How Included Are You in Your Workplace?:

The Effects of Different Social Structures on Perceived Inclusion

by

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ABSTRACT

While prior diversity management research has extensively focused on having a representative workforce in public organizations, recent discussions on racism and social equity have shed light on the importance of an inclusive work environment, where individuals feel integrated into organizations and involved in organizational processes. Perceived inclusion in the workplace, defined as the extent to which individuals perceive they are part of significant organizational processes, is the core theme of this dissertation. This study focuses on the perceived inclusion of academic scientists in the US. Inclusion of Scholars of Color (SOCs) and women in science is of particular importance given the low representation and retention of SOCs and women as well prolonged marginalization in academic science.

This dissertation aims to understand what shapes perceived inclusion in the workplace by looking at how the demographic and social compositions of one's social environment shape individuals' perceptions of workplace inclusion. Focusing on race and gender, the dissertation recognizes the relative and contingent relationships among individuals and networks that affect perceived inclusion. To investigate, I ask two key questions, each focusing on different social structures and their interplay:

1. How do different aspects of social structure in networks (demographics, social network structural characteristics, social network compositional characteristics) influence perceived inclusion in the workplace?
2. How do individuals' demographic attributes shape the impacts of social structures on workplace inclusion?

To explore these questions, I draw from social identity theories, focusing on intergroup relations, and social capital theory to develop hypotheses. To investigate how social network structures shape inclusion in the workplace, I use a 2011 National Science Foundation-funded national survey of Science, Technology, Engineering, and Mathematics (STEM) faculty in four science fields (biology, biochemistry, civil engineering, and mathematics) at diverse types of higher education institutions. I find that perceived inclusion is a function of social network structure, but the effects depend on the demographic characteristics of the individual and the network. I conclude this study with a discussion about the implications of findings for future research and diversity and inclusion policies.

DEDICATION

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INTRODUCTION

1.1 Introduction

Public organizations are increasingly putting effort into creating a diverse workplace by hiring women and minorities to reflect the demographics of the population they serve (Pitts & Wise, 2010; Sabharwal, 2014). As the effective management of diversity influences employees' motivation, commitment, and retention (Harris et al., 2009; Kim & Fernandez, 2017; Pitts, 2009; Roberson, 2006; Shore et al., 2011), public organizations have institutionalized functional and structural changes, such as diversity training and management policies, to recruit, retain, and manage a diverse workforce. Yet, the real challenge comes from integrating the diverse workforce members into the organization, valuing their potential, and involving them in the work group (Ferdman et al., 2010; Pless & Maak, 2004; Sabharwal, 2014).

This dissertation focuses on inclusion in the workplace, which goes beyond diversity management and policies. In this study, inclusion in the workplace is defined as the extent to which individuals perceive that they are part of significant processes in the organizations (Mor Barak et al., 1998; Mor Barak & Cherin, 1998). Prior studies on diversity in the public sector have focused on issues related to representation and diversity policies (e.g., Kellough & Naff, 2004; Pitts, 2009; Riccucci, 2009; Wise & Tschirhart, 2000). However, integrating diverse workforce members into public organizations (Pless & Maak, 2004), welcoming them, and creating an environment where they are treated as insiders by others remain as major issues to be addressed

(Pelled et al., 1999). Despite efforts in the legal system to support diversity (e.g., title VII of the Civil Rights Act of 1964, affirmative actions, and equal employment legislation), the legislation does not necessarily create an inclusive environment in the organization (Sabharwal, 2014).

Public management scholars recently have started to investigate the concept of inclusion by looking at how diversity or representation affects inclusion in the public sector (e.g., Andrews & Ashworth, 2015; Bae et al., 2017; Sabharwal, 2014; Selden, 2006; Shore et al., 2018). Recent studies on inclusion have emphasized the importance of workplace inclusion that empowers employees and distributes influence (Holvino et al., 2004; Pelled et al., 1999; Sabharwal, 2014). Perceived inclusion often depends on how individuals define and categorize themselves within their work unit; they often define themselves based on the characteristics of other members as well as their own characteristics (J. C. Turner, 1975). While scholars have extensively studied the impact of individuals' demographic characteristics (e.g., gender, race, age) on perceived inclusion (e.g. Bae et al., 2017; Sabharwal, 2014; Shore et al., 2018; Tsui et al., 1992), few have paid attention to the effects of the organizational and social network structures within which individuals are embedded. Organizational demography or team demography has a profound effect on employees' job satisfaction and intention to leave the organization (Choi, 2013; Pitts, 2009); yet the impact of the demographic composition of social structures on workplace inclusion is understudied.

This dissertation's goal is to understand how diverse aspects of social structures can shape individuals' perceived inclusion in the workplace and how they interplay with each other. Social structures include (1) the overall social network, (2) the work unit

network, and (3) the external network. This study aims to confirm prior literature on race and gender that demonstrates the marginalization of people of color and women in workplace and career outcomes (Acker, 2006; Bellas & Toutkoushian, 1999; Reskin et al., 1999), but also to understand the impacts of different aspects of social networks on one's perceived inclusion. One of the key aspects that could affect perceived inclusion is how networks are structured around the individual, the ego. The structure could include network size, closeness of relationships, and characteristics of the people with whom the individual is connected.

Yet, depending on the demographic characteristics of the social structures, individuals' perceptions of their inclusion may vary. A growing number of scholars have started to pay attention to the relative nature of the perceived inclusion (Bae et al., 2017; Shemla et al., 2016), which is based on the theoretical foundation that the interaction between an individual's characteristics and other members' characteristics in the same unit influences the individual's perceptions and experience in that unit (Tsui & Gutek, 1999). Workplace experiences are bounded by people's views and sense-making of their positions in the unit relative to other members (Mowday & Sutton, 1993), and their demographic attributes often define their positions (Brewer, 1979; Tsui et al., 1992; J. C. Turner, 1975). In addition to demographic characteristics, this dissertation examines whether the location of the social network (i.e., in their work unit or outside of their work unit) influences individuals' sense-making of their work unit.

Perceived inclusion in the workplace depends on how individuals interpret their social structures given their demographics, such as gender or race, as well as their social structure outside of the work unit. Based on their interpretation, their definition of group

boundaries that determine individuals' identities may change leading to a different level of perceived inclusion. In this dissertation, I ask the following set of questions to explore the relationships between social structures and perceived inclusion and the interplay between different social structures to shape perceived inclusion:

1. How do different aspects of social structures influence perceived inclusion in the workplace?
    a. How do individuals' demographic characteristics affect perceived inclusion?
    b. How do network structural characteristics influence perceived inclusion?
    c. How do network compositional characteristics affect perceived inclusion?
2. How do individuals' demographic attributes shape the impacts of social structures on workplace inclusion?
    a. How do individuals' demographic characteristics affect the relationship between network structural characteristics and perceived inclusion?
    b. How do individuals' demographic characteristics affect the relationship between network compositional characteristics and perceived inclusion?

1.2 Inclusion in the Workplace

An inclusive workplace offers equal opportunities to be part of the organization to diverse individuals and welcomes each individual's unique values and attributes. The goal of creating an inclusive organization is to appreciate individuals as members of the organization through fair treatment and equal participation (Shore et al., 2011). Inclusion, or the lack of inclusion, can lead to improvement or aggravation of other work outcomes

such as job satisfaction, turnover intentions, performance, and organizational commitment (e.g., Acquavita et al., 2009; Ferdman, 2017). Increasing attention has been given to promoting inclusive workplaces as a higher number of individuals belonging to diverse categories have been hired in organizations and the need for equitable experience cannot be ignored (Gooden, 2017; Sabharwal et al., 2018). Therefore, creating an inclusive workplace or improving employees' perception of inclusion becomes a critical task for public managers and organizations. This study looks at higher education institutions to understand workplace inclusion. The following section illustrates inclusion in higher education and why it is important to address inclusion in a higher education setting.

1.2.1 Disparity in Inclusion in Higher Education

Universities are the ideal place to investigate the topics of inclusion. First, universities resemble general work organizations, as their operation is driven by organizational goals, they have hierarchical labor divisions, and they have classified labor (faculty and staff) by tasks (Bird, 2011). Despite the efforts to improve diversity in universities, most faculty have been male and White dominant and White- and male-led norms and culture have been institutionalized throughout the departments and colleges. Those norms often guide tenure processes, job evaluations, productivity expectations, and career advancement opportunities while favoring men and White people and disadvantaging scholars of color (SOCs) and women (Acker, 1990, 2006). Several studies have demonstrated that SOCs and women have been significantly marginalized from decision-making processes and experienced race- and gender-based discrimination

(Lease, 1999). For example, it is common to find SOCs or women in administrative positions either because of race- and gender-based bias or because they are just symbolic representations of diversity (Freeman Jr et al., 2019; C. S. Turner, 2003; Valverde, 2003). In short, the marginalization of SOCs and women is deeply rooted in the universities.

In particular, the field of science has been hostile to SOCs and women due to their historically lower representation. Low representation in the fields led to the systematic exclusion of SOCs and women in science. Although the U.S. Congress passed the Science and Technology Equal Opportunities Act of 1980 to address inequities in the science (Oakes, 1990), SOCs and women continue to be disadvantaged in terms of career opportunities and report low inclusion in the field. For example, SOCs and women go through different career paths compared to White or male scientists (Leggon, 2006). They are often excluded from mentoring opportunities, are less likely to be hired by prestigious universities, and face harsher tenure promotion criteria from senior scientists (Banerjee & Pawley, 2013; Long & Fox, 1995; Maranto & Griffin, 2011). As inclusion directly connects to one's job satisfaction, productivity, and intentions to leave (Acquavita et al., 2009; Ferdman, 2017; Ferdman et al., 2010), it is important to understand the determinants of inclusion for scientists in universities.

1.3 Social Networks

Individuals connect and interact with others to get access to information and resources or professional advice but also to receive social support (Etzkowitz et al., 2000; Ibarra, 1992). Whom you know and how you are connected to others are important for professional development and psychological support in the university (Belle et al., 2014;

Xu & Martin, 2011). Social networks in science provide opportunities for collaborations, access to equipment, mentoring, and emotional support which can be transformed into resources that improve job satisfaction, offer leadership positions, and help productivity (Feeney & Bernal, 2010; Parker & Welch, 2013; Siciliano et al., 2018). Hence, social ties are a vital part of one's academic career path.

According to social capital theory, social capital is "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition" (Bourdieu, 1986, p. 248). Social capital develops and is maintained through interactions and can take the form of information, knowledge, reputation, or advice (Benbow & Lee, 2019). Previous literature has explored professional networks based on research or grant collaboration, informal networks that provide emotional support, and networks particularly formed to discuss teaching issues.

The extensive marginalization of SOCs and women in science also applies to science networks. Women and SOCs have limited opportunities to network and benefit from social networks. Women and SOCs face difficulties in identifying potential collaborators and mentors (Xu & Martin, 2011), and even when they find such social ties, they receive unequal returns compared to their male or White colleagues (Gupta et al., 2005). Because White- or male-dominant networks are more likely to share career advice or advancement opportunities among themselves (Mcdonald, 2011), it is harder for women and SOCs to benefit from social networks. The low representation of SOCs and women in science and their historical marginalization make exploring the social structures of SOCs and women a crucial part of my dissertation.

1.4 Organization of Dissertation

This study is composed of six chapters. The second chapter illustrates the building blocks for the study by reviewing possible explanations for perceived inclusion: race and gender, social identities, and social networks. First, I review the literature on perceived inclusion in the workplace and what it means for higher education institutions to address the marginalization of SOCs and women, including differences based on field and institutional types. I then review social identity theories to develop a theoretical lens through which to understand factors of perceived inclusion. Next, I include a discussion of the literature on social capital as it is pivotal for understanding social network benefits.

The third chapter describes the proposed hypotheses that integrate the literature on the marginalization of SOCs and women, social identity, and social capital. The first hypothesis is about the impact of demographic attributes on inclusion which is proposed to confirm the previous literature on marginalization. Second, I develop hypotheses on network structural characteristics by proposing that the size of one's network and friends can positively affect inclusion. In addition, I propose that SOCs and women will benefit more from those network structural characteristics. I then hypothesize about network compositional characteristics by looking at network homophily, which is a natural inclination to find and interact with others who share similar characteristics (McPherson & Smith-Lovin, 1987). I investigate network homophily at a whole network level but also for two separate networks based on location – an internal network and an external network. I also make a comparison of the two networks' homophily to explore the

difference in networks based on locations. Last, I propose that the impacts of network compositional characteristics are more meaningful for SOCs and women.

The fourth chapter provides descriptions of the data and data analysis method used for this study. I use a grant-funded national survey of academic scientists in 2011 that drew samples from all types of higher education institutions. The survey was particularly designed to explore the careers and networks of underrepresented SOCs and women in four science fields: biology, biochemistry, civil engineering, and mathematics. The description of variables (dependent variable, key independent variables, control variables) is included in this chapter. The chapter concludes with a description of the estimation model. The fifth chapter presents the findings from a regression analysis. I first present descriptive information about the data and then discuss the results from the ordinary least squares models are discussed. The last chapter further discusses the findings from Chapter 5, identifies limitations of this study, and concludes with possible implications of the findings for theory and practice.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This dissertation argues that the perceived sense of inclusion in the workplace is a function of different demographics as well as social network characteristics in the higher education setting. Specifically, this study confirms prior studies' findings on the impacts of demographic characteristics and social network characteristics on perceived inclusion and expands the discussion of social network effects by looking at internally and externally located social networks and comparing them. To make my arguments, I look at inclusion literature, social network literature, and social identity theories.

This dissertation provides two contributions in the context of academic science, social network theories, and social identity in the workplace. First, this study expands the understanding of social network impacts on the perception of inclusion in the workplace by acknowledging that depending on the location of the social networks, their impacts can vary. Second, while this dissertation confirms prior findings on inclusion and demographic factors such as race and gender, it disentangles the nuanced effects of demographic categories by breaking them down into narrower categories and confirms that perception of inclusion reflects the complicated nature of one's demographic attributes and social environment.

The current chapter aims to provide a foundation to understand the complicated relationships among demographic characteristics, social network characteristics, and perceived inclusion in the workplace. This chapter illustrates prior literature on

workplace inclusion, social networks, and social identities to develop the subsequent hypotheses and the empirical model presented in the next chapter. To achieve this chapter's goal, I take four steps. First, I present a short overview of current literature on perceived inclusion in the workplace as well as how inclusion matters in the higher education setting, in particular, in the field of science. To emphasize the importance of inclusion in the workplace, I use the literature on the marginalization of women and SOCs in universities and science. Second, as the foundation of hypotheses presented in the ensuing chapter is based on social identity theories, I provide an overview of traditional social identity theories as well as recent developments in social identity theories. In this part, I explain how individuals draw group boundaries and define themselves within the groups. Third, I discuss what kinds of roles social networks play in the workplace, highlighting the definitions of different social network characteristics and the impacts of social network aspects in the workplace. Since I use a survey data that looks at academic scientists, a brief discussion of the meaning of social networks in higher education and science is presented. Moreover, I present a survey of prior literature on social capital theory to improve the connections between social network characteristics, social identities, and perceived inclusion in the workplace. I then conclude this chapter with a plan for the subsequent chapter.

2.2 Perceived Inclusion in the Workplace

Changes in the demographic compositions of the general U.S. population and workplace emphasize the creation of inclusive workplaces, as social marginalization and economic disparity of diverse individuals have been evidenced throughout US history

(Mor Barak, 2014; Winters, 2014). As social categories have been expanded to address and identify diverse individuals, Ferdman (2017) described an inclusive organization and society as being where "people of all identities and many styles can be fully themselves while also contributing to the larger collective, as valued and full member" (p. 235), highlighting the importance of valuing each individual as they are and as a member of the group. In the current dissertation, I focus on addressing inclusion in the organization, particularly looking at individual employees' inclusion in their organizations.

Overall, an inclusive workplace is expected to provide equal opportunities for underrepresented groups and support them to be engaged in all organizational processes, while also welcoming the unique values held by each of its organizational members. Inclusive organizations empower individuals because "employees perceive that they are esteemed members of the workgroup" (Shore et al., 2011, p. 1265). Inclusive organizations delegate responsibility to employees and emphasize a fair and participative decision-making process (Moon, 2018; Nishii, 2013; Prasad, 2001). Employees' perception of inclusion in the workplace is pivotal for managing organizations as it impacts organizational outcomes such as organizational commitment (Ferdman, 2017), job satisfaction (Acquavita et al., 2009), turnover (Hwang & Hopkins, 2012; Mor Barak et al., 2006), and organizational participation (Waters & Bortree, 2012). Multiple studies have found that exclusion hurts the psychological and physical health of employees, in particular when exclusion takes subtle and microaggressive forms of discriminations (K. P. Jones et al., 2016; Sue et al., 2007). Hence, creating an inclusive workplace has received growing attention from organizational leaders (Nishii & Rich, 2014).

Scholars have taken different approaches to investigate inclusion in organizations: work group, leadership, perception, and practices. First, a substantial body of literature has looked at inclusion by examining inclusion within a work group. Grounded in optimal distinctiveness theory (Brewer, 1991), which argues that individuals strive to reach a balance between finding their own unique identity and finding similarities with others, the concept of inclusion in a work group focuses on belonging in the work group while having each individual's values respected (Jansen et al., 2014; Shore et al., 2011). According to Brewer (1991), individuals fundamentally have contrasting needs: a need to belong and a need to stay distinctive. The first need is satisfied by sustaining strong and frequent interactions with others through group memberships and by developing high levels of attachment; while the second need is fulfilled when individuals can distance themselves from others based on their own idiosyncratic attributes (Jansen et al., 2014; Snyder & Fromkin, 1977; J. C. Turner et al., 1987). When individuals reach a balance between uniqueness and belongingness, they are more likely to experience improved relationships with other work group members and leaders, performance, and well-being. In short, this stream of research posits that inclusion is improved when both the uniqueness and belongingness of individuals are reached in work groups.

Second, another set of scholars has looked at the role of leadership in inclusion. The main argument is that the level of the leader's inclusiveness and their inclusion practices determine the inclusion of employees. Leadership has received great attention since leaders exert influence on shaping organizational culture and practices (Ashikali et al., 2021; Gallegos, 2013; Randel et al., 2018) and leaders include both direct supervisors and senior managers. Leaders' inclusiveness refers to their efforts to address diversity,

become acceptable, create an open dialogue, and show interest in learning about their employees (Boekhorst, 2015; Cottrill et al., 2014). Inclusive leaders improve employees' psychological safety and employee's creativity (Carmeli et al., 2010; Hirak et al., 2012) as well as create a perceived climate of diversity, in which employees report a higher level of openness toward people of color and women (Randel et al., 2016). Moreover, this stream of scholars also has looked at how leaders interact with their followers based on the leader-member exchange theory (Nishii & Mayer, 2009). Leader-member exchange theory takes a relational approach to understand the relationship between leader and followers and posits that leaders interact with their followers in different ways (Graen & Uhl-Bien, 1995; Power, 2013). Based on low-quality interactions with their leaders—that is, leaders showing greater differentiation of interactions among their followers—followers are more likely to be dissatisfied. For example, employees in human service organizations reported higher feelings of inclusion when they perceived that they had high-quality interactions with their managers (Brimhall et al., 2017). Hence, this approach looks at leadership practices and how leaders connect with their followers.

Third, the perception of organizational inclusion looks at inclusion at the individual level. According to Mor Barak (2014), inclusion in the workplace refers to an "individual's sense of being a part of the organizational system in both the formal processes, such as access to information and decision-making channels, and the informal processes" (p. 155). That is, individuals feel included in their workplace when they are fully participating in organizational processes and their contribution is valued. The perceived sense of inclusion includes three different components: having access to information and resources, being involved in workgroups, and exerting influence on

decision-making (Mor Barak & Cherin, 1998; Pelled et al., 1999; Schein, 1971; Shore et al., 2011). These three components work together to shape how individuals evaluate the level of inclusiveness of their organization. By looking at inclusion at the individual level, scholars find that inclusion increases satisfaction and organizational commitment while lowering turnover rates and stress (Acquavita et al., 2009; Cho & Mor Barak, 2008; Findler et al., 2007; Hwang & Hopkins, 2012). Hence, this approach looks at inclusion in terms of how well employees are integrated into their workplace, focusing on inclusion in organizational processes.

Last, scholars have been exploring organizational practices to understand inclusion. Inclusive organizational practices are mainly aimed at improving the workplace experience of historically marginalized groups (Shore et al., 2018). For example, inclusive practices in organizations would involve leadership's commitment to improving inclusion, employees' capacity to affect organizational decisions, and fair treatment (Sabharwal, 2014). Moreover, inclusive practices can include promoting collaborations at work and devising conflict resolution methods (Roberson, 2006). Inclusive organizational practices can improve organizational citizenship behavior and organizational identification (Gotsis & Grimani, 2016; Tremblay, 2017). In particular, top leadership's dedication to creating an inclusive workplace environment and encouraging employees' participation in organizational processes can improve organizational performance (Sabharwal, 2014). In short, research on organizational inclusion practices looks at the top leaders' decision to foster a supportive environment, where every employee in the organization is valued and treated equitably.

This dissertation focuses on a perceptual approach to inclusion in the workplace, defined in the literature as the degree to which individuals feel part of critical organizational processes (Mor Barak & Cherin, 1998; Sabharwal, 2014; Shore et al., 2011, 2018). Mor Barak and Cherin's (1998) model has been tested and verified by many scholars in diverse disciplines and different cultures (Shore et al., 2018). Mor Barak and Cherin (1998) identified three primary components of perceived inclusion: being part of a work group, participating in organizational processes, and having access to information and resources all shape perceived inclusion. First, taking part in a work group indicates that individuals are not systematically excluded in their organization and they have others to work with (Mor Barak & Cherin, 1998). Second, participation in organizational processes suggests that individuals are able to influence organizational processes as well as that their opinions are valued (Mor Barak & Cherin, 1998). Last, having access to information and resources suggests that individuals have the capacity to contribute to their organization and its organizational processes (Mor Barak & Cherin, 1998). These three components together add up to the perception of inclusion in the workplace, as they demonstrate an individual's level of participation, influence, and connectedness.

Among the three, having an influence on the core decision-making process is recognized as the main component of perceived inclusion as it is directly linked to fair treatment and employee empowerment (Ely & Thomas, 2001; Nishii, 2013; Pelled et al., 1999). In this dissertation, I focus on the degree to which individuals exert influence on the decision-making process to understand their perceived sense of inclusion.

Prior research on perceived inclusion in the workplace suggests that it is strongly associated with demographic similarity or dissimilarity within the work unit. O'Reilly

and colleagues (1989) defined individual demographic dissimilarity as an individual-level difference of demographic characteristics with others in the organization or the work unit. Individuals use their salient demographic characteristics to identify other members as in-group and out-group and ultimately use their demographic features to identify with one of the groups (Fiske & Taylor, 1991; Tsui & Gutek, 1999). For example, Bae and colleagues (2017) found that dissimilarity based on gender reduces perceived inclusion in an organization by looking at state agencies in Florida and Texas. By looking at private companies, both Pelled et al. (1999) and Mor Barak et al. (1998) found that both gender- and race-based dissimilarity account for lower perceived inclusion.

2.2.1 Inclusion in Higher Education and Science

An academic setting, which includes structures and cultures, affects the faculty's workplace sensemaking. Many universities prioritize promoting diversity and building an inclusive community. Although the number of women and people of color in science and engineering has increased, the gaps in representation remain across different STEM fields (National Science Board [NSB], 2019a, 2019b, 2020). For example, women have been historically and continue to be well represented in doctoral programs in biological sciences, while fields such as engineering, physics, and computer sciences lack women's participation (NSB, 2019a). Despite the increased student enrollment in baccalaureate, master's, and doctoral programs in STEM fields by women and people of color, recruiting and retaining diverse faculty has thus far not been successful (Blackburn, 2017; Whittaker & Montgomery, 2014).

The Civil Rights Act of 1964 makes it clear that discrimination in recruitment and tenure processes is illegal and that educational institutions need to diversify their populations. To promote inclusivity, the National Science Foundation initiated the Organizational Change for Gender Equity in STEM Academic Professions and Alliances for Graduate Education and the Professoriate programs to reduce institutional barriers to creating inclusive and equitable science communities in the higher education (James & Singer, 2016). However, despite various efforts to recruit and retain diverse students and faculty in STEM fields, efforts to hire and keep women and SOCs have not been sufficient.

2.2.2 Experience of Scholars of Color and Women in Higher Education

The marginalization of women and SOCs is not new in higher education settings. In this section, I discuss how SOCs and women have been underrepresented in science, as well as their experiences.

Despite multiple efforts to recruit and retain diverse faculty in universities to address the increasing need to improve the gender, racial, and ethnic diversity of students, faculty, and staff (Stanley, 2006), women and SOCs remain significantly underrepresented in U.S. universities (Settles et al., 2019; C. S. V. Turner et al., 2008). For example, non-Hispanic White faculty comprises approximately three-fourths of the full-time faculty (U.S. Census Bureau, 2016). In particular, the underrepresentation of SOCs is more prevalent in science. According to the NSB (2022), the representation of diverse race and ethnicity categories varies. Also according to the NSB (2022), slightly less than one-fourth (23%) of the STEM workforce in 2019 were African American,

Hispanic, American Indian, and Alaska Native. In particular, African Americans comprised only about 7% of the STEM workforce with a bachelor's degree or higher.

According to the NSB (2022), female scientists currently make up about one-third of the U.S. STEM workforce, which is lower than women's representation in the general US workforce (approximately 48%). When looking at the skilled technical workforce, female representation has been stagnant since 2010 (NSB, 2022). The representation of women with a bachelor's degree or higher in STEM has only slightly increased over the same period, to 44% in 2019 from 42% in 2010. The representation significantly varies by the science disciplines. The NSB reports that while women make up about 48% of the workforce in life sciences, only about 35% of physical scientists and about one-fourth of mathematicians and computer scientists are women.

Lower representation often leads to mistreatment and unequal experience of SOC and female faculty, as they are considered to be low-status groups (Seyranian et al., 2008). Since White or male faculty have higher status and are the dominant population, they often become gatekeepers of who can join the field or train, attach stereotypes excluding those who do not meet their criteria (Settles et al., 2022; Vacha-Haase et al., 2004), leading to a disproportionate workload and burdens for women and SOCs.

Science is a demanding field, with longer hours in labs and greater pressure to produce grant funding compared to other disciplines (Britton, 2017). Gender- and race-based stereotypes often hinder women and SOCs in their efforts to pursue an academic career or, once in one, to stay in it (Cho et al., 2009), while they lack role models or mentors (Leavey, 2016; Xu & Martin, 2011) who can guide them in navigating these already competitive fields. For example, women and SOCs are often given a greater load

of advising because they are one of the very few women or ethnic minorities in the department (Blackwell et al., 2009; Pedersen & Minnotte, 2018; C. S. V. Turner et al., 2008). Additional workloads such as teaching and service disproportionately disadvantage SOCs and female faculty who are already stressed in ambiguous tenure processes (Corneille et al., 2019; Durodoye et al., 2020) and who already struggle to balance their work and family life (Corneille et al., 2019; Feeney et al., 2014; O'Meara et al., 2018). Prior research has suggested that the navigation process for tenure or promotion becomes more difficult for them because they do not get proper guidance from their senior faculty or colleagues compared to their male and White colleagues (Bird & Rhoton, 2021; Corneille et al., 2019). In addition, marginalized faculty have lower social capital (Amon, 2017), face constant pressure to prove themselves (Bird & Rhoton, 2021; Williams & Phillips, 2016), and are less likely to hold leadership positions in the department or research centers (Parker & Welch, 2013). Women and SOCs have limited access to the information, informal networks, and benefits that are given to group insiders (Banerjee & Pawley, 2013; Bird & Rhoton, 2021).

An additional barrier to improving racial and gender representation comes from the negligence of fellow faculty. For example, male and White faculty who have prevailed in STEM fields have reported that they feel their masculinity is threatened (Hall, 2016) and that the current institutional effort to increase recruitment and retention of women and minorities is sufficient (Danbold & Huo, 2017). Interestingly, a qualitative study of STEM female faculty in research-intensive institutions found that about 30% of female interviewees reported that systemic inequalities no longer persist in the academic STEM (Bird & Rhoton, 2021).

2.2.3 Different Experiences by STEM Fields

Not all STEM disciplines lack faculty diversity. It is important to note that there are field-based differences in academia in the U.S. (Hughes et al., 2017; Seron et al., 2018). For example, disciplinary cultures that emphasize masculinity can lead to different levels of workplace experience for diverse individuals (Diekman et al., 2010; Simon et al., 2017). Because some STEM fields have been dominated by White men for a long time, they are heavily shaped by a masculine culture that emphasizes competition, autonomy, production, and power (Carrigan et al., 2011; Su & Rounds, 2015; Winkle-Wagner & McCoy, 2018). This eventually leads to the disproportionate experience of faculty who do not fit into this disciplinary culture.

The extensive literature on career trajectory and development acknowledges that faculty's workplace experience is improved when their work environment is congruent with their interests and norms (Ackerman, 1996; Holland, 1997). In particular, female scientists face hardships trying to fit into the masculine culture that is deeply rooted in certain STEM fields such as engineering and physical sciences (Cho et al., 2009; Scharrer & Blackburn, 2018; Su & Rounds, 2015). While masculine culture highlights competition and research production, female scientists value cooperation, close relationships with colleagues, and access to mentoring and support (Simon et al., 2017; Su & Rounds, 2015).

