THE COMPARATIVE VALUE OF NETWORK CAPITAL

IN ACADEMIC CAREERS

by

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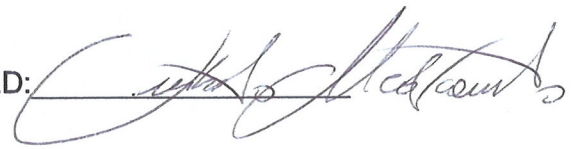
SIGNED: 

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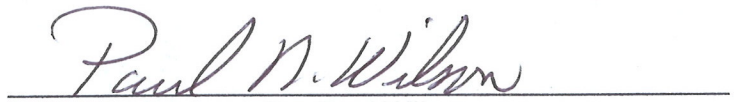

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ABSTRACT

Relationships are a striking issue in determining success within competitive contexts. Through relationships formal and informal norms, ruling behaviors and opportunities, are established and updated. People continuously invest in personal and professional relationships accumulating a new form of capital: the Social Capital. Investments in social capital and relational portfolio management may be determinant for success. While sociology, organizational studies, and management started to study individual social capital some decade ago, yet economists have given little attention to studying the issues in individual social capital. Through the analysis of social capital in academic career, I attempt to comprehensively examine impacts of personal characteristics and career choices on individual social capital and human capital. I analyze social capital and human capital complementarities and their impact on career success. I show that social capital is a form of capital itself, it matters for career success, and it can be highly diversified in its composition and use.

CHAPTER 1

INTRODUCTION

In recent decades, discussion about the economic role of capital has been enriched by the introduction of relatively new forms of capital: human capital (HC) and social capital (SC). While the definition and the measurement of HC has been formally assessed by the scientific community (Becker; Mincer; Le Clerque; Dakhli; Florin and Schulze), SC and its role in economics are still the subjects of intense debate. Discussion centers on whether or not SC is a form of capital, and how this form of capital is established and maintained. “Social Capital has been placed at the forefront of research, [..] the term has spread out” from “the Social Sciences and it has spawned a huge literature that runs across disciplines” (Durlauf, p.3).

Definitions of SC have varied in the professional literature as a function of the research issue in question. Definitional uncertainty raises concerns among some analysts concerning the rigor of the SC concept. Nevertheless, a wide agreement on the relational nature of SC has been reached (Putnam, Coleman, Burt), as well as about the usefulness of this concept in economics (Woolckock, Durlauf, Jackson). SC research has evolved from a focus on personal individual relationships to stepping back to a more aggregate level of SC analysis (Kadushin, Breiger, Galaskiewicz). Embedded networks and the study of the individuals’ dependence on the networks, represent the research frontier in SC.

SC can be thought of as a set of intangible assets and outcomes arising from relational activities among individuals, which ultimately generate behavioral norms and rules. SC's foundation is relationships that are both enhanced and constrained by norms. Since personal relationships are embedded in a wider network, SC of an individual depends on the SC (i.e. relationships) of other individuals.

Sociologists were the first to analyze the importance of a relational life in society. Management scholars soon followed with a special focus in organizational studies, investigating the role of relationships in determining profits. The number and strength of relationships controlled by an individual or an economic entity has been defined as relational or network capital (NC). What makes relational capital particularly interesting to economists is the absence of a market for it. Relationships cannot be acquired by third parties, but are produced over time by individuals, and with significant investments of time, energy and money (Costabile, 2001). Also, the correlation of individual NC (or SC) with other forms of capital, particularly HC, has received increasing attention in the literature.

HC has been classified mainly by the subject who holds it, identifying: 1) firm-specific HC, as not transferable know-how; 2) industry-specific HC, as high quality knwoledge that generates innovation, and 3) individual-specific HC. The latter specification is applicable to a wide range of situations. It includes managerial and entrepreneurial experience, education, physical conditions, and well being. Individual-specific HC is defined also as "individual's knowledge and abilities that allow for changes in action and economic growth" (Coleman, 1988). HC can be also divided into general HC

and specific HC, depending on the level of specificity at which skills can be applied (Florin and Shultze, 2000).

Researchers have invested significant effort in correlating NC (or individual SC) and HC with personal success. These studies have been extended to the determinants of career success, with some applied to the academic work environment. In these latter studies, faculty scientific productivity, in terms of published articles and funded research projects, has provided a metric for faculty evaluation as well. Universities have developed evaluation tools to better grasp the quality of the scientific contribution of their best employees, from evaluation committee guidelines, to survey based research on this topic, peer reviews and outside evaluations. Professors may look to a wide range of forces determining academic success. In this study we assume that faculty success implies increasing rank and salary. Faculty work in a national, if not global, market. Universities compete to maintain their productive faculty. An understanding of the relative value of HC and NC in this academic market should be of interest to the academy, to both faculty and administrators.

1.1 Overall Research Design.

This study analyses the role of *social network capital* (SNC) in career advancement in the academy. I investigate the independent and complementary role of NC, as NC interacts with the *human capital* (HC) endowments of each faculty member. NC is an intangible asset that can be a source of competitive advantage (or career enhancement) for the individual. The objective of this study is to capture the relative value of NC in

academic careers within an organization. Secondly, the study advances the understanding of the career role of affiliation networks in the academic environment.

Most of the NC studies focus on work environments, management, or networks within and between organizations. Very few researchers have explored the role of NC within the academy. Several studies have either evaluated the efficiency of the academy as an organization, or analyzed both the sources and distribution of career support for faculty, with specific attention given to the roles of gender and race. The majority of these studies have only analyzed HC. Few efforts have been done, to my knowledge, to provide an analysis of the role of NC in faculty advancement.

My hypothesis is that trust, reputation and information are significant contributors to career advancement. Especially in the academy, reputation is a determinant for career success. Reputation implies reliability, and is built on reciprocal trust among colleagues. Reciprocal trust is enforced by personal abilities and skills (human capital) and collective norms. Academics recognize HC ultimately through the individual's scientific contributions. Relationships, however, have a twofold role: they amplify and ease the HC recognition process, and they are the means through which norms are established and shared. Once reputation is established, relationships also reduce the costs of information gathering, and ease the access to funding and scientific collaboration. Individuals develop their career by choosing to "optimally" invest in same combination of HC and NC.

My first concern is to understand the role of NC in career development and then to look at the nature of the relationships inside the academic network. I perform a qualitative analysis of network capital and an affiliation network analysis. Affiliation networks

provide insights on the structure of the relations generated by the actors' personal participation on a set of events and on the actors' behavior. Secondly, I evaluate the differences in the use of relationships and the correlations between different relational portfolios and career profiles. The use of an interdisciplinary approach allowed accounting for the variability of individual choices, due mainly to different needs and to field specificities. Linear regression models control for the academic discipline and for the variance due to gender, rank, and professional history. These models generate insights on the use and the role of relationships, as well as HC, in the academy. Finally, I provide evidence that NC addresses the "undersocialized conception of man" that Granovetter and others scientists have described as a limitation of neoclassical economic theory.

1.2 Thesis Organization

The subsequent parts of this thesis are organized as follows: Chapter Two examines the theoretical background behind the study of NC, or individual SC, and of SC at the aggregate level. Chapter Two presents the philosophical basis and the literature review relating to the use of the SC concept in the academic environment. At the end of Chapter Two a list of the hypothesis for this research is presented. Chapter Three introduces the data used for the empirical study: population, sample selection, data collection, and data analysis from a stratified random sample of the population of faculty in the College of Agriculture and Life Sciences (CALS) at the University of Arizona. Chapter Three also discusses the empirical models. Chapter Four presents the qualitative analysis, and Chapter Five and Chapter Six present the quantitative analyses, based on econometric models, and network analysis respectively. Chapters Five and Six also present the re-

sults of these analyses. The last chapter presents my concluding remarks and suggestions for further studies.

CHAPTER 2
THE LITERATURE REVIEW

2.1 The theoretical approach.

2.1.1 The Idea of Capital

Before exploring the nature of human capital and social capital, a brief discussion of the fundamental concept of "capital" is necessary. In classical economics capital is one of the three basic production factors (four if we include management) together with land and labor. Capital is any form of good that can be used in the production of other goods, and which has been produced itself (in contrast to land).

HC and SC are among the most recent forms of capital being analyzed in the literature. Some debates center on the issue of whether these factors meet the criteria for capital (both tangible and intangible). For capital to be capital, the asset must match the following characteristics: 1) it must be possible to invest in it, 2) to maintain it, 3) to accumulate it, and ultimately it must be possible 4) to spend it in order to obtain an outcome. While HC literature indicates that this factor meets all these criteria, researchers are still uncertain if SC adheres to the traditional idea of capital (Sabatini, Crudeli, Grootaert et al.).

2.1.2 Human Capital

The notion of human capital (HC) was introduced in the 1960's by T.W. Schultz and Gary Becker (Woolcock). The concept originated with Adam Smith and was further elaborated by many others such as A.W. Lewis and A.C. Pigou. HC is considered to be a factor of production (Mincer, Becker). It is possible to invest in HC, HC has a rate of re-

turn, and it is a substitute for other assets. On the other hand, HC is not transferable (like land, labor and other forms of fixed capital). HC "emanates from the fundamental assumption that humans posses skills and abilities that can be improved, and, as such can change the way people act" (Becker). HC has many different components, like education, nutrition, health, vocational skills and knowledge (Durlauf). HC may be developed through formal training and education aimed at updating and renewing one's capabilities for individual and societal benefit.

Some analysts have made a distinction between different types of HC (Le Clerque and Dakhli, Florin and Shultzer). We have individual specific HC which "refers to knowledge that is applicable to a broad range of firms and industries. [and, at the same time] [P]rior researchers have shown that one's overall level of HC has an impact on economic success, both on the business level and the macro level" (Le Clerque, Dakhli, p. 6 and 7). HC has been found to be a source of competitive advantage in many studies (Gimeno, Folta, Cooper and Woo; Pennings, Lee, and van Witteloostuijn; Coleman). For example, Gimeno et al. found a positive association between the level of HC, as measured by education level and work experience, and economic performance at both the entrepreneur's level and the firm's level. Generally, the idea is that those who are better educated, have more work experience, and invest more time, energy, and resources in refining their skills and are better able to gain higher benefits. Furthermore, Black and Lynch (1996) proposed that investment in HC through on-the-job training and education increases productivity and competitiveness at the organizational level. Accordingly, several measures have been used to gauge individuals' HC, such as the level of education, the age, and the management or industry experience. For this study I will refer to

the concept of HC as pertaining to an individual's knowledge and abilities that allow for changes in action and economic growth where knowledge, in particular, is expandable and self-generating, transportable and sharable (Coleman).

2.1.3 The relational approach

Currently, relational-actor and norm-based models, based on the idea that entities come first and relations among them only subsequently, are being abandoned for viable analytic "approaches that reverse basic assumptions and depict social reality instead in dynamic, continuous and processual terms" (Emirbayer, p. 281). In short terms, the debate focuses on the dichotomy between substantialist and processual (relational) thinking.

A substantialist approach that has gained popularity in recent years is game theory. This analytical approach assumes that *players* (individual subjects of the analysis) choose between one or more *strategies*, which generates different *rewards*, and that rewards depend on the choices of the other players. The assumption is that the players make their decision independently of each other, which eliminates the possibility of any *coordination*. As a processual alternative, *interaction* is translated in the variable-centred approach (Emirbayer) where fixed entities interact to create outcomes that can be measured as attributes of the same entities. This modelling framework encourages the use of a wide assortment of analytical tools, from multiple regression to factor analysis. Unlike the interactional approach, the relational approach has the advantage of considering the entities as generators of the action instead of entities' attributes. Processual models emphasize the acting of the subjects in an embedded environment, and

accounts for a multitude of attributes. The attributes are constantly changed by the subject depending on the agent he is relating to.

2.2 Social and Network Capital and their Relationship with Human Capital.

2.2.1 Network Capital

The number and strength of relationships owned by an individual or an economic entity is defined as Network Capital (when the spectrum of investigation is enlarged to the surrounding environment beyond the unit of study). Relationships with people who have a large relational portfolio produce further advantages for the individual. For example, being connected to people with many relationships makes possible to get to know new people and to access the resources (tangible and intangible) that flow through those relationships.

In recent years, the interest has grown in SC as an investigative device to understand human behavior. The association between SC and relational networks has become the subject of thoughtful analysis, where researchers explore the cause-effect relationships between these two concepts. Intuitively, social ties represent an asset that people can use to reach their goals. Conversely, the absence of social ties is considered uncommon, if not pathological. Recently, for example, organizations such as the World Bank and the OECD have included SC in their research portfolio. Studies provide empirical evidence in support of the important role of SC for the households and community. NC is considered a subset of SC, an asset whose management produce SC in different quantities and qualities.

2.2.2 The Economic Value of Social Capital in Business.

SC has recently entered economic debates as an independent factor of production that can determine economic performance. Much of the interest in SC among economists has been directed at the structure of networks and social relations, as well at the behavioral dispositions (such as trust, reciprocity, honesty) and institutional quality measures (“rule of law”, “contract enforceability”, “civil liberties”). The relational nature of SC makes the concept useful for management, where intangible assets, namely information, trust and organizational skills, represent a source of competitive advantage and cost reduction.

Some analysts have challenged researchers to go beyond a merely qualitative analysis. But there is a call for a step further. When trying to investigate the intangible assets, SC and Network Analysis represent reliable tools. As Burt wrote, in fact (Burt, 2000, p. 2), “Social capital is at its core two things: a potent technology and a critical issue. The technology is network analysis and the issue is performance. [..] “Social capital is a metaphor about advantage”. Burt describes SC as a complement to HC and, as a perfect mirror of the managerial culture; he sees those who perform better as those who are better connected. The word “better” refers to holding a strategic position within a network of exchanges. The position, then, becomes an asset to achieve better performance.

2.2.3 The Network Foundation of Social Capital

Social capital (SC) is a metaphor for many different ideas, all related to social interaction, rules and norms. The operational mechanism for SC is the net of relationships. The structure of the network arises from the interactions between the actors involved,

where SC operates as a governance tool founded on trust and supported by reciprocity and mutual adjustment (Granovetter). Each context can be viewed as a game with its own norms and rules and determined both by the present state of things and by the player's activity.

SC studies follow two paths: an individual perspective and a collective perspective. Some recent studies treat SC as a community level attribute. The most relevant contribution to SC as a collective good belongs to Putnam who, unlike Coleman, built on a theory of collective action, leaving open problems like indivisibility, free riding, and selective incentives. As a result, SC has been often studied as a public good (Cecchi, Trigilia). Even if these studies established a new approach to social problems, the collective perspective makes it difficult for economists to think of communities as decision makers (Glaeser, Laibson, and Sacerdote).

In contrast, SC can be treated as a personal asset (Glaeser et al.). These authors, using a model of an optimal individual investment decision, tested the hypothesis that SC rises and declines with age (life cycle effect) just like any other form of capital, that mobility drives down SC returns and consequently investments in SC, that individuals who work in occupations for which social skills are relatively important accumulate more SC, and that people who invest in HC also invest in SC. Using data from the General Social Survey (GSS) across 26 years (in the United States, the GSS is a repeated annual cross-section of 1,200 to 2,500 repsondents), Glaeser et al. found that individuals with a high value of time (i.e. high wage) will accumulate less SC. This particular result may depend on whether SC skills are necessary for pecuniary success or are complementary to forms of HC. On the other hand, these authors also found SC comple-

mentarities predict that SC covaries within peer groups, but they did not find this pattern once they used instrumental variables. They also failed to find evidence that SC investments fall with the value of time or that geographic/religious groups generate social capital complementarities.

An alternative approach to the individual vs. the collective dichotomy is the study of the network foundation of SC. One example is the work of Mark Granovetter. According to Granovetter dense networks ease trust and norms by facilitating effective sanctions, such that the threat of sanctions makes trust more likely between people who have mutual friends. Therefore, relationships become the tool through which each actor plays in the social game to which he belongs, establishing alliances, forming groups, sharing and building norms, and carrying strategic information.

Coleman provides another important contribution to the definition and understanding of networks and SC. He established three main concepts. First, he developed a theory that combined socialized action with economic rationality, opening a road for further studies that could merge these two antithetic views[1]. Secondly, aside from providing proof of the value of SC for a number of outcomes, Coleman investigated the role of SC in generating HC, and the complementarity of HC and SC. Thirdly, he explored the role of obligations, expectations, trustworthiness and finally closure inside social environments.

[1] Coleman bridged the neoclassical thought with the social sciences perspective to produce the theory of rational choices (Coleman, 1988). In the neoclassical school, SC is an individual resource, derived by rational choices of investment. Each agent owns a stock of SC commensurate with the amount of social relationships that he is able to have and to manage. Coleman built his theory on Bourdieu's idea that SC production is a collective phenomenon that involves at least two persons, extending the use of the methodological individualism to the study of social relationships.

Coleman established that “individuals with high levels of obligation outstanding have more social capital on which they can draw. The density of [these] obligations means, in effect, that the usefulness of the tangible resources is amplified by the availability of others when needed”. Additionally “individual actors [..] differ in the number of credit slips outstanding on which they can draw at any time” (Coleman, p.103). Organizations, which are built on norms enforced by closure, “once brought into existence for one set of purposes, can also aid others, thus constituting social capital available for use” (Coleman, p.108).

Based on Coleman’s ideas, Burt developed his theory of structural holes, which casts certain actors as providing a brokerage role that produces economic gains. A structural hole within a network exists when the removal of the broker disconnects neighbors from one another. Brokerage across structural holes opens the access to a set of advantages. The broker can manage information flows, relate with different people putting them in contact, and has a “vision of advantage that can translate into social capital” (Burt, 2004, p. 3). “Given greater homogeneity within and between groups, people whose networks bridge structural holes [..] have earlier access to a broader diversity of information and have experience in translating information across groups” and “have an advantage in detecting and developing rewarding opportunities. Information arbitrage is their advantage”. (Burt, 2004, p. 6). Although a structural hole is not a necessary and sufficient condition for advantage, there is a growing literature providing evidence that structural holes generate more positive performance evaluations, faster promotions, higher compensations and team success.

In the case of an academic environment, trust relationships are the most useful to achieve career goals. Faculty members use trust relationships to build reputation, to access reliable information and funding sources, and to build strong alliances. Trust can arise from “a great need of secrecy during the initial stages of a research project” (Friedkin). Furthermore, “the culture of a university [..] often entails a tacit obligation of receptiveness, if not compliance” when faculty members have to select a research-exchange partner; the culture of a university could also have the “capacity to impose [..] social and material penalties on deviants from its culture” which “makes the university a place where new ideas [..] can be developed with relative ease and security” (Friedkin). Under this hypothesis we can imagine that each actor invests time, efforts and perhaps money to build his own relationship portfolio to be used in professional life or even sold to the highest bidder (e.g. another university) to reach higher levels of academic success.

2.3 The Role of Social and Network Capital in the Academy.

2.3.1. The Importance of Social Networks in Academic Careers.

There have been clear motivating factors that drive researchers to study the academic environment and its organization. Key examples are “the persistent dilemma of how to shape an academic career without “careerism”-worrying more about the rate than the quality of publications; waiting until after tenure to pursue an interest in teaching; delaying the start of a family.” (Huber, p. 73). Faculty turnover rates may vary between the 2-10% - reaching 55% over a period of 10 years - implying high turnover costs for the university (Harrigan).

A higher salary from a competing university is clearly an important reason for leaving, but a higher salary may serve as the catalyst in the decision process when compounded by more powerful sources of dissatisfaction (Ambrose, Huston, Norman). These negative sources often are associated with the professor's relational life. The lack of collegiality (time and interest paid to colleagues, presence of intra-departmental tensions, episodes of incivility), inadequate mentoring, unclear knowledge of the reappointment, promotion and tenure process, unpredictable department head behavior, unpleasant city or local region where the university belongs, and lack of the interdisciplinary nature of the Institution, all may contribute to the decision to leave. The authors found that mentoring was highly significant in the decision to leave or stay at a university. Mentoring included advice on how to establish professional connections outside of the department and how to balance professional demands within the department. From their interviews, Ambrose, Huston and Norman. discovered that "advice about navigating the political landmines of departmental life, reading the hidden agendas underlying departmental affairs, and learning how to "play the game" successfully to secure departmental resources (eg. graduate students, or lab space)", and the "importance of multiple mentors" was critical for academic success (p. 15).

Faculty members use a wide range of people for help in professional advancement. Manning et al. interviewed a panel of successful professors about their insights on how to raise and enhance their competitiveness and efficiency. These professors cited the importance of networking strategies and methods, international collaboration, the selection of co-authors, and manuscript submission and review process strategies as determinants of career success.

Evidence of the importance of relationships in academic careers is revealed even in studies that did not focus on the relational component of a faculty member's professional life. In a study about determinants of faculty research productivity based on the 1999 National Study of Postsecondary Faculty, Betsey found that time spent on relationships external to the academy, such as consulting activities, has a surprisingly positive impact on research productivity. Even if research and consulting compete for faculty time, the fact is they are complements in the academic career process. Betsey also found that the source of research funding is significantly related to productivity, with federal support in first place (Betsey).

Personal and professional networks then, both on campus and off campus, contribute to faculty success. Friends, colleagues, professors, mentors, businessmen, and even family members, contribute value to the academic enterprise. These people provide support, encouragement, friendship, information and advice about the profession, visibility within the profession, improved resources for research and teaching, and intellectual guidance (Parson, Sands, and Duane). Other helpful people are fellow graduate students and faculty advisors especially in the earlier stages of the career (Corcoran and Clark, Hood).

Since research and teaching are generally considered the most important tasks for career advancement, the availability of university funds, sabbaticals and release time represent precious assets for faculty members. As a result, relationships with the department chair or other administrators become critical for career advancement. The department chair, particularly, is a source of support since he evaluates performance, pro-

vides information to junior faculty about promotion and tenure guidelines, maintains morale, handles conflict, and allocates resources (Bennett, Tucker, Perna)

Other researchers have examined the role of family networks in academic careers. Some researchers have found that marital and parental status influence salary level (Barbezat, Bellas, Johnson and Stafford, Toutkoushian,), research productivity (Bellas and Toutkoushian, Creamer), and employment status (Ferber and Hoffman, Perna) among college and university faculty. Others focused on the effects of having an academic spouse on employment outcomes such as research productivity, salaries, and academic rank (Astin and Milem, Creamer, Ferber and Hoffman).

