥ 1861					
985	Società Italiana per le Strade Ferrate del Mediterraneo	PUBLIC_UTILITIES	44.64	0.99	0.03
227	Banca Napoletana (Società di Credito Meridionale)	FINANCE	42.56	0.97	0.04
211	Società di Credito Meridionale	FINANCE	28.80	0.96	0.06
310	Banca Meridionale	BANK	28.00	1.00	0.04
179	Compagnie Napolitaine d'Éclairage et de Chauffage par le gaz	PUBLIC_UTILITIES	24.77	0.99	0.05
2129	Società pel Risanamento di Napoli	INDUSTRY	24.76	0.99	0.05
2012	Società generale Napoletana di credito e costuzioni	FINANCE	19.00	0.95	0.07
436	Cassa Marittima di Napoli	FINANCE	14.50	0.91	0.10
537	Società Generale per l'Illuminazione (a gas fino al 1886) (SGI)	PUBLIC_UTILITIES	12.88	0.99	0.08
412	Banca Popolare di Napoli	BANK	12.85	0.99	0.08
664	Banca Agricola Commerciale Napoletana	BANK	12.00	1.00	0.08
2189	Società di assicurazioni marittime, fluviali e terrestri	FINANCE	12.00	1.00	0.08
2176	Banca Italo Germanica	FINANCE	12.00	1.00	0.08
283	Banca Commerciale di Torre Annunziata	BANK	11.00	1.00	0.09

curazioni), and one from the public utilities sector (*Compagnia di illuminazione a gas della città di Napoli*) have efficiency values equal to 1 and low values for constraint index. This indicates that all their contacts are non-redundant. After 1861, new actors emerged having a dominant position in the network. Business entities from all sectors have larger effective size and efficiency (scoring around 1) val ues, these include *Società Italiana per le Strade Ferrate del Mediterraneo, Banca Napoletana (Società di Credito Meridionale since 1885),* and *Banca Meridionale.*

   This change occurred as the Neapolitan economic context evolved. In the poor local economic structure before 1861, local and foreign private bankers (including *Meuricoffre and Sorvillo*) represented the ruling *financial oligarchy* (Davis, 1979, p. 46) whose profit opportunities were strongly linked to the insurance sector. In turn, the most important insurance companies (especially *Società di Assicurazioni Diverse*), were a crossroads of de-specialising their investment interests from credit to trade and financial intermediation (Ostuni, 1986). These concentrated interests in finance, and its related services, explain why the financial sector is the most interconnected within the network (Figure 3a), since the majority of relations resulted largely from intra-sectoral connections. In the postunitarian decades, the direct ownership distribution among firms and companies is more complex.

   After Italian political unification, the Naples business network highlights less concentrated lines of communication and diversified flows of resources across business sectors (Figure 3b). In this period, the network structure evolved based on both national institutional changes and the start of the region's economic growth process. The wider infrastructure plan (railway companies, public utilities, etc.), the creation of banks of credit mobilising (including the *Società di Credito Meridionale*), the widespread diffusion of cooperative banks (such as the *Banca Meridionale*) and, above all, the liberalisation of joint stock companies explain the structuring of cross-shareholding and the increasing complexity of ownership relations and, thus, the positions and the roles of the mentioned companies.

   Some caveats are necessary for a correct interpretation of the network results described above. For example, network data displayed in the form of ego-centred subgraphs can provide important information about the equity networks originated by large companies in which the company itself could either be an active or passive actor with regard to ownership relations. Indeed, a company could alternatively be:

- The target of inter-corporate shareholding relations, especially in the case of cooperative banks (see ego-centred network 1 related to the *Banca Meridionale* in Figure 2a) or large commercial banks or big public-utilities companies;

- An active actor directly subscribing other companies' shares, mainly in the case of large commercial or investment banks or big public-utilities companies or

Fig. 2: Three examples of ego-centred network graphs: a) *Banca Meridionale* **–code 310, b)** *Società Italiana per le Strade Ferrate del Mediterraneo* **–code 985, and c)** *Compagnie Napolitaine d'Éclairage et de Chauffage par le gaz* **–code 179.**

trade companies, often activating cross-shareholding relations (both passive and active roles) (ego-centred network 2 related to the *Società Italiana per le Strade Ferrate del Mediterraneo* in Figure 2b).

