The (uncertain) invisible college of Spanish accounting scholars

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Abstract

In order to test empirically the invisible college thesis in an accounting academic community and evaluate the internal mechanisms that are embedded in its reproduction, we explore in this paper the social network of Spanish accounting scholars. The social network examined arises from one event that combines formal and informal aspects of interaction between scholars: the selection of members of Ph.D. panels for the period 1994-2003. Results are consistent with the existence of an oligarchic academic community that shows a strong and positive association with measures of local influence, but that is decoupled from measures of scholarly contribution. In this regard it is difficult to sustain that high profile scholars in this community generate a disproportionate volume of new ideas, which is the basic tenet of the invisible college hypothesis. This finding is also indicative of the schizophrenia in which non-tenured Spanish accounting scholars live, between increasing demands of refereed publications by academic institutions and a hierarchical academic community sponsoring very different values.

Keywords: Accounting; invisible college; academic communities; network analysis; Spain.

1. Introduction

Students of scientific activity argue that while natural sciences exhibit stable and coherent core knowledge, social sciences are characterized by controversy and low consensus (Hargens, 2000), with paradigms having social and political, rather than "scientific" roots (Alvesson & Deetz, 2000; Arrington & Schweiker, 1992; Burrell & Morgan, 1979; Crane, 1972; Kuhn, 1962). The observation of this fragmentation in accounting research (Arrington & Schweiker, 1992; Chua, 1986; Hopper & Powell, 1985; Puxty, 1993) has motivated a growing body of literature that examines the reasons why accounting researchers select particular research paradigms. The interdisciplinary literature has proposed hegemonic explanations for the predominance of accounting research derived from neoclassical economics in the U.S. (Lee, 1997; Reiter & Williams, 2002; Schwartz, Williams & Williams, 2005), but has also noted that, globally, there exists a great deal of methodological variation and research communities disintegration (Ballas & Theoharakis, 2003; Carmona, Gutierrez & Camara, 1999; Lowe & Locke, 2005; Lukka & Kasanen, 1996; Panozzo, 1997). Research, ideas and methods tend to be influenced by the group of people researchers interact with and the authorities recognized by the group (Crane, 1972; Kuhn, 1962; Moody, 2004). Specifically in the accounting literature, Arrington and Schweiker (1992) argue that the research community, as an anticipated audience, conditions research and conclude that there is a lack of research on the sociology of accounting research.

The aim of this study is to investigate the structure of the accounting research community. Arrington and Schweiker (1992) introduced the notion of invisible colleges to the study of accounting research communities while other students of accounting research practice have explored the role of academic elites in controlling and defining accounting research (Lee, 1997; Williams, Jenkins & Ingraham, 2006). This stream of research has conceived research communities atomistically, considering the characteristics of members individually and identifying the core/elite of the discipline by the number of publications or citations. But research communities are more than the addition of scholars, they are networks of scholars connected by a diversity of social and academic ties. This has been acknowledged in other disciplines that have undertaken the study of academic communities with the assistance of network analysis

concepts and methods (Acedo, Barroso, Casanueva & Galán, 2006; Hargens, 2000; Jones, Sharifi & Conway, 2006; Moody, 2004; Newman, 2004).

This article contributes to the previous literature on accounting research communities by empirically testing the existence of accounting invisible colleges, conceived as networks. More specifically, this study explores the social network that emerges from the selection of members of Ph.D. panels in Spain for the period 1994-2003 and examines to what extent the local influence and the scholarly contribution of actors can explain the centrality of Spanish scholars in such network.

The rest of the article is structured as follows. The next section carries out a review of the literature that has explored the notion of invisible colleges and its significance for the study of the accounting research community and develops our hypotheses. The third section describes the procedure followed to obtain the social data and the methods of social network analysis that are employed to characterise the Spanish academic community. The fourth section describes the results obtained from the relational analysis and, finally, the fifth section discusses the results and sets out some conclusions.

2. Invisible colleges

Moody (2004) contextualised the study of invisible colleges in the "increasing interest in linking the distribution of cultural ideas and practise to the interaction structure of social communities" (p. 215). In the scientific community specifically, Kuhn (1962) argued that scientists embedded in research communities, using established patterns of interpretation, tend to disregard available empirical evidence that is not consistent with accepted theories. Scientific communities acquire special relevance in the case of the scientist's activities because she needs recognition by his peers (de Solla Price, 1963). These ideas raised an interest in the study of research communities and lead de Solla Price (1963) to formulate the invisible college hypothesis: disciplines are characterised by a core, and inter-institutional, group of highly productive and high profile scientists that interact, formally and informally, with each other in the field and generate a disproportionate volume of new ideas, including its rules and certain research problems (Jones et al., 2006; Moody, 2004; Zuccala, 2006). If de Solla Price (1963) stresses that

invisible colleges arise from informal interaction, Crane (1972) emphasises the multiple interactions between researchers stemming from co-authorships, citations, exchanges of drafts, a joint presence at events and membership of associations. According to Crane (1972) scientific communities are characterised by the presence of both direct and indirect ties between many but not all of its members. Moreover, it is through some highly influential members how most networks actors are indirectly linked with each other. The invisible college is, therefore, a network of very active sicientits "linking separate groups of collaborators within a research area (…) [in such a way that] the absence of an effective invisible college (…) can inhibit the development of a field" (Crane, 1972, p. 54). de Solla Price (1963, p. 91) also argued that the invisible college is self-perpetuating, through internal mechanisms that work "to increase their strength and power within science". The invisible college is thus an autopoietic network of researchers that provide consistency to a scientific community and that is somehow institutionalised by means of some internal mechanisms or values that are embedded in the network.

The discussion of invisible colleges in accounting has served to explain, for example, the divide between the U.S. and Europe (specially the U.K.). Panozzo (1997) argued the significance of institutional contexts for shaping accounting research and described the sociological and methodological distance between research communities in both sides of the Atlantic. Likewise, Lukka and Kasanen (1996) described a scenario in which co-authorships between scholars of different nationalities are rare, in which the authors use data from their own country, and in which the discipline has become polarised between two elites, one from the United States and the other from Europe. They also concluded that research quality is confused in this polarised research community with questions relating to methods, cultures and power.

Jones and Roberts (2005) examined co-authorship in accounting journals, concluding that the discipline in the United States is of a local nature. The literature also points to the existence of research communities that in Europe are confined to the limits of each state and heavily influenced by national academic traditions. Thus, a European academia should be seen as supplementing national traditions rather than as an integrated research community (Carmona et al., 1999; Lukka & Kasanen, 1996; Panozzo, 1997). Institutions such as the bureaucratic system that governs the appointment of academics to positions in Spanish and virtually all European universities

(Frey & Eichenberger, 1993), as well as the language barriers that work to exclude in practice academics from other countries, would account for the weakness of a European academic community.