Finally, some studies provide empirical evidence for the existence of different faculty networks based on gender. Exum notes that women (and minority faculty) are often excluded from networks that help in successful research and publishing. Astin and Davis state that women, especially young unmarried faculty, tend to be excluded from male networks, and the result is lower research productivity. Kaufman studied the colleague and friend networks of female and male assistant professors or higher rank in the College of Human Ecology at Northeastern University. He discovered that both women and men tended to have same-sex colleague-friend networks. Men were more likely than women to include higher-rank colleagues in their networks and women were more likely than men to include colleagues with whom they share no common research interests. In a related study, Sorcinelli and Andrews reported that when asked about people influencing career decisions, both women and men emphasized the influence of "significant others". A significant difference emerged where women were more likely to recognize the role of relatives, peers in graduate school, and colleagues. Men, on the

other hand, acknowledge another professor as having the most important career influence.

2.3.2 Network Dynamics in the Academic Environment.

As Harald Bauder writes, "While incoming graduate students in North American geography programs may expect that their program will teach them geographic knowledge and scientific truths, few students probably anticipate that a great deal of their program involves learning how to perform the social and cultural roles expected of academic geographers." and "The realization that academia is a self-reproducing institution is nothing new" (Bauder, p. 1). With these words Bauder alludes to a social game that more clever students learn to play in the academy, a game that once understood by the students, allows them to achieve their career goals before the “slower” students. The academy defines a social field with “its own logic”, which differs from that of, for example, the business world or politics (Bourdieu). One way of thinking about an academic field and its practices is through habits which describe a system of behaviors and thoughts shared among the members of a social group (Bourdieu). Young academics need to play by the rules of the game if they want to be included as members of the club. Academic reproduction also solidifies existing hierarchies and configurations of prestige within the academy.

To study academic networks it is necessary to integrate economic and sociological perspectives. The usefulness of network-based SC as a conceptual tool that, merging these two perspectives, can explain personal outcomes within the academic labor market was recently recognized in literature (Perna, 2005). In the academic labor market

the drivers for competitive advantage for academic career are accessible through social norms and rules, both formal and informal. Relationships are the tool that actors use to access and to play the social game to which they belong, establishing alliances and groups. The choice of the unit of analysis is very important. With this regard, it should be considered that the academy is multidisciplinary in its nature, as well academic relationships. Blau was one of the first to write about multidisciplinarity, pointing out as the constitution of an integrate multidisciplinary social network within the universities are often controversial (Blau, 1973). Despite Blau's skepticism, Friedkin found out that the formal division in departments does not represent at all the real pattern of communication among faculty.

The research of Peter Friedkin has to be recognized as one of the first network analyses of the academy[2]. Friedkin analyzed the behavioral foundation underneath the relational structure. He states that "different social network paths" may lead to the diffusion of scientific knowledge and visibility of scientific role performance, clearly bonding relationships to performances. Friedkin indeed studied network structures within different departments. He argued that the same different paths could bring to the implementation of rules among scientists and to act as a group and as an organization.

In summary, faculty members use trust relationships to build their reputations, to access reliable information, to access funding sources, and to build strong professional alliances. Each faculty member invests time, energy and money to build a relationship portfolio. This portfolio is utilized on a daily basis and even can be sold to the highest

[2]Friedkin interviewed 128 faculty members who had appointments in at least one of the physcal science departments of a single university, including assistant, associate and full professors. These faculty were asked to identify other faculty out of a complete list of faculty, with whom they had at least three conversations about research problems.

bidder to promote their academic career. This relationship portfolio is a personal network of relationships which is embedded in a wider network over the entire work environment.

2.4 Contribution to Literature.

With the qualitative analysis, I will provide an in-depth description of the dynamics of faculty member behavior as they seek career success and as they plan their professional life. The network analysis will add details about network structure and strategic behaviors that currently, to my knowledge, do not exist in the literature. The quantitative analysis makes use of econometric modeling techniques to test a set of hypothesis, relating SC to personal and professional characteristics.

2.4.1. The Hypotheses.

The overriding hypothesis of this study is that numerous factors influence faculty members' investments in SC (in its relational foundation), and that SC affects academic career success. This study has been structured around four main hypotheses concerning scientific area, previous non-academic job experience, gender, and years of experience. The hypothesis are summarized in table 2.4.1.1.

2.4.1.1 Scientific Areas.

Career development can significantly differ across scientific areas. Salary levels, the relative importance of grants, projects and collaboration, external financial partners, and lab management have very different roles in the biological sciences and physical

sciences departments than in the social sciences. Biological and physical scientists may place more value on external relationships than those in other departments. These professors need laboratories, research staff, and funding. Most of the financial support comes from governmental agencies, foundations, or the private sector. Social scientists, ironically, may be less dependent on relational activities, because they are relatively less dependent on laboratories and primary data gathering.

2.4.1.2 Previous External Job Experience.

Professors who have had other employment prior to starting their tenure-track academic careers, (eg. a prior academic position in another university, a position in a company or in a governmental agency) may place a higher value on network capital. I hypothesize that faculty with previous employment to their current academic position, invest more energy and resources in maintaining outside relationships, and utilize previously established relationships more than other faculty. The effect of this differentiated accumulation can bring to place more efforts in maintaining and using the previously established relations. On the other hand, mobility can drive down SC (Glaeser et al.). Coming from another job environment also can affect the salary level because of the bargaining process prior to accept the new position.

2.4.1.3 Gender.

Literature provides several insights about differences on the role of relationships with respect to gender (Exum, Astin and Davis, Kaufman, Sorcinelli and Andrews). On these premises, I hypothesize women's NC to be differentiated in its value. The main differ-

ence related to gender seems to be in relationships' management. Women tend to establish alliances horizontally with peers and colleagues looking for friendship and support, while men are more incline to relate to others vertically, with persons holding a higher position within the hierarchy.

2.4.1.4 Age and experience.

SC in its network foundation rises and declines with age just any other form of capital (life cycle effect) (Glaeser et al.). Relationships can be accumulated over the years and their value can be exploited during the professional life cycle. SC and its exploitation decline with the personal relational portfolio narrowing in the later stages of life. Since I have no detailed data on age, I based my hypothesis on the years of experience, or professional age. I hypothesize that experience positively affects HC. Individual-level HC increases with increasing knowledge and know-how. Experience may reflect in some cases, the managerial and relational skills that also positively affect SC. Hence SC with respect to experience can follow a life cycle effect. I expect the latter effect to be stronger than the first.

2.4.1.5 Academic Rank.

The relative value of SC varies depending on the career stage. I hypothesize that associate professors make a larger use of and accumulate more SC. Different career stages implies different career goals and different informal norms, that makes SC a determinant asset for career development. Associate professors are in the middle of their career where transition to the higher rank will be decided in few years. I also hypothes-

ize that assistant professors invest more than other professors in HC compared to SC. Accordingly, I also hypothesize that SC affects the salary levels.

Table 2.4.1.1: Expected Effects on Salary Levels and Social Capital (from the Literature).

Variables	Expected effects	
	On salary	On social capital
RANK		
Full professor	+	+
Associate professor	+	+
Assistant professor	-	-
SCIENTIFIC AREA		
Biological sciences	-	+
Physical sciences	-	-
Social sciences	+	+
OTHER EFFECTS		
Year of experience	+	+
Previous external work experiences	+	+
Gender (being a man)	No influence	+

CHAPTER 3

THE CASE STUDY

In order to explore the comparative individual value of human capital and social capital assets within a professional environment, I chose as population all the on-campus faculty members in the College of Agriculture and Life Sciences (CALS) at the University of Arizona (Tucson, U.S.A.) in tenure - or continuing – track positions. This multidisciplinary approach, where faculty from a wide range of disciplines participate, produces a valuable contrast that would be lost if only one discipline was considered. This mixed method study contains a qualitative analysis and a quantitative analysis. Questionnaires and face-to-face interviews (both anonymized to protect faculty privacy) was used to collect the data. Econometric and network analysis methods were utilized in the quantitative section of this study.

3.1 The survey plan

When planning a survey, the first step is to define the population. Our *population of inference* is the set of all faculty in tenure track or continuing appointment positions in the College of Agriculture and Life Sciences (CALS) at the University of Arizona. The *target population* is a subset of the inference population, obtained by excluding the faculty who were not in tenure track or continuing appointment, and those with offices off campus. These choices were made because on-campus faculty were more accessible and I assumed that faculty working in off-campus offices and laboratories participated less in on-campus academic life.

Another part of the population excluded by the study is the set of all the “unsuccessful” individuals, those previous faculty members who have left the academy. As a result, in this analysis there is no counterfactual group to test the relative value of SC in academic success. Our discussions to include this group produced a realization that unsuccessful professors would be difficult to trace and contact, making this task beyond the time and financial resources of this study.

The *frame population* (FP) is the list of the elementary units we used for the sampling. The frame population (the list of faculty on which the survey procedure has been applied) was composed of 198 individuals, across 12 different academic departments or schools. From this population, a sample of 100 individuals was extracted. The extraction was performed by a stratified random sampling procedure without replacement, reproducing several key population characteristics. Three strata were drawn: gender, rank (associate, assistant or full professor), and the third one is the department. The final sample (table 3.1.1) included 51 professors.

3.2 Survey procedure.

Two main types of errors can occur in this type of survey. First, there can be a non-coverage error, or *selection bias*, produced by the selection of the individuals to be included in the frame population. Secondly, there can be the total *non-response bias*, when the survey population does not reflect the frame population because individuals, for different reasons, chose not to participate in the study. The latter error is the most important since it is more difficult to estimate (Montinaro). The non-coverage error was drastically reduced since a complete database of all CALS faculty is available on departmental websites.

Via an email message, each individual in the frame population was asked to be part of the study. The email briefly explained the research objectives, the investigators involved, the survey process, and the content of the questionnaire. If response was not received from the faculty member in a week, a follow-up email message was sent. A phone call followed in a week if there was no response to the second email message. In the case of positive response, an appointment was scheduled to interview the faculty member. In preparation for the interview, each respondent was asked to complete the questionnaire before the appointment. Faculty members who did not participate were on sabbatical, traveling, or had scheduling conflicts (i.e. too busy). Some professors, especially younger assistant professors, were concerned about the privacy of their information. Before proceeding to the interview, an informed consent was submitted to each faculty member. Faculty were asked to listen to the investigator's explanation of the research project and to sign the informed consent. Permission to record the interview was also requested. One faculty member has been excluded because during the interview. It was clear that this individual did not take the interview seriously.

Non-response bias is a problem because non-respondents are likely to be busy professors and busyness may be associated with the survey questions. To reduce the non-response rate, the first mail contact was from my advisor, whose name recognition decreased the non-response rate even for the busier professors. The privacy protection guarantee, the opportunity to complete the questionnaire prior to the interview, and willingness to schedule the interview at the subjects' convenience are likely to have increased the response rate as well.

There are several procedures to account for non-response bias. For example, it is possible to add a second step in the survey procedure, randomly selecting new units, and taking in account the proportion between the strata. Alternatively it is possible to use post stratification techniques, weighting differently individuals that were under-represented or over-represented in the survey population. I adopted post-stratification weighting. The most important feature of post-stratification is the reduction of the standard error.

A standard error is an estimate, based on a knowledge of the survey design, of how far the sample estimate is from the average estimate that might be obtained for many surveys. To reduce the standard errors, weights were calculated as the inverse ratio between the proportion of each stratum within the population, and the same proportion within the sample[3].

Theoretically, weighting can either improve the precision of survey estimates or make them worse. If there is no relationship between the outcome being measured and the probability of selection in a survey then weighting will, on average, decrease precision. The main motivation for post-stratification is to remove bias and reduce the standard errors of most survey estimates. It is good practice to check the distribution of the weights and if there are some very large weights, to make sure to understand how and why they have arisen.

The distribution of the weights for this study is shown in figure 3.2.1. It immediately appears that only two weights are particularly high. These values correspond to the

[3] Stata ver.9 presents the advantage to handle post-stratification procedures to run mean estimations, tests, regressions and other statistical estimations, using weights to recalculate more precise standard errors.

weights assigned (1) to male associate professors in the Department of Soil, Water and Environmental Sciences, and (2) to male full professors in the School of Natural Resources. These two weights can be explained with the differences among the frame population and the final sample for these two strata: 20 to 3 and 7 to 2, respectively. Other important items that do not appear in the weight distribution can be found in Appendix. For example, no professors from the Department of Entomology took part at the survey, and no male professors from the Norton School of and Family and Consumer Sciences participated in the study. Given these differences and the weights distribution, it is appropriate to get a rough measure of what the effect of post-stratification weighting could be. This effect was estimated by calculating the square root of the ratio among the average squared weights, and the square of the average weight. The result is .93, indicating that the post-stratification reduced the standard error by the 7 percent.[4]

3.3 The final sample.

Interviews were conducted on a final sample of 51 professors. Twenty-six of them were full professors representing 49.5 percent of the sample (98 in the FP, or 51%) (tab. 3.3.1); associate professors amounted to 15, or 29.4 percent (61, or 30.8% in the FP), while the assistant professors were 10, or the 19.6 % (39, or 19.7% in the FP).

Post-stratifying by gender, proportions between the final sample and the FP are still very close (tab. 3.3.2). Men in the final sample amounted to 38, or 74.5 percent (142, or

[4] The standard error for a stratified random sample with variance s_i^2 from stratum i, is: $S_{ST} = \frac{1}{N}\sqrt{\sum_i N_i^2 \left(\frac{N_i - n_i}{N_i - 1}\right)\frac{s_i^2}{n_i}}$, where N_i is the stratum population size, N is the population size, n_i is the sample size from stratum. If s_i^2 tends to be smaller than the sample variance from a simple random sample, then S_{ST} will be smaller than the standard error from a simple random sampling (Heiberger and Holland, 2004).

71.7% in the FP), and women were 13, or 25.5 percent (against 56, or 28.3% in FP). Men were then slightly over-represented in the final sample, relative to women.

With regard to rank and gender, assistant female professors were the most under-represented in the final sample, with just two of them and a percentage of 3.9% versus a FP percentage of 8.6% (table 3.3.3). Women are also just slightly under-represented as associate professors (9.8% versus 10.1). Associate and full male professors were also under-represented, even if with very small differences with the FP, while the male assistant professor is the category that is slightly over-represented (15.75 versus 11.1% in the FP). The sample results demonstrate that the survey procedure with weighting closely resembles the frame population. Looking at the distribution of previous work experiences (tab. 3.3.4), with respect to rank and gender, we can see that globally about the 37% of the professors worked in another place before accepting employment in CALS. Most of these individuals were men (27.4%) and full professors (almost 25.5%).

Professors were differentiated with respect to their time allocation. Time allocation between outreach and extension, research, administration, and teaching is determined by their academic contract. Professors are somewhat free to reallocate their time within these categories, taking into account changing work expectations. Faculty often mentioned that the contractual time allocation could be inaccurate, especially in the earlier stage of their career. Also, administration duties were very time consuming, and often coincided with a particular career stage, when professors assumed the role of dean, head of department, or another administrative role.

Figure 3.3.1 shows the time allocation distribution scores among the different ranks. Table 3.3.5 report the corresponding weighted means. Significance t-values for the dif-

ferences between the means are reported in table A.3.3 (see Appendix). For assistant professors the median score for outreach and extension is zero, with mean 6 and one outlier. The highest average score for outreach and extension is found in full professors, who also show a wider variation. Administrative duties are most prominent for full professors, as predictable. Average time for research is almost the same for associate and assistant professors (50.6% and 47.9%, respectively), while for full professors the time allocated to research is definitively lower (39%). The median value (around 40%) is instead the same for all the professors, with associate professors showing a higher variability. No outliers were found. Finally, time for teaching and advising, shows the greatest variability, with a higher average value for associate professors.

Figure 3.3.2 shows the time allocation distributions among the different scientific areas, with table 3.3.4 reporting the corresponding weighted means. Test for significance (t-values) for the differences between the means are reported in table A.3.4 (see Appendix). Time allocation among scientific areas shows more variation than among ranks. Outreach and extension has a distribution almost similar among the three areas, but with a wider variation for biological sciences. The highest average score for administration is from the social sciences (22.1%). The highest average score for time for research is among physical scientists (53.7%), with higher variability as well. Looking also at the distribution of time of teaching and advising, physical sciences professors are more focused on research and present less variation in all their other time allocation choices. The need to manage lab activities may be one of the reasons for this more strict time management.

In summary, stratification successfully reproduced the frame population characteristics. Female assistant professors are the most under represented category. A consistent share of the sample had previous external job experience. Outreach and extension is mainly a task of full professors who instead invest less time in research activities. Assistant professors focus more than other on research, as well as do physical scientists. Time for teaching and mentoring varies greatly among the strata.

3.4. The Questionnaire

The questionnaire was divided into two parts. The first part included information about the individuals' characteristics: year they earned the Ph.D., the year they started the first tenure track position, the year they were promoted and granted tenure or continuing appointment status, their time allocation (in percentage) between administration duties, outreach and extension, research, and teaching/advising. Finally the subjects were asked to include themselves in one of three categories that most accurately describes their professional training (biological sciences, physical sciences, social sciences). Other individual characteristics that were collected during the face-to-face survey were the gender and academic rank.

In the second part of the questionnaire, I included two types of assets (career contributing factors) that professors use to achieve the same goal (career advancement): HC assets and SC assets (see Appendix).

The selected professional collaborative relationships capture nearly all the relationships in a faculty relational portfolio. The choice of other contributing factors was provided at the end of the list, in order to cover all the possibilities (e.g. family and friends).

The subjects were asked to respond on their relationships both inside and outside the academy. This choice brought a wider comprehension of the dynamics involved in career development, bringing results that can be generalized to open environments not constrained to a few sets of norms (Friedkin, 1978).

Professors were asked to rank the contributing factors in a Likert scale from 1 to 5, were 1 stands for ”not important” and 5 for “very important”. After the ranking, professors were asked to weight each of the assets considering that the weights must sum to 100. The value of each asset, therefore, has been expressed as a percentage proportional to their perceived relevance.

In addition to the contributing factors, respondents were asked to rank, on the same Likert scale, a set of activities in which the subjects invested their time and efforts during their career in developing and maintaining HC and SC. Participants also were asked to weight these activities in the same relative manner, so that they would sum to 100. This scoring procedure forced respondents to compare investments in HC with investments in SC and backward.

The ranking and weighting procedure was adopted to insure the subjects could familiarize themselves with the questionnaire, grasp the individual importance of the relational assets and activities, and provide more precise and realistic answers. Given the intangible nature of the task, a one-step procedure would produce more superficial evaluations The two step process allowed the respondents to reflect on their assigned rankings and weights. The procedure made it also possible that professors could be ready for the face-to-face interview.

Finally, the questionnaire accounted for the time dimension. Except for assistant professors, the ranking and weighting procedure was repeated twice: first reflecting on the current period, and second a recollection of the period before the associate or full professors was granted tenure or continuing appointment.

3.5. The Interviews.

The interview protocol was designed to understand (1) the reasons behind the answers in the questionnaire and (2) to check for any error or misunderstanding. The protocol enhanced the researcher's understanding of the role of SC in academic careers.

The use of interviews capitalizes on what Maxwell indentified as the principle strengths of qualitative research that include: the individual meaning of events, situations and actions in which the subjects are involved; the features of the context within which they act and how the context influences their actions, which emerge spontaneously in open-ended interviews in ways that cannot in structured surveys; the mechanism by which events and actions take place; and complex casual relationships (Maxwell, pp. 17-20). Applying this framework to the present study allowed me to unpack the norms, the reputation and trust building process, detect the presence and functionality of obligations and expectations, explore the nature and the value of relationships and their use, both at the individual and collective level, and ultimately to obtain their relative value to the individual.

For the quantitative analysis only the questionnaire data referring to the current period has been used. Using information referring to the pre-promotion period implies the loss of data from the assistant professors reducing the number of observation. In the

qualitative analysis I have utilized information from both the questionnaire and the interviews for both time frames. Like survey data, qualitative data can be coded and aggregated to reveal patterns, but it goes beyond survey data in clarifying the particularities of a given issue (for example, what faculty mean when they talk about ‘‘networking’’ or ‘‘building reputation’’). Interviews, moreover, provide context and details, revealing the chronology and interaction of events that shape the professional lives and influence the decisions of faculty members (Ambrose, Huston and Norman).

In interviews, professors were asked to give a brief summary or history of their professional life, including previous work or academic career experiences prior to accepting their position with CALS at the University of Arizona. This question was very important for two reasons: first, when a professor coming from an external work environment is hired, the negotiation process may include bargaining for a higher position, a higher salary and/or better research facilities. Secondly, there can be an effect on career development due to transferred SC from the previous position. This embedded SC may facilitate access to the business environment, governmental agencies, or research partners on grants and projects.

After the first question, professors were asked to provide an explanation concerning the highest ranks and weights for the contributing factors and the professional activities listed in the questionnaire. In some cases, the researcher asked for further clarification of some of their lowest scores. This was the case when answers conflicted with previous answers, or if the respondent’s personal experiences were particularly different from others. The respondents were allowed to change their rankings and weights during the interview.

During the interview the researcher guided the discussion about the underlying interrelation among the key factors and activities, their logical connections, and their temporal sequence. Special effort was given to understand the personal and collective norms that influenced the faculty member's career development. In some cases, professors cited special events that constrained or enhanced their professional life. These events always involved other people, especially colleagues, mentors or advisors, people in business or governmental agencies, friends, family or the non-accademic community (e.g. their church).

Another aspect that the researcher focused on during the interviews was the reputation accumulation process and its impact on career development, trying to understand any differences across the personal characteristics and fields of specialization. Interviews were used to test and possibly substantiate the idea that relationships constitute capital. Professors were finally asked to describe the nature of their relationships. Every interview ended with the same hypothetical question: "Would the loss of all your relationships in just one day affect your career?" This hypothetical situation pushed the faculty members into imagining themselves in an extreme situation. This hypothetical loss of their relational capital enabled them to reflect clearly on the value of their SC assets. Faculty responses to this last question were almost always emotional, sometimes immediate, and other times time consuming. Although interviews were planned for 30 minutes, some lasted 50 minutes.

