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Networked solidarity economy: Gender in interorganizational networks. An evaluation with ERGMs

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Abstract

For their economic success, organizations in the social economy are particularly dependent on access to collective resources through interorganizational networks. Because self-organised network governance of an economy is notoriously intransparent, there is the danger that existing societal inequalities get replicated particularly well. This creates a tension with the equality-promoting mission of these organizations. This paper investigates the degree to which the goal of gender equality has been realized in the social economy of Barcelona. By analysing networks of advice-seeking and economic collaboration with exponential random graph models, network mechanisms are analysed to estimate gender-based inequality.

Keywords: Advice network, Social economy organizations, Collaboration, ERGMs, Gender, Gender-based inequality, Interorganizational networks, Solidarity economy

Introduction

Recent research recognizes the emergence of a “new wave of ‘citizens’ cooperatives, embedded in the social-cooperative social enterprise model” in Western Europe (Defourny et al. 2021, p. 17). In this context, Barcelona emerges as a hub for alternative economic practices, in response to the 2008 financial crisis, and as a worldwide reference for the social and solidarity economy (Castells et al. 2017; Llabrés et al. 2018). In this article we focus on 84 organizations from the Network of Solidarity Economy (XES for ‘Xarxa d’Economia Solidaria’). Since its creation in 2003, this network has been growing to be one of the main actors in the social and solidarity economy in Catalonia with the aim to organizing consumption and production in alternative ways.¹

The solidarity economy (SE) consists of initiatives with explicit egalitarian goals working for the collective social and economic well-being of their members and communities. Organizations from the SE prioritize people over profit and can involve both market or entrepreneurial initiatives, and non-market production (Chaves Ávila and Monzón Campos 2018). These organizations commit to local development, social

¹ <https://xes.cat/>.

cohesion, stable employment, and sustainability, while functioning under democratic and transparent governance and distributing revenues among their members (Defourny et al. 2021; Defourny and Nyssens 2010). They encourage values of solidarity in contrast to competitive individualism (UNRISD 2018). One example of this type of initiatives is housing cooperative (Cabré and Andrés 2017).

Their mission differentiates these organizations from mainstream competitive economics. By comparison, they individually face stronger resource constraints and therefore especially depend on collective resources available in their own organizational ecosystem. These resources can be accessed in interorganizational networks, in particular networks of knowledge sharing and collaboration. Such networks are known to be important for building collaborative capacity and resilience already for conventional organizations (Heranz 2010; Nielsen 2004). Arguably, this is especially the case for organizations from the SE.

Their mission makes these organizations also accountable to higher standards of societal ethics. In particular, they are expected to avoid the reification of typical societal inequalities (Amis et al. 2020). In fact, the promotion of equality (e.g., gender equality) is one of their main core values and missions (Pereira Simon 2019).

While the SE has been recently further heralded as a viable alternative for working conditions comparing to mainstream economics (CIRIEC-International 2017), it is important to determine whether the SE indeed offers fairer access to resources, e.g., to women. Recent research has more broadly looked at solidarity economy organizations to analyse whether gender-based inequalities are being reproduced also in these organizational settings (Sobering 2016) finding mixed results; while some scholars recognize better working conditions such as stability and wage for women (Santero Sánchez and Castro Núñez 2016), other research expose that organizations with men in governance structures perform better in the SE (Teixeira et al. 2021).

Our main research question examines whether interorganizational networks in an ecosystem from the SE are gendered, and to what degree, and identifies some of the network mechanisms responsible for gender-based inequalities in these settings. Therefore, the main research objective is to develop a relational approach to investigate whether gender-based inequalities take place in the SE from Barcelona. Specifically, the research objectives are (a) to analyse gender differences in advice seeking and economic collaboration interorganizational networks from the SE; (b) to disentangle the mechanisms that conform the networks structure in XES (i.e., “Network of Solidarity Economy”).

This paper presents a first attempt to fill the research gap in social inequalities among interorganizational networks and to the existing research on gender differences in social networks. Specifically, we contribute to the study of networked inequalities by identifying patterns based on gender in a cooperative context.

Our study provides some new theoretical and practical insights for the study of gender inequality at work within and between organizations. Further, the paper provides new insights for work organizations with alternative values, such as the ones from the SE, and gendered networks scholarship. Specifically, the paper presents a first attempt to fill the research gap in social inequalities among interorganizational networks and to the existing research on gender differences in social networks.

The next section sketches the background of the study. This is followed by a description of the research design and data in section two. Section three presents the results. Section four discusses the findings and provides suggestions for future research.

Solidarity economy ecosystem and its interorganizational networks

Solidarity economy

Organizations from the solidarity economy (SE) share certain cooperative values that are different from traditional businesses. They are different mainly because profit seeking is not their main goal but an instrument to accomplish their social mission and political objectives (Defourny and Nyssens 2010). Consequently, those organizations pursuing profit and its distribution to the owners as an ultimate goal are not considered part of the SE; even when they have some social responsibility initiatives or call themselves social businesses. More importantly, what differentiates organizations belonging to SE from traditional corporations is their values, motivations, objectives, democratic governance, social oriented functioning, and identification in interaction with other stakeholders. While conventional firm's organizational ecosystems largely function under the logic of competition, SE's underlying mechanisms are mostly collaborative and oriented towards accomplishing common goals (Eriksona and Shirado 2021, p. 4). This distinction is key when studying relations between organizations (e.g., interorganizational networks).

Organizations from the SE are special types of alternative organizations that comprise cooperatives, associations, mutuals, social enterprises and other non-formal grass-roots initiatives among its organizational forms (CIRIEC-International 2017). This is especially true for the case of Barcelona, where the legal forms or organizational arrangements are not the only defining variable to be a member of the social and solidarity economy (Padilla Suriñach 2016). Therefore, organizational diversity within the SE is part of this study developed in the city of Barcelona.

Solidarity in this context means that women and men working in SE's organizations collaborate (i.e., sharing resources) based on cooperative principles. Specifically, actors in XES are highly interdependent to achieve common goals (social, economic, and political), and with their activities aim to promote pro-social values that give centrality to human needs over profit making, respect the environment, and intent to surpassing economic and social hierarchies such as the ones based on gender (Xarxa d'Economia Solidària de Catalunya 2017). Previous research about groups for natural resource management has found gender differences in collaboration and solidarity (Westermann et al. 2005) but gender differences remain unknown for the SE in a "whole" network approach.

Interorganizational networks: advice and economic collaboration

Interorganizational collaboration is important because allows organizations sharing key resources (Conteh 2013; Gray 1985; Whetten 1981) to tackle certain challenges that might not be possible to be achieved separately. For instance, a small cooperative might not be able to provide a monthly basis service to several big clients, but it can better face some of the challenges by collaborating with other compatible or resource complementarity (Ahuja et al. 2012) cooperatives. For these reasons, interorganizational ties in SE are crucial for organizational survival, growth, and goal achievement (Conteh 2013; Lee et al. 2012). Organizations from the SE make special efforts to devote time of their

working hours to participate in activities related with interorganizational cooperation, as it has been recognized in the case of Barcelona's SE (Padilla Suriñach 2016).