From the outset, empirical studies of invisible colleges (Crane, 1969) relied on the concepts and methods of social network analysis (Wasserman & Faust, 1994). The most important contribution of network analysis, compared with other analytical approaches, is the consideration of concepts and information about relationships between actors, not just information about the attributes of actors considered individually. Developed in sociology, social network analysis has evidenced for example the "small-world hypothesis", according to which even for large populations most pairs of people can be connected by a short chain of acquaintances (Newman, 2001).

In the last decade, social network analysis allowed studying the invisible college hypothesis in diverse academic disciplines from humanities to physics (Acedo et al., 2006; Barabasi, Jeong, Néda, Ravasz, Schubert & Vicsek, 2002; Cappell & Guterbock, 1992; Hargens, 2000; Moody, 2004; Newman, 2001; Verspagen & Werker, 2004; Zuccala, 2006). Most of these studies are based on collaboration networks (edges based on co-authorship of research papers), although Cappell and Guterbock (1992) is based on affiliation networks (membership to associations), Hargens (2000) on citations, and Verspagen and Werker (2004) in questionnaires addressed to the members of the network. The results of these investigations point to well-connected research communities, in which the largest cluster of the network, with all its members connected, accounts for 50% to 80% of the network. However, unsurprisingly every single actor has only a few ties with other actors, leading in most cases to a network density (proportion of all possible ties that are actually present) that is lower than 1%. These studies also indicate a higher density in local neighbourhoods (local subsets of actors that interact disproportionately, compared to the whole network), denoting a general pattern of collaborations with a closer group of colleagues. Finally, these studies show that some star actors in the academic community have a disproportionate number of ties with other actors, something that would be consistent with the invisible college hypothesis. We state our first hypothesis as follows:

> *Hypothesis 1:* A small group of scholars show a disproportionate number of ties with other actors in the academic community. And it is through this

small group of scholars that most scholars are indirectly connected linked to each other.

One extension of the invisible college hypothesis is the study of the internal mechanisms or values that are embedded in, and help to reproduce, the network. One basic tenet of this hypothesis is that the social network that gives rises to the invisible college arises from formal and informal interactions. Students of academic communities have focused on more formal interactions among scientists derived from research dissemination (e.g. co-authorship) and on more informal interactions that would account for the existence of sources of influence that are incidental to the research activity itself (Cappell & Guterbock, 1992). Therefore, it is relevant to study not just the distribution of academic status in academic communities, but also the mechanisms that allow different scholars to obtain more or less academic status. As regards its distribution, it has been argued that oligarchic research communities are likely to repress different modes of research in accounting and hinder the intellectual vitality of the discipline (Arrington & Schweiker, 1992; Lee, 1997; Reiter & Williams, 2002; Williams et al., 2006). However, the understanding of the effects of academic hierarchies requires insight into what are the mechanics that contributed to the construction of those more or less oligarchic communities (Williams et al., 2006).

Frey and Eichenberger (1993) contend that the excellence of academic economists in Continental Europe is defined by reference to the formal examinations passed (e.g. a full professor has to pass a, often country-wide, formal examination), to the membership to particular academic schools, and to the hierarchical position attained, but not necessarily to the quality and quantity of publications and citations achieved. In some countries, even nepotism seem to play a relevant role (Allesina, 2011). Following this reasoning, it is possible to distinguish for analytical purposes between two sources of power in academic communities: the status of one scholar in the larger academic community (e.g. Germany or Spain) and the *local influence* of this same scholar, derived from her hierarchical position, attained at the department/university level. For example, in the case of German universities Muller-Camen and Salzgeber (2005) describe how power is locally concentrated in the hands of chair holders that enjoy life-long employment in the same university. The situation in Spain is similar (Casanueva & Gallego, 2010), with full professors having exclusive entitlement to participate in key roles (e.g. hiring committees). Further, the Spanish regulation between 1984 and 2002

generalized the practice of promoting local faculty members to full professor positions, a process that was only loosely coupled with broader academic achievement and reputation. Under this inbreeding practice, there is some ground to suggest that full professorship in Spain stemmed from local influences, rather than from the recognition of scholarly contribution (see Rocca, 2007).

Additionally, we would argue that life-long employment in the same university confers all tenured faculty members, regardless of whether they attained full professorship, with some influence at the local level that grows with seniority. The rationale for such proposition is that seniority is better valued in public-sector organizations such as Spanish universities, and in cultures characterized by a strong uncertainty avoidance such as the Spanish (Fischer, 2008).

Taking into account the distinction between academic status and local influence, as well as the considerations about the sources of local influence, we suggest that scholar's status in the broader academic community reflects local conditions because members of the broader community are attentive to them. Therefore, we state the following hypothesis:

> *Hypothesis 2:* The centrality of individuals in the academic community, measured by their selection as member of Ph.D. panels, is positively associated with their local influence, measured by full-professorship and seniority, ceteris paribus.

Alternatively, scholar's status in the broader academic community could derive from the excellence in the quality and quantity of his scholarly contribution. Notwithstanding the importance of informal interactions, research dissemination is the formal interaction that, par excellence, gives rise to invisible colleges. In this regard, previous research on invisible colleges using network analysis has focused on co-authorship (Acedo et al., 2006; Barabasi et al., 2002; Moody, 2004; Newman, 2001) or citations (Hargens, 2000). Accordingly, we formulate the following hypothesis, whose confirmation would point to the existence of a more formally established research community.

> *Hypothesis 3:* The centrality of individuals in the academic community, measured by their selection as member of Ph.D. panels, is positively

associated with their scholarly contribution, measured by their publications in academic journals, ceteris paribus.

3. Method.

Empirical setting

As discussed earlier the European academia is not a uniform academic community and, therefore, the study of the accounting academic communities requires focusing on the exploration of one single European country; we focus in this study in Spain. The definition of the network of accounting scholars required the selection of specific ties between actors. The panel of expert examiners appointed by Spanish universities to assess the doctoral dissertation that is required for a Ph.D. degree (Ph.D. panel thereafter) provided the opportunity to derive such network from one institution that combines formal and informal aspects of interaction between scholars. The Ph.D. panel is one formal institution regulated (as well as Ph.D. degrees themselves) by Spanish law (between 1994 and 2003 were regulated by decrees 185/1985 and 778/1998). Its significance derives from the fact that a Ph.D. degree has been required by Spanish law for associate professor and professor positions in the university. Its regulation established that across all Spanish universities, a Ph.D. degree requires the submission of a doctoral dissertation endorsed by the supervisor that needs to be approved by the department and the university before the oral defence. The doctoral dissertation is meant to be an original piece of investigation and the institutional norm (not included in the law) has been that the doctoral dissertation consisted in a book, hundreds of pages long.