Women are more likely to thrive in collegial departments that put heavy emphasis on cooperation and collaboration (Etzkowitz et al., 2000). For example, female engineers showed a higher turnover rate than their peers in biology (Gumpertz et al., 2017), and

female biologists have reported higher levels of comfort in their fields compared to their colleagues in chemistry (Leboy & Madden, 2012). Therefore, field-based differences in disciplinary culture can shape individuals' workplace experience.

2.2.4 Different Experiences by Institutions

To understand the academic setting of higher education better, it is worthwhile to note the differences between various types of higher education institutions. The institutional characteristics, structures, norms, and policies affect women and SOCs in science differently (Perna et al., 2009). For instance, less selective institutions are more likely to have demographically diverse students, staff, and faculty (Massey et al., 2003). This dissertation will discuss both mission-driven institutions, such as Historically Black Colleges and Universities (HBCUs) and women's colleges, and non-mission-driven institutions.

HBCUs are higher education institutions that are designated to address a specific group of historically underrepresented students—African Americans (Redd, 1998)—and are located in geographic areas that include a large population of African Americans (Hubbard & Stage, 2009). The Higher Education Act of 1965 defines an HBCUs as "any historically black college or university that was established before 1964, whose principal mission was, and is, the education of black Americans" (Department of Education, n.d.). The role of HBCUs in engendering a diverse science workforce is not marginal; about 30% of African Americans with a bachelor's degree in a STEM discipline earned their degree in an HBCU (Perna et al., 2009). HBCUs provide greater psychological support to African American students, who are more likely to report higher self-efficacy (Lent et al.,

2005, 2010). For example, STEM students at HBCUs are more interested in pursuing a graduate degree than African American students at predominantly White institutions (Wenglinsky, 1997).

The faculty's experience in HBCUs has been similar to that of the students. According to Betsey (2007), there are significant differences in faculty composition between HBCUs and predominantly White institutions. For example, more than half of full-time faculty at HBCUs are African Americans and non-U.S. born, and the number of doctoral degree holders is higher in HBCUs (Betsey, 2007). In terms of productivity, Betsey (2007) found that while the average number of publications is higher for faculty at predominantly White institutions than those at HBCUs, their regression results showed that faculty at HBCUs are more productive when controlling for other variables. SOCs at HBCUs have reported that their departments are more diverse and their needs have been supported by the institution, while SOCs at predominantly White institutions have reported that they find institutional barriers to developing inclusive culture in their department (Winkle-Wagner & McCoy, 2018).

2.3 Social Identity Theories

Organizations are made up of smaller groups, which share commonalities based on their members' identities, tasks, positions, or an interplay of these (Alderfer & Smith, 1982). Organizational members form diverse groups as they build, expand, or strengthen social relationships with others. Individuals cognitively categorize themselves into two separate groups—in-group and out-group—based on certain categories that become ad hoc criteria required for the group membership (Billig & Tajfel, 1973). Such categories,

which can be either salient or invisible, are common attributes shared across group members that define their group and become a borderline that distinguishes them from non-group members (Tajfel, 1982; J. C. Turner, 1975). Once the group boundaries are drawn, individuals in a demographically similar group identify themselves as in-group members, while recognizing others in demographically dissimilar groups as out-group members (Hogg & Terry, 2000; Tajfel & Wilkes, 1963).

Group boundaries result in different levels of workplace experience, such as limited access to resources or information, and build members' affection toward other in-group members or stereotypes about out-group members (Alderfer, 1977; Alderfer & Smith, 1982; T. H. Cox, 1991; Lasswell & Kaplan, 1950; LeVine & Campbell, 1972). It is not unusual for group boundaries to create a dominant group, which comprises a majority of organizational members, and a less dominant group, which is composed of excluded members (Shaw, 1976; J. C. Turner, 2010). Once the group boundaries are defined, individuals are perceived and evaluated based on their group membership and attributes. Compared to members in a dominant group, individuals in a less dominant group are more likely to have less access to information, leadership positions, and opportunities to engage in organizational processes (Hogg, 2001; Saguy et al., 2008; Tajfel, 1982), which leads to lower inclusion. In short, organizational members categorize themselves into different groups as they socialize and interact with others and such group membership often can lead to disproportionate outcomes and workplace experiences. To increase understanding of how demographic characteristics such as race and gender play a role in shaping one's workplace perceptions and experience, this section presents an overview of social identity theory based on a traditional approach that

looks at a single group and identity as well as a more recent approach that looks at the existence of multiple social groups and identities.

2.3.1 Social Identity and Group Membership

Social identity is defined as "part of an individual's self-concept which derives from his knowledge of his membership or a social group (or groups) together with the value and emotional significance attached to that membership" (Tajfel, 1978, p. 63). Group membership influences organizational members' social identities in a way that depersonalizes and homogenizes organizational members. When individuals are categorized into groups, they are no longer considered unique persons but instead are seen in terms of their relevant group membership or by group prototypes (Ashforth & Mael, 1989; Tajfel & Turner, 1979). As group characteristics or prototypes represent individuals within the group, those shared group attributes become strong criteria that reinforce social identities and divide groups within organizations (Ashforth & Mael, 1989; Brewer, 1991; Tajfel & Turner, 1979). Once the group criteria become salient, it ties similar individuals together in a shared social identity.

Prior literature has extensively demonstrated that demographic attributes such as race and gender are pertinent criteria that lead to the systematic distinction of groups (Alcoff, 2005; Hogg & Terry, 2000; Mummendey & Wenzel, 1999; J. C. Turner, 2010). Often a majority in U.S. organizations, men and White people are members of the in-group, while people of color and women are categorized as members of out-groups (Carli & Eagly, 2001; Reskin, 2000; Ridgeway, 2001). As members of a dominant in-group, White people or men exert greater influence within the organization and are more

engaged in organizational processes, while out-group members (women and people of color) are marginalized in general. In short, demographic characteristics often have defined social identities by drawing group boundaries leading to different levels of organizational experiences including the perception of inclusion.

Based on visible indicators, such as demographic characteristics, individuals tend to perceive or define themselves as an in-group member (when they share the same indicators as others in the group) or an out-group member (when they do not share the same indicators as the rest of the group (Billig & Tajfel, 1973; Tajfel & Turner, 1979). Prior literature has used social identity to understand how the demographic makeup of a team or workplace shapes workplace outcomes such as productivity, leadership attainment, empowerment, commitment, leader-subordinate relationships, and so on (Bakar & McCann, 2014; Chattopadhyay et al., 2004; Drury & Reicher, 1999; Hogg & van Knippenberg, 2003; Meyer et al., 2006). Therefore, social identity becomes a critical factor in investigating workplace perceptions.

Based on social identity theory, relational demography literature further describes how demographic factors shape and affect one's social identity. Individuals interpret and make sense of their work environment based on their demographic characteristics (Mowday & Sutton, 1993; Tsui & Gutek, 1999). Individuals with commonly known demographic characteristics of out-group members (e.g., people of color, female) are more attentive to their social identities. For example, minorities and women are more likely to be exposed to stereotype threats within the work unit (Beasley & Fischer, 2012; Hoyt et al., 2016; Shapiro & Williams, 2012), which, as a result, affect how they perceive their workplace. According to Spencer and colleagues (2016), individuals are

discouraged and feel unwelcome when negative stereotypes frame the interpretation of their behaviors by the group. Because culturally held stereotypes attached to group attributes provide situational cues that often bound their perceptions of the workplace (Spencer et al., 2016; Steele et al., 2002), demographic factors not only can draw group boundaries and define individuals' social identities but also can influence how they view their groups and their level of attachment to them.

2.3.2 Recent Developments in Social Identity Theories

Recent discussions of social identity have expanded the basic assumption of social identity theory that individuals define their social identities based on a single group. More recently, social identity literature has started to accept that social identity definition is a process and that individuals can develop and activate multiple identities, which potentially could affect each other (Kang & Bodenhausen, 2015; Levy et al., 2017). The underlying assumption of multiple identities is that individuals face complex sets of categories to which they can attach their social identities and that their group memberships coexist, leading to simultaneous activation of different identities (Brewer & Pierce, 2005; E. U. Choi & Hogg, 2020b). In this section, I provide two theories that build on each other to demonstrate that individuals develop multiple identities at the same time and the level of the salience of each identity varies by context.

Social Identity Complexity Theory

Social identity complexity theory raises the possibility that individuals can belong to various social groups where they can find multiple identities that exist simultaneously

(Brewer & Pierce, 2005; Roccas & Brewer, 2002). The key premise of social identity complexity theory is that individuals navigate through the process of integrating and differentiating different identities and frame group membership as a result of the process and group identification is subjective (Miller et al., 2009; Roccas & Brewer, 2002). Depending on how individuals activate and combine coexisting social identities, individuals will report different levels of attachment to one group. Based on Roccas and Brewer (2002), while holding diverse group memberships, individuals can find their social identities in each group to be overlapping, contradicting, or distinctive. As a result, individuals will juggle different social identities and develop a complex set of social identities.

Social identity complexity theory argues that when individuals have highly complex social identities, they are more likely to be open to, less biased against, and more tolerant of out-group members; complex social identities permit individuals to perceive their environment as more inclusive (Roccas & Brewer, 2002). For example, Brewer and Pierce (2005) found that individuals with complex social identities are more likely to support and work well with diverse individuals. However, an individual's development of multiple social identities is a function of various situational factors, such as their level of stress in the workplace, their cognitive load, their level of interactions, and any external identity threat (Pettigrew & Tropp, 2006; Riek et al., 2006; Roccas & Brewer, 2002; Schmid et al., 2009). Based on social identity complexity theory, it is valid to assert that individuals can belong to diverse social groups from which they generate multiple social identities.

Uncertainty-Identity Theory

Another theory used to support the present dissertation is uncertainty-identity theory. Based on social identity theory, particularly on the self-categorization process, the uncertainty-identity theory posits that self-uncertainty plays a fundamental role when individuals with multiple social identities stemming from various group memberships try to develop a preference for or attachment to a particular group membership (Abrams & Hogg, 1999; Hogg, 2000). Individuals are intrinsically inclined to reduce their level of self-uncertainty, as being uncertain about oneself is aversive and increases anxiety (Jonas et al., 2014). Uncertainty has been a key motivation to make individuals think and act, because with uncertainty individuals face difficulties planning their actions and anticipating others' reactions (Swann Jr. & Bosson, 2010). Uncertainty about their status will drive individuals to seek ways to alleviate or resolve it.

Individuals can reduce their uncertainty through group identification and by changing their behaviors (J. C. Turner et al., 1987). Group identification and attachment can affect self-uncertainty as while individuals go through the process of self-categorization to define their social identities, their level of self-uncertainty is significantly reduced when they find a social identity they can strongly associate with (E. U. Choi & Hogg, 2020b; J. C. Turner et al., 1987). Individuals cognitively self-categorize themselves into social groups, which are represented as prototypical attributes, and define their social identities by presenting similarities within one group, while separating them from others (E. U. Choi & Hogg, 2020b; Hogg, 2007; J. C. Turner et al., 1987). Having a shared social identity with others can validate one's perception of self and decrease the possible chance of being an out-group member in an organization or work unit. The

process of self-categorization based on common attributes results in increased attachment to the group and depersonalizes individuals, causing them to comply with the group's prototypical attributes as an in-group member (E. U. Choi & Hogg, 2020b; Grieve & Hogg, 1999; Reid & Hogg, 2005). The sense of in-group membership can be translated as a validation of one's social identity.

When individuals seek a group that will offer in-group membership, they can also handle multiple group memberships at the same time. In such cases, individuals will develop more favorable attitudes and preferences toward an entitative group (Hogg et al., 2007; Lickel et al., 2000). Group entitativity is perceived as the level of similarity or cohesiveness of the group in terms of salient physical characteristics, psychological attributes, or both (Dasgupta et al., 1999). An entitative group tends to have clearer group boundaries that distinguish them from other groups, have a firmer internal support structure, and are more interdependent (Grant & Hogg, 2012; Hamilton et al., 1998; Hogg et al., 2007). Self-uncertain individuals will strongly prefer entitative groups over nonentitative groups because uncertainty activates one's motivation to identify with a group defined around self-inclusive categories (Hogg et al., 2010). Since entitative groups offer clear and focused prototypes to which individuals can attach, individuals are more likely to self-identify with entitative groups. Hence, the more cohesive the group is, the higher the likelihood that individuals will feel reduced uncertainty and exhibit a higher preference for it.

2.3.3 Understanding Race and Gender Through a Social Identity Lens

Social identity theory has demonstrated that women and people of color have been marginalized in their work units and organizations. Key tenets of social identity theory are that (1) individuals define their social identity based on shared attributes that offer them group membership and (2) once the social identity or group boundary is defined, individuals tend to favor others who share in-group membership while exhibiting hostile behavior toward out-group members, who do not share common attributes with them (Billig & Tajfel, 1973; Hogg & Terry, 2000). For example, in-group members are less likely to interact with out-group members and to exhibit prosocial behaviors (Bourgeois & Leary, 2001; Twenge et al., 2007).

Salient characteristics, such as race, gender, and age, are commonly used for social categorization in organizations (Ashforth & Mael, 1989; Steele et al., 2002). Because organizations historically have been male and White dominant and still lack representation of women and people of color, women and people of color often have been identified as out-group members as they do not share the visible attributes (e.g., being a man, being White, or both). The male or White colleagues are likely to view other male or White colleagues (in-group members) as attractive, competent, and trustworthy (Tsui & Gutek, 1999), while attaching race- or gender-based stereotypes, biases, and prejudices to women and people of color (out-group members) (Ely, 1994; O'Reilly et al., 1989). These biases and stereotypes lead to the disproportionate experience of women and people of color in terms of social interactions, resources, information, and career advancement opportunities (Corneille et al., 2019; Mehra et al., 1998; Settles et al.,

2019). Therefore, drawing from social identity theory, individuals who are socially identified as out-group members will experience marginalization and exclusion.

2.4 Professional Networks in the Workplace

In organizations, individuals interact with each other creating interpersonal relationships to provide or receive information, resources, validation, and psychological boosts (Adler & Kwon, 2002). Social networks include various individuals who are connected by a set of ties (Borgatti & Foster, 2003; Wasserman & Faust, 1994). Social networks can either harm or improve how individuals navigate their organization and their career in an organization. Social network literature suggests that there are two types of networks in organizations: formal and informal networks. The former, formal networks, are formally established relationships in the organization based on explicit role divisions and hierarchies (Ibarra, 1993b). The latter, informal networks, involves a set of relationships that naturally emerges through socialization or other work-related interactions or both (Ibarra, 1993b; Xu & Martin, 2011) and often reflects individuals' interests in their work or career goals (Galaskiewicz, 1979; Tichy & Fombrun, 1979). The current dissertation focuses on informal networks formed by individuals in an organization.

Prior literature on workplace social networks separates ties based on their function. While instrumental ties are ties that emerge as a result of work and exchange of job-related resources (e.g., information, professional advice, career advice, promotion opportunities, physical resources, etc.), expressive ties are ties that offer friendship, psychological support, and mentoring (Ibarra, 1993b; Methot, 2010). Compared to

instrumental ties, expressive ties are characterized by closeness and trust and are less restricted by formal structure (Krackhardt, 1992). Ties can be both instrumental and expressive (Kram, 1988).

The extent to which individuals can benefit from their social network depends on different network characteristics: network composition and relationship characteristics. First, the benefit from the social network can depend on to whom the individual is connected. It is important to understand how the network is composed since depending on similarities and differences in ascribed characteristics such as race and gender influence the types and amount of resources exchanged (Blau, 1964). For example, similarity in demographic attributes often results in common experience, a higher level of attraction and trust, and a higher likelihood of exchange of scarce resources (Kossinets & J. Watts, 2009; McPherson & Smith-Lovin, 1987). Homophily is defined as the extent to which individuals are similar in terms of their identity or attributes, such as demographic characteristics or organizational group affiliations (Marsden, 1988; McPherson & Smith-Lovin, 1987). Similarity improves communication as well as resource exchange because relationships based on interpersonal similarities are built upon higher levels of trust and reciprocity (Lincoln & Miller, 1979).

In addition, relationship characteristics can affect the extent to which social networks influence individuals. For example, strong ties develop based on time spent together, emotional closeness, and level of reciprocity (Granovetter, 1973). While strong ties are more likely to offer social support (Krackhardt, 1992; Nelson, 1989), they are less likely to offer instrumental benefits to the individuals because they often provide redundant information and resources (Granovetter, 1973). Another relationship

characteristic that affects the impact of social networks is network density, which is the extent to which the individual is influenced by interactions among other network members (Marsden, 1990). High network density indicates that the members of one's network are closely connected and offer a greater level of psychological support and solidarity (Wellman, 1992).

Science is heavily dependent on science networks where scientists voluntarily organize, share information, and distribute resources (Etzkowitz et al., 2000). Science networks are informal groups that share information such as mentoring advice and grant opportunities but also formally work on projects or collaborate for publications (Gaughan et al., 2018; Miriti, 2020). Social networks help science faculty advance their career, research productivity, and teaching as well as improve their overall satisfaction (Feeney et al., 2014; Gaughan et al., 2018; Welch & Jha, 2016). For example, social networks provide advancement opportunities that positively affect publication (Palepu et al., 1998). The consequence of the exclusion of scientists from such networks is substantial leading to negative impacts on performance, tenure processes, and retention (Laden & Hagedorn, 2000; Xu & Martin, 2011). In short, science networks are critical for scientists because of how they influence productivity, mentoring, and workplace experience.

The present dissertation explores informal academic networks for productivity, advice, and mentors. Networks for productivity include individuals who collaborate for research publications as well as offer information for teaching issues. Many studies have demonstrated that research collaboration networks significantly affect productivity (M. F. Fox, 2005; Gaughan et al., 2018; Siciliano et al., 2018), while teaching networks have not been studied as much. Science faculty also collaborate for teaching, sharing information

or resources based on their prior experience (Roxå & Mårtensson, 2009; Van Waes et al., 2016). Moreover, an advice network comprises individuals who interact for advice on professional development and general administrative issues. Advice networks are important since they inform individuals about academic norms and culture (Feeney et al., 2014). Information on career opportunities, administrative rules, and culture retrieved from an informally constructed network offers a higher level of psychological support. For example, being part of an advice network reduces the faculty's stress level while offering more trustworthy and verified information (House et al., 1988; Welch & Jha, 2016). In addition, advice networks can inform publication strategies to improve productivity as well as strategies to navigate through organizational politics in ways that will decrease stress (Kiopa et al., 2009). Lastly, this study looks at mentors who provide extensive support ranging from a sense of belongingness to networking opportunities (Gaughan et al., 2018; Kram, 1988; Spreitzer, 1995, 1996). Mentors are "more experienced colleagues who provide support, direction, and feedback regarding career-related issues and discuss issues with a less experienced colleague" (NETWISE II, 2011). Mentors can share information on career opportunities, informally review works, and provide overall guidance about the mentee's personal life as well as professional life. Having a good mentor discourages turnover and improves workplace satisfaction and productivity (M. F. Fox & Mohapatra, 2007; Steiner et al., 2002). For instance, mentors offer access to social networks that are resource rich and provide personal references (Melkers et al., 2008). In short, there are different types of informal networks that can emerge in the STEM field and offer diverse types of resources, information, and support.

2.5 Social Capital Theory

2.5.1 Social Capital Theory

Bourdieu (1986) defined social capital as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition" (p. 248). According to Adler and Kwon (2000), social capital stems from the social relationships that expedite individual or collective goods production. It refers to tangible or intangible resources embedded in relationships that are potentially exchangeable and can be understood as resources in social networks that develop from these interactions. Social capital can take the form of information, influence, a sense of belongingness, or resources (Adler & Kwon, 2002), and depending on how the network is formed or characterized, accessibility to social capital and the amount individuals can get may vary (Burt, 2000; Podolny & Baron, 1997). Social capital can be used to achieve one's desires or needs. For example, individuals can use their network resources to attain a leadership position, exert influence, advance their career, improve resource exchange, and remain in an organization (Brass, 1984; Burt, 1992; Coleman, 1988; Krackhardt & Hanson, 1993; Tsai & Ghoshal, 1998). Those network resources can be transformed into substantial financial resources or into tacit knowledge that can help individuals attain what they want, particularly for career advancement.

When individuals interact with each other, social capital develops while interactions and resource exchanges are governed by reciprocity and members of the network build a mutual social support system (Coleman, 1988; Etzkowitz et al., 2000). The essence of social capital is goodwill, which can be understood as trust and sympathy,

that shapes the social capital exchange and flow (Adler & Kwon, 2002). A wide range of resources can be included in social capital: opportunities, access to financial resources, emotional support, reputation, recognition, and so on. Individuals can use different resources to address their needs (Adler & Kwon, 2002; Burt, 2000; Coleman, 1988). For example, science faculty can collaborate with others with the expectation that they will have access to data sets, equipment, and advice on grant applications, as well as improvement of their reputation (Bozeman & Corley, 2004; Dietz & Bozeman, 2005). Hence, social capital is a useful resource that can help individuals prosper.

Once the social relationships are established, they are maintained based on trust. Trust is defined as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (Mayer et al., 1995, p. 712). Social relationships that lack trust are more vulnerable and see less frequent interactions, which eventually leads to a decreased exchange of social capital (Granovetter, 1973; Portes, 1998). Therefore, trustworthy relationships are more sustainable and guide how many resources individuals can retrieve from their social networks.

Social capital is critical in shaping one's perceptions and behavior in organizations because social cues and resources can change how individuals see and interpret their workplace (Baldwin et al., 1997; Brass, 2011; Flap & Völker, 2001). For example, social support in the workplace helps improve job satisfaction (Hurlbert, 1991); yet the impact of social networks can have a different meaning for women or people of color (Coates, 1987; Ibarra, 1995). Hence, this dissertation takes a social network

approach to understand the determinants of perceived inclusion. In particular, I look that the social network's structure (e.g., network size, friends) and structural compositions (e.g., the extent to which the network is similar to the individual).

2.5.2 Difference in Social Networks by Race and Gender

Organizational studies have demonstrated that women and people of color have been disproportionately benefitting from their social networks. Social relationships often develop based on the opportunity context, which can either enable or disable the individuals' interactions (Blau, 1977). Within organizations, such context can be shaped by demographic characteristics. For example, individuals are more likely to interact based on demographic similarities such as race and gender (Alderfer & Smith, 1982; Blau, 1977). Women and people of color can be excluded from network opportunities or face limited access to networks because men and Whites people, who have been largely representing organization (Mcdonald, 2011), tend to interact and exchange social capital with similar others (Ibarra, 1993b; McPherson & Smith-Lovin, 1987). For example, an "old boys' club" composed of White men helps each other's career advancement opportunities (Ibarra, 1992; Mcdonald, 2011). Women and people of color, as a result, face limited access to the information and resources shared in those networks and are left with female- and people-of-color-dominated networks. Limited network opportunities exacerbate women's and people of color's careers, as their female- and people-of-color-dominated networks offer relatively few benefits compared to the old boys' club (Reskin & McBrier, 2000; Stainback, 2008).

The marginalization of women and people of color in social networks is more evident in science than in other fields. According to National Academy of Sciences et al. (2007), different career outcomes based on gender are the result of social structures in which individuals are embedded and of social networks. Prior literature has highlighted the importance of social networks in STEM fields for productivity, career, and mentorship (Dietz & Bozeman, 2005; Feeney & Bernal, 2010; Gaughan et al., 2018), yet women and SOCs often have been excluded from the networks or could not identify potential networks (Xu & Martin, 2011). Limited access to resource-rich or supportive networks has a significant impact on the career outcomes of women and people of color, including productivity outcomes (Belle et al., 2014; M. F. Fox & Mohapatra, 2007; V. J. Rosser, 2004). Similar to their male colleagues, female scientists actively look for ways to build and get access to networks to better navigate their careers (S. V. Rosser & Zieseniss, 2000). However, they have different experiences from their male counterparts. They receive different levels of social capital-based resources. For example, compared to men, women are less effective in generating social capital from their networks, leading to differential access to career-related resources (Gupta et al., 2005; Hetty Van Emmerik et al., 2006). In short, the exclusion of women and people of color in social networks has been prevalent in organizations and science.

2.6 Conclusion

This chapter introduced the foundations of this study's approach by looking at the marginalization of women and people of color, social identity, social networks, and perceived inclusion.

The subsequent chapter will provide detailed hypotheses for this study. Based on social identity theory and social capital theory, I argue that social network characteristics can explain perceived inclusion in the workplace, borrowing the theoretical lens of the social identity approach. First, based on social identity theory and literature on inclusion, I expect that an individual's demographic attributes such as race and gender will have an impact on inclusion in their workplace. Second, I tie in social capital theory with inclusion literature to argue that social network characteristics such as network size and number of friends have a direct impact on inclusion, as they can offer different levels of social capital which individuals can leverage to improve their perception of inclusion. Third, I connect social identity literature, social capital theory, and inclusion to posit that a social network's structural composition, such as the extent to which the social network resembles the individual, can affect inclusion, as depending on whom they are connected to, individuals can receive various types of social capital. Connecting social identity theory, social capital theory, relational demography literature, and inclusion literature, I theorize that an individual's demographic attributes will moderate the relationship between the social network's characteristics and inclusion, as social capital can buffer individuals who have been marginalized. Last, I argue that demographic attributes moderate the relationship between the social network's structural composition and inclusion, as demographic attributes lead to differential experiences by combining social identity theory, relational demography literature, and inclusion studies.

CHAPTER 3

THEORETICAL FRAMEWORK AND HYPOTHESES

3.1 Introduction

This study's main research goals are to find answers to the following questions: How do different aspects of social structures influence perceived inclusion in the workplace? and How do individuals' demographic attributes affect the impacts of social structure on inclusion? by looking at individual-level and social network characteristics that affect inclusion. The previous chapter set up the context to understand how diverse individuals experience and interpret their workplace by looking at perceived inclusion in academic science. It focused on how individuals construct their social identities and group memberships and how a social network approach can influence inclusion in the workplace and social identity construction. This chapter builds a theoretical framework to outline the hypotheses of this study to understand how different social structures, such as individuals' demographic attributes, and social networks can shape one's perception of inclusion in the workplace.

This dissertation draws on social identity theories and social capital theory to develop the theoretical framework and investigate the workplace inclusion of academic scientists. Based on social identity theory and social capital theory to understand perceived inclusion in the workplace, this study assumes that (1) individuals can be embedded in various social groups, (2) such groups determine their social identities, and (3) such social groups and identities lead to different levels of perceived inclusion in the workplace. In this dissertation, I acknowledge that individuals can be embedded in

various social groups in and beyond their workplaces. Because this dissertation looks at individuals who are embedded in their work unit and who are expected to work with others outside of their workplace (Freeman et al., 2015), I argue that individuals will compare and contrast their group memberships in each social group, and eventually make decisions on how to construct their social identities given their multiple group memberships. Therefore, because individuals are embedded in many social groups inside and outside of their organization and each social group uniquely contributes to their social identity construction, how they define their social identities becomes complicated, resulting in different levels of inclusion.

In the current chapter, I recap the theoretical background of group formation and social identities in the work unit and their relevance to perceived inclusion in the workplace, and further develop hypotheses to test the direct and indirect effects of demographic attributes on inclusion and the direct effects of different aspects of social networks on inclusion.

This chapter is organized as follows. First, I discuss the importance of perceived inclusion in the workplace. Second, I summarize how groups in organizations, including social networks, lead to the construction of social identities, which are a critical aspect in determining perceived inclusion. Third, I develop hypotheses on the impacts of individual attributes and social networks on perceived inclusion. Next, I discuss how individual attributes can affect the relationship between perceived inclusion and social networks. Last, I present the theoretical framework with the hypotheses identified and a list of the hypotheses.

3.2 Perceived Inclusion in the Workplace

Understanding determinants of perceived inclusion is pivotal given the increasing number of diverse individuals in public organizations and the attention to equitable workplace experience. Perceived inclusion can offer insights into how individuals are supported, connected, and accepted by the organization and work units (Robbins et al., 2004). Perception of inclusion in the workplace refers to the extent to which individuals feel that they are part of core organizational processes (Mor Barak, 2000; Mor Barak & Cherin, 1998; Shore et al., 2018). It is a critical workplace outcome because it includes whether individuals belong to work groups, participate in organizational decision-making processes, and have access to information and resources (Mor Barak & Cherin, 1998). Perceived inclusion is directly connected to employees' feelings of empowerment and being equally treated, as it suggests that employees are valued, incorporated, and heard in the organization. Feeling oneself to be part of the organization affects other work-related outcomes such as performance, openness to diversity, organizational commitment, retention, and satisfaction (Acquavita et al., 2009; Brimhall & Mor Barak, 2018; Cho & Mor Barak, 2008; Randel et al., 2018; Shore et al., 2011). Prior studies have focused on an individual's demographic similarity or dissimilarity or the general work group's demographic composition to explain the variation in the perceived inclusion (Andrews & Ashworth, 2015; Bae et al., 2017).

3.3 Groups, Social Identities, and Inclusion

Prior literature on perceived inclusion has argued that the characteristics of work groups or organizations in which individuals are embedded provide social cues that help

individuals define their social identity and group memberships based on social identity theory.

