Solidarity as a Byproduct of Professional Collaboration: Social Support and Trust in a Coworking Space

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Abstract

This article investigates solidarity arising from economic exchange, by studying a multiplex network of collaboration, trust and social support. After a qualitative pre-study, we performed a full-network survey on a group of independent professionals sharing a coworking space and occasionally collaborating with each other. By running multivariate Exponential Random Graph Models, we showed that successful collaboration might not determine expectations of social support. However, these relationships were related to business-based trust ties, which were predicted by collaboration. Our results suggest that solidarity can emerge as a byproduct of peer economic exchange when trust mediates between professional relationships and expressive ties.

Keywords: Solidarity; Social support; Trust; Collaboration; Multivariate ERGM

1 Introduction

The relationship between economic exchange and solidarity is still a subject of debate in social sciences. On the one hand, some scholars suggest that successful economic interactions structured as "negotiated exchanges" (Blau 1964; Emerson 1981; Molm 2003) can generate solidarity, provided that joint

bargaining promotes coordination of common interests between partners. The perception of cooperative attitudes would confer expressive value to the relationship (Lawler 2001; Thye, Yoon, and Lawler 2002; Lawler, Thye, and Yoon 2008; Kuwabara 2011). On the other hand, other scholars argue that economic exchanges cannot easily generate solidarity, because negotiated agreements binding subjects' interaction tend to exacerbate conflict between their mutual interests. Moreover, by preventing individuals from mutually exploiting each other, an economic exchange would not allow partners to show their trustworthiness, thereby hindering the development of mutual trust, a crucial component of solidarity (Molm, Collett, and Schaefer 2007; Molm, Schaefer, and Collett 2009; Molm, Takahashi, and Peterson 2000; Molm 2003; Molm, Collett, and Schaefer 2006).

This paper aims to contribute to this debate by empirically studying the effect of economic exchange on expectations of social support in a group of ICT professionals working as independent freelancers, while sharing the same coworking space (DeGuzman and Tang 2011). . Our study was conducted in 'Talent Garden Brescia' (TaG), a coworking space located in Brescia, Northwestern Italy. TaG was composed of 29 'residents', who were mostly freelancers and small company associates. These included, for instance, software developers, web designers, photographers, graphic artists, and video makers, who worked on commissioned and subcontracted orders by external companies, such as start-ups, private companies or public administration. Mostly due to technological and business complementarity, they relied extensively on collaborations by formally and informally subcontracting activities to other residents.

This setting provided us with the opportunity to observe self-organized economic exchanges among peers who were free to select their partners outside the constraints of a formal organizational or hierarchical structure. Furthermore, due to the volatility of market demand by external clients and their moderate returns, these professionals engaged in multiple overlapping activities at the same time, increasing the likelihood of opportunistic behaviour against the sub-contractors (e.g., time delay in deliveries, quality shrinking). Therefore, this setting also provided us with the opportunity to consider economic exchanges where partners had to face the risk of being exploited. Finally, the absence of a formal organization allowed us to study expectations of social support among subjects who did not share any group-related collective interest.

We analyzed the multiplex network of professional collaborations, business-related trust, and expectations of social support among these professionals. We looked at social support – defined as the perceived or actual provision of material or emotional resources by others (Lin, Dean, and Ensel 1982) – as one of the instances of "solidary behaviour" at a dyadic level (Lindenberg 1998; see also Flache and Hegselmann 1999a, 1999b). It is interesting to note here that Lindenberg (1998, p. 63) claimed that 'solidarity' is a "behavioural

pattern *across* five different situations", i.e. "*common good*", "*sharing*", "*need*", "*breach temptation*", and "*mishap*". Here, we looked only at a situation where an actor expects support from others in a situation of *need*. . As a proxy for economic exchange, we analyzed professional collaboration between partners.

At the same time, we also analyzed the *structural logic* (Markovsky, Willer, and Patton 1988; Rank, Robins, and Pattison 2010) of the network of expected social support emerging among collaborating partners. To do so, we assessed the impact of reciprocity (Wasserman and Faust 1994) and closure (Davis 1970; Holland and Leinhardt 1971) independent of the multiplex effects of collaboration and trust.

The rest of the paper is organized as follows. The following section presents our research background, while Section 3 describes data collection and analysis. Section 4 discusses our results, while the final section summarizes the main findings and discusses limitations and prospects.

2 Research Background

The importance of the "embeddedness" of an economy within social structures is a key point of sociological analysis (Granovetter 1985). Social network research has shown that the control and exchange of social resources, such as advice or information, affect the performance of entrepreneurs and organizations through informal interpersonal relationships (e.g., Krackhardt 1992; Ingram and Roberts 2000; Lazega 2001; Brass et al. 2004; Rank, Robins, and Pattison 2010; Brailly et al. 2015), which often entail trust and support (Coleman 1988; Coleman 1990; Granovetter 2002). Though it is acknowledged that "most forms of social capital are created or destroyed as a byproduct of other activities" (Coleman 1990, p. 317), we know less about the structural conditions under which instrumental relations, such as professional collaboration, develop into expressive ties (Ibarra 1992), such as social support.

Social support mainly encompasses a *material* (or tangible) along with an *emotional* (or intangible) component, according to the nature of the resources which one is asked to mobilize in order to help the recipient (van der Poel 1993; see also Lin, Dean, and Ensel 1982). Research on social support has mainly focused on actual personal support networks (Hall and Wellman 1985), by identifying certain regularities in the determinants of support relationships along individual lines. While kinship members are usually considered more important as a source of emotional support, workmates play a prominent role in the provision of material support (Wellman and Wortley 1989, 1990; Wellman et al. 2001).

In this study, expectations of social support are looked at as instances of expected "solidary behaviour" (Lindenberg 1998). This was suggested by past works in which solidarity was studied through the investigation of social support relationships. For instance, Flache and Hegselmann (1999a, 1999b)

studied the emergence of "solidarity networks" by simulating the exchange of "support" among heterogeneously motivated individuals. Moreover, Uehara (1990) analyzed the structural logic of solidarity by conducting an ethnography of the mobilization of support networks in a group of low-income African-American women in cases of job loss.

One of the most important facets of solidary behaviour is that its scope goes beyond one's kinship or proximate social circle. More precisely, new social support relationships can be established between two individuals who were previously connected by other social relationships. Dyadic exchange relations provide individuals with opportunities to develop beliefs about each other that may trigger the change of that relation into a different one, or to develop new relations of different nature (Emerson 1976; Molm and Cook 1995). Following Granovetter's claim that "[c]ontinuing economic relations often become overlaid with social content that carries strong expectations of trust" (1985, p. 490), we argue that expectations of social support between two otherwise unrelated individuals might arise as the byproduct of an economic exchange relationship between them.

Exchange theorists (Homans 1974 [1961]; Blau 1964; Emerson 1976; Molm and Cook 1995) have provided a sound conceptualization of *economic exchange* as a specialized form of social exchange (Homans 1974 [1961]), which is often referred to as *negotiated exchange* (Blau 1964; Lawler 2001; Molm 2003). In this conceptualization, economic exchange between two partners is defined as a bilateral transfer of resources which benefits both, upon a jointly negotiated agreement. The benefits yielded to both partners occur as two paired events, although the agreement is reached through a joint bargaining process. The terms of the agreement can be either binding or non-binding (Molm, Schaefer, and Collett 2009; Kuwabara 2011).

Experimental research in social psychology has provided conflicting evidence on the effects of economic exchange on solidarity (Molm, Takahashi, and Peterson 2000; Thye, Yoon, and Lawler 2002; Molm, Collett, and Schaefer 2007; Barrera 2007; Lawler, Thye, and Yoon 2008; Molm, Schaefer, and Collett 2009; Kuwabara 2011). Some scholars suggest that economic exchange is more likely to prevent the emergence of solidarity than non-economic forms of exchange. (see Molm 2010 for a comprehensive account). The joint character of the decision-making process inherent in the negotiating activity and bilateral transfer of benefits during transactions, while providing room for cooperation, may also exacerbate at the same time the salience of conflict between the two partners' interests (Molm, Collett, and Schaefer 2006). First, the bilateral structure of exchange heightens the perception of competition between partners, who can frame splitting benefits as a zero-sum game. Secondly, the instrumental and strategic nature of other partners' commitment is made explicit by constraining exchange within the terms of a negotiated agreement (Molm 2003; Molm, Collett, and Schaefer 2007). Finally, the most relevant point is that the act of establishing an agreement limits the exchange

partners' opportunity to form beliefs about each other's trustworthiness, thus preventing the generation of trust. More precisely, even in case of a successful exchange, the existence of an agreement designed to neutralize structural risk would make an exchange partner attribute the cooperative behaviour of the other to the incentives or sanctions provided by the agreement terms, rather than to the partner's benevolence. (Molm, Takahashi, and Peterson 2000; Molm 2003; Molm, Collett, and Schaefer 2007).