The oral defence of the dissertation by the Ph.D. candidate before the Ph.D. panel is public and not only the panel, but also any attending doctor is entitled to make questions relative to the dissertation that the Ph.D. candidate needs to answer. This regulation also mandates that every panel, appointed by the university, has to include five members, including a president and a secretary. Members need to hold a Ph.D. degree and the Ph.D. supervisor is excluded from the panel. The defence also reflects deep-rooted traditions, for example in the way the panel sits in front of the Ph.d. candidate, during the event: the president sits customarily in the centre of the panel, on his right and then on his left the following academics in terms of academic rank. Rank is customarily

established according to, first, professorial standing and, second, seniority. During the discussion with the Ph.D. candidate panel members make questions in reverse order, concluding with the president. Finally, after the defence, the panel deliberates in private and qualifies the doctoral dissertation, according to different options, from unsatisfactory to *cum laude*. The oral defence is conceived as a final act, without any possibility to revise the doctoral dissertation.

The panel is also an informal institution. Although it needs to be approved by the university, the panel is in practice appointed by the department, with the influential opinion of the supervisor. It is common practice to invite a majority of experts in the area from other universities and to use this invitation to pay respect to reputed academics in the accounting academic community, which in turn increases the reputation of both the Ph.D. student and the doctoral program. The selection of the president is not regulated and, in practice, it is again the choice of the Ph.D. supervisor, whose proposal is usually endorsed by the department and approved by the university. Further, as the oral defence is conceived as a final act and the panel only meets once the doctoral dissertation has attained the standards set by the department and the supervisor. Poor qualifications (but not critique) are avoided and the development of the defence runs along the path of ritual and ceremony. Substandard doctoral dissertations are blocked in previous steps by either the supervisor or the department. This could explain in part why a high percentage of Ph.D. candidates in accounting never complete the degree, but only in very rare circumstances a Ph.D. candidate fails in the oral defence.

Therefore, different formal and informal ties between the supervisor, the panel president and the remaining four panel members can be derived from this institution. In particular, this study considers three different social relations stemming from Ph.D. panels: (a) the selection by one scholar (the supervisor) of others within the academic community (panel members); (b) the recognition of the prestige and academic or personal ascendancy over the panel members of those members who are appointed to preside over the panel; and (c) the mutual acquaintances that arise between panel members and with the thesis supervisor, before, during and after the public defence itself.

Following Lauman *et al.* (1989), the boundaries of this network were set in two steps. First, network nodes (academics) were identified from the composition of Ph.D. panels that examined doctoral dissertations on accounting in Spain over the period between

1994 and 2003. That interval of ten years may be considered a sufficiently long period to reflect the relational situation and sufficiently short to control for structural changes derived from the retirement of individuals of from the changes introduced in the regulation of Spanish universities in 2002. Data on doctoral dissertations and panel members' identities are available in TESEO[1] database. Affiliation networks, as derived from these data, are thought to be an accurate measure of the community for the purposes of network analysis (Newman, Watts & Strogatz, 2002). The search strategy used to identify accounting doctoral dissertations held in TESEO database consisted in recovering those that included "economic accounting" in their keywords. This provided 468 doctoral dissertations, which after removing 85 corresponding to fields such as economics or national accounting, provided a final figure of 383 doctoral dissertations. This information was adapted for treatment as relational data, allowing the identification of an affiliation network of 550 participants in 383 events. It is interesting to note that, although this is not enacted in the regulation, the president of our 383 committees was always a full professor.

The second step taken to set the boundaries of this network consisted in reducing the network to consider the characteristics of the nodes (Laumann et al., 1989); in this case we considered only researchers that hold academic positions in the field of accounting and for whom academic and biographical data for subsequent analysis were available. 295 individuals, mainly students of other fields, were removed from the dabase, leaving an academic community of 255 accounting scholars. The process of exclusion of those 295 individuals was accomplished through the examination of the lists of professors employed in universities (obtained from the Spanish Ministry of Education) and a thoughtful inspection of university web pages. Deleting 295 peripheral individuals increased network density from 0.0073 to 0.0250, if we consider the relation based on the selection of panel members (and from 0.0436 to 0.1377, when the joint presence on panels is considered). Thus, by excluding about half of the participants density increased roughly fourfold. While the network analysed included 255 accounting scholars, different attribute variables (see below) were missing for 16 of those individuals and, therefore, this network needed to be reduced to 239 individuals for the regression analysis.

Social Network Analysis

Since its origin, social network analysis has been frequently employed in the study of invisible colleges. The availability of bibliographic databases on co-authorships and citations in scientific publications has fuelled this type of analysis. Unlike conventional quantitative research methods in social sciences, based on the analysis of the attributes of a sample, the interest of social network analysis is the relations between actors of a network (Hanneman & Riddle, 2005; Wasserman & Faust, 1994). For some researchers social network analysis amounts to more than a method, a specific focus or even a paradigm in the study of social sciences (Wellman & Berkowitz, 1988).

Relational data is generally presented as a set of vertices or nodes denoting actors, joined in pairs by edges that denote acquaintance or interaction (see, for example, figure 2 below). But beyond the mere representation of relational data, social network analysis seeks to understand its structure, identifying general patterns of social relations that arise from the abstraction of individual choices or from the relations between different elements. Social network analysis allows the identification of patterns and sequences of relational behaviour that explain the density of the network, the actors' capacity to obtain advantages from their position (various measures of centrality) and the existence of subgroups or sub-networks within the network under analysis (through different procedures related to grouping and role-identification) (Scott, 1991).

Two types of variables are the object of social network analysis: structural and attribute variables (Wasserman & Faust, 1994). The most characteristic variables in social network analysis, structural variables, measure ties of a specific kind between a pair of actors and can be represented in a matrix, where $a_{i,j}$ takes the value of the interaction between *i* and *j*. Structural variables can measure binary ties (e.g. 1 for acquaintance and 0 otherwise) or any value of the ties: for example, in the structural variable that measures the selection by the supervisor of panel members within the academic community, $a_{i,j}$ =3 means that supervisor i selected academic j 3 times, in the circumstances specified. Attribute variables do not differ from those employed in conventional quantitative research methods. For example, we defined in this study an attribute variable that measures the number of articles in academic journals published by a given scholar. Social network analysis allows a combination of both structural and attribute variables to be studied.