In this section, I describe that group memberships lead to different workplace experiences through social identity construction. And when individuals hold multiple group memberships, they seek to find positive validation of their identities.

Within organizations, individuals can form groups, either voluntarily based on their common interests or demographic attributes, or involuntarily, based on their work unit or tasks (Alderfer & Smith, 1982; Hogg & Terry, 2000). Individuals are free to connect to or strengthen their social relationships with others to form these groups. Groups can be formed formally based on individuals' work units or roles within the organization, or informally based on individuals' selection of others with whom they find similarities or commonalities (Ibarra, 1993b). During the process of group formation, individuals can cognitively define their social identity, which is one's self-concept characterized based on social groups, as in-group or out-group, depending on visible or invisible categories which become criteria defining group membership (Billig & Tajfel, 1973). Group boundaries are drawn by commonly shared attributes across group members, which are often demographic characteristics, that reinforce and confirm social identities (Ashforth & Mael, 1989; Billig & Tajfel, 1973; Hogg & Terry, 2000; Tajfel & Wilkes, 1963). Once the groups are set, in-group members prefer and develop a higher level of affection toward in-group members while attaching stereotypes to out-group members and excluding them from information or resource exchanges (Alderfer, 1977; T. H. Cox, 1991; Lasswell & Kaplan, 1950). Hence, group membership defines one's social identity, which can result in differential experiences of employees.

However, individuals rarely belong to a single group. Rather, individuals hold various group memberships, as they are embedded in multiple social groups both within and outside their organizations, such as social networks, making their social identities complex and flexible (E. U. Choi & Hogg, 2020b; Roccas & Brewer, 2002). Individuals can belong to multiple social groups that serve different purposes. For example, they can have intimate groups composed of friends and task-based groups composed of colleagues in the same work unit (Lickel et al., 2000). In fact, individuals often develop multiple social identities within the organization, as they belong to multiple subgroups and networks inside and outside of their work unit that provide different social cues (C. Jones & Volpe, 2011; Labianca et al., 1998; Podolny & Baron, 1997; Sluss & Ashforth, 2007), and those multiple identities are often not alike (Petriglieri, 2011). When belonging to multiple social groups, individuals show different behavioral patterns from one group to another depending on the extent to which each group reaffirms their in-group membership (Ashforth, 1998; Hogg, 2007). Individuals evaluate their multiple identities and search for positive identity validation, which reduces their self-uncertainty (A. D. Brown, 2015; E. U. Choi & Hogg, 2020a; Dutton et al., 2010; Levy et al., 2017; Roccas & Brewer, 2002; Sluss & Ashforth, 2007; Tajfel & Turner, 1979; J. C. Turner et al., 1987).

Social groups in organizations such as work units and professional networks impact perceived inclusion in the workplace by shaping organizational members' social identities. For example, the demographic composition of the work unit can divide the work unit into two groups - demographically similar group or dissimilar group (Tajfel & Turner, 1979); the latter offers less access to information and resources as well as

opportunities to participate in organizational processes, which may lead to marginalization within the organization. Moreover, social networks can buffer the perceived exclusion of commonly known out-groups in their workplace because individuals can utilize social capital (e.g., psychological support, instrumental resources) embedded in their network to compensate for the exclusion (Lin, 1999). Yet, because individuals also socialize outside of their workplace, they may have multiple group memberships that provide different social cues for identity construction and validation. When individuals are positively perceived in one group but not in another, they develop a positive attitude toward that particular group (Ashforth & Mael, 1989; A. D. Brown, 2015; E. U. Choi & Hogg, 2020a; Roccas & Brewer, 2002). Workplace experiences, hence, may become relative depending on the types of group memberships individuals hold (e.g., in-group or out-group) in each social group and their interactions.

3.4 Hypotheses

According to social identity theory, individuals define their "self " in terms of their group memberships, which are often distinguished by prototypical characteristics such as race, gender, and education (Ashforth & Mael, 1989; Tajfel et al., 1971; Tajfel & Turner, 1986). Such characteristics, which can be either salient or invisible, identify individuals and strengthen group boundaries between members and nonmembers, creating in-groups and out-groups Group divisions can frame workplace experiences and perceptions. For example, in U.S. organizations, men and White people are often identified as in-group members, having more access to information or resources (Carli & Eagly, 2001; Ridgeway, 2001). In addition, other structural characteristics of social

networks, such as psychological closeness or attachment, can draw lines between different groups. For example, friends, who do not necessarily share prototypical characteristics, often define the groups (Fine, 1986). In short, the diverse structural characteristics of groups influence social identity development and can lead to different levels of workplace inclusion.

How individuals perceive inclusion in their workplace may become relative based on three determinants: individuals' demographic characteristics, social network structural characteristics, and social network compositional characteristics.

First, individuals' demographic attributes can directly shape inclusion but also influence how individuals view and retrieve cues from their workplace. Because personal characteristics such as race and gender are commonly used criteria to systematically divide people into in-groups and out-groups, people of color and women have reported exclusion from their workplace, coworkers, and organizations (Elliott & Smith, 2004; Hirshfield & Joseph, 2012; Reskin et al., 1999). For example, in a highly White-dense work unit, people of color can feel less included as they are more likely to perceive that they are dissimilar from the prototypical characteristics of the majority of group members (Bae et al., 2017; Chattopadhyay, 1999). In addition, demographic attributes can offer additional situational cues that change how individuals perceive and interpret their workplace. Demographic attributes can change whom individuals approach and interact with (Bristol & Shirrell, 2019; McGuire, 2000). Having more network ties in the work unit that share demographic similarities (e.g., race, gender) may improve how individuals experience their work environment, yet the impact may vary by race and gender. For example, a female scholar of color (SOCs) will perceive herself as dissimilar to her

network, categorize herself as out-group, and reduce social exchanges with alters in her work unit in a mostly White male department (Bae et al., 2017; Chattopadhyay, 1999; Harrison et al., 1998; Hogg & Terry, 2000). Therefore, race and gender not only lead to different levels of inclusion but also moderate the impact of social networks on perceived inclusion.

Second, social network characteristics such as how large the network is or how close network ties are to the individuals can affect how individuals interpret their workplace. For example, the closeness of social relationships translates into a higher level of trust and psychological support while reducing the chances of conflict in the organization (Nelson, 1989). Highly connected individuals in networks are more likely to share information and resources, which are trustworthy, reinforcing individuals' perception that they have more knowledge and are engaged in their work unit and organization (Brass, 1984; Ibarra, 1993a; Mehra et al., 1998). In addition, the number of ties individuals have in their network can shape their perception of the workplace. For example, individuals with larger social networks have a higher likelihood of receiving information and resources, including psychological support, than those with a smaller network (Cross & Sproull, 2004; Granovetter, 1973; Podolny & Baron, 1997). Therefore, the structural characteristics of social networks can help us understand how individuals perceive and evaluate their workplace.

Last, individuals' networks inside and outside of the work unit can shape how they perceive inclusion in the workplace. Individuals seek to find a relatively secure, positive, and consistent social identity in order to function effectively (Ashforth & Kreiner, 1999; Tajfel & Turner, 1979; D. C. Thomas, 1999); they construct their social

identity based on their general social environment (Tajfel & Turner, 1986), which may exist both within the workplace and outside of it. Individuals monitor their whole social environment for cues and signals, personalize them, and use them as a reference in their cognition to create or modify their sense of self as well as their categorization of themselves as in-group or out-group (Jackson et al., 1992; Otten & Jansen, 2014; Sveningsson & Alvesson, 2003; Watson, 2008). When their social identities are negatively evaluated in the work unit or group, they start reevaluating their social identities (A. D. Brown, 2017; DeRue & Ashford, 2010), using social cues to guide and revise their social identities (Ashforth & Kreiner, 1999; Brown, 2015; Ibarra & Barbulescu, 2010). Depending on how they integrate information, individuals tend to show a positive inclination toward the group where their social identities are positively validated, as it reduces the self-uncertainty of not having approved "selves" (E. U. Choi & Hogg, 2020a; Hogg, 2007). Hence, understanding the demographic compositions of the general social structure, represented as internal and external professional networks, is crucial for understanding individuals' social identity construction and how they make sense of their workplace.

3.4.1 Individuals' Demographic Attributes

Social identity theory postulates that individuals construct structures for comparison when noticeable similarities and differences exist (Hogg & Terry, 2000; Tajfel & Turner, 1979; J. C. Turner, 1975). These similar or dissimilar attributes separate individuals in organizations into in-groups and out-groups, where in-group members show a preference for similar others and develop negative attitudes toward those who fall

outside their group boundary (Brewer, 1999; Moon, 2018). In-group members become more intimate, creating their league based on mutual trust and obligations while isolating or ignoring out-groups. As the boundary between in-group and out-group becomes more prominent, group distinctions influence social interactions and opportunities that result in poor group relationships (Brewer, 1999; J. C. Turner, 1975), leading to disproportionate power distribution and access to participation and resources, which eventually reduces the sense of inclusion (Fernandez & Moldogaziev, 2013). Simply put, individuals who do not belong to the in-group perceive the organization less favorably and feel more excluded as their group membership offers limited access and workplace experience (Alderfer & Smith, 1982; Mor Barak et al., 1998).

The existence of in- and out-groups can limit the inclusion or empowerment of individuals by creating divisions between who can engage in the decision-making process and who cannot. For example, in a highly diverse work group, there is greater access to information and knowledge that can improve decision-making capabilities as the group boundary becomes less prominent (Cox, 1991; Cox & Blake, 1991; Moon, 2018). Therefore, when the group division becomes salient, individuals will perceive that they are excluded from major decision-making processes undermining the perceived sense of inclusion.

In organizations, personal attributes such as race, gender, and status are salient criteria that systematically divide in-groups and out-groups. Traditionally, White people or men have dominantly occupied the majority positions (Brescoll, 2011; Carli & Eagly, 2001; Chin, 2013; Owen, 2008; Rosette et al., 2008). Because the institutionalization of male privilege and racial stereotypes has accrued over a long time, White men are more

likely to attain core leadership positions because they are considered to be leader prototypes who deserve to be decision-makers (Chin, 2013; Hogg, 2001; Owen, 2008; Ridgeway, 2001; Stainback & Tomaskovic-Devey, 2009). White men emerge as better candidates than others to attain power or positions that come with influence in organizations (Hogg & Reid, 2001; Ospina & Foldy, 2009). They form a prominent in-group while marginalizing women or people of color who do not align with their in-group attributes.

In male-dominant or White-dominant organizations, women and people of color tend to report that they feel barriers to getting information and resources, while those barriers are invisible to men and White people (Elliott & Smith, 2004; McIntosh, 2001; Morrison & Von Glinow, 1990; O'Leary & Ickovics, 1992). Gender and race scholars have shown that invisible barriers exist that limit women's and people of color's access to leadership positions, in which they could exert influence in the decision-making process (O'Leary & Ickovics, 1992; Ospina & Foldy, 2009; van Vianen & Fischer, 2002). In addition, Ibarra (1993) found that seniority results in different levels of power in organizations because seniority indicates systematic legitimacy and demonstrates knowledge of how to navigate the organizational process. Senior organization members derive power by utilizing their know-how to navigate through information and contacts in the decision-making process (French & Raven, 1959). Because women and people of color have been historically underrepresented in organizations, men and White people have been taking the positions from which they can exert influence and seniority. Hence, the existence of group division results in an unequal workplace experience.

In higher education institutions, group marginalization by demographic characteristics, such as race and gender, persists. For instance, we have witnessed many senior male faculty or White male faculty disproportionately dominating resources and decision-making processes (Arday, 2018; Corneille et al., 2019; Owen, 2008). Senior male faculty have more access to leadership positions and resources, while women and SOCs have reported lower satisfaction due to limited access to power and influence (Amey, 2006; Middlehurst, 2012; Valverde, 2003). In addition, women and SOCs do not have the same level of mentoring from senior faculty (Leggon, 2006). While senior White male faculty, who are often considered as in-group members, dominate the decision-making process by forming a majority group, others who do not share similarities with them are left behind. Since a dominant group of decision-makers has been formed and identified as the in-group, the non-dominant individuals will perceive that they do not have the same level of opportunities to engage in the organizational processes and feel less included. Drawing from previous literature, I hypothesize that:

Hypothesis 1 (H1): SOCs and women will report lower levels of perceived inclusion in the workplace

3.4.2 Network Structural Characteristics

Social network structural characteristics can affect how individuals attach to a particular social group by offering social capital. Defined as "an aggregate of the actual and potential resources" (Bourdieu, 1986, p. 248) in social relationships, social capital emerges and grows from the relationships and interactions between group members.

Social capital takes the form of information, access to resources, sense of belongingness, reputation, and so on, and can be used to benefit both individuals engaged in the social interaction (Adler & Kwon, 2002; Brass, 1984). Once the social relationship is built, the extent to which individuals can benefit from their social network depends on how their social network is structured. For example, friends in the network can provide each other with more credible and richer information than loosely connected individuals, or a greater number of network ties can signify that an individual can draw resources from a more diverse collection of individuals (Lincoln & Miller, 1979; Wellman, 1992).

In this study, I focus on social network size and friends in social networks. First, the size of a professional network refers to the total number of individuals in one's network (Wasserman & Faust, 1994). The larger the social network an individual has, the more likely that it will offer tangible and intangible support and resources to help the individual define themselves (Adler & Kwon, 2002; Wellman, 1992). A higher number of individuals in the network translates into a larger potential pool of contacts that are likely to support the individual and share resources (Wellman, 1992). On the other hand, smaller networks have more limited access to information, resources, and support (Granovetter, 1973). Having a larger network can signify to individuals that they are part of a majority group (in-group), as informational and resource benefits received from the larger network can be transformed into psychological resources that offer positive cues for defining social identity and group membership. Therefore, I propose that:

Hypothesis 2 (H2): Individuals with larger professional networks will report higher perceived inclusion in the workplace.

Moreover, strong ties can shape how individuals perceive themselves in the work unit. Close and intimate ties are one example of strong ties (Burt, 2000; Nelson, 1989). Friends are known to provide verified and trustworthy resources and information for career advancement opportunities (Granovetter, 1995; Lin & Dumin, 1986). Friends, who are made through voluntary relationships, provide a more reliable and wider range of support than non-friends (Wiseman, 1986), as friends have a higher level of motivation and feel an obligation and urge to help each other, as well as display greater availability for each other (Granovetter, 1973; Wellman, 1992). Prior studies have demonstrated that friends are more likely to provide each other emotional support, as reciprocity of the support is highly guaranteed (Hobfoll et al., 1986; Wiseman, 1986). Friendships also encourage trust development and cooperative behavior (Lee & Kim, 2011; Lin, 1999) that offer positive cues for social identity definition verifying an individual's in-group membership (Hogg, 2009). Hence, I propose the following hypotheses:

Hypothesis 3 (H3): Individuals with more friends in professional networks will report higher perceived inclusion in the workplace.

3.4.3 Network Structural Characteristics and Individuals' Demographic Attributes

An individual's demographic characteristics shape the impacts of their network size and number of friends on their perceived inclusion. Individuals interpret and make sense of their work environment based on their demographic characteristics (Mowday & Sutton, 1993; Tsui & Gutek, 1999). Individuals with demographic characteristics of the

commonly known out-group members (e.g., people of color, female) are more attentive to their social identities. For example, people of color and women are more likely to be exposed to stereotype threats within the work unit (Beasley & Fischer, 2012; Hoyt et al., 2016; Shapiro & Williams, 2012), which, as a result, affects how they interpret their workplace. According to Spencer and colleagues (2016), individuals feel discouraged and unwelcome when negative stereotypes frame the interpretation of their behaviors by the group.

Similarly, experience in social networks varies by race and gender (Tropp, 2006) and women and people of color are disadvantaged in social interactions with men and White people (Hässler et al., 2020; Saguy et al., 2008). Demographic characteristics often reflect the difference in the number or quality of resources and information individuals can access. For example, people of color and women are considered to be less valuable ties, having fewer or invalid resources, by White people and men and receive fewer network benefits, such as psychological support and career advancement opportunities (Ibarra, 1992; McGuire, 2000; Ridgeway, 2001). As culturally held stereotypes attached to group attributes provide situational cues that shape their perceptions of the workplace (Spencer et al., 2016; Steele et al., 2002), the impacts of social network size and friends on perceived inclusion will depend on individuals' demographic characteristics. Therefore, I propose the following set of hypotheses:

Hypothesis 4 (H4): SOCs and women with larger professional networks will report higher perceived inclusion in the workplace than Whites and men.

Hypothesis 5 (H5): SOCs and women with more friends in professional networks will report higher perceived inclusion in the workplace than Whites and men.

3.4.4 Network Compositional Characteristics

How individuals make sense of their work unit may depend on their overall social environment as well as their subnetworks in both their work unit and outside of it because social cues from social networks can change how individuals perceive their workplace. Social networks provide contexts in which individuals find, construct, and transmit their social identities, given their group membership in the networks (Foreman & Whetten, 2002; Ibarra & Andrews, 1993). Information retrieved from social interactions provides cues that not only help individuals define their social identities but also validate their existing identities (Labianca et al., 1998; McPherson et al., 1992). Social interactions within the network can affect their identities, which in turn can shape how they perceive their workplace. For example, individuals' social relationships can bring information or resources that can be utilized toward increasing a sense of inclusion. Engagement in organizational processes, which is a vital component of perceived inclusion, involves not only the demographic composition of organizational members but also the social relationships among members (Salancik & Pfeffer, 1977; Weick, 1969).

When establishing relationships, individuals tend to seek ties based on homophily, which is a psychological inclination to find and connect with others with whom they have similar attributes, such as gender or race, values, experiences, and background (McPherson & Smith-Lovin, 1987). Interpersonal commonalities lower communication barriers and are more likely to foster trust and cooperative behavior among the network

members (Hoffman, 1985; Ibarra, 1993b). A tendency to form homophilous ties is higher for people of color or women in White- or male-dominant settings as they often find those settings unwelcoming and seek comfort that is more likely to be provided by similar others (Brief et al., 1997; Ely, 1995; D. A. Thomas, 1993). Homophilous relationships provide a higher level of psychological support than multi-race relationships (Thomas, 1993), which positively affects individuals' identities (T. Cox, 1993; Ibarra, 1993b).

Similar others in the network provide psychological support and such informal support positively shapes one's identity (T. Cox, 1993; Ibarra, 1993b; D. A. Thomas, 1993). In particular, identity based on demographic characteristics such as race becomes stronger and improves through social interactions with similar-race other ties (Brookins et al., 1996; Robinson & Smith-Lovin, 1992), because interactions with similar others help maintain, strengthen, and validate individual identities (Robinson & Smith-Lovin, 1992). As the construction of "self" emphasizes a desired image of positive self (Abrams & Hogg, 1990; J. C. Turner, 1975), individuals will exhibit a greater level of commitment and attachment to a group where they can find similar others (Bacharach et al., 2005; Currarini & Mengel, 2016). For example, by looking at Hispanic students, Ethier and Deaux (1994) found that participating in Hispanic student organizations and having Hispanic friends improved students' ethnic identity as Hispanic. Similarly, students in an MBA program at a state university showed a greater tendency to form their network based on race when they entered the program despite that everyone joined the program at the same time and the students were exposed to racially diverse work groups throughout their program (Mollica et al., 2003).

Individuals establish professional networks both inside and outside the organization. The internal workplace network includes relationships within the boundary of the organization, while the external network includes individuals employed in other units or organizations. Interactions with organizational members in internal networks can shape individuals' subjective experiences in the workplace through socialization and identity development (Gersick et al., 2000), while external networks provide additional cues and signals that can be utilized by individuals when they make sense of their workplace (Shrivastava, 2009). External networks provide additional cues and signals that can be utilized by individuals when they make sense of their work unit (Kunda & Thagard, 1996; Shrivastava, 2009). For example, heterogeneity of external networks may affect interaction opportunities for individuals (Blau, 1977). Following the prior literature on workplace inclusion and network homophily (Bae et al., 2017; Chattopadhyay et al., 2010), I expect the demographic network homophily of an individual's overall professional network, as well as the composition of their internal and external networks, will have similar influences on their perceptions of workplace inclusion. Therefore, I propose the following set of hypotheses:

Hypothesis 6 (H6): Individuals with higher network homophily will report higher perceived inclusion in the workplace.

Hypothesis 6a (H6a): Individuals with higher internal network homophily will report higher perceived inclusion in the workplace.

Hypothesis 6b (H6b): Individuals with higher external network homophily will report higher perceived inclusion in the workplace.

3.4.5 The Interplay of Internal and External Networks

An internal network and an external network can affect perceived inclusion in the same or different ways, as they can offer individuals two different group memberships (e.g., in-group and out-group). Individuals who hold multiple group memberships differentiate and integrate their identities in different ways. When individuals are embedded in various social groups, in this case, work unit network and social network outside the workplace, individuals may develop multiple social identities specific to each social group. When they start constructing social identities, they prefer to find a more secure and positive group membership, such as in-group membership, over a negative membership, such as out-group membership (Ashforth & Kreiner, 1999; Tajfel & Turner, 1979; D. C. Thomas, 1999).

Prior studies have demonstrated that individuals shape, customize, and change their definition of "selves" depending on their workplace situation and others they interact with (Pratt et al., 2006; Sluss & Ashforth, 2007). For example, according to social complexity theory, individuals develop different perceptions of their group memberships when they hold multiple group memberships (Miller et al., 2009; Roccas & Brewer, 2002). That is, when individuals are embedded in multiple groups in which they hold in-group member status (i.e., group membership status overlaps across different social groups), they are likely to simplify their construction of "selves," while when they are embedded in different groups that offer in-group member status and out-group

member status, they seek to resolve competing implications from their groups (Roccas & Brewer, 2002). Similarly, uncertainty-identity theory suggests that in the latter case, individuals will develop a higher level of attachment to the group that provides in-group member status because individuals seek a positive image of self (E. U. Choi & Hogg, 2020b; Swann Jr. & Bosson, 2010).

Drawing from uncertainty-identity theory, individuals show different behavioral patterns to one group than to another one depending on the extent to which each group reaffirms their in-group membership (Hogg, 2007). With multiple group memberships, individuals go through a constant process of cognitive evaluation, validation, and confirmation of their social identities when they have multiple group memberships (van Dommelen et al., 2015) to reduce the uncertainty about their identities (E. U. Choi & Hogg, 2020a; Hogg, 2009, 2014). That is, individuals play with their multiple identities until they find an assured identity to which they can attach (Ashforth, 1998). Because positive group identification reduces self-uncertainty, individuals with multiple social identities constantly negotiate or configure their coexisting social identities in an effort to find more positive validation of their identities (A. D. Brown, 2015; E. U. Choi & Hogg, 2020a; Dutton et al., 2010; Levy et al., 2017; Roccas & Brewer, 2002; Sluss & Ashforth, 2007; Tajfel & Turner, 1979; J. C. Turner et al., 1987). After individuals compare and contrast their identities within each social group, they may define new identities, strengthen former social identities, or change their attributes to match with existing groups (Alderfer, 1977; Bienenstock et al., 1990; Ibarra & Barbulescu, 2010; McPherson et al., 1992).

Because the construction of "self" pursues a positive image of the self (Abrams & Hogg, 1990; Brewer & Pierce, 2005; Hogg & Mahajan, 2018; Tajfel & Turner, 1986; J. C. Turner et al., 1987) and demographic characteristics become more salient criteria for identity development (Ashforth & Mael, 1989; Tajfel & Turner, 1986), individuals tend to develop favorable perceptions and show greater inclination for or attachment to a group where their identities are positively evaluated (E. U. Choi & Hogg, 2020a; Luhtanen & Crocker, 1991; Markus & Nurius, 1986; Oakes, 1990; Petriglieri, 2011). For example, a person who is an Asian male professor will cognitively evaluate each of the identities as Asian, man, and professor, and choose the one that offers the highest possibility that he will be positively accepted in the group. He will develop negative perceptions and attitudes toward the group that negatively validates his identities, while showing a greater commitment or attachment to the group that positively validates him (E. U. Choi & Hogg, 2020a; Sherman & Cohen, 2006). When their social identities receive negative feedback from one social group, individuals will seek other social groups that provide positive evaluations while psychologically distancing themselves from the one that provides a negative evaluation of themselves (Hogg & Mahajan, 2018; Sherman & Cohen, 2006). That is, when people are embedded in multiple social groups, they evaluate how their identities are perceived in each group and develop a positive attitude toward the group in which their identities are positively accepted.

In short, when individuals belong to multiple groups, they will compare the extent to which their social identities are positively or negatively perceived by others and show a preference for a group that has a higher likelihood of giving positive validation of their social identities. Based on how individuals differ from or resemble their social networks

inside and outside of the workplace, they will report different levels of inclusion after comparing their social identity status in each social network. I argue that individuals (1) seek to reduce the possibility that their identity will be disproved and (2) develop affection and positive attitudes toward the social networks that provide positive validation when they belong to various social groups. Because internal networks located in one's workplace have a more direct impact on workplace inclusion compared to external networks, I hypothesize that homophily in an internal network will have a more positive impact on one's inclusion than homophily in an external network.

> *Hypothesis 7 (H7): Individuals with a higher ratio of internal network homophily to external network homophily will report higher perceived inclusion in the workplace.*

3.4.6 Network Compositional Characteristics and Individuals' Demographic Attributes

Prior literature has demonstrated that individuals interpret and make sense of their social and work environments based on their race and gender (Mowday & Sutton, 1993; Tsui & Gutek, 1999) and particular types of individuals, who share nondominant demographic characteristics (people of color, women), are more aware of their demography-based social identities. People of color and women have been marginalized from social networks, excluded from resource exchange, and received differential returns from social interactions (Beasley & Fischer, 2012; R. P. Brown & Pinel, 2003; Ibarra, 1992). Based on their experience of marginalization, they will develop their own personal perspective on their workplace.

Women and people of color can benefit more from network homophily, especially for psychological outcomes such as perceived inclusion. The impacts of network homophily become more significant for social identity construction for women and people of color, as the social interactions with similar others generate positive impressions of their identities (Abrams & Hogg, 1990; Brookins et al., 1996); that is, they offer positive identity validation. As social identity construction focuses on developing a positive image of self, women and people of color are likely to develop a stronger preference for and a greater level of attachment to a group composed of similar others (Bacharach et al., 2005; Currarini & Mengel, 2016). Within homophilous networks, people of color and women can share their experiences of marginalization, common interests, and worldviews (Lazarsfeld & Merton, 1954; McPherson & Smith-Lovin, 1987). For them, these similarities indicate that they can talk more openly, trust similar others, and expect reciprocity. For example, Ibarra (1992) found that women show a preference to connect with other women in their organization and receive social support and friendship. Therefore, I expect that people of color and women will receive greater benefits from homophilous networks and propose the following set of hypotheses:

Hypothesis 8 (H8): SOCs and women with more homophilous networks will report higher perceived inclusion in the workplace.

Hypothesis 8a (H8a): SOCs and women with more homophilous internal network will report higher perceived inclusion in the workplace.

Hypothesis 8b (H8b): SOCs and women with more homophilous external network will report higher perceived inclusion in the workplace.

Hypothesis 9 (H9): SOCs and women with a higher ratio of internal network homophily to external network homophily will report higher perceived inclusion in the workplace.

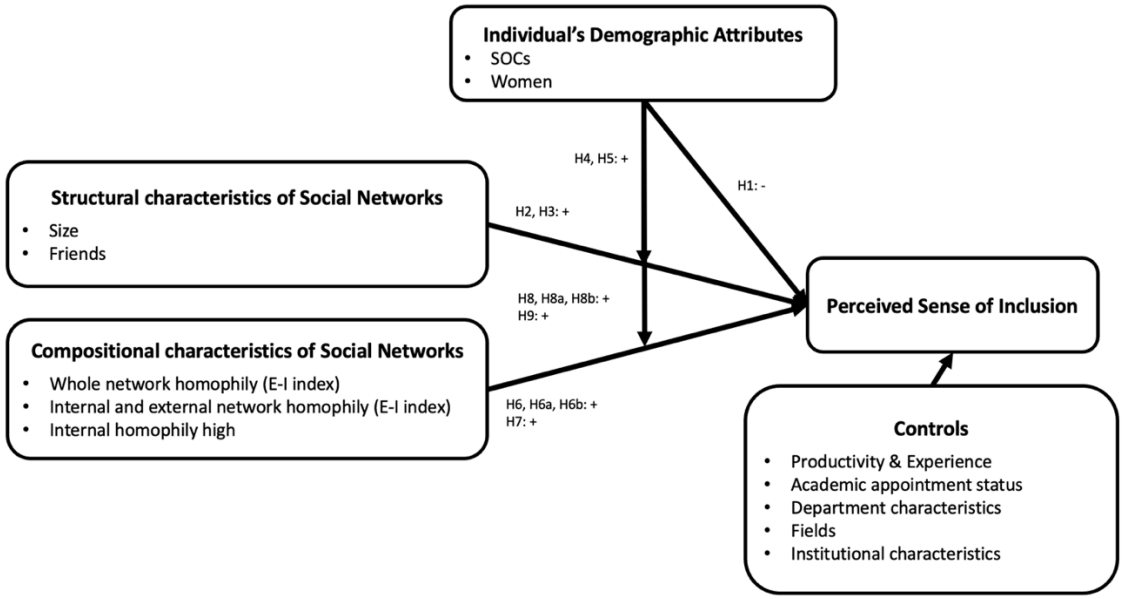
3.5 Conclusion

To better understand how the level of inclusion varies by social structure, this dissertation explores four impacts of social structure on perceived workplace inclusion: (1) the impacts of the individual's demographic attributes, (2) the impacts of social network structural characteristics, (3) the impacts of social network compositional characteristics, and (4) the interplay of demographic attributes and social network structural and compositional characteristics. **Error! Reference source not found.** describes the theoretical model for this study.