Therefore, the risk of being exploited is a necessary condition for this kind of cognition-based trust (McAllister 1995) to develop within an exchange relation. This is because it provides individuals with the opportunity to prove themselves to be trustworthy (Gambetta 1988; Hardin 2002; see also Kollock 1994; Yamagishi, Cook, and Watabe 1998). If subjects succeed in finding an agreement, trust is not particularly necessary for a positive outcome, as they can rely on assurance provided by the agreement (Yamagishi and Yamagishi 1994; Malhotra and Murnighan 2002). Instead, this kind of cognition-based trust would arise if one could believe that an exchange partner would not exploit him/her even if he/she had the opportunity to do so.

Nonetheless, other studies suggest that the structure of joint negotiation entailed by economic exchanges generates solidarity between the partners. This is achieved through a cognitive mechanism, which allows them to attribute the positive outcomes to themselves and their relationships as a unit (see Thye, Yoon, and Lawler 2002 for a review; see also Lawler, Thye, and Yoon 2008). First, Lawler, Thye, and Yoon (2008) showed that the character of "jointness" entailed by bargaining activity promotes coordination and the partners' collective responsibility, which eventually increases the chances to reach an agreement. In these cases, the benefit of exchange can trigger positive emotions that individuals tend to link to collective responsibility. The relationship in itself is made more important by the task-interdependence of the negotiating process, which makes individual contributions difficult to separate (Lawler 2001). However, laboratory experiments have found conflicting evidence of the effects of economic exchange on solidarity (Lawler, Thye, and Yoon 2008; Molm, Collett, and Schaefer 2007).

Other laboratory experiments have questioned the negative effect of economic exchange on trust, by providing more flexible versions of the negotiated exchange model. For instance, Barrera (2007) has shown that repeated economic exchange generates trust between subjects with equal distribution of resources. However, it is unclear whether this is due to learning a partner's trustworthiness or to personal characteristics. By loosening the terms of agreement between partners, Molm, Schaefer, and Collett (2009) showed that economic exchanges based on *non-binding* agreements can successfully generate trust, as partners can prove their trustworthiness to each other. However, the higher risk of opportunistic behaviour undermines the likelihood of success of such exchanges. Finally, Kuwabara (2011) suggests that the structure of joint negotiation underlying economic exchange may either gen-

erate solidarity or exacerbate conflict depending on contextual factors. More precisely, varying levels of perceptions of risk-taking, conflict and expressive value entailed by various forms of economic exchanges yield different results in terms of trust and solidarity.

Our aim here is to empirically test the effect of negotiated exchanges based on non-binding agreements, such as collaborations between independent professionals, on expectations of social support, as a potential behavioural display of solidarity at a dyadic level. The peculiarity of our empirical setting allowed us to look at these aspects in detail. On the one hand, we examined a group of independent professionals who were all subject to uncertainty (e.g., moderate revenues and demand volatility). In order to cope with market uncertainty, they could benefit from informal coordination, self-organization and complementarity with other professionals. On the other hand, under time and client pressures, informally sub-contracting or collaborating with other residents could be risky as even only a minimal time delay or low quality in product or service delivering imposed by a partner could disappoint the final client. In this respect, we also wanted to understand the role of trust in the formation of expectations of social support.

Here, we hypothesized that where there is no hierarchical structure or formal organization providing top-down incentives, engaging in a professional collaboration among peers is not sufficient alone to develop expectations of social support. However, if a trust relationship develops between partners of an economic exchange, this is enough to develop expectations of social support.

Thus, assuming a group of peers who are autonomous in establishing collaboration relationships and selecting their partners, we formulated the following hypotheses:

> *Hypothesis 1*: There is no net association between successful collaboration and expectations of social support.
>
> *Hypothesis 2*: There is a positive association between business-related trust and expectations of social support.

3 Research Design and Method

In order to test our hypotheses, we conducted a full-network study on a group of 29 independent professionals sharing the same 'coworking space'. Our empirical strategy included the collection of relational and individual survey data on the entire population.

3.1 Empirical setting

Coworking spaces are office-like working environments where freelancers, entrepreneurs, or employees of small companies are allowed to pursue in-

dependent activities while sharing the same working space. Members of a coworking space usually get access to self-managed goods (e.g., personal desk, mailbox) and collective goods and services (DeGuzman and Tang 2011).

It is important to note that, since they mostly work as freelancers, members of a coworking space do not usually share any collective economic interest. Moreover, unlike employees in a company, members of a coworking space are not embedded in any formal organizational structure. Thus, the selection of collaboration partners is by no means related to any superimposed directive. Finally, the absence of any hierarchy makes members of a coworking space peers to each other. Thus, studying a coworking space allows us to disentangle the effects of professional collaboration on trust and expectations of social support from confounding factors of an institutional or organizational nature.

As a suitable case, we collected data on the whole population of TaG, a coworking space located in Brescia, Northwestern Italy. The lack of a shared collective identity allowed us to control *a priori* for self-selected orientation towards solidarity among the subjects. Moreover, as all TaG members were ICT professionals, skill complementarity allowed us to observe a sufficiently dense network of professional collaborations.

By the time of this study, TaG was controlled by Talent Garden SRL, an Italian-based company whose core business was to encourage the foundation of coworking spaces on a global scale. TaG hosted 29 workers – called 'residents' – among freelancers and small companies. Besides, the TaG space was used by two freelance workers – called 'mentors' – who had special contractual arrangements with the TaG company in exchange of being available for business-related advice to residents. Furthermore, the TaG space was managed by an office manager, while the founder was often present. A researcher's access to TaG facilities as a regular 'resident' was negotiated with the founder and the office manager, who also allowed us to approach the other 'residents' for the survey. While the founder, the office manager and the mentors were consulted for qualitative information about the empirical setting, we administered the survey only to the 29 TaG residents.

3.2 Qualitative fieldwork

Before collecting network data, we conducted a qualitative study of the empirical setting, in order to shed light on the content of interaction between residents and the institutional and organizational context in which they worked. This was accomplished through a 4-month participating observation, during which casual contacts with coworkers were established. The aim was twofold: (i) establishing a rapport with the subjects in order to maximize the rate of participation to the survey (e.g., Johnson 1990); (ii) calibrating the survey questionnaire with a meaningful content for subjects in order to maximize validity and reliability of the data.

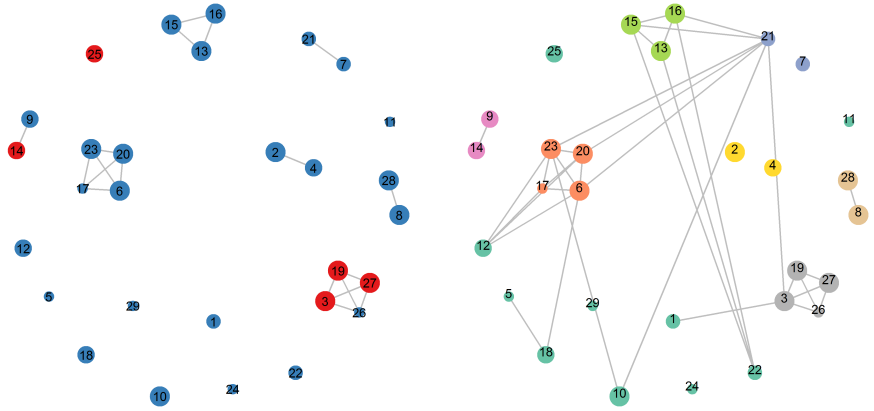
During the fieldwork, qualitative information about organizational and

contextual characteristics of TaG were collected via interviewing the founder, office manager and the mentors. Since the institutional context of the coworking space provided no top-down incentives for cooperation, all collaborations between coworkers were self-organized. They mainly took the form of subcontracting and were enhanced by skill complementarity among coworkers. The residents typically tended to outsource a portion of their projects to internal rather than external partners in order to reduce transaction costs. According to most residents, outsourcing to other coworking members allowed them to avoid the cost of searching for highly specific skills in the external market. Moreover, physical proximity facilitated coordination by reducing organizational costs. As indicated by some interviewees, commitment to other residents held even in the presence of more profitable alternatives with external partners (Cook and Emerson 1978; Kollock 1994).