Tab. 3.1.1: The Final Sample: Interviews by Department, Rank and Gender

	Men			Women			Σ
	Full professors	Associate professors	Assistant professors	Full professors	Associate professors	Assistant professors	
Agricultural & Bio-systems Engineering	2	1	1	0	0	0	4
Agricultural Education	2	0	0	1	1	0	4
Agricultural & Resources Economics	4	1	1	1	0	0	7
Animal Sciences	2	2	1	0	0	0	5
Entomology	0	0	0	0	0	0	0
Norton School of Family & Consumer Sciences	0	0	0	1	2	2	5
Office of Arid Land Studies	1	0	0	0	0	0	1
Plant Sciences	0	3	1	2	0	0	6
School of Natural Resources	3	2	1	0	0	0	6
Nutritional Sciences	0	0	1	1	2	0	4
Soil, Water & Environmental Sciences	4	1	2	0	0	0	7
Veterinary Sciences & Microbiology	2	0	0	0	0	0	2
Total	20	10	8	6	5	2	51

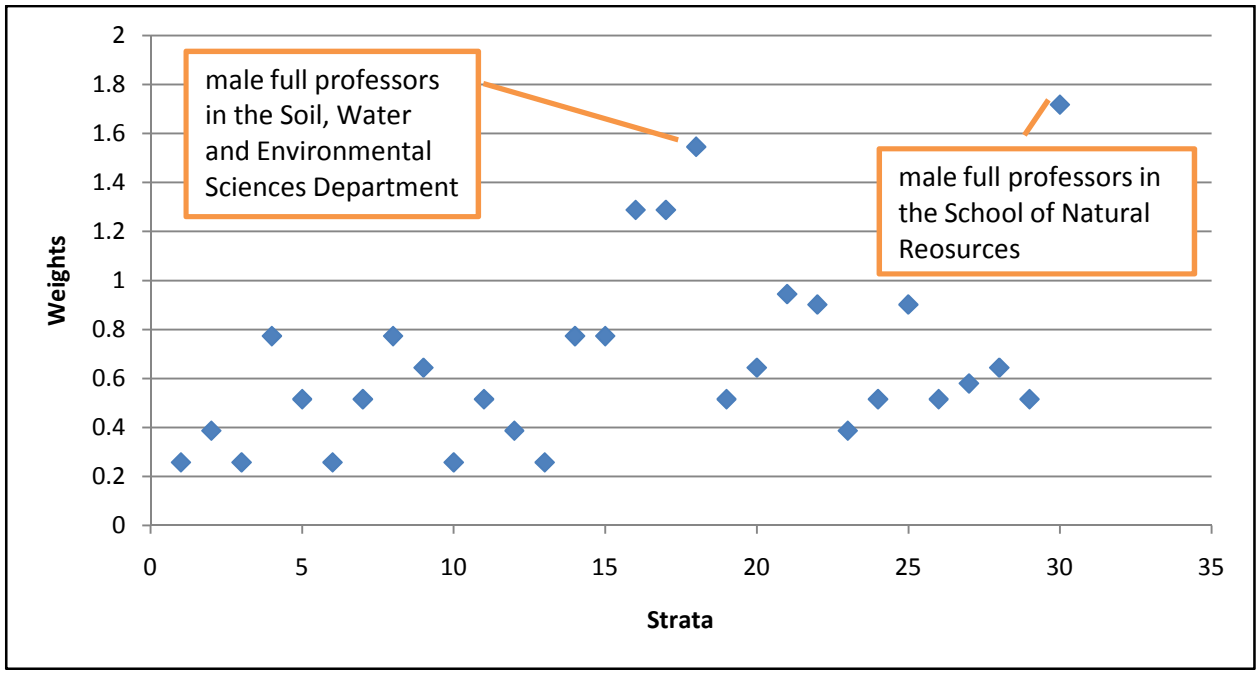

Figure 3.2.1: Post-stratification Weights Distribution

Tab. 3.3.1: Sample and Frame Population Distributions

	Full professors	Associate professors	Assistant professors
Sample (%)	51.0	29.4	19.6
Population (%)	**49.5**	**30.8**	**19.7**
	Men		Women
Sample (%)	74.5		25.5
Population (%)	**71.7**		**28.3**

Tab. 3.3.2: Sample and Frame Population Distributions by Rank and Gender

	Men			Women		
	Full professors	Associate professors	Assistant professors	Full professors	Associate professors	Assistant professors
Sample (%)	39.2	19.6	15.7	11.8	9.8	3.9
Population (%)	39.9	20.7	11.1	9.6	10.1	8.6
Within gender (%)	55.6	28.9	15.5	33.9	35.7	30.4

Tab. 3.3.3.: In Sample Previous External Job Experience Distribution by Gender and Rank

	women	men	Full professors	Associate. professors	Assistant professors	Sum
No (%)	15.69	47.06	25.49	19.61	17.65	62.75
Yes (%)	9.8	27.45	25.49	9.8	1.96	37.25
Total	25.49	74.51	50.98	29.41	19.61	

Table 3.3.4: Time Allocation among Scientific Areas, Weighted Means

	Biological Sciences	Physical sciences.	Social Sciences
Outreach & extension	7.6	7.6	7.4
Administration	11.9	6.6	22.5
Research	45	53.7	36.6
Teaching & advising	35.5	32.1	33.5

Table 3.3.5: Time Allocation among Ranks, Weighted Means

	Full professors	Associate professors	Assistant professors
Outreach & extension	10	4.5	6
Administration	18.9	6.8	10.6
Research	39	50.6	47.9
Teaching & advising	32.1	38.1	35.5

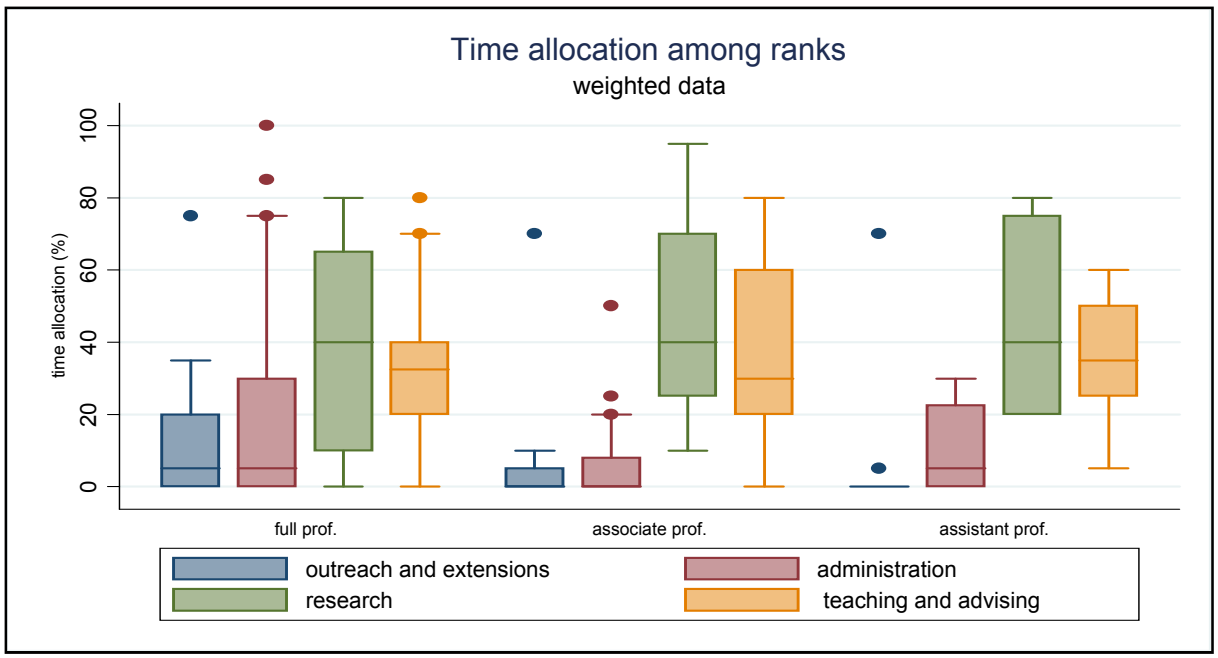

Figure 3.3.1: Time Allocation among Ranks (dots indicate outliers).

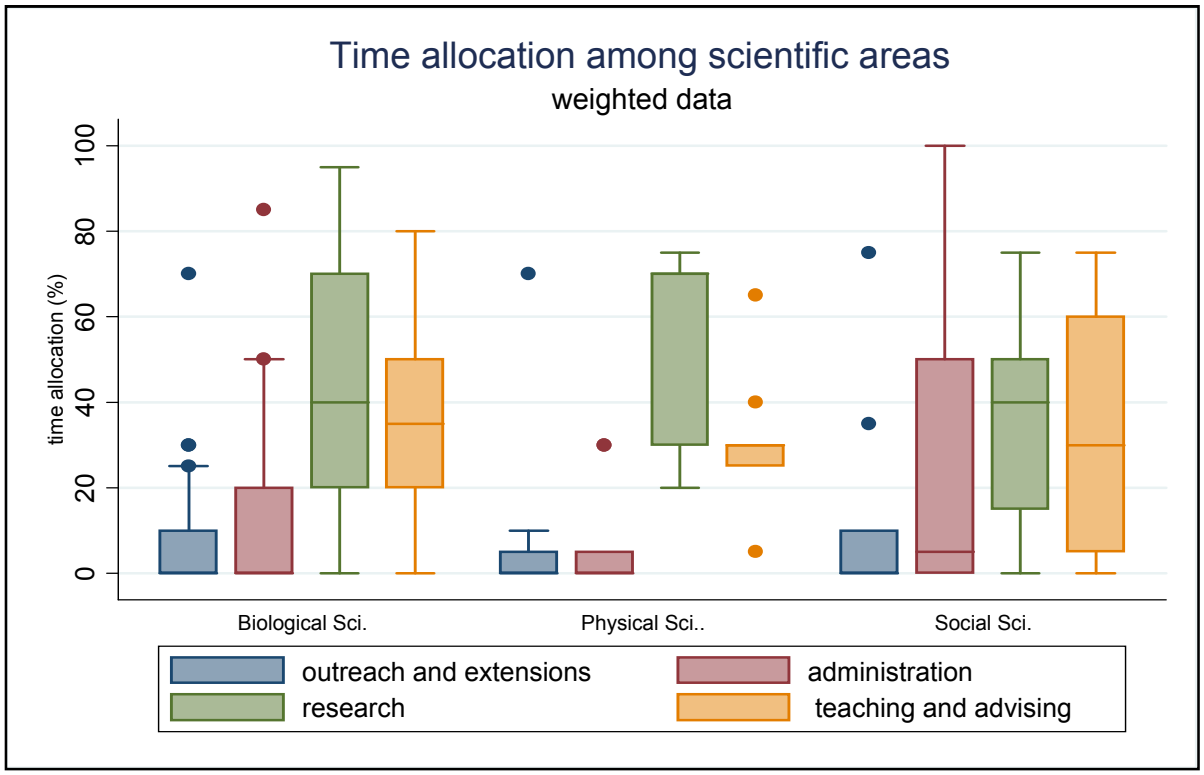

Figure 3.3.2: Time Allocation among Scientific Areas (dots indicate outliers).

CHAPTER 4

FACULTY SOCIAL CAPITAL: A QUALITATIVE ANALYSIS WITH SUPPORTING DATA

4.1. A General Overview of the Career Contributing Factors.

The weighted mean of HC career contributing factors is 74.61%, while SC factors account for 25.39% (tab. 4.1.1). Faculty members attribute HC their success by a margin of 3. When interviewed, professors explained that the career evaluation processes that determined promotion, tenure and merit raises were research productivity, teaching and advising abilities, and professional reputation. SC factors, then, do not directly influence the assessment because they are not scrutinized during the evaluation process. The respondents explained that SC increases their chances of a positive evaluation because SC acts as complement to their HC.

Perception differences in assessment criteria emerged between older and younger professors. While older professors explained how their teaching and mentoring duties were largely taken into consideration, younger professors considered their research activities and their ability to develop grants and projects as the most critical activities (particularly within biological sciences and physical sciences departments).

Table 4.1.2 ranks the contributing factors. The table presents the results for both time windows: pre and post promotion (stratified by professional rank). Columns two to four show results for the post-promotion time frame (that refers to the present time) respectively for the whole sample, for associate and full professors, and for the only assistant professors. Data for assistant professors were collected on the actual situation, since

they have no pre-promotion period. Column one displays weights for the pre-promotion time frame for full and associate professors, respectively.

Contributing factors in table 4.1.2 are ordered by decreasing relevance. The first six factors belong to HC, summing to 69.14. The most important are work ethic (17.39), ability to obtain grants and contracts (13.5), and creativity (12.8). Work ethic means the willingness to work hard, to handle work overloads and to work on nights and week-ends. In some cases, work ethic was interpreted as “being a good citizen”. Work ethic is not a task on which professors are formally evaluated, but is critical for academic success. Professors explained that in the earliest stages of their career, working hard was a “requirement” to accomplish their duties and they expected heavy work schedules. Respondents reported that they were informally evaluated on their work load by their departments.

The ability to obtain grants and contracts weighting is controversial. Interviews revealed that the respondents define this factor differently and in many cases this factor has elements of both HC and SC. Professors explained that to obtain external grants and contracts depends on some key issues. First, information flows - knowing exactly what governmental agencies, industry or other financial partners are looking for is crucial to success. Secondly, skills and technical abilities (i.e. “know how”) to implement projects are required. Professors can be divided into two subgroups: those that consider the ability to obtain grants as an individual ability, and those who consider this factor a “collective” or “relational” ability. For the latter group, being able to interact with peers with differentiated skills, with stakeholders and administration, and moreover to coordinate activities with these people is an important skill. For these managerial-oriented pro-

fessors, communication, relational and organizational skills are all part of managing a successful grant or program.

The importance of this factor resides in its indirect effects on the evaluation process, on its positive effect on leveraging productivity output (eg. number of publications), and in making professors valuable assets for the home department. Re-calculating the weighted means of HC and SC factors, considering the ability to obtain external grants and contracts a SC factor, brings to 61.30 and 38.7 the relative HC and SC scores.

Creativity was widely recognized by respondents as the ability of bringing new ideas to the discussion, which is necessary to produce valuable research and to interact productively with peers. Some of the respondents recognized in creativity the ability to find new solutions for old problems, or to find new problems to work on. In some cases the former idea involved the communication and organizational skills to put together different and complementary interests, and even to choose new communication channels as radio and tv broadcasting, and the web. In some cases creativity was applied to teaching.

The next contributing HC factors, in order of importance, are academic training (9.18), teaching and advising abilities (9.17), and research area (7.1). Academic training is crucial for research success and curricula improvement. The choice of the research area, choosing a field of interest for the home department, or for the College, creates opportunities for a faster career. Also, highly specialized research skills are a source of competitive advantage.

Teaching and advising abilities deserves some further analysis. The importance of this factor is largely influenced by older full professors. The interviews revealed a break point in the history of the tenure, promotion and merit raise policy adopted by the Col-

lege of Agriculture and Life Science, and more generally by the University of Arizona, that could be dated between 10 and 15 years ago. At that time, according to faculty, and as a response to emerging budget constraints, CALS decided that grant-funded research was more important than teaching responsibilities for career success. Assistant professors scored “research area” more highly than full and associate in the pre-promotion period, while for these latter professors teaching and advising abilities are perceived to be more influential in their careers at the present time. Comparing the two time frames, the availability of grant funds is more important for assistants today than for assistants 20 or 30 years ago.

The next three factors belong to the SC subset, and represent professional collaborative relationships with individuals in the home department (6.78), other similar departments in other universities (5.95) and governmental agencies (4.62). Collaborative relationships within the home department are important for several reasons: colleagues in the home department help to improve personal HC and they are the most direct source of professional feedback. In addition, being fully integrated in the department increases professional recognition and participation in the profession.

4.2 Detailed Contributing Factor Analysis by Groups.

The previous section introduced the “story” behind the empirical results. A more detailed explanation of the relevance of some of the contributing factors, differentiating by rank, gender and scientific area will help us to understand how these factors are perceived to matter in the evaluation process, and therefore for career success.

4.2.1 Analysis by Rank.

Figure 4.2.1.1 shows the kernel density plots of the SC scores. Kernel density plots present smooth representations of frequency classes, independent of the end points of bins. I chose to use a normal (Gaussian) kernel with bandwidth or standard deviation of 0.1. for SC. I focus only on the SC plots since HC plots are exactly symmetric given the constraint imposed to the weighting procedure.

With respect to SC scores full professors show the highest frequency corresponding to 30, and the second highest frequency between 0 and 10. On the right side of the graph there is a third small group of professors, whose SC score is close to 70. Associate professors are grouped around 30 and 5, while assistant are grouped mostly around 20 and zero. The average score for SC factors for full professors is 24.6 (table 4.2.1.1), not significantly different from the averages score for associate (29.22) and assistant (21.5) professors. The main significant differences among professors' ranks regard assistant professors. Full professors and associate professors, indeed, do not significantly differ in terms of perceived relevant factors (significance refers to the use of a t-test).

The five most important factors for full professors are work ethic (19.77), creativity (14.87), ability to obtain external grants and contracts (10.8), teaching and advising abilities (10.56) and academic training (9.19) (see Appendix).

Three main differences appear with associate professors. Associate professors rank as the first factor the ability to obtain external grants and contracts (17.61). Not surprisingly the importance for this factor is the same for full and assistant professors, while associate significantly differ from the other professors (99% and 95% probability levels respectively). Associate rank teaching sixth, and the choice for a timely research area is

more important than for full professors. Associate professors are concerned about how much their research activities and their ability to bring in grant money influence the evaluation process, despite their mentoring and teaching attitudes.

Assistant professors ranked work ethic in first place (17.3), like full professors, followed by academic training (14.08), ability to obtain external grants and contracts (12.3), creativity (13.2) and research area (8.23). Working hard is important in all ranks but assistant professors focus more on research and training than full professors. Teaching abilities are again among the less important factors. Availability of funds, finally, is significantly important for assistant professors (4.25) when compared to other professors.

Assistant professors ranked the relationships with the private sector very low. Interviews revealed that assistant professors are too young to be related with the business sector or to consider those relationships relevant for their immediate career success. Their focus on training and research excludes the influence of any other factor. It is important to note that for assistant professors collaboration with faculty, mentors and advisors in their home department and their Ph.D.-granting department plays a vital role in their career development.

4.2.2 Analysis by Gender.

Differences related to gender are not significant (table 4.2.2.1, see Appendix). Data tell us that gender does not influence either the actual or the perceived emphasis that HC and SC factors have in the evaluation process. Looking at the kernel density plots of SC scores (fig. 4.2.2.2), women and men can be both grouped in two subgroups, one

around the mean and one around the zero. Women also present a very small group with high SC scores.

Both women and men ranked first work ethic (23.06 and 16.01 respectively, see Appendix) even though work ethic is significantly more relevant for women than for men (99% probability level). Women ranked second the ability to obtain grants and contracts (14.22), while men ranked this factor third (13.1). The difference is not statistically significant. Significant differences among genders can be found in relative importance of creativity and teaching and advising abilities. Both are more important for men. Women invest more on their training and skills than men. This phenomenon seems to be a plausible explanation for women weighting teaching lower than men. One other possible explanation could be found in a higher percentage of assistant and associate professors among women (tab. 3.3.3), but the average number of years of professional experience by gender (years since the PhD) does not sustain this hypothesis (tab. 4.2.2.2). Finally, women and men interestingly assign different weights to collaborative relationships with colleagues in other universities (see Appendix). The higher relevance of these relationships for men (6.47 against 4.2, significant with 95% probability level) does not lead itself to a straightforward explanation. However if we compare the frequency of previous external job experiences by gender (significatively higher for women than for men, tab. 4.2.2.3), and compare the relevance of relationships with business interests (also higher for women than for men, see Appendix), a possible explanation worth exploring further is that women are more likely than men to start their professional life outside of the academy. When they take their academic jobs, women continue to use their relational portfolio for academic career purposes.

4.2.3 Analysis by Scientific Area.

Differences between the three scientific areas are not significant. (table 4.2.3.1). While in social sciences and biological sciences there are two main groups of professors, those corresponding to lower SC scores (near zero) and higher SC score (around 35), physical scientists are quite homogeneous (fig. 4.2.3.2). Looking more in detail there are only few differences across scientific areas. Academic training is slightly more important for social scientists (13.91), ability to obtain external grants and contracts is more relevant for professors in biological sciences, and relationships with governmental agencies are more important in the physical sciences. Remarkably, professors believe the same factors are instrumental in their academic success irrespective of their scientific area. The only small differences are that biological sciences depend relatively more on grant money, than the social sciences, and the physical sciences relies more heavily on governmental agencies for their funding.

In summary younger professors heavily believe that research and grants were the principle determinants for their promotion. But while associate professors refer on their project management skills, assistant professors give more weight to their training and less about relationships. Hence, assistant professors score work ethic like full professors, even if there are younger. Finally, teaching and creativity are perceived as critical only by full professors, showing a clear demarcation between academic generations. On the relational side, assistant professors rank relationships with mentors more highly, while associate and full professors emphasize relationships with colleagues and peers. Work ethic is the most important career factor for both genders. Male professors give

more weight to creativity while training is more relevant for women. Interestingly, women give a higher weight to business relationships and a lower weight to relationships with colleagues in other departments. Finally, among the three scientific areas, the ability to obtain grants is more important for biological scientists while relationships with governmental agencies are more important for physical scientists.

4.3. A General Overview of HC and SC Investments.

After exploring which factors faculty members perceive to be influential in their career, I now turn to an analysis of the investments in HC and SC they make in support of their professional activities. Survey information is enriched with the insights provided by the interviews.

Tab. 4.3.1 presents a list of the activities in which professors were asked to rank those activities in which they invest time and efforts to build HC and SC. Protecting time for research is the most important activity (18.9), followed by collaborating on grants and publications (14.6), and being updated on the current literature (10.1). Communication with colleagues, teaching, attendance to meetings and investments on personal skills, all received lower scores ranging between 7.7 and 5.7. All the other activities have lower importance at an aggregate level such as taking leadership in professional groups (4.8) and to develop a personal website (1.2).

The results reveal that professors allocate their time mainly towards several key areas captured by the first nine factors. Summing up the scores accordingly, HC activities scored on average 47.8, and social activities 50.2. However, the faculty noted that this twofold classification between individual and social activities was too strict. In most cas-

es the time given to individual activities depends on the time invested in the relational ones. Protecting time for research (18.9), and collaborating on grants and publications (14.6) are complementary activities. The time spent on research is partially devoted to projects developed with other colleagues. Collaboration on grants and publications is very important for career development because publications are one of the key criteria for academic evaluation. In addition, successful grant proposals are considered indicators of professional competence and success.