While controlling for an individual's characteristics, experience, productivity, organizational characteristics, and institutional characteristics, I investigate the demographic characteristics, network characteristics, and demographic compositions of three social networks (whole, internal network, and external network), and how they interact together and with the individual's demographic characteristics to affect perceived inclusion.

Figure 1

Theoretical Model



includes a summary of the hypotheses. First, I hypothesize that SOCs and women will report lower inclusion because they have been identified as part of an out-group in organizations. Second, I propose that a larger network will improve perceived inclusion, as more people in the network indicate that the individual has more potential connections to find resources and support. Third, I propose that friends will improve perceived inclusion because friends provide psychological and trustworthy support. Fourth, I propose that people of color and women will benefit more from network size and friends because benefits from social networks can buffer their marginalized status. I then hypothesize that having more demographically similar others will improve inclusion because similar others indicate a lowered barrier of communication, offer a higher level of trust, and provide positive cues for social identities. Moreover, I compare the homophily in internal and external networks to hypothesize that when internal network

homophily is higher than external network homophily, individuals will report higher inclusion. Given that individuals compare their social identities when embedded in multiple social groups, they will develop an attachment to the one that offers a positive validation of their identities. Finally, I hypothesize that women and SOCs will benefit more from having higher internal network homophily than external network homophily.

Table 1 includes a summary of the hypotheses. First, I hypothesize that SOCs and women will report lower inclusion because they have been identified as part of an out-group in organizations. Second, I propose that a larger network will improve perceived inclusion, as more people in the network indicate that the individual has more potential connections to find resources and support. Third, I propose that friends will improve perceived inclusion because friends provide psychological and trustworthy support. Fourth, I propose that people of color and women will benefit more from network size and friends because benefits from social networks can buffer their marginalized status. I then hypothesize that having more demographically similar others will improve inclusion because similar others indicate a lowered barrier of communication, offer a higher level of trust, and provide positive cues for social identities. Moreover, I compare the homophily in internal and external networks to hypothesize that when internal network homophily is higher than external network homophily, individuals will report higher inclusion. Given that individuals compare their social identities when embedded in multiple social groups, they will develop an attachment to the one that offers a positive validation of their identities. Finally, I hypothesize that women and SOCs will benefit more from having higher internal network homophily than external network homophily.

Table 1.

Summary of Hypotheses

Hypotheses	
H1	SOCs and women will report lower levels of perceived inclusion in the workplace.
H2	Individuals with larger professional networks will report higher perceived inclusion in the workplace.
H3	Individuals with more friends in professional networks will report higher perceived inclusion in the workplace.
H4	SOCs and women with larger professional networks will report higher perceived inclusion in the workplace than Whites and men.
H5	SOCs and women with more friends in professional networks will report higher perceived inclusion in the workplace than Whites and men.
H6	Individuals with higher network homophily will report higher perceived inclusion in the workplace.
H6a	Individuals with higher internal network homophily will report higher perceived inclusion in the workplace.
H6b	Individuals with higher external network homophily will report higher perceived inclusion in the workplace.
H7	Individuals with a higher ratio of internal network homophily to external network homophily will report higher perceived inclusion in the workplace.
H8	SOCs and women with more homophilous network will report higher perceived inclusion in the workplace.
H8a	SOCs and women with more homophilous internal network will report higher perceived inclusion in the workplace
H8b	SOCs and women with more homophilous external network will report higher perceived inclusion in the workplace
H9	SOCs and women with a higher ratio of internal network homophily to external network homophily will report higher perceived inclusion in the workplace

The next chapter provides descriptions of the data and methods used to test the proposed set of hypotheses.

CHAPTER 4

DATA AND METHOD

4.1 Introduction

Previous chapters describe a review of prior literature on perceived inclusion, marginalization of Scholars of Color (SOCs) and women, social identity theories, and social capital theory to build foundations to develop hypotheses that investigate how different components of social networks and demographic attributes are expected to impact the perceived inclusion in the workplace. In this study, perceived inclusion is defined as the degree to which individuals perceive and feel that they are taking part in crucial organizational processes (Mor Barak & Cherin, 1998). To investigate the structural determinants of perceived inclusion, I argue that various characteristics of social networks – network size, strong ties, homophily, and location of social networks – shape how individuals perceive their workplace in addition to individual's demographic attributes.

The key research questions of this dissertation are: How do different aspects of social structures influence perceived inclusion in the workplace? and How do individuals' demographic attributes shape the impacts of social structures on workplace inclusion? To find the answers to my research questions, I take several steps. First, this dissertation seeks to confirm the relationship between demographic attributes and perceived inclusion in the higher education setting by looking at women and SOCs. Second, the dissertation expects a positive correlation between some aspects of social network structure and perceived inclusion. Moreover, this research separates social

network domains – internal and external to the workplace – to investigate the effects of differential internal and external homophily effects. Additionally, this dissertation argues that the impacts of social networks on the level of inclusion in the workplace will differ for women and SOCs.

This chapter provides descriptions of how data used for this research has been collected, how variables are measured, and how data will be analyzed. The descriptions of data, variables, and correlation among variables are presented. First, a detailed description of the survey data used for the presented research is presented, including the sample frame development, data collection process (including survey administration), and how the final sample for the analyses is constructed. The next section describes the operationalization of dependent variable (i.e., perceived inclusion), independent variables (i.e., SOCs status, gender, social network characteristics), and control variables (i.e., prior experience, rank, productivity, field, institutional types). The last section provides an overview of the data analysis methods and empirical models.

4.2 Sample Development and Data Collection Process

This dissertation uses a 2011 National Science Foundation (NSF) funded national survey (NETWISE II) of academic scientists in four disciplines – biology, biochemistry, mathematics, and civil engineering – at all types of higher education institutions. The survey is specifically designed to look at female and underrepresented minorities in Science, Technology, Engineering, and Mathematics (hereafter, STEM) fields and explores their career, work environment, and professional and collaboration networks. The main goal of the survey was to have a representative sample of gender and different

race and ethnic groups to make significant comparisons among different demographic groups. The sampling strategy includes having faculty in (1) all Carnegie designated institutions, following Carnegie Foundation 2000 classification, and (2) STEM fields designated by the NSF as having low, medium, and high representation of women.

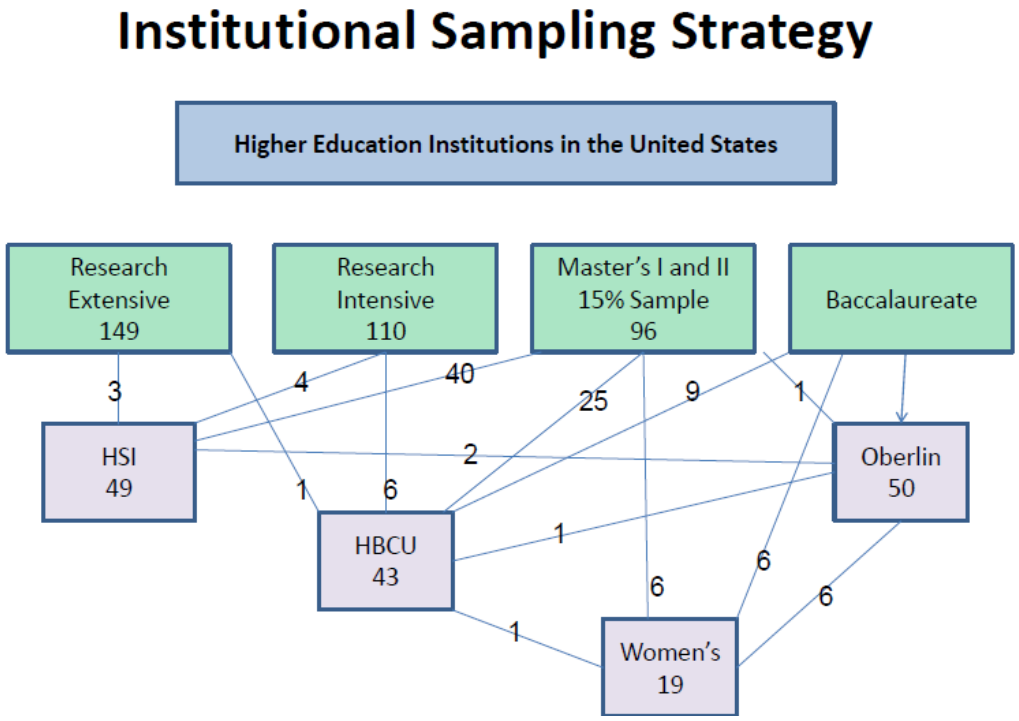
The sampling frame of the surveys includes tenured or tenure-track faculty in four science fields in four main higher education institutions - Research extensive (currently known as Very high research), Research intensive (currently known as High research), Master's I and II, and Baccalaureate. The four STEM fields have been selected based on gender representation using the number of female faculty. Female doctorates are mostly represented and active in biology and biochemistry (high representation), followed by mathematics (medium representation), and civil engineering (low representation) (National Science Foundation, 2006). Given that all STEM disciplines have a low representation of SOCs, race or ethnicity was not considered in the sample frame.

Based on early work on STEM faculty in higher education, Master's I and II and Baccalaureate institutions are included as they also support STEM pipelines. The institutional sampling strategy excludes Associate's institutions, Tribal institutions, Specialty institutions (including medical colleges), and institutions located in Puerto Rico. As a result, the institutional sample includes: 149 Research extensive universities, 110 Research intensive universities, 43 Historically Black Colleges and Universities (HBCUs) in the White House initiative, 49 Hispanic-serving institutions (HSIs), 50 Oberlin Liberal Arts institutions, and 19 Women's Colleges. HBCUs, HSIs, Oberlin Liberal Arts and Women's Colleges are found across the four Carnegie designated

institutional types (Research extensive, Research intensive, Master's I and II, and Baccalaureate). Figure 2 illustrates how the institution sample was drawn.

Figure 2.

Higher Education Institutions Sampling Strategy



Following the sampling strategy, the population of the survey included the following types of institutions: all research-extensive universities and research-intensive universities classified by Carnegie Foundation 2000, historically black colleges, and universities (HBCUs), Hispanic-serving institutions (HSIs), liberal arts colleges, Women's colleges, and Master's I and II institutions. Fields included in the sample frame are biology, biochemistry, civil engineering, and mathematics.

Among the sampling frame of 26,435 faculty in 527 higher education institutions, a random sample of 10,499 faculty in 527 higher education institutions was drawn. The initial population data was developed by retrieving tenured or tenure-track faculty information (names, e-mail address, rank, gender, race) from university department directories and faculty webpages of 527 higher education institutions. During the construction of the population data, faculty's race and gender have been identified by name, photo, individual webpages, and news articles that used gendered pronouns or race-based descriptions. This procedure ensured that there is enough sample size to conduct race- and gender-based analyses and comparisons. Because race identification was harder, the coders were asked to identify the faculty who were likely minorities.

Once the names and other information were collected, the information was merged into a population database. The database entailed information on the faculty's race and ethnicity status, gender, academic rank, institution type, and contact information. The respondents verified their demographic information in the survey. Once the respondents entered the survey, they were asked to self-identify their race and ethnicity as White, Asian/Pacific Islander, African American, Hispanic, Native American/Alaskan, and Other (open-ended text option). Table 2 describes the characteristics of the population and sample.

Table 2.

Characteristics of the Population and Identified Sample

	Population	**Sample**
Total size	26,435	10,499
Number of Institutions	527	527

Number of faculty members in Institution (range)	1 to268	1 to 82
Proportion of faculty who are:		
Female	22%	37%
Assistant Professor	25%	31%
Associate Professor	26%	28%
Full Professor	47%	39%
Distribution by Field		
Biology	37%	32%
Biochemistry	10%	15%
Mathematics	37%	32%
Civil Engineering	16%	18%
Other	1%	2%

The final stratified sample frame includes 9,925 faculty out of 25,928 academic scientists in the US that represent diverse combinations of the stratified categories (gender, race/ethnicity status, discipline/field, and institution type) after removing wrong or bad emails retrieved from university websites. After collecting the faculty information, their emails have been evaluated to see if (1) they are correct e-mail accounts and (2) they are valid (or live) using the ping program. Unless the e-mail accounts were correctable, they were dropped for the final sample. The 25,928 faculty were partitioned into a sampling grid of 112 cells that represented each institution, field, gender, and race combination. Most of the individuals in these cells (83) were sampled with certainty (p=1.0) and 29 cells were sampled at n=200 with a proportion ranging from 0.052 (White male civil engineers in Research extensive universities) to 0.97 (White male biologists in Liberal Arts colleges). The combination of selection-with-certainty and proportional-to-size resulted in the final sample of 9,925 faculty, which is about 38% of the original sampling frame.

In addition, to increase the representation of underrepresented races and ethnicities, a saturated snowball sampling approach was taken. A snowball sample of

1,262 faculty was included from the social network questions in which the respondents named SOC ties in their networks. Respondents in the original sample were asked about their ties and asked to identify if they are underrepresented minorities or not. Those ties who are identified as a minority were considered as possible candidates for the snowball sample. With names and institutional affiliation of those ties, information on contact, rank, affiliation, and field was retrieved. The criteria for inclusion in the respondent-driven sample were if the named individual in the question is tenured or on tenure-track in a STEM field at a 4-year institution. After confirming the information of the named SOC ties (academic rank, discipline/field, gender, race/ethnicity status), the same survey was shared with those SOC ties.

4.2.1 Survey Administration

The research team administered the survey online using Sawtooth® software. The Sawtooth® software allowed the research team to have non-duplicative names of ties from the name-generator questions, in which the respondents were asked to provide names of their ties in their networks so that those non-duplicative names could be piped into the name-interpreter questions, in which the respondents were asked to provide various characteristics of each tie. Individuals were invited through their university e-mails and followed up by reminder e-mails at regular intervals. Before sending out the invitation, their university e-mail addresses were verified through the ping program to confirm that they are correctly working e-mails. The invited individuals received a personalized email letter, which included a personal password and a link to the online survey. Passwords have been uniquely generated for each faculty. The invitees received

two follow-up emails to improve the final response rate. The survey took about 40 minutes to complete.

4.2.2 Survey Data

The NETWISE II survey includes questions about faculty's personal background (e.g., race/ethnicity, gender, citizenship status), professional background (e.g., education), job experience and placement process, productivity (e.g., publications, grants), mentoring, teaching activities, research activities, job satisfaction, work environment, diverse work experience (e.g., leadership, committee), psychometric measures, and professional networks.

A large proportion of the survey was dedicated to collecting network data. The network data collected from this survey is ego-centric data, which indicates that the data looks at the selected relationships of the respondents (i.e., ego) instead of the whole network that the ego is a part of (Wasserman & Faust, 1994). Using Sawtooth ® software enabled the generation of non-duplicative names of social network ties and detailed information on the nature and characteristics of their network for each respondent. The name generator questions asked the respondents to name up to five individuals (i.e., alters) for each of the following work-related activities: research collaboration, seeking teaching advice, seeking career advancement advice, seeking administrative advice, and mentoring (both mentors and mentees).

The survey not only asked about the respondents' network in their workplace but also about their network outside of their work unit. First, the respondents were asked about their social networks to identify colleagues in various categories: research

collaborators, people for teaching advice, people for career advice, people for administrative advice, etc. (the name-generator questions). Following prior literature on social network survey methods (Marsden, 2006; Merluzzi & Burt, 2013), respondents were asked to name up to five individuals in seven different name generating questions: people with whom they go to seek teaching advice and discuss classroom matters (inside and outside the department), people with whom they do research together (inside and outside the department), people with whom they get advice on career or professional development, people with whom they discuss university or department matters, and mentors not mentioned in the previous name generating questions. A total of 35 unique names were possible. Once the individuals were named, the nature and characteristics of the survey asked about the relationships between the respondent and each of the named individuals (name-interpreter questions). Data collected for each tie includes frequency of interactions, length of the relationship, whether the respondents consider their ties as friends, how they met, resources exchanged, gender, underrepresented minority status, whether they are in their department or university, whether they are junior or senior to the respondent, etc.

After removing bad invalid e-mails from the ping program, the final sample includes 9,925 scientists of all ranks (assistant, associate, and full) in 521 academic institutions and the whole survey resulted in a total of 4,196 valid responses out of 4,313 partial and complete responses. Among 4,313 responses, 117 responses were removed because of rank and discipline ineligibility. The final responses of 4,196 faculty resulted in 32,810 non-duplicative network ties. The response rate of the survey was 40.4% based on the American Association for Public Opinion Research (AAPOR) calculation for the

Response Rate 2 (NETWISE II, 2011). Table 3 illustrates how the survey responses are distributed.

Table 3.

General Responses of the Survey Data

	N
Number of complete responses	3560
Number of partial or break-off with partial information	636
Number of explicit refusals	339
Number of nothing was ever returned	5551
Number of unreachable respondents	295
Number of selected respondents screened out of sample	116
Number of ineligibles for sample	114
Removed cases	117

Two additional data are used along with NETWISE II survey data. First, the population data collected by the research team was merged into the survey data. The population data contains information on the department including the whole faculty population, faculty's rank, gender, and whether they are people of color. I aggregate the department-level information to measure and control the department characteristics and merge them into the survey data.

Second, I combined NETWISE II survey data with data from the Integrated Postsecondary Education Data System (IPEDS) from the National Center for Education Statistics (NCES). The research team used the same IPEDS identification number for each university which enabled me to merge two data sets. From the 2011 IPEDS institutional data, I use two institutional characteristics: (1) the proportion of international faculty per university and (2) the locational characteristics of the institution in 2011.

4.3 Final Sample

The dissertation looks at how social network characteristics can explain perceived inclusion in the workplace and how the relationship varies by race and gender. The final sample used for this study includes 2,238 responses. 470 responses are initially removed because (1) participants did not self-identify as an assistant, associate, or full professor, (2) their field was not in the original sample frame, (3) their institution was not part of the original sample frame, or (4) they did not respond to the network questions. After listwise deletion, the final sample used for this research includes 2,238 responses. The primary reasons for the removal of responses were that the respondent did not complete the inclusion and professional experience questions. Table 4 presents the distribution of the respondents in the final sample.

Table 4.

Distribution of Survey Respondents in the Final Sample (N=2,238)

	N	%
SOCs	537	24%
Women	1,021	46%
Assistant Professor	603	27%
Associate Professor	788	35%
Full Professor	847	38%
Biology	851	38%
Biochemistry	427	19%
Civil Engineering	412	18%
Math	548	24%
Research Extensive	570	25%
Research Intensive	408	18%
HBCUs and HSIs	377	17%
Women's and Liberal Arts Colleges	883	39%

Note: HBCU stands for Historically Black Colleges and Universities and HSI stands for Hispanic-serving Institutions.

Slightly less than one quarter (24%) of the final sample is SOCs and about 46% are women. Approximately 38% of the final sample is Full professors followed by Associate professors (35%) and Assistant professors (27%). Looking at disciplines, less than 40% are biologists (38%), followed by mathematicians (24%), biochemists (19%), and civil engineers (18%). When divided by institutional types, about 39% of respondents were from Women's and Liberal Arts Colleges, followed by research extensive universities (25%), research intensive universities (18%), and HBCUs and HSIs (17%). Research extensive universities currently are classified as Very High Research University (R1), while research intensive universities are classified as High Research University (R2) by the Carnegie Classification of Institutions of Higher Education in 2021 (Indiana University Center for Postsecondary Research, 2021).

4.4 Measurements

In this section, I describe how the variables are measured for the analyses in Chapter 5.

4.4.1 Dependent Variable

The dependent variable is *Perceived Sense of Inclusion*, a continuous variable that accounts for how much influence the respondents have compared to their colleagues in their department or unit. The survey asked, "Compared to your colleagues in your department or unit, how much influence do you have over the following decisions?" It is a 5-point Likert scale from Much less influence (=1) to Much more influence (=5) including nine items: "Selection of new faculty", "Selection of unit head", "Selection of

reviewers for your own tenure/promotion", "Who receives tenure or promotion", "Admission of new graduate students", "Allocation of budget/departmental research funding", "Allocation of your service/committee assignments", "The courses that you teach", and "Selection of your teaching/research assistants". To create the inclusion index, the responses across items are averaged. Perceived Sense of Inclusion ranges from 1 to 5, in which a higher score indicates that the individual perceives that they are influential in their department or unit. Cronbach's alpha is 0.85.

Table 5 presents a summary of Confirmatory Factor Analysis using varimax rotation. Descriptive statistics for the dependent variable are presented in Table 6.

Table 5.

Summary of Confirmatory Factor Analysis Result

Variable name	Variable descriptions	Loadings	Communality	Uniqueness
workinfluence_r1	Selection of new faculty.	0.77	0.6	0.4
workinfluence_ r2	Selection of unit head.	0.76	0.57	0.43
workinfluence_r3	Selection of reviewers for your own tenure/promotion.	0.52	0.27	0.73
workinfluence_r4	Who receives tenure or promotion.	0.73	0.54	0.46
workinfluence_r5	Admission of new graduate students.	0.46	0.21	0.79
workinfluence_r6	Allocation of budget/departmental research funding.	0.75	0.56	0.44
workinfluence_r7	Allocation of your service/committee assignments.	0.68	0.46	0.54
workinfluence_r8	The courses that you teach.	0.53	0.28	0.72

workinfluence_r9	Selection of your teaching/research assistants.	0.44	0.2	0.8

Table 6.

Descriptive Summary of Dependent Variable

Variable	N	Mean	Std. Dev.	Min	Max
Perceived inclusion	2,238	2.93	0.66	1	5

4.4.2 Independent Variables

Demographic Characteristics

Demographic composition in the workplace is one of the most studied determinants of perceived inclusion as it matters to the behavioral patterns of employees (Jackson et al., 1991). Bae and colleagues (2017) find that when individuals' gender is different from others in the group, it reduces the perception of inclusion as individuals feel uncomfortable when they interact with others of a different gender. I include two variables to control for individual demographics. First, *SOCs* is a binary variable (1=yes) indicating whether the respondent is either African American, Asian, or Other. Other Race includes respondents who are American Indian or Alaskan Native and who belong to multiple race categories. Second, *Female* is a binary variable (1=yes) that indicates whether the respondent self-identify as female.

Network Characteristics

Before I move to the description of each network variable that has been constructed, I would like to recap how network data has been collected. The relationships

are measured using data on the individual's network in their department as well as outside of their department – research collaborators, career-related advisors, administration-related networks, mentors, and teaching-related advisors. The survey asked respondents to name up to five individuals in seven different name generating questions: people with whom they interact for teaching advice and discussion in and outside the department, people with whom they collaborate on research in and outside the department, people with whom they discuss career or professional development, people with whom they discuss university issues, and mentoring ties not mentioned in the previous name generating questions. In total, respondents possibly enter a total of 35 unique names.

The study uses a non-duplicated list of individuals who are identified to be in the respondent's department and outside of their work unit. Once names were generated, the online software automatically eliminated duplicative names and piped the full set of unique names into subsequent questions in the survey asking about specific characteristics of each tie. This means that the generated names populated the first column of grid questions asking about the demographic (e.g., race and gender) and other characteristics of relationships with each person they named. One of the grid questions asked respondents to indicate whether individuals named were located in the department or outside of it. This variable was used to assign network ties either to internal or external networks. Using the term "close collaborators" for the research questions is reasonable, given that it is typical for scientists to have many collaborators, and our interest was to collect rich personal and relational data.

Network structural characteristics include network size and number of friends and network compositional characteristics include network homophily.

Network Size

Network Size is a count variable that indicates the sum of the individuals named as the respondent's research collaborators, career-related advisors, teaching advisors, administration-related ties, and mentors in his/her department.

Friends

Because close personal relationships in the workplace offer psychological support, friends in the workplace are important determinants of workplace perceptions (Fine, 1986; Kram, 1988; Lincoln & Miller, 1979). The number of individuals they interact with and closer relationships such as friends can assure that individuals have personal contacts, have credible information, and increase the sense of their job security (Pelled et al., 1999). *Friends* is a count variable of names that the respondents have identified as a close friend.

Network Homophily

Using the highly detailed survey data, a measure of network homophily using a metric called the external-internal (E-I) index has been calculated. The E-I index measures the extent to which the respondent's network is demographically similar or dissimilar to their network ties (Krackhardt & Stern, 1988). To construct the E-I index, the following formula has been used:

$$E - I\ Index = \frac{(\text{Demographically dissimilar ties } - \text{ Demographically similar ties})}{(\text{Demographically dissimilar ties } + \text{ Demographically similar ties})}$$

The E-I index ranges from −1 to +1. As the index approaches +1, the ratio of demographically dissimilar ties to similar ties increases, indicating that the network is more heterophilous (dissimilar) from the respondent. If the E-I index equals +1, everyone in the network is dissimilar to the respondent. As the index gets close to −1, the ratio of demographically similar ties to dissimilar ties increases, indicating that network is more homophilous to the respondent. If the E-I index equals −1, everyone in the network is demographically similar to the respondent—it is a completely homophilous network. E-I indices for the whole network (both internal and external) as well as for the internal and external networks, respectively, were created. Since the demographic factors are a strong indicator of homophily, three E-I indices were created for race and gender.

Internal-to-external Network Homophily

A variable to indicate cases in which internal network homophily is higher than external network homophily was created. First, the continuous E-I indices have been recoded into positive scales and then I created a binary variable, *Higher-Internal Homophily* (1=yes), that indicates that the homophily of the internal network is higher than the homophily of the external network. This ratio variable has also been created for both race and gender.

Table 7 illustrates the descriptive summary of independent variables and a correlation table among key variables is presented in Table 8.

Table 7.

Descriptive Statistics of Independent Variables

Variables		N	Mean	Std. Dev.	Min	Max
Demographic characteristics	SOCs	2,238	0.24	0.43	0	1
	Female	2,238	0.46	0.5	0	1
Network structural characteristics	Network Size	2,238	9.59	3.67	2	25
	Non-research Network Size	2,238	6.08	2.90	0	18
	Friends	2,238	2.90	2.64	0	18
	Non-research Friends	2,238	2.21	2.12	0	15
Network compositional characteristics by race	Whole Network E-I index	2,238	-0.50	0.75	-1	1
	Internal Network E-I index	2,238	-0.49	0.79	-1	1
	External Network E-I index	2,238	-0.51	0.76	-1	1
	Higher-internal homophily	2,238	0.16	0.36	0	1
Network compositional characteristics by gender	Whole Network E-I index	2,238	-0.18	0.6	-1	1
	Internal Network E-I index	2,238	-0.15	0.71	-1	1
	External Network E-I index	2,238	-0.20	0.68	-1	1
	Higher-internal homophily	2,238	0.34	0.48	0	1

Table 8.

Correlation Matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Demographic characteristics	SOCs	1													
	Female	-0.08	1												
Network structural characteristics	Network size	-0.12	0.1	1											
	Friends	-0.1	-0.01	0.51	0.5	1									
Network compositional characteristics by race	Whole Network E-I index	0.93	-0.1	-0.11	-0.15	-0.1	-0.12	1							
	Internal Network E-I index	0.86	-0.09	-0.1	-0.13	-0.1	-0.11	0.94	1						
	External Network E-I index	0.92	-0.1	-0.11	-0.15	-0.1	-0.11	0.97	0.86	1					
	Higher-Internal Homophily	0.05	0.01	0.12	0.11	0.1	0.09	0.07	-0.12	0.19	1				
Network compositional characteristics by gender	Whole Network E-I index	-0.08	0.81	0.11	0.13	-0.04	0.02	-0.09	-0.08	-0.09	0	1			
	Internal Network E-I index	-0.08	0.64	0.12	0.14	0	0.03	-0.09	-0.09	-0.09	0.01	0.83	1		
	External Network E-I index	-0.06	0.77	0.09	0.11	-0.05	0	-0.07	-0.06	-0.07	0	0.91	0.58	1	
	Higher-Internal Homophily	-0.03	0.13	0.09	0.09	0.05	0.06	-0.03	-0.01	-0.03	0.03	0.11	-0.31	0.38	1

4.4.3 Control Variables

Diverse factors besides demographic attributes and social network characteristics can shape perceived inclusion in the workplace. The models control for individual characteristics (e.g., productivity and experience, academic appointment), department characteristics, field, and institutional characteristics (e.g., the proportion of international faculty, location, institution types) that may explain variation in the perceived sense of inclusion.

Productivity and Experience

Personal attributes, such as productivity, experience, and professional activities, can be important factors of power and influence which are closely linked to the concept of inclusion (French & Raven, 1959; Ibarra, 1993a; Mor Barak & Cherin, 1998). These variables are convertible to different psychological and social resources such as self-efficacy and influence (Bandura, 1986; Lin & Dumin, 1986). Four variables measure productivity and experience.

First, *Publication* is a continuous variable that indicates the self-reported annual average of peer-reviewed publications over the past five academic years. The survey asks: "Over the past five academic years, on average how many peer-reviewed articles have you published per year?". Because the distribution of the variable is skewed (mean=2.35, sd=3.81, min=0, max=53), it will be log-transformed for analysis to account for the skewness.