The same could be true for lender/borrower relations between firms: directed ego-centred network graphs could better depict evidence of the giver/receiver relations by revealing the extent to which an examined firm had access to external financing (see ego-centred network 3 related to the *Compagnie Napolitaine d'Éclairage et de Chauffage par le gaz* in Figure 2c) or the multifaceted credit activities of an investment bank.

5.2 RELATIONS AMONG THE FINANCE AND BUSINESS SECTORS

Actors are embedded in groups based on their sector affiliation. To understand the extent to which these groups describe the interaction patterns of the business units that fall within them, group-external and group-internal ties were computed within the $E – I$ index neglecting the direction of the links. The resulting $E – I$ index values at the whole network and groups levels (Table 2) show relevant changes before and after the Italian political unification period. The network as a whole is characterised by its sub-populations' tendency toward closure before 1861 (-0.32) and toward openness after 1861 (0.26). With respect to the behaviour of each sector (Table 2), it was noted that the public utilities sector and banks appear to be somewhat more likely to have out-group ties than either of the other sectors in both periods (0.67 and 0.45, respectively). In contrast, the industry and trade sectors changed their tendency to interact with members of the same sector before 1861 (-0.30 and -0.20, respectively) and with members of different sectors after 1861 (0.48 and 0.44, respectively). The finance sector showed a high propensity to have ties within its sector before 1861 (-0.52) and to balance its group-external and group-internal ties after 1861 (-0.08).

As seen in the graphical representation (i.e. circlesize graph layout) in Figure 3, these changes in the inter-linked relationships among sectors before and after Italian political unification are described by the size of the circle in which the links within actors in the same sector and outside the sector are shown by shades of gray.

Different behaviours among actors in terms of their propensity to have in-group and out-group ties were also found (Table 6). Some actors from the finance sector tended toward closure only after 1861 (*Società generale Napoletana di credito e costruzioni,* -0.80), having a prevalence of ties within their own group. Instead, banks either exhibited a tendency toward the total presence ($E – I$ index equal to 1 for *Banca Agricola Commerciale Napoletana, Banca Commerciale di Torre Annunziata,* and *Banca Meridionale*) or a prevalence for creating ties outside

their groups (*Banca Popolare di Napoli,* 0.85). A similar openness is shown by two companies in the public utilities sector, *Società Italiana per le Strade Ferrate del Mediterraneo* (0.96) and *Compagnie Napolitaine d'Éclairage et de Chauffage par le gaz* (0.76), and by the firm *Società per il Risanamento di Napoli* (0.76).

Tab. 6: *E – I* **index of the relevant business units before and after the Italian unification period**

CODE	LABEL	SECTOR	INTERNAL	EXTERNAL	TOTAL	*E-I*
< 1861						
1308	Meuricoffre, Sorvillo e Compagni (1817)	FINANCE	5	0	5	-1.00
1312	Bourguignon, Falconnet, Sorvillo e Compagni	FINANCE	4	0	4	-1.00
1313	Falconnet e C.	FINANCE	4	0	4	-1.00
896	Banca Fruttuaria nel Regno delle due Sicilie	FINANCE	6	1	7	-0.71
1467	Gennaro Giuseppe Volpicelli q.m Costantino	FINANCE	5	1	6	-0.67
772	Società Napolitana di Assicurazioni	FINANCE	9	6	15	-0.20
≥ 1861						
2012	Società generale Napoletana di credito e costuzioni	FINANCE	18	2	20	-0.80
436	Cassa Marittima di Napoli	FINANCE	12	4	16	-0.50
2176	Banca Italo Germanica	FINANCE	9	3	12	-0.50
227	Banca Napoletana (Società di Credito Meridionale)	FINANCE	29	15	44	-0.32
2189	Società di assicurazioni marittime, fluviali e terrestri)	FINANCE	6	6	12	0.00
211	Società di Credito Meridionale	FINANCE	11	19	30	0.27
537	Società Generale per l'Illuminazione (a gas fino al 1886) (SGI)	PUBLIC_UTILITIES	3	10	13	0.54
179	Compagnie Napolitained'Éclairage et de Chauffage par le gaz	PUBLIC_UTILITIES	3	22	25	0.76
2129	Società pel Risanamento di Napoli	INDUSTRY	3	22	25	0.76
412	Banca Popolare di Napoli	BANK	1	12	13	0.85
985	Società Italiana per le Strade Ferrate	PUBLIC_UTILITIES	1	44	45	0.96
310	Banca Meridionale	BANK	0	28	28	1.00
664	Banca Agricola Commerciale Napoletana	BANK	0	12	12	1.00
283	Banca Commerciale di Torre Annunziata	BANK	0	11	11	1.00