The third most important investment activity is keeping up-to-date on the current literature (10.1), followed by regular communication with colleagues (7.7). Reading the current literature is important to explore and discover new research ideas, to know the most recent techniques and methodologies, to understand what other researchers are doing, and to be aware of what is the research frontier. As pointed out by the respondents, communication with colleagues is relevant also for the exchange of ideas, to receive feedback, to keep abreast on the latest issues about academic and professional events, and to receive news about the department. Regular communication is also necessary to maintain previously established relationships that otherwise would depreciate in value or be lost.

Developing and teaching new classes (7) is the fifth investment activity in order of importance. Faculty seem to concentrate more on their personal achievements than the strictly instructional part of their job. The interviews revealed that professors are highly differentiated in assessing the importance of teaching, and many of them included mentoring as part of it. Improving personal HC and SC positively affects teaching quality and

mentoring. One of the criteria for students to choose their advisors or mentors is the advisors' reputation, which affects the student's expectation of success.

Finally, professional meetings (6.3) and specialized research meetings (6.2) are important because they facilitate the interaction of professors in a professional venue. The most important reasons for a regular attendance at meetings is to establish and maintain a reputation and to find new collaborators. With just a few exceptions, the interviewed professors, both those who heavily weighted SC activities and those who assigned a low weight to SC, agreed on the value of reputation in determining success through the establishment of new collaborative relationships. Hence, interacting with colleagues greatly increases professional recognition. Improving (6.1) and updating (5.7) personal skills are the last among the most highly ranked activities.

Same attitude toward relational activities is generally showed by those professors who focus on reading literature, improving their skills, and learning new skills and techniques. It seems, then, that time devoted to ameliorate the own HC, competes with time reserved for social activities. On the other hand, those professors who score highly on SC activities, explained how they could take advantage of that, saving time to access, acquire and summarize information. Anyhow, time allocation between HC and SC activities greatly varies. In general, professors who tend to extend their relationships, are also inclined to differentiate their relational portfolio.

4.4 Detailed SC and HC Investment Analysis by Groups.

4.4.1 Analysis by Rank.

4.4.1.1 Full Professors.

Full and assistant professors place significantly more time in research activities than associate professors. Associate professors appear to have a higher level of collaboration (even though the score is significant only when compared with assistant professors). Being an associate professor implies that the individual is exploiting all the skills acquired in the earlier career stage through the relational capital as a source of collaborations and as a mean to achieve success. In the interviews, associate professors noted that they were in the middle of their reputation accumulation process. On the other hand, full professors noted that they had already reached the maximum level of reputation so that they preferred to go back to focusing on their research. In some cases, after several years working on grants, projects, and applied research, full professors choose to dedicate their time to theoretical studies or to teaching and mentoring.

In summary, full professors are clustered in two subgroups: those who focus on their research (generally because of a personal choice or because in the final stage of their career) and those highly inclined to relate with others, to take part into meetings and professional groups where they often provide a leadership, and to develop their visibility even with the help of a website (full professors gave on average an higher score to taking leadership roles, 6.2, than the other faculty). These highly active full professors are not in the last stage of their careers. As they explained, their relational capital is extremely useful to access professional outcomes such as projects and publications. These professors, in response to the hypothetical question on the loss of all their rela-

tional capital reacted more emotionally, depicting a terrible situation comparable to “the loss of [the] own home”. Professors with administrative duties, such as departmental deans, gave the same answer. Full professors at the end of their career or professors that work individually were less concerned about losing their SC. Associate and assistant professors (especially if coming from another job environment) declared they would to be ready to start developing their relational portfolio all over again.

4.4.1.2 Associate Professors.

Associate professors rank high the importance of collaborating. In this career phase, faculty start accumulating their relational capital, developing their reputation, and establishing collaborations. The interviews revealed that this result can be addressed to the previously mentioned focus on research in the college’s policy. This decision provoked a shift in personal career development choices toward a larger time allocation in research and collaboration on grants.

As noted above, faculty stated that professional meetings are important to establish a reputation. Interviews revealed that for associate professors research meetings are the place where they meet peers and colleagues, where they are exposed to future peer reviewers, and where collaborations with governmental agencies are initiated. Interestingly, professors who develop a personal website are also those who interact with community groups and business interests.

4.4.1.3 Assistant Professors.

Assistant professors significantly differ from the other professorial ranks in their scoring higher protecting time for research (21.7), reading current literature (11.35), and improving personal skills (9.85). Assistant professors also significantly differ for collaborations on grants projects and publications (11.7), and taking leadership in professional groups (1.37), activities that were scored less by other ranks. A brief profile of young professor is a faculty member mainly focused on enhancing their individual HC; they are not involved in relational activities; and these assistant professors do not take a prominent role within their professions.

4.4.2. Analysis by Gender.

Differences and similarities between women and men faculty are revealing and informative. Based on our sample, being a woman or a man does not influence the ranking given to the time allocated to research and to reading literature, as well as collaborating on grants projects and publications and keeping communicating with colleagues. Statistically significant differences are found in time spent to develop and teaching new classes - definitively more important for men. Other activities in which men spend more effort than women are regular attendance at professional and specialized meetings, and regular communication with governmental agencies.

Women are more inclined than men to spend time on improving their HC, developing their skills and learning new ones, and playing a leadership role in professional groups. Based on the interviews, the fact emerged that women who were successful in the academy perceived that they faced more professional obstacles than men. These ob-

stacles consisted of a lack of support by their home department, especially from the leading professors (mostly males), and even a lack of financial support. These professional challenges were combined by domestic or motherhood responsibilities. Younger female faculty members did not report these difficulties.

In summary, women focus on their HC more than men, in order to achieve leadership positions and success, while men achieve the same goals relying on their SC, arising from investments in relational capital.

4.4.3 Analysis by Scientific Areas.

I found interesting differences between faculty across scientific areas. Each scientific area has unique differences in their research, teaching, outreach and service cultures. For example, physical scientists significantly differ from their colleagues in biological and social science disciplines by placing less weight on protecting time for research, on investing time on collaboration with others on grants, projects and publications, and on reading literature. Physical scientists invest significantly more time in regular communication with governmental agencies. Physical scientists seem to prefer individual work oriented to develop research projects with public funds. I was expecting to find more openness from this scientific area towards collaboration and business interests, given the need of lab space and expensive instruments. But the interviews made it clear that research in the physical sciences can be classified as theoretical or field research. Nevertheless, access to funding to acquire pricy instruments is still large, so it coincides with public support.

From the interviews the use of a website also appeared to differ across scientific areas. A website works as a window on the academic relevance of the subject, but also to act as a mean to supply the lack of time for communication. The use of a website is mainly for scientific purposes then, but at the same time the information provided makes the own research ready to be confuted, and also speaks about the reliability of the researcher, generating reputation, and developing new contacts. Physical scientists have a long tradition of communicating through a personal website. A website serves as an efficient window to the outside world where these faculty communicate with others. The use of a website for scientific purposes encourages peer review, reputation enhancement, and developing new contacts.

Professors in social science disciplines invest less time in developing and teaching new classes and focus more on professional meeting attendance. The survey also showed that social scientists are less likely to spend time on periodic consulting work. Protecting time for research (19.41) and collaborating with others on grants projects and publications (16.21) are the most important HC and SC investment activities for social scientists. Furthermore, this indicates that for social scientists time invested in increasing SC does not compete in developing HC, indeed it SC investments are complementary to HC investments activities.

Finally, professors in biological sciences consider it more important to have a leadership position (see Appendix, table A.4.6). The most important activities for biological scientists are protecting time for research (19.87) and collaborating with others on grants projects and publications (14.54). For biological scientists protecting time for research often competes with the most of the SC activities. Learning new skills and tech-

niques compete with time for collaboration, and is largely related to improving personal skills. It indicates that time investments in SC often compete with developing HC, for biological scientists.

Table 4.1.1: HC and SC Overall Scores (Weighted Means)

Contributing factors	Weighted average sum, CI and SE.
Human capital	74.61 (71.65 – 77.56) (1.47)
Social capital	25.39 (22.43 – 28.35) (1.47)

Tab. 4.1.2: Career Contributing Factors Ranking (Weighted Means)

Contributing factors		Pre-promotion (only full and associate)	Post-promotion		
			All	only full and associate	only assistant
Human Capital	Work ethic	17.3	17.39	17.3	18.53
	Ability to obtain external grants and contracts	12.3	13.5	13.48	13.64
	Creativity	13.2	*12.8*	13.24	*10.11*
	Academic training	14.1	*9.18*	8.85	*11.45*
	teaching/advising abilities	5.95	*9.17*	9.36	*7.4*
	Research area (timely or urgent topic)	8.22	7.1	6.94	7.6
Social Capital	Home department	5.05	6.78	6.59	6.9
	Other similar departments in other universities	5.55	*5.95*	6.14	*2.33*
	Government agencies	5.5	4.62	4.46	4.4
	The private sector (business)	.9	2.99	3.35	1.1
	Availability of lab space from your employer	3.2	2.66	2.57	2.1
	Other contributing factors (both belonging to HC or SC)	*0*	*2.65*	3.1	*6.29*
	Availability of funds from employer to support research	4.25	2.49	2.19	2.58
	The non-academic community (non-business)	1.15	1.32	1.35	1.07
	Ph.D.-granting department	1.6	.75	.6	2.63
	Post-doc department	1.75	*.63*	.44	*1.67*

Table 4.2.2.1: SC Factors Sums Distributions by Strata: Weighted Means and t-Tests

	Mean, CI and S.E	Men	
Women	24.58 (21.31 – 27.85) (1.62)	-.57$^{n.s.}$	
Men	25.95 (22.42 – 29.48) (1.75)	-	
		Physical Sci.	Social Sci.
Biological Sciences	25.6 (21.28 – 29.91) (2.15)	-.38$^{ns.}$	.02$^{n.s.}$
Physical Sciences	26.53 (23.92 – 29.13) (1.29)	-	.46$^{n.s.}$
Social Sciences	25.4 (22.08 - 29) (1.72)	-	-
		Associate pr.	Assistant pr.
Full professors	24.6 (19.3 - 29.9) (2.63)	-1.51$^{n.s.}$	1.16$^{n.s.}$
Associate professors	29.22 (26.06 – 32.38) (1.57)	-	4.75*
Assistant professors	21.5 (20.66 – 22.33) (.41)	-	-

Note: single (*) and (n.s.) denote “significant” at 1% and “not significant” respectively.

Table 4.2.2.2: Years of Experience by Genders: Weighted Means and t-Tests

	Mean, range and S.E	Men
Women	19.6 (18.31 – 20.88) (.63)	-1.39$^{n.s.}$
Men	21.13 (19.33 – 22.92) (.89)	-

Note: (n.s.) denotes “not significant”.

Table 4.2.2.3: External Job Experience by Genders: Weighted Means and t-Tests

	Mean, range and S.E	Men
Women	54% (41.64 – 66.35) (.06)	2.38$^{**.}$
Men	34.2% (23 – 45.45) (.05)	-

Note: double (**) denote “significant” at 1%, 5% and level respectively.

Tab. 4.3.1: Investments in Professional Activities Ranking (Weighted Means)

	Weighted averages	
	Pre-promotion	Post-promotion
Protecting time for research	18.3	18.9
Collaborating with others on grant projects and publications	12.5	14.6
Reading the current literature	11.9	10.1
Regular communication with colleagues	7.3	7.7
Developing and teaching new undergraduate and/or graduate classes	5.9	7
Regular attendance at professional meetings	7.5	6.3
Regular attendance at specialized research meetings	6.4	6.2
Improving technical skills and techniques	6.4	6.1
Learning new technical skills and techniques	6	5.7
Taking leadership roles in professional groups	4.9	4.8
Regular communication with government agencies	3.12	4
Periodic consulting work	1.6	2.1
Regular communication with community groups	1.2	2
Regular communication with business interests	2	2
Developing a personal website	.3	1.2
Other	4.31	1.3

CHAPTER 5

FACULTY SOCIAL CAPITAL: AN ECONOMETRIC EXPLORATION

5.1 The Empirical Models for the Quantitative Analysis.

Few econometric models have been applied to investments in SC. Even fewer econometric analyses exist for personal investments in SC. To understand the importance of SC and its value in academic careers, this study offers an empirical approach to academic network capital. As an empirical approach, it tests different models and functional forms to find the best explanation for the variability of 2 dependent variables: the Social Capital Score Ratio (SCSR) and the salary level (table 5.1.1).

Two basic econometric models were estimated with each one corresponding to the two principal ideas being explored in this research. Data refer to the actual academic career. The first model tests the hypotheses concerning network-based SC. The second model tests the hypotheses regarding the value of network-based SC, regressing faculty salary on several explaining variables, including the individual's amount of SC. For both the models, several interaction terms and additional hypotheses were tested.

5.1.1 The First Model.

The dependent variable in the first model is the ratio between the individual sum of weights for investments in SC activities, and the corresponding sum of HC weights, for the post-promotion time frame. This ratio is called the SC score ratio (SCSR). The SCSR expresses investments on SC "normalized" by investments on HC. It is a percentage expressing the magnitude of investment of SC compared to HC. A SCSR = 0.42,

for example, indicates that the sum of SC factors' scores is the 42% of the HC factors' scores, while SCSR= 2.33 indicates that the SC score more than doubles the HC score.

The first empirical model is:

$$SCSR_i = \beta_0 + \beta_1 Gender_i + \beta_2 PExJob_i + \beta_3 Yexperience_i + \ +\beta_4 Yexperience^2$$
$$+\beta_5 Rfull_i + \beta_6 Rassociate_i + \beta_7 Biosci_i + \beta_8 Physci_i + \epsilon_i$$

where,

$Gender$ - dummy variable for gender (1= male, 0= female)

$PExJob$ - dummy indicating (*PExJob =1, 0*) a previous job experience prior to the current position

$Yexperience$ – number of years since earning the Ph.D. degree

$Rfull$ – dummy variable for full professors (1= full, 0=all others)

$Rassociate$ – dummy variable for associate professors (1= associate, 0=all others)

$Salary$ – individual salary level

$Biosci$ – dummy variable for professors in biological sciences (1= biological sciences, 0=all others)

$Physci$ – dummy variable for professors in physical sciences (1= physical sciences, 0=all others)

5.1.2 The Second Model

The second model explores the role of SC in contributing to career achievements, principally salary level. The second model is

$$Salary_i = \beta_0 + \beta_1 Yexperience_i + \beta_2 Yexperience^2 + \beta_3 Biosci_i + \beta_4 Physci_i + \beta_5 Gender_i + \beta_6 PExJob_i + \beta_7 SumSC.$$

where $Salary$ is the individual salary level in 2007, and $SumSC$ appears as an explanatory variable. Interaction effects are tested also in this model.

$Salary$ was not used as an independent variable in the first model specifications. Salary levels could explain investments in SC activities since a higher salary provides funding for relational activities, eg. travel to meetings. On the other hand, higher investments in SC can boost career advancement leading to higher salary levels. It seems that further research efforts should work on this identity problem. In the case at hand, a significant relationship between higher $Salary_i$ and a higher $sumSC_i$ was rejected since the data revealed that the relationship was weak. It would be more appropriate to relate investment in SC with a measure of academic success that accounts for both pecuniary success and prestige. Furthermore, if data about salary from grants and projects were available, the use of another variable, faculty $Income$, instead of $Salary$ and the relationship between $sumSC_i$ and $Income_i$could lead to interesting results.

Secondly for both the models, interaction terms were specified generating an extended version of the models. Interaction effects facilitate a more in-depth exploration and understanding of my data. For example, the effect of years of experience (“professional age”) may be more significant for full professors, since associate professors are generally younger. Also, a previous external job experience (or mobility) may have a positive influence on SCSR in those areas where relationships with business and stakeholders can be an asset (physical sciences and biological sciences), and a negative effect in other areas (social sciences). Mobility may have a more negative effect for

women (loss of SC). Finally I expected that previous external job experiences would positively affect the SCSR for both full and associate professors.

5.2 Results for the First Econometric Model.

5.2.1 Age and Experience

Years of experience were included in the model in both their linear and squared specification in order to capture the life-cycle effect of experience on SC investments. According to the life cycle model, the size of the marginal returns of investments in HC along an individual's life is higher in the first years and lower in the last years, until any additional investment in HC produce a constant or even a declining rate of return. The curve can be divided in stages. In the first stage, the growth stage, marginal returns increase rapidly, in the second stage, the maturity stage, the curve is flat and in the third stage, the decline stage, the slope becomes negative.

In the basic specification of the first model (table 5.2.1), where no interaction terms were utilized, the number of years of experience is statistically significant, but the signs for the coefficients are opposite to the life-cycle model. In the extended version of the model the effects of experience is specified for the rank. The signs now respect the life-cycle effect but they refer to those professors not specified by any dummy variable, the assistant professors (fig. 5.2.1.1). The coefficients for full professors and associate professors continue to be opposite to my hypothesis. Since years of experience are globally recognized in literature as a proxy for HC the results indicate competition between HC accumulation and SC accumulation.

5.2.2 Academic Rank.

In the basic model only the coefficient for the dummy variable indicating associate professors is significant and it shows that associate professors' investments on SC increases by 19% (with respect to HC) compared to full and assistant professors. In the extended model, the coefficient is no longer significant. The introduction of a more detailed specification reduces the influence of academic rank.

5.2.3 Gender.

Gender does not influence the level of SCSR, contrary to my hypothesis and the published literature. This result may be influenced by the nature of my case study. As found by the qualitative part of this work, differences can be found in the kind of relationships that women and men establish and in the use they make of their relational portfolio, as other research describes. There is no evidence of a different level of investments in SC between genders however literature suggests that men prefer to establish vertical relationships and women horizontal relationships. In my case differentiation can be found in external relationships: men most likely establish relationships with peers while women maintain relationships from previous external job experiences (mainly business).

5.2.4 Previous External Job Experience.

In the basic specification of the first model, professors who have had other employment prior to starting their tenure-track position significantly place more value on net-

work capital - 14% more than those professors who “professionally grew” within the Uo-fA’s walls. Interaction terms were specified to account for the combined effect of rank, scientific area, gender and previous external job experience. Results show that once interaction terms are specified the coefficient for $PExJob$ is still significant but highly negative (- .354) indicating that mobility drastically decreases SC in young assistant professors (it should be considered that these professors tend to invest less in SC). Furthermore, interaction effects show that mobility has a consistent positive effect on SCSR for both full and associate professors (+30% and +17.5% respectively) but the coefficient is significant only for full professors. This finding supports the existing literature that has found that mobility reduces SC returns and then SC investments (Glaeser et al.). $PExJob$ is not significant when distinguishing its effect by gender indicating that there are no differences in the influence of mobility on SCSR among women and men.

Finally, mobility has a significant and consistent effect on SCSR for biological scientists (+23.4%). The result indicates that biologists coming from another job environment tend to maintain their previous relationships for professional goals. As I hypothesized, mobility positively affects the level of a faculty member’s relational portfolio and the SC stock for professors in biological sciences. I hypothesized that relationships with both the private sector and governmental agencies could be strategic in biological research. This result also corroborates what I found with the qualitative analysis. Finally, the same effect is positive but not significant for physical scientists. However, I expected (younger) associate professors to take more advantage of their mobility. Full professors may have more time to further “cultivate” those external relationships coming from a previous job while associate professors are too busy establishing their research program.

5.2.5 Scientific Area.

Coefficients for the scientific areas are not significant. Only in the extended model being a biologists have a significant and negative effect on SCSR, but this result refers to those professors in biological sciences without a previous external job experience. Finally, it was not possible to distinguish the effects of being a social scientist to not incur in the “dummy variables trap”. I can make some inference on the constant term which specifies being a woman, assistant professor, with no previous external job experiences, teaching in social sciences. The constant term is significant at a 1% level, and positive.

5.3 Results for the Second Econometric Model.

Looking at the basic model specification (table 5.3.1) with $Salary$ as the dependent variable, three of the seven explanatory variables are significant. Also in the second model’s basic specification the null hypothesis of all the coefficients being equal to zero can be rejected with a less than 1% probability level, meaning that the model is globally well specified. The r-squared is .36 (.56 for the extended version).

5.3.1 Age and Experience

The effect of an additional year of experience in its life-cycle model specification is not significant in the basic model. In the extended version of the second model years of experience are significant both in the linear and in the quadratic specification as are the interaction terms for full and associate professors. For the interaction terms the effect of

the years of experience on salary follows the life-cycle model with a probability level of 1%. The coefficients for the same variable presents opposite signs when considered alone, indicating that for assistant professors the life-cycle effect of HC on salary does not exist. This results support my hypothesis derived from the literature, that HC accumulation through years rises the salary level until it reaches a maximum level.

5.3.2 Gender.

As expected, gender has no influence on the salary level, neither in the basic nor in the extended version of the second model. Given the sample distribution of gender across ranks, and given the fact that a good share of the surveyed women occupies administrative roles, there is no reason to expect gender to influence the salary. Some interaction terms including gender are significant, and are discussed in the following paragraphs.

5.3.3 Previous External Job Experience.

Mobility significantly increases the salary level. This finding fully supports my hypothesis that faculty coming from another job environment can gain a higher salary level than other professors because of the bargaining process prior to accept the new position. According this model, a previous external job experience significantly increases the salary level by $ 12,000, on average. In the extended version of the model the effect of mobility is specified by gender and scientific area. In this model specification the coefficient for this variable is significant only with regards to gender: mobility seems to positively affect the salary level greatly for men. However, given the small data in my sam-

ple, the sign of these coefficients may not be helpful. We cannot say if this result indicates that the bargaining process prior to taking a position in the college is more effective for men than women, or if women generally bargain less than men. But, having isolated the effect of SC on the salary level (as shown later), I can say that this result does not depend on the amount of relationships that can be lost or acquired with mobility.

Finally, I expected that mobility could lead to higher salary for biological scientists, but this was not the case. One of the possible reasons for this result is the exclusion of grants and funding from the variable $Salary$. In summary, a previous external job experience increases salary only for men ($ 41,000). As seen in the qualitative analysis, men invest more than women in their relational portfolio and in SC, but most of the women, especially among older full professors, join the academy after previous off-campus experience. The result confirms the hypothesis that women are mostly evaluated on their HC with respect to men, while male professors tend to exploit their relational capital accumulated in different job environments.

5.3.4 Scientific Area.

Contrary to my hypothesis, working in the biological sciences and physical sciences implies a lower salary level. The (weighted) mean for salary is $ 115,000 for social scientists compared to $ 88,000 for biological and physical scientists. It is important to note that using an income measure that adds to the salary money from grants and contracts likely would lead to opposite results.