Standard statistical tests cannot be applied to relational data insofar as the independence of observations cannot be assumed: each observation depends on the rest of observations as the variables in social networks are the ties between actors, and excluding any actor with his relations modifies the entire network. In fact, Krackhardt (1988) found that when structural autocorrelation exists OLS can become severely positively biased, concluding that OLS procedures are inappropriate for the analysis of network data because the degree of autocorrelation in network data cannot be reliably estimated. In order to avoid autocorrelation bias, social network analysis use an alternative procedure known as the permutations test or Hubert's test (Wasserman & Faust, 1994). The permutations test may be applied to estimate standard errors and significance using random permutations, as an alternative to more conventional statistical tests for attribute data. Network analysis and regressions were computed with the assistance of UCINET 6 software (Borgatti, Everett & Freeman, 2002).

Variables

Seven variables were derived from the three different social ties stemming from Ph.D. panels (see above) to describe the accounting academic community in Spain and the structural position of each individual in the network (see table 1, panel A). Three of them are the matrices (SELECT, ASCENDANCY and MET) that represent the network that arises from each social tie. Four more vector variables (IN-SELECT, NPRES, FLOCK, CORE) were derived from the previous matrices to express the position of individuals in the networks in terms of centrality.

[Table 1: about here]

SELECT (ties of selection) is a matrix than represent the ties between the Ph.D. supervisor and each of the five members of the panel that he selects, subject to the approval of the university. SELECT is a matrix with non-symmetric ties in which $a_{i,j}$ equals the times *i*, as a Ph.D. supervisor, selected *j* as member of Ph.D. panels, over the

ten years of the study. Derived from SELECT matrix, IN-SELECT is the times each individual in the network acted as member of Ph.D. panels, i.e. the in-degree centrality of the network nodes. As such IN-SELECT provides an indication of the centrality and, therefore, the status of each individual in the invisible college (Hanneman & Riddle, 2005).

ASCENDANCY (ties of pre-eminence) is a non-symmetric matrix representing the ties of authority, prestige or ascendancy between the chairs of Ph.D. panels and the rest of members, as well as the supervisor herself. $a_{i,j}$ equals the times *i* chaired over a Ph.D. panels of which *j* was a member or a supervisor. Derived from ASCENDANCY matrix, NPRES is the times each individual has presided over Ph.D. panels and FLOCK is the number of other individuals in the network who were Ph.D. supervisors or have participated in panels over which that individual has presided[2]. Both NPRES and FLOCK provide a measure of the centrality of each individual (Hanneman & Riddle, 2005).

MET (ties of joint presence) is a symmetric matrix representing the acquaintance of members of the network, derived from their joint presence in Ph.D. panels in any of the existing roles (supervisor, chair and others members). Applying a genetic algorithm to matrix MET allowed to split the network into two sub-groups, the first being the core, comprising 19 actors that interacted disproportionately, compared to a periphery of more isolated academics: the density of the valued network for the 19 individuals was 4.123, while for the remaining actors was 0.065. A dummy variable was thus obtained, CORE that measures centrality taking the value of 1 if individual is in the core and 0 if she is in the periphery.

Testing the hypotheses also required the development of four attribute variables (see table 1, panel B). Two different variables proxy for the local influence construct, considering the previous discussion about the internal dynamics of Spanish accounting departments, where a web of influence is created around the chair, with new positions usually awarded to locals, and where life-long employment was guaranteed to faculty regardless of scholarly contribution. The first variable, SEN accounts for the seniority of the scholar and is the number of years elapsed since she obtained her Ph.D. up until 2000 (see Williams et al., 2006 for a similar approach). The second variable, PROF

accounts for the professorial status of the individual by the end of 2000 and is a dummy variable that takes a value of 1 for full professor, and 0 otherwise.

Finally, two more variables were developed to proxy for the scholarly contribution construct that are based on the number of refereed academic publications by each scholar in the network. To that end, previous literature (Ballas & Theoharakis, 2003; Brown, 1996; Carmona et al., 1999; Larrinaga, 2005; Lee, 1997; Román & Giménez, 2000) allowed identifying a list of 35 refereed journals (table 2), whose volumes between 1992 and 2004 were systematically browsed to compute the number of articles published by each of the 255 individuals in the social network. Only research articles in the accounting discipline (discounting book reviews, news and invited articles) were considered. ART is the number of refereed articles published by each individual between 1992 and 2004 in the list of journals exhibited in table 2. ARTINTER is the number of refereed articles published in the sub-set of the 28 international (non-Spanish) journals that table 2 shows.

[Table 2 about here]

Different attribute values were missing for 16 individuals in the network, reducing thus the network usable for the regression analysis to 239 individuals.

4. Results

Network analysis

We considered three matrices derived from Ph.D. panels (SELECT, ASECENDANCY and MET) to measure the network of Spanish accounting academics. This social network can be represented graphically and synthetized in measures of density, centrality and sub-structures that characterize the network. Figures 1 to 3 plot SELECT, ASCENDANCY and MET networks and table 3 displays the essential indicators of the networks.

[Figures 1 to 3 about here]

[Table 3 about here]

The density of the (binary) network provides insights into the extent to which the average individual is well connected and is defined as the proportion of all possible ties that are actually present. Figures 1 to 3 illustrate that MET is more dense than the other networks, which is confirmed in table 3. The density of MET is well above those reported in the literature (Acedo et al., 2006), indicating a high level of acquaintance in the academic community. The lower density of SELECT and ASCENDANCY networks (less than 2% of possible ties) could be explained by the low number of positions available in a Ph.D. panel in relation to the size of the network, but also by the centralization of those ties in a sub-set formed by individuals who have privileged access to the rest of the network. Results on centralization are discussed next.

