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Faculty Parental Status: An Investigation of Network Homophily, Marginalization, and Supportive Work-Family Academic Culture

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FACULTY PARENTAL STATUS: AN INVESTIGATION OF NETWORK

HOMOPHILY, MARGINALIZATION, AND SUPPORTIVE WORK-FAMILY

ACADEMIC CULTURE

by

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FACULTY PARENTAL STATUS: AN INVESTIGATION OF NETWORK HOMOPHILY, MARGINALIZATION, AND SUPPORTIVE WORK-FAMILY ACADEMIC CULTURE

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Serious incompatibility between work and family life among faculty is well known, and various work-family policies have become available to faculty. Due to the traditional academic work culture (e.g., the ideal worker norms and the individualism norms), however, these policies tend to be underused. Therefore, it is necessary to develop an academic work culture that is more supportive of faculty's work-family needs. Using data collected on tenure-line faculty at a research-intensive Midwestern university, this dissertation pursues three complementary research objectives that provide new insight into the culture of academic work environments. First, based on social identity theory and homophily theory, I assess the presence of parent homophily within departmental friendship networks and explore if it varies by gender. Second, I investigate whether parents, especially mothers, have smaller friendship networks (i.e., hold marginalized network positions) within academic departments compared to non-parents. Finally, I examine how parent homophily and network size predict perceptions of work-family culture in the department. Results show that parent homophily exists in faculty friendship networks, but there is a gender divide. Mothers tend to have friendship connections with other mothers while fathers tend to be friends with other fathers (the tendency is especially strong among mothers). Parental status and gender are not

associated with network marginalization. Among faculty parents, however, larger friendship networks are associated with more positive perceptions of work-family culture. Moreover, greater parent homophily is associated with more negative perceptions of supportive work-family culture only for mothers. The findings of this study imply that encouraging non-work related interactions with colleagues (e.g., discuss personal matters, and share free time) might help foster a more work-family supportive work culture in academia. Care must be taken, however, because parent homophily (being primarily friends with other parents) might negatively affect perceptions of work-family culture for faculty mothers.

DEDICATION

This dissertation is dedicated to my mother, Machiko Watanabe, who gave me much love

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GRANT INFORMATION

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CHAPTER 1: INTRODUCTION

Increasing gender diversity among faculty is essential to the future success of academia. Men and women often have different backgrounds, interests, and approaches toward research, thus gender diversity within the academic workforce should enrich the process of knowledge creation (Fehr 2008). The reality, however, is that women are under-represented, especially in the fields of Science, Technology, Engineering, and Mathematics (STEM) (National Science Foundation [NSF] 2013; Rosser 2012). Despite the rising inflow of women into STEM as undergraduate and graduate students, women are less likely than men to stay in academia and move up the ladder to become full professors (Goulden, Mason, and Frasch 2011; Mason and Ekman 2007; May 2008). This doctoral dissertation research focuses on supportive work-family culture in academic departments as a key component to retaining more women faculty and ultimately increasing the representation of women in the US faculty population as a whole.

To increase gender diversity among faculty, we cannot avoid discussing work-family conflict. Researchers have repeatedly pointed out that raising a family while managing the heavy workloads of a tenure-line faculty member is challenging (Mason and Goulden 2004; O'Laughlin and Bischoff 2005; Ward and Wolf-Wendel 2004, 2012; Wolfinger, Mason, and Goulden 2009). *Work-family conflict* arises when "the role pressure from the work and family domains are mutually incompatible in some respect" (Greenhaus and Beutell 1985: 77). While there are other factors that go into faculty turnover intentions and the actual act of turnover (e.g., job satisfaction, salary, opportunities for career advancement, pursuit of research interests, department climate) (Callister 2006; Daly and Dee 2006; Matier 1990; Rosser 2004; Smart 1990; Xu 2008a,

2008b; Zhou and Volkwein 2004), work-family conflict is also a key factor in faculty retention (Preston 2004). The challenge of combining work and family life is particularly difficult for women who are disproportionately primarily responsible for housework and childcare (Bianchi et al. 2000; Coltrane 2000; Misra, Lundquist, and Templer 2012). As a result, a considerable number of women faculty leave tenure track academic positions during the period in the life course when heavy job requirements coincide with childrearing (Kaminski and Geisler 2012; Mason and Ekman 2007).

In academic workplaces, motherhood is often considered a characteristic that signifies women's lack of professional qualification and commitment to work (Ward and Wolf-Wendel 2012). Similar to women in leadership positions, women faculty are therefore in a double bind situation (Jamieson 1995). When they delay or forgo having children to focus on their career, they are likely to experience social pressure to attain a motherhood status. On the other hand, when they meet gender appropriateness in society by becoming a mother, they are likely to receive penalties at work because motherhood calls into question their seriousness about work. For men, in contrast, it is less difficult to be both a faculty member and a father at the same time. In many cases, fatherhood actually works to the advantage for their career development (e.g., tenure and promotion rates) (Mason, Wolfinger, and Goulden 2013). Clearly, an effort to create work environments that facilitate the integration of work and family life for both men and women is necessary to retain more women and achieve gender diversity in academia.

When the goal is organizational change, such as creating work-family supportive work environments, it is important to consider both structural and cultural approaches. Kossek, Lewis, and Hammer (2010) define *structural approaches* as alterations of

"human resource policies and practices and job structures" (p.4). Much attention has been directed to the necessity of structural support for faculty, and various work-family policies and programs are widely available at academic institutions today (e.g., paid/unpaid parental leaves, tenure-clock extension, part-time tenure-track positions, teaching load modification, transitional support programs, dual career hiring, and university-supported childcare) (Hollenshead et al. 2005; Mayer and Tikka 2008; Quinn, Lange, and Olswang 2004; Spalter-Roth and Erskine 2005; Wolf-Wendel, Twombly, and Rice 2000).

Less attention, however, has been paid to how to promote faculty's work-family integration through cultural approaches. *Cultural approaches* are defined as alterations of "informal workplace social and relational support" (Kossek, Lewis, and Hammer 2010: 4). For example, changes in the workplace norms and informal relational support (e.g., social support from coworkers and supervisors) are part of cultural approaches. The concept of *work-family culture* (sometimes called *work-family climate*) is relatively new, but it generally refers to "the extent to which work environment is supportive with regard to employees' work-family needs" (Mauno et al. 2006: 214).