However, in order to cope with the need for organizational flexibility, the residents mostly relied on informal and non-binding agreements of subcontracting, thereby allowing for opportunistic exploitation. For instance, some residents reported about failing to meet deadlines with an end client because of a partner's delay. The quality of a partner's delivery was often key, especially because subcontractors often could not directly supervise any specific activity before delivering the final product or service to the end client. Here, it is important to note that the residents often compensated for low revenues and demand volatility by managing multiple tasks for different customers at the same time. This context could provide room for opportunistic behaviour, such as shrinking the quality at the expense of the subcontractor and the end client.

Therefore, on the one hand, relying on informal and non-binding agreements for collaboration with other TaG members allowed the residents to avoid higher coordination costs with external partners. On the other hand, the nature of non-binding agreements exposed especially those subcontracting to other partners to the risk of being exploited by opportunistic behaviour.

By means of direct observation and administrative data, we reconstructed the structure of company co-membership among TaG residents. While 10 out of 29 residents worked as independent freelancers, 19 TaG residents were distributed among seven small companies of 2, 3, or 4 members each. In general, business revenues were moderate especially for freelancers, with only 2 out of 10 reporting more than 15,000 € in the previous year. Concerning small companies, three reported that they had collected less than 100,000 € of revenues, two between 100,000 € and 200,000 €, and one more than 200,000 € in the previous year. Figure 1a shows the network of co-membership to the same company among TaG residents.



(a) *Company co-membership.* (b) *Previous acquaintance.*

Figure 1: The networks of *Company co-membership* (left) and *Previous acquaintance* (right). On the left panel, node colours represent subjects' gender (blue = male; red = female). On the right panel, node colours represent company co-membership (dark green = freelancers) and coordinates are kept fixed as in the left panel. In both panels, node size represents seniority in the group.

3.3 Data: Variables and measures

We collected relational and individual-level data by means of a CAPI questionnaire personally and individually administered to all 29 TaG residents – from here on 'the subjects' – by one interviewer. Since we could not apply leverage on any formal hierarchy to ensure participation to the survey, respondents were invited by casual contact during the fieldwork. Twenty-eight out of twenty-nine interviews were conducted through a 2-week time period, while one interview was conducted with a 2-month delay. Respondents filled out the questionnaire independently, although the interviewer was always available to help respondents and improve respondent recall (e.g., Brewer 2000). Response rate was 100%.

In order to control for the interplay between coworkers' individual properties and the relationships between them, we collected node-level attribute data about both sociodemographic and business-related characteristics: *Gender*, *age*, *family status*, *seniority* in TaG, *educational degree*, and *entry motivations*. Table 1 summarizes the main characteristics of respondents.

Relational data were collected by means of sociometric questions formatted according to the conventional repeated roster method (Kilduff and Krackhardt 2008). English translations of the questions are provided in Appendix A.

Social support is the *explanandum* of this study (see Figure 2). A tie-variable was built by merging the answers to two different questions, ad-

Number of coworkers	29
Gender	Male = 24, Female = 5
Age (years)	Mean = 31.83 (SD = 6.04)
Family status	Single = 4 In a stable relationship = 6 Cohabitant with partner = 11 Married = 8
Seniority in coworking space (months)	Mean = 29.34 (SD = 14.26)
Educational degree	Middle school or vocational training = 2 High school = 10 Bachelor = 7 Master = 10
Entry motivations	facilitating market relations = 7 building professional relationships with other residents = 6 reducing costs = 5 improving working conditions through social relationships with residents = 3 Other = 8

Table 1: Members of Talent Garden Brescia coworking space: Main characteristics.

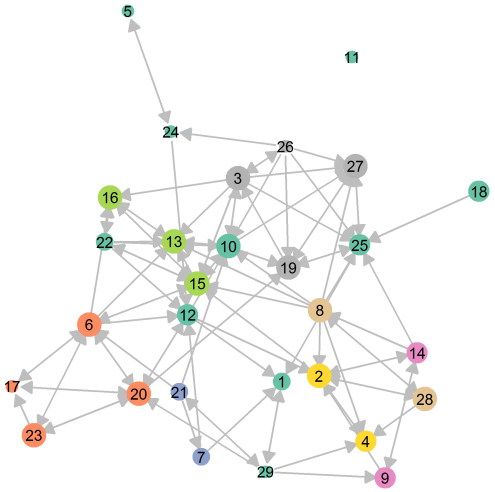
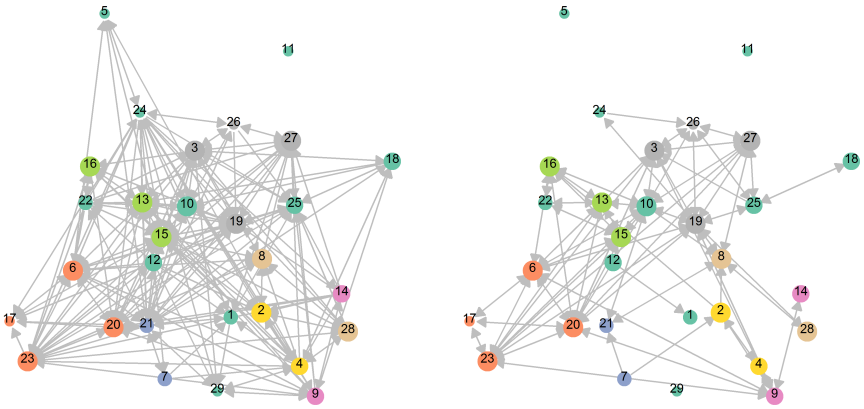


Figure 2: The *Social support* network. Node colours represent company co-membership (dark green = freelancers). Node size represents seniority in the group.

dressing respectively the mobilization of *material* and *emotional* resources in the context of out-of-work private life (van der Poel 1993; Lin 1999), so that $x_{ij} = 1$ if i expects j to support her/him with either material or emotional resources and $x_{ij} = 0$ otherwise. Both questions were formulated as passive and attitudinal measures, in order to minimize social desirability and avoid the biasing effect of the opportunity of being in a situation of need (van der Poel 1993; De Lange, Agneessens, and Waege 2004). We did not include a baseline measure of *Social support* because this would have increased the length of the questionnaire. More specifically, a general measure of subjects' perceived social support from other subjects would have required the administration of many-item psychometric scales (Procidano and Heller 1983; Zimet et al. 1988, e.g.,), which would have made interviews excessively time-demanding for subjects.

In the *Trust in business* variable, $x_{ij} = 1$ if i considered j to be trustworthy for a hypothetical risky business partnership and $x_{ij} = 0$ otherwise. This was to relate our measure to the concept of trust in a risky situation (Gambetta 1988; Hardin 2002). Figure 3a shows the *Trust in business* network.

Data concerning professional collaboration were collected, by asking three questions, according to the types of collaboration observed during the fieldwork. Firstly, we asked about the actual 'incoming commissions' that they received from other residents in the past, starting from their entry in TaG. Respondents had to select other residents offering them one or more effectively completed commissions. Secondly, a similar question was asked to measure 'outgoing commissions'. Thirdly, respondents were asked about



(a) *Trust in business.* (b) *Positive collaboration.*

Figure 3: The networks of *Trust in business* (left) and *Positive collaboration* (right). Node colours represent company co-membership (dark green = freelancers). Node size represents seniority in the group. Coordinates are kept fixed as in Figure 2.

other subjects with whom they had worked at jointly designed new projects.

Furthermore, we measured subjects' satisfaction levels of their collaboration partners by asking them to express how much they would recommend them as business partners to others on the basis of their own past experience through a 1-7 Likert scale. We then built a *Positive collaboration* network, where $x_{ij} = 1$ if i has collaborated with j and evaluated her/him with a value > 4. Otherwise, $x_{ij} = 0$. This was made to create a proxy for successful economic exchange relations (Lawler, Thye, and Yoon 2008). Figure 3b shows the *Positive collaboration* network.