Second, *Leadership Experience* is a binary variable (1=yes) indicating whether the respondent currently holds or has ever held leadership positions in their department,

college, or research center. The survey asks if the respondent currently holds or has ever held the following positions: “Appointed or elected department chair or department head”, “Appointed or elected the dean of a school or college”, and “Director of a Research Center or Institute”.

Third, *Committee Experience* is a binary variable (1=yes) which indicates whether the respondent provided services for his/her department or college in the past academic year. The service includes: “Faculty search committees”, “Other department committees”, and “University or College committees”.

Last, *Award Experience* is a count variable which indicates the number of awards the respondent received. Different types of awards include: “Best dissertation award”, “Best book or paper award”, “Junior faculty award from your university”, “Junior faculty award from outside your university”, “Mid-level or advanced career award from a government organization or foundation”, “Teaching award”, “Minority targeted award”, “Gender targeted award”, and “Industry funding for your work”.

Academic Appointment

The degree to which individuals are integrated into the department matters for the perception of inclusion. For example, the length of time spent in the work unit and the formal positions they occupy affect the individuals’ experience in their work units (Katz & Kahn, 1978; O’Reilly et al., 1989; Salancik & Pfeffer, 1977). In addition, a higher concentration of women and SOCs is often found in the lower ranks in the higher education (Corneille et al., 2019; M. F. Fox, 2001). There are two variables that measure academic appointment. First, *Years in Current Appointment* is a continuous variable that

indicates the length of time in the current department. The year that the respondent began the current appointment was subtracted from 2011. Because the distribution of the variable is skewed (mean = 10.96, SD = 9.30, min = 0, max = 46), it will be log-transformed in the analyses to account for the skewness. Second, *Rank* is a binary variable (1=yes) which indicates whether the respondent is Assistant, Associate, or Full professor.

Department Controls

Prior studies have demonstrated that organizational characteristics determine the perceived sense of inclusion within the organization. Because there is a disproportionate representation of women and SOCs in STEM (Blackburn, 2017), how the department is composed can affect how individuals perceive and experience their workplace. For example, low representation of women limits women's ability to find colleagues for research, teaching, and psychological support (Feeney & Bernal, 2010).

Proportion of White Faculty is a continuous variable ranging from 0 to 1 which indicates the ratio of White professors in the department. The number of White faculty was divided by the total number of faculty in the department.

Proportion of Male Faculty is a continuous variable ranging from 0 to 1 which indicates the ratio of male professors in the department. The number of male faculty was divided by the total number of faculty in the department.

Field Characteristics

Unequal representation of women and SOCs is prevalent in STEM fields, yet there are differences among fields (Chang et al., 2014; Cheryan et al., 2017; Hurtado et al., 2010). For example, more women are found in biology-related departments compared to physical sciences (Cheryan et al., 2015). *Field* is a binary variable (1=yes) that indicates whether the respondent belongs to four STEM fields – Biology, Biochemistry, Civil Engineering, and Mathematics.

Institutional Characteristics

There are institutional attributes that could influence how faculty experience their workplace. I include three variables to account for institutional characteristics: proportion of international faculty, institution types, and location of the institution.

First, the number of international faculty can suggest the diverse nature of the institution which can insinuate that the university is more open to accepting diverse individuals (Gahungu, 2011). *Proportion of International Faculty* is the ratio of international faculty in the institution. The demographic information on faculty in 2011 was retrieved from the IPEDS. The sum of international faculty was divided by the total number of faculty in the institution.

Second, because this study includes all types of higher education institutions, it is important to control for institutional differences. For example, less selective institutions are more likely to have collegial workplace culture and a diverse body of students, staff, and faculty (Lent et al., 2010; Mamiseishvili, 2011; Massey et al., 2003; Webber, 2019). *Institution Type* is a binary variable (1=yes) which indicates whether the institution

belongs to four types of institutions: Research Extensive, Research Intensive, HBCUs and HSIs, and Women and Liberal Colleges (Women's and Liberal Arts Colleges, Master's Comprehensive).

Last, the location of the institution make difference in how individuals perceive their workplace. For instance, foreign-born doctorates prefer to work in urban areas where they can find similar immigrants and a more welcoming political environment (Grogger & Hanson, 2015; Isaac & Boyer, 2007; van Holm, 2021). *Institution in City* is a binary variable (1=yes) which indicates whether the institution is located in an urbanized area and inside a principal large city. The locational information of institutions in 2011 was retrieved from the IPEDS. Based on the institution's physical address, the IPEDS identified an urban-centric locale code through a methodology developed by the U.S. Census Bureau's Population Division in 2005. The institutions in the urbanized area include the institutions in: "Territory inside an urbanized area and inside a principal city with population of 250,000 or more", "Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000", and "Territory inside an urbanized area and inside a principal city with population less than 100,000".

Table 9 presents the descriptive statistics for the control variables.

Table 9.

Descriptive Statistics of Control Variables

Variables	N	Mean	Std. Dev.	Min	Max
Publication	2,238	2.35	3.81	0	53
Leadership experience	2,238	0.31	0.46	0	1

Variables	N	Mean	Std. Dev.	Min	Max
Committee experience	2,238	0.63	0.48	0	1
Award experience	2,238	1.13	1.19	0	8
Years in Current Appointment	2,238	10.96	9.30	0	46
Assistant professor	2,238	0.27	0.44	0	1
Associate professor	2,238	0.35	0.48	0	1
Full professor	2,238	0.38	0.49	0	1
Proportion of White Faculty	2,238	0.83	0.2	0	1
Proportion of Male Faculty	2,238	0.71	0.18	0	1
Biology	2,238	0.38	0.49	0	1
Biochemistry	2,238	0.19	0.39	0	1
Civil Engineering	2,238	0.18	0.39	0	1
Mathematics	2,238	0.24	0.43	0	1
Proportion of International Faculty	2,238	0.05	0.06	0	0.64
Research Intensive	2,238	0.18	0.39	0	1
Research Extensive	2,238	0.25	0.44	0	1
HBCU & HIS	2,238	0.17	0.37	0	1
Women & Liberal Colleges	2,238	0.39	0.49	0	1
Institution in City	2,238	0.58	0.49	0	1

4.5 Data Analysis Method

This section is dedicated to discussing the method and model estimation. The analyses focus on investigating the determinants of perceived inclusion of academic science by looking at demographic characteristics and social network structural and compositional characteristics. The dependent variable and independent variables come from the NETWISE II survey of science faculty in 2011 with additional data on departments and institutions collected by the research team and from IPEDS.

This study adopts a quantitative-method design; in particular, I use a quantitative methodology (survey and statistical analysis). Workplace inclusion in US universities is of particular interest and significance due to the high proportion of diverse faculty. Specifically, this study looks at workplace inclusion in the field of science by looking at STEM departments and scientists' networks in the department and outside of the

department. Despite the increasing effort to include diverse faculty, traditionally dominant demographic groups (e.g., White or men, or both) have dominated STEM fields in terms of their presence, influence, and leadership. Prior literature has found that women and SOCs have been left out of leadership positions, organizational processes, and resources (Chin, 2013; Valverde, 2003). In this study, I look at how race and gender play out as group boundaries defining one's social identity status. In addition, scientists not only share knowledge through their collaboration networks but also share values and cognitive dispositions through interactions with network members (Crane, 1972; Hagstrom, 1964). Hence, I look at how individuals develop different social identities using race and gender as criteria that determine social identity in the workplace and external networks and compare their group membership status across different social structures. Controlling for individual characteristics (e.g., age, rank, productivity, awards received, leadership experience), organizational characteristics (e.g., fields, department characteristics), and institutional characteristics (e.g., location, institution types), I test hypotheses using Ordinary Least Squares (OLS) regression on data from 2011 NSF-funded national survey of academic faculty on work environment and careers in US universities.

The use of OLS regression models is based on a number of assumptions about the data and the study (Kachigan, 1991; Wooldridge, 2010). Because the dependent variable, perceived inclusion, is a continuous variable which is normally distributed, OLS regression is more appropriate than other generalized linear modeling techniques such as logistic regression or log-linear regression (Hutcheson, 1999). Additionally, post estimation analysis demonstrated that the residuals for the regression equations were

normally distributed, further confirming the selection of OLS regression models. To account for heteroscedasticity, I use clustered robust standard errors and adjust them for clusters at the department level since each respondent is nested in their own disciplinary departments and universities (Cameron & Miller, 2015).

Each model has been checked with multicollinearity issues which stem when independent variables (or explanatory variables) are highly correlated (Farrar & Glauber, 1967). High multicollinearity disrupts estimation by creating a larger variance for the estimates which results in overestimated standard errors.

To make sure that the models do not have issues with multicollinearity, each model has been assessed by looking at the Variance Inflation Factors (VIFs). VIFs are used to measure the extent to which the variance of the coefficients is overestimated by comparing the non-inflated baseline of predictors which are linearly independent (Thompson et al., 2017). In general, the rule of thumb for social science research is that VIF larger than 10 signifies high multicollinearity across predictor variables (Lewis-Beck et al., 2003; Thompson et al., 2017). Results for the multicollinearity for each model are presented along with the regression results in the subsequent chapter. None of the estimation models has shown VIF larger than 10, which confirms that multicollinearity is not an issue.

In particular, high correlations between race and race-based homophily, and gender and gender-based homophily make it necessary to conduct sub-group analysis for race and gender to examine the impact of different types of professional networks on perceptions of inclusion for Whites and SOCs as well as men and women. For this research, racial homophily was based on "SOCs" status because the network survey items

only asked about whether each network tie is a minority, not whether the tie is African American, Asian, etc.

4.6 Estimation Model

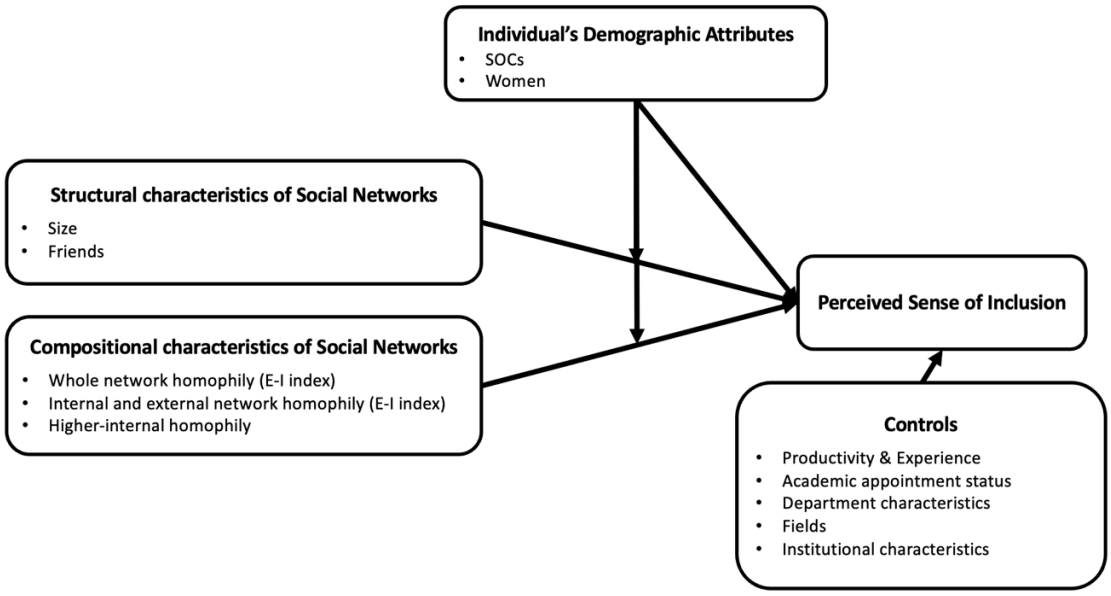
The empirical models[1] for predicting perceived inclusion are presented in Figure 3. First, I predict the perceived sense of inclusion with individual's demographic attributes (SOC status, gender) while controlling for control variables. I expect that SOCs and women will report lower inclusion than White and male colleagues. Second, I predict sense of inclusion by structural characteristics of social networks by looking at the impacts of network size and number of friends. I expect that network size and friends will increase one's inclusion. Moreover, I predict perceived inclusion with compositional characteristics of social networks using network homophily variables. I use the E-I index for the whole network, internal network, and external network to find support for my expectations that network homophily improves inclusion. I then use *Higher-Internal Homophily* variable, which suggests that the respondent has higher internal network homophily compared to their external network, to see if the higher internal network homophily increases inclusion. Fourth, I test how individual's demographic attributes moderate the relationships between a perceived sense of inclusion and network characteristics. I expect that SOCs and/or women will benefit more from their networks to improve their perception of inclusion.

[1] Please note that each model has clustered standard errors by departments and reference groups for each model are Assistant professor, Biology, and Research intensive.

In the next chapter, I analyze the respondent sample, present descriptive statistics, and report the regression estimation results to test my hypotheses presented in Chapter 3.

Figure 3.

Presentation of Estimation Models for Analyses



CHAPTER 5

RESULTS

5.1 Introduction

A key objective of this dissertation is to understand how network structural factors shape one's perception of inclusion in the workplace. In Chapter 3, hypotheses to investigate the relationship between social structures and perceived inclusion have been developed based on social identity theory and social capital theory. In Chapter 4, data, measurement, and research methods used for empirical analyses were presented. This chapter presents empirical models, hypotheses testing, and the results of the models.

To understand the relationship between different social structures (individual's demographic characteristics, social network structural and compositional characteristics), the subsequent sections include detailed descriptions of the respondent sample, results of the empirical models as well as interpretations of the findings. The chapter concludes with a summary table of findings.

5.2 Respondent Sample Distribution

In this section, basic information about the respondent sample is presented to better understand the respondents included in this study. I, first, present the description of the sample by race and gender, respectively to account for the diverse demographic backgrounds of the individuals. I then present the description of the network characteristics by race and gender, respectively.

5.2.1 Description of Sample by Race and Gender

The survey asked respondents to self-report their gender as well as their race and ethnicity. Respondents could identify as either male or female for gender and as either White, African American or American Indian or Alaskan Native or Asian, or Others. Table 10 presents the summary of respondents by gender and race. Descriptive statistics on self-reported gender show that about 46% are women in the sample. Descriptive statistics on race show that slightly more than three-fourths of the respondents are White (76%), followed by Asians (15%) and African Americans (5%). Because there were too few American Indians and Alaskan Natives (n=5), I incorporated them into the 'Others' category which includes individuals who did not identify as either White, African American, Asian or American Indian or Alaskan Native or who identified as belonging to multiple race categories. The merge resulted in 76 respondents (about 3% of total respondents) in the 'Others' category.

Table 10.

Summary of Demographic Characteristics of the Respondents

Demographic categories	N	%
Female	1,021	46%
Male	1,217	54%
White	1,701	76%
African American	118	5%
Asian	343	15%
American Indian or Alaskan Native	5	0.2%
Others	71	3%

Furthermore, Table 11 illustrates the respondent breakdown by race and gender. Among the White respondents, about 48% are women. Approximately 40% of African Americans and Asians are women. Among the respondents who fit in 'Others' (American Indian or Alaskan Native and original Others) category, about 37% are women (n=28).

Table 11.

Summary of the Respondents by Race and Gender

Race/Ethnicity	Gender	N	%
White	Female	815	48%
	Male	886	52%
African American	Female	46	39%
	Male	72	61%
Asian	Female	132	38%
	Male	211	62%
American Indian or Alaskan Native	Female	3	60%
	Male	2	40%
Others	Female	25	35%
	Male	46	65%

In the following analyses, I combine African American, Asian, and Others into a single category of Scholars of Color (SOCs) for two reasons. First, because the correlations between race and race-based homophily and between gender and gender-based homophily are high, I had to conduct a sub-group analysis for race and gender to investigate the impacts of social networks on White, SOCs, men, and women. Second, because this study looks at the demographic match between the respondents and their network, I had no choice but to combine diverse race categories. The survey items on the network only ask about whether each respondent's tie is minority or not, not about a

specific race or ethnic category. The limitation of this approach will be discussed in Chapter 6.

5.2.2 Description of Sample' Network Characteristics by Race and Gender

In this section, I present the network characteristics of the respondents. The survey asked the respondents to name up to five individuals for seven different professional networks, including research collaborators, individuals they talk about teaching or general university matters, and mentors.

Table 12.

Summary of Network Characteristics

Variables		N	Mean	Std. Dev.	Min	Max
Network structural characteristics	Network Size	2,238	9.59	3.67	2	25
	Friends	2,238	2.90	2.64	0	18
Network compositional characteristics by race	Whole Network E-I index	2,238	-0.50	0.75	-1	1
	Internal Network E-I index	2,238	-0.49	0.79	-1	1
	External Network E-I index	2,238	-0.51	0.76	-1	1
	Higher-Internal Homophily	2,238	0.16	0.36	0	1
Network compositional characteristics by gender	Whole Network E-I index	2,238	-0.18	0.6	-1	1
	Internal Network E-I index	2,238	-0.15	0.71	-1	1
	External Network E-I index	2,238	-0.20	0.68	-1	1
	Higher-Internal Homophily	2,238	0.34	0.48	0	1

Table 12 shows the summary descriptive statistics of network-related variables. Overall, the respondents have a network with about 9 ties on average and have about 3 friends in their overall network. The whole network E-I indices, which measure the extent to which the network is demographically similar or dissimilar to the respondents (-1 indicating complete homophily and +1 indicating complete heterophily), show values of -0.50 for race and -0.18 for gender. This suggests that the respondents were more likely to have higher racial homophily than gender homophily. Looking at *Internal Network E-I index* and *External Network E-I index*, external networks are slightly more likely to be homophilous by both race and gender. *Higher-Internal Homophily* is a binary variable that indicates whether internal network homophily is higher than external network homophily (1=yes). About 16% of respondents have higher race-based homophily in their internal network compared to their external network and approximately 34% have higher gender-based homophily in their internal network compared to their external network.

The network characteristics are broken down by race in

Table 13. When looking at the network structural characteristics (size, friends), Whites have more ties and friends than SOCs. The difference between White faculty and SOCs becomes more prominent when we look at E-I indices by race. Whereas White faculty have highly homophilous networks regardless of the location of the networks, SOCs have highly heterophilous networks. To see if the differences are statistically meaningful, I conduct Welch Two Sample *t*-tests in Section 5.6.

Table 13.

Summary of Network Characteristics by Race

Variables		Race	N	Mean	Std. Dev.	Min	Max
Network structural characteristics	Network Size	White	1,701	9.84	3.65	2	25
		SOCs	537	8.77	3.61	2	21
	Friends	White	1,701	3.05	2.66	0	18
		SOCs	537	2.43	2.54	0	16
Network compositional characteristics by race	Whole Network E-I index	White	1,701	-0.89	0.2	-1	0.5
		SOCs	537	0.73	0.44	-1	1
	Internal Network E-I index	White	1,701	-0.87	0.33	-1	1
		SOCs	537	0.73	0.57	-1	1
	External Network E-I index	White	1,701	-0.9	0.24	-1	1
		SOCs	537	0.73	0.47	-1	1
	Higher-Internal Homophily	White	1,701	0.15	0.36	0	1
		SOCs	537	0.19	0.39	0	1
Network compositional characteristics by gender	Whole Network E-I index	White	1,701	-0.15	0.58	-1	1
		SOCs	537	-0.27	0.66	-1	1
	Internal Network E-I index	White	1,701	-0.11	0.69	-1	1
		SOCs	537	-0.25	0.76	-1	1
	External Network E-I index	White	1,701	-0.18	0.66	-1	1
		SOCs	537	-0.27	0.72	-1	1
	Higher-Internal Homophily	White	1,701	0.35	0.48	0	1
		SOCs	537	0.32	0.47	0	1

Higher-Internal Homophily is a dummy variable for when respondents have higher internal network homophily than external network homophily (1=yes). About 15% of White faculty have higher internal network homophily based on the race compared to their external network, while about 19% of SOCs have higher internal network homophily based on race. When looking at compositional characteristics of the network by gender, overall, both White and SOCs have homophilous networks regardless of the locations of networks (external or internal). It is notable that SOCs' gender-based E-I index is larger in absolute terms indicating that they have more gender homophilous

networks than Whites. However, when E-I indices are compared by network locations, approximately 35% of White faculty have higher internal homophily based on gender compared to the external network and about 32% of SOCs have higher internal network homophily than external network.

Table 14 shows the network characteristics broken down by gender. Looking at network structural characteristics, women have about 10 ties in their whole network and about 3 friends in the overall network on average, whereas men have about 9 ties in their whole network and 3 friends in the overall network. Women have more racially similar networks than men, regardless of network locations. About 15% of men have higher internal racial homophily when compared to their external network and about 16% of women have higher internal racial homophily to their external network.

Table 14.

Summary of Network Characteristics by Gender

Variables		Gender	N	Mean	Std. Dev.	Min	Max
Network structural characteristics	Network Size	Male	1,217	9.26	3.59	2	25
		Female	1,021	9.97	3.73	2	24
	Friends	Male	1,217	2.93	2.78	0	18
		Female	1,021	2.86	2.46	0	16
Network compositional characteristics by race	Whole Network E-I index	Male	1,217	-0.43	0.79	-1	1
		Female	1,021	-0.58	0.69	-1	1
	Internal Network E-I index	Male	1,217	-0.42	0.83	-1	1
		Female	1,021	-0.57	0.74	-1	1
	External Network E-I index	Male	1,217	-0.44	0.8	-1	1
		Female	1,021	-0.59	0.71	-1	1
	Higher-Internal Homophily	Male	1,217	0.15	0.36	0	1
		Female	1,021	0.16	0.37	0	1
Network	Whole Network E-I index	Male	1,217	-0.63	0.32	-1	0.5
		Female	1,021	0.36	0.39	-1	1
		Male	1,217	-0.56	0.5	-1	1

Variables		Gender	N	Mean	Std. Dev.	Min	Max
compositional characteristics by gender	Internal Network E-I index	Female	1,021	0.35	0.59	-1	1
	External Network E-I index	Male	1,217	-0.68	0.39	-1	1
		Female	1,021	0.37	0.48	-1	1
	Higher-Internal Homophily	Male	1,217	0.29	0.45	0	1
		Female	1,021	0.41	0.49	0	1

Looking at network compositional characteristics by gender, the difference between men and women becomes more salient. While men have gender homophilous networks in general (regardless of network locations), women overall report that they have gender heterophilous networks. While about 29% of men have higher internal than external gender-based network homophily and approximately 41% of women have higher internal than external gender-based network homophily. To see if the differences are statistically significant, I conduct Welch Two Sample *t*-tests in Section 5.6.

5.3 Descriptive Summary

The current section provides a general descriptive summary of all variables used in the analyses. Descriptive statistics of variables used in the analyses can be found in Table 15. The mean of the dependent variable, perceived inclusion, is 2.93. About 24% of the respondents are SOCs, which include African Americans, Asians, American Indian or Alaskan Native, and other races and ethnicities, and approximately 46% are self-reported women. On average, the respondents have 9 ties in their network and about 3 are considered their friends. When looking at E-I indices, regardless of the demographic attribute, the respondents have homophilous social networks (negative value indicates homophily). In Table 15, *Higher-Internal Homophily* indicates whether the respondents

have higher homophily in their internal network compared to their external network (1=yes). Approximately 16% of the respondents have higher race-based homophily in their internal network compared to their external network and about 34% have higher gender-based homophily in their internal network compared to their external network.

Moreover, about 31% of the respondents are currently in leadership positions or have held a leadership position in the past, and approximately 63% of the respondents report that they have served on a committee in their department and university. On average, respondents received one award and published about two peer-reviewed publications. About 38% of the respondents are full professors, followed by associate professors (35%) and assistant professors (27%). On average, the respondents stayed in their current institution for 11 years. Less than 60% of respondents' institutions are in the metropolitan area.

Table 15.

Descriptive Summary of All Variables

Variables	N	Mean	Std. Dev.	Min	Max
Dependent variable					
Perceived inclusion	2,238	2.93	0.66	1	5
Independent variables					
Demographic attributes variables					
SOCs	2,238	0.24	0.43	0	1
Female	2,238	0.46	0.5	0	1
Network structure variables					
Network size	2,238	9.59	3.67	2	25
Friends	2,238	2.9	2.64	0	18
Network composition variables by race					
Whole Network E-I index	2,238	-0.5	0.75	-1	1
Internal Network E-I index	2,238	-0.49	0.79	-1	1

Variables	N	Mean	Std. Dev.	Min	Max
External Network E-I index	2,238	-0.51	0.76	-1	1
Higher-Internal Homophily	2,238	0.16	0.36	0	1
Network composition variables by gender					
Whole Network E-I index	2,238	-0.18	0.6	-1	1
Internal Network E-I index	2,238	-0.15	0.71	-1	1
External Network E-I index	2,238	-0.2	0.68	-1	1
Higher-Internal Homophily	2,238	0.34	0.48	0	1
Control variables					
Productivity and experience					
Leadership experience	2,238	0.31	0.46	0	1
Committee experience	2,238	0.63	0.48	0	1
Award experience	2,238	1.13	1.19	0	8
Average publication	2,238	2.35	3.81	0	53
Academic appointment					
Assistant professor	2,238	0.27	0.44	0	1
Associate professor	2,238	0.35	0.48	0	1
Full professor	2,238	0.38	0.49	0	1
Years in current appointment	2,238	10.96	9.3	0	46
Department characteristics					
Proportion of White faculty	2,238	0.83	0.2	0	1
Proportion of male faculty	2,238	0.71	0.18	0	1
Field characteristics					
Biology	2,238	0.38	0.49	0	1
Biochemistry	2,238	0.19	0.39	0	1
Civil engineering	2,238	0.18	0.39	0	1
Math	2,238	0.24	0.43	0	1
Institutional characteristics					
Proportion of international faculty	2,238	0.05	0.06	0	0.64
Research intensive	2,238	0.18	0.39	0	1
Research extensive	2,238	0.25	0.44	0	1
HBCU and HSI	2,238	0.17	0.37	0	1
Women & Liberal Colleges	2,238	0.39	0.49	0	1
Institution in city	2,238	0.58	0.49	0	1

5.4 Correlations

This section illustrates the correlation between variables used in the analyses. Table 16 presents the correlations among variables. One noticeable thing is that demographic attribute variables (SOCs, female) are highly correlated to E-I indices. These correlations are not surprising given that demographic characteristics are strong indicators of with whom individuals connect and interact (McPherson et al., 2001; McPherson & Smith-Lovin, 1987; Mollica et al., 2003). Because the current study seeks to investigate how the impacts of social networks on workplace inclusion vary by diverse individuals, it is necessary to conduct sub-group analyses to investigate how social structures impact perceived inclusion. For models for network homophily, the race variable has been removed from the equation which predicts perceived inclusion by race-based homophily and the gender variable has been removed from the equation which predicts perceived inclusion by gender-based homophily to remove potential multicollinearity issues.

Table 16.