Researchers have become increasingly aware that simple availability of work-family policies does not necessarily help alleviate employees' work-family conflict. This is because work-family culture influences the willingness of employees to use the policies (Allen 2001; Kinnunen and Mauno 2005; Kossek, Lewis, and Hammer 2010; Lewis 1997, 2001). For example, fear of negative career consequences makes employees reluctant to use available policies (Eaton 2003). This tendency applies to faculty, and they often avoid bringing up family matters and using work-family policies (Colbeck and

Drago 2005; Drago et al. 2006; Hollenshead et al. 2005; Spalter-Roth and Erskine 2005). Furthermore, positive perceptions of work-family culture lower faculty's turnover intentions specifically due to better work-family balance (Watanabe and Falci 2014). Therefore, in addition to development of work-family policies, it is crucial to address work-family culture in academia.

Using data on over 500 faculty in 41 STEM and Social and Behavioral Sciences (SBS) departments, the purpose of this study is to better understand faculty' informal personal connections and how informal social networks shape work-family culture in the department for faculty parents. Throughout this paper, I use the term *friendship connections* to refer to non-work related social interactions (e.g., discuss personal matters, share free time). My research consists of three parts: (1) to assess network homophily (i.e., tendency to be connected to similar others) in faculty friendship networks across parental status and gender, (2) to investigate differences in network size of faculty's friendship networks across parental status and gender, and (3) to examine how network homophily and network size in friendship networks are related to the perceptions of work-family culture among faculty parents (and if gender moderates these associations).

My first research objective is to study parent homophily in faculty friendship networks. I define *parent homophily* as the tendency to interact with others who share parental status (parents or non-parents). Given that we tend to integrate with those who share social characteristics, such as gender and race (Hewstone, Rubin, and Willis 2002; Hogg 2006), I expect that parents tend to form friendship connections with other parents while non-parents tend to be friends with other non-parents. Because the experience of

being a faculty mother can be more difficult than being a faculty father (Mason and

Goulden 2004; Mason, Wolfinger, and Goulden 2013; Ridgeway and Smith-Lovin 1999),

I also assess homophily in faculty friendship networks by gender in addition to parental

status. Specifically, I expect mothers to have a particularly strong tendency to interact

with other mothers.

My second research objective is to explore if the presence of children reduces

faculty's friendship connections with colleagues. Based on the ideal worker norms (Blair-

Loy 2003; Drago 2007; Jacobs and Gerson 2004; Williams 2000; Williams, Alon, and

Bornstein 2006) and the norm of individualism (Drago 2007), it is likely that parents are

more marginalized in departmental friendship networks compared to non-parents. Since

faculty mothers tend to spend more time on childcare than faculty fathers (Misra,

Lundquist, and Templer 2012), mothers may have even smaller networks than fathers.

Thus, I also examine whether the association between parental status and network size is

moderated by gender.

After looking into the role of parental status and gender in homophily and

network size, the third objective of my research is to explore how these social network

factors are related to perceptions of work-family culture. While the outcomes of work-

family culture, such as the use of work-family policies, work-family conflict, and

turnover intentions, have been empirically studied (Allen 2001; Kinnunen and Mauno

2005; Thompson, Beauvais, and Lyness 1999), we lack research on factors that

contribute to perceptions of work-family culture (Mauno et al. 2006). Therefore, this

study uses network analysis to identify the structures of friendship networks that are

associated with more positive perceptions of work-family culture. Again, the possibility of gender moderation is explored.

The third research objective only includes faculty with children (i.e., parents) in the analytic sample. This is because the experience of balancing career and personal life and perceptions of supportive work environment are different between parents and non-parents (Casper, Weltman, and Kwesiga 2007; Young 1999). For example, the presence of children dramatically increases time spent on caregiving (Misra, Lundquist, and Templer 2012), and the level of work-family conflict is higher among faculty parents compared to non-parents (Fox, Fonseca, and Bao 2011). For these reasons, the third research objective focuses on faculty parents and explores the role of social network factors in their perceptions of work-family culture.

This study expands previous research in three ways. First, no one has used complete network data to explore whether parental status leads to homophilous connections and marginalized network positions (i.e., smaller network size) within workplaces. Research has identified that childrearing affects the extent to which parents have interactions with relatives, friends, and neighbors (Belsky and Rovine 1984; Bost et al. 2002; Gallagher and Gerstel 2001; Ishii-Kuntz and Seccombe 1989; Munch, McPherson, and Smith-Lovin 1997). Yet it is not clear how parental status is associated with friendship formation among coworkers. Several researchers have studied gender and race differences in informal interaction patterns in non-academic work settings, such as an advertisement firm, a newspaper publishing company, and state government (Brass 1985; Ibarra 1992; Moore 1988, 1992). To the best of my knowledge, however, this study

is the first study to take a social network approach to examine parent homophily and parental marginalization in friendship networks among work colleagues.

Second, Exponential Random Graph Models (ERGMs) are used to assess parent homophily for my first research objective. ERGMs are recently developed probability models for network analyses (Robins et al. 2007). Qualitative studies have noted male-dominated or "old boys" informal networks in academia, which depict the tendency of senior men faculty to interact with each other forming exclusive networks (Clark and Corcoran 1986; Fox and Colatrella 2006; Monroe et al. 2008; Roos and Gatta 2009). This line of research implies that there exists homophily by gender and seniority in faculty's social networks. No one, however, has applied ERGMs to study any kind of homophily in faculty friendship networks within tenure home departments. Therefore, the use of ERGMS and the focus on parent homophily make my dissertation research unique.

Third, my analysis of friendship connections advances previous research on work-family conflict in academia. Many researchers have addressed the necessity of work-family policies to alleviate work-family conflict among faculty (Drago and Williams 2000; Mayer and Tikka 2008; Quinn, Lange, and Olswang 2004; Wolf-Wendel, Twombly, and Rice 2000). Through my research, I emphasize that in addition to the structural or institutional contexts, we need to pay attention to what is happening at the cultural or interaction level. To be specific, I attempt to clarify how friendship connections with colleagues shape work-family supportive work environments. I believe my cultural approach makes a valuable contribution to the studies of work-family integration among faculty.

This introductory chapter is followed by seven chapters. In Chapter 2, I explain the over-arching theoretical framework of this study. I also discuss social network theories and gender approach that are useful in addressing social relationships and work-family culture. Chapter 3 provides a review of the existing literature and explains the hypotheses based on previous research. Chapter 4 explains the data, sample, measures, and data analysis strategies used for my three research objectives. Chapters 5, 6, and 7 present the results for Objective #1 ("Homophily across Parental Status and Gender in Faculty Friendship Networks"), Objective #2 ("The Effect of Parental Status by Gender in the Size of Faculty Friendship Networks"), and Objective #3 ("Friendship Networks (Parent Homophily and Network Size) and Perceptions of Supportive Work-Family Culture"), respectively. Chapter 8 summarizes these results and discusses the implication of this study as well as limitations and suggestions for future research.