5.3.5 Social Capital.

Investments in relational-based SC (here measured as the sum of the SC investment's scores) are significant in explaining salary levels and, very interestingly, SC follows the life-cycle model when measuring its effects on salary (fig. 5.3.5.1).

Substituting the estimated coefficients within the equation used for the second model specification restricted for the SC effects, and using this new equation to estimate the salary level it is possible to plot the salary level against the sum of the investments in SC activities.

$$\widehat{Salary}_i = \widehat{\beta_0} + \widehat{\beta_{13}} SumSC_i + \widehat{\beta_{14}} SumSC_i^{\,2}$$

The plot (fig.5.3.5.1) clearly shows a well defined life-cycle effect. It is possible to recognize the growth stage, the maturity stage, and the declining stage. Equating to zero the first derivative of the $\widehat{Salary}_i$ I calculated the maximum level of investments in SC activities which is equal to 30.1. The result indicates that, on average, the optimal energy or time allocation among HC and SC is close to 3:1. Moreover, further investments in relational activities produce negative marginal returns on the salary level. One explanation for the declining stage is that on average investing more than 30.1% of time and efforts in relational activities subtracts energies to HC activities. The resulting lower quality level of personal skills and knowledge would determine less professional recognition, reputation and success. However, this could not be the only explanation. Higher investments in SC may imply to maintain a large number or/and a high frequency of relationships. To manage this complexity could be so difficult that it diminishes the prod-

uctivity. Information over-flow, conflict management, optimal time allocation among relationships could be some of the problems connected to a large number of relationships.

Calculating the maximum SC level for assistant, associate and full professors (using the estimated coefficients from the extended version of the second model) I obtained 44.9, 29.64 and 24.92 respectively. If correct, this result indicates that even if assistant professors generally invest more on HC (as described in the qualitative analysis), SC is more critical for younger professors and less for older professors. It seems that younger professors who invest more on SC are those who gain the most in terms of salary level.

Furthermore, some very interesting results emerge when specifying interaction effects for SC and gender, scientific area and full professors. SC has a positive effect on salary for professors in physical and biological sciences (about $1,300 and $700 respectively). My hypothesis would be supported if it were not for the negative and significant coefficients of SC for men, full and associate professors, and professors with an external job experience. I hypothesized a positive effect of SC's investments for these categories. Probably, using income as previously specified in place of salary might lead to results supporting my hypothesis.

As for the first model, the effect for being a social scientist is difficult to explore since it is included in the amount of information enclosed in the constant term.

5.4. HC and SC Complementarities.

Complementarities between SC and HC have been explored in the first model. Here I present a further test on the hypothesis that the effect of HC on salary level could be

complementary to the relational-based SC effect. I run a Wald test on both the basic and expanded version of the second model, accordingly to the following scheme:

$$\beta_a Yexperience_i + \beta_b Yexperience_i^2 = \beta_c SumSC + \beta_d SumSC_i^2$$

The tests results are contradictory: for the basic version of the model the test indicates that it is not possible to reject the hypothesis that HC and SC are complementary, while for the extended version the test indicates that it is possible to reject the hypothesis that HC and SC have complementary effects at the 1% probability level. This problem could be the object of further research.

In summary, the effect on SCSR of years of experience does not follow a life –cycle model suggesting for a competition among HC and SC. However, looking at the effects of SC and years of experience on the salary level, results indicates complementary effects between these two intangible assets. Result from the qualitative analysis show that associate professors make a larger use of and accumulate more SC, but SC investments are more critical for younger assistant professors when looking at salary. These findings partially contrast with literature: individuals with a high value of time will not accumulate less SC as found by Glaeser et al. But while these authors could not find proof of complementarities between SC and HC, I found differences among faculty categories with respect to HC and SC complementarity/competition. Neither the SCSR nor the salary level are influenced by gender. Mobility drives down the SCSR for assistant professors, while it has a positive effect for associate and full professors, and for

biologists. Furthermore, mobility increases the salary level. The scientific area has no effect on the SCSR but they differ by career planning. Faculty in physical sciences consider less important protecting time for research, collaborations and reading literature, and they are more focused on maintaining relationships with governmental agencies and on individual work. Biological scientists find that investments in SC compete with HC and they tend to take advantage of professional meeting, events and groups. Professors in social sciences are opened to collaboration on grants and projects, protect time for research and think that SC does not compete with HC.

Finally SC has a positive effect on salary and it follows a life-cycle model organized in a growth stage, a maturity stage, and a declining stage.

Table 5.1.1: Dependent Variables and their Definitions

Name	Extended name	Definition
$SCSR$	Social Capital Ratio	$\sum SC\ investments_i \Big/ \sum HC\ investments_i$
$SumSC$	Sum of SC investments	$\sum SC\ investments_i$
$Salary$	Salary level	Individual salary level in 2007

Table 5.2.1: Regressions Results for the SC Score Ratio Model.

Variables	Basic first model	Extended first model
$Yexperience$	-.031*	.08*
$Yexperience^2$	.001*	-.004*
$Yexperience * Rfull$		-.091*
$Yexperience * Rfull^2$		.005*
$Yexperience * Rassociate$		-.006 n.s
$Yexperience * Rassociate^2$		.002 n.s
$Rfull$	.085 n.s.	.227 n.s
$Rassociate$	.188*	.014 n.s
$Biosci$	.069 n.s.	-.112**
$Physci$	.039 n.s.	-.048 n.s
$Biosci * PExJob$		.234**
$Physci * PExJob$		.063 n.s
$Gender * PExJob$		.128 n.s
$Gender$	.031 n.s.	-.042 n.s
$PExJob$	.141**	-.354*
$Rfull * PExJob$		.299*
$Rassociate * PExJob$		.175 n.s
$constant\ term$	.379*	.101***
r-squared	.16	.33
Prob>F	0.000	0.000

Note: single (*), double (**), and triple asterisk (***) denote “significant” at 1%, 5% and 10% level respectively.

Table 5.3.1: Regressions Results for the Salary Level Model.

Variables	Basic model	Extended model
$Yexperience$	636.2[n.s.]	-9,169.2[*]
$Yexperience^2$	10.6 [n.s.]	526.3[*]
$Yexperience * Rfull$		10,534.2[*]
$Yexperience * Rfull^2$		-542.3[*]
$Yexperience * Rassociate$		9,572.5[*]
$Yexperience * Rassociate^2$		-569.4[*]
$Biosci$	-16,815.2 [*]	-28,047.8[*]
$Physci$	-11,769.6 [*]	-50,078.2[*]
$Biosci * PExJob$l		-17,350[n.s.]
$Physci * PExJob$l		-16,601.1[n.s.]
$Gender * PExJob$		41,418[*]
$Gender$	-5,826.7 [n.s.]	-5,957.9[n.s.]
$PExJob$	13,158.6 [*]	9,307.4[n.s.]
$SumSC$	751.7 [**]	2,082.5[*]
$SumSC^2$	-12.5 [**]	-23.17[**]
$SumSC * gender$		-694.2[**]
$SumSC * Physci$		1,349.8[*]
$SumSC * Biosci$		636.3[**]
$SumSC * full$		-927.9[*]
$SumSC * associate$		-755[*]
$SumSC * external$		-214.3[n.s]
$constant\ term$	79,169.7 [*]	96,574.5[*]
r-squared	.36	.56
p>F	0.000	0.000

Note: single (*)denote “significant” at 1% level; n.s denotes note significant.

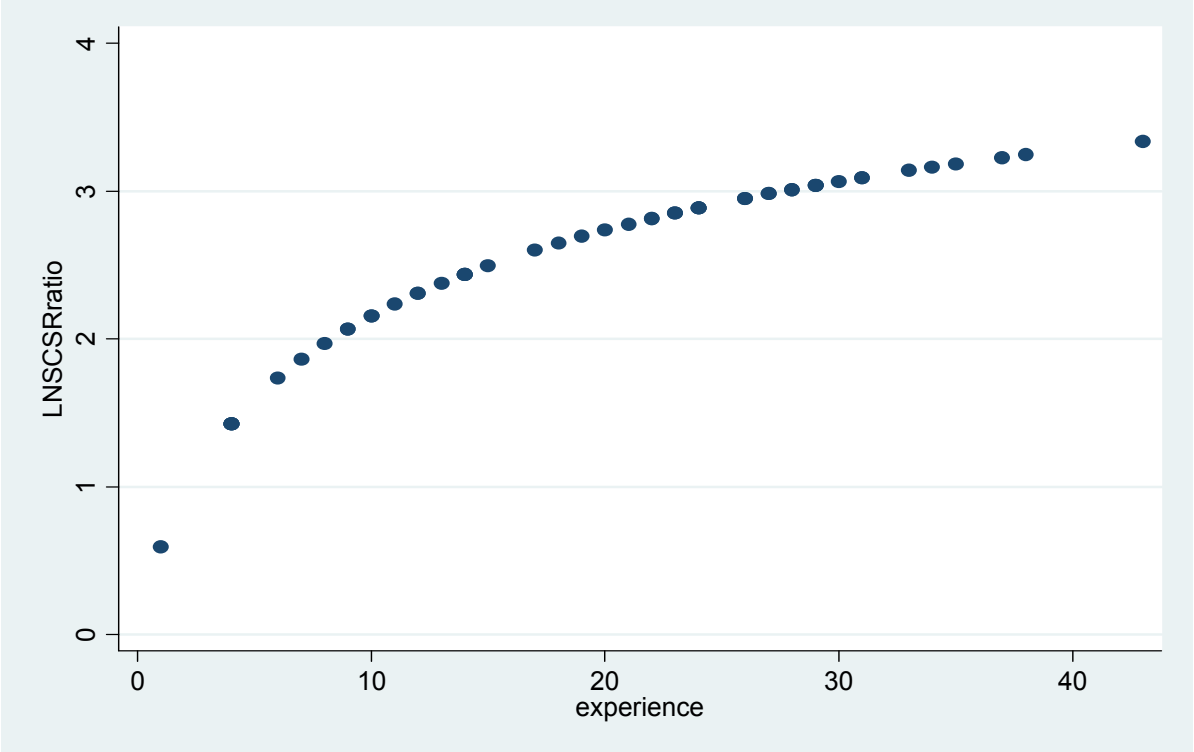

Fig. 5.2.1.1: results for SCSR versus years of experience: a life-cycle model (an ln transformation has been applied to make results more visible).

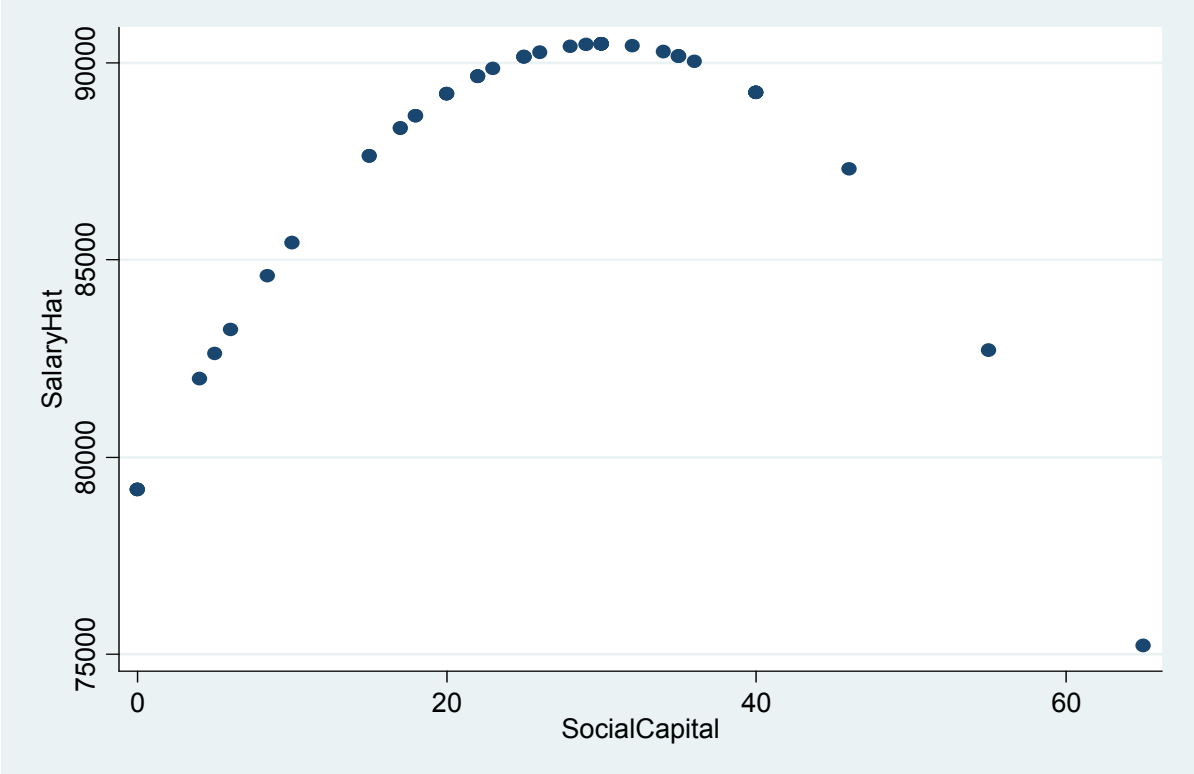

Fig. 5.3.5.1: Results for salary level versus SC investments: a life-cycle model.

CHAPTER 6

FACULTY SOCIAL CAPITAL: A NETWORK ANALYSIS EXPLORATION

6.1 The Network Analysis.

Affiliation networks among professors have been created to represent *behavioral maps*. In these networks, relationships between actors occur when two actors choose the same factors that create a career advantage. Strength of relationships and closeness in the network are positively related with the number of shared factors. The term "behavioral map" is the graphic representation of similarities and differences among faculty members.

6.1.1 Affiliation Networks.

An affiliation network (AN) is a *two-mode* network (actors-by-events), where the connections among members of one mode are defined by the second mode. ANs allow the study of the dual perspective of actors and events (Breiger; Wasserman and Faust). ANs are used to research individuals' behavior in *social circles,* where a social circle is a physical place, event or circumstance in which the actors take part. In this case, the social circle is represented by the faculty in CALS. Social circles also may be unobservable. For example, an unobservable social circle is a social entity that must be inferred from behavioral similarities among a collection of individuals (Kadushin). I use AN analysis to map and explain the presence of unobservable social circles determined by faculty career development choices.

A social circle has three defining characteristics:

- “a circle may have a [..] network of indirect interaction. [..] it is thus not a pure face-to-face group”.
- “The network exists because members of the circle share the same interests - political or cultural”.
- “The circle is not formal: no clear leaders, no clearly defined goals, though it almost always has some implicit functions; no definite rules which determines modes of interaction, thought there are customary relationships; no distinct criteria of membership” (Kadushin, p. 692).

In the current case study, indirect interaction may exist between professors who share a common sense or idea about what matters for their academic reputation and career, and consequently, professors may share the same interests and “political” ideas about the environment in which they are embedded. Being part of an informal group, faculty must understand the formal and informal norms governing the academic environment. Membership also depends on peer acceptance. Being a part of an academic social circle facilitates socialization, professional recognition, and reputation development.

To build an AN, the actors and the career advantage factors are organized in a binary-data matrix, with the actors on the rows and the factors on the columns, where the presence of “ones” indicate the choice for a factor, while “zeros” indicate no choice. This matrix is called an *affiliation network matrix* (AM) (table 6.1.1.1) that produces an AN, represented by a bipartite graph. For example, the bipartite graph in fig. 6.1.1.1 represents the affiliation of a college made up of 5 faculty with respect to three different

academic activities. Mary share the same choice with Lucy and John, while Lucy only with Mary. John is the faculty who has more commonalities with the rest of the college. He probably is the faculty who can better mediate among the others, or take advantage of his position, or drive the college policy creating a social circle. An AM is indicated by the notation $\boldsymbol{A} = \{a_{ij}\}$, or the set of affiliations of actor i to event j. Using matrix algebra on the AM, it is possible to obtain two squared *incidence matrices* (IM): a factor-by-factor IM, called an event overlaps matrix $X^{\mathcal{M}} = \boldsymbol{A}\boldsymbol{A}'$ (table 6.1.1.2), and an actor-by-actor IM, called a co-membership matrix $X^{\mathcal{N}} = \boldsymbol{A}'\boldsymbol{A}$ (table 6.1.1.3). If two actors $i$and j are both affiliated with an event k, then $a_{ik} = a_{jk} = 1$. Each one of the IMs represent a one-mode network, respectively an event-overlap and a co-membership network. The actor-by-actor matrix is of interest for this study. Stepping back to the previous example and looking at the right hand side of fig. 6.1.1.2 it is possible to see how central is John within the co-membership network of his department. The actor-by-actor IM has been checked for the presence of subgroups of actors and for individuals' centrality measures. Network density and Network Centralization Index (N.C.I.) also have been calculated. Finally, simple regressions on subsamples of observations (gender, scientific area, and rank) have been run to estimate the effect of the actor-level centrality indexes on salary levels.

6.1.2 Network Density

The ratio between the sum of the relationships among the actors of a network, and the highest number of relationships that could possibly exist within the network produce

the network density. This ratio provides valuable information. For example, network density can express how much a network is “animated” or, on the other hand, how much “space” there is for action, since it provides an idea of the degree of embedded of actors. In this study, density expresses the degree of complexity of choices since the higher the density the higher is the number of different choices.

6.1.3 Network Centrality Index

The N.C.I. represents the distance, expressed as a percentage, from the *star network,* a hypothetical network which is the most centralized network possible (fig, 6.1.3.1). The N.C.I. expresses a measure of the concentration of the relationships in few actors. Sparse star-like networks, for example, have an high N.C.I., indicating that the network has a centralized structure, with a few actors holding a central position.

The number of vertices adjacent to a given vertex in a symmetric graph is the degree of that vertex. For a given binary network with vertices $v_1 .... v_n$ and maximum degree centrality c_{max} , the network degree centralization measure is $N.C.I. = \sum\left(c_{max} - c(v_i)\right)$ divided by the maximum value possible, where $c(v_i)$ is the degree centrality of vertex v_i (Borgatti S. and Everett M.G.). The N.C.I., a more sophisticated version of network density, contributes additional information to the network analysis. For example, the N.C.I. for the network in fig. 6.1.1.2 (on the right side) is 66.67%. The interpretation of the N.C.I. for this study, is a measure of behavioral dissimilarities in the network. Higher N.C.I. signal greater diversity in how professors manage their SC. In this case study, I interpret a higher NCI as indicating that few professors make common

choices about career planning and the rest of the sample have few commonalities. The NCI is a proxy for how narrow the social circle is within the network.

6.1.4. Subgroups.

Looking for subgroups is one of the most important steps in analyzing a network. Grouping actors into subgroups and sub-structures can be very important to understand how the network as a whole behaves. Overlapping memberships may be more important than group mapping because it can show particular interactions. Knowing how an individual is embedded in a structure of groups is critical in understanding his/her behavior (Hanneman and Riddle). For example, some individuals may act as “bridges” between groups. Others have all their relationships within a single group, while other individuals are part of closed elites or work as isolates (i.e., work nearly totally alone). In the academic world, “bridges” may correspond to researchers and faculty who communicate with peers and colleagues that have a completely different idea of how life in the college should flow, or how to be professional. “Bridge” faculty have many commonalities with others and ease communication among groups, mediating between the needs expressed by, for example, teaching-focuses professors and research-focused professors. On the other hand there could be a leading group of faculty within the college who share the same view of an ideal professional. Other faculty could work in complete isolation. Another way of looking at network structures is to search for sub-structures weakly connected to the rest of the network that can create brokerage opportunities or constraints to action. We could simplify the reality, for example, to a college where two groups of faculty have an opposite but complementary idea about career planning and

activities in which to invest time and efforts. The lack of connections between the two groups creates an opportunity of brokerage.

To explore groups and substructures, network algorithms follow two approaches. The first method is a bottom-up approach that starts with dyads (pairs of connected actors) and searches for tight or relaxed groups of a growing number of actors. The second approach follows a top-down strategy, looking for network sub-areas that are locally dense but separated to some degree from the rest of the network (Hanneman and Riddle).

6.1.5 Centrality Measures.

Centrality is a network measure closely related to the idea of power. Holding a central position within a net of relationships brings a wide range of advantages that ultimately create some degree of control over other actors. For example, power can arise from control over the information flows or over money flows. A person can be powerful because she/he is influential and influence arises from being the reference point for a considerable number of people. Within the academy a faculty holding this kind of power could be a Department Head, or a leading researcher who manages research groups. In this study, being a central actor implies sharing ideas with a large number of peers. I assume that centrality reflects greater embeddedness, recognition and influence. Measures of centrality largely vary to the extent that power can be exerted. Centrality can be categorized as: *degree*, *closeness*, and *betweennes*. In this study I utilize only degree and closeness since the nature of the relationships in the academic network, and the survey process adopted, could lead easily to misinterpretation of more complex

indexes like betweenness. I already discussed the degree centrality. Closeness calculates the farness (and normalized closeness centrality) of each vertex, and gives the overall network closeness centralization.

The farness of a vertex is the sum of the lengths of the geodesics (where a geodesic is the shortest path connecting a couple of actors) to every other vertex. The reciprocal of farness is closeness centrality. In addition the routine also allows the researcher to measure distance by the sums of the lengths of all the paths or all the trails. I test this calculation in my study. Since the data is directed the routine calculates separate measures for in-closeness and out closeness, meaning differentiating by incoming and outgoing ties. The program also provides some further descriptive statistics.

6.2 Social Network Analysis Results.

The AN analysis produced interesting results. The co-membership matrix utilized to draw the network was built starting from the affiliation matrix of faculty-by-activities, where events were the single factors in which the actors invested their time and effort. The AN analysis utilized both valued and dichotomized relationships. The latter have been obtained assigning 1 to relationships with value higher than zero, and 0 otherwise. Dichotomization has been necessary in order to calculate the NCI, and to calculate an easy to read density measure (Borgatti and Everett). The software used for the AN analysis is Ucinet (latest version), developed by Steve Borgatti. The AN analysis produced results that describe the actors' behavior with respect to their career planning choices. The co-membership network features describe the distribution and the structure of the relationships, giving a new perspective on individual faculty behavior. The AN

analysis I performed does not offer the possibility to test hypothesis using confidence intervals and tests. Nonetheless I tested for the effect of degree centrality on salary level. I hypothesize, in fact, centrality being positively related to salary. Centrality, within this particular AN, is a degree of choice similarity with a group of peers, working as a proxy of membership in a social circle. The idea behind this hypothesis is that active participation within a social circle makes it easier to be recognized as a professional, increasing the chances for career advancement. I expect, then, this membership to be positively related to salary level.