Social network analysis provides also measures of centrality, whose basic tenet is that some individuals have privileged access to the social network, i.e. they have ties with more individuals and, therefore, better access to social resources (degree centrality) or have a brokering power because more individuals need to pass through them to get connected (betweenness centrality). Depending on the centrality of the most central individuals, the structure of the network can be more or less oligarchic. A darker core and a star shape in figures 2 and 3 evidence that centralization in both MET and ASCENDANCY is higher than in SELECT. This is confirmed by the measures of degree centralization in table 3, which are expressed as a percentage of the most inequitable social network: the autocratic (star shape). In-degree centralization is the relevant measure for SELECT (11.94%) because it indicates the extent to which the network is concentrated around certain researchers that are selected for Ph.D. panels. Out-degree centralization is the relevant measure for ASCENDANCY (24.6%) and degree centralization (ignoring direction for symmetric ties) for MET (28.1%). In every case centralization is well above the reported in the literature (Acedo et al., 2006), corroborating that some accounting scholars enjoy a privileged position in the social network, leading to an oligarchic research community that is consistent with the invisible college hypothesis (H1) (de Solla Price, 1963).

As regards betweenness centralization, the results are still well above those reported in the literature for academic social networks (Acedo et al., 2006), but are lower than those found in this study for degree centralization. The implication is that it is possible that some scholars have a brokering power, but this source of power is less relevant because academics can access other points on the network along different paths. The explanation of the low brokerage opportunities stem from the observation that there are not relevant sub-groups in the academic community analyzed.

Social network analysis allows also inspecting the existence of sub-structures in a network. A sub-structure is integrated by scholars that interact more often between them than with the rest of the network. The analysis of sub-structures can reveal different characteristics at different loci of the network, even conflicts among them. As stated above, it can also evidence that some individuals in the intersection have a brokerage power. Table 3 indicates that there are not relevant sub-structures in this social network, with one component covering 100% of SELECT and MET networks and 94.5% of the ASCENDANCY network. Studies on invisible colleges in social science have found a main component that amounts to approximately 50% of the network (Acedo et al., 2006; Moody, 2004). Barabasi *et al.* (2002, p. 597) argue that "*in most research fields, apart from a very small fraction of authors that do not collaborate, all authors belong to a single giant cluster from the very early stages of the field*". The clustering coefficient further reinforces the lack of sub-structures. The clustering coefficient is the probability of two scholars interacting if both had ties with a third scholar (Newman, 2001) and accounts for the degree in which the network is likely to be structured around cliques. Studies based on co-authorship have found clustering coefficients above 0.6 (Acedo et al., 2006; Barabasi et al., 2002) and although the clustering coefficient of MET is quite high, it should be considered carefully because this coefficient derives from the very definition of this transitive network (joint presence in events).

To recap, the characterization of the networks analyzed above evidences the existence of a single-structured network of accounting scholars with a relative high centrality that evidences the rather oligarchic nature of the network, providing therefore support to the invisible college hypothesis (H1) (de Solla Price, 1963) in the academic community of Spanish accounting scholars.

Descriptive analysis

Table 4, panel A exhibits descriptive statistics of the four variables that, derived from matrices, help to characterize the scholar's position in the social network. Panel B displays attribute variables. The maximum of IN-SELECT reveals that one individual was invited 52 times to participate in Ph.D. panels, i.e. every 10 weeks. The minimum of 0 indicates that some Ph.D. supervisors were not invited themselves to any Ph.D. panel. The average network member was invited 6.57 times. NPRES indicates that one individual chaired 35 Ph.D. panels and FLOCK indicates that 154 different actors participated in panels chaired by just one scholar. The CORE (of the MET network) is integrated by 8% of the 239 scholars considered in this analysis. Panel B shows that 31% of the individuals in the network are full professors and that the average scholar completed her Ph.D. eleven years before 2000, published 1.85 refereed papers between 1992 and 2004 in journals listed in table 2, 0.4 of which in international journals.

[Table 4 about here]

Table 5 shows how the variables drawn from the same construct are positively correlated: ART and ARTINTER; FLOCK and CORE; PROF and SEN. There is also a positive correlation between the variables derived from the three networks: IN-SELECT, NPRES, CORE and FLOCK. This suggests that it may be difficult to separate the effects of some of them. Therefore, to make sure that multicollinearity is not affecting significantly the results the models are regressed after excluding some of the collinear variables.

[Table 5 about here]

Regression analysis

To test H2 and H3 the following models were regressed:

Model 1: $IN\text{-}SELECT_i = \alpha + \beta_1\ SEN_i + \beta_2\ PROF_i + \beta_3\ CORE_i + \beta_4\ ART_i + \beta_5\ ARTINTER_i + \beta_6\ FLOCK_i + \varepsilon_i$

Model 2: $NRES_i = \alpha + \beta_1\ SEN_i + \beta_2\ PROF_i + \beta_3\ CORE_i + \beta_4\ ART_i + \beta_5\ ARTINTER_i + \varepsilon_i$

where

i = actor 1 through n; n=239

Variables defined in table 1

ε = residual

The dependent variable in the first model is the centrality in the academic community, expressed by the selection as panel members, while de independent variables account for local influence (SEN and PROF), for scholarly contribution (ART and ARTINTER) and for other measures of centrality in the academic community (CORE and FLOCK). In the second model the dependent variable is the centrality of the president tie (NPRES) and the independent variables are the same as in model 1 excepted FLOCK, which is derived from the same ties as the dependent variable. Table 6 shows the regressions.

[Table 6 about here]

The results of all regressions across both models are strongly consistent. All of them show high and significant adjusted R^2, although it declines when the variables derived from the different networks are removed. Those diverse measures of centrality show a positive and significant association, pointing to the probably internal logic that follows the reproduction of the network. But R^2 is still highly significant when the independent variables considered are only those accounting for local influence and scholarly

contribution. Further, the sign of the coefficient and, and to a lesser extent, the significance level remain constant across all the regressions.

The findings in table 6 show a positive and significant association in all regressions between the centrality in the academic community and measures of local influence, i.e. professorial standing (PROF) and seniority (SEN). The changes in the coefficients and significance levels of these variables further confirms their correlation, but this does not detract from our conclusions, since we are using both variables to proxy for the same theoretical construct. In this regard, these results are consistent with the local influence hypothesis (H2). The findings in table 6 also indicate that, excepted in one regression there is not a significant association between the centrality in the academic community and the measures of scholarly contribution considered in this study: number of academic publications (ART) and number of academic publications in international journals (ARTINTER). Even in the case that the number of articles seems to explain centrality, the level of significance is just below the 0.05 significance level. These results are not consistent with our expectations that scholarly contribution could explain central positions in the academic network (H3). Taken together these results would suggest that the selection of individuals as members and president of Ph.D. panels is driven by their local influence and is decoupled from his scholarly contribution, in terms of his academic publications. Therefore, while the existence of a hierarchical network of accounting scholars would be consistent with the invisible college hypothesis, the poor scholarly contribution of its central members would suggest that the "generation of a disproportionate number of new ideas" element of the invisible college hypothesis was not present in the Spanish accounting academia.