CHAPTER 2: THEORETICAL PERSPECTIVES IN WORK-FAMILY

RESEARCH AND APPLICATION OF SOCIAL NETWORK THEORIES

I start this chapter by briefly reviewing some of the theoretical perspectives on work and family. Depending on academic disciplines, work-family researchers use different theoretical perspectives (Kossek, Sweet, and Pitt-Catsouphes 2006). For example, many psychologists use role theory to explain how participation in multiple roles in the work and family domains negatively and positively affects employee well being (Barnett and Gareis 2006; Hanson et al. 2006; Ruderman et al. 2002). Sociologists often take into account the impact of status characteristics (e.g., gender, race, and class) and examine how the experience of combining work and family roles varies across groups (Gerstel and Sarkisian 2006; Kossek, Sweet, and Pitt-Catsouphes 2006). The applied versions of Bronfenbrenner's ecological systems theory (1979) are frequently used across disciplines (Grzywacz and Marks 2000; Voydanoff 2005a; Wayne et al. 2007). From the ecological perspective, work and family are microsystems where individuals participate in roles, activities, and interpersonal relationships. When the two microsystems are linked to each other, they comprise a mesosystem. The job demands-resources perspective is another typical theoretical approach in work-family research (Bakker and Demerouti 2007). Because this study takes the job demands-resources orientation, I further discuss this theoretical perspective below.

Job Demands-Resources Perspective

This study applies the concepts of job demands and resources to address the importance of creating academic environments that are supportive of faculty with work-family needs. Among the diverse theories across disciplines, the job demands-resources

perspective is one of the most frequently-used approaches in work-family research (Bianchi and Milkie 2010). The advantages of the job demands-resources model include its applicability to employees in various occupations with different job characteristics (Bakker and Demerouti 2007; Bianchi and Milkie 2010). For organizations, it is usually easier to support employees by improving their work life compared to intervening in their family life. The job demands-resources model is especially useful when researchers want to identify the work-related characteristics that contribute to the incompatibility between work and personal life (Bakker and Geurts 2004; Schieman, Milkie, and Glavin 2009; Voydanoff 2004).

The job demands-and resources approach separates job characteristics into two broad categories: job demands and job resources. *Job demands* are defined as "those physical, psychological, or organizational aspects of the job that require sustained physical and/or mental effort and are, therefore, associated with certain physiological and/or psychological costs" (Bakker and Geurts 2004: 348). The examples of job demands include work hours and emotional demands. *Job resources* are defined as "those physical, psychological, or organizational aspects of the job that may be functional in meeting task requirements (i.e., job demands) and may thus reduce the associated physiological and/or psychological costs – and at the same time stimulate personal growth and development" (Bakker and Geurts 2004: 348). The examples of job resources include autonomy, opportunities for learning and development, and sense of meaningful work. Job demands are generally detrimental for work-family integration while work resources are likely to reduce the role conflict between work and family domains (Bianchi and Milkie 2010).

Voydanoff (2004) proposes that demands and resources can originate at work and serve as a demand or resource in both work and family domains. These are called *boundary-spanning demands* and *boundary-spanning resources*. Overnight traveling and bringing work home are the examples of boundary-spanning demands. According to Voidanoff's job demands-resource framework, supportive work-family culture, the focus of this study, is an example of boundary-spanning resources. Supportive work-family culture originates at work and improves employee well-being in both work and family life (e.g., increase in job satisfaction and life satisfaction, decrease in stress) (Beauregard 2011; Haar and Roche 2011).

There are several reasons why this study pays particular attention to work-family culture, which is one aspect of the job demands-resources model. First, work-family culture is of increasing importance for workers in general (Andreassi and Thompson 2008; Kossek et al. 2011). Work-family culture plays an essential role in improving workers' ability to combine work with family (Anderson, Coffey, and Byerly 2002; Behson 2002; Mauno et al. 2006; Mesmer-Magnus and Viswesvaran 2006). For example, it impacts an employee's willingness to use available work-family policies (Allen 2001; Kinnunen and Mauno, 2005; Kossek, Lewis, and Hammer, 2010; Lewis 1997, 2001). Supportive work-family culture also has a negative relationship with work-family conflict (Beauregard 2011; Voydanoff 2004; Wayne, Casper, Matthews, and Allen 2013) and turnover intentions (Allen 2001; Thompson, Beauvais, and Lyness 1999; Thompson and Prottas, 2005). Secondly, particularly among faculty, a study found that positive perceptions of work-family culture decrease turnover intentions specifically due to a desire for a better work-family balance (Watanabe and Falci 2014). This previous study

implies that developing a supportive work-family culture can help academic institutions avoid losing faculty for work-family conflict. Thus, I pursue the possibility of retaining more faculty parents by exploring factors that contribute to their perceptions of work-family culture.

Although previous research has rarely looked at factors that create supportive work-family culture, there is one exception. Valcour et al. (2011) used data from over 2000 employees working for nine US organizations in various industries and found a few factors that significantly predicted perceptions of organizational work-family support. The significant predictors were work hours, work overload (negative associations), job security, availability and fit of flexible work arrangement, and supervisor support and coworker support (positive associations). The current study examines the role of the last predictor (coworker support) further by analyzing faculty friendship networks within their department. A social network approach, as taken in this research, should help us gain valuable knowledge of faculty friendships and how to develop more supportive work-family culture in academia.

Network Theories of Social Capital

In addition to the job demands-resources model, network theories of social capital guide the analyses of this study. *Social capital* refers to resources that are acquired through direct and indirect social interactions (Bourdieu and Wacquant 1992; Burt 2000; Coleman 1990; Putnam 1993). Such resources give individuals an advantage and help pursue one's goals. For this study, I argue that faculty build social capital (e.g., receive social support) through friendship connections with colleagues. Faculty with more social capital are likely to feel that their work environment is work-family supportive because

they can receive helpful information and resources from their contacts. At the same time, faculty who have less social capital may perceive that their work environment is less supportive of their work-family needs compared to faculty who have more social capital.

This study treats composition (e.g., homophily) and network size as different measures of social capital. After exploring variation in homophily and network size across parental status and gender, I examine how these measures of social capital are associated with perceptions of supportive work-family culture. Heterophilous networks usually work to the advantage of employees by providing diverse network relationships and resources (Granovetter 1983; Lin 2001). No research, however, has looked at the outcomes of parent homophily. Therefore, I use social identity theory and homophily theory to understand how parental status affects to whom faculty have friendship connections to and also how parent homophily is related to perceived work-family culture (more discussions about these theories in Chapter 3). In terms of network size, larger networks are usually associated with more resources (Burt 1992). Having a large network indicates that the person has many connections from whom to draw resources. Based on this approach, faculty possessing larger friendship networks should have more social capital compared to faculty with smaller friendship networks. This study explores how parental status affects the size of faculty's friendship networks and how network size is related to perceptions of work-family culture among parents (more details in Chapter 3).