Correlation Matrix of All Variables

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1	Perceived inclusion	1																																
2	Female	-0.14	1																															
3	SOCs	-0.14	-0.08	1																														
4	Network size	0.13	0.1	-0.12	1																													
5	Friends	0.1	-0.01	-0.1	0.51	1																												
6	Whole Network E-I index (race)	-0.14	-0.1	0.93	-0.11	-0.1	1																											
7	Internal Network E-I index (race)	-0.13	-0.09	0.86	-0.1	-0.1	0.94	1																										
8	External Network E-I index (race)	-0.14	-0.1	0.92	-0.11	-0.1	0.97	0.86	1																									
9	Higher-internal homophily (race)	-0.03	0.01	0.05	0.12	0.1	0.07	-0.12	0.19	1																								
10	Whole Network E-I index (gender)	-0.11	0.81	-0.08	0.11	-0.04	-0.09	-0.08	-0.09	0	1																							
11	Internal Network E-I index (gender)	-0.06	0.64	-0.08	0.12	0	-0.09	-0.09	-0.09	0.01	0.83	1																						
12	External Network E-I index (gender)	-0.12	0.77	-0.06	0.09	-0.05	-0.07	-0.06	-0.07	0	0.91	0.58	1																					
13	Higher-internal homophily (gender)	-0.04	0.13	-0.03	0.09	0.05	-0.03	-0.01	-0.03	0.03	0.11	-0.31	0.38	1																				
14	Leadership experience	0.41	-0.16	-0.09	0.08	0.06	-0.09	-0.09	-0.08	0.02	-0.12	-0.06	-0.15	-0.08	1																			
15	Committee experience	-0.02	0.04	-0.05	-0.02	-0.01	-0.04	-0.04	-0.04	-0.04	0.02	-0.01	0.03	0.08	-0.03	1																		
16	Award experience	0.16	-0.01	0	0.17	0.08	0	-0.01	0	0.03	-0.01	0	-0.02	-0.02	0.12	-0.03	1																	
17	Average publication	0.04	-0.09	0.08	0.06	0.05	0.08	0.07	0.08	-0.04	-0.06	-0.05	-0.06	-0.02	-0.01	-0.01	0.16	1																
18	Assistant professor	-0.39	0.15	0.08	-0.07	-0.11	0.08	0.08	0.08	0.01	0.13	0.08	0.13	0.06	-0.35	0	-0.18	-0.07	1															
19	Associate professor	0	0.04	0	-0.02	-0.02	0	0	0	0	0.02	0.02	0.02	0.01	-0.16	0.04	-0.05	-0.05	-0.45	1														
20	Full professor	0.36	-0.17	-0.08	0.09	0.12	-0.08	-0.07	-0.08	-0.01	-0.14	-0.1	-0.14	-0.07	0.48	-0.04	0.21	0.11	-0.47	-0.58	1													
21	Years in current appointment	0.23	-0.14	-0.12	-0.02	0.08	-0.13	-0.11	-0.13	-0.04	-0.12	-0.09	-0.13	-0.06	0.41	0.01	0.07	-0.05	-0.47	-0.12	0.54	1												
22	Proportion of white faculty	0.13	0.07	-0.31	0.08	0.03	-0.27	-0.25	-0.26	-0.1	0.08	0.09	0.06	0.01	0.05	0.08	-0.05	-0.05	-0.06	0.02	0.03	0.08	1											
23	Proportion of male faculty	0	-0.19	0.02	-0.09	-0.07	0.03	0.05	0.03	-0.07	-0.14	-0.1	-0.14	-0.09	-0.04	-0.03	0.13	0.12	-0.05	-0.01	0.05	0.02	0.14	1										
24	Biology	0	0.11	0.01	0.17	0.1	0.01	-0.01	0.02	0.05	0.09	0.07	0.1	0.07	-0.04	0.01	-0.09	-0.03	0.05	0.02	-0.06	-0.04	0.11	-0.32	1									
25	Biochemistry	0	-0.05	-0.08	0.04	-0.02	-0.07	-0.07	-0.07	-0.03	-0.03	-0.02	-0.03	0.01	0.02	0	0.01	0.05	-0.05	0	0.04	0.02	0.11	0	-0.38	1								
26	Civil engineering	0.01	-0.06	0.04	-0.11	-0.1	0.06	0.07	0.05	-0.02	-0.06	-0.06	-0.04	-0.04	0.01	-0.04	0.22	0.08	0.01	0	-0.01	-0.08	-0.24	0.33	-0.37	-0.23	1							
27	Math	-0.02	-0.02	0.03	-0.14	-0.01	0	0.01	-0.01	-0.01	-0.03	0	-0.05	-0.05	0.02	0.03	-0.11	-0.08	-0.02	-0.03	0.05	0.1	-0.01	0.06	-0.45	-0.28	-0.27	1						
28	Proportion of international faculty	-0.05	0	0.04	0.01	-0.03	0.04	0.04	0.04	-0.05	0.02	0.03	0.01	-0.04	-0.06	-0.01	0.12	0.11	0.03	-0.01	-0.02	-0.02	-0.04	0.14	-0.02	-0.01	0.11	-0.07	1					
29	Research intensive	0.01	-0.02	-0.01	-0.01	-0.03	0	0	0	-0.05	-0.04	-0.04	-0.03	0	-0.05	0	0.01	0.07	-0.03	0.03	0	-0.03	0.08	0.13	-0.02	-0.02	0.06	-0.02	-0.02	1			
30	Research extensive	-0.11	0.09	0.1	0.06	-0.02	0.12	0.11	0.11	-0.07	0.11	0.09	0.1	-0.03	-0.15	-0.05	0.16	0.21	0.03	-0.03	0.01	-0.03	-0.12	0.18	-0.07	0.06	0.15	-0.12	0.42	-0.28	1			
31	HBCU and HSI	-0.04	-0.05	0.14	-0.03	0.02	0.09	0.08	0.09	0.13	-0.07	-0.07	-0.04	0.03	-0.01	-0.05	-0.04	-0.03	0.06	-0.02	-0.03	-0.05	-0.26	0	0.11	-0.11	-0.09	0.05	-0.11	-0.21	-0.26	1		
32	Women & Liberal Colleges	0.13	-0.02	-0.19	-0.02	0.03	-0.17	-0.16	-0.17	0	-0.02	0.01	-0.04	0	0.17	0.08	-0.12	-0.21	-0.04	0.02	0.01	0.09	0.24	-0.26	-0.01	0.04	-0.11	0.08	-0.28	-0.38	-0.47	-0.36	1	
33	Institution in city	-0.03	-0.03	0.11	0	-0.01	0.09	0.08	0.1	0.02	-0.01	-0.01	-0.01	-0.04	-0.11	-0.04	0.02	0.09	0.04	-0.01	-0.03	-0.05	-0.1	0.13	0.03	-0.05	0.06	-0.04	0.07	0.04	0.15	0.17	-0.3	1

5.5 Model Estimation

The results of OLS models that predict structural determinants of perceived inclusion are presented in Table 19Table 31. For each model, I report coefficients and robust standard errors, which are clustered at the department level, as well as Variance Inflation Factors (VIFs). I run models on full sample and sub-sample by race and gender (White, SOCs, men, women, White men, White women, male SOCs, and female SOCs). Sub-sample analyses allow me to investigate more nuanced impacts of social networks on perceived inclusion. In the models in which I predict perceived inclusion with network homophily variables, network size is added as a control variable to account for variation in how many individuals are in one's network. In addition to regression analyses, I run *t*-tests to investigate whether there is a difference in dependent variable and homophily variables by race and gender.

5.6 T-tests

In section 5.3, I notice differences across race and gender for the variable of interest (perceived inclusion) and one of the key independent variables (network homophily). This section describes *t*-test results to confirm race- and gender-based differences.

5.6.1 Perceived Inclusion

When looking at perceived inclusion, on average, White and men report slightly higher inclusion in their workplace than SOCs and women (

Table 17).

Table 17.

Descriptive Comparison of Perceived Inclusion by Race and Gender

	N	Mean	Std. Dev.	Min	Max
White	1,701	2.98	0.64	1	5
SOCs	537	2.76	0.69	1	5
Men	1,217	3.01	0.67	1	5
Women	1,021	2.83	0.63	1	5

To check if there is a statistical mean difference by race and gender, I conduct Welch two-sample *t*-tests using R statistical Computing Software. SOCs (mean=2.76) reported significantly lower levels of perceived inclusion compared to White faculty (mean=2.98), $t(839)=6.60$, $p<0.001$. Moreover, women (mean=2.83) reported significantly lower levels of perceived inclusion than men (mean=3.01), $t(2205)=6.86$, $p<0.001$.

5.6.2 Network Homophily

To check if the race- and gender-based differences are statistically significant for network homophily variables (see Table 18), I conduct Welch two-sample *t*-tests on the following variables: *Internal Network E-I index, External Network E-I index*, and *Higher-Internal Homophily*.

Table 18.

Descriptive Statistics of Network Homophily by Race and Gender

Variables		Category	N	Mean	Std. Dev.	Min	Max
Network compositional characteristics by race	Internal Network E-I index	White	1,701	-0.87	0.33	-1	1
		SOCs	537	0.73	0.57	-1	1
	External Network E-I index	White	1,701	-0.9	0.24	-1	1
		SOCs	537	0.73	0.47	-1	1
	Higher-Internal Homophily	White	1,701	0.15	0.36	0	1
		SOCs	537	0.19	0.39	0	1
	Internal Network E-I index	Male	1,217	-0.42	0.83	-1	1
		Female	1,021	-0.57	0.74	-1	1
	External Network E-I index	Male	1,217	-0.44	0.8	-1	1
		Female	1,021	-0.59	0.71	-1	1
	Higher-Internal Homophily	Male	1,217	0.15	0.36	0	1
		Female	1,021	0.16	0.37	0	1
Network compositional characteristics by gender	Internal Network E-I index	White	1,701	-0.11	0.69	-1	1
		SOCs	537	-0.25	0.76	-1	1
	External Network E-I index	White	1,701	-0.18	0.66	-1	1
		SOCs	537	-0.27	0.72	-1	1
	Higher-Internal Homophily	White	1,701	0.35	0.48	0	1
		SOCs	537	0.32	0.47	0	1
	Internal Network E-I index	Male	1,217	-0.56	0.5	-1	1
		Female	1,021	0.35	0.59	-1	1
	External Network E-I index	Male	1,217	-0.68	0.39	-1	1
		Female	1,021	0.37	0.48	-1	1
	Higher-Internal Homophily	Male	1,217	0.29	0.45	0	1
		Female	1,021	0.41	0.49	0	1

Internal Network E-I index

- By race: SOCs (mean=0.73) report that they have a significantly heterophilous network based on race compared to White faculty (mean=-0.87), $t(652)=-61.84$, $p<0.001$; women (mean=-0.57) report that they have significantly homophilous network based on race compared to men (mean=-0.42), $t(2229)=4.41$, $p<0.001$.

- By gender: SOCs (mean=-0.25) report that they have significantly homophilous network based on gender compared to White faculty (mean=- 0.11), $t(831)= 3.80$, $p<0.01$; women (mean=0.35) report that they have significantly heterophilous network based on gender compared to men (mean=-0.56), $t(1999)=-38.93$, $p<0.001$.

External Network E-I index

- By race: SOCs (mean=0.73) report that they have significantly heterophilous network based on race compared to White faculty (mean=-0.90), $t(624)=-78.01$, $p<0.001$; women (mean=-0.59) report that they have significantly homophilous network based on race compared to men (mean=-0.44), $t(2230)= 4.73$, $p<0.001$.
- By gender: SOCs (mean=-0.27) report that they have significantly homophilous network based on gender compared to White faculty (mean=-0.18), $t(841)=2.67$, $p<0.01$; women (mean=0.37) report that they have significantly heterophilous network based on gender compared to men (mean=-0.68), $t(1964)= -56.49$, $p<0.001$.

Higher-Internal Homophily

- By race: SOCs (mean=0.19) report that they are significantly more likely to have higher internal network homophily based on race compared to White faculty (mean=0.15), $t(832)=-2.20$, $p<0.05$; women (mean=0.16) report that they are more likely to have higher internal network homophily based on race compared to men (mean=0.15) but the difference is not significant, $t(2149)= -0.64$, $p>0.10$.

- By gender: SOCs (mean=0.32) report that they are more likely to have higher internal network homophily based on gender compared to White faculty (mean=0.35) but the difference is not statistically significant, $t(919)=1.48$, $p>0.10$; women (mean=0.41) report that they are more likely to have higher internal network homophily based on gender compared to men (mean=0.29) but the difference is not significant, $t(2098)=-6.01$, $p<0.001$.

5.7 Summary of Descriptive Findings

From previous sections, it is notable that descriptive statistics of main variables, such as perceived inclusion and network characteristics, vary by race and gender. First, I look at how descriptive findings differ for perceived inclusion. Using Welch two-sample *t*-tests, I find that although the numerical difference between Whites and SOCs, men and women are not big, SOCs and women report significantly lower inclusion compared to their White or male colleagues.

Moreover, network characteristics differ by race and gender. In particular, descriptive statistics of network compositional characteristics, which are presented in Table 13 and Table 14, differ by race and gender. I conduct *t*-tests to investigate whether the differences are statistically meaningful. For internal network homophily based on race, I find that SOCs have significantly more heterophilous internal networks than White colleagues and women have significantly more homophilous internal networks than men. For internal network homophily based on gender, I find that SOCs have significantly more homophilous internal networks than Whites and women have significantly heterophilous internal networks. For external network homophily based on race, SOCs

have significantly more heterophilous external networks than Whites and women have significantly more homophilous networks than men. For external network homophily based on gender, SOCs have significantly more homophilous external networks than White faculty and women have significantly more heterophilous external networks than men.

Furthermore, there are race- and gender-based differences in *Higher-Internal Homophily* variable, which indicates whether they have higher homophily in the internal network compared to the external network (1=yes). For *Higher-Internal Homophily* based on race, SOCs are significantly more likely to have higher internal-to-external network homophily than Whites but the difference between men and women is not significant. For *Higher-Internal Homophily* based on gender, women are significantly more likely to have higher internal-to-external network homophily than men, yet the difference between Whites and SOCs is not statistically significant.

5.8 Hypotheses Testing

In this section, I present and discuss the regression analysis results to determine if the hypotheses outlined in Chapter 3 are supported or not. Models are estimated using R statistical Computing Software. Sandwich package is used to estimate models with clustered standard errors (Zeileis, 2004; Zeileis et al., 2020) and Car package has been used to evaluate VIFs (J. Fox & Weisberg, 2019).

The presentation of hypotheses testing is as follows. First, I test and present the baseline model in which I predict perceived inclusion with demographic variables to confirm the prior literature on the marginalization of SOCs and women in the workplace.

Second, I predict perceived inclusion with general network structural characteristics such as network size and number of friends to investigate the general network impact on inclusion. I then present my investigation on the impacts of network structural characteristics by race and gender by conducting a sub-group analysis. Fourth, I move on to the impact of network compositional characteristics by looking at the impact of the whole network's demographic composition on inclusion in the workplace. Fifth, I separate the whole network by locations, internal network and external network, to investigate differential effects of the network's locations. Sixth, I present regression analysis results on the impact of internal to external network homophily ratio on inclusion in the workplace to test the relative impact of network locations. Moreover, I investigate the impact of the demographic composition of the whole network on perceived inclusion by race and gender. I then explore and present the impacts of internal and external networks' demographic composition by race and gender. Lastly, I present the results of sub-group analysis on the influence of internal to external network homophily ratio on inclusion.

5.8.1 Effects of Demographic Factors on Perceived Inclusion

This section reports the OLS regression estimation where perceived inclusion is predicted by demographic characteristics (race and gender) to test Hypothesis 1 which states that SOCs and women will report lower perceived inclusion in their workplace than White and men. From the regression estimation presented in Table 19, SOCs ($p<0.01$) and women ($p<0.05$) report significantly lower inclusion, confirming Hypothesis 1.

In addition, professional experience such as leadership experience ($p<0.01$) and award experience ($p<0.10$) improve perceived inclusion but committee experience ($p<0.01$) lowers inclusion in the workplace. The length of stay in the current institution significantly lowers inclusion ($p<0.01$). There are field-based differences as well. Compared to biologists, biochemists ($p<0.01$) and mathematicians ($p<0.01$) report lower inclusion, whereas civil engineers ($p<0.01$) report higher inclusion. Lastly, the respondents in the institution located in the metropolitan area report significantly higher inclusion ($p<0.01$).

Table 19.

OLS Model Predicting Perceived Inclusion by Demographic Attributes

	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.43	0.06	0.00	***	-
SOCs	-0.11	0.02	0.00	***	1.16
Female	-0.08	0.04	0.04	**	1.15
Leadership experience	0.35	0.01	0.00	***	1.45
Committee experience	-0.02	0.01	0.00	***	1.02
Award experience	0.04	0.02	0.02	*	1.17
log(Average publication)	0.02	0.02	0.16		1.31
Associate professor	0.38	0.03	0.00	***	1.81
Full professor	0.54	0.05	0.00	***	2.87
log(Years in current appointment)	-0.05	0.01	0.00	***	1.65
Proportion of white faculty	0.30	0.06	0.00	***	1.48
Proportion of male faculty	-0.11	0.08	0.14		1.53
Biochemistry	-0.07	0.01	0.00	***	1.30
Civil engineering	0.03	0.01	0.02	***	1.74
Math	-0.05	0.01	0.00	***	1.38
Proportion of international faculty	0.03	0.13	0.82		1.26
Research extensive	-0.08	0.03	0.01	***	2.03
HBCU and HSI	0.00	0.05	0.93		1.79
Women & Liberal Colleges	0.06	0.05	0.23		2.22
Institution in city	0.05	0.02	0.01	***	1.12
R-squared	0.28				
N	2,238				

Notes: Clustered standard errors by department.
Reference: Assistant professor, Biology, Research intensive
* $p<0.10$; ** $p<0.05$; *** $p<0.01$

5.8.2 Effects of Network Size and Friends on Perceived Inclusion

This section reports the regression estimations where I predict perceived inclusion by network structural characteristics, such as network size and number of friends, to test Hypothesis 2 which expects a positive relationship between network size and perceived inclusion and Hypothesis 3 which anticipates a positive relationship between friends and

perceived inclusion. Hypothesis 2 is supported. The regression estimation results presented in Table 20 show that individuals with a larger network report significantly higher inclusion ($p<0.01$). However, I do not find support for the effect of friends on inclusion.

Like findings in Table 19, professional experience such as leadership experience ($p<0.01$) and award experience ($p<0.10$) improve perceived inclusion but committee experience ($p<0.01$) lowers inclusion in the workplace. The respondents who stayed in the current institution longer report significantly lower inclusion ($p<0.01$). The field-based differences continued. Compared to biology faculty, biochemistry ($p<0.01$) and math ($p<0.01$) faculty report lower inclusion, whereas civil engineering faculty ($p<0.01$) report higher inclusion. Lastly, institutions in the metropolitan area significantly increased inclusion ($p<0.01$).

5.8.3 Effects of Network Size and Friends on Perceived Inclusion by Race and Gender

In this section, I investigate further the impacts of network size and friends on perceived inclusion by conducting a sub-group analysis to test Hypothesis 4 where I posit that the relationship between network size and perceived inclusion is positively moderated by demographic attributes and Hypothesis 5 that hypothesizes that the relationship between friends and perceived inclusion is positively moderated by demographic attributes. Table 21 presents the estimation results by race and gender (White vs. SOCs; men vs. women) and Table 22 presents the estimation results with interactions between race and gender (White men, White women, SOC men, SOC

women). I first describe the results in Table 21 and then continue to illustrate the results in Table 22.

Table 20.

OLS Model Predicting Perceived Inclusion by Network Structural Characteristics

	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.33	0.08	0.00	***	
Network size	0.01	0.00	0.00	***	1.50
Friends	0.00	0.00	0.70		1.41
SOCs	-0.10	0.02	0.00	***	1.18
Female	-0.09	0.04	0.03	**	1.16
Leadership experience	0.34	0.01	0.00	***	1.46
Committee experience	-0.02	0.01	0.00	***	1.02
Award experience	0.03	0.02	0.06	*	1.20
log(Average publication)	0.02	0.01	0.29		1.33
Associate professor	0.37	0.03	0.00	***	1.81
Full professor	0.54	0.05	0.00	***	2.89
log(Years in current appointment)	-0.05	0.01	0.00	***	1.65
Proportion of white faculty	0.29	0.06	0.00	***	1.49
Proportion of male faculty	-0.10	0.08	0.23		1.53
Biochemistry	-0.06	0.01	0.00	***	1.31
Civil engineering	0.05	0.01	0.00	***	1.78
Math	-0.03	0.01	0.00	***	1.41
Proportion of international faculty	0.05	0.12	0.71		1.26
Research extensive	-0.08	0.03	0.00	***	2.03
HBCU and HSI	0.00	0.05	0.94		1.79
Women & Liberal Colleges	0.06	0.05	0.25		2.23
Institution in city	0.05	0.02	0.01	***	1.12
R-squared	0.28				
N	2,238				

Notes: Clustered standard errors by department.
Reference: Assistant professor, Biology, Research intensive
* $p<0.10$; ** $p<0.05$; *** $p<0.01$

Table 21.

OLS Model Predicting Perceived Inclusion by Network Structural Characteristics by Race and Gender

	White					SOCs					Men					Women				
	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.34	0.11	0.00	***	-	2.08	0.19	0.00	***	-	2.15	0.05	0.00	***	-	2.43	0.12	0.00	***	-
Network size	0.01	0.00	0.00	***	1.49	0.01	0.00	0.06	*	1.54	0.02	0.00	0.00	***	1.50	0.01	0.01	0.22		1.54
Friends	0.00	0.00	0.02	**	1.40	0.00	0.00	0.59		1.39	-0.01	0.00	0.14		1.39	0.01	0.00	0.00	***	1.46
SOC	-	-	-	-	-	-	-	-	-	-	-0.08	0.03	0.01	***	1.19	-0.13	0.05	0.02	**	1.19
Female	-0.09	0.05	0.06	*	1.19	-0.09	0.05	0.04	**	1.12	-	-	-	-	-	-	-	-	-	-
Leadership experience	0.33	0.01	0.00	***	1.48	0.36	0.07	0.00	***	1.46	0.34	0.03	0.00	***	1.44	0.34	0.01	0.00	***	1.45
Committee experience	-0.01	0.02	0.61		1.02	-0.05	0.08	0.54		1.04	-0.02	0.03	0.47		1.02	-0.01	0.04	0.74		1.03
Award experience	0.03	0.02	0.12		1.22	0.04	0.02	0.02	**	1.19	0.04	0.02	0.08	*	1.21	0.03	0.02	0.08	*	1.22
log(Average publication)	0.03	0.03	0.38		1.37	0.00	0.06	0.93		1.28	0.02	0.01	0.06	*	1.31	0.02	0.03	0.58		1.33
Associate professor	0.35	0.03	0.00	***	1.93	0.41	0.05	0.00	***	1.60	0.45	0.01	0.00	***	2.01	0.31	0.04	0.00	***	1.69
Full professor	0.51	0.05	0.00	***	3.09	0.61	0.12	0.00	***	2.50	0.58	0.06	0.00	***	3.17	0.50	0.03	0.00	***	2.46
log(Years in current appointment)	-0.05	0.01	0.00	***	1.69	-0.05	0.06	0.40		1.55	-0.05	0.02	0.01	***	1.66	-0.06	0.02	0.00	***	1.62
Proportion of white faculty	0.32	0.07	0.00	***	1.31	0.26	0.10	0.01	***	1.57	0.33	0.08	0.00	***	1.54	0.21	0.12	0.06	*	1.43
Proportion of male faculty	-0.10	0.12	0.39		1.52	-0.07	0.08	0.39		1.67	-0.10	0.18	0.59		1.48	-0.11	0.11	0.30		1.52
Biochemistry	-0.04	0.01	0.00	***	1.32	-0.15	0.01	0.00	***	1.27	0.00	0.02	0.90		1.39	-0.14	0.02	0.00	***	1.24
Civil engineering	0.06	0.02	0.01	***	1.82	0.02	0.01	0.14		1.75	0.07	0.04	0.08	*	1.94	0.03	0.05	0.49		1.61
Math	-0.02	0.01	0.10	*	1.40	-0.06	0.02	0.00	***	1.49	0.00	0.03	0.89		1.51	-0.07	0.02	0.00	***	1.34
Proportion of international faculty	-0.11	0.22	0.61		1.28	0.36	0.20	0.08	*	1.26	0.41	0.12	0.00	***	1.20	-0.60	0.28	0.03	**	1.37
Research extensive	-0.14	0.05	0.01	***	2.01	0.07	0.03	0.03	**	2.20	-0.09	0.03	0.00	***	1.90	-0.06	0.05	0.19		2.26
HBCU and HSI	-0.03	0.05	0.54		1.65	0.11	0.04	0.00	***	2.25	0.03	0.06	0.64		1.83	-0.01	0.04	0.74		1.76
Women & Liberal Colleges	0.02	0.05	0.63		2.21	0.19	0.07	0.00	***	2.08	0.10	0.08	0.19		2.18	0.03	0.03	0.43		2.32
Institution in city	0.03	0.03	0.27		1.11	0.11	0.03	0.00	***	1.14	0.04	0.03	0.19		1.12	0.07	0.02	0.00	***	1.15
R-squared	0.28					0.26					0.29					0.25				
N	1,701					537					1,217					1,021				

Notes: Clustered standard errors by department.

Reference: Assistant professor, Biology, Research intensive

* $p<0.10$; ** $p<0.05$; *** $p<0.01$

Table 22.

OLS Model Predicting Perceived Inclusion by Network Structural Characteristics by Race and Gender (cont'd)

	White men					White women					SOC men					SOC women				
	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.20	0.09	0.00	***	-	2.40	0.25	0.00	***	-	1.77	0.20	0.00	***	-	2.39	0.31	0.00	**	-
Network size	0.01	0.00	0.00	***	1.50	0.01	0.01	0.18		1.51	0.02	0.01	0.08	*	1.48	0.00	0.01	0.92		1.74
Friends	0.00	0.00	0.79		1.40	0.01	0.00	0.05	**	1.46	-0.02	0.01	0.10	*	1.40	0.01	0.02	0.60		1.50
Leadership experience	0.34	0.04	0.00	***	1.46	0.33	0.04	0.00	***	1.45	0.35	0.06	0.00	***	1.43	0.36	0.22	0.10	*	1.63
Committee experience	-0.03	0.05	0.54		1.02	0.01	0.06	0.89		1.04	0.00	0.09	0.99		1.06	-0.12	0.08	0.13		1.09
Award experience	0.04	0.03	0.13		1.24	0.02	0.02	0.33		1.23	0.04	0.02	0.09	*	1.19	0.06	0.03	0.08	*	1.31
log(Average publication)	0.03	0.02	0.24		1.35	0.04	0.07	0.58		1.39	0.01	0.04	0.86		1.29	-0.02	0.10	0.85		1.31
Associate professor	0.43	0.03	0.00	***	2.20	0.29	0.06	0.00	***	1.80	0.46	0.05	0.00	***	1.72	0.34	0.06	0.00	***	1.54
Full professor	0.55	0.07	0.00	***	3.50	0.48	0.05	0.00	***	2.57	0.63	0.13	0.00	***	2.59	0.55	0.13	0.00	***	2.41
log(Years in current appointment)	-0.05	0.01	0.00	***	1.70	-0.05	0.02	0.03	**	1.64	0.00	0.07	0.98		1.54	-0.12	0.04	0.00	***	1.62
Proportion of white faculty	0.40	0.18	0.02	**	1.37	0.18	0.16	0.24		1.26	0.28	0.09	0.00	***	1.60	0.20	0.17	0.23		1.61
Proportion of male faculty	-0.12	0.25	0.64		1.45	-0.09	0.09	0.33		1.53	-0.04	0.06	0.51		1.62	-0.08	0.33	0.82		1.68
Biochemistry	0.02	0.02	0.23		1.39	-0.12	0.01	0.00	***	1.28	-0.11	0.04	0.00	***	1.41	-0.13	0.01	0.00	***	1.14
Civil engineering	0.07	0.06	0.25		1.99	0.07	0.04	0.12		1.68	0.11	0.04	0.00	***	1.99	-0.10	0.10	0.31		1.49
Math	0.00	0.03	0.90		1.49	-0.04	0.02	0.04	**	1.35	0.01	0.03	0.81		1.65	-0.18	0.02	0.00	***	1.40
Proportion of international faculty	0.04	0.25	0.86		1.22	-0.35	0.31	0.26		1.37	0.98	0.46	0.03	**	1.24	-1.87	0.35	0.00	***	1.51
Research extensive	-0.12	0.05	0.02	**	1.86	-0.14	0.07	0.05	**	2.25	0.05	0.08	0.47		2.18	0.23	0.12	0.06	*	2.54
HBCU and HSI	-0.04	0.05	0.42		1.71	-0.01	0.08	0.92		1.59	0.20	0.06	0.00	***	2.22	0.03	0.09	0.77		2.50
Women & Liberal Colleges	0.06	0.08	0.48		2.18	0.00	0.02	0.97		2.27	0.22	0.09	0.02	**	2.00	0.18	0.17	0.28		2.43
Institution in city	0.03	0.04	0.50		1.12	0.05	0.02	0.05	**	1.13	0.06	0.02	0.01	***	1.12	0.18	0.11	0.11		1.28
R-squared	0.27					0.25					0.30					0.26				
N	886					815					331					206				

Notes: Clustered standard errors by department.

Reference: Assistant professor, Biology, Research intensive

* $p<0.10$; ** $p<0.05$; *** $p<0.01$

I find partial support for Hypotheses 4 and 5. I conduct a sub-group analysis by race and gender (White vs SOCs; men vs. women) (Table 21) and then by the interaction between race and gender (White men, White women, SOC men, SOC women) (Table 22) to further investigate how demographic factors are associated with workplace experience. First, I find partial support for Hypothesis 4 that hypothesizes that SOCs and women benefit more from network size for perceived inclusion. In Table 21, network size is significantly and positively associated with perceived inclusion for SOCs ($p<0.10$) but not for women. Moreover, I find that network size ($p<0.01$) and friends ($p<0.05$) significantly improve inclusion for Whites, and network size ($p<0.01$) significantly increases inclusion for men. However, when I interact race and gender in Table 22, I find partial support for Hypothesis 4 by looking at SOC men ($p<0.10$). I also find that network size significantly improves perceived inclusion for White men ($p<0.01$).

I also find partial support for Hypothesis 5 which hypothesizes that SOCs and women benefit more from friends for perceived inclusion. Friends are significantly and positively associated with perceived inclusion for women ($p<0.01$) but not for SOCs (Table 21). In addition, looking at Table 22, friends significantly increase perceived inclusion for White women ($p<0.05$) but significantly decreases SOC men's inclusion ($p<0.10$). There are no significant findings supporting Hypothesis 5 for SOC women.

In terms of noticeable control variables, leadership experience continues to have a significantly positive impact on inclusion for everyone, while award experience significantly and positively affects inclusion for SOCs, men, and women. In particular, award experience significantly increased inclusion for SOC men and women. There are some variations by field. Compared to biologists, White biochemists and mathematicians

report significantly lower inclusion, whereas White civil engineers report higher inclusion. Similarly, SOCs biochemists and mathematicians report lower inclusion than biologists. Male civil engineers report significantly higher inclusion than male biologists; female biochemists and mathematicians report significantly lower inclusion than female biologists. Lastly, I find significant findings for the location of the institution for SOCs and women. For both, being in the institution located in the city positively affect their perceived inclusion.