There are different factors determining an interorganizational network structure, namely at the individual, dyad and structural levels (Ahuja et al. 2012; Broekel and Hartog 2013). Therefore, a whole network approach better allows to capture these different levels and interdependencies (for a review of the empirical literature on interorganizational networks in whole networks see the work of Provan et al. 2007).

Cooperation is defined as a behavioural predisposition to achieve common goals (Castañer and Oliveira 2020), and in opposition to competition. In a community and solidarity oriented organizational ecosystem as the SE, these collaboration networks entail the promotion and maintenance of economic and social equality and fair relationships in line with organizations' core principles and values (Chaves Ávila and Monzón Campos 2018; Defourny et al. 2021). However, in collaborative processes men and women can face power tensions and inequalities within interorganizational networks. As a result of these relationships certain interorganizational network structures emerges (Ahuja 2000). Yet, interorganizational studies have remained gender blind, namely that it is unknown which gender differences are salient when women and men, in representation of their organizations, create formal or informal ties. This is problematic because having those organizational inequalities unnoticed, they remain unsolved. If mostly men are the ones who make the important decisions regarding how to implement collaborations inside the organizational ecosystem, gender biases might incur. Therefore, vital aspects for women well-being will not be considered. For example, organizing important meetings in hours that neglects care work mainly carried by women.

Organizational social network research has proven the importance of advice and collaboration networks for work organizations and work-related tasks achievement (Borgatti 2003; Brennecke and Rank 2017; Kilduff and Brass 2010). Advice networks are informal and involve trust for sharing information and knowledge that impact on the organization (Uzzi 1996). Although advice networks are quite important in collaboration processes, it is in formal economic organizational networks where collaboration is ultimately materialized. We study advice and economic networks together to investigate gender differences in informal and formal networks in the SE context. By comparing informal and formal interaction patterns in the form of advice-seeking and economic collaboration, respectively, this paper presents a first attempt to understand to what degree interorganizational networks in the SE are gendered, and the differences between these networks.

Gender in interorganizational networks

Gender

Gender is developed in different levels and in interactions over time (Ridgeway and Smith-Lovin 1999). As a multilevel phenomenon, gender arises in individual, interactional, organizational, and institutional levels (Ridgeway and Correll 2004). We distinguish the concept of gender from sex; the former being a social construct, and the latter a socially agreed biological criterion to classify persons as females or males (West and Zimmerman 1987).

In an interactional approach towards work and organizations, gender arises as an important social identity associated with norms, stereotypes, behaviours, and the resulting hierarchies that enable discrimination (Acker 1990, 2006, 2012; Williams et al. 2012). In this context, gender has been recognized as “a major force” (Ridgeway 1997, p. 231) from which inequalities emerge regarding resources and opportunities access. These inequalities occur through interactions within and between genders (Ridgeway and Smith-Lovin 1999).

Gender in solidarity economy organizations

Previous studies on SE's organizations, such as cooperatives or social enterprises, indicate that these organizations make special efforts to minimize social inequalities (Acker 2006). Women and men embedded in the SE develop their activity in a context in which pro social principles, such as democratic control, the primacy of the individual and social objectives over capital (CIRIEC-International 2017), are broadly spread among its members. Hence, it can be expected that organizations from the SE offer better opportunities to women (Rothschild and Tomchin 2006). For instance, a study about Basque Mondragon system of industrial cooperatives suggests that women might hold better conditions than in private firms in terms of employment, earnings and job security (Hacker and Elcorobairutia 1987). Likewise, a study about a worker-recovered cooperative in Argentina explains the actions developed by the organization to reduce the gender wage gap and improve decision making (Sobering 2016).

Previous studies highlighted the higher presence of women in the social and solidarity economy (Esteban-Salvador et al. 2016; Núñez et al. 2020). However, research also indicates the persistence of gender-based inequalities among the women already included in the SE (Xarxa d'Economia Solidària de Catalunya 2019). Gender segregation by activities and occupations (Sobering 2016), and women exclusion in decision making are some of the identified problems (Parente and Martinho 2018; Sobering 2016). Therefore, it is particularly insightful to analyse gendered inequalities within a social context supposedly favourable for avoiding these types of behaviours, so we gain new knowledge about how and to what degree these gender-based inequalities are reproduced in solidarity economy organizations.

Collaboration networks and gender-based inequalities

Research has been trying to disentangle the organizational practices involved in social and economic inequalities (Amis et al 2020). Collaboration involves information and resources sharing between actors with the aim to accomplish organizational goals; therefore collaboration is relational (Castañer and Oliveira 2020). A relational approach understands the emergence of inequalities as a result of interactions between actors (Avent-Holt and Tomaskovic-Devey 2010), when actors “extracting more value from the work efforts of others (exploitation) and hoarding resources and opportunities from other actors (opportunity hoarding)” (Avent-Holt and Tomaskovic-Devey 2010, p. 164). In a competitive context, collaboration might be driven by individuals' perceived status (e.g., resources, power). Previous research showed that differences in men and women's status lead to both men and women to give more nominations to men (Burt 2019; Kwiek and Roszka 2021; Loscocco et al. 2009;

McDonald 2011; McDonald et al. 2009; McGuire 2000, 2002). Therefore, in competitive contexts status affects cooperation resulting in gender-based inequalities that negatively affect women. In particular, for gender-based inequalities this would mean that through interactions men extract more value from the work efforts of women and hoard resources and opportunities from women. The study of organizational social networks helps to identify some of the underlying mechanisms that create and recreate those gender-based networked inequalities (Burt 2019; Kwiek and Roszka 2021; McDonald et al. 2009). Among the organizational practices, however, inequalities emerging from interorganizational settings remain understudied.

Studied from a social network perspective, previous research found that through informal and formal organizational networks, gender-based inequalities are created and reproduced in terms of structure, composition and social capital (Blommaert et al. 2019; Lutter 2015; McGuire 2002), indicating the prevalence of gendered organizational networks (Burt 1998; Dawson et al. 2011; Pines et al. 2012). Research has explained gender-based inequalities through different mechanisms such as homophily (i.e., the preference for interaction with others who are similar to oneself on given attributes such as gender and class), and gender composition (i.e., the number of women and men in a group of people) affecting women and men in terms of resources and opportunities access (Burt 2019; McDonald 2011; McDonald et al. 2009).

Gender homophily in networks as the tendency of individuals to create ties with others with the same gender, might result in different types of gender segregations (i.e., reducing or not having ties between genders). Furthermore, research distinguishes between induced homophily and choice homophily. While induced homophily emerges from the group (gender) composition, and the subsequent opportunities and constraints for women and men to interact, choice homophily results from individual choices to interact with similar others (McPherson et al. 2001; McPherson and Smith-Lovin 1987; Ridgeway and Smith-Lovin 1999).