6.2.1 AN Descriptive Statistics.

The mean centrality degree for the valued AN is 47,903 (table 6.2.1.1), corresponding to a mean share of centralization of 2%. This value is quite close to the maximum possible (2.9%) indicating a quite homogeneous distribution of degree centrality between the faculty. The density for the valued AN is 958.1. The valued density is calculated by dividing the total of all values by the number of possible ties (Borgatti and Everett). In this case density gives the average valued relationships. The density from the dichotomized AN is quite low, 7.04, meaning that of all the possible ties in the AN only 7% are effectively present. This indicates that the network is quite sparse. Within a sparse academic network, being a central actor can be an important.

The NCI is 19.03. a quite low value (table 6.2.1.1) indicating that relationships within the AN are not centralized, but quite equally spread among the actors. The information provided by the densities and the NCI describes a network quite disperse and not centralized, suggesting a wide range of choices for the professional activities. The opposite

situation would have required the presence of a restricted group of actors fully interconnected, and the rest of the actors disconnected or isolated. This interpretation is also confirmed by the absence of subgroups as N-cliques, N-clan, or K-plexes.

6.2.2. AN Network Hypothesis Test.

Salary levels are regressed on degree centrality.

$$Salary_i = \beta_0 + \beta_1 Centrality$$

Results are listed in table 6.2.2.1. Regressions were run separately for subgroups of observations with respect to rank, scientific area and gender. Coefficients are significant for full and associate professors. The higher the actor's centrality, the lower is the salary for full professors and the higher is the salary for associate professors. Hence, the more associate professors share similar professional activities investments portfolios, the more their career development are similar to their peers and the more they earn. This is not the case for full professors. I believe this opposite result is due to the presence of older full professors in the sample. Many of these professors, are at the end of their academic careers, so the value of SC is in the upper part (i.e. maturity, decline) of the life-cycle. Their position of very senior faculty within the network is no more related to their salary. In other words, membership in a social circle represents less of an asset (in terms of higher salary) for full professors than associate professors. The relationship between salary and centrality is not significant for assistant professors and faculty in the biological and physical sciences.

The only scientific area where centrality matters is the social sciences. The coefficient is significant at 5% probability level but has a negative sign. Given the nature of the so-

cial sciences, there may be fewer possibilities to create different relational portfolios. Variability is an asset, and centrality expresses the lack of variability. In this sense, the relational portfolio in the social sciences of those who are central does not provide added value in terms of high salaries. So this result does not support my earlier hypothesis.

Finally, centrality has no effect on salary when actors are distinguished by gender. This result could mean that there are no social circles that determine differences in salary achievement between women and men.

Tab. 6.1.1.1: Affiliation Matrix of Actors by Events

Actors	Events		
	Regular communication with business interests	Protecting time for research	Developing and teaching new undergraduate and/or graduate classes
Lucy	0	1	0
Mary	1	1	0
John	1	1	1
Steve	0	0	1
Mark	0	0	1

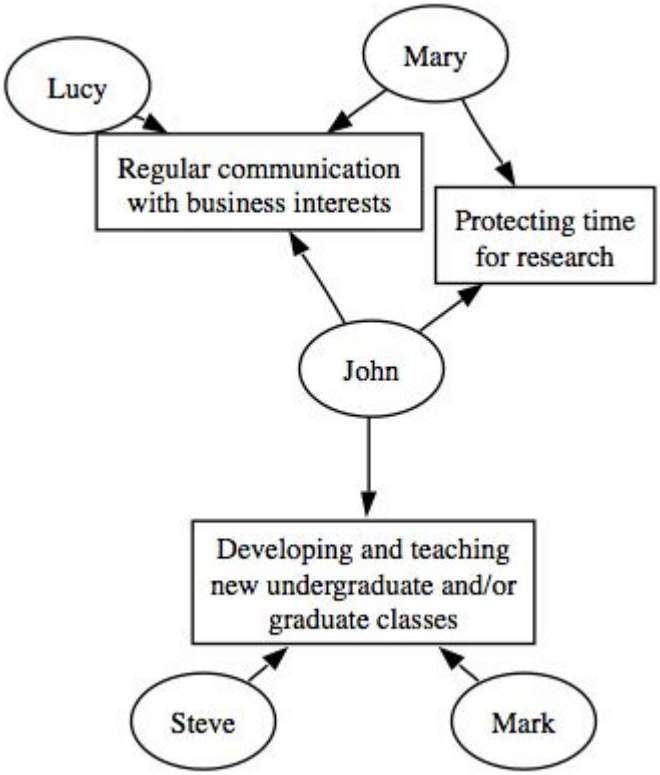

Fig. 6.1.1.1: Bipartite Graph, Actors by Events, Resulting from Table 6.1.1.1

Tab. 6.1.1.2: Event Overlap Matrix (Events by Events Incidence Matrix) Originated from Table 6.1.1.1

	Regular communication with business interests	Protecting time for research	Developing and teaching new undergrad. and/or grad. classes
Regular communication with business interests	2	2	1
Protecting time for research	2	3	1
Developing and teaching new undergraduate and/or graduate classes	1	1	3

Tab. 6.1.1.3: Co-membership (Actor by Actor Incidence Matrix) Originated from Table 6.1.1.1

	Lucy	Mary	John	Steve	Mark
Lucy	1	1	1	0	0
Mary	1	3	2	1	1
John	1	2	2	0	0
Steve	0	1	0	1	1
Mark	0	1	0	1	1

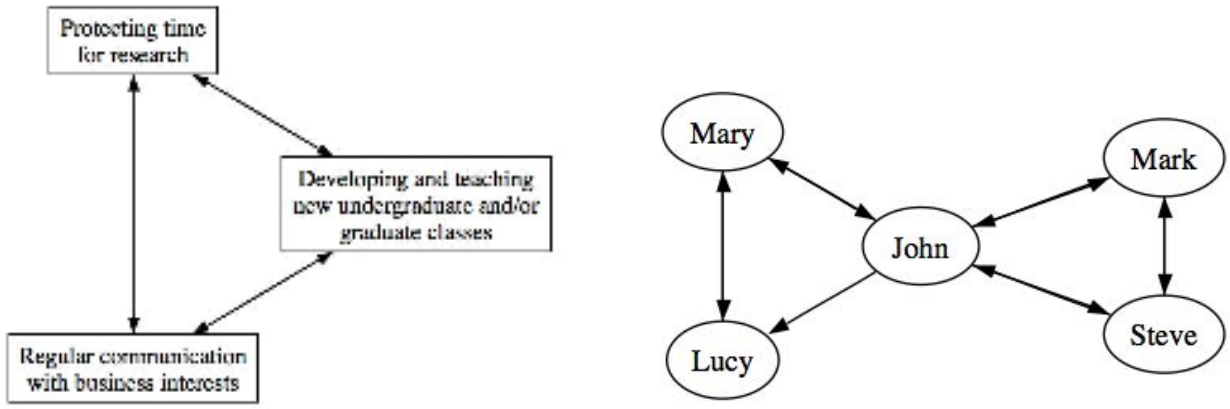

Fig. 6.1.1.2 Overlap Network (left) and Co-Membership Network (right), Originated from Table 6.1.1.2 and Table 6.1.1.3 respectively.

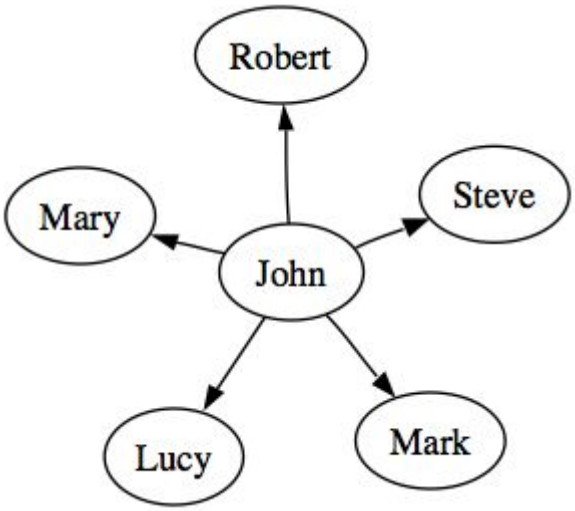

Fig. 6.1.3.1: A "Star" Network

Table 6.2.1.1: Affiliation Network Descriptive Statistics

	Degree	Share
Mean	47,903.1	.02
Std Dev	10,904.8	.004
Minimum	25,025	.01
Maximum	71,130	.029
Density	958.1	(valued data)
Std Dev	424.1	
Density	7.04	(dichotomized data)
Std Dev	3.06	
N.C.I.	19.03%	(dichotomized data)

Table 6.2.2.1: Individual Degree Centrality Effects on Salary Level, by Subsamples

	Coefficient	t-value	r squared
Full professor	-1707.6*	-2.74	.13
Associate professors	925.8***	1.92	.18
Assistant professors	-78.8	-1.39	0
Biological sciences	-128.9	-.42	0
Physical sciences	-623.9	-.5	.01
Social sciences	-2491.2**	-2.5	.16
Men	-433.9	-1.12	.01
Women	-1005.2	-1.09	.04

Note: single (*), double (**), and triple asterisk (***) denote “significant” at 1%, 5% and 10% level respectively.

CHAPTER 7

SUMMARY AND CONCLUSIONS

Universities compete to maintain their productive faculty. An understanding of the relative value of HC and SC can help universities and colleges to optimize the investments. Trust, reputation and information are significant contributes to career advancement. SC is a metaphor for many different ideas, all related to interaction rules and norms. The operational mechanism for SC is the net of relationships. Relationships help to build shared norms, trust, and professional recognition. Relationships amplify and ease HC recognition and reduce the cost of information gathering, the access to funding and ease scientific collaboration.

The main purpose of this thesis was to make a small contribution to our knowledge of individual SC, its use and its economic value. A qualitative and a quantitative analysis were performed within a unique organizational context, the university college. Qualitative analysis about SC revealed precious insights about the effective nature and use of relationships and norms among people that together generate SC. Quantitative analysis helped to test hypothesis about the economic value of SC (and about SC as intangible asset), the correct use of the term “capital”. I also tested the use of Affiliation Networks Analysis to evaluate the network effect. Finally, this study contributes information about the role of SC within the academy, a field that offers many opportunities for further research.

I found that SC matters for academic career. Academic planning involves resource allocation to SC activities, and SC enhances career advancement indirectly by affecting

the evaluation process and leveraging productivity outputs. I now argue that SC studies should make a constructive use of qualitative analysis. SC investments greatly vary with the values, beliefs and attitudes of the individual. Generally, professors consider that work ethic, ability in obtaining grants and projects, and creativity are most critical for advancement. Younger professors strongly believe that research and grants are the principle determinants for their promotion. While associate professors emphasize their project management skills, assistant professors give more weight to their training and less about relationships. As a result assistant professors score work ethic similar to full professors, even if they are younger and less experienced. Teaching and creativity are perceived as critical only by full professors, showing a clear demarcation between academic generations.

On the relational side, assistant professors rank relationships with mentors more highly, while associate and full professors emphasize relationships with colleagues and peers. Work ethic is the most important career factor for both genders. Male professors give more weight to creativity while training is more relevant for women. Interestingly, women give a higher weight to business relationships and a lower weight to relationships with colleagues in other departments. Finally, among the three scientific areas, the ability to obtain grants is relatively more important for biological scientists while relationships with governmental agencies are relatively more important for physical scientists.

With regards to personal investments in career factors full professors are clustered in two subgroups: those who focus on their research (generally because of a personal choice or because in the final stage of their career) and those, in the middle of their ca-

reer, who are more inclined to relate with others, by taking part into meetings and professional groups. Mid-career academics are more likely to provide leadership in meeting and professional groups, and even more likely to develop their visibility with the help of a website. As the respondents noted, relational capital is extremely useful to access professional outcomes such as projects and publications. Same professors, in response to the hypothetical question on the loss of all their relational capital reacted more emotionally, depicting a terrible situation comparable to “the loss of [the] own home”. Interestingly, associate and assistant professors (especially if coming from another job environment) declared they would to be ready to start developing their relational portfolio all over again.

From the quantitative analysis the competition between investments in HC and SC activities was not completely solved. The problem can be solved looking at the results from combined use of questionnaires and interviews. Faculty can be divided in two subgroups: (1) professors who score highly on SC activities and (2) professor who invest more in HC activities. The former group seems to take advantage of SC investments, saving time to access, acquire and summarize information, and building their reputation on a large consensus and on collaborations. These professors show complementarities between HC and SC. Professors in the second group build their reputation mostly on their individual activities considering SC investments as competitors for HC.

There is no evidence of different levels of investments in SC, relatively to HC, between genders. On the other side, men and women manage their relationships and plan their career differently: men tend to weight more relationships with peers in other departments or other universities, while women invest in maintaining relationships with

business interests, most likely coming from previous job experiences. However, I found no difference with regards being part of a social circle within the college. Interviews revealed as this absence of discrimination within the CALS is a recent achievement.

Other important findings provided by my thesis interest SC more generally. I found that SC can be considered as any other form of capital, it follows a life-cycle model, and it is possible to invest, maintain, accumulate and spend SC. SC can be transferred from a place to another since it is and it increases salaries. Even if SC has embedded to a social environment, individual stocks of SC can be transferred from a place to another. SC stocks positively affect the salary level. However, I found SC accumulation being competitive with HC accumulation with older professors. On the other hand, for younger professors the capital formation process is complementary. Mobility increases SC investments with respect to HC but it depends on the career stage and scientific area (e.g. it is not true for assistant professors). Furthermore, as a further proof of the nature of SC as an intangible asset, I found that a shift in the policy of an organization (as in CALS) determine changes in career planning that basically interests efforts given to HC and SC. Finally the position within a network and the network structure are useful to shed a light on the role of social structures within the academia, such as social circles. I found that within an academic environment with a narrow social circle, membership to this social structure facilitates career success for some categories of professors.

Some of my hypotheses were not confirmed by the data: (1) experience does not always have a life-cycle effect on SC; (2) there is no influence of gender on SC; (3) to belong to a different scientific area has no effect on SC and (4) mobility does not lead to higher salaries for biologists. Finally, (5) faculty in biological and physical sciences have

on average a lower salary level, supporting the idea that salary may not be the appropriate measure of income.

In summary, HC is the product of both tangible and intangible processes based on information, HC is field-specific and it is developed through time. For the individual competences to become real capital and source of value, they have to be “amplified” at the organizational level. Consequently, the enhancement of the individual competences has to be helped with both initiatives directed to individual knowledge and with initiatives directed to individual organizational skills. So, to develop skills takes time. For this reason, within dynamic contexts characterized by high knowledge density and competitiveness, knowledge can be acquired by interaction, even using external actors for specific purposes. Relationships are a form of capital that generates value and growth opportunities. The relational capital within the academy is made up of peers, colleagues, business man, stakeholders, governmental agencies. The interaction between HC and SC produces also new learning opportunities (eg. learning networks; Powell et al.). The use of technology helps to organize information but it also drive relationships with a higher level of information. Within an organization like the academy faculty develop this framework through exploiting personal reputation and taking part to professional life of their college. Centrality within the college life is then important, especially for young associate professors.

Further studies should try to better define the economic value of SC. For example, different results may be found considering the ability to obtain grants and projects as a SC activity, or selecting another proxy for career success. Larger samples would probably lead to more detailed results. However, the college resulted to be an appropriate

population for this kind of studies, since it makes possible to control for variability across different disciplines within a set of people that reasonably share part of their professional life. Finally, even though I provided a logical framework to understand the relative investments in SC stocks my empirical analysis does not address the fundamental causality issues raised by Durlauf (2002).

I also hope this research effort contributes in same small way to our understanding of the “undersocialized conception of man” in economics.

APPENDIX TO CHAPTER 3

Tab. A.3.1: The Survey Design

Population	Description
Population of inference	All faculty with tenure or continuing appointments in the College of Agricultural and Life Sciences, at the University of Arizona, Tucson (U.S.A.).
Target population	On-campus faculty (with a Ph.D.)
Frame population	198 faculty, in 12 different Departments.
Sample	100 faculty, extracted with a stratified random sampling procedure without replacement. Strata: Department, gender, and rank.
Final sample	51 individuals, post-stratified.

Tab. A 3.2: Sample and Population Distribution by Department, Rank and Gender (%)[a].

Department	Men			Women		
	Full	Associate	Assistant	Full	Associate	Assistant
Agriculture & Biosystems Eng.	3.9	2	2	**0**	**0**	0
	1.5	**2.5**	**.5**	**1**	**.5**	**0**
Agricultural Education	3.9	0	**0**	2	2	0
	2	**0**	**.5**	**.5**	**.5**	**0**
Agriculture & Resources Econ.	7.8	2	2	2	0	0
	4.5	**1**	**.5**	**1**	**0**	**0**
Animal Sciences	3.9	3.9	2	0	0	0
	2.5	**2.5**	**1.5**	**0**	**0**	**0**
Entomology	**0**	**0**	**0**	**0**	**0**	**0**
	3	**.5**	**.5**	**1**	**0**	**1.5**
Norton Sc. Family Consumer Sci.	**0**	**0**	**0**	2	3.9	3.9
	1.5	**.5**	**.5**	**1.5**	**3**	**1**
Arid Land Studies	2	0	**0**	0	0	0
	1	**.5**	**.5**	**0**	**0**	**0**
Plant Sciences	**0**	5.9	2	3.9	**0**	**0**
	4.5	**5.5**	**1.5**	**2.5**	**3**	**2**
Natural Resources	5.9	3.9	2	0	0	0
	10	**3.5**	**2.5**	**.5**	**0**	**1.5**
Nutritional Sciences	0	0	2	2	3.9	0
	1.5	**0**	**1**	**1**	**1.5**	**1.5**
Soil, Water & Environmental Sci.	7.8	2	3.9	0	0	0
	4	**3**	**1.5**	**.5**	**.5**	**0**
Veterinary Sci. & Microbiology	3.9	0	0	0	0	0
	3.5	**1**	**0**	**0**	**1**	**1**

[a]: In bold, the frame population distribution.

Table A.3.3: Time Allocation among Ranks, Average Scores and t-Tests.

	Mean, C.I., and S.E.	Differences significance tests	
Outreach & extension		Assoc. pr.	Assist. pr.
Full professors	10 (6.27 – 13.7) (1.85)	2.3*	1.07n.s.
Associate professors	4.5 (1.54 –7.5) (1.5)	-	-.41n.s.
Assistant professors	6 (***-.48*** – 12.28) (3.23)	-	-
Administration		.	
Full professors	18.9 (11.93 – 25.84) (3.46)	2.91*	2.38**.
Associate professors	6.8 (2.15 – 11.4) (2.3)		1.66**
Assistant professors	10.6(10.16 – 11.08) (.23)		-
Research			
Full professors	39 (30.39 – 47.53) (4.26)	-1.97***	-1.79**.
Associate professors	50.6 (42.43 – 58.92) (4.05)		.57n.s.
Assistant professors	47.9 (42.77 – 52.97) (2.53)		-
Teaching & advising			
Full professors	32.1 (27.05 – 37.25) (2.53)	-1.33n.s.	-1.24n.s.
Associate professors	38.1 (30.7 – 45.54) (3.69)		.69n.s.
Assistant professors	35.5 (33.64 – 37.35) (.92)		-

Note: single (*), double (**), and triple asterisk (***) denote “significant” at 1%, 5% and 10% level respectively; (n.s.) denotes “not significant”.

Table A.3.4: Time Allocation among Scientific Areas, Average Scores and t- Tests.

	Mean, CI, and S.E.	Differences significance tests		
Outreach & extension		Bio.Sci	Phy.Sci.	Soc.Sci.
Biological Sci.	7.6 (4.31 – 10.9) (1.63)	-	-.01$^{n.s.}$	.11$^{n.s.}$
Physical Sci.	7.6 (***-1.71*** –15.46) (3.9)	-	-	-.06$^{n.s.}$
Social Sci.	7.4 (6.43 – 8.4) (.49)	-	-	-
Administration				
Biological Sci.	11.9 (6.8 – 16.94) (2.52)		1.6***	-2**.
Physical Sci.	6.6 (3.03 – 10.2) (1.78)			-3.18*
Social Sci.	22.5 (13.1 – 31.81) (22.45)			-
Research				
Biological Sci.	45 (37.18 – 52.78) (3.88)		-1.39$^{n.s.}$	1.94**.
Physical Sci.	53.7 (43.78 – 63.56) (4.92)			3.23*.
Social Sci.	36.6 (32.81 – 40.4) (1.88)			-
Teaching & advising				
Biological Sci.	35.5 (30.68 – 40.4) (2.41)		.86$^{n.s.}$	.48$^{n.s.}$
Physical Sci.	32.1 (25.3 – 38.8) (3.36)			-.3$^{n.s.}$
Social Sci.	33.5 (26.5 – 40.51) (3.49)			-

Note: single (*), double (**), and triple asterisk (***) denote “significant” at 1%, 5% and 10% level respectively; (n.s.) denotes “not significant”.

A.3.1 Confidentiality protection and Human Subjects Protection Plan Procedures.

This process respects the requirements imposed by the risk of loss of confidentiality involved in the study. The entire project has been reviewed in all its details by the Human Subjects Protection Plan Office (HSPP) of the University of Arizona, Tucson. The details included the first contact email text and informed consent.

The informed consent included:

- an explanation of the purposes of the research
- the expected duration of the subject's participation
- a description of the procedures to be followed
- a description of the benefits of the study
- a description explaining how the investigator/institution will maintain confidentiality of records
- the specific office, name, and telephone number (s) of whom to contact for further information regarding the research subjects' rights, the research study, or for research-related injury.
- a statement that participation is voluntary, that refusal to participate involves no penalty or loss of benefits to which the person is otherwise entitled, and that the subject may discontinue at any time.

Part of the project included a risk profile and all the measures adopted to preserve the subjects' responses confidentiality. The approval from the HSPP, that includes an eventual further inspecting procedure, ensures the efficacy of these measures. Both the in-

vestigators have been trained before submitting the project. The risk level has been categorized as minimal.