5. Discussion and conclusions

This study has investigated the structure of the accounting research community in Spain, using insights from the literature that proposed the invisible college hypothesis. For this purpose, we derived a social network, integrated by scholars that interacted in Ph.D. panels adjudicating Ph.D. degrees on accounting in Spain. Social network analysis allowed describing a well-connected and oligarchic academic community, in which it is not possible to identify sub-structures. The first inference that stem from this analysis is that some elements of an invisible college do exist, arising from an

interaction between academics in one institution that is a formal academic event, but also an informal encounter (Ph.D. panels). There is a core of high profile accounting academics that interact, formally and informally, in the field.

Considering that the existence of an oligarchic academic community inescapably confers status to some scholars, this study has sought to gain some insight as to what are the mechanics that allow the creation and institutionalization of their elites. To this end, we tested the hypothesis that centrality in the network derived from the selection of Ph.D. panel members and chairs is positively associated with their local influence; we also tested the hypothesis that centrality is positively associated to the scholarly contribution of the members of the academic community. The local influence hypothesis was confirmed: a professorial standing (which cannot be separated from scholars' seniority) in Spain (Casanueva & Gallego, 2010), as in the German context (Muller-Camen & Salzgeber, 2005), is an important source of centrality and status in the broader academic community.

The influence of professorial standing and seniority in the academic community seems to be an expected finding, if we think that professorship and seniority accounts for academic factors, such as the scholar's superior scientific contribution. However, Larrinaga (2005) found that the level of publication by Spanish accounting professors is not significantly different from publication by associate professors, something that is confirmed by the weak correlation between professorial standing and seniority, on the one hand, and different measures of publications, on the other hand. These findings are consistent with the proposition that academic publications were not a decisive factor for the promotion to accounting chair positions in Spain, that were allocated according to different criteria. Taken together, these findings suggest that professorial standing and academic publications variables were measuring different constructs in this context and confirm the pertinence of the analysis carried out. Finally, the rejection of the scholarly contribution hypothesis provides some ground to affirm that scholars are not assigned central positions in the social network of the Spanish accounting academia according to their number of publications.

At a preliminary analytical level, these findings leads us conclude that the Spanish invisible college is "dysfunctional", since Ph.D. degrees do not seem to be adjudicated by the most competent researchers. Further, the rejection of hypothesis 3, a different

result from what is reported in the Anglo-Saxon literature (Lee, 1997; Reiter & Williams, 2002), signals that refereed publication in journals was not a value embedded in the Spanish academic community and academic status was not apparently mediated by means of journals. In these circumstances, it is difficult to sustain that the Spanish academic community of accounting would propel the development of the discipline through the generation of a disproportionate volume of new ideas, which is Crane's (1972) invisible college thesis. Our results also suggest that the Spanish academic community would not be immediately visible for those observers who examine the academia through the lenses of research dissemination and publication, and that the examination of different ties might be necessary for the understanding of different research networks.

Despite the rejection of hypothesis 3, as in the case of Germany (Muller-Camen & Salzgeber, 2005), formal academic institutions encourage Spanish scholars to publish in refereed journals, leading to an increasing number of refereed publications specially in international journals (Larrinaga, 2005). If we consider the self-perpetuating nature of invisible colleges (de Solla Price, 1963) and the fact that publishing in refereed journals does not seem to be a value embedded in the Spanish academic community, we can conclude that the publication activity of Spanish scholars seems to be driven from outside of it. The decoupling between the Spanish social accounting network and scholarly contribution further reinforces the notion that academic networks matter and suggests the presence of self-reproducing institutions in Spanish accounting academia that remain relatively undamaged by recent discourses of research production and dissemination. This finding is also indicative of the schizophrenia in which non-tenured Spanish accounting scholars live, between increasing demands of refereed publications by academic institutions and an academic community sponsoring very different values. Following Crane (1972) it could be concluded that the absence of an invisible college in the Spanish accounting academia might be inhibiting the development of the field.

As we conceived this research, Ph.D. panels are but a proxy for the Spanish accounting academic community, a symptom of a more general situation that is precisely described by Frey and Eichenberger (1993) when they characterise the economics discipline in Europe. Some limited changes have been taking place in Spain since 2003. Singularly, now all faculty positions require a Ph.D. degree and candidates need to hold credentials given by national accreditation bodies that seek to ensure compliance with a minimum

of scholarly contribution. In these circumstances, it is likely that since 2003 the correlation between the professorial standing and scholarly contribution has increased. However, other signs points to the reproduction of the academic community described in this article. In particular, local influence continues to be reproduced by inbreeding, i.e. departments have accommodated to the requirement for credentials of scholarly contribution by appointing to higher academic positions their most prolific, rather than their most senior, members, but the new systems has not opened the departments.

As regards the consequences of the absence of an invisible college in Spain it could be argued that this could be an opportunity for the development of interdisciplinary accounting research. There is ground to hold this view, as previous literature (Arrington & Schweiker, 1992; Lee, 1997; Reiter & Williams, 2002; Williams et al., 2006) suggested that oligarchic research communities are likely to repress different modes of research and hinder intellectual vitality. However, the Spanish accounting academia still shows elements of an oligarchic academic community, but one whose high profile scholars do not generate many new ideas. Therefore, on the one hand, the oligarchic academic community could still repress different modes of research. We have to think that the inherent conservative bias of a research community that encourages a conformist personal attitude to local hierarchies is very unlikely to be a hotbed of critical accounting studies. On the other hand, the development of critical accounting studies in Spain would still require an invisible college that generate new ideas and signal the acceptability of this kind of research in the academic community.

Finally, the results suggest a positive interaction effect between different social ties in Ph.D. panels. It shows, for example, that selection is positively associated with ties of pre-eminence and ties of joint presence. This effect could account for other important factors in an academic social network, such as previous acquaintance or the existence of common interests or approaches. A better understanding of the Spanish accounting academy would require a more profound appreciation of the interplay between those factors. Moreover, the lack of consideration given to the persistence of publications in the form research monographs, as a remainder of a former university culture, is a further limitation of the present study, as is the existence of social networks that are not specifically concerned with research (professionals and teaching staff), but which interact with the research community, could also help to enlighten about the Spanish accounting academia.

Endnotes

[1] TESEO database (*Consejo de Coordinación Universitaria - Ministerio de Educación y Ciencia* [Council for University Coordination - Ministry of Education and Science]) stores information on doctoral theses approved at Spanish universities since 1976 and may be consulted on-line at www.mcu.es/TESEO.