Gender

It is impossible to understand coworker interactions without paying attention to gender. Gender is embedded in the society and strongly influences how we organize our social relations (Acker 1990; Ridgeway 2011; West and Zimmerman 1987). Gender

affects our lives in three dimensions: individual, interactional, and institutional levels (Risman 2004). Status beliefs (e.g., stereotypes) are often created and sustained at the interaction level, but we do not know much about how gender interacts with parental status and affects coworker interactions. Using social network analysis, this study quantitatively examines variation in homophily and network size across parenthood and gender. The intersection of parental status and gender may reveal important differences in workplace network inequality.

Thus far, previous research has shown that parental status differently affects men and women's work experiences. Compared to women without children, mothers are paid less (so called "motherhood penalty") (Budig and Hodges 2010; Gangle and Ziefle 2009; Gough and Noonan 2013). On the other hand, men get a "fatherhood bonus", and fathers tend to earn more compared to men without children (Hodges and Budig 2010; Kmec 2011). This wage inequality is partly because mothers often receive biased performance evaluations (Correll, Benard, and Paik 2007; Ridgeway and Correll 2004b). For example, mothers are viewed as less competent and committed than fathers and non-parents when they have equal qualifications (Benard and Correll 2010). In contrast, being a father helps men's career development. The presence of children increases the perception that men are devoted to work because they have a family to provide for (Killewald 2013; Milkie and Peltola 1999). These research findings suggest that we cannot fully understand the influence of parenthood at work without paying attention to how it interacts with gender. Therefore, this study explores friendship networks among faculty focusing on both parental status and gender.

   To summarize this chapter, this study focuses on one aspect of the job demands-resources model and expands the understanding of supportive work-family culture. Through the application of network theories of social capital, it investigates the relationship between social capital (measured by parent homophily and network size) and perceptions of supportive work-family culture. This study should contribute to both the field of work-family research and the field of social network analysis by exploring how parenthood interacts with gender to shape coworker relationships and workplace perceptions.

CHAPTER 3: LITERATURE REVIEW

The previous chapter discussed the theoretical perspectives on which this study is based. In this chapter, I explain work-family culture specific to academic work settings, review more literature that is relevant to this study, and state expected findings.

Work-Family Culture in Academia

For a long time, we have known that academic work culture disadvantages faculty who have involvements outside of work. Under the influence of the traditional workplace norms, striking a balance between work and family life is still challenging for faculty. It is well known that the ideal worker norms, which expect a high commitment to one's career without allowing family responsibilities to interfere with work, contribute to work-family conflict for workers in general (Blair-Loy 2003: Drago 2007; Jacobs and Gerson 2004; Williams 2000). Faculty are not exception to these ideal worker norms (Ward and Wolf-Wendel 2012; Williams, Alon, and Bornstein 2006). Faculty jobs involve heavy workloads and high job pressures. For example, to obtain tenure and promotions, faculty must meet high performance expectations (e.g., publications, grants, and teaching evaluations) (Grant, Kennelly, and Ward 2000). Although there is variation by multiple factors (e.g., gender, academic rank, type of institution, and life stage), faculty typically work over 50 hours per week (Jacobs and Winslow 2004b). Previous research suggests that the violation of such extremely high work commitments leads to stigmatization for faculty parents (Cech and Blair-Loy 2014).

As mentioned before, work-family policies, such as paid/unpaid parental leaves and tenure-clock extension, are now widely available for faculty. Despite the increasing availability of work-family policies in academia, many researchers show strong concern

that faculty are not taking full advantage of their work-family benefits (Colbeck and Drago 2005; Drago et al. 2006; Hollenshead et al. 2005; O'Maera and Campbell 2011; Spalter-Roth and Erskine 2005). In fact, one study of faculty at a large research-intensive university found that only 61% of eligible faculty took a paid parental leave (Lundquist, Misra, and O'Meara 2012). The pressure from the department to return to work is considered one of the major reasons behind the underuse of work-family policies among faculty (Finkel, Olswang, and She 1994).

In addition to the ideal worker norms that are nonpermissive of family needs, faculty are also influenced by the norms of individualism. The individualism norms expect workers in traditionally male-dominated occupations to deal with work-family conflict as a personal matter (Drago 2007). Because of this individualistic perspective, parents (especially mothers who are likely to be the primary caregivers) work under the pressure not to bring up family issues at work or ask for support.

It is clear that academic work culture, represented by the ideal worker norms and the individualism norms, becomes an obstacle to increase the actual use of work-family policies. Workplace norms within the department especially affect faculty's decisions about whether or not to take a parental leave (Finkel, Olswang, and She 1994; O'Meara and Campbell 2011). Therefore, it is of great importance to develop a department work culture that is supportive of those who have non-work related obligations. The problem, however, is that we know little about how to develop supportive work-family culture in and outside of academia (Mauno et al. 2006). As such, this study explores the role of social capital (or social support) acquired through friendship networks within the

department. It starts by investigating the roles of parental status and also gender in network homophily.

Parental Status and Network Homophily

Social psychologists argue that social characteristics (e.g., gender, race) are deeply embedded in our personal interactions (Massey 2007). For example, we tend to automatically categorize others by gender to facilitate daily interactions (Ridgeway and Correll 2004a; Ridgeway 2011). Social identity theory focuses on the sense of group membership (called *social identity*) to explain patterns of personal interactions (Hewstone, Rubin, and Willis 2002). According to the theory, we develop a sense of "we/us" and "they/them" based on social characteristics and separate others and ourselves into *in-group* and *out-group*. We tend to favor in-group members over out-group members.

In the field of social network analysis, the tendency to be attracted to in-group members is explained as *network homophily*. Homophily theory states that we tend to interact with "similar" others (e.g., others who share social characteristics) and form *homophilous* networks (Lazarsfeld and Merton 1954; McPherson, Smith-Lovin, and Cook 2001). Generally, we prefer similar others over dissimilar others because we anticipate having common interests and easy interactions with similar others. For example, within a mixed gender work setting, connections between workers of the same gender are likely to happen at a higher rate than connections across gender (Ibarra 1992). Empirical research has repeatedly supported the presence of homophily (e.g., gender homophily, race homophily) in the US (e.g., Marsden 1987; Smith, McPherson, and Smith-Lovin 2014; Mayhew et al. 1995).

Parental status is likely to function as a source of social identity among faculty on which homophily is based. Previous research suggests that identifying as a parent could influence people's behaviors at work (Nuttbrock and Freudiger 1991). As a salient identity, parents may favor spending time with other parents over non-parents while non-parents favor other non-parents over parents. Thus, I expect:

H1: Parents will tend to interact with other parents and non-parents with other non-parents more often than expected due to chance.