As a consequence, specific patterns of gender-based inequalities might emerge depending on the social context. This means that homophily might work both in favour and against women depending on the social context (Ibarra 1993; McPherson and Smith-Lovin 1993). For instance, the outcomes from homophily in feminist organizations and in men-only financial networks might be quite different regarding women's access to key resources. A well-known example of the latter being the "old (white) men networks" in businesses context (McDonald 2011).

For example, studies about social networks in work organizations contexts have broadly reported the disadvantages that women usually face (Kwiek and Roszka 2021; McDonald 2011; McGuire 2000). Specifically, previous studies in small business found disadvantages for women compared with men when it comes to networks with formal organizations that can provide help or advice about the business, and also with regard to the number of individuals to talk about the business (Loscocco et al. 2009). Likewise, men-owned small businesses were more successful than women-owned ones (Bird and Sapp 2004). Moreover, research on start-ups' owners found that even when women were more active advice seekers, men turned to other men for assistance and women also turned mostly to men for assistance (Aldrich et al. 1997).

However, previous research applying social network analysis also found that “women prefer other women” (Burt 1998, p. 20), and that women benefit from informal and supportive connections with other women at work (Ibarra 1992).

In the SE's context, we expect women to turn more to women because they might be more embedded in feminists' perceptions and experiences, and as a result more willing to support each other. We also control for structural network parameters and examine patterns of gender homophily/heterophily at the node, dyad and structure levels (Ahuja et al. 2012).

Advice seeking networks and gender

Previous research has found gender-based inequalities in advice networks in work related contexts (Podolny and Baron 1997). Generally, scholars found that men ask less for advice than women (Lomi et al. 2011; McNamara and Pitt-Catsoupes 2014), and that both men and women seek advice more from men than from women in entrepreneurial contexts (Aldrich et al. 1989, 1997). This pattern is consistent with a status asymmetry between male and female employees. From previous research, it is clear that informal interactions in men-dominated professions (e.g., entrepreneurship, universities) favour men over women (Seron et al. 2015). This usually results in negative consequences for women and minorities in terms of work advancement (McDonald 2011; McNamara and Pitt-Catsoupes 2014). Likewise, women proven to have bigger advice networks in workplaces (Loscocco et al. 2009; McNamara and Pitt-Catsoupes 2014). The SE context has a higher presence of women and more pro-cooperative behaviours, so we do not expect these same network pattern to emerge to the same extent as in competitive contexts. Still, we will test for the presence of these mechanisms in our data. For advice seeking we state the three following hypotheses:

(Advice seeking activity) **Hypothesis 1a:** Women in the SE seek for advice more (and hence create more advice seeking ties) than men.

(Advice seeking popularity) **Hypothesis 1b:** Women in the SE are asked less for advice than men.

(Advice seeking homophily) **Hypotheses 1c:** Women in the SE selectively seek advice from women, while men selectively seek advice from men.

Economic collaboration networks and gender

Although the SE is expected to be a more egalitarian context, it is embedded in mainstream gender values and expectations: behaviours from mainstream economics might also affect this cooperative ecosystem (Savarese et al. 2021). Specifically, because organizations from the SE participate in commercial activities, usually controlled by men, it can be expected that gender discrimination might occur due to gender expectations and stereotypes. Examples of this effects can be found in entrepreneurship contexts, where women face more barriers for business funding (Marlow and Patton 2005), and in voluntary organizations, where

men might be in better positions (McPherson and Smith-Lovin 1982). As a result, women often are less connected to others in their economic activities. In addition, these connections might be gender-selective, echoing the situation in the traditional economy. For economic collaboration networks we state the following hypotheses:

(Economic collaboration activity) **Hypothesis 2a:** Women in the SE report less economic collaboration ties than men do.

(Economic collaboration popularity) **Hypothesis 2b:** Women in the SE are less often reported as collaboration partners than men are.

(Economic collaboration homophily) **Hypothesis 2c:** Women in the SE selectively collaborate with other women while men selectively collaborate with other men.

All hypotheses are formulated such that the null hypothesis corresponds to the case of gender equality, the alternative hypothesis (i.e., the expected direction of the gender differences) corresponds to the gender-stereotypical expectations.

Research context and case

Barcelona is recognized by its associative and cooperative tradition (Izquierdo 2018), in line with other Southern European regions (Defourny and Nyssens 2010), and a worldwide reference for SE (Chaves-Avila et al. 2020; Llabrés et al. 2018). What makes Barcelona especially interesting for studying SE is that the city has become a hub for social oriented and social innovative initiatives, and it holds a growing organizational ecosystem (Chaves-Avila et al. 2020; Padilla Suriñach 2016) characterized by emerging social initiatives and alternative economic practices (Castells et al. 2017; Lynch 2020).

The *Network of Solidarity Economy* (XES for Xarxa d'Economia Solidària) was created in 2003, and since its creation it has become one of the main actors in the social and solidarity economy in Catalonia (Xarxa d'Economia Solidària de Catalunya 2017). XES aims at organizing consumption and production in alternative ways and provides advice and networking opportunities. Organizations that belong to XES work together in a cooperative framework and constitute a “whole network” in the sense of Lemaire and Provan (2018) and Lemaire (2019) since they work together to achieve their collective goal to promote the solidarity economy (see also Provan et al. 2007; Provan and Kenis 2008). Furthermore, organisations in XES clearly differentiate organizations and individuals that are members of XES from those who are non-members, which suggests a clear network boundary (Laumann et al. 1983).

From a social network analysis perspective, XES can be studied as a *multilayer* or *multilevel* network of economic collaboration between the solidarity economy organizations and advice seeking between uniquely identified representatives of these organisations (Kivelä et al. 2014; Lazega and Snijders 2015). Because the organisations' representatives are unique, we can transfer the gender variable from the representatives to the organisations and study its role not only in the interpersonal advice-seeking network, but also in the inter-organisational collaboration network.

Data and methods

Sample and procedure

Survey data collection

A Survey was delivered during 2017, starting in March, with a web survey in *Unipark*.² Organizations identified as potentially being part of the SE were contacted and received access to the online survey for self-completion with unique access code, while an open access link to the survey was also distributed through official online communication channels in XES.³ The survey included several dimensions: interorganizational networks, the organization itself, gender perceptions and beliefs, care work, working situation, workers' engagement participation and satisfaction, use of digital tools, personal situation (i.e., wellbeing and satisfaction), and demographics. For a detailed explanation of the measurements see "Appendix 1".

In our study, questionnaires were filled in by core members from the SE's organizations. The gender of the respondent person was asked in a specific question and used as a proxy for gender (1: woman, 2: man, 3: non-binary). We specially considered for the analysis the gender declared by the individuals representing their own organizations as the organizations gender in networks with other organizations, and the unit of knowledge is the interorganizational gendered structure in multiplex networks.