APPENDIX TO CHAPTER 4

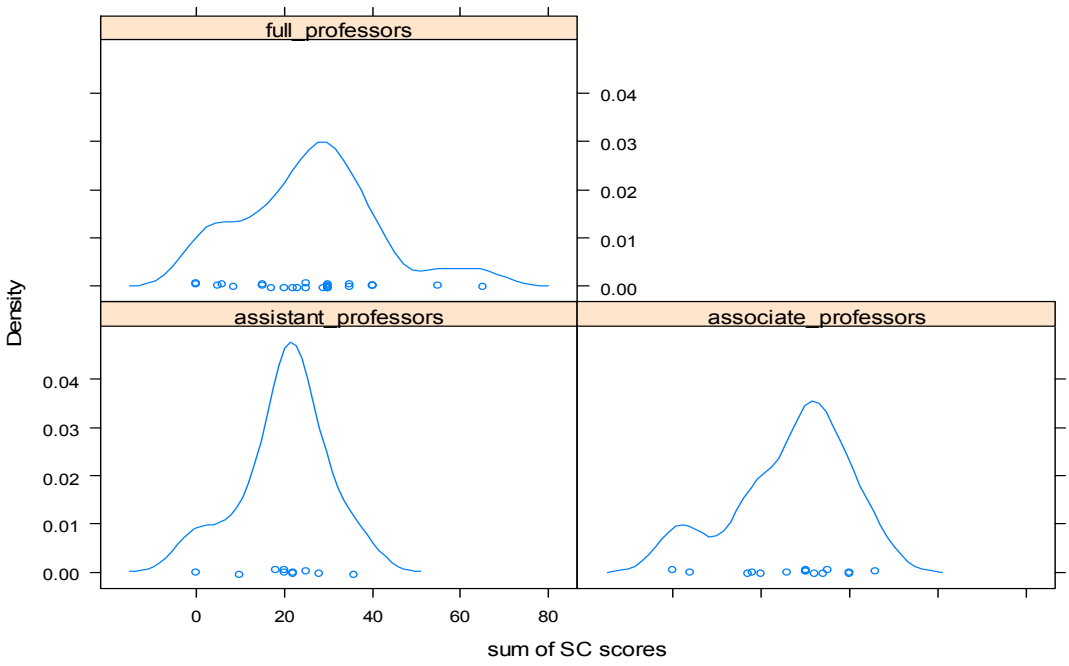

Fig. 4.2.1.1: Kernel Density Plots of SC Scores (Weighted Data) Between Ranks

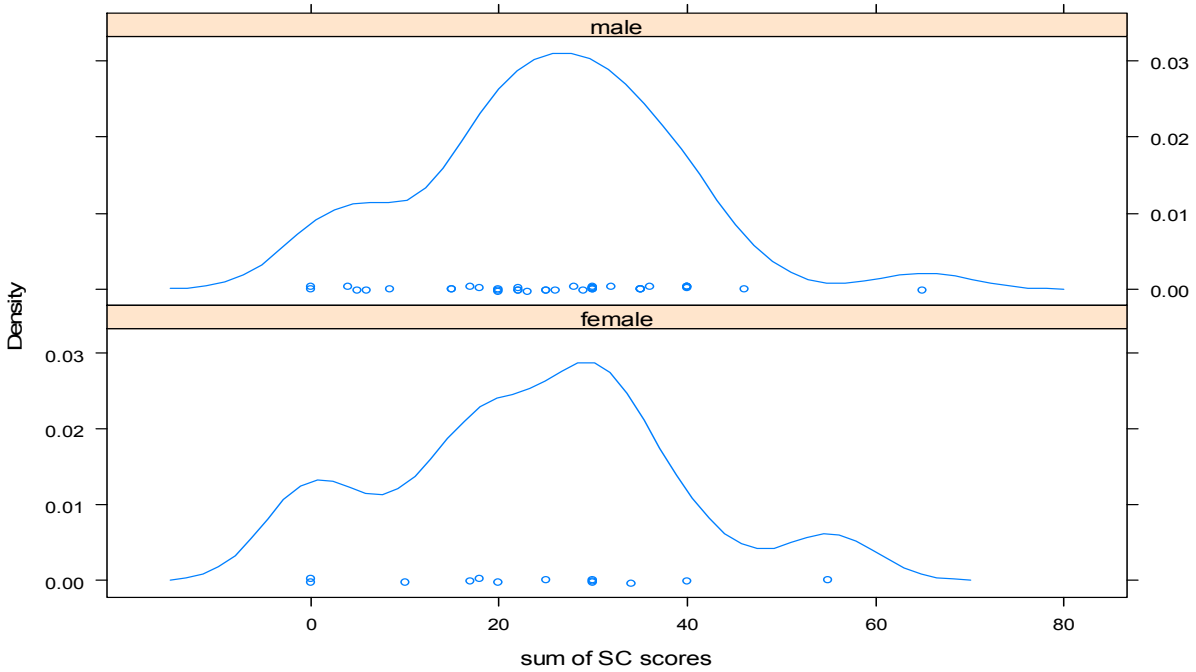

Fig. 4.2.2.2: Density Plots of SC scores (Weighted Data) Between Genders

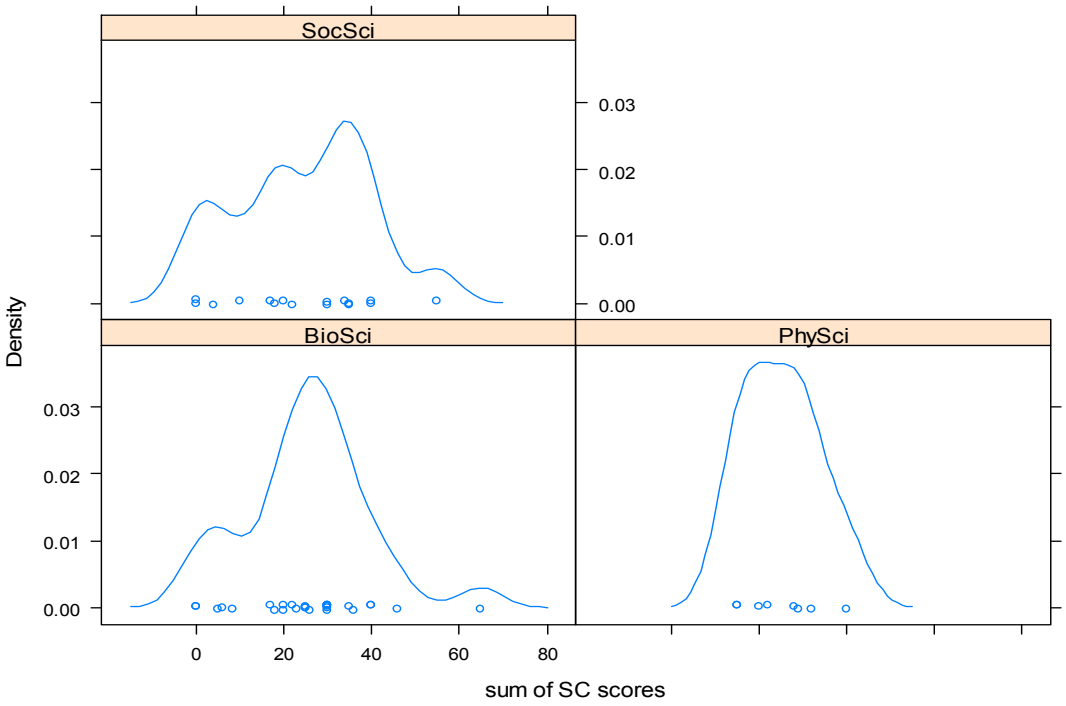

Fig. 4.2.3.2.: Density plots of SC Scores (Weighted Data) Between Scientific Areas.

Tab. A.4.1: Weighted scores for career contributing factors by academic rank and t-Tests.

Contributing factor	Academic rank	Mean, CI and S.E.	Differences significance tests	
			Associate	Assistant
Academic training	Full	9.2 (7.02- 11.35) (1.08)	$.52^{n.s.}$	$-2.6^{*.}$
	Associate	8.3 (5.85 – 10.82) (1.23)	-	-2.91^{*}
	Assistant	14.1 (10.98 - 17.17) (1.54)	-	-
Creativity	Full	14.9 (10.61 - 19.14) (2.12)	1.78^{***}	$.77^{n.s.}$
	Associate	10.7 (8.76 - 12.7) (.98)	-	-2.28^{**}
	Assistant	13.2 (12.27 - 14.13) (.46)	-	-
Work ethic	Full	19.8 (14.3 - 25.25) (2.72)	$2.05^{**.}$	$-.9^{n.s.}$
	Associate	13.5 (10.62 - 16.34) (1.42)	-	-2.53^{**}
	Assistant	17.3 (16.32 - 18.28) (.49)	-	-
Research area (timely or urgent topic)	Full	5.8 (4.07 - 7.55) (.87)	$-2.45^{**.}$	$-2.44^{**.}$
	Associate	8.7 (7.08 - 10.27) (.8)	-	$.49^{n.s.}$
	Assistant	8.2 (7.25 - 9.2) (.48)	-	-

Table A.4.1 (Continued)

Contributing factor	Academic rank	Mean, CI and S.E.	Differences significance tests	
			Associate	Assistant
Ability to obtain external grants and contracts	Full	10.8 (7.82 - 13.78) (1.48)	-2.79$^{*.}$	-.78$^{n.s..}$
	Associate	17.6 (13.71 - 21.52) (1.94)	-	- 2.32$^{**.}$
	Assistant	12.3 (9.85 - 14.75) (1.22)	-	-
Teaching and advising abilities	Full	10.6 (5.02 - 16.11) (2.76)	- 1.05$^{n.s.}$	1.67$^{***.}$
	Associate	7.5 (5.6 - 9.4) (.95)	-	1,63$^{n.s.}$
	Assistant	5.9 (5.64 - 6.26) (.15)	-	-
Availability of funds from employer to support research	Full	2.13 (1.17 - 3.09) (.48)	-.23$^{n.s.}$	-3.99$^{*.}$
	Associate	2.28 (1.35 - 3.21) (.46)	-	- 3.78$^{*.}$
	Assistant	4.25 (3.77 - 4.73) (.24)	-	-
Availability of lab space from your employer	Full	2.27 (1.51 - 3.02) (.38)	- .83$^{n.s.}$	- 1.52$^{n.s.}$
	Associate	3.04 (1.33 - 4.74) (.85)	-	- .17$^{n.s.}$
	Assistant	3.2 (2.22 - 4.18) (.49)	-	-

Table A.4.1 (Continued)

Contributing factor	Academic rank	Mean, CI and S.E.	Differences significance tests	
			Associate	Assistant
PhD granting Department	Full	.39 (.14 - .65) (.13)	- 2.53$^{*.}$	- 8.64$^{*.}$
	Associate	.92 (.59 - 1.26) (.17)	-	- 3.79$^{*.}$
	Assistant	1.6 (1.48 - 1.72) (.6)	-	-
Post-Doc Department	Full	0	-3.33$^{*.}$	28.84*
	Associate	1.13 (.45 - 1.82) (.34)	-	- 1.79**
	Assistant	1.75 (1.63 - 1.87) (.06)	-	-
Home Department	Full	6.27 (3.06 - 9.49) (1.6)	- .42$^{n.s.}$	.76$^{n.s.}$
	Associate	7.07 (4.89 - 9.25) (1.08)	-	1.81$^{**.}$
	Assistant	5.05 (.26) (4.52 - 5.58)	-	-
Other similar Departments in other Universities	Full	5.98 (3.49 - 8.48) (1.24)	-.27$^{n.s.}$	.35$^{n.s.}$
	Associate	6.39 (4.51 - 8.27) (.92)	-	-.91$^{n.s.}$
	Assistant	5.55 (0)	-	-

Table A.4.1 (Continued)

Contributing factor	Academic rank	Mean, CI and S.E.	Differences significance tests	
			Associate	Assistant
Governmental agencies	Full	4.26 (2.69 - 5.83) (.78)	- .53$^{n.s.}$	-1.37$^{n.s.}$
	Associate	4.78 (3.62 - 5.94) (.58)		-.98$^{n.s.}$
	Assistant	5.5 (4.57 - 6.43) (.46)		
The non-academic community (non-business)	Full	1.35 (.79 - 1.92) (.28)	.01$^{n.s.}$	.73$^{n.s.}$
	Associate	1.35 (.47) (.4 - 2.3)		.43$^{n.s.}$.
	Assistant	1.15 (0)		
The private sector (Business)	Full	4.06 (2.02 - 6.1) (1.02)	1.57$^{n.s.}$	3.11*
	Associate	2.25 (1.19 - 3.32) (.53)		2.56**
	Assistant	.9 (0)		
Other	Full	2.28 (.62 - 3.93) (.82)	- 0.85$^{n.s.}$	2.78*
	Associate	4.39 (-.32 - 9.11) (2.35)		1.88**
	Assistant	0		

Note: single (*), double (**), and triple asterisk (***) denote “significant” at 1%, 5% and 10% level respectively; (n.s.) denotes “not significant”.

Tab. A.4.2: Weighted Scores for Career Contributing Factors by Gender and t-Tests.

Contributing Factors	Gender	Mean, CI and SE	Differences significance tests
			Men
Academic training	Women	12.5 (7.63 – 17.3) (2.41)	1.39[n.s.]
	Men	9 (7.54 – 10.4) (.71)	-
Creativity	Women	9.7 (6.02 – 13.19) (1.74)	- 1.97[***]
	Men	14 (11.32 – 16.73) (1.34)	-
Work ethic	Women	23.1 (20.66 – 25.46) (1.19)	3.26[*]
	Men	16 (12.4 – 19.62) (1.79)	-
Research area (timely or urgent topic)	Women	7.8 (5.21 – 10.39) (1.28)	.58[n.s.]
	Men	7 (5.82 – 8.13) (.57)	-
Ability to obtain external grants and contracts	Women	14.2 (11.28 – 17.15) (1.46)	.59[n.s.]
	Men	13.1 (10.68 – 15.53) (1.2)	-
Teaching and advising abilities	Women	4.7 (2.25 – 7.1) (1.2)	- 2.39[**]
	Men	9.8 (6.25 – 13.34) (1.76)	-

Tab. A.4.2 (Continued)

Contributing Factors	Gender	Mean, CI and SE	Differences significance tests
			Men
Availability of lab space from your employer	Women	2.4 (1.06 – 5.7) (.38)	.73[n.s.]
	Men	2.5 (1.81 – 3.19) (.85)	-
PhD granting Department	Women	.08 (-.01 - .17) (.04)	- 7.05[*.]
	Men	.9 (.68 – 1.1) (.1)	-
Post-Doc Department	Women	.08 (-.02 - .18) (.05)	- 4.59[*.]
	Men	.8 (.47 – 1.03) (.14)	-
Home Department	Women	6.4 (3.47 – 9.32) (1.46)	.02[n.s.]
	Men	6.3 (4.23 – 8.48) (1.06)	-
Other similar Departments in other Universities	Women	4.2 (3.46 – 4.94) (.37)	-2.4[**.]
	Men	6.5 (4.73 – 8.22) (.87)	-
Governmental agencies	Women	3 (1.69 – 4.27) (.64)	- 2.4[**.]
	Men	5 (3.9 – 6.05) (.53)	

Tab. A.4.2 (Continued)

Contributing Factors	Gender	Mean, CI and SE	Differences significance tests
			Men
The private sector (Business)	Women	4.8 (2.96 – 6.68) (.92)	1.98**
	Men	2.6 (1.28 – 3.88) (.64)	
Other	Women	3 (.86 – 5,.17) (1.07)	.29n.s.
	Men	2.6 (.43 – 4.71) (1.06)	

Note: single (*) double (**) and triple asterisk (***) denote “significant” at 1%, 5% and 10% level respectively; (n.s.) denotes “not significant”.

Tab. A.4.3: Weighted Scores for Career Contributing Factors by Scientific Area

Contributing factors	Scientific area	Mean, CI and SE	Differences significance tests	
			Physical Sci.	Social Sci.
Academic training	Biological Sci.	8.2 (6.29- 10.1) (.95)	-.81$^{n.s.}$	-3.01$^{*.}$
	Physical Sci.	9.2 (7.58 – 10.77) (.79)	-	- 2.6*
	Social Sci.	13.9 (10.61 – 17.22) (1.64)	-	-
Creativity	Biological Sci.	13.4 (10.08 – 16.78) (1.66)	- .12$^{n.s.}$	.46$^{n.s.}$
	Physical Sci.	13.7 (11.37 – 15.98) (1.14)	-	.69**
	Social Sci.	12.4 (9.65 – 15.22) (1.38)	-	-
Work ethic	Biological Sci.	16.7 (12.21 – 21.3) (2.36)	.89$^{n.s.}$	-1.53$^{n.s.}$
	Physical Sci.	14.5 (12.35 - 16.76) (1.09)	-	-4.54*
	Social Sci.	20.4 (19.04 – 21.68) (.65)	-	-
Research area (timely or urgent topic)	Biological Sci.	7 (5.6 – 8.43) (.7)	-1.26$^{n.s.}$	.4$^{n.s.}$
	Physical Sci.	8.8 (6.35 – 11.18) (1.2)	-	1.47$^{n.s.}$
	Social Sci.	6.5 (4.74 – 8.37) (.9)	-	-

Table A.4.3 (Continued)

Contributing factors	Scientific area	Mean, CI and SE	Differences significance tests	
			Physical Sci.	Social Sci.
Ability to obtain external grants and contracts	Biological Sci.	14.9 (12 – 17.91) (1.48)	2.39$^{**.}$	2.41$^{**.}$
	Physical Sci.	10 (7.1 – 12.95) (1.45)	-	- .19$^{n.s.}$
	Social Sci.	10.4 (7.98 – 12.78) (1.19)	-	-
Teaching and advising abilities	Biological Sci.	9.17 (4.73 – 13.6) (2.21)	.4$^{n.s.}$	.32$^{n.s.}$
	Physical Sci.	8.15 (5.67 – 10.62) (1.23)	-	-.16$^{n.s.}$
	Social Sci.	8.39 (6.48 – 10.3) (.95)	-	-
Availability of funds from employer to support research	Biological Sci.	2.12 (1.34 – 2.9) (.38)	- 2.55$^{**.}$	-1.01$^{n.s.}$
	Physical Sci.	3.68 (2.8 – 4.5) (.44)	-	.98$^{n.s.}$
	Social Sci.	2.89 (1.56 – 4.2) (.66)	-	-
Availability of lab space from your employer	Biological Sci.	2.75 (1.74 - 3.77) (.5)	- 3.39$^{*.}$	2.9$^{*.}$
	Physical Sci.	5.44 (4.21 – 6.66) (.6)	-	6.23$^{*.}$
	Social Sci.	.87 (.05 – 1.69) (.4)	-	-

Table A.4.3 (Continued)

Contributing factors	Scientific area	Mean, CI and SE	Differences significance tests	
			Physical Sci.	Social Sci.
PhD granting Department	Biological Sci.	.81 (.59 - 1.03) (.13)	- 1.23$^{n.s.}$	1.85$^{**.}$
	Physical Sci.	1.05 (.75 – 1.36) (.17)	-	2.64$^{*.}$
	Social Sci.	.39 (**-.19**^{a} - .79) (.6)	-	-
Post-Doc Department	Biological Sci.	.95 (.6 -1.3) (.17)	5.41*	4.92*
	Physical Sci.	0	-	- 1.63**
	Social Sci.	.06 (**-.01**^{a} - .14)	-	-
Home Department	Biological Sci.	5.1 (2.65 – 7.63) (1.24)	- 1.03$^{n.s.}$	-2.18$^{**.}$
	Physical Sci.	7.1 (4.1 – 10.2) (1.51)	-	-1.06$^{n.s..}$
	Social Sci.	9.4 (6.36 – 12.5) (1.52)	-	-
Other similar Departments in other Universities	Biological Sci.	6 (3.9 – 8.14) (1.06)	-.01$^{n.s.}$	-.16$^{n.s.}$
	Physical Sci.	6 (4.95 -7.04) (.52)	-	-.23$^{n.s.}$
	Social Sci.	6 (4.56 – 7.9) (.83)	-	-

Note: (^{a}) a negative confidence interval may depend by a large number of observations close to zero.

Table A.4.3 (Continued)

Contributing factors	Scientific area	Mean, CI and SE	Differences significance tests	
			Physical Sci.	Social Sci.
Governmental agencies	Biological Sci.	5 (3.66 – 6.32) (.66)	-1.76***	3.54*
	Physical Sci.	6.7 (5.12 – 8.34) (.8)		5.03*
	Social Sci.	2.4 (1.68 – 3.04) (.38)		
The non-academic community (non-business)	Biological Sci.	1.5 (.88 – 2.18) (.32)	.94n.s.	2.06**.
	Physical Sci.	1 (.42) (.18 – 1.88)		.37n.s.
	Social Sci.	.87 (0)		
The private sector (Business)	Biological Sci.	3 (1.38 – 4.66) (.82)	.3n.s.	.03n.s.
	Physical Sci.	2.8 (2.13 – 3.46) (.33)		.69n.s
	Social Sci.	3 (.4) (2.2 – 3.8)		
Other	Biological Sci.	3.1(.45 – 5.76) (1.32)	1n.s.	.74n.s.
	Physical Sci.	1.8 (1.4 – 2.12) (.18)		-.07n.s.
	Social Sci.	1.8 (**-.35**[a] – 4.03) (1.09)		

Note: single (*) double (**) and triple asterisk (***) denote “significant” at 1%, 5% and 10% level respectively; (n.s.) denotes “not significant”.