At the same time, the extent of parent homophily may differ by gender. Being a father and being a mother have different meanings in family life. Compared to faculty mothers, faculty fathers are generally less likely to have full-time employed spouses (Jacobs and Winslow 2004b) and spend less time on housework per week (Misra, Lundquist, and Templer 2012; Suiter, Mecon, and Feld 2001). Due to the gendered division of household labor, men faculty are more likely than women faculty to have children as a whole and especially at an early stage of a tenure-line faculty career (Mason and Goulden 2004). Because it is less common for academic departments to have mothers compared to fathers, motherhood might be more salient than fatherhood in the department. Gender has implications for both family and work roles. Women are generally more likely than men to report feeling socially isolated in academic workplaces (Monroe et al. 2008; Roos and Gatta 2009; Yen et al. 2007). Also, due to persistent stereotypes and gender bias in regard to competence and suitability, faculty mothers are often disadvantaged in evaluation and promotion (Valian 1998; Williams 2004). Therefore, I expect mothers to be more likely than fathers to form homophilous groups looking for mutual understanding and support.

H2: The tendency for parent homophily will be stronger among women (i.e.,

mothers) than men (i.e., fathers).

Parental Status and Network Size

In addition to parental status shaping to whom faculty form connections, it may

also affect the number of friendship connections established within the department. There

are a few reasons to believe that being a parent may constrain friendship connections for

faculty. First, childrearing can influence parents' amount of social contact in general

(Ishii-Kuntz and Seccombe 1989; Munch, McPherson, and Smith-Lovin 1997).

Specifically, research suggests that increases in family demands (e.g., new children)

decrease time and energy that fathers invest in social activities with non-family members

(Knoester and Eggebeen 2006) (this study did not have mothers in the sample).

Additionally, as I have explained, the norm of individualism in male-dominated

workplaces puts pressure on parents to find solutions to work-family conflict by

themselves (Drago 2007). Working under this norm, parents might be too busy handling

work and family responsibilities. Thus, they might not have time to interact with

colleagues unless it is necessary to carry out their work. It is also possible that colleagues

might avoid non-work related interactions with parents because they assume that parents

(especially mothers) have limited time. For these reasons, I expect parents to have fewer

friendship connections with colleagues (i.e., hold marginalized network positions)

compared to non-parents.

H3: Parents will have smaller friendship networks in the department than non-

parents.

Increasing attention is paid to work-family conflict among faculty fathers (Marotte, Raynolds, and Savarese 2010; Reddick et al. 2012; Sallee 2012). Yet women faculty are still likely to experience greater work-family conflict than men (DeAngelo et al. 2009; Drago et al. 2006; Fox, Fonseca, and Bao 2011). Therefore, it is possible that the impact of parental status on network marginalization is stronger for women compared to men:

H4: Mothers will have smaller friendship networks compared to fathers.

Friendship Networks and Work-Family Culture

Thus far, I have discussed the potential impact of parental status and also gender on the structures of friendship networks (parent homophily and network size). This section, in contrast, will discuss the possible association between friendship networks and perceived work-family culture.

Parent homophily and work-family culture. According to social identity theory, we tend to perceive that out-group members are less variable (or more homogeneous) compared to in-group members (called *out-group homogeneity effects*) (Hewstone et al. 2006; Voci et al. 2008). This type of depersonalization leads to biased evaluation of out-group members based on stereotypes (Fiske et al. 2002). Applying the idea of out-group homogeneity effects, parents might view non-parents as a homogeneous group of people who are less understanding of difficulty combining work and childrearing compared to parents. Therefore, faculty parents might feel more understood and more supported when they have friendship connections primarily with other parents in the department.

The lack of previous research makes it difficult to predict how parent homophily is associated with the perceptions of work-family culture. Generally, however, studies

that compared homophilous and heterophilous work groups suggest that homophilous groups tend to be efficient due to shared identity and norms (Civettini 2007) and also that they often get along better than heterophilous groups (Kirchmeyer 1995; Williams and O'Reilly 1998). Moreover, there has been research on the impact of involvement with workplace support groups for minority workers (minority in terms of race, disability, sexual orientation, and gender) (Friedman and Holtom 2002). The researchers found that interactions with similar others provided the minority workers with opportunities to build more casual and deeper personal relationships at work. Such social relationships helped the minority workers receive work-related information, such as how to adapt to the work environment and how to find mentors. Although parents are not minority in academia, forming a homophilous support group with other parents might help them cope with work-family conflict and have more positive perceptions of their work environment.

On the other hand, there is also a possibility that cross-group interactions are linked to positive perceptions of work-family culture. Interactions between members of different social groups often change stereotypical views on out-group members (Allport 1957; Brown and Hewstone 2005; Pettigrew 1998; Pettgrew and Tropp 2006, 2008). Therefore, compared to parents who are primarily friends with other parents, parents who have more friendship connections with non-parents might be less likely to feel that non-parents are different from them (i.e., non-parents do not understand the difficulty juggling work and childrearing). From this perspective, a greater extent of parent heterophily should be associated with more positive perceptions of understanding and support with work-family needs. In this instance, then, I do not develop a specific directional hypothesis for the relationship between parent homophily and work-family culture.

It is important to remember that traditionally there are fewer mothers than fathers in academia (Mason and Goulden 2004). Considering the gender composition among faculty parents, there might be a gender variation in the association between parent homophily and perceptions of work-family culture. For example, mothers might value friendship with other parents and non-parents differently compared to fathers. For this reason, I assess whether or not gender moderates the association between parent homophily and work-family culture. Again, I do not have a specific directional hypothesis for the moderation effect.

Network size and work-family culture. While parental status of connected colleagues might predict perceived work-family culture, simply network size might also explain perceptions of work-family culture. There is pressure on parents to separate personal life from work in academia, and faculty parents are often hesitant to discuss work-family conflict in the workplace (Colbeck and Drago 2005; Drago et al. 2006; Rice, Sorcinelli, and Austin 2000; Ward and Wolf-Wendel 2004). They are afraid that their colleagues might doubt their commitment to work if they bring up family commitment. Previous research warns that workers who struggle with work-family conflict on their own and work in individualistic work environments are at high risk of burnout (Drago 2007; Stone 2007). To diminish the negative impact of such individualism norms, it might be helpful for faculty parents to have friends (or allies to share personal life) in the department. Through conversations with colleagues, for instance, better-connected parents are more likely than marginalized parents to receive a variety of information about work-family policies and programs. Additionally, building support networks with

colleagues helps increase faculty's sense of agency when making work-family decisions (O'Meara and Campbell 2011). Thus, I expect the following hypothesis:

H5: Having more friendship connections to colleagues (i.e., less marginalization) will be associated with more positive perceptions of work-family culture among faculty parents.