Finally, as a control variable, we asked subjects to cite those TaG members whom they had already known in person before becoming a TaG member. The resulting answers constitute the *Previous acquaintance* network, which is reported in Figure 1b.

Table 2 reports descriptive graph-level statistics of the *Social support*, *Trust in business* and *Positive collaboration* networks.

	Social support	*Trust in business*	*Positive collaboration*
Number of ties	99	235	130
Density	0.122	0.290	0.160
Mean in/outdegree	3.414	8.103	4.483
Minimum outdegree	0	0	0
Maximum outdegree	8	20	12
Outdegree centralization	0.170	0.440	0.278
Minimum indegree	0	0	0
Maximum indegree	7	16	11
Indegree centralization	0.133	0.292	0.241
Number of reciprocated pairs	25	64	58
Number of transitive triads (030T)	11	89	0
Number of cyclic triads (030C)	0	1	0

Table 2: Basic statistics for *Social support*, *Trust in business* and *Positive collaboration* networks

3.4 Model specification

In order to test our hypotheses, we estimated univariate and multivariate Exponential Random Graph (p^*) Models (ERGMs) for the *Social support* and *Trust in business* networks (Pattison and Wasserman 1999; Snijders et al. 2006; Robins, Pattison, Kalish, et al. 2007; Robins, Snijders, et al. 2007; Robins, Pattison, and Wang 2009; Lusher, Koskinen, and Robins 2013). Univariate ERGMs for social network analysis have the following general form:

$$Pr(Y = y) = \frac{1}{k}\, exp\left[\sum_{A} \lambda_A z_A(y)\right], \tag{1}$$

where, $Pr(Y = y)$ represents the probability of the network-variable Y taking the observed value y, $\frac{1}{k}$ is a normalizing quantity, A represents a potential network substructure , λ_A is the parameter corresponding to configuration A and $z_A(y)$ is the graph statistic corresponding to configuration A, which indicates the presence of configuration A in the observed network.

In case of the multivariate model, the statistics $z_A(y)$ are defined within and among ties from different types of networks (Pattison and Wasserman 1999), such that:

$$z_k(y) = \sum_{A \in A_k} \prod_{(i,j,m) \in A} x_{ijm}\,, \tag{2}$$

where A_k is a collection of isomorphic configurations A of tie-variables.

For the multivariate ERGMs, we simulated the emergence of the observed networks of *Social support* and *Trust in business* simultaneously, assuming

the exogenous occurrence of the observed network of *Positive collaboration*. Note here that while the measure of expectations of social support was related to the interview time, collaboration data were event-based and situated in the past. Instead, *Trust in Business* ties could not be considered exogenous to the formation of expectations of social support, because of the cross-sectional nature of our data and the attitudinal measure applied to both *Trust in Business* and *Social Support*. In order to test our hypotheses, we computed estimates of the entrainment effect of *Positive collaboration* and *Trust in business* on *Social support*. In the former case, the effect measures how likely i expects support from j if i and j have collaborated and i would recommend j as a partner. In the latter case, the effect measures how likely it is that i expects support from j and considers her/him trustworthy in business as well. In order to control for the co-occurrence of other confounding processes, we specified the models with endogenous structural effects, exogenous actor-relation effects and exogenous network covariate effects.

For within-network structural effects, we specified the model with basic reciprocity, closure and connectivity parameters for directed networks (Robins, Pattison, and Wang 2009; Lusher, Koskinen, and Robins 2013). As regards to actor-relation effects, we included parameters concerning individual demographic properties, namely *gender* and *age*, along with the subjects' working experience, namely *seniority* in the coworking space. For each attribute, the value of the *sender* effect measured the likelihood for a tie to be directed from a subject with a particular attribute rather than another, while the *receiver* effect expressed the likelihood of a tie to be received by a subject with that attribute. The *homophily* effect statistics measured the propensity for subjects to form ties with others of the same categorial attribute. In multivariate models, actor-relation effects were also estimated for both *Social support* and *Trust in business* networks.

Finally, the entrainment effect of *Previous acquaintance* as covariate network was estimated as a control factor. We also estimated model versions controlling for a similar effect of *Agency Co-Membership* instead of *Previous Acquaintance*, but results did not change qualitatively, meaning that estimates did not vary in sign or significance..

We estimated our models through Monte Carlo Markov Chain Maximum Likelihood Estimation (MCMCMLE) (Snijders et al. 2006) using the PNet software (Wang, Robins, and Pattison 2005) for the univariate models and the XPNet software (Wang, Robins, and Pattison 2006) for the multivariate model.

4 Results

4.1 QAP correlations

Table 3 shows that both *Positive collaboration* and *Trust in business* were significantly correlated with *Social support*, with slight differences between the two values (Krackhardt 1987). By considering the number of entrained arcs between the three networks, Table 4 shows that out of 130 ties of *Positive collaboration*, 58 co-occur with ties of *Social support*, while 72 do not, with a Multiplexity Index $\upsilon = 0.712$ (*z-score*=11.676) (Skvoretz and Agneessens 2007) [1]. A higher multiplexity was observed between *Trust in business* and *Social support*, as 82 out of 99 ties of social support expectations co-occur with trust in business-related situations, with $\upsilon = 0.821$ (*z-score*=12.788).

Table 3: Pearson graph correlations of *Social support*, *Positive collaboration* and *Trust in business* networks with Quadratic Assignment Procedure (QAP) tests.

Network	1	2
1. Social support		
2. Positive collaboration	0.433∗	
3. Trust	0.443∗	0.410∗

∗ $p < 0.001$, QAP test with 1,000 repetitions.

Table 4: Entrained arcs for *Social support*, *Trust in business* and *Positive collaboration*

	1	2
1. Social support		
2. Positive collaboration	58	
3. Trust in business	82	93

.

QAP correlation is a well-established technique for analyzing the association between two networks at the dyadic level. However, it did not allow us to test our hypotheses while controlling at the same time for potential confounding effects yielded by within-network structural effects, other cross-network effects, or actor-relation effects, which in turn could be handled through ERGMs (Zhao and Rank 2013).

1. The index depends on the calculation of the maximum number of multiplex pairs that could occur and of the expected number conditioned on outdegree.

4.2 ERGM results

Table 5 shows estimates and standard errors of univariate ERGMS of *Social support*, while Table 6 reports the same values estimated in multivariate ERGMs of *Social support* and *Trust in business*. Following established procedures in the literature, we considered those effects whose standard errors were greater than twice the absolute value of the estimated coefficient as statistically significant (see Appendix B for goodness of fit of the models).

In order to test *Hypothesis 1*, we first looked at the entrainment effect of *Positive collaboration* on *Social support*, as estimated in Model 1.1 (see Table 5). Our results showed that the estimated coefficient was positive and significant. This would mean that the observed proportion of positive collaboration ties which overlapped with expectations of social support was greater than we would expect by chance, controlling for exogenous actor-relation effects and other structural within-network effects of the *Social support* network. Model 1.2 (see Table 5) shows that such effect held true even when controlling for the subjects' previous acquaintance. More precisely, the model shows that, although expectations of social support were directed preferably towards those with whom i was previously acquainted, a positively evaluated collaboration made it more probable that i expected support from a

partner j rather than from others, even if i did not already know j previously.

Table 5: Parameter estimates and standard errors for univariate ERGMs of *Social support*.