Reports of the "Balanz Social"⁴ from October 2016 and October 2017 indicate that the XES consisted of 80 and 117 organizations, respectively (Xarxa d'Economia Solidària de Catalunya 2016, 2017). Assuming a linear growth, and considering that our survey was taken in Spring, the population around the survey time is assumed to have consisted of about 100 organisations. Collecting data from these organizations was a challenge since our survey was quite time demanding (in average 1 h) and the organizations mainly small or highly dependent on voluntary work (see Table 1). From our survey data collected at the beginning of 2017, we obtained 96 organizations' responses declaring to belong to XES. After further revising the responses during data processing and analysis, we dropped 12 cases because they either did not belong to the sample or had relevant missing data. This left us with 84 full survey organizational responses. Given our population size estimate of ~100, the response rate was about 80%, which is enough for valid ERGM inference when assuming missingness at random (Schweinberger et al. 2020).

We informed participants about the purpose of the study and assured confidential handling of their data. All the fieldwork and related procedures were developed entirely by the first author.

Networks, organizational attributes, and individual attributes (socio-demographic variables) were answered by mainly founders, directors or by one of the main persons involved in the organization's daily activities (for the network questions see

² Unipark is the academic program of Questback, which is an online survey and feedback software company. For more information see: <https://community.questback.com/s/what-is-unipark>

³ A database was created with the available data sources since no official updated databases on the solidarity economy were available in Barcelona at the moment of data collection. The basis upon which a dataset with the organizational population was crafted were the in-depth interviews and ethnographic fieldwork. Though, this list was complemented by desk research techniques.

⁴ "Social Balance is a tool for accountability and measurement of social, environmental and good governance impact" for organizations from the Solidarity Economy and the Social Market. Social Balance is completed by organization in an online questionnaire. Source: <http://mercatsocial.xes.cat/ca/eines/balancsocial/>

“Appendix 1”). Regarding social networks data, a realistic approach was applied (i.e., actors themselves defining social boundaries) to make meaningful specifications of the nodes and relations. Network questions were placed at the beginning of the survey (Borgatti et al. 2013). Organizations were asked with which other organization they looked for advice during the last year (referring to 2016). They had to indicate who are they working with, who they ask for advice. Here we helped them by a list with autocomplete function to choose from. Following Ibarra (1992), space for ten contacts were provided for each network question, but respondents were informed that additional contacts were possible to be included. During the data collection processes, special attention was given to ethical aspects by providing explicit consent forms and protecting the confidentiality of respondents (Borgatti and Molina 2005; Robins 2015).

Exponential random graph models

Exponential Random Models (ERGMs) are one of the most used methods in empirical social networks to test hypotheses about who is connected to whom in a social network (Robins 2015). Because network data collected in a whole network design violate the independence assumptions underlying standard inferential procedures like regression analysis, stochastic network models like ERGMs have to be used. They allowed us to test if the ties in interorganizational networks can be explained by gender as hypothesized above, accounting for endogenous interdependencies between the ties, such as reciprocation, hub formation or transitive closure (Lusher et al. 2013). To the best of our knowledge, no other studies have analysed SE's networks with ERGMs.

To account for the interdependencies in advice seeking and collaboration patterns between gender represented organizations, and to simultaneously model the network effects that explain the interorganizational network structure we estimated two separated ERGMs, one for each dependent network.

ERGMs express the probability of a global network structure y in terms of the prevalence of local subgraph configurations in it. For the configuration-specific statistics $g(y)$ selected into a model specification, parameters θ are estimated that can be interpreted as actors' tendencies to create these local configurations (if the parameter is positive) or destroy them (if the parameter is negative) (Robins et al. 2007). Expressed as a formula (e.g., Goodreau et al. 2011; Wasserman 1996) the probability of observing a given network y among a given set of individual actors is:

$$P(Y = y|\theta) = \frac{\exp(\theta' g(y))}{k(\theta)}$$

where Y is a random network with the specified ERGM distribution and $k(\theta)$ is the summed numerator on all possible networks among the set of actors.

For studying whether the gender variable affected tie formation in advice seeking and economic collaboration according to the hypotheses formulated above, ERGMs were specified for both networks. The hypotheses were operationalized by including so-called

nodemix effects for the gender variable. As structural dependencies, reciprocity, isolates, and transitive closure effects. In the nomenclature established in the “*ergm*”- package of the *Statnet* suite of packages for R (Handcock et al. 2008, 2019), we estimated for both networks: effects of Nodal Attribute Mixing, referring to the connections between actors of the different gender groups (women and men); the Mutual effect, referring to reciprocated ties; Isolates in our networks, referring to nodes with both in-degree and out-degree equal to zero; and Geometrically Weighted Edgewise Shared Partnerships (GWESP), referring to number of indirect relations through third parties that co-occur with a direct relation, thus accounting for transitively closed triangles in the network.

Results

Data analysis

Descriptive

Table 1 contains the descriptive statistics of the sample. On average, organizations from the sample had 13 employees (without counting volunteers). When taking into account volunteers, the average increased to 32 individuals, although the majority remained smaller: more than 50% of the sample were between 1 and 10 workers in the organization (with and without volunteers). With regard to years of existence at the moment of data collection, organizations had on average been functioning for almost 13 years.

Data obtained at the individual level shows a certain homogeneity in terms of demographics. Most respondents had between 30 and 40 years old and hold a master’s degree (43%). In terms of gender, the sample was quite equally distributed between women and men: 49% were women and 51% men; the non-binary category was only chosen once, and therefore we had to exclude it from the analysis. Additionally, most respondents were locals and nationals.

Table 1 Sample description

	Min	Max	Mean/ Proportion
<i>Description of organizations (n = 84)</i>			
Size	1	58	13
Size (with volunteers)	1	575	32
Age since foundation	0	49	12,7
<i>Description of respondents (n = 84)</i>			
Age	29	61	42
Education			
Master’s degree			43%
Bachelor’s degree			30%
University diploma			13%
High school/Professional/PhD			14%
Gender			
Women			49% (41 women)
Men			51% (43 men)

Source: self-elaboration

Table 2 Networks descriptive statistics

	Number of ties	Average degree	Transitivity
Advice	170	2.02	0.15
Collaboration	156	1.85	0.16

Source: self-elaboration

Table 2 contains other descriptive information such as the number of ties, average degrees, and transitivity in networks data. The average degrees indicate that founders of organizations ask for advice to 2 other organizations in average. Advice network has a slightly higher average degree value (2.02) than collaboration network (1.85). Transitivity, however, is almost the same for advice (0.15) and collaboration (0.16) networks.

Advice seeking network by gender

We estimated network models using the most recent version of the *statnet* ergm package 4.1.2 in R (Krivitsky et al. 2021). The model was estimated conditioning on the number of edges because unconditional estimation turned out to be unstable. Results are presented in Table 3. The pair “woman seeks advice from woman” is the reference category. By comparison, men do not differ from this reference category, neither when asking advice from women (mix.gender.man-to-woman) nor when asking advice from other men (mix.gender.man-to-man). However, women ask significantly less advice from men (mix.gender.woman-to-man). The endogenous control effects indicate significant evidence for reciprocity in advice seeking (1.25, $p < 0.001$), isolation of some nodes (1.08, $p < 0.01$), and transitive closure (1.14, $p < 0.001$).