The hypothesis above applies to all faculty parents, but I expect gender difference in such an association. Compared to faculty fathers, faculty mothers are more likely to hide family commitments from colleagues. Mothers are often aware of bias against caregiving in academic workplaces (e.g., adverse reaction, decreased opportunities for promotion and raise), and they try to minimize or avoid potential career penalties by not mentioning caring responsibilities at work (Drago et al. 2006). Therefore, having friends to share private matters might help mothers more than fathers to have a sense of support and positive perceptions of work-family culture:

H6: The positive association between friendship connections and perceptions of work-family culture will be stronger for mothers compared to fathers.

The Present Study

This study first explores the presence of homophily across parental status and gender within faculty's departmental friendship networks. Using social network analysis, it provides answers to two key questions: "Are parents more likely to be friends with other parents than non-parents while non-parents are more likely to be friends with other non-parents than parents?" and "Are mothers particularly likely to be friends with other mothers?" Second, it investigates whether parents, especially mothers, have smaller friendship networks (i.e., hold marginalized network positions) within the departments

compared to non-parents. Finally, it examines how the structures of friendship networks (parent homophily and network size) predict faculty parents' perceptions of work-family culture in the department and also explores gender variation in these relationships. These three research objectives provide new insight into the culture of academic work environments and identify the social network factors that can produce more supportive work-family culture.

CHAPTER 4: METHODS

Sample

The data for this study come from the *Faculty Network and Workload Study* (FNWS), a mail/web survey conducted at a large research-intensive Midwestern university between March and May 2011. 744 full-time faculty with a tenure-line in 26 STEM and 16 SBS departments were asked to participate in the survey. Over 75% (N=559) of the surveyed faculty provided an answer to at least one questionnaire item, but there was considerable variation in response rates by department. The lowest response rate was 41.7% while the highest response rate was 100.0%. Basic demographic data (e.g., gender, race, academic rank, and academic discipline) were obtained from the Office of Institutional Research and Planning (IRP) for all faculty and were matched to the FNWS survey data.

The data from IRP were available for everyone in the survey population. Thus, it was possible to perform an analysis of nonresponse. There were no gender or race differences in survey nonresponse. Associate professors were least likely to participate in the survey among all ranks (assistant: 81.7%, associate: 68.9%, full: 75.4%, Chi-square=7.86, p<.05). Finally, faculty in Engineering (65.1%) were generally less likely to participate compared to faculty in other disciplines (Physical Sciences: 76.9%, Biological Sciences: 78.3%, Business: 71.4%, and Education and Social Sciences: 77.9%, Chi-square=9.55, p<.05).

Parental status is a key variable in this study, thus I limited my sample to the FNWS respondents who provided information on parental status (N=536). The size of the

analytic sample varied across the three research objectives. Further details on each analytic sample are provided below in Chapters 5, 6, and 7.

Measures

My three research objectives have different dependent variables. I first explain the dependent variable for each objective and then review the independent and control variables that are utilized across all three research objectives.

Dependent Variable for Research Objective #1

In the first research objective, the dependent variable in an exponential random graph model (ERGM) is not an individual level variable, rather it is dyadic. Specifically, it is a dichotomous variable that indicates the absence or presence of a tie (0=tie absent, 1=tie present). I used a network mapping question in the FNWS to create adjacency matrices and then ran ERGMs on these adjacency matrices. I will explain how I created the adjacency matrices first.

Creating the adjacency matrices. The network mapping question measured non-work related social interactions among faculty within their tenure home department (Figure 1 illustrates the network question for a fictional department). Friendship connections (*ties*) were measured with a question that asked faculty to report how often they spent free time together (such as having coffee, sharing a meal, and leisure or exercise activities) or discussed personal matters (such as about the people in their personal life, social activities, and joys or struggles) with other faculty member during the 2010-2011 academic year. Faculty were provided with a list of all faculty names in their tenure home department and asked to identify the frequency they interacted with each faculty member on the list. There were five response options (1=not in this

academic year; 2=once or twice this year; 3=once or twice a semester; 4=once or twice a month; and 5=once a week or more often).

This study is interested in the presence of friendship ties rather than the frequency of interactions. In addition, current ERGM modeling is best suited to handle binary data instead of valued data. Therefore, I selected a cut-off point from the five response options in order to identify the presence of a friendship tie. I used "3= once or twice a semester" as the cut-off. In other words, faculty who selected either "1=not in this academic year," or "2=once or twice this year" were assigned a value indicating that a tie did not exist. The cut-off was chosen for the following reasons. Providing a list of all network members makes respondents more inclined to identify a connection (Brewer 2000). I wanted to ensure that the ties measured were not weak connections. One way to assess tie strength is the frequency of contact between the two actors. Strong ties are characterized as having a higher frequency of interaction (Granovetter 1973). In the context of this study, interacting a couple times in the academic year or less was considered a weak tie. In contrast, interacting a couple times a semester or more was considered a strong tie.

Using the cut-off point, adjacency matrices were created at the department level. In an adjacency matrix, the number of rows and columns is equal to the number of full-time, tenure-line faculty (*actors*) in the department. So, if the department have 12 faculty members, there are 12 rows and 12 columns, one for each member of the department. The adjacency matrix is binary because 1 indicates the presence of the friendship tie and 0 indicates its absence. The adjacency matrix is also asymmetric because the lower and upper halves of the matrix were allowed to differ. For each actor in the network, their row identifies ties they sent to other actors in the network and their column identifies ties

received from other actors in the network. In an asymmetric adjacency matrix, then, there can be a tie sent from actor A to actor B, but actor B might not reciprocate the tie. By keeping the created matrices asymmetric, I was able to include variables that are specific about the direction of the ties (sent ties vs. received ties) in my ERGM analysis. Thus, the *asymmetric binary adjacency matrices* allowed for the most stringent test possible for the dyadic analysis of parent homophily for the first research objective.

Although the dichotomous dependent variable (0=tie absent, 1=tie present) might make the impression that ERGMs are similar to logistic regression models, they are fundamentally different. Importantly, in contrast to conventional logistic regression models observations within an ERGM analysis are not independent. Moreover, ERGMs can include independent variables that are measured at the network, dyadic and individual-level (though see here Wang et al. 2013).