Parameters	**Estimates (S.E.)**	
	Model 1.1	Model 1.2
Structural effects (endogenous)		
Arc	-3.843 (1.429)∗	-3.938 (1.487)∗
Reciprocity	1.905 (0.551)∗	1.708 (0.532)∗
Simple 2-path	-0.409 (0.166)∗	-0.340 (0.173)
Popularity (in-degree)	-0.442 (0.519)	-0.435 (0.513)
Activity (out-degree)	-0.087 (0.373)	-0.063 (0.420)
Path closure (transitivity)	0.918 (0.228)∗	0.762 (0.240)∗
Cyclic closure	-0.118 (0.196)	-0.138 (0.179)
Multiple connectivity	0.117 (0.189)	0.037 (0.195)
Actor-relation effects (exogenous)		
Gender (sender)	-0.551 (0.529)	-0.527 (0.578)
Gender (receiver)	-0.943 (0.567)	-0.752 (0.597)
Gender (homophily)	0.811 (0.561)	0.552 (0.645)
Age (sender)	0.017 (0.023)	0.025 (0.024)
Age (receiver)	0.070 (0.025)∗	0.073 (0.025)∗
Age (difference)	-0.028 (0.024)	-0.041 (0.028)
Seniority (sender)	0.002 (0.011)	0.005 (0.013)
Seniority (receiver)	0.023 (0.015)	0.027 (0.016)
Seniority (difference)	-0.009 (0.010)	-0.025 (0.011)∗
Covariate network effects (exogenous)		
Positive collaboration (entrainment)	1.833 (0.294)∗	1.447 (0.312)∗
Previous acquaintance (entrainment)		1.530 (0.388)∗

∗ $|\text{Est.}|/\text{S.E.} > 2$
$\lambda = 2.00$

Hypothesis 2 can be tested by looking at the entrainment effect of *Trust in business* and *Social support* in the multivariate models reported in Table 6. Model 2.1 shows that i was more likely to expect social support from j if the former trusted the latter for business-related issues, beyond the effect of all other processes specified in the model. This effect remained positive and significant even when we controlled for the entrainment effect of *Positive collaboration* (Model 2.2) and *Previous acquaintance* (Model 2.3) on both *Social support* and *Trust in business*.

Our results showed that the likelihood that i expected social support from j if the latter was considered trustworthy by i was greater than we would have expected by chance. This remained true even when we controlled for

the occurrence of previous successful collaborations and the fact of being previously acquainted. These results provide clear support for *Hypothesis 2*.

In addition, the multivariate models reported in Table 6 show that the effect of *Positive collaboration* on *Social support* was not significant when we controlled for the endogenous emergence of *Trust in business*. By comparing the entrainment effect of *Positive collaboration* on *Social support* in Models 2.1 and 2.2, we noticed that the estimate was not significant once we controlled for the effect of positive collaboration ties on those pairs with overlapping *Social support* and *Trust in business* ties. More precisely, Model 2.2 shows that *Positive collaboration* yielded a positive and significant effect on *Trust in business*. This means that, beyond other effects in the model, if i had collaborated satisfactorily with j, it was more likely that i trusted j for business-related issues rather than others. Indeed, after including this in the model, the proportion of ties of *Positive collaboration* which co-occurred with expectations of social support was not greater than expected by chance, given other processes at work. More precisely, in 55 out of 58 pairs with entrained ties of *Positive collaboration* and *Social support*, ties of *Trust in business* occurred as well[2]. Furthermore, results did not qualitatively change when we controlled for the entrainment effect of *Previous acquaintance* on both emergent networks (see Model 2.3). Finally, it is also worth mentioning that being previously acquainted with j made i more likely to trust her/him or to expect social support, beyond all other factors, as is shown by Model 2.3 (see Table 6).

Therefore, our results suggest that, once we accounted for the endogenous effect of trust, there was no net association between a successful collaboration and the expectation of social support from the partner, beyond other confounding processes. This would confirm *Hypothesis 1*. This would also imply that there is an association between positive collaborations and expectations of social support, but only as long as the collaboration generates trust for the partner. If i's collaboration with j, though positively evaluated, did not generate business-related trust for the partner, then i was not any more likely to expect social support from j than from other subjects.

An additional point to mention is the importance of looking at the structural logic of the *Social support* network by examining the endogenous structural parameters of the ERGMs, concerning the structural logic (Markovsky, Willer, and Patton 1988; Rank, Robins, and Pattison 2010) of the *Social support* network. Concerning reciprocity, the estimate in the multivariate models reported in 6 is positive but not significant, which allows us to conclude that the amount of reciprocated ties in the *Social support*

2. It is also meaningful that simulations of Model 2.2 without including the effect of *Positive collaboration* on entrained *Trust in business* and *Social support* ties were sufficient to generate networks with an average of 54.74 overlapping ties of *Trust in business* and *Social support* (see Table 8 in Appendix B).

Table 6: Parameter estimates and standard errors for multivariate ERGMs of *Social support* and *Trust in business*.

Parameters	Estimates (S.E.)					
	Model 2.1		Model 2.2		Model 2.3	
	Social support	Trust	Social support	Trust	Social support	Trust
Arc	-6.653 (1.763)∗	-2.490 (1.611)	-5.982 (1.730)∗	-3.146 (1.647)	-5.946 (1.893)∗	-3.198 (1.767)
Reciprocity	0.765 (0.599)	0.999 (0.365)∗	1.048 (0.586)	0.890 (0.388)∗	0.919 (0.613)	0.879 (0.385)∗
Out-2-star		0.168 (0.019)∗		0.171 (0.019)∗		0.171 (0.019)∗
Simple 2-path	-0.452 (0.192)∗	-0.020 (0.029)	-0.461 (0.184)∗	-0.023 (0.031)	-0.421 (0.200)∗	-0.019 (0.032)∗
Popularity	-0.625 (0.546)	0.775 (0.514)	-0.580 (0.554)	0.977 (0.508)	-0.606 (0.559)	1.056 (0.552)
Activity	-0.566 (0.431)	0.051 (0.534)	-0.530 (0.447)	0.124 (0.538)	-0.535 (0.455)	0.157 (0.556)
Path closure	0.853 (0.234)∗	0.344 (0.224)	0.863 (0.241)∗	0.299 (0.210)	0.740 (0.241)∗	0.252 (0.218)
Cyclic closure	-0.081 (0.192)	-0.114 (0.122)	-0.078 (0.210)	-0.103 (0.125)	-0.093 (0.193)	-0.111 (0.124)
Multiple connectivity	0.115 (0.206)	0.033 (0.051)	0.123 (0.201)	0.053 (0.054)	0.076 (0.219)	0.051 (0.059)
Entrainment	2.271 (0.368)∗		2.019 (0.414)∗		2.033 (0.407) ∗	
Exchange	1.173 (0.356) ∗		1.004 (0.344))∗		0.932 (0.357)∗	
Gender (sender)	-0.120 (0.665)	-0.740 (0.629)	-0.233 (0.590)	-0.818 (0.646)	-0.141 (0.705)	-0.876 (0.677)
Gender (receiver)	-0.434 (0.639)	-0.919 (0.670)	-0.485 (0.591)	-1.010 (0.670)	-0.299 (0.745)	-1.017 (0.708)
Gender (homophily)	0.310 (0.732)	0.919 (0.715)	0.390 (0.648)	1.014 (0.724)	0.112 (0.742)	1.025 (0.759)
Age (sender)	0.051 (0.027)	-0.019 (0.011)	0.043 (0.026)	-0.013 (0.012)	0.048 (0.028)	-0.011 (0.013)
Age (receiver)	0.102 (0.027)∗	-0.041 (0.018)∗	0.094 (0.027)∗	-0.034 (0.018)	0.096 (0.028)∗	-0.034 (0.019)
Age (difference)	-0.037 (0.027)	0.011 (0.014)	-0.035 (0.026)	0.009 (0.015)	-0.047 (0.028)	0.004 (0.016)0
Seniority (sender)	0.006 (0.014)	-0.014 (0.006)∗	0.008 (0.013)	-0.018 (0.005)∗	0.012 (0.013)	-0.019 (0.007)∗
Seniority (receiver)	0.019 (0.017)	0.026 (0.009)∗	0.021 (0.016)	0.022 (0.009)∗	0.027 (0.018)	0.022 (0.009)∗
Seniority (difference)	0.010 (0.011)	-0.027 (0.009)∗	0.006 (0.011)	-0.026 (0.008)∗	-0.011 (0.014)	-0.029 (0.009)∗
Positive collaboration	1.835 (0.288)∗		0.939 (0.717)	0.884 (0.287)∗	0.558 (0.791)	0.827 (0.294)∗
Previous acquaintance					1.954 (0.810)∗	1.065 (0.510)∗

∗ $|\text{Est.}|/\text{S.E.} > 2$
$\lambda = 2.00$

network was not significantly different from what we would expect by chance, given the other effects in the model. Instead, reciprocity was significant if the model was specified without controlling for the emergence of *Trust in business* (see Table 5). When not controlling for the presence of other ties, we found a tendency of subjects to reciprocate expectations of social support. However, by taking into account the positive effects of reciprocity within *Trust in business* and entrainment between the latter and *Social support*, we could say that this data supports the view that direct reciprocation of expectations of social support is mainly due to the co-occurrence of trust ties.