[2] More formally, FLOCK indicates the out-degree of a matrix in which $a_{i,j}$ takes the value of 1 if *i* has presided over boards in which *j* was a member, and 0 otherwise. This matrix is a transformed (dichotomized) from ASCENDANCY.

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Table 1. Definition of Variables

	Definition	Type
Panel A: Variables derived from the three networks		
SELECT	Times i, as Ph.D. supervisor, selected *j* as Ph.D. panel member (ties of selection)	Network (asymmetric ties)
ASCENDANCY	Times *i* chaired over a Ph.D. panel of which *j* was a member or a Ph.D. supervisor (ties of pre-eminence)	Network (asymmetric ties)
MET	Times *i* and *j* played any role in the same Ph.D. panel (ties of joint presence)	Network (symmetric ties)
IN-SELECT	Derived from SELECT network, times *j* has been selected for Ph.D. panels	Vector
NPRES	Times *i* has presided over Ph.D. panels	Vector
FLOCK	Derived from ASCENDANCY, number of other actors that have participated in committees over which *i* has presided	Vector
CORE	Derived from MET, dummy variable taking the value of 1 if *i* is in the core of the network and 0 otherwise	Vector
Panel B: Attribute variables		
SEN	2000 – (year when *i* obtained his/her doctorate)	Vector
PROF	Dummy variable (1 if *i* is a full professors, 0 otherwise)	Vector
ART	Number of articles published by *i* in sample of academic journals (1992-2004)	Vector
ARTINTER	Number of articles published by *i* in sample of international academic journals (1992-2004)	Vector

Table 2. Research articles examined (1992-2004)

Journal	*Number of articles published*	Average number of authors per article
Abacus	1	2.00
Accounting and Business Research	1	3.00
Accounting Historians Journal	3	2.33
Accounting History	7	2.00
Accounting Review	-	-
Accounting, Auditing and Accountability Journal	3	3.67
Accounting, Business and Financial History	5	2.20
Accounting, Organizations and Society	4	3.00
Auditing: a Journal of Practice and Theory	-	-
British Accounting Review	1	3.00
Contemporary Accounting Research	-	-
Critical Perspectives on Accounting	5	2.60
Cuadernos de Economía y Dirección de la Empresa	10	2.70
Economía Industrial	1	4.00
European Accounting Review	33	2.64
European Business Review	7	3.00
Financial Accountability and Management	12	1.83
International Journal of Accounting	6	2.67
Issues in Accounting Education	-	-
Journal of Accounting and Economics	-	-
Journal of Accounting and Public Policy	2	2.00
Journal of Accounting Research	-	-
Journal of Accounting, Auditing and Finance	-	-
Journal of Business Finance and Accounting	-	-
Journal of Management Accounting Research	-	-
Journal of Management and Governance	3	2.67
Journal of the American Taxation Association	-	-
Management Accounting Research	3	2.67
Managerial Auditing Journal	-	-
Review of Accounting Studies	-	-
Revista de Contabilidad (1997-)	60	2.35
Revista Española de Estudios Agrosociales and Pesqueros	1	1.00
Revista Española de Financiación y Contabilidad	265	2.14
Revista Europea de Dirección y Economía de la Empresa	8	2.63
Spanish Economic Review (Revista Española de Economía)	1	2.00
Total	442	2.27

Table 3. Network indicators of the three relations under study

	Structural variables		
	SELECT	*ASCENDANCY*	*MET*
Nodes	255	255	255
Density of the valued network	0.0250	0.0210	0.1377
Density	0.0188	0.0146	0.0744
In-degree centralization	11.94%	6.63%	----
Out-degree centralization	15.50%	24.61%	----
Degree centralization	----	---	28.10%
Betweenness centralization	7.21%	3.22%	6.32%
Number of Components	1	15	1
Isolated	0	14	1
Size of main component	255	241	255
% of main component	100%	94.5%	100%
Clustering coefficient	0.264	0.346	0.656

Networks indicators computed with the assistance of UCINET 6. These indicators are defined in the literature on network analysis (Hanneman & Riddle, 2005; Wasserman & Faust, 1994)
Density is the total number of binary ties (number of adjacencies that are present) divided by the total number of possible binary ties. It signals the proportion of all possible dyadic connections that are actually present.
Density of the valued network it is the total of all values (considering not binary ties, but any measure for the ties; number of interactions in this case) divided by the number of possible ties. It denotes the average strength of ties across all possible ties.
Degree centralization is the percentage to which the structure of the network has a totally centralised form, differentiating between in-degree and out-degree centrality in the directional relations.
Betweeness centralization shows the level at which the possibility exists of exploiting the broker position due to the elements linked to each other by the shortest paths)
Components are the groupings of two or more connected elements.
The number of isolated components, the size of the main (largest) component and the clustering coefficient shows the propensity of the network to form ties around cohesive groups.

Table 4. Descriptive statistics (N=239)

	Mean	*Std. dev.*	*Min.*	*Max.*
Panel A: Variables derived from the three networks				
IN-SELECT	6.57	9.07	0	52
NPRES	1.31	4.16	0	35
FLOCK	5.56	17.64	0	154
CORE	0.08	0.27	0	1
Panel B: Attribute variables				
SEN	11.03	7.28	0	33
PROF	0.31	0.46	0	1
ART	1.85	3.24	0	18
ARTINT	0.40	1.14	0	10

Table 5. Correlation matrix (N=239)

	1	2	3	4	5	6	7
1. IN-SELECT	-						
2. NPRES	0.745	-					
3. SEN	0.554	0.539	-				
4. PROF	0.594	0.416	0.628	-			
5. CORE	0.826	0.622	0.376	0.372	-		
6. ART	0.148	0.011	-0.039	0.096	0.129	-	
7. ARTINTER	0.084	0.026	0.020	0.082	0.073	0.748	-
8. FLOCK	0.738	0.998	0.536	0.416	0.614	0.015	0.028

Table 6. Regressions (N=239)

Dependent variable	*Model 1* *IN-SELECT*					*Model 2* *NPRES*			
Independent variables									
SEN	-0.060	0.194*	0.062			0.334***	0.350***	0.462***	
PROF	0.236*		0.304**	0.335***	0.585***	0.026		0.124	0.419***
CORE	0.536***	0.565***				0.493***	0.497***		
ART	0.095	0.126	0.184*	0.107	0.091	-0.064	-0.061	0.027	-0.029
ARTINTER	-0.054	-0.063	-0.096			0.030	0.028	-0.013	
FLOCK	0.279*	0.287*	0.578***	0.597***					
Adjusted R^2	0.826***	0.794***	0.653***	0.650***	0.353***	0.485***	0.486***	0.286***	0.163***

Because network data do not conform to assumptions underlying OLS methods, significance levels are determined using a permutation-based test (Krackhardt, 1988; Wasserman & Faust, 1994).