The results in Table 3 do not support Hypotheses 1a (“women seek more advice than men do”) and 1b (“men are more often asked for advice than women are”). In fact, contrariwise, women seek significantly less advice from the men (-0.48 , $p < 0.05$), leading to overall lower advice seeking activity by the women compared to the men, and overall lower popularity as advisors for the men compared to the women. The same result partially confirms Hypothesis 1c, that women create more advice ties with other women. This is in line with key works from Burt (1998), Ibarra (1997), and more recent research (Yang et al. 2019). However, according to our analysis, men in the solidary economy do not show a gender preference as in other organizational contexts (Burt 1998). The results from Table 3 suggest that while women might still need to support each other, they might not face such an active exclusion from men as in conventional firms (Brass 1985).

Table 3 Monte Carlo maximum likelihood results for advice seeking network

Configuration	Estimate	Std. error	z value	Pr(> z)
<i>mutual</i>	1.26	0.37	3.4	< 0.001
<i>mix.gender.man-to-woman</i>	-0.01	0.17	-0.03	0.969
<i>mix.gender.woman-to-man</i>	-0.48	0.19	-2.5	0.012
<i>mix.gender.man-to-man</i>	-0.14	0.11	-1.2	0.228
<i>isolates</i>	1.08	0.40	2.7	0.007
<i>gwesp.fixed.0.5</i>	1.14	0.10	11.3	< 0.001

Coefficients from ergm package in R

Reference category in all analyses is the “woman-to-woman” dyad

Parameters that are statistically significant are shown in boldface type

Economic collaboration network by gender

Results of the ERGM analysis for the collaboration network are presented in Table 4. The model again was conditioned on edges because unconditional estimation was unstable. The pair “woman indicates collaboration with woman” again is the reference category. By comparison, all the other combinations of gender in relation to collaboration do not differ significantly from this reference category. This result suggests that collaboration might indeed not be gendered in the solidarity economy. With regard to the endogenous control effects also in the economic collaboration network we found significant evidence for reciprocity (0.97, $p < 0.05$), isolation of some nodes (1.37, $p < 0.001$), and cluster formation (1.16, $p < 0.001$). Finally, accounting for advice seeking in an enriched model (results not shown here) gave a significant effect but did not alter the rest of the results.

For economic collaboration networks, ERGMs results do not confirm the proposed hypotheses, that women are less active and less popular in economic collaboration than men are (H2a and H2b, respectively). They also seem not to create more ties with other women (H2c) and also men do not create more ties with other men. Overall, these results suggest that these gender-based inequalities might not be operating in interorganizational networks from the SE as in more competitive environments from the mainstream economics (Burt 2019; Kwiek and Roszka 2021; Loscocco et al. 2009; McDonald 2011; McDonald et al. 2009; McGuire 2000, 2002; Seron et al. 2015).

Gender differences and similarities in advice and collaboration networks

The analysis of gender differences in advice seeking and economic collaboration networks was developed to further understand whether informal and formal networks in the SE context are gendered. Results suggest that economic collaboration networks are not structured by gender, and inequalities based on gender are not occurring from a relational standpoint. Women, however, tend to selectively ask less advice from men, which goes against stereotypical expectations.

ERGM results show that reciprocation and transitive closure are important mechanisms for understanding the network structures of advice seeking and economic collaboration. Additionally, advice might predict collaboration, namely that previous personal relationships that involve trust might help economic partnership.

Table 4 Monte Carlo maximum likelihood results for economic collaboration network

Configuration	Estimate	Std. Error	z value	Pr(> z)
<i>mutual</i>	0.97	0.39	2.5	0.012
<i>mix.gender.man-to-woman</i>	-0.20	0.18	-1.1	0.277
<i>mix.gender.woman-to-man</i>	-0.19	0.18	-1.1	0.270
<i>mix.gender.man-to-man</i>	-0.19	0.15	-1.3	0.192
<i>isolates</i>	1.37	0.36	3.8	< 0.001
<i>gwesp.fixed.0.5</i>	1.17	0.10	11.5	< 0.001

Coefficients from *ergm* package in R

Reference category in all analyses is the “woman to woman” dyad

Parameters that are statistically significant are shown in boldface type

Conclusion and discussion

In this paper we explored interorganizational network structures to understand how resources such as information and knowledge flow in a solidarity economy ecosystem on the basis of gender. Specifically, the aim of this article was to identify social inequalities by revealing gender similarities and differences when organizations exchange resources. The study focused on gender of the individuals considering that other social basis for connection such as nationality, language and socioeconomic status were quite homogeneous among the population of study.

In this study, we analysed unique data collected among organizations within a solidarity economy network (XES). This network constitutes an ideal setting to study gendered interorganizational relationships because its members make special efforts to minimize social inequalities. Furthermore, we undertake the first ever investigation of gender homophily and heterophily in interorganizational advice and economic collaboration ties. We look at the micro level practices, namely with whom men and women collaborate in order to shed light on the mechanisms that shape gender inequalities in the SE organizational ecosystem. We estimated exponential random graph models (ERGMs) for 2 different types of inter-organizational networks: advice-seeking and economic collaboration. The analysis reveals both gender similarities and differences.

Our research provides new insights for solidarity economy organizations and gendered networks scholarship. This study contributes to the research gap in social inequalities in interorganizational networks and to the existing research on gender differences in social networks. Conversely existing social networks research, this study differentiates gender from sex and explicitly asked survey respondents their gender (women, men, non-binary). Furthermore, in this study we understand gender not only as an identity process (i.e., something cognitive) but also as determinant to resources' access (Ridgeway and Correll 2004). In the context of our study, we speculate that men in the solidarity economy might be more receptive to progressive narratives and values coming from the feminist movement.

Our study addresses the call by many authors for tackling gender-based inequalities in work settings. Investigating to what degree interorganizational networks are gendered is significantly important for recognizing that more equality efforts are needed in interorganizational contexts. While most studies focus on one single organization, this study addresses an organizational ecosystem with clear interorganizational interdependences in terms of values and mission. For this purpose, we analyse interorganizational networks, that are particularly important in collaborative settings such as the social economy.

We presented ERGMs to assess how gendered the advice seeking and collaboration networks among organizations from the social economy are. By modelling gender-based mechanism within this context, we gained new insights about whether interorganizational networks in the SE ecosystem are gendered and to what degree. When modelling these possible power imbalances among organizations our findings reveal that there are not such significant differences in the way women and men participate in formal and informal ties with other organizations.

Contribution to theory

Gender-based inequalities are created and reproduced in organizations beyond their own boundaries, both in formal and informal networks. However, the degree to which these inequalities take place in interorganizational settings has remained understudied.