Another interesting point is that the estimates for degree-related parameters were not significant. This would indicate that the in- and out-degree centralization of *Social support* was not significantly different from chance, controlling for other effects.

Finally, certain interesting effects were shown by the multivariate models on the emergence of the *Trust in business* network. The reciprocity effect was positive and significant, while neither path closure nor cyclic closure were significant. This is consistent with previous studies of trust in intra-organizational networks, which found that trust is often reciprocated at the dyadic level (see e.g., Robins, Pattison, and Wang 2009; Lusher et al. 2012).

5 Discussion and conclusions

Eliciting solidarity beyond inner social circles is of particular importance in modern complex societies, where an increasing number of individuals interact without necessarily sharing a group identity. Economic exchanges, such as business relations or professional collaborations, can be a means of developing social relationships as byproducts of professional or economic interests. However, the conflict between individual interests, intrinsic to strategic motivations and uncertainty, may prevent the formation of expressive ties that can magnify collective outcomes even beyond the original scope of the interaction.

Our study shows that the formation of certain behavioural patterns of solidarity can be triggered by professional collaboration. On the one hand, our results suggest that a successful economic exchange *per se* is not sufficient to generate expectations of social support, which are rather associated with the occurrence of a form of cognition-based trust (Molm, Collett, and Schaefer 2007). On the other hand, our results corroborate the idea that even economic exchange based on non-binding agreements allow partners to develop trust (Molm, Schaefer, and Collett 2009). Trust, in turn, might co-occur with expectations of social support. Here, our study suggests that individuals who are engaged in an economic exchange with a non-binding agreement might develop expectations of social support towards the partners as a *byproduct* of their economic relationship.

Furthermore, our study has two important methodological strengths. First, we conducted an in-depth intra-organizational analysis, by integrating qualitative information from ethnographic observation and statistical analysis of a multiplex social network. This integration helped us to verify that the empirical context was instrumental in testing more general hypotheses on the link between economic and social relations. Secondly, to our knowledge, our study is the first to investigate the peculiar organizational setting of coworking spaces, where economic and social exchange relations are not influenced by formal hierarchy and collective interests.

Unfortunately, the cross-sectional nature of our data does not allow us to draw any causal inference on social mechanisms. Although accepting caveats concerning the limited explanatory power and the context-specific nature of the work, our study could have general implications on the analysis of the interplay of economic motivations and social outcomes. First, studying social support among business partners is relevant to understand the micro-foundations of cooperation. Along the same lines, Baldassarri (2015) recently suggested looking at how interactions change individuals' motives and expectations towards prosocial behaviour as the key to understand cooperation and social relationships. Simpson and Willer (2015) suggested that relational mechanisms of cooperation are critical for the emergence and maintenance of large-scale social formations. This is because social relations can amplify the effect of norms and reputations beyond individual-level characteristics, so contributing to establish contexts that can sustain cooperation.

Secondly, by analyzing expectations of social support within a network of economic exchanges, we suggest that trust can have a mediating function of turning professional collaboration into ties with expressive value and so even being self-reinforcing (Granovetter 1985). Indeed, it is probable that trust developed while individuals professionally collaborate side-by-side could have expressive value as individuals not only appreciate each other's expertise and skills during a collaborative project but also observe each other's standards of conduct and moral attitude.

Finally, our results imply that behavioural patterns of solidarity between peers in an organization can emerge from spontaneous economic interaction. However, this is conditional on decentralized partner selection (see also Grimm and Mengel 2009; Chiang 2010; Bravo, Squazzoni, and Boero 2012). Indeed, the lack of formal enforcement, e.g., top-down directives or hierarchical roles, exposes peers to the risk of exploitation and so requires mutual learning of each others' trustworthiness in direct or mediated relations. Our results suggest that organizational policies aiming to create social relations through top-down incentives might not be the only appropriate design for nurturing social relations. An understanding of the appropriate mix of top-down and bottom-up forces to stimulate collaboration, trust and social support is an important topic to be investigated in the future (Squazzoni 2014).

More research is also needed to investigate the emergence of solidarity

from economic exchange as a general socio-economic phenomenon. Here, synthesizing economic and social analysis is also key to understand the link between individual behaviour and social constraints. In particular, other empirical studies are needed to test existing theories on various organizational contexts, where specific forms of economic exchange could yield different combinations of cooperation and conflict affecting subjects' framing of their partner's motivations (Molm, Schaefer, and Collett 2009; Kuwabara 2011). A potential extension of our study would be to reconstruct the link between collaboration, trust and social support in organizational contexts with different degrees of top-down constraints, e.g., hierarchical roles, over-imposed collaboration and the presence of more established status dynamics within a workplace. This would give a more comprehensive picture of the factors which stimulate or inhibit the pivotal function of collaboration-driven trust we found here.

Appendix A: Sociometric questions

The questionnaire was administered in Italian, the mother tongue of all interviewees. In this appendix section, we present all sociometric questions in the original version (ITA)[3], each followed by an English translation (ENG).

Previous acquaintance

ITA:

> *Quali delle/degli abitanti conosceva già prima di entrare in TaG Brescia? Per "conoscenza" si intende l'essersi conosciuti personalmente, indipendentemente dal contesto. Ad esempio: amico/a, ex collega, familiare, ex compagna/o di scuola o università, semplice conoscente.*

ENG:

> *With which TaG members were you already acquainted before joining TaG? As 'acquaintance' we mean having met in person, independent of the context. E.g., friends, relatives, former colleagues or school mates, simple acquaintance.*

Professional collaboration

Incoming commission

ITA:

> *Lei o la Sua agenzia ha mai ricevuto una commessa o un'offerta di collaborazione da un(a) abitante o un'agenzia di TaG Brescia? Se sì, indichi i nomi soltanto nei casi in cui abbiano accettato la proposta. Consideri soltanto le attività regolate da un chiaro accordo (formale o informale) sulla ripartizione delle attività e dei compensi.*

ENG:

> *Have you ever been offered a commission or a collaboration opportunity by another TaG member? If so, please select their names only in the case you accepted the offer. Please consider only those cases that were regulated by an explicit (formal or informal) agreement about timing, resources and payment.*

3. TaG members call themselves 'abitanti' (*sing.*, 'abitante'), which means 'resident' in Italian.

Outgoing commission

ITA:

> *Lei o la Sua agenzia ha mai offerto una commessa o un'opportunità di collaborazione a un(a) abitante o un'agenzia di TaG Brescia? Se sì, indichi i nomi soltanto nei casi in cui abbiano accettato la proposta. Consideri soltanto le attività regolate da un chiaro accordo (formale o informale) sulla ripartizione delle attività e dei compensi. Non consideri i casi di informazione o intermediazione offerta gratuitamente a un membro o un'agenzia di TaG Brescia.*

ENG:

> *Have you ever offered a commission or a collaboration opportunity to another TaG member? If so, please select their names only in the case they accepted the offer. Please consider only those cases that were regulated by an explicit agreement about timing, resources and payment. Please do not consider simple information sharing with other TaaG members.*

Common projects

ITA:

> *Lei o la Sua agenzia ha mai intrapreso un progetto comune con un(a) altra/o abitante o agenzia (es. una nuova attività in partnership, una nuova iniziativa imprenditoriale)? Se sì, indichi i nomi, indipendentemente dal successo finale. Consideri soltanto le attività regolate da un chiaro accordo (formale o informale) sulla ripartizione delle attività e dei compensi.*

ENG:

> *Have you ever started a new common project with another TaG member (e.g., a new partnership, a joint venture, etc.)? If so, please select their names, independently of the outcome. Please consider only those cases that were regulated by an explicit agreement about time, resources and payment.*

Partner evaluation

ITA:

> *Consideri le/gli abitanti di TaG Brescia citate/i finora con cui ha collaborato professionalmente (commesse ricevute, commesse offerte, progetti comuni). Sulla base dell'esperienza diretta maturata nell'ambito di tali collaborazioni, quanto raccomanderebbe ad altri queste persone come potenziali partner professionali? Nel caso di collaborazioni con agenzie, risponda solo per quelle persone con le quali ha effettivamente interagito nell'ambito delle collaborazioni avvenute.*

ENG:

> *Please consider all TaG members whom you have cited so far as collaborators (incoming or outgoing commissions, common projects). Based on your personal experience, how much would you recommend them as business partners to others? In case you collaborated with agencies, please rate only those people with whom you actually interacted.*