5.8.4 Effects of Network Homophily on Perceived Inclusion

In this section, I present findings for the regression model in which I predict perceived inclusion by whole network homophily to test Hypothesis 6 which hypothesizes that homophilous networks will positively influence perceived inclusion.

I find support for Hypothesis 6. The regression estimations provided in Table 23 show that the E-I index based on race is significantly ($p<0.01$) and negatively associated with perceived inclusion. In addition, it shows that the gender-based E-I index is significantly ($p<0.05$) and negatively associated with perceived inclusion. Because the E-I index is coded as a continuous variable ranging from -1 to +1, where -1 indicates complete homophily and +1 indicates complete heterophily, the negative coefficient signifies that race- and gender-based homophily have a positive impact on inclusion.

Results from Table 23 continue to suggest positive impacts of leadership experience and award experience on inclusion and negative impacts of committee experience. In addition, compared to biologists, biochemists and mathematicians report lower inclusion, while civil engineers report higher inclusion.

Table 23.

OLS Model Predicting Perceived Inclusion by Network Homophily

	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.19	0.04	0.00	***	-
Whole net E-I index (race)	-0.06	0.01	0.00	***	1.14
Whole net E-I index (gender)	-0.05	0.02	0.03	**	1.12
Leadership experience	0.34	0.02	0.00	***	1.45
Committee experience	-0.02	0.01	0.00	***	1.02
Award experience	0.03	0.02	0.06	*	1.20
log(Average publication)	0.02	0.02	0.18		1.31
Associate professor	0.37	0.03	0.00	***	1.81
Full professor	0.54	0.04	0.00	***	2.87
log(Years in current appointment)	-0.05	0.01	0.00	***	1.65
Proportion of white faculty	0.29	0.06	0.00	***	1.46
Proportion of male faculty	-0.07	0.08	0.36		1.50
Network size	0.01	0.00	0.00	***	1.13
Biochemistry	-0.06	0.01	0.00	***	1.30
Civil engineering	0.04	0.01	0.00	***	1.77
Math	-0.03	0.01	0.00	***	1.41
Proportion of international faculty	0.06	0.11	0.59		1.26
Research extensive	-0.08	0.02	0.00	***	2.04
HBCU and HSI	0.00	0.04	0.96		1.79
Women & Liberal Colleges	0.07	0.05	0.19		2.21
Institution in city	0.05	0.02	0.01	***	1.12
R-squared	0.28				
N	2,238				

Notes: Clustered standard errors by department.
Reference: Assistant professor, Biology, Research intensive
* $p<0.10$; ** $p<0.05$; *** $p<0.01$

5.8.5 Effects of Internal and External Network Homophily on Perceived Inclusion

In this section, I discuss the regression estimation results where I predicted perceived inclusion with E-I indices for internal and external networks. The aim of

separating the network by location is to further disentangle the impacts of demographic social structure on inclusion in detail and to investigate the differences by network locations. The estimation results are presented in Table 24.

I find support for Hypothesis 6b that hypothesizes the positive impact of external network homophily on perceived inclusion but not for Hypothesis 6a which hypothesizes that internal network homophily positively influences perceived inclusion. Looking at network homophily by race, the external network E-I index is significantly ($p<0.01$) and negatively associated with perceived inclusion. Looking at network homophily by gender, the external network E-I index is significantly ($p<0.01$) and negatively associated with perceived inclusion. However, I do not find empirical support for internal network homophily.

Findings for control variables (e.g., professional experience, fields, location of institutions) echo findings from prior models.

Table 24.

OLS Model Predicting Perceived Inclusion by Internal and External Network Homophily

	Race					Gender				
	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.27	0.06	0.00	***	-	2.25	0.04	0.00	***	-
Internal net E-I index (race)	0.02	0.04	0.64		3.95	-	-	-	-	-
External net E-I index (race)	-0.08	0.02	0.00	***	4.04	-	-	-	-	-
Internal net E-I index (gender)	-	-	-	-	-	-0.01	0.02	0.52		1.55
External net E-I index (gender)	-	-	-	-	-	-0.04	0.01	0.00	***	1.59
SOC	-	-	-	-	-	-0.10	0.02	0.00	***	1.18
Female	-0.09	0.04	0.02	**	1.16	-	-	-	-	-
Leadership experience	0.34	0.01	0.00	***	1.46	0.34	0.02	0.00	***	1.46
Committee experience	-0.02	0.01	0.00	***	1.02	-0.02	0.01	0.00	***	1.02
Award experience	0.03	0.02	0.05	**	1.20	0.03	0.02	0.06	*	1.20
log(Average publication)	0.02	0.02	0.31		1.33	0.02	0.02	0.16		1.31
Associate professor	0.37	0.03	0.00	***	1.81	0.37	0.03	0.00	***	1.81
Full professor	0.53	0.04	0.00	***	2.88	0.54	0.05	0.00	***	2.87
log(Years in current appointment)	-0.05	0.01	0.00	***	1.65	-0.05	0.01	0.00	***	1.65
Proportion of white faculty	0.29	0.06	0.00	***	1.46	0.28	0.06	0.00	***	1.49
Proportion of male faculty	-0.10	0.08	0.22		1.53	-0.07	0.08	0.34		1.50
Network size	0.01	0.00	0.00	***	1.13	0.01	0.00	0.00	***	1.14
Biochemistry	-0.06	0.01	0.00	***	1.30	-0.06	0.00	0.00	***	1.30
Civil engineering	0.04	0.01	0.00	***	1.78	0.04	0.01	0.00	***	1.78
Math	-0.03	0.01	0.00	***	1.41	-0.03	0.01	0.00	***	1.41
Proportion of international faculty	0.04	0.12	0.73		1.26	0.06	0.11	0.60		1.26
Research extensive	-0.08	0.03	0.00	***	2.03	-0.08	0.02	0.00	***	2.04
HBCU and HSI	0.00	0.05	1.00		1.79	0.01	0.04	0.87		1.79
Women & Liberal Colleges	0.06	0.06	0.26		2.22	0.07	0.05	0.19		2.22
Institution in city	0.05	0.02	0.01	***	1.12	0.05	0.02	0.01	***	1.12
R-squared	0.29					0.28				
N	2,238					2,238				

Notes: Clustered standard errors by department.
Reference: Assistant professor, Biology, Research intensive
* p<0.10; ** p<0.05; *** p<0.01

5.8.6 Effects of Internal to External Network Homophily Ratio on Perceived Inclusion

This section reports findings for the OLS regressions in which I predict perceived inclusion by comparing internal network homophily to external network homophily (Table 25). I do not find empirical support for Hypothesis 7 in which I hypothesize that higher internal-to-external network homophily (*Higher-Internal Homophily*) is positively associated with perceived inclusion. *Higher-Internal Homophily* is a binary variable that

indicates that homophily is higher in the internal network compared to the external network (1=yes). I find the opposite of Hypothesis 7. In Table 25, I find that when internal network race-based homophily is higher than external network homophily, the respondents report significantly lower inclusion in their workplace ($p<0.01$). I do not find statistically significant findings for the case when internal network gender-based homophily is higher than external network homophily. Findings for control variables resemble findings in previous estimations reported above.

Table 25.

OLS Model Predicting Perceived Inclusion by Internal-to-external Network Homophily Ratio

	Race					Gender				
	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.25	0.06	0.00	***	-	2.25	0.04	0.00	***	
Higher-internal homophily (race)	-0.07	0.02	0.00	***	1.05	-	-	-	-	-
Higher-internal homophily (gender)	-	-	-	-	-	0.00	0.02	0.94		1.04
SOC	-	-	-	-	-	-0.10	0.02	0.00	***	1.17
Female	-0.09	0.04	0.03	**	1.15	-	-	-	-	-
Leadership experience	0.34	0.02	0.00	***	1.46	0.35	0.02	0.00	***	1.46
Committee experience	-0.02	0.00	0.00	***	1.02	-0.02	0.01	0.00	***	1.02
Award experience	0.03	0.02	0.04	**	1.20	0.03	0.02	0.05	**	1.20
log(Average publication)	0.01	0.02	0.56		1.32	0.03	0.01	0.06	*	1.31
Associate professor	0.37	0.03	0.00	***	1.81	0.38	0.03	0.00	***	1.81
Full professor	0.54	0.04	0.00	***	2.87	0.55	0.04	0.00	***	2.85
log(Years in current appointment)	-0.05	0.01	0.00	***	1.65	-0.05	0.01	0.00	***	1.65
Proportion of white faculty	0.34	0.06	0.00	***	1.40	0.27	0.06	0.00	***	1.47
Proportion of male faculty	-0.11	0.09	0.20		1.53	-0.04	0.07	0.57		1.47
Network size	0.01	0.00	0.00	***	1.14	0.01	0.00	0.00	***	1.14
Biochemistry	-0.06	0.01	0.00	***	1.30	-0.06	0.00	0.00	***	1.30
Civil engineering	0.06	0.01	0.00	***	1.76	0.04	0.01	0.00	***	1.78
Math	-0.03	0.01	0.01	***	1.41	-0.03	0.01	0.00	***	1.41
Proportion of international faculty	0.06	0.13	0.67		1.26	0.08	0.10	0.45		1.26
Research extensive	-0.09	0.03	0.01	***	2.03	-0.10	0.02	0.00	***	2.01
HBCU and HSI	0.01	0.05	0.88		1.80	0.01	0.04	0.85		1.79
Women & Liberal Colleges	0.07	0.06	0.22		2.22	0.07	0.05	0.16		2.21
Institution in city	0.05	0.02	0.01	***	1.12	0.05	0.02	0.00	***	1.12
R-squared	0.28					0.28				
N	2,238					2,238				

Notes: Clustered standard errors by department.
Reference: Assistant professor, Biology, Research intensive
* $p<0.10$; ** $p<0.05$; *** $p<0.01$

5.8.7 Effects of Network Homophily on Perceived Inclusion by Race and Gender

In this section, I present the regression estimations to test Hypothesis 8 that expects positive moderation of SOC and women on the relationship between whole network homophily and perceived inclusion. The regression estimations are presented in Table 26 and Table 27. I do not find empirical support for Hypothesis 8. It is important to note that the negative coefficients for E-I indices indicate that homophily improves inclusion due to the nature of how the variable has been constructed.

In Table 26, the coefficients for the whole network E-I index (both based on race and gender) are positive for SOCs but they are not significant and the coefficients for the whole network E-I index (both based on race and gender) are negative for women but they are not significant. Yet, the results suggest that race-based network homophily significantly improves Whites' perceived inclusion ($p<0.01$) and men's perceived inclusion ($p<0.05$), and that gender-based network homophily significantly decreases men's perceived inclusion ($p<0.01$).

To investigate further, I conduct a sub-group analysis based on the interaction between race and gender (White men, White women, SOC men, SOC women) and present the regression results in Table 27, race-based network homophily significantly improves White men's inclusion ($p<0.01$) but aggravates SOC men's inclusion ($p<0.05$). I do not find any significant findings for White women and SOC women.

Table 26.

OLS Model Predicting Perceived Inclusion by Network Homophily by Race and Gender

	White					SOCs					Men					Women				
	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.23	0.11	0.00	***	-	2.10	0.20	0.00	***	-	2.14	0.07	0.00	***	-	2.38	0.10	0.00	***	-
Whole net E-I index (race)	-0.17	0.05	0.00	***	1.10	0.02	0.05	0.72		1.49	-0.07	0.03	0.02	**	8.14	-0.05	0.06	0.36		6.64
Whole net E-I index (gender)	0.02	0.03	0.62		2.81	0.04	0.05	0.40		3.63	0.10	0.03	0.00	***	1.23	-0.04	0.03	0.14		1.26
SOC	-	-	-	-	-	-	-	-	-	-	0.04	0.05	0.39		8.38	-0.05	0.06	0.37		6.93
Female	-0.11	0.05	0.04	**	2.98	-0.13	0.09	0.16		3.68	-	-	-	-	-	-	-	-	-	-
Leadership experience	0.34	0.01	0.00	***	1.48	0.36	0.07	0.00	***	1.45	0.34	0.02	0.00	***	1.44	0.34	0.01	0.00	***	1.45
Committee experience	-0.01	0.02	0.54		1.02	-0.05	0.08	0.53		1.04	-0.03	0.03	0.44		1.03	-0.01	0.04	0.74		1.04
Award experience	0.03	0.02	0.12		1.22	0.04	0.02	0.02	**	1.19	0.04	0.02	0.08	*	1.21	0.03	0.02	0.09	*	1.22
log(Average publication)	0.03	0.03	0.42		1.37	0.00	0.06	0.97		1.29	0.02	0.01	0.10	*	1.31	0.02	0.03	0.45		1.3
Associate professor	0.35	0.03	0.00	***	1.92	0.41	0.05	0.00	***	1.60	0.45	0.01	0.00	***	2.02	0.31	0.04	0.00	***	1.7
Full professor	0.50	0.05	0.00	***	3.07	0.61	0.12	0.00	***	2.50	0.59	0.06	0.00	***	3.19	0.50	0.03	0.00	***	2.5
log(Years in current appointment)	-0.05	0.01	0.00	***	1.68	-0.05	0.06	0.41		1.54	-0.05	0.02	0.01	***	1.66	-0.06	0.02	0.00	***	1.6
Proportion of white faculty	0.28	0.06	0.00	***	1.33	0.25	0.11	0.02	**	1.64	0.31	0.09	0.00	***	1.57	0.21	0.11	0.06	*	1.5
Proportion of male faculty	-0.10	0.12	0.41		1.52	-0.06	0.08	0.45		1.68	-0.05	0.17	0.78		1.56	-0.09	0.10	0.36		1.6
Network size	0.01	0.00	0.00	***	1.13	0.01	0.00	0.07	*	1.17	0.01	0.00	0.00	***	1.18	0.01	0.01	0.06	*	1.1
Biochemistry	-0.05	0.01	0.00	***	1.32	-0.15	0.01	0.00	***	1.27	0.00	0.02	0.90		1.38	-0.14	0.02	0.00	***	1.24
Civil engineering	0.07	0.03	0.01	***	1.82	0.02	0.02	0.25		1.76	0.07	0.04	0.07	*	1.94	0.03	0.04	0.49		1.61
Math	-0.02	0.01	0.09	*	1.40	-0.06	0.01	0.00	***	1.51	0.00	0.03	0.87		1.51	-0.07	0.02	0.00	***	1.34
Proportion of international faculty	-0.14	0.22	0.52		1.28	0.37	0.19	0.06	*	1.26	0.40	0.12	0.00	***	1.20	-0.61	0.29	0.03	**	1.4
Research extensive	-0.14	0.05	0.01	***	2.02	0.07	0.03	0.02	**	2.20	-0.08	0.03	0.01	***	1.91	-0.06	0.05	0.25		2.3
HBCU and HSI	-0.01	0.05	0.80		1.69	0.12	0.05	0.02	**	2.56	0.02	0.06	0.76		1.84	-0.02	0.05	0.71		1.77
Women & Liberal Colleges	0.03	0.05	0.58		2.21	0.19	0.06	0.00	***	2.09	0.09	0.08	0.22		2.19	0.03	0.03	0.41		2.32
Institution in city	0.03	0.03	0.25	***	1.11	0.11	0.03	0.00	***	1.14	0.03	0.03	0.25		1.12	0.07	0.02	0.00	***	1.15
R-squared	0.28					0.27					0.30					0.25				
N	1,701					537					1,217					1,021				

Notes: Clustered standard errors by department.

Reference: Assistant professor, Biology, Research intensive

* $p<0.10$; ** $p<0.05$; *** $p<0.01$

Table 27.

OLS Model Predicting Perceived Inclusion by Network Homophily by Race and Gender (cont'd)

	White men					White women					SOC men					SOC women				
	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.12	0.12	0.00	***	-	2.23	0.22	0.00	***	-	1.85	0.28	0.00	***	-	2.47	0.28	0.00	***	-
Whole net E-I index (race)	-0.18	0.02	0.00	***	1.14	-0.18	0.11	0.11		1.12	0.11	0.05	0.02	**	1.45	-0.09	0.09	0.32		1.86
Whole net E-I index (gender)	0.09	0.06	0.12		1.24	-0.06	0.05	0.19		1.28	0.18	0.11	0.11		1.30	0.03	0.10	0.77		1.34
Leadership experience	0.34	0.04	0.00	***	1.46	0.33	0.04	0.00	***	1.45	0.35	0.06	0.00	***	1.43	0.36	0.21	0.08	*	1.64
Committee experience	-0.03	0.05	0.48		1.03	0.01	0.06	0.87		1.04	0.00	0.10	0.99		1.06	-0.12	0.08	0.14		1.08
Award experience	0.04	0.03	0.14		1.24	0.02	0.03	0.34		1.23	0.03	0.02	0.11		1.20	0.06	0.03	0.05	**	1.31
log(Average publication)	0.03	0.02	0.29		1.35	0.04	0.07	0.54		1.41	0.01	0.04	0.85		1.30	-0.02	0.10	0.87		1.36
Associate professor	0.43	0.03	0.00	***	2.20	0.30	0.06	0.00	***	1.79	0.48	0.06	0.00	***	1.77	0.34	0.06	0.00	***	1.54
Full professor	0.55	0.06	0.00	***	3.50	0.49	0.05	0.00	***	2.56	0.65	0.15	0.00	***	2.63	0.55	0.13	0.00	***	2.42
log(Years in current appointment)	-0.06	0.01	0.00	***	1.70	-0.04	0.02	0.06	*	1.65	-0.01	0.08	0.93		1.52	-0.12	0.04	0.00	***	1.62
Proportion of white faculty	0.33	0.17	0.05	**	1.43	0.15	0.17	0.36		1.28	0.19	0.08	0.02	**	1.79	0.24	0.18	0.18		1.71
Proportion of male faculty	-0.07	0.23	0.77		1.54	-0.03	0.10	0.73		1.67	0.02	0.10	0.83		1.71	-0.13	0.30	0.66		1.81
Network size	0.01	0.00	0.00	***	1.18	0.01	0.01	0.02	**	1.13	0.01	0.01	0.26		1.18	0.00	0.00	0.50		1.28
Biochemistry	0.02	0.02	0.25		1.39	-0.12	0.02	0.00	***	1.28	-0.11	0.04	0.01	***	1.41	-0.13	0.01	0.00	***	1.14
Civil engineering	0.08	0.06	0.23		1.99	0.07	0.04	0.10	*	1.67	0.12	0.05	0.01	***	2.00	-0.11	0.11	0.32		1.49
Math	0.01	0.03	0.84		1.48	-0.04	0.02	0.05	**	1.35	0.02	0.03	0.56		1.66	-0.19	0.02	0.00	***	1.42
Proportion of international faculty	0.01	0.24	0.98		1.23	-0.39	0.35	0.27		1.37	1.02	0.44	0.02	**	1.24	-1.93	0.36	0.00	***	1.51
Research extensive	-0.12	0.05	0.03	**	1.86	-0.14	0.07	0.06	*	2.26	0.06	0.06	0.37		2.18	0.23	0.11	0.05	**	2.54
HBCU and HSI	-0.02	0.05	0.65		1.74	0.02	0.07	0.76		1.65	0.21	0.08	0.01	***	2.46	-0.02	0.07	0.73		3.04
Women & Liberal Colleges	0.06	0.08	0.48		2.19	0.00	0.01	0.80		2.26	0.21	0.08	0.01	***	2.01	0.17	0.17	0.31		2.45
Institution in city	0.02	0.04	0.54		1.11	0.05	0.02	0.05	**	1.13	0.06	0.02	0.01	***	1.12	0.18	0.12	0.13		1.28
R-squared	0.27					0.25					0.30					0.26				
N	886					815					331					206				

Notes: Clustered standard errors by department.

Reference: Assistant professor, Biology, Research intensive

* $p<0.10$; ** $p<0.05$; *** $p<0.01$

5.8.8 Effects of Internal and External Homophily on Perceived Inclusion by Race and Gender

In this section, I present the regression estimation results of a model that predicts perceived inclusion by internal and external networks homophily separated by race and gender. I find the opposite support for Hypothesis 8a that hypothesizes the positive moderation effect of SOCs and women on the relationship between internal network homophily and perceived inclusion. I find confirmation for Hypothesis 8b that hypothesizes the positive moderation effect of SOCs and women on the relationship between external network homophily and perceived inclusion. Again, negative coefficients for E-I indices indicate that homophily has a positive impact, while positive coefficients signify that heterophily offers a positive effect.

Table 28 shows the OLS estimation results by race and gender. For SOCs, internal network race-based homophily ($p<0.05$) has a significant but negative impact on perceived inclusion, while external network race-based homophily ($p<0.01$) has a significant and positive impact on inclusion. For women, external network gender-based homophily ($p<0.01$) significantly improves their inclusion in the workplace. In addition, external network race-based homophily improves White's inclusion ($p<0.10$); while external network gender-based homophily decreases men's inclusion ($p<0.01$).

When the respondents are further disentangled as White men, White women, SOC men, and SOC women, the impacts of network homophily become more nuanced. In Table 29, I present the regression estimation results. I find that White women can improve inclusion when they have internal network race-based homophily ($p<0.01$) and external network gender-based homophily ($p<0.01$), while SOC women only benefit from

external network race-based homophily ($p<0.01$). I also find that SOC men report lower perceived inclusion when they have internal network gender-based homophily ($p<0.05$) and internal network race-based heterophily ($p<0.01$). Additionally, external network race-based homophily ($p<0.10$) and external network gender-based homophily ($p<0.01$) improve White men's perceived inclusion.

Table 28.

OLS Model Predicting Perceived Inclusion by Internal and External Network Homophily by Race and Gender

	White					SOCs					Men					Women				
	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.22	0.12	0.00	***	-	2.10	0.21	0.00	***	-	2.23	0.08	0.00	***	-	2.46	0.13	0.00	***	-
Internal net E-I index (race)	-0.05	0.03	0.15		1.11	0.12	0.05	0.03	**	1.70	-	-	-	-	-	-	-	-	-	-
External net E-I index (race)	-0.10	0.06	0.09	*	1.07	-0.11	0.02	0.00	***	1.47	-	-	-	-	-	-	-	-	-	-
Internal net E-I index (gender)	-	-	-	-	-	-	-	-	-	-	0.01	0.04	0.87		1.24	0.02	0.01	0.22		1.25
External net E-I index (gender)	-	-	-	-	-	-	-	-	-	-	0.10	0.02	0.00	***	1.12	-0.07	0.02	0.00	***	1.14
SOC	-	-	-	-	-	-	-	-	-	-	-0.08	0.03	0.01	***	1.19	-0.13	0.05	0.01	***	1.19
Female	-0.10	0.05	0.04	**	1.19	-0.09	0.04	0.03	**	1.13	-	-	-	-	-	-	-	-	-	-
Leadership experience	0.34	0.01	0.00	***	1.48	0.37	0.08	0.00	***	1.46	0.35	0.02	0.00	***	1.46	0.34	0.01	0.00	***	1.45
Committee experience	-0.01	0.02	0.57		1.02	-0.05	0.08	0.54		1.04	-0.03	0.03	0.45		1.03	-0.01	0.04	0.75		1.03
Award experience	0.03	0.02	0.12		1.22	0.04	0.02	0.02	**	1.19	0.04	0.02	0.07	*	1.21	0.03	0.02	0.10	*	1.22
log(Average publication)	0.03	0.03	0.42		1.37	0.00	0.06	0.95		1.28	0.02	0.01	0.05	**	1.31	0.03	0.03	0.41		1.35
Associate professor	0.35	0.03	0.00	***	1.92	0.41	0.04	0.00	***	1.59	0.45	0.01	0.00	***	2.02	0.31	0.04	0.00	***	1.69
Full professor	0.50	0.05	0.00	***	3.08	0.61	0.13	0.00	***	2.49	0.59	0.06	0.00	***	3.18	0.51	0.03	0.00	***	2.47
log(Years in current appointment)	-0.05	0.01	0.00	***	1.69	-0.05	0.06	0.41		1.54	-0.05	0.02	0.01	***	1.66	-0.06	0.02	0.00	***	1.62
Proportion of white faculty	0.29	0.06	0.00	***	1.33	0.24	0.10	0.02	**	1.64	0.31	0.09	0.00	***	1.59	0.21	0.11	0.06	*	1.45
Proportion of male faculty	-0.10	0.12	0.42		1.52	-0.07	0.08	0.36		1.67	-0.08	0.16	0.64		1.60	-0.12	0.10	0.23		1.70
Network size	0.01	0.00	0.00	***	1.13	0.01	0.00	0.13		1.17	0.01	0.00	0.00	***	1.19	0.01	0.01	0.09	*	1.15
Biochemistry	-0.05	0.01	0.00	***	1.32	-0.15	0.01	0.00	***	1.27	0.00	0.02	0.84		1.38	-0.14	0.02	0.00	***	1.24
Civil engineering	0.07	0.03	0.01	***	1.82	0.00	0.01	0.88		1.78	0.07	0.04	0.07	*	1.94	0.03	0.05	0.50		1.61
Math	-0.02	0.01	0.07	*	1.40	-0.06	0.01	0.00	***	1.51	0.01	0.03	0.78		1.51	-0.07	0.02	0.00	***	1.34
Proportion of international faculty	-0.14	0.22	0.53		1.28	0.39	0.20	0.05	**	1.26	0.41	0.12	0.00	***	1.20	-0.62	0.27	0.02	**	1.37
Research extensive	-0.14	0.05	0.01	***	2.02	0.07	0.03	0.02	**	2.20	-0.08	0.03	0.01	***	1.91	-0.05	0.05	0.28		2.27
HBCU and HSI	-0.02	0.05	0.76		1.69	0.14	0.07	0.04	**	2.56	0.02	0.06	0.73		1.84	-0.01	0.05	0.86		1.77
Women & Liberal Colleges	0.03	0.05	0.57		2.21	0.18	0.06	0.00	***	2.09	0.09	0.08	0.21		2.19	0.03	0.03	0.39		2.32
Institution in city	0.03	0.03	0.27		1.11	0.12	0.03	0.00	***	1.14	0.04	0.03	0.23		1.12	0.07	0.02	0.00	***	1.15
R-squared	0.28					0.27					0.30					0.25				
N	1,701					537					1,217					1,021				

Notes: Clustered standard errors by department.
Reference: Assistant professor, Biology, Research intensive
* $p<0.10$; ** $p<0.05$; *** $p<0.01$

Table 29.

OLS Model Predicting Perceived Inclusion by Internal and External Network Homophily by Race and Gender (cont'd)

	White men					White women					SOC men					SOC women				
	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.17	0.14	0.00	***	-	2.30	0.23	0.00	***	-	1.85	0.28	0.00	***	-	2.51	0.31	0.00	***	-
Internal net E-I index (race)	-0.01	0.06	0.80		1.15	-0.12	0.04	0.00	***	1.11	0.15	0.05	0.00	***	1.66	0.03	0.08	0.68		2.07
External net E-I index (race)	-0.15	0.08	0.07	*	1.10	-0.03	0.04	0.38		1.06	-0.04	0.06	0.44		1.53	-0.15	0.02	0.00	***	1.67
Internal net E-I index (gender)	-0.03	0.04	0.43		1.26	0.01	0.03	0.82		1.30	0.11	0.05	0.03	**	1.24	0.03	0.07	0.67		1.33
External net E-I index (gender)	0.12	0.04	0.00	***	1.13	-0.08	0.02	0.00	***	1.14	0.04	0.09	0.64		1.20	-0.01	0.04	0.81		1.24
Leadership experience	0.35	0.04	0.00	***	1.48	0.33	0.04	0.00	***	1.45	0.36	0.07	0.00	***	1.46	0.36	0.20	0.07	*	1.66
Committee experience	-0.04	0.05	0.46		1.03	0.01	0.06	0.85		1.04	-0.01	0.10	0.92		1.08	-0.09	0.08	0.30		1.17
Award experience	0.04	0.03	0.13		1.24	0.02	0.02	0.37		1.24	0.04	0.02	0.09	*	1.20	0.06	0.03	0.04	**	1.30
log(Average publication)	0.03	0.03	0.17		1.37	0.04	0.07	0.53		1.41	0.01	0.05	0.82		1.31	-0.01	0.10	0.92		1.39
Associate professor	0.43	0.03	0.00	***	2.20	0.30	0.06	0.00	***	1.79	0.48	0.06	0.00	***	1.77	0.34	0.05	0.00	***	1.55
Full professor	0.55	0.06	0.00	***	3.51	0.50	0.05	0.00	***	2.57	0.64	0.16	0.00	***	2.63	0.55	0.11	0.00	***	2.44
log(Years in current appointment)	-0.06	0.01	0.00	***	1.71	-0.04	0.02	0.04	**	1.65	-0.01	0.08	0.93		1.52	-0.12	0.04	0.00	***	1.65
Proportion of white faculty	0.37	0.18	0.04	**	1.46	0.15	0.16	0.37		1.29	0.18	0.09	0.04	**	1.79	0.23	0.20	0.25		1.75
Proportion of male faculty	-0.13	0.25	0.59		1.60	-0.06	0.12	0.62		1.77	0.03	0.07	0.64		1.72	-0.17	0.30	0.57		1.90
Network size	0.01	0.00	0.00	***	1.21	0.01	0.01	0.06	*	1.15	0.01	0.01	0.31		1.19	0.00	0.00	0.98		1.31
Biochemistry	0.02	0.02	0.19		1.39	-0.12	0.01	0.00	***	1.28	-0.13	0.04	0.00	***	1.43	-0.12	0.01	0.00	***	1.15
Civil engineering	0.08	0.06	0.20		1.99	0.08	0.04	0.07	*	1.68	0.10	0.05	0.06	*	2.03	-0.12	0.10	0.25		1.50
Math	0.01	0.03	0.76		1.49	-0.04	0.02	0.03	**	1.36	0.00	0.03	0.98		1.68	-0.19	0.01	0.00	***	1.43
Proportion of international faculty	0.01	0.22	0.98		1.23	-0.43	0.33	0.19		1.38	1.00	0.45	0.03	**	1.24	-1.76	0.41	0.00	***	1.55
Research extensive	-0.12	0.05	0.02	**	1.86	-0.13	0.07	0.07	*	2.28	0.06	0.07	0.37		2.18	0.22	0.11	0.05	**	2.56
HBCU and HSI	-0.02	0.05	0.61		1.75	0.03	0.07	0.71		1.65	0.23	0.09	0.01	***	2.48	-0.01	0.09	0.88		3.05
Women & Liberal Colleges	0.06	0.08	0.44		2.21	0.00	0.01	0.79		2.27	0.21	0.08	0.01	***	2.04	0.17	0.16	0.31		2.48
Institution in city	0.03	0.04	0.51		1.11	0.05	0.03	0.08	*	1.13	0.06	0.02	0.01	***	1.13	0.19	0.12	0.11		1.30
R-squared	0.28					0.26					0.31					0.26				
N	886					815					331					206				

Notes: Clustered standard errors by department.