This paper provides a first approximation to the study of gender-based inequalities in interorganizational networks; it is, to the best of our knowledge, the first to examine how interorganizational networks are gendered. Likewise, the paper contributes to the broad literature on gendered social networks in work organizations (Burt 1998; Dawson et al. 2011; Pines et al. 2012) and connects two otherwise disconnected streams of research: interorganizational networks studies and social inequalities scholarship, specifically in this case focused on inequalities based on the gender. It is the first to develop this approach from a social network perspective by visualizing social mechanisms that hide the persistence of gender-based inequalities in interorganizational settings. Network configurations examined with ERGMs helped us to identify some underlying social processes among organizations from the social economy. While previous studies have acknowledged the reproduction of gender-based inequalities by homophily mechanisms (McPherson and Smith-Lovin 1986), where men in organizations usually have more potential contacts and resources (McPherson and Smith-Lovin 1982), this study has applied statistical network models to identify the operating mechanisms in empirical interorganizational data collected from the solidarity economy in Barcelona.

Previous research highlights the importance of considering the social and organizational contexts in which women and men interact when studying gender-based inequality in networks (Ibarra 1993; Loscocco et al. 2009; McPherson and Smith-Lovin 1993). As in other workplace contexts, our analysis suggests that women might create more ties with other women for advice. This result is in line with key works from Burt (1998), Ibarra (1997), and more recent research (Yang et al. 2019). However, men in the solidary economy do not show a gender preference as in other organizational contexts (Burt 1998). We speculate that while women might still need to create trust with other women, they do not face such and active exclusion from men as in conventional firms (Brass 1985).

One explanation provided by existing literature about possible reactions to how women are treated is the “combat-birth metaphor” (Burt 1998). This metaphor refers to how women’s networks help them to breaking through the ‘glass ceiling’ in work organizations (Burt 1998, p. 20). In this study, however, our interpretation relays in a feminist perspective that allows us to understand the reasons why gender differences are not significant in the SE organizational ecosystem. Feminist movement and solidarities within the SE might play a role in explaining gender differences and similarities as previous research has suggested (Rothschild and Tomchin 2006).

This paper therefore contributes to the intersection of gender studies, solidarity economy, and social network analysis, which has not sufficiently developed till now. As for our theoretical contribution to the solidarity economy scholarship, our results indicate that a feminist approach developed by women social entrepreneurs might contribute to the fact that men do not actively avoid creating economic collaboration ties with women.

Implications for practice

The degree to which interorganizational networks structures are gendered is an important issue for both men and women. The results provide useful insights on how organizations can better support women in social and solidarity economy organizations.

The differences in interorganizational networks need to be disentangled as it has been shown in this paper for the case of gender-based inequalities. The type of social inequalities that should be addressed are context dependent: for certain social phenomena and specific socio-cultural contexts, other sources of inequalities such as class, ethnicity, caste, religion, nationality, citizenship, among others, might be more salient. Moreover, an intersectional perspective might address how those inequalities intersect with the gender-based ones.

Interorganizational networks provide important opportunities for the SE's initiatives. While these networks constitute key resourceful mechanisms, they are intertwined with existing sources of inequality. Interorganizational network analysis provides a better understanding of the connection between SE organizations. Hence, these results might be of interest for both scholars and members of the SE and might help program interventions to ensure and strengthening the SE organizational ecosystem while studying further mechanism to hamper gender-based inequalities in interorganizational collaborations.

Limitations and future studies

This research presents some limitations that provide opportunities for future studies. Among the limitations, advice seeking, and economic collaboration were captured at one point in time and could not account for their evolution. Following Provan et al. (2007), we consider that when studying interorganizational networks it would ideally “require researchers to study multiple networks during a period of years”, although this type of work “is generally very time-consuming and costly” (Provan et al. 2007, p. 510). Future research could study interorganizational networks from a longitudinal approach to gain insights on the process and evolution over time. Even though these limitations, Lusher et al. (2013, p. 18) stated that cross sectional network patterns in itself give relevant insights about social mechanisms that drive the structure of the network.

Data collected was self-reported variables. This could affect the accuracy of the results due to recall bias (Borgatti et al. 2013). The reported interorganizational networks were operationalized in a large scope because of the complexity that entails socially driven actions and value-focused organizations. This approach and measurement, however, presents some assessment limitations.

Future studies will gain much insight from including gender status' beliefs variables into ERGM modelling for gender-based inequalities analysis. When gender status is salient both men and women implicitly form status' beliefs (Ridgeway and Correll 2004; Thébaud 2011) that favour men expecting from them greater competence than from women, considering all else equal. These expectations have behavioural consequences in interaction rates, influence in work settings, among others (Rashotte and Webster 2005), that should be also integrated for understanding the causes of gender segregation and inequalities.

Although cross-sectional studies that focus on one context do not allow to generalize the results, similar gendered networks patterns can be found across similar contexts as it is the case for entrepreneurship (Aldrich et al. 1989). Therefore, it is needed to develop

more social network studies on gender in SE to find the specific common gendered network patterns that prevail in these cooperative contexts.

In this study gender was salient while other demographic and contextual variables in the sample were quite homogeneous. Future research could further study organizational collaboration considering gender-based inequalities and additional sources of social inequalities. Likewise, future studies with a qualitative approach emphasizing intersectionality could further investigate the situation of LGBTIQ+ members in the social and the solidarity economy.

What was left out of our analyses is the ties of advice and economic collaboration that link the SE to firms outside the SE, in particular the financial institutions. Arguably, when interacting with more traditional organisations, also more traditional gender roles could play a role. By investigating such external relationships and the role of the SE, it could be studied to what degree there is evidence for a spillover in gender equality practices from the SE to the traditional economy.

Future studies could compare our results with other similar organizational ecosystems to know whether these results also hold for SE in different contexts. This research path could contribute to the SE's organizational knowledge, its values, its challenges, and prospects. In this regard, we make a call for more research on the interorganizational networks for the social and solidarity economy because its core assumptions differ from for profit-oriented organizations.

Conclusions

This study is the first to test whether gender predicts interorganizational networks' structure, and the first to use ERGMs for networks in the context of the social and solidarity economy. By applying ERGMs on advice seeking and economic collaboration networks, this research suggests that gender-based inequalities are not occurring as in more competitive driven environments from the mainstream economics. Our results show that women ask more advice from women than from men, and that reciprocity and transitive closure are important mechanisms for understanding the network structures of advice seeking and economic collaboration.

Appendix 1: Questionnaire dimensions and measurement

The structure of the questionnaire was designed in the following survey blocks:

Introduction: In this first part of the survey the research project was presented as well as the funding organization, questions regarding respondents' confidentiality, data storage, and information about the survey software. After this introduction, some basic questions were placed about the respondent position in the organization, and the number of people working in her/his organization.

First block: Networks' questions. To collect social network data, respondents from organizations were asked to report about which other organizations they 1) looked for advice (advice seeking), and 2) worked with (economic collaboration) during the last year prior to the study. For these two networks they responded rosters-based

questions, with an autocomplete function, to choose from. They were also allowed to add more organizations to the roster.