Social support

Material support

ITA:

> *Immagini di avere un problema pratico che riguarda la Sua vita quotidiana. Per risolverlo, immagini di avere bisogno di un aiuto da parte di un'altra persona, che implichi tempo, impegno o il prestito di attrezzature (es. un aiuto per un trasloco o piccole riparazioni in casa). A quali delle/degli abitanti si rivolgerebbe?*

ENG:

> *Suppose that you need to solve some practical problems related to your daily life. In order to accomplish this, you needed help from another person, who will provide time, effort, or tools. To which TaG member would you turn?*

Emotional support

ITA:

> *Immagini di avere un problema relativo alla Sua vita privata e di volerne parlare con qualcuna/o per ricevere un consiglio o del conforto. A quali tra le/gli abitanti si rivolgerebbe?*

ENG:

> *Suppose that you have a problem related to your private life and you needed to talk about it with someone for advice or comfort. To which TaG member would you turn?*

Trust in business

ITA:

> *Immagini di poter coinvolgere le/gli abitanti in un Suo progetto lavorativo personale, potenzialmente aperto a tutte le competenze presenti all'interno di TaG Brescia. Di quali abitanti si fiderebbe come eventuali partner o collaboratori? Non consideri, per favore, la compatibilità delle competenze delle/degli abitanti.*

ENG:

> *Suppose that you needed to involve other TaG members in a new personal business project, potentially open to all competencies supplied within TaG. Whom would you trust as business partners? Please, do not consider the competencies needed for your actual business.*

Appendix B: Goodness of fit of ERGMs

Univariate ERGM

Parameter (PNet name)	Obs.	Mean	Std. Dev.	t-ratio
Arc	99	99.183	6.283	-0.029
Reciprocity	25	25.061	3.431	-0.018
2-In-Star	190	198.59	32.647	-0.263
2-Out-Star	179	176.227	24.882	0.111
3-In-Star	240	297.832	110.244	-0.525
3-Out-Star	217	208.115	59.67	0.149
Mixed-2-Star	306	306.789	39.5	-0.02
030T	114	111.159	19.447	0.146
030C	25	26.336	6.42	-0.208
Sink	0	1.417	1.109	-1.277
Source	1	1.789	1.144	-0.69
Isolates	1	0.187	0.415	1.959
K-In-Star(2.00)	108.375	108.568	11.06	-0.017
K-Out-Star(2.00)	105.266	105.455	10.438	-0.018
K-L-Star(2.00)	72.859	71.423	5.003	0.287
K-1-Star(2.00)	150.797	149.178	14.187	0.114
1-L-Star(2.00)	154.758	154.036	14.843	0.049
AKT-T(2.00)	86.5	86.518	12.071	-0.001
AKT-C(2.00)	62.375	62.434	12.664	-0.005
AKT-D(2.00)	81.344	81.428	11.368	-0.007
AKT-U(2.00)	86.75	84.295	11.825	0.208
A2P-T(2.00)	259.625	260.261	30.82	-0.021
A2P-D(2.00)	145.344	144.425	18.515	0.05
A2P-U(2.00)	154.688	165.438	25.248	-0.426
Interaction (gender)	67	67.324	5.604	-0.058
Sender (gender)	80	80.203	6.336	-0.032
Receiver (gender)	76	76.287	5.928	-0.048
T2u11 (gender)	18	16.585	2.987	0.474
T1u11 (gender)	22	20.945	3.335	0.316
T1au14 (gender)	140	144.955	29.451	-0.168
T1au13 (gender)	239	227.891	33.745	0.329
T1au12 (gender)	145	141.944	24.561	0.124
Sender (age)	3107	3110.8	199.906	-0.019
Sender (seniority)	3195	3183.338	207.256	0.056
Receiver (age)	3261	3266.29	220.673	-0.024
Receiver (seniority)	3458	3470.842	233.313	-0.055
Single Sum (age)	6368	6377.09	413.234	-0.022

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Parameter (*PNet* name)	Obs.	Mean	Std. Dev.	*t*-ratio
Single Sum (seniority)	6653	6654.18	410.792	-0.003
Single Difference (age)	580	581.754	65.418	-0.027
Single Difference (seniority)	1131	1137.274	153.983	-0.041
Single Product (age)	103048	102735.861	7004.307	0.045
Single Product (seniority)	115719	114859.503	7806.12	0.11
Mutual Sum (age)	1599	1600.261	224.067	-0.006
Mutual Sum (seniority)	1714	1797.349	240.269	-0.347
Mutual Difference (age)	125	124.543	29.079	0.016
Mutual Difference (seniority)	264	222.243	62.569	0.667
Mutual Product (age)	25692	25667.497	3792.406	0.006
Mutual Product (seniority)	30599	33164.653	4662.229	-0.55
CovariateArc (Positive collaboration)	58	57.85	5.031	0.03
Std. Dev. in-degree dist.	2.205	2.298	0.303	-0.306
Skew in-degree dist.	0.26	0.699	0.455	-0.966
Std. Dev. out-degree dist.	2.026	1.942	0.243	0.346
Skew out-degree dist.	0.424	0.343	0.368	0.22
Global Clustering Cto	0.318	0.317	0.043	0.043
Global Clustering Cti	0.3	0.282	0.043	0.409
Global Clustering Ctm	0.373	0.362	0.043	0.237
Global Clustering Ccm	0.245	0.257	0.051	-0.233

Table 7: Goodness of fit of Model 1.1. Observed values (Obs.) relate to empirical data, while mean and standard deviations (Std. Dev.) relate to simulated networks.

Multivariate ERGM

Parameter (XPNet name)	Obs.	Mean	Std. Dev.	*t*-ratio
Social Support (S)				
Arc	99	100.206	6.661	-0.181
Reciprocity	25	25.018	3.608	-0.005
2-In-Star	190	204.495	33.993	-0.426
2-Out-Star	179	188.002	31.830	-0.283
3-In-Star	240	317.613	122.199	-0.635
3-Out-Star	217	263.461	113.006	-0.411
Mixed-2-Star	306	309.821	37.752	-0.101
030T	114	113.480	19.170	0.027
030C	25	26.233	6.516	-0.189
Sink	0	1.034	0.978	-1.058

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Parameter (*XPNet* name)	Obs.	Mean	Std. Dev.	*t*-ratio
Source	1	1.709	1.219	-0.582
Isolates	1	0.179	0.411	1.996
K-In-Star (2.00)	108.375	110.317	11.339	-0.171
K-Out-Star (2.00)	105.266	107.032	11.254	-0.157
K-L-Star (2.00)	72.859	72.147	5.175	0.138
K-1-Star (2.00)	150.797	150.417	14.398	0.026
1-L-Star (2.00)	154.758	156.904	14.685	-0.146
AKT-T (2.00)	86.500	87.822	12.194	-0.108
AKT-C (2.00)	62.375	62.649	13.119	-0.021
AKT-D (2.00)	81.344	82.668	11.589	-0.114
AKT-U (2.00)	86.750	86.126	12.132	0.051
A2P-T (2.00)	259.625	262.194	29.721	-0.086
A2P-D (2.00)	145.344	153.743	24.477	-0.343
A2P-U (2.00)	154.688	169.133	26.122	-0.553
Interaction (gender)	67	68.306	6.376	-0.205
Sender (gender)	80	81.258	6.814	-0.185
Receiver (gender)	76	77.265	6.560	-0.193
T2u11 (gender)	18	16.754	3.137	0.397
T1u11 (gender)	22	21.101	3.530	0.255
T1au14 (gender)	140	149.704	31.733	-0.306
T1au13 (gender)	239	231.608	33.739	0.219
T1au12 (gender)	145	153.668	32.334	-0.268
Sender (age)	3107	3142.373	212.418	-0.167
Sender (seniority)	3195	3209.835	197.393	-0.075
Receiver (age)	3261	3305.946	238.160	-0.189
Receiver (seniority)	3458	3493.315	233.993	-0.151
Single Sum (age)	6368	6448.319	443.442	-0.181
Single Sum (seniority)	6653	6703.150	396.426	-0.127
Single Difference (age)	580	590.931	68.421	-0.160
Single Difference (seniority)	1131	1152.222	159.019	-0.133
Single Product (age)	103048	104042	7590.026	-0.131
Single Product (seniority)	115719	115324	7229.245	0.055
Mutual Sum (age)	1599	2235.815	1731.771	-0.368
Mutual Sum (seniority)	1714	3825.659	4461.707	-0.473
Mutual Difference (age)	125	1370.345	1030.963	-1.208
Mutual Difference (seniority)	264	-2020.535	2444.118	0.935
Mutual Product (age)	25692	55243.534	56743.489	-0.521
Mutual Product (seniority)	30599	146431	161275	-0.718
Covariate Arc (Positive Collaboration)	58	58.159	4.769	-0.033
Trust in Business (T)				