Reference: Assistant professor, Biology, Research intensive

* $p<0.10$; ** $p<0.05$; *** $p<0.01$

5.8.9 Effects of Internal to External Network Homophily Ratio on Perceived Inclusion by Race and Gender

This section provides the regression estimation results of models, in which I predict perceived inclusion with internal to external network homophily ratio by race and gender (Table 30 and Table 31). The regression analysis is conducted to test Hypothesis 9 which hypothesizes that the positive moderation effect of SOCs and women on the relationship between higher internal to external network homophily and perceived inclusion. I find the opposite of my expectation.

In Table 30, *Higher-Internal Homophily* based on gender is significantly and negatively associated with perceived inclusion for women ($p<0.05$), while I do not find significant findings for SOCs. Moreover, higher internal to external network homophily based on race significantly lowers inclusion for White ($p<0.10$), and higher internal to external network homophily based on gender improves inclusion for men ($p<0.01$).

When the respondents are split into more detail (Table 31), I find that higher gender-based homophily in the internal network compared to the external network decreases inclusion for White women ($p<0.10$). Yet, I do not find any significant findings on *Higher-Internal Homophily* for SOC men and SOC women. *Higher-Internal Homophily* based on race ($p<0.05$) decreases inclusion, while *Higher-Internal Homophily* based on gender ($p<0.01$) improves inclusion for White men.

Looking at the control variables, leadership experience continues to significantly and positively shape perceived inclusion regardless of the demographic split of the respondents. In terms of field differences, White biochemists and mathematicians report lower inclusion than White biologists, while White civil engineers report higher

inclusion. SOC biochemists and mathematicians report lower inclusion than their SOC colleagues in biology. Moreover, male civil engineers report higher inclusion than male biologists; female biochemists and mathematicians report lower inclusion than female scientists in biology.

Table 30.

OLS Model Predicting Perceived Inclusion by Internal-to-external Network Homophily Ratio by Race and Gender

	White					SOCs					Men					Women				
	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.35	0.11	0.00	***	-	2.10	0.20	0.00	***	-	2.15	0.06	0.00	***	-	2.47	0.14	0.00	***	-
Higher-internal homophily (race)	-0.06	0.03	0.09	*	1.04	-0.10	0.07	0.14		1.16	-	-	-	-	-	-	-	-	-	-
Higher-internal homophily (gender)	-	-	-	-	-	-	-	-	-	-	0.06	0.02	0.01	***	1.08	-0.06	0.03	0.03	**	1.09
SOC	-	-	-	-	-	-	-	-	-	-	-0.08	0.03	0.01	***	1.19	-0.14	0.06	0.01	***	1.19
Female	-0.09	0.05	0.06	*	1.19	-0.09	0.04	0.04	**	1.12	-	-	-	-	-	-	-	-	-	-
Leadership experience	0.33	0.01	0.00	***	1.48	0.36	0.07	0.00	***	1.45	0.34	0.02	0.00	***	1.45	0.33	0.01	0.00	***	1.45
Committee experience	-0.01	0.02	0.56		1.02	-0.05	0.07	0.53		1.04	-0.03	0.03	0.39		1.04	-0.01	0.04	0.78		1.03
Award experience	0.03	0.02	0.12		1.22	0.04	0.02	0.01	***	1.19	0.04	0.02	0.07	*	1.21	0.03	0.02	0.08	*	1.22
log(Average publication)	0.03	0.03	0.38		1.36	0.00	0.06	0.97		1.28	0.01	0.01	0.11		1.31	0.02	0.04	0.57		1.33
Associate professor	0.35	0.03	0.00	***	1.92	0.41	0.04	0.00	***	1.59	0.45	0.01	0.00	***	2.01	0.31	0.04	0.00	***	1.69
Full professor	0.51	0.05	0.00	***	3.07	0.61	0.12	0.00	***	2.49	0.59	0.06	0.00	***	3.18	0.50	0.03	0.00	***	2.45
log(Years in current appointment)	-0.05	0.01	0.00	***	1.69	-0.05	0.06	0.41		1.54	-0.05	0.02	0.01	***	1.66	-0.06	0.02	0.00	***	1.62
Proportion of white faculty	0.31	0.07	0.00	***	1.31	0.25	0.10	0.01	***	1.58	0.34	0.08	0.00	***	1.54	0.22	0.12	0.06	*	1.44
Proportion of male faculty	-0.11	0.12	0.38		1.52	-0.08	0.07	0.29		1.67	-0.12	0.17	0.49		1.50	-0.16	0.09	0.09	*	1.58
Network size	0.01	0.00	0.00	***	1.15	0.01	0.01	0.10	*	1.17	0.01	0.00	0.00	***	1.18	0.01	0.01	0.05	**	1.12
Biochemistry	-0.05	0.01	0.00	***	1.32	-0.15	0.00	0.00	***	1.27	0.00	0.02	0.89		1.38	-0.14	0.02	0.00	***	1.24
Civil engineering	0.06	0.02	0.01	***	1.82	0.01	0.02	0.40		1.76	0.07	0.04	0.05	**	1.94	0.03	0.05	0.53		1.61
Math	-0.02	0.01	0.09	*	1.40	-0.06	0.02	0.00	***	1.49	0.00	0.03	0.91		1.51	-0.07	0.02	0.00	***	1.34
Proportion of international faculty	-0.12	0.22	0.59		1.28	0.35	0.20	0.08	*	1.26	0.43	0.12	0.00	***	1.20	-0.63	0.27	0.02	**	1.36
Research extensive	-0.14	0.05	0.01	***	2.02	0.07	0.03	0.01	***	2.20	-0.08	0.03	0.01	***	1.90	-0.06	0.05	0.24		2.27
HBCU and HSI	-0.03	0.05	0.57		1.65	0.14	0.05	0.01	***	2.35	0.03	0.06	0.64		1.83	0.00	0.05	0.94		1.77
Women & Liberal Colleges	0.03	0.05	0.59		2.20	0.19	0.06	0.00	***	2.08	0.10	0.08	0.18		2.18	0.03	0.03	0.39		2.32
Institution in city	0.03	0.03	0.26		1.11	0.12	0.03	0.00	***	1.14	0.04	0.03	0.18		1.12	0.06	0.02	0.00	***	1.15
R-squared	0.28					0.27					0.29					0.25				
N	1,701					537					1,217					1,021				

Notes: Clustered standard errors by department.

Reference: Assistant professor, Biology, Research intensive

* $p<0.10$; ** $p<0.05$; *** $p<0.01$

Table 31.

OLS Model Predicting Perceived Inclusion by Internal-to-external Network Homophily Ratio by Race and Gender (cont'd)

	White men					White women					SOC men					SOC women				
	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF	Estimate	Std. Error	P-value	Sig.	VIF
(Intercept)	2.23	0.10	0.00	***	-	2.44	0.27	0.00	***	-	1.82	0.23	0.00	***	-	2.42	0.27	0.00	***	-
Higher-internal homophily (race)	-0.09	0.04	0.02	**	1.06	-0.03	0.03	0.34		1.05	-0.09	0.06	0.11		1.17	-0.09	0.10	0.38		1.33
Higher-internal homophily (gender)	0.07	0.01	0.00	***	1.10	-0.05	0.03	0.07	*	1.12	0.04	0.06	0.50		1.10	-0.06	0.09	0.53		1.20
Leadership experience	0.34	0.04	0.00	***	1.46	0.32	0.04	0.00	***	1.45	0.37	0.07	0.00	***	1.42	0.35	0.20	0.09	*	1.65
Committee experience	-0.04	0.05	0.44		1.04	0.01	0.06	0.91		1.04	-0.01	0.09	0.92		1.08	-0.10	0.10	0.32		1.15
Award experience	0.04	0.02	0.11		1.24	0.02	0.02	0.35		1.23	0.04	0.02	0.04	**	1.20	0.06	0.03	0.05	**	1.30
log(Average publication)	0.03	0.03	0.23		1.35	0.04	0.07	0.59		1.39	0.00	0.05	0.99		1.31	-0.02	0.10	0.88		1.32
Associate professor	0.43	0.03	0.00	***	2.20	0.30	0.05	0.00	***	1.79	0.47	0.05	0.00	***	1.72	0.33	0.07	0.00	***	1.55
Full professor	0.56	0.07	0.00	***	3.51	0.49	0.05	0.00	***	2.56	0.63	0.13	0.00	***	2.59	0.55	0.13	0.00	***	2.42
log(Years in current appointment)	-0.06	0.01	0.00	***	1.72	-0.04	0.02	0.03	**	1.65	-0.01	0.08	0.91		1.52	-0.12	0.04	0.00	***	1.64
Proportion of white faculty	0.39	0.17	0.02	**	1.37	0.19	0.16	0.24		1.26	0.28	0.10	0.01	***	1.60	0.19	0.17	0.27		1.65
Proportion of male faculty	-0.16	0.26	0.55		1.48	-0.13	0.10	0.16		1.63	-0.06	0.08	0.44		1.63	-0.11	0.28	0.71		1.73
Network size	0.01	0.00	0.00	***	1.21	0.01	0.01	0.02	**	1.15	0.01	0.01	0.18		1.16	0.00	0.00	0.08	*	1.28
Biochemistry	0.02	0.02	0.32		1.39	-0.12	0.01	0.00	***	1.28	-0.12	0.03	0.00	***	1.43	-0.11	0.03	0.00	***	1.15
Civil engineering	0.08	0.06	0.20		1.99	0.07	0.05	0.13		1.67	0.10	0.04	0.00	***	1.99	-0.11	0.11	0.30		1.48
Math	0.01	0.03	0.85		1.48	-0.04	0.02	0.03	**	1.36	0.01	0.03	0.74		1.65	-0.17	0.02	0.00	***	1.40
Proportion of international faculty	0.04	0.22	0.86		1.23	-0.38	0.32	0.23		1.37	0.96	0.50	0.05	**	1.24	-1.79	0.40	0.00	***	1.54
Research extensive	-0.12	0.05	0.02	**	1.86	-0.14	0.08	0.07	*	2.27	0.06	0.07	0.39		2.19	0.22	0.11	0.04	**	2.55
HBCU and HSI	-0.03	0.05	0.53		1.71	0.00	0.08	0.98		1.60	0.21	0.07	0.00	***	2.28	0.07	0.11	0.55		2.75
Women & Liberal Colleges	0.07	0.08	0.42		2.20	0.00	0.02	0.90		2.27	0.21	0.08	0.01	***	2.02	0.19	0.16	0.23		2.48
Institution in city	0.02	0.04	0.51		1.12	0.04	0.02	0.08	*	1.13	0.07	0.03	0.01	***	1.11	0.19	0.13	0.14		1.29
R-squared	0.27					0.25					0.30					0.26				
N	886					815					331					206				

Notes: Clustered standard errors by department.
Reference: Assistant professor, Biology, Research intensive
* $p<0.10$; ** $p<0.05$; *** $p<0.01$

5.9 Summary of Findings

This section summarizes the findings from the hypotheses testing. Overall, 7 out of 13 hypotheses are supported (Table 32). The findings for three hypotheses are the opposite of what was expected.

The regression analyses confirm prior literature that SOCs and women report lower inclusion in their workplace. I also find evidence that network size improves inclusion, and the impacts of network size and friends vary by demographic attributes. Looking at demographic compositions of social networks, I find evidence that whole network homophily improves perceived inclusion; yet when the whole network is separated by location, only external network homophily enhances perceptions of inclusion. In addition, unlike my expectation, I find that when individuals have higher internal network homophily compared to their external network, they tend to have lower inclusion. Demographic attributes result in different experiences. Being SOC or women positively moderates the relationship between perceived inclusion and external network homophily. However, for internal network homophily and higher internal-to-external network homophily, I find the opposite results.

Table 32.

Summary of Hypotheses Testing

Hypotheses		Supported	Table
Individual demographic attributes			
H1	SOCs and women (-)	Yes – for both SOCs and women	Table 19
Network structural characteristics			
H2	Network size (+)	Yes	Table 20
H3	Friends (+)	No	Table 20
H4	Network size by SOCs and women (+)	Yes – for SOCs	Table 21, Table 22
H5	Friends by SOCs and women (+)	Yes – for women	Table 21, Table 22
Network compositional characteristics			
H6	Whole homophily (+)	Yes – for both race- and gender-based homophily	Table 23
H6a	Internal homophily (+)	No	Table 24
H6b	External homophily (+)	Yes – for both race- and gender-based homophily	Table 24
H7	Higher-Internal Homophily (+)	Opposite – for race-based homophily	Table 25
H8	Whole homophily by SOCs and women (+)	No	Table 26, Table 27
H8a	Internal homophily by SOCs and women (+)	Opposite – for SOCs	Table 28, Table 29
H8b	External homophily by SOCs and women (+)	Yes – for SOCs and women	Table 28, Table 29
H9	Higher-Internal Homophily by SOCs and women (+)	Opposite – for women	Table 30, Table 31

The findings suggest that the implications of social networks on one's perceived inclusion are nuanced and complex. For example, I find that network size significantly improves perceived inclusion (H2) but when I separate the respondents by demographic attributes (H4), it only benefits SOCs but not women. Similarly, I do not find statistically meaningful findings for number of friends in general; yet when I conduct sub-group analysis, women, particularly White women, can benefit from friends in their network. When I look at network composition and how much it resembles the respondents, the impacts of social networks on inclusion are subtle. For example, I find general confirmation on the impact of network homophily on perceived inclusion, however, when sub-group analyses are conducted, I find that having similar others has positive effects on particular groups, and where the demographically similar network is located matters for SOCs and women. The next chapter discusses the findings in more detail and concludes this study.

CHAPTER 6

DISCUSSION AND CONCLUSION

6.1 Discussion of Results

In this section, I summarize the findings from the Ordinary Least Squares (OLS) regression analyses in Chapter 5. Next, I discuss findings further to explain possible explanations for expected and unexpected findings.

6.1.1 Summary of Findings

The results of this study suggest mainly three things: (1) social networks can shape perceived inclusion in the workplace, (2) the impacts of the social network depend on the location of the social network, and (3) the impacts of the social network depend on individual's demographic characteristics. The findings also echo prior literature on the marginalization of women and people of color in organizations: Scholars of Color (SOCs) and women continue to report low inclusion compared to White and male colleagues.

First, the findings about network structural characteristics suggest that, in general, the number of people individuals have in their network improves inclusion in the workplace, but the number of friends does not necessarily increase inclusion. Yet, when investigated closer, the impacts of network size and friends become meaningful for certain groups of people. The results show that SOCs' perceptions of inclusion can benefit from having more people in their network, while women can benefit from having more friends.

Second, the findings about network compositional characteristics (network homophily) suggest that overall network homophily improves perceived inclusion; yet, when the networks are disentangled by location, only external network homophily increases workplace inclusion. In addition, I compare the network homophily in the internal and external networks to identify cases in which internal network homophily is higher compared to external network homophily. I find the opposite of my hypothesized direction. That is, I find that higher internal network homophily reduces one's workplace inclusion when the homophily is based on race. The effects of network compositional characteristics on perceived inclusion become more nuanced based on an individual's demographic characteristics. I do not find support for the whole network homophily for SOCs and women. Instead, I find that internal network homophily reduces inclusion for SOCs, while external network homophily improves inclusion for both SOCs and women. Finally, I find that higher internal network homophily compared to external network homophily leads to lower inclusion for women.

6.1.2 Discussion of Findings

In this section, I further discuss the meanings or potential explanations of the findings. I first discuss the impacts of network structural characteristics (network size and friends) and then explain the impacts of network compositional characteristics (network homophily).

First, the results show that having a larger network is associated with higher perceived inclusion but having friends does not necessarily translate into improved inclusion. This is an unexpected finding since multiple studies demonstrate that friends

improve the workplace experience and perceptions (Coleman, 1988; Lingo & O'Mahony, 2010; Obstfeld, 2005; Uzzi, 1996). One possible explanation is that strong ties could be less efficient in generating social capital to improve inclusion. Granovetter (1973) argued that weak ties, as loosely connected social relationships, are more effective in getting access to information and resources than close relationships because they are non-redundant channels to receive social network benefits. Friends, in this case, are likely to offer overlapping resources that do not necessarily help or improve inclusion. Because I look at inclusion as an extent to which individuals feel like a part of organizational processes, it is possible that what individuals look for from their network varies. While friends could provide psychological comfort, having more ties from whom they can retrieve information and resources that directly offer ways to engage in organizational processes may have greater significance. With a greater number of ties they can reach out to and ask for information or resources, individuals' social identity can be perceptually reassured as an in-group member, which helps them develop a positive attitude toward their workplace.

Another possible case could be that friendship is one-sided for SOCs. The survey asked the respondents if they consider their ties as friends, but it is known if the alters consider the respondents (ego) as friends as well. Friendships are based on close interactions and require maintenance (Lazarsfeld & Merton, 1954); those interactions are expected to be rewarding to both connected individuals (Block, 2015). This indicates that friends are evaluating each other's interactions and resource exchanges, and it is often possible that one side perceives that friendship is highly rewarding while the other side does not. If there is a mismatch of evaluations (which can be also perceived as distance in

relationships), the one who has a negative evaluation of the other can renounce the friendship, while the other who has a positive evaluation may still consider the other as a friend. Removal of friendship status can result in decreased interactions and resource exchanges. Therefore, it is possible that individuals that SOCs identified as friends are less likely to be supportive and provide network benefits to SOCs because they do not consider SOCs as friends.

Second, network size and friends have a different meanings for SOCs and women. While SOCs can improve inclusion by having more people in their network, women benefit from friends. The differential impact of network size and friends could be explained by the difference in the representation of SOCs and women in science. While female scientists are about to reach 40% of the total science and technology workforce in higher education, underrepresented minorities only occupy about 9% in 2019 (National Center for Science and Engineering Statistics, 2021). Friends often develop from sharing similar attributes, such as gender and race, and experiences (Lincoln & Miller, 1979). It is possible that women have a greater likelihood of developing close relationships with female colleagues because they have been more prevalent in science than SOCs. On the other hand, SOCs may have difficulty finding friends in their workplace or fields as there are so few of them. As a result, it becomes harder for SOCs to find close ties with similar demographic backgrounds; that is, their networking strategies can be limited to developing non-close relationships. They may focus on expanding their network to engender benefits from their ties.

Third, network homophily improves inclusion. Overall network homophily based on race and gender increases inclusion, in particular, external network homophily has a

greater impact on inclusion than internal network homophily. One potential explanation could be that the meaning of network homophily is more significant for external networks because individuals have the option to choose whom they want to connect to and interact with compared to a work unit network. In the work unit, individuals have less discretion about whom they include in their network and interact with. For example, they form a network because they work together in the same location or share tasks; that is, they interact because they have to.

Fourth, the internal and external network homophily have different effects on SOCs and women. Homophilous internal networks are associated with lower levels of SOCs' perceived inclusion. Otherwise stated, SOC perceptions of inclusion rise with more dissimilar others (Whites in this case) in their networks. One potential explanation is that as SOCs have limited options to find other SOCs from their work unit, they put more effort into fitting in their workplace by searching for a common source of identity other than race. Other common sources for social identity can include age, educational background, and research interests. SOCs tend to deemphasize their race to change their self-representation as their way to reduce or overcome identity threats (Newheiser & Barreto, 2014; Pronin et al., 2004; Van Laar et al., 2019). They can increase the chance of belonging to the workplace by displaying and emphasizing other commonly sharable attributes. For example, they seek to fit into social groups based on research interests to gain in-group membership. This way, SOCs can find positive validation for their social identities from other colleagues by defining their social identity based on non-race categories. In short, race becomes a less meaningful social identity criterion for finding in-group membership.

Moreover, I find that external network homophily increases inclusion for both SOCs and women. A possible explanation could be that similar others outside of their work unit can strengthen and improve their sense of group and improve expectations on inclusion. For example, a high level of external network homophily can boost group entitativity for women and people of color. Group entitativity refers to the extent to which groups perceive themselves as a consolidated entity (Campbell, 1988). Individuals in highly entitative groups are extremely interconnected and dependent on each other (Gaertner & Schopler, 1998; Hamilton et al., 1998; Hogg et al., 2007). SOCs and women who have homophilous external networks can improve workplace inclusion as the external network can offer indirect positive cues for their workplace perceptions. As they join an external network that offers prototypical categories to which they can attach and positively identify, they can hold in-group membership outside their work unit (Castano et al., 2003). In-group membership in an external network suggests positive validation of their identities which indirectly shape their perceptions of selves and expectations about their influence in their network and workplace (Bandura, 1993; Tajfel et al., 1971; Vroom, 1995).

Fifth, the findings suggest that a higher internal network race-based homophily compared to external network homophily reduces inclusion. That means when individuals have a higher number of racially similar others in their external network than in their internal network, their perception of inclusion in the workplace improves. In particular, the comparison of internal and external network homophily is more significant for women. When women have higher internal network homophily compared to their external network, their level of inclusion decreases, while higher internal network

homophily compared to their external network can improve men's inclusion. This means that women's inclusion decreases from having more women in their internal network than in their external network. Marginalization of women has been institutionalized in organizations and that can offer possible explanations (Acker, 1990; N. Thomas et al., 2015). Women may try to fit into the male-dominant world for adaptation and survival. Because of a deeply rooted masculine culture and male-dominant environment, women could seek male ties for their own benefits rather than finding other female ties which are deemed to be less effective for career-related outcomes (Stainback, 2008). It is not rare to find women who try to fit into the masculine culture and disapprove gender-based inequities experienced by fellow women. Some female STEM faculty report that they perceive that the current masculine culture is adequate for everyone and fellow women need to try harder to fit into the expectations of male colleagues (Bird & Rhoton, 2021). It could be the case that women's social identity as an in-group member is approved when they are connected to male colleagues in their work unit because they think that they are part of the majority group.

For male colleagues, having more men in their internal network compared to their external network improves their inclusion. Having more gender-similar internal networks located in their work unit can reassure them of their in-group membership which positively validates their social identities.

6.2 Research Limitations

This dissertation has a few limitations. First, the study results may not be generalized across all types of organizations. This study looks at science disciplines in

higher education institutions. Universities are special cases of organizations in which collaborations in disciplines and across disciplines are strongly encouraged and network types and structures vary by discipline (Kyvik & Reymert, 2017). An academic culture, such as disciplinary expectations, norms, and frequency of collaboration, can affect how individuals develop and expand their networks and how they compose their networks. For example, compared to social sciences, science and engineering fields are characterized by higher qualifications and higher interdependence of research and collaboration. The implications of findings may not be applicable to other types of organizations that are governed by different norms and cultures for collaboration.

Second, there are limitations regarding the data I use for this dissertation. The nature of cross-sectional data limits the study to investigate the relationship among variables at a single point in time which reduces the certainty of causal directions. A longitudinal survey would be helpful to understand the causal relationships between each social structure (individual, work unit, and network) and perceived sense of inclusion. Moreover, this study uses survey data of academic scientists in 2011, given that more aggressive diversity and inclusion policies have been devised and implemented in more recent years, workplace experiences may have changed over time.

Moreover, this study has measurement issues. First, defined by Mor Barak and Cherin (1998), perceived inclusion includes three components: access to information and resources, participation in the decision-making processes, and work group involvement. Yet this study only looks at one aspect – participation in the decision-making process. I argue that the extent to which individuals perceive themselves can be measured as having an influence on departmental decision-making processes compared to their colleagues. In

the current study, I assume that having information and being involved in workgroups are sufficient conditions to exert influence in the decision-making process. Future studies should investigate the impacts of social networks on other components of perceived inclusion. Second, the data constrains further investigation of the experience and perceptions of diverse individuals. Because of the limited data, I had to combine different race categories into a single category, as SOCs, which overshadows the differential experiences of each unique individual. Future studies should look at disentangling the racial and ethnic categories and examine how the impacts of social networks on perceived inclusion differ by diverse race and ethnicity.

Lastly, this dissertation does not look at other determinants that could shape inclusion in the workplace such as leadership and organizational practices. Prior research emphasizes that depending on leadership styles or even the leader's demographics, individuals' interpretation of the workplace can change (Ashikali & Groeneveld, 2015; Nembhard & Edmondson, 2006; Nishii & Mayer, 2009). Leaders can devise and implement inclusive practices across the organization that guides organizational culture but also can improve interactions with employees that offer positive cues to their workplace experience. Also, inclusive practices, such as the promotion of cross-departmental collaboration or efforts for fair treatment can affect perceived inclusion (Roberson, 2006; Sabharwal, 2014). Hence, future studies could examine how leadership and organizational practices can shape the relationship between perceived inclusion and social networks.

6.3 Contribution of the Research

This dissertation offers several contributions to organizational behavior literature, public administration, and diversity and inclusion policies. First, this dissertation improves the understanding of how perceived inclusion can become relative based on individuals' demographic characteristics, where their networks are located, and how their networks are composed of. By looking at how the impacts of social structures on perceived workplace inclusion are contingent on demographic characteristics and external social contexts, this dissertation suggests that the experience of inclusion in the workplace depends on various aspects of social structures. Second, this dissertation demonstrates how social structures account for the perception of inclusion in public organizations. Prior studies that looked at demographic compositions of workgroups have primarily looked at private firms. This dissertation enriches the understanding of workplace inclusion in the public sector. Lastly, this dissertation provides some policy implications for diversity and inclusion policies. The dissertation suggests that having a representative workforce is important, yet further understanding of how a diverse workforce interacts in and experiences the workplace is indeed an essential part of creating a truly inclusive work environment.

6.3.1 Theoretical Contribution

This dissertation contributes to inclusion research and literature in public organizations, focusing on higher education institutions. Prior literature on inclusion in the workplace has been looking at workgroup demography, which looked at the proportional composition of work units, and individual level of demographic

dissimilarity, which explored the extent to which work group resembles employees' demographic attributes (Andrews & Ashworth, 2015; Bae et al., 2017; O'Reilly et al., 1989). The current study expands the inclusion research by examining social networks individuals form inside and outside of their workplace. In particular, the study suggests that networks, in which individuals have more choice and leverage to form a network, are more advantageous for the improvement of inclusion. Given that individuals interact with other colleagues within work units and organizations and across different organizations, it is essential to understand how social network can explain their inclusion in the workplace.

Previous studies on social identities have been focusing on a single social category that assigns group memberships to individuals as they assumed that social identity is defined by a single social group, they are part of. More recently, scholars have started to look at the construction of multiple group memberships and social identities (E. U. Choi & Hogg, 2020a). This study contributes to supporting the tenet of recent arguments of social identity scholars that individuals are exposed to multiple group membership, compare and contrast their social identities in each group, and develop favorable attitude or attachment toward the group that provides positive validation of their social identities (E. U. Choi & Hogg, 2020b; Reid & Hogg, 2005). Yet, the research on multiple identities and how they play a role in workplace perceptions and outcomes is understudied. By comparing the network homophily in two different social groups – internal network and external network, men are likely to receive positive validation from other men in their work unit network. The findings show that they develop a positive perception of their workplace when their internal network is composed of more men than

their external network. Other men in their network can confirm and verify their in-group status.

6.3.2 Policy Contribution

This dissertation offers insights into diversity and inclusion practices in public organizations that resemble universities and have a culture of internal or cross-organizational collaborations. Findings suggest that inclusion is a function of broader implications of diversity and social environment. In addition to considering an individual's demographic characteristics as key criteria for devising diversity and inclusion policies, there is a need to identify mechanisms to use social networks to improve the workplace experience of women and people of color. The findings imply that women's and people of color's inclusion can be improved by having similar others outside of their work unit. This encourages to rethink proactive policies and programs that help find similar others in other departments or organizations. Programs could be developed to build cross-department or inter-agency networks for women and people of color. In addition, leadership and organizations can foster an inclusive work environment which can make individuals aware of different levels of inclusion. In such an environment, individuals are expected to feel free to discuss workplace injustice, receive diversity and inclusion training, create a safe space to share discriminatory practices, and take collective actions to find solutions.

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