Tab. A.4.4: Weighted Scores for Investment in Professional Activities by Rank

Professional Activities	Academic rank	Mean, CI and S.E.	Differences significance tests	
			Associate	Assistant
Protecting time for research	Full	20.6 (14.5 – 26.86) (3.1)	1.64***	-.34n.s.
	Associate	15.2 (12.6 – 17.7) (1.3)	-	- 3.87*
	Assistant	21.7 (19.5 – 23.97) (1.1)	-	-
Collaborating on grants projects and publications	Full	14.4 (10.51 – 18.31) (1.94)	-.72n.s	1.36n.s.
	Associate	16.2 (13.25 – 19.1) (1.44)	-	2.95*
	Assistant	11.7 (10.9 – 12.54) (.4)	-	-
Reading current literature	Full	10.3 (8.16 – 12.38) (1.04)	.79n.s.	-1.03n.s.
	Associate	9.3 (8.16 – 10.49) (.58)	-	-3.47*
	Assistant	11.3 (11.28 – 11.41) (.03)	-	-
Regular communication with colleagues	Full	8.6 (5.75 – 11.4) (1.4)	.77n.s.	1.94**
	Associate	7.2 (4.96 – 9.43) (1.11)	-	1.23n.s.
	Assistant	5.8 (5.08 – 6.46) (.34)	-	-

Table A.4.4 (Continued)

Professional Activities	Academic rank	Mean, CI and S.E.	Differences significance tests	
			Associate	Assistant
Developing and teaching new classes	Full	5.8 (3.21 – 8.45) (1.3)	-1.06$^{n.s.}$	-.59$^{n.s.}$
	Associate	8.9 (3.74 – 13.97) (2.54)	-	- .87$^{n.s.}$
	Assistant	6.6 (6.06 – 7.18) (.28)	-	-
Regular attendance at professional meetings	Full	6.27 (4.74 – 7.81) (.76)	-.28$^{n.s.}$	-.75$^{n.s.}$
	Associate	6.59 (4.87 – 8.32) (.85)	-	1,03$^{n.s.}$
	Assistant	5.67 (5.14 – 6.2) (.26)	-	-
Regular attendance at specialized research meetings	Full	6.34 (4.06 – 8.63) (1.13)	.2$^{n.s.}$	.09$^{n.s.}$
	Associate	6.08 (4.59 – 7.56) (.74)	-	- .22$^{n.s.}$
	Assistant	6.25 (6 – 6.49) (.12)	-	-
Improving personal skills and techniques	Full	4.23 (2.84 – 5.63) (.69)	-2.43$^{**.}$	-4.76$^{*.}$
	Associate	7.31 (5.18 – 9.44) (1.05)	-	-1.78$^{***.}$
	Assistant	9.85 (7.93 – 11.76) (.95)	-	-

Table A.4.4 (Continued)

Professional Activities	Academic rank	Mean, CI and S.E.	Differences significance tests	
			Associate	Assistant
Learning new skills and techniques	Full	4.23 (3.08 – 5.37) (.57)	-3.56$^{*.}$	-4.52$^{*.}$
	Associate	7.53 (6.06 – 9) (.73)	-	-.56$^{n.s.}$
	Assistant	7.1 (6.54 – 7.65) (.27)	-	-
Taking leadership roles in professional groups	Full	6.22 (4.6 – 7.85) (.8)	1.91$^{***.}$	5.84*
	Associate	4.09 (2.54 – 5.64) (.77)	-	3.42*
	Assistant	1.37 (1 – 1.74) (.18)	-	-
Regular communication with Governmental agencies	Full	3.86 (1.71 – 6.01) (1.07)	.08$^{n.s.}$	-.67$^{n.s.}$
	Associate	3.77 (2.95 – 4.59) (.4)	-	- 1.18$^{n.s.}$
	Assistant	4.72 (3.33 – 6.11) (.69)	-	-
Periodic consulting works	Full	2.62 (1.25 – 4) (.68)	1.36$^{n.s.}$	1.32$^{n.s.}$
	Associate	1.47 (.47 – 2.47) (.49)	-	-.37$^{n.s.}$
	Assistant	1.67 (1.21 – 2.13) (.23)	-	-

Note: single (*) double (**) and triple asterisk (***) denote “significant” at 1%, 5% and 10% level respectively; (n.s.) denotes “not significant”.

Tab. 4.5: Weighted Scores for Investment in Professional Activities by Gender

Professional activities	Gender	Mean, CI and SE	Differences significance tests
			Men
Protecting time for research	Women	19.76 (14.6 – 24.9) (2.54)	.3$^{n.s.}$
	Men	18.78 (14.88 – 22.68) (1.93)	-
Collaborating on grants projects and publications	Women	15.62 (12.89 – 18.34) (1.35)	.65$^{n.s.}$
	Men	14.38 (11.7 – 17.06) (1.33)	-
Reading current literature	Women	9.56 (6.91 – 12.2) (1.31)	-.46$^{n.s.}$
	Men	10.23 (8.94 – 11.52) (0.64)	-
Regular communication with colleagues	Women	6.46 (2.83 – 10.08) (1.8)	-.76$^{n.s.}$
	Men	7.98 (6.14 – 9.83) (.91)	-
Developing and teaching new classes	Women	2.06 (1.29 – 2.82) (.37)	-4.33*
	Men	8.06 (5.38 – 10.73) (1.33)	-
Regular attendance at professional meetings	Women	4.48 (2.97 – 5.98) (.74)	-2.35**
	Men	6.7 (5.54 – 7.86) (.57)	-

Table A.4.5 (Continued)

Professional activities	Gender	Mean, CI and SE	Differences significance tests
			Men
Improving personal skills and techniques	Women	10.28 (7.9 – 12.65) (1.18)	3.88*
	Men	5.15 (3.97 – 6.32) (.58)	-
Learning new skills and techniques	Women	8.56 (7 – 10.11) (.77)	3.84*
	Men	5.13 (4.25 – 6.02) (.44)	-
Taking leadership roles in professional groups	Women	7.46 (5.26 – 9.65) (1.09)	2.65*
	Men	4.2 (3.09 – 5.31) (.55)	-
Regular communication with Governmental agencies	Women	2.32 (2.27 – 2.36) (.02)	-2.82*
	Men	4.32 (2.89 – 5.75) (.71)	-
Periodic consulting works	Women	1.98 (.12 – 3.83) (.92)	-.15n.s.
	Men	2.12 (1.25 – 3) (.43)	-

Note: single (*) double (**) and triple asterisk (***) denote “significant” at 1%, 5% and 10% level respectively; (n.s.) denotes “not significant”.

Tab. A.4.6: Weighted Scores for Investment in Professional Activities by Scientific Area

Professional activities	Scientific area	Mean, CI and S.E.	Differences significance tests	
			Physical Sci.	Social Sci.
Protecting time for research	Biological Sci.	19.87 (14.93 – 24.8) (2.45)	2**	.16n.s.
	Physical Sci.	13.38 (9.17 – 17.58) (2.09)		-2.34**
	Social Sci.	19.41 (16.38 – 22.43) (1.5)		-
Collaborating on grants projects and publications	Biological Sci.	14.54 (11.31 – 17.78) (1.61)	1.58***	-.73n.s.
	Physical Sci.	12 (11.3 – 12.69) (0.34)		-2.56*
	Social Sci.	16.21 (12.97 – 19.45) (1.61)		-
Reading current literature	Biological Sci.	10.82 (9.3 – 12.35) (.75)	2**	0.16n.s.
	Physical Sci.	8.2 (7.14 – 9.27) (.52)		-2.34**
	Social Sci.	9.11 (6.54 – 11.67) (1.27)		-
Regular communication with colleagues	Biological Sci.	7.28 (5.12 – 9.44) (.75)	.02n.s.	-.88n.s.
	Physical Sci.	7.26 (6.02 – 8.5) (.61)		-.97n.s.
	Social Sci.	9.17 (5.43 – 12.91) (1.86)		-

Tab. A.4.6: (Continued)

Professional activities	Scientific area	Mean, CI and S.E.	Differences significance tests	
			Physical Sci.	Social Sci.
Developing and teaching new classes	Biological Sci.	7.62 (4.7 – 10.53) (1.45)	-.71$^{n.s.}$	2.75*.
	Physical Sci.	10.38 (2.94 – 17.81) (3.7)		1.91**
	Social Sci.	3.2 (1.85 – 4.56) (.67)		-
Regular attendance at professional meetings	Biological Sci.	5.47 (4.12 – 6.81) (.66)	-1.06$^{n.s.}$	-2.8*.
	Physical Sci.	6.38 (5.11 – 7.64) (.62)		-2.03**
	Social Sci.	8.6 (6.8 – 10.45) (.9)		-
Regular attendance at specialized research meetings	Biological Sci.	6.59 (4.8 – 8.37) (.88)	-.15$^{n.s.}$	.99$^{n.s.}$
	Physical Sci.	6.41 (4.79 – 8.03) (.8)		.9$^{n.s}$
	Social Sci.	5.16 (2.89 – 7.43) (1.13)		-

Tab. A.4.6: (Continued)

Professional activities	Scientific area	Mean, CI and S.E.	Differences significance tests	
			Physical Sci.	Social Sci.
Improving personal skills and techniques	Biological Sci.	5.55 (4.09 – 7.01) (.72)	-.82$^{n.s.}$	-1.6$^{n.s.}$
	Physical Sci.	6.38 (4.98 – 7.77) (.69)		-.92$^{n.s.}$
	Social Sci.	7.4 (5.56 – 9.35) (.94)		-
Learning new skills and techniques	Biological Sci.	5.3 (4.28 – 6.33) (.51)	-.66$^{n.s.}$	-1.74**.
	Physical Sci.	5.79 (4.79 – 6.79) (.49)		-1.26$^{n.s.}$
	Social Sci.	7.04 (5.32 – 8.75) (.85)		-
Taking leadership roles in professional groups	Biological Sci.	4.06 (2.72 – 5.4) (.66)	-2.44**.	-1.67***.
	Physical Sci.	6.41 (5.04 – 7.78) (.68)		.31$^{n.s.}$
	Social Sci.	6.04 (4.07 – 8) (.97)		-

Tab. A.4.6: (Continued)

Professional activities		Mean, CI and S.E.	Differences significance tests	
			Physical Sci.	Social Sci.
Regular communication with Governmental agencies	Biological Sci.	3.96 (2.2 – 5.72) (.87)	-2.86*	2.32**.
	Physical Sci.	7.76 (5.83 – 9.69) (.96)		5.99*
	Social Sci.	1.87 (1.47 – 2.27) (.19)		-
Periodic consulting works	Biological Sci.	2.81 (1.61 – 4) (1.45)	-.71n.s.	2.75*.
	Physical Sci.	1.7 (.34 – 3.06) (3.7)		1.91**
	Social Sci.	.28 (-0.47 – .61) (.67)		-

Note: single (*) double (**) and triple asterisk (***) denote “significant” at 1%, 5% and 10% level respectively; (n.s.) denotes “not significant”

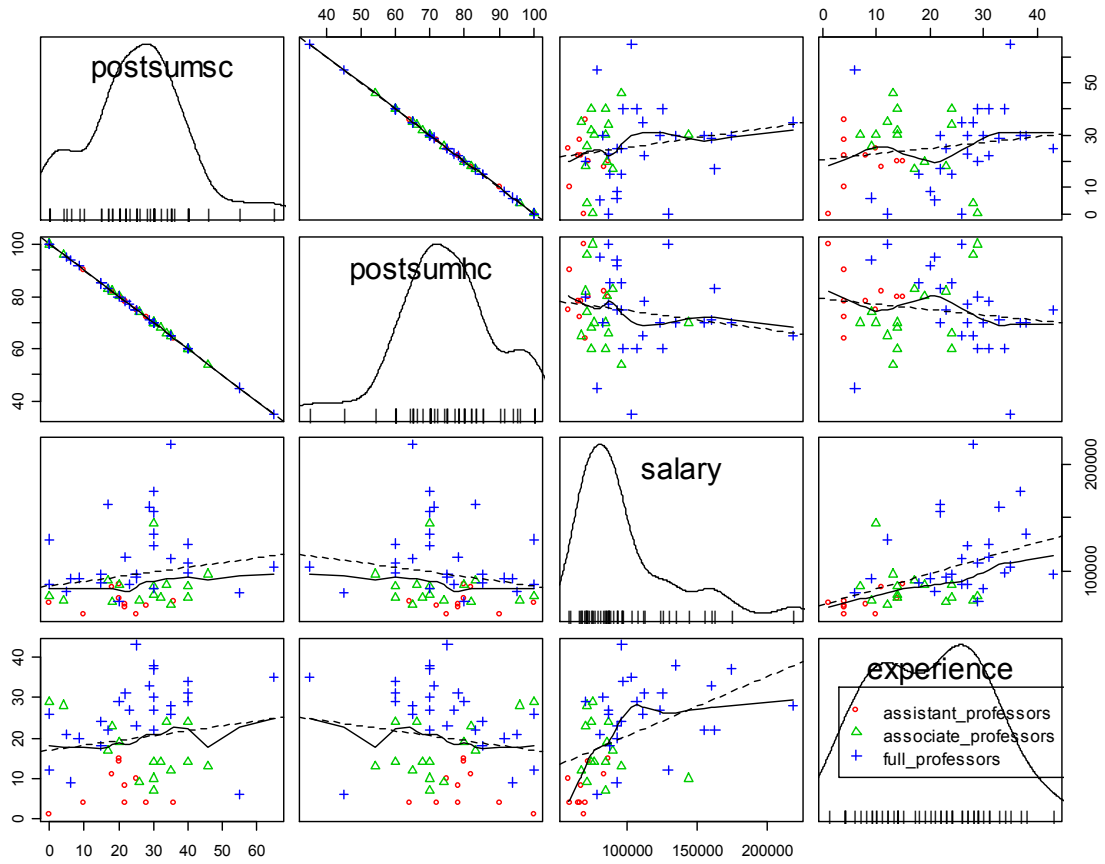

Fig. A.4.1: Scatterplot Matrix - SC, Salary Levels and Years of Experience, Differentiating by Rank.

(Questionnaire for Associate and Full Professors)[5]

The Value of Network Capital in Academic Careers

Thank you for your willingness to take some time out of your busy day to reflect on the role of professional relationships in your academic career. This research will produce valuable information for academia in general, but more specifically to graduate students, faculty and administrators. Again, we appreciate your assistance.

1. In what year did you earn your Ph.D.? _____

2. In what year did you start your first tenure track or continuing appointment position? _____

3. In what year were you promoted and granted tenure or continuing appointment status? _____

4. At the time of the change in your academic status in Question 3, what is your best recall of the allocation of time between the following four responsibilities? Please provide a percentage (%) of your actual time allocation, not the official allocation according to your academic appointment.

Administration	_____
Outreach and Extension	_____
Research	_____
Teaching/Advising	_____
Total	100%

5. At the current time, what is your best estimate of the allocation of time between the following four responsibilities? Please provide a percentage (%) of your actual time allocation, not the official allocation according to your academic appointment.

Administration	_____
Outreach and Extension	_____
Research	_____
Teaching/Advising	_____
Total	100%

5. Which of the following categories most accurately describes your professional training? Please √ the appropriate box.

Biological Sciences	☐
Physical Sciences	☐
Social Sciences	☐

[5] The questionnaire for assistant professor differs from the questionnaire for full and associate professors in not asking for the pre-promotion time frame.

Please reflect back to the time when you were granted tenure or continuing appointment and promoted to the next level of academic ranking (e.g. Assistant to Associate Professor, or Assistant Specialist to Associate Specialist).

6. Please rank the importance of the following contributing factors to the successful outcome of your promotion decision by circling the most appropriate number.

CONTRIBUTING FACTOR	Not Important		Moderately Important		Very Important
Human capital:					
Your academic training	1	2	3	4	5
Your creativity	1	2	3	4	5
Your work ethic	1	2	3	4	5
Your research area (timely or urgent topic)	1	2	3	4	5
Your ability to obtain external grants and contracts	1	2	3	4	5
Your teaching/advising abilities	1	2	3	4	5
Availability of funds from employer to support research	1	2	3	4	5
Availability of lab space from your employer	1	2	3	4	5
Professional collaborative relationships with individuals in:					
your Ph.D.-granting department	1	2	3	4	5
your post-doc department	1	2	3	4	5
your home department	1	2	3	4	5
other similar departments in other universities	1	2	3	4	5
government agencies	1	2	3	4	5
the non-academic community (non-business)	1	2	3	4	5
the private sector (business)	1	2	3	4	5
other (Please specify)_____ _____	1	2	3	4	5

Please be prepared to describe to the researcher your rankings in #6, particularly for those contributing factors that received a ranking of four and above. What was the nature of this factor's importance? Would you have received your promotion if this factor had not been so prominent?

7. Now rank, in a relative sense, the contributing factors to the successful outcome of your promotion decision listed in Question #6 by giving each factor a weight of importance on a scale of 0 to 100. All factor weights should sum to 100.

Contributing Factor	Weight
Human capital:	
Your academic training	
Your creativity	
Your work ethic	
Your research area (timely or topic)	
Your ability to obtain external grants and contracts	
Your teaching/advising abilities	
Availability of funds from employer to support research	
Availability of lab space from your employer	
Professional collaborative relationships with individuals in:	
your Ph.D.-granting department	
your post-doc department	
your home department	
other similar departments in other universities	
government agencies	
the non-academic community (non-business)	
the private sector (business)	
other (Please specify)_____ _____	
Total	**100**

Please be prepared to explain your relative weights to the researcher. Why was one factor weighted more heavily than another? Why did the professional collaborative relationships receive the weights they received?

8. Given your rankings in Questions #6 and #7, please reflect on the investment and maintenance activities you pursued that either created or maintained professional valuable for your career advancing prior to tenure/continuing appointment and promotion.

Investment and Maintenance Activities	Not Important		Moderately Important		Very Important
Protecting time for research	1	2	3	4	5
Reading the current literature	1	2	3	4	5
Improving technical skills and techniques	1	2	3	4	5
Learning new technical skills and techniques	1	2	3	4	5
Collaborating with others on grant projects and publications	1	2	3	4	5
Regular attendance at professional meetings	1	2	3	4	5
Regular attendance at specialized research meetings	1	2	3	4	5
Taking leadership roles in professional groups	1	2	3	4	5
Regular communication with colleagues	1	2	3	4	5
Regular communication with community groups	1	2	3	4	5
Regular communication with business interests	1	2	3	4	5
Regular communication with government agencies	1	2	3	4	5
Developing and teaching new undergraduate and/or graduate classes	1	2	3	4	5
Developing a personal website	1	2	3	4	5
Periodic consulting work	1	2	3	4	5
Other (Please specify)	1	2	3	4	5

Please be prepared to discuss with the researcher your rankings.

9. Now rank, in a relative sense, the investment and maintenance activities listed in Question #8 by giving each factor a weight of importance on a scale of 0 to 100 with regard to their value in the career advancement decision prior to tenure/continuing appointment and promotion. All factor weights should sum to 100.

Investment and Maintenance Activities	**Weight**
Protecting time for research	
Reading the current literature	
Improving technical skills and techniques	
Learning new technical skills and techniques	
Collaborating with others on grant projects and publications	
Regular attendance at professional meetings	
Regular attendance at specialized research meetings	
Taking leadership roles in professional groups	
Regular communication with colleagues	
Regular communication with community groups	
Regular communication with business interests	
Regular communication with government agencies	
Developing and teaching new undergraduate and/or graduate classes	
Developing a personal website	
Periodic consulting work	
Other (Please specify)_____ _____	
Total	**100**

Please be prepared to discuss with the researcher your relative weights with the researcher.

Now please reflect on your current academic career (2007-2008).

10. Please rank the importance of the following contributing factors to your professional success at the current time by circling the most appropriate number.

CONTRIBUTING FACTOR	Not Important		Moderately Important		Very Important
Human capital:					
Your academic training	1	2	3	4	5
Your creativity	1	2	3	4	5
Your work ethic	1	2	3	4	5
Your research area (timely or urgent topic)	1	2	3	4	5
Your ability to obtain grants and contracts	1	2	3	4	5
Your teaching/advising abilities	1	2	3	4	5
Availability of funds from employer to support research	1	2	3	4	5
Availability of lab space from your employer	1	2	3	4	5
Professional collaborative relation-ships with individuals in:					
your Ph.D.-granting department	1	2	3	4	5
your post-doc department	1	2	3	4	5
your home department	1	2	3	4	5
other similar departments in other universities	1	2	3	4	5
government agencies	1	2	3	4	5
the non-academic community (non-business)	1	2	3	4	5
the private sector (business)	1	2	3	4	5
other (Please specify) Interdisciplinary Research Collaborating with Faculty in Other Departments on Campus	1	2	3	4	5

Please be prepared to describe to the researcher your rankings in Question #10, particularly for those contributing factors that received a ranking of four and above. What is the nature of this factor's importance? Why is your ranking different or similar to your ranking in Question #6?

11. Now rank, in a relative sense, the contributing factors listed in Question #10 by giving each factor a weight of importance on a scale of 0 to 100. All factor weights should sum to 100.

CONTRIBUTING FACTOR	Weight
Human capital:	
Your academic training	
Your creativity	
Your work ethic	
Your research area (timely or urgent topic)	
Your ability to obtain grants and contracts	
Your teaching/advising abilities	
Availability of funds from employer to support research	
Availability of lab space from your employer	
Professional collaborative relationships with individuals in:	
your Ph.D.-granting department	
your post-doc department	
your home department	
other similar departments in other universities	
government agencies	
the non-academic community (non-business)	
the private sector (business)	
other (Please specify) Interdisciplinary Research Collaborating with Faculty in Other Departments on Campus	
Total	**100**

Please be prepared to discuss your relative weights with the researcher. Why did the professional collaborative relationships receive the weights they received?

12. Given your rankings in Questions #10 and #11, please reflect on the investment and maintenance activities you pursue that either create or maintain professional valuable for your career advancing at the current time.

Investment and Maintenance Activities	Not Important		Moderately Important		Very Important
Protecting time for research	1	2	3	4	5
Reading the current literature	1	2	3	4	5
Improving technical skills and techniques	1	2	3	4	5
Learning new technical skills and techniques	1	2	3	4	5
Collaborating with others on grant projects and publications	1	2	3	4	5
Regular attendance at professional meetings	1	2	3	4	5
Regular attendance at specialized research meetings	1	2	3	4	5
Taking leadership roles in professional groups	1	2	3	4	5
Regular communication with colleagues	1	2	3	4	5
Regular communication with community groups	1	2	3	4	5
Regular communication with business interests	1	2	3	4	5
Regular communication with government agencies	1	2	3	4	5
Developing and teaching new undergraduate and/or graduate classes	1	2	3	4	5
Developing a personal website	1	2	3	4	5
Periodic consulting work	1	2	3	4	5
Other (Please specify)	1	2	3	4	5

Please be prepared to discuss with the researcher your rankings.

13. Now rank, in a relative sense, the investment and maintenance activities listed in Question #12 by giving each factor a weight of importance on a scale of 0 to 100 with regard to their value in the career advancement decision. All factor weights should sum to 100.

Investment and Maintenance Activities	**Weight**
Protecting time for research	
Reading the current literature	
Improving technical skills and techniques	
Learning new technical skills and techniques	
Collaborating with others on grant projects and publications	
Regular attendance at professional meetings	
Regular attendance at specialized research meetings	
Taking leadership roles in professional groups	
Regular communication with colleagues	
Regular communication with community groups	
Regular communication with business interests	
Regular communication with government agencies	
Developing and teaching new undergraduate and/or graduate classes	
Developing a personal website	
Periodic consulting work	
Other (Please specify)_____ _____	
Total	**100**

Please be prepared to discuss with the researcher your relative weights with the researcher.

Thank you for your time and your cooperation.

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