Dependent Variable for Research Objective #2

For the second research objective, *degree centrality* is used as a dependent variable (degree centrality is also used as a focal independent variable for the third objective). Degree centrality is a network measure that was developed from a network mapping question in the FNWS, and it indicates the number of friendship connections (or network size) for each actor. It required a two-step process to create degree centrality. The first step was to create symmetrized binary adjacency matrices based on the asymmetric binary adjacency matrix. As the second step, degree centrality was calculated for each actor using the symmetrized adjacency matrices. I will explain these steps next.

The process of creating degree centrality was as follows. First, using the asymmetric binary adjacency matrices that were already made for the ERGM analysis, I

created binary adjacency matrices in which the friendship ties were symmetrized. In this instance, the lower and upper halves of the adjacency matrix were forced to be equal. There are two methods for symmetrizing an asymmetric matrix. First, when an asymmetric matrix is *maximally* symmetrized, then a tie exists if one or both actors nominated the other. To create a *minimally* symmetrized matrix, a tie exists only if both actors nominated each other. I used the former for this study and calculated degree centrality by summing the rows or columns of the symmetrized adjacency matrix (Scott [1991] 2000; Wasserman and Faust 1994). Using the *maximally symmetrized binary matrices* for the individual level of analyses should have produced more accurate network measures in the presence of lower response rates for some departments. In addition to degree centrality, the maximally symmetrized binary adjacency matrices were used to calculate parent homophily at the individual level, which is used as a focal independent variable for the third research objective and will be described shortly. Before I move on to the independent variables, I will explain the last dependent variable.

Dependent Variable for Research Objective #3

For the third research objective, perceived work-family culture is the dependent variable. *Supportive work-family culture* was measured using three FNWS items which pertained to work-family specific coworker support in the department. The items asked "My colleagues are respectful of my efforts to balance work and home responsibilities," "My colleagues do what they can to make family obligations and an academic career compatible," and "In my department, faculty may comfortably raise personal or family responsibilities when scheduling work activities or meetings." The first two items were from the Collaborative on Academic Careers in Higher Education (COACHE) survey.

The third item was developed by the FNWS research team. It was inspired by the work-family literature on supervisor and co-worker support (Drago et al. 2006; Thomas and Ganster 1995). Faculty were asked to identify the level of agreement with each statement using a five-point scale (1=strongly disagree; 2=slightly disagree; 3=neither agree not disagree; 4=slightly agree; 5=strongly agree). I took the mean of at least two items to create the supportive work-family culture index (α=.84).

Independent and Control Variables

In this section, I review the individual-level independent and control variables used in this dissertation. Some predictors are only included in one or two of the research objectives whereas others overlap across all three objectives. It is important to note that the individual-level survey data described below are used to create the dyadic-level (e.g., homophily) independent variables within the ERGM models (Objective #1). These independent variables were constructed during the data analysis process and are discussed in the data analysis section.

Basic demographic variables were created based on the administrative data from IRP: *gender* (0=man; 1=woman), *race* (1=nonwhite; 0=white), *academic rank* (series of dummy variables for assistant, associate, and full professors), *academic discipline* (series of dummy variables for three disciplines: Biological Sciences, Physical Sciences, and Business, Education, and Social Sciences), and *size of the department* (a continuous variable).

Parental status was determined based on the responses to a question on the FNWS "Do you have any biological, adopted or step children?" (yes or no). Faculty who answered "yes" to the question were considered a parent (1=parent; 0=non-parent). The

FNWS provided those faculty who answered "yes" to the parental status question with a subsequent question. The questions asked about the age of their children, and parents identified how many children for each of the five age ranges were living with them: "newborn to 4 years old," "5 to 9 years old," "10 to 13 years old," "14 to 18 years old," and "19 years and older." The response options were "none," "1 child," "2 children," and "3 or more children." Depending on the answers to this question, parents were separated into three groups, and a series of dummy variables were created for *age of children* (at least one child under the age of five, at least one child between the age of five and 18 (no child under the age of five), and child(ren) all above 19 or not living together (e.g., empty nesters and non-custodial parents)).

In addition to parental status, this study used the FNWS data to create a few more family-related variables. The first measure is a dummy variable which indicated whether or not faculty were *married or partnered* (1=married or partnered; 0=single). The another one is *hours on household work*, which is a continuous variable. Hours on household work was measured using the reported number of hours spent on home and family responsibilities, such as food preparation, shopping, yard work, laundry, cleaning, and dependent care, in a typical week.

Two measures for work-family conflict were adapted from the work-family conflict index developed by Carlson, Kacmar, and Williams (2000), which captured time- and strain-based conflict (Greenhaus and Beutell 1985).[1] Results from a factor analysis

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[1] According to Greenhaus and Beutell (1985), behavior-based conflict is also possible when behaviors required to fill one role are incompatible with expected behaviors in another role. Because it is difficult to operationalize the concept, behavior-based conflict is rarely included in empirical research (Kelloway, Gorrlieb, and Barham 1999).

revealed one factor for the role pressure at work that negatively affected the participation in the family domain, and a second factor for the role pressure in the family that was incompatible with the job performance. A two-item index assessed *work-to-family conflict* (α=.77). For this index, respondents answered the following questions: "The time I must devote to my job keeps me from family activities more than I would like" and "Being emotionally drained after work prevents me from enjoying my family/personal life." A two-item index also captured *family-to-work conflict* (α=.49)[2]: "The time I spend with family often keeps me from spending time on work activities that could be helpful to my career" and "Due to stress in my family/personal life, I am often preoccupied with personal matters at work" (1=strongly disagree to 6=strongly agree). Indices were created by taking the mean of the two items. The *job satisfaction* index was calculated by taking the mean of at least two items from the following three items (α=.82): "Overall, I enjoy the work I do as a faculty member"; "The work I do as a faculty member is meaningful to me"; "If I had to do it over again, I would still become a professor" (1=strongly disagree to 6=strongly agree).

General department collegiality was measured with five items (α=.86): "Faculty in my department are supportive of one another," "Faculty in my department are sometimes rude to one another" (reverse coded), "Faculty in my department enjoy working together," "Tension among faculty in my department make it uncomfortable working here" (reverse coded), and "Faculty in my department spend time getting to know one another." Faculty provided answers with a six-point scale (1=strongly disagree;

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[2] Although this was a 2-item index, the Cronbach's alpha was still quite low. In sensitivity analyses, I included each item on its own in different models and both items together in same model. All cases replicated the research findings reported in Chapter 7.

2=disagree; 3=slightly disagree; 4=slightly agree; 5=agree; 6=strongly agree). An index for individual faculty was calculated by taking the mean of at least three valid items.