*** Significant at the .001 level

** Significant at the .01 level

* Significant at the .05 level

Figure 1. Graphical representation of the invisible college, ties of selection considered (SELECT)

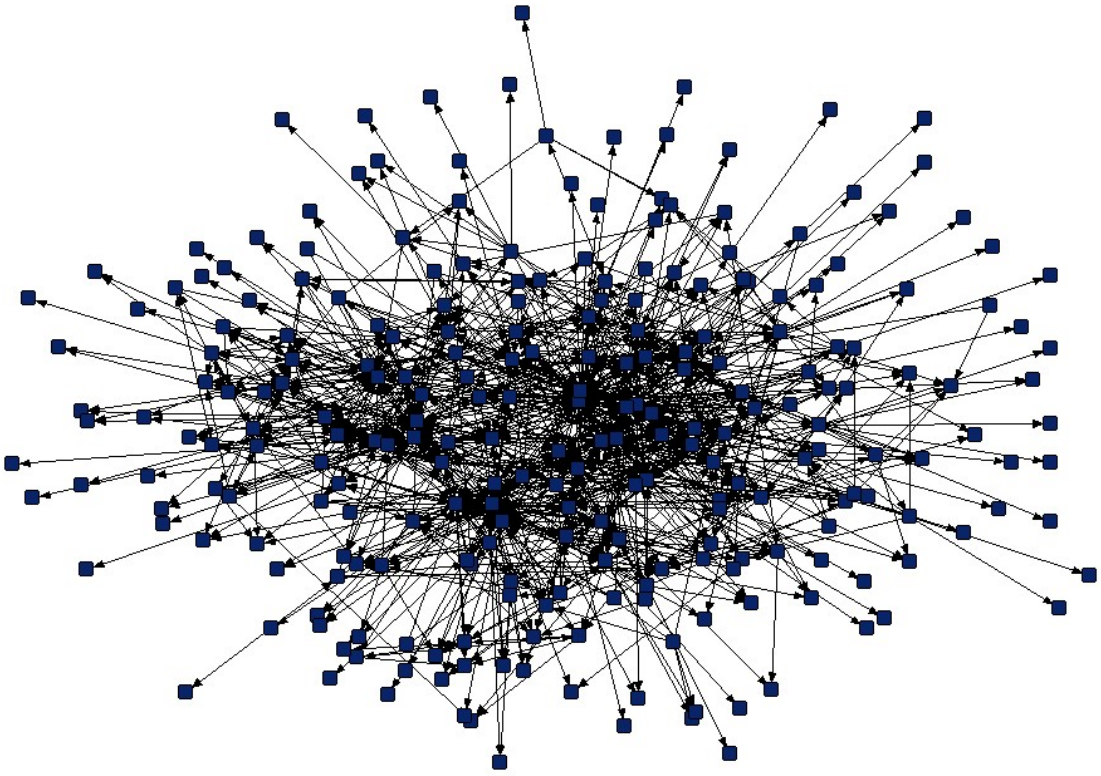

Figure 2. Graphical representation of the invisible college, ties of pre-eminence considered (ASCENDANCY)

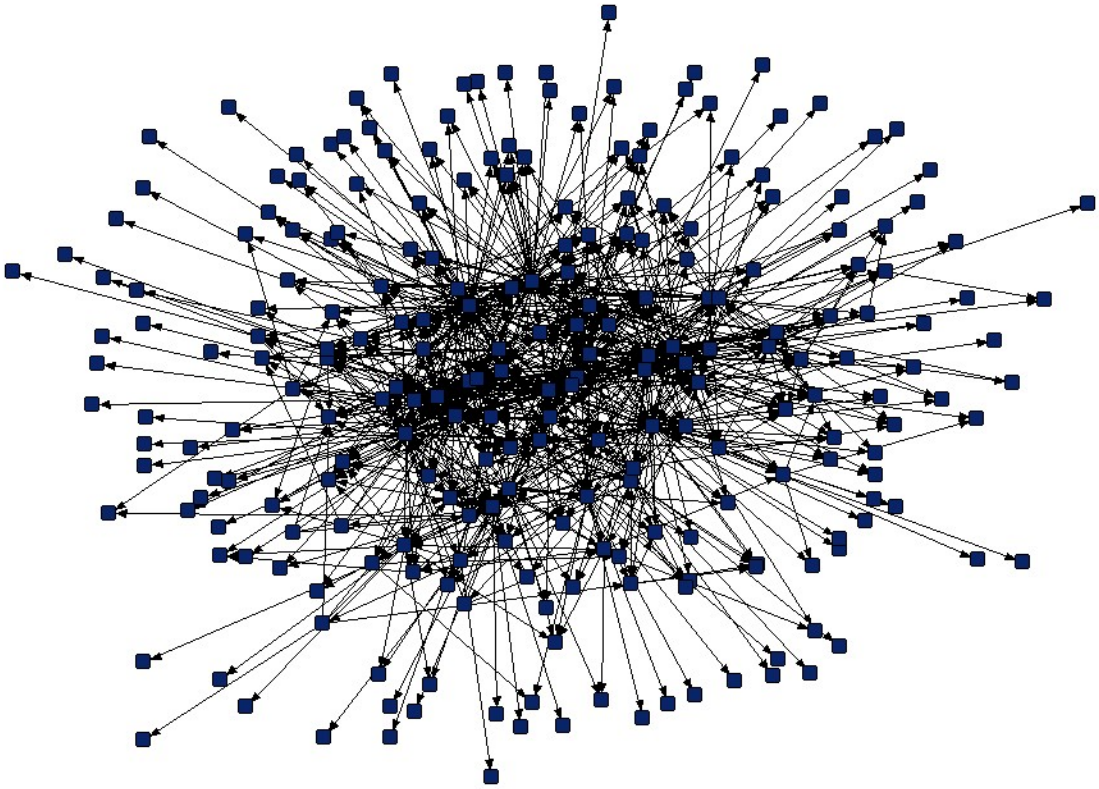

Figure 3. Graphical representation of the invisible college, ties of joint-presence considered (MET)