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Parameter (*XPNet* name)	Obs.	Mean	Std. Dev.	*t*-ratio
Arc	235	242.003	29.877	-0.234
Reciprocity	64	65.653	9.278	-0.178
2-In-Star	1117	1082.950	205.711	0.166
2-Out-Star	1272	1341.543	319.113	-0.218
3-In-Star	3795	3263.516	844.089	0.630
3-Out-Star	5321	5958.039	2181.201	-0.292
Mixed-2-Star	2035	2123.819	418.930	-0.212
030T	1016	994.048	241.848	0.091
030C	256	261.484	60.995	-0.090
Sink	0	0.688	0.841	-0.818
Source	0	0.648	1.185	-0.547
IsolatesB	1	0.103	0.358	2,502
K-In-Star (2.00)	361.773	374.166	54.212	-0.229
K-Out-Star (2.00)	364.252	377.542	56.974	-0.233
K-L-Star (2.00)	101.976	101.615	7.743	0.047
K-1-Star (2.00)	452.906	468.855	68.695	-0.232
1-L-Star (2.00)	443.899	453.268	61.177	-0.153
AKT-T (2.00)	386.483	401.350	65.469	-0.227
AKT-C (2.00)	337.897	350.512	61.031	-0.207
AKT-D (2.00)	387.013	411.986	73.557	-0.340
AKT-U (2.00)	381.768	376.769	60.689	0.082
A2P-T (2.00)	1005.271	1037.361	135.473	-0.237
A2P-D (2.00)	588.603	619.582	103.209	-0.300
A2P-U (2.00)	496.693	492.996	58.296	0.063
Interaction (gender)	152	157.919	25.667	-0.231
Sender (gender)	188	194.634	28.969	-0.229
Receiver (gender)	184	190.317	26.557	-0.238
T2u11 (gender)	44	41.280	8.064	0.337
T1u11 (gender)	58	59.194	9.264	-0.129
T1au14 (gender)	836	824.308	172.884	0.068
T1au13 (gender)	1602	1638.552	374.993	-0.097
T1au12 (gender)	1030	1092.781	311.386	-0.202
Sender (age)	7301	7515.194	951.633	-0.225
Sender (seniority)	7169	7294.593	692.895	-0.181
Receiver (age)	7351	7578.516	968.973	-0.235
Receiver (seniority)	7935	8109.761	794.291	-0.220
Single Sum (age)	14652	15093.710	1915.625	-0.231
Single Sum (seniority)	15104	15404.354	1446.645	-0.208
Single Difference (age)	1368	1412.334	229.911	-0.193
Single Difference (seniority)	2984	3098.706	514.579	-0.223

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Parameter (*XPNet* name)	Obs.	Mean	Std. Dev.	*t*-ratio
Single Product (age)	103048	104042	30887.112	-0.219
Single Product (seniority)	115719	252928	19928.683	-0.212
Mutual Sum (age)	3933	3010.124	3234.445	0.285
Mutual Sum (seniority)	4331	29003.794	14563.029	-1.694
Mutual Difference (age)	341	-3232.056	4693.508	0.761
Mutual Difference (seniority)	733	-3655.780	2266.717	1.936
Mutual Product (age)	60050	44977.127	76500.217	0.197
Mutual Product (seniority)	75315	869129	433498	-1.831
Covariate Arc (Positive Collaboration)	93	93.582	5.979	-0.097
Multiplex effects ST				
Arc ST	82	83.607	7.831	-0.205
Reciprocity ST	70	70.795	7.350	-0.108
Reciprocity SST	45	46.066	6.852	-0.156
Reciprocity STT	60	64.489	7.339	-0.612
Reciprocity SSTT	20	21.572	3.440	-0.457
In2Star ST	886	886.318	126.741	-0.003
Out2Star ST	801	957.981	166.388	-0.943
Mix2Star ST	762	828.177	122.530	-0.540
Mix2Star TS	805	863.214	124.308	-0.468
T-STS	174	168.704	26.159	0.202
T-STT	336	376.858	66.667	-0.613
T-TTS	466	430.707	83.641	0.422
T-TST	354	386.908	71.234	-0.462
T-SST	178	179.046	29.352	-0.036
T-TSS	186	205.387	36.950	-0.525
C-SST	147	147.727	24.068	-0.030
C-TTS	319	334.616	58.315	-0.268
Isolates ST	1	0.005	0.071	14,1
TKT-STS 2.00)	140.875	134.977	18.788	0.314
CKT-STS (2.00)	119.625	118.716	17.272	0.053
DKT-STS (2.00)	135.063	136.298	19.952	-0.062
UKT-STS (2.00)	144.938	159.746	25.770	-0.575
TKT-TST 2.00)	154.552	158.800	18.161	-0.234
CKT-TST (2.00)	148.003	148.544	17.335	-0.031
DKT-TST (2.00)	169.730	171.148	21.786	-0.065
UKT-TST (2.00)	150.421	150.802	16.841	-0.023
mrs (gender)	65	66.413	7.701	-0.183
mrr (gender)	62	62.735	7.545	-0.097
exab (gender)	56	54.692	6.882	0.190
exba (gender)	54	52.324	7.069	0.237

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Parameter (*XPNet* name)	Obs.	Mean	Std. Dev.	*t*-ratio
mrb (gender)	55	55.265	7.335	-0.036
mrbm (gender)	49	45.701	6.791	0.486
msender (age)	2880	2934.413	254.694	-0.214
msender (seniority)	2950	3056.581	219.469	-0.486
mreceiver (age)	3041	3130.004	275.804	-0.323
mreceiver (seniority)	3164	3282.294	249.773	-0.474
msum (age)	1185	1328.417	526.302	-0.272
msum (seniority)	1464	1688.875	447.260	-0.503
mdiff (age)	1925	1957.511	73.609	-0.442
mdiff (seniority)	2174	2167.271	156.534	0.043
mexabm (age)	1863	1908.012	243.390	-0.185
mexabm (seniority)	2138	2280.096	230.786	-0.616
mexbam (age)	3683	3686.909	257.214	-0.015
mexbam (seniority)	4165	4267.951	240.747	-0.428
msumm (age)	267	315.921	497.650	-0.098
msumm (seniority)	569	814.047	461.643	-0.531
mdiffm (age)	0	8.743	71.376	-0.122
mdiffm (seniority)	0	-54.085	136.316	0.397
Covariate Arc ST (Positive Collaboration)	55	55.180	4.862	-0.037
Std. Dev. In-degree dist. S	2.205	2.338	0.316	-0.420
Skew In-degree dist. S	0.260	0.752	0.462	-1.065
Std. Dev. Out-degree dist. S	2.026	2.080	0.319	-0.170
Skew Out-degree dist. S	0.424	0.745	0.563	-0.570
Global Clustering Cto S	0.318	0.305	0.046	0.286
Global Clustering Cti S	0.300	0.280	0.042	0.469
Global Clustering Ctm S	0.373	0.366	0.044	0.144
Global Clustering Ccm S	0.245	0.253	0.052	-0.157
Std. Dev. In-degree dist. T	4.413	3.483	0.453	2,054
Skew In-degree dist. T	0.220	-0.062	0.310	0.909
Std. Dev. Out-degree dist. T	5.492	5.431	0.819	0.074
Skew Out-degree dist. T	0.645	0.764	0.336	-0.355
Global Clustering Cto T	0.399	0.372	0.027	1.042
Global Clustering Cti T	0.455	0.455	0.041	-0.003
Global Clustering Ctm T	0.499	0.464	0.033	1.064
Global Clustering Ccm T	0.377	0.368	0.030	0.320

Table 8: Goodness of fit of Model 2.2. Observed values (Obs.) relate to empirical data, while mean and standard deviations (Std. Dev.) relate to simulated networks.

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