Second block: Inter-cooperation (networks) questions regarding criteria, obstacles, and preferences for interorganizational cooperation.

Third block: Gender-related questions. These questions include scales on gender perceptions, beliefs about women and men in the social economy, and about how tasks and responsibilities' distribution between women and men in the household.

Fourth block: Uses of time (including care unpaid work) and salary perceived (i.e. material situation and satisfaction).

Fifth block: Organizational questions. This block contains questions related with the organizations' main values and purpose, organizations' main features (such as year of creation), sources of funding, and membership to existing networks.

Sixth block: Working situation and satisfaction questions. The questions include workers' engagement and participation, and satisfaction with different dimensions of their job position.

Seventh block: Use of technology in the organization. The questions referred to the use of social media and other important platform or technological tools.

Eighth block: Demographics and overall satisfaction. This last block contained questions about the respondents such as age, gender, education, and questions referring to the satisfaction with working and the personal life.

Additionally, some open-ended questions were included regarding the organizational ecosystem. For instance, the following question was incorporated: What are your personal worries and fears/concerns about participation in the social economy in Barcelona?

Sociometric questions

Dependent variables

Advice seeking network

Advice seeking was operationalized as follows: Networks have proven to play a crucial role in the economy. Please, identify your key alliances and social relationships based on your own experience in the city of Barcelona. Thinking about the informal ties with other members of the social economy community during the past year, can you indicate which organizations have members that you personally know and who you go to for guidance and personal advice? Please, enter the names of all organizations and the name of the person with whom you communicate more. If there are other collaborators in Barcelona in addition to those provided in the list, please include them at the end of the list (in "others" option). You just have to type the first name of the person. If you do not remember the name, indicate if is man, woman, or non-binary. After writing 3 letters, the questionnaire will suggest names of organizations.

Economic collaboration network

Economic collaboration networks were operationalized by the following question: Thinking of your relationships with other initiatives of the social economy during the last year, could you indicate which people, and their organizations were among your suppliers, customers and organizations with which you collaborate economically in the city of Barcelona? (In

the economic collaboration we include activities like giving money for a joint public activity). Please, enter the names of all organizations and the name of the person with whom you communicate more. If there are other suppliers or collaborators in Barcelona in addition to those provided in the list, please include them at the end of the list (in “others” option). You just have to type the first name of the person. If you do not remember the name, indicate if is man, woman, or non-binary. After writing 3 letters, the questionnaire will suggest names of organizations.

Independent variable

Gender

Gender was specifically asked in the questionnaire and not used interchangeably with sex. Gender was coded as 1 for women, 2 for men and 3 for non-binary, and was used as a proxy for gender.

Appendix 2: Convergence and goodness-of-fit tests

Advice seeking network

Convergence

The above results rely on convergence of the ERGM’s estimation algorithm, which is documented in Fig. 1.

Goodness-of-fit tests

The statistics used for testing the goodness of fit were the in- and out-degree distributions, the minimum geodesic distance (shortest path length) distribution, and edgewise shared partners distributions. From the estimated model, simulated networks were compared with the configurations in the observed network, which is represented with the black lines in Fig. 2. Goodness of fit for advice seeking network show a good fit on degree and shared partners distributions. Nevertheless, the minimum geodesic distance distribution fit poorly. In the model-simulated networks, finite distances are longer than in the data, whereas infinite distances (disconnected components) occur less often than in the empirical data, as shown in Fig. 2.

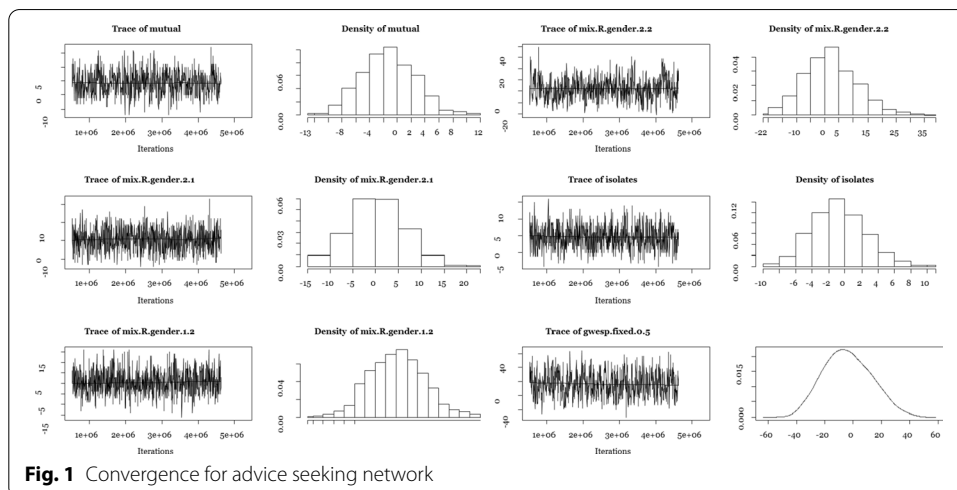
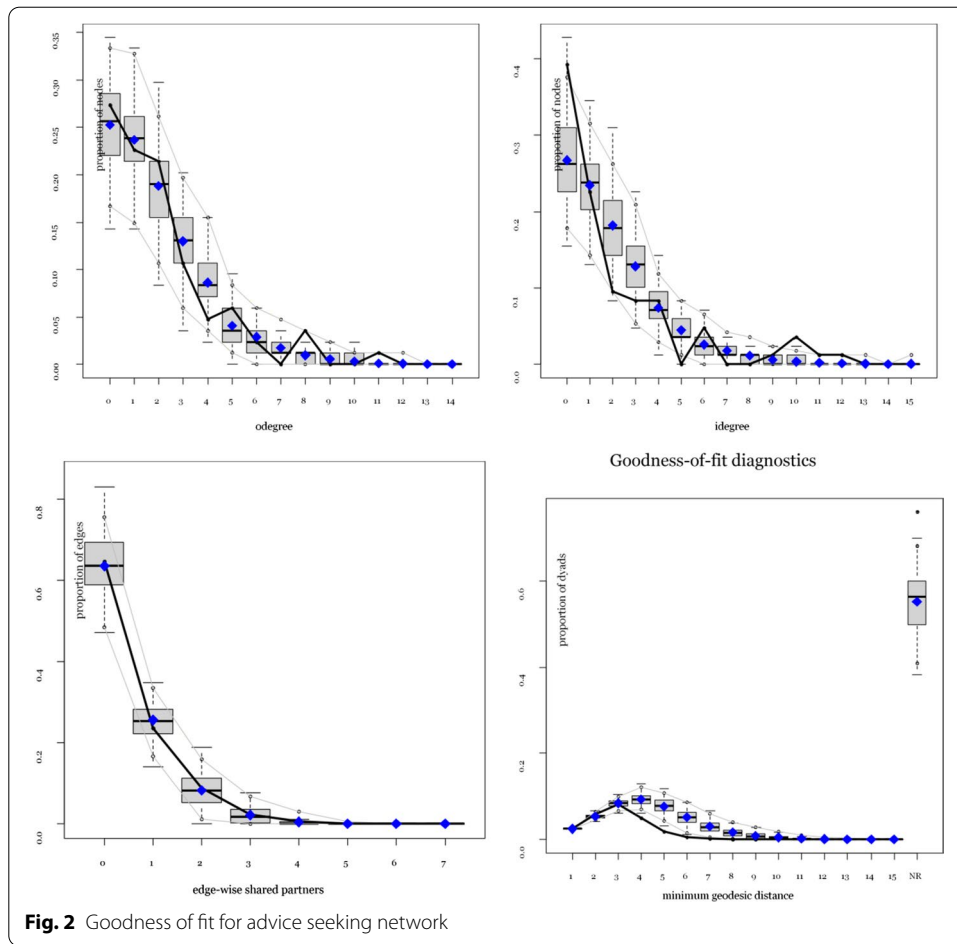