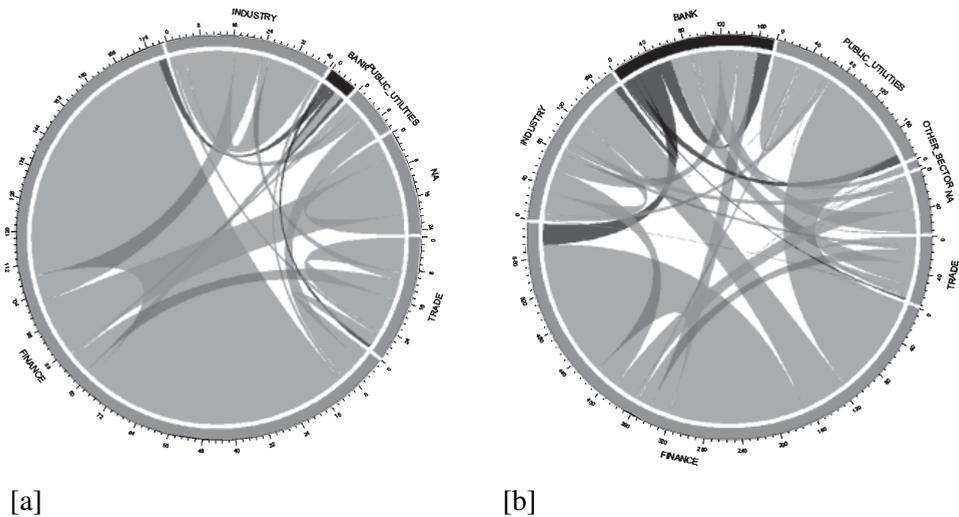[a]   [b]

Fig. 3: Business units' relationships in Naples a) before and b) after the Italian political unification according to the sector of business units.

6. CONCLUSIONS

The present contribution addresses the issue of studying the relationships among Neapolitan business units during two main time intervals, before and after the Italian political unification (1861). Revisiting the research questions, the paper provides some interesting answers. The network measures provide evidence for the central role that the financial sector played in both of the examined periods. Furthermore, it highlights the changes in the way in which the finance sector was interconnected with other business sectors, showing a higher propensity towards intra-sectoral ties before 1861 and a tendency to balance group-external and group-internal ties after 1861. These changes in inter-link relations among sectors before and after Italian political unification are coherent with the evolution of the local economic structure over the period under analysis, as characterised by changes in the governmental and commercial rules, and the evolution of forms of business and credit organizations.

Thanks to new original data, revealing the patterns of relationships among business units, and the SNA approach, this exploratory analysis reveals some other interesting and fresh aspects. This enabled the study to: *i*) focus on the structure of the Neapolitan business environment and its changes over time; *ii*) visualise and describe the lines of communication and flows of resources across business sectors and the Neapolitan business network as a whole; and *iii*) appraise, given the

prominence of ownership ties, the degree of finance control "in size, power, scope of responsibility, and freedom of action" (Marchand, 1998, p. 9) within the Neapolitan business network in the 19th century.

Until now, the prominent role of finance within the business networks in Naples during the 19th century has always been described in the literature as a result of social relations between the local and foreign actors operating in that city. With regard to Italy as a nation-state, most previous studies tended to highlight the finance-industry relationship by analysing interlocking directorates. Thanks to massive data collection (and cleaning) on shareholding (secondary owners, i.e. companies and firms), the construction of relational data and the application of SNA tools, this present study provides new insights on the direct ownership structure of Neapolitan business units, assessing the role of finance in a decidedly different perspective in comparison to the existing literature.

This study presents something that has not been done before, and it paves the way for the analysis of a series of issues worthy of further sharp and effective historical investigation on the Neapolitan economic and financial structure at both the micro-level and the macro-level.

Future research tracks should aim to further illuminate network dynamics in order to identify groups in the network structure by means of clustering and blockmodeling techniques (Doreian et al., 2005) and to provide a deep analysis of the role played by strategic core actors in the network. Future work should also analyse the networking effects in terms of the information asymmetries and structural consequences of the possible creation of market entry barriers.

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