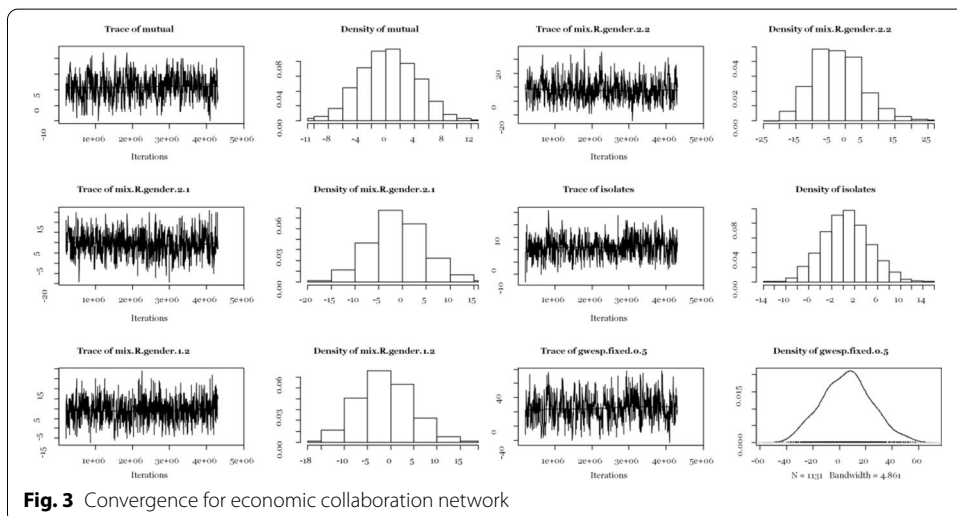
Fig. 1 Convergence for advice seeking network

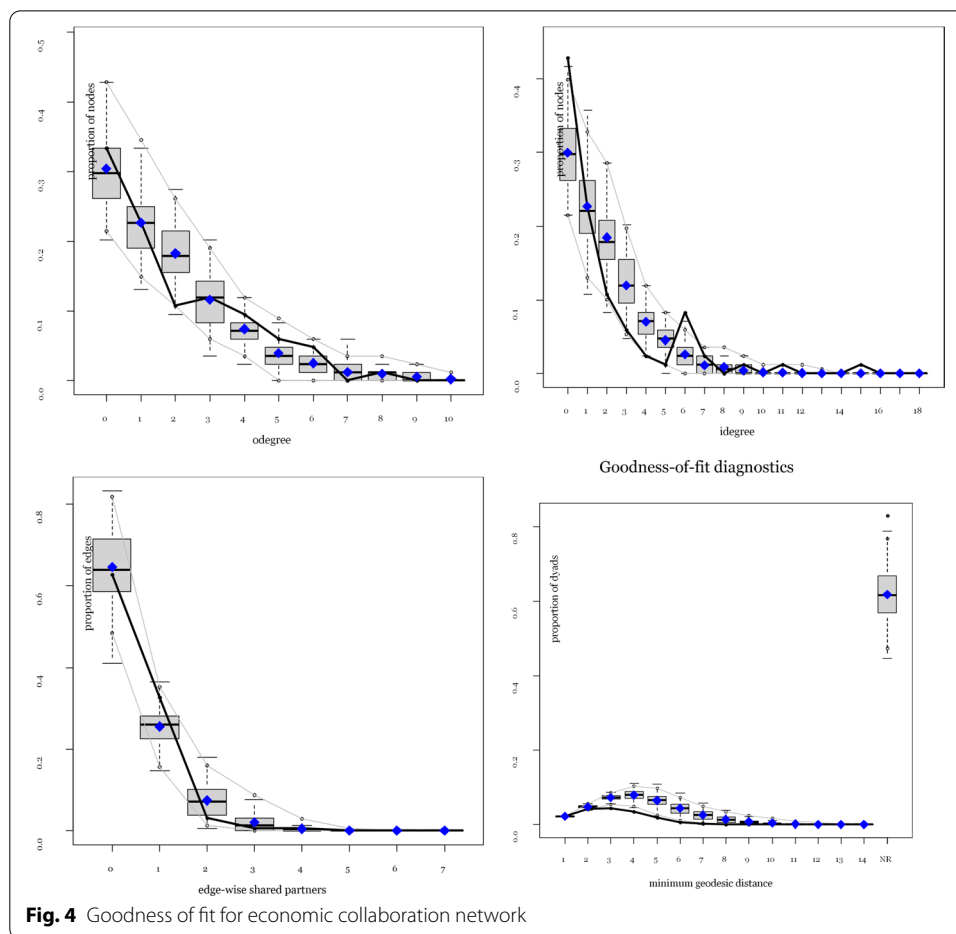


Economic collaboration network

Convergence

The above results rely on convergence of the ERGM's estimation algorithm, which is documented in Fig. 3.





Goodness-of-fit tests

The statistics used for testing the goodness of fit in economic collaboration network were the in- and out-degree distributions, the minimum geodesic distance (shortest path length) distribution, and edgewise shared partners distributions. From the estimated model, simulated networks were compared with the configurations in the data (the black lines in Fig. 4).

As in the case of advice seeking network, the goodness of fit for economic collaboration network show a good fit on degree and shared partners distributions, but the minimum geodesic distance distribution fit poorly. In the model-simulated networks, finite distances are longer than in the data, whereas infinite distances (disconnected components) occur less often than in the empirical data, as shown in Fig. 4.

Abbreviations

ERGMs: Exponential random graph models; GOF: Goodness of fit; SE: Solidarity economy; XES: Network of Solidarity Economy (XES for *Xarxa d'Economia Solidaria*, in Catalan).

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Authors' contributions

NGS conceived the presented idea and collected the data. CS supervised and contributed to the whole process. NGS and CS prepared the data, performed the analysis, interpreted the results, and prepared the manuscript. Both authors read and approved the final manuscript.

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Declarations**Competing interests**

The authors declare that they have no competing interests.

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