As I have mentioned before, the level of parent homophily was calculated on the maximally symmetrized binary matrices for Objective #3, which predicted perceptions of supportive work-family culture. Parent homophily at an individual level (i.e., not as part of the ERGM model but used in a conventional regression analysis) was measured using the point bi-serial correlation (PBSC). *PBSC* is typically used to measure levels of homophily for categorical attributes, such as gender and race. PBSC is calculated on each actor's *ego network* (*ego* means the person of interest) using a contingency table (see Appendix A for a sample contingency table). The advantage of using PBSC is that it takes into account ties that do not actually exist but have a potential to exist. PBSC is represented by the following equation:

$$PBSC = \frac{ab - bc}{\sqrt{(a+c)(b+d)(a+b)(c+d)}} \text{ (Borgatti, Everett, and Freeman 2002)}$$

where *a* is the number of ego's ties to alters who have the same attribute, *b* is the number of ego's ties to alters with a different attribute, *c* is the number of ties that do not actually exist but could have existed between ego and potential alters who have the same attribute, and *d* is the number of ties that do not actually exist but could have existed between ego and potential alters with a different attribute (Borgatti, Everett, and Freeman 2002). With PBSC, the value of -1 indicates that the ego network is completely heterophilous in terms of parental status (in this case, the ego only have ties to faculty who do not share their parental status – for example a parent has only non-parent alters) while the value of +1 indicates that the ego network is completely homophilous (in this case, the ego only has ties to faculty who share their parental status - for example a parent has only parent

alters). The value of 0 means that alters with the same attribute and alters with a different attribute are equally represented in the ego network.

Data Analysis Strategy

Research Objective #1: Exponential Random Graph Models (ERGMs)

My goal for the first objective was to explore if a friendship tie was more likely to exist when an ego and an alter shared parental status (i.e., parent-parent pair or non-parent-non-parent pair) compared to when they did not. I also explored if mothers had a stronger parent homophily among themselves compared to among fathers. Therefore, I ran ERGMs with the statistical software **R** to examine homophily in faculty friendship networks. ERGMs are probability models that assess what factors predict the presence of ties between actors (Lusher, Koskinen, and Robins 2012). ERGMs are quite different from typical regression analyses found in most social science research. The key features of these models are described below.

Key Features of an ERGM

ERGMs use dyads as the unit of analysis and are usually run on a single network. This study uses a joint network of faculty in six departments and a single network of one of department (I will explain these networks later in Chapter 5). For example, a network with 12 members contains 132 (n(n-1)=12(12-1)=132) dyadic pairs or *directed* ties. The advantage of ERGMs over standard logistic regression models with a dichotomous dependent variable (0=tie is absent, 1=tie is present) is that in addition to actor attributes, ERGMs can have dyadic predictors and take into account *dyadic dependence* (Handcock et al. 2008; Koskinen and Daraganova 2012; Robins et al. 2007). Dyadic dependence happens when "the state of one dyad depends stochastically on the state of other dyads"

(Handcock et al. 2008: 5). An example of dyadic dependence is a "the friend of my friend is my friend" phenomenon, in which the probability of a tie between an ego *i* and an alter *j* increases when both *i* and *j* have a tie to a third person *k*. By adding variables on network structures (*structural properties*), such as transitivity, ERGMs allow us to analyze what actor and dyad attributes are associated with the probability of ties controlling for dyadic dependence (Hunter et al. 2008; Morris, Handcock, and Hunter 2008; Valente 2010).

Running an ERGM is a three step process: (1) Estimation, (2) Simulation, and (3) Goodness of fit (GOF) testing (Robins et al. 2007). Estimation (Step 1) entails various forms of network structural properties, actor attributes, and dyadic attributes as independent variables in the model predicting the observed network. The parameters we get for each independent variable indicate whether or not the probability of tie being present is high or low given the value of the independent variable. There are numerous structural properties and attribute variables to choose from for inclusion in the estimation of the ERGM – which are generally referred to as ERGM-terms (see the section on ERGM-terms). Steps 2 and 3 are used to assess how well the model estimated in Step 1 fits the data (i.e., the observed network). Steps 2 and 3 are discussed in more detail below after the explanation of the ERGM-terms.

ERGM-Terms

Network structural properties. Density, centralization, and clustering are the basic types of structural properties that are often included in ERGM estimations. In addition, reciprocity is often added for directed networks. I provide some examples in this section, but there are numerous structural properties to choose from within each of these three

types (Morris, Handcock, and Hunter 2008; Robins and Lusher 2012). As is standard

procedure, I tried multiple structural properties and ultimately included the ones that best

described the observed networks in my ERGMs (more details about model fit in Chapter

5). Figure 2 graphically shows the structural properties described below.

Density (the model term I used with the **R**'s ERGM package: "*edge*") is the

proportion of ties (or *edges*) that actually exist among all possible ties within the network.

Although density is not a dyadic dependent term, it is almost always included in ERGMs

to control for the overall probability of a tie being present. *Reciprocity* (the model term

used: "*mutual*") deals with dyad mutuality and captures the number of dyads where there

are a tie from an ego *i* to an alter *j* and also a tie from *j* to *i*.

Centralization (the model terms used: "*gwodegree*" and "*gwidegree*") is the

tendency that ties are centered around certain actors (i.e., star actors have more ties

compared to other actors). Within directed networks, for example, *gwodegree* measures

centralization based on out-degrees, which show how actively actors are sending out ties

(self-nominated ties). On the other hand, *gwidegree* captures popularity, which deals with

centralization based on in-degrees which are received ties.

Clustering (the model term used: "*gwesp*") is the tendency to form a closed

triangle (triad closure) where an ego *i* and an alter *j* share a third actor *k*. That is, it

measures the "the friend of my friend is my friend" phenomenon. In many cases, simple

transitivity ERGM terms, such as the "*triangle*" term in the **R**'s ERGM package, cause

degenerate models, and network researchers recommend using *gwesp* (an abbreviation

for "geometrically weighted edgewise shared partner") instead to capture clustering

(Hunter et al. 2008). The gwesp term "adds a statistic equal to the geometrically weighted

edgewise (not dyadwise) shared partner distribution with weight parameter alpha"

(Morris, Handcock, and Hunter 2008: 13).[3] The gwesp term deals with the frequency at

which each edge (connected two actors) shares a common third actor, but the marginal

return decreases as the number of shared third actors who can complete a closed triangle

increases.

When structural properties are included in ERGMs as independent variables, they

are basically used as a count of the structural property in the network. Thus, positive (or

negative) parameters of structural properties in ERGM outputs suggest that the observed

network has more (or fewer) configurations of the specified types than we would expect

by chance. With the example of gwesp, a positive parameter indicates that there is a

higher degree of triad closure than we would expect due to chance, a negative parameter

indicates a lower degree, and a null effect indicates that triad closure is not something

that explains the ties that exist in this network.

Actor attributes. Several different types of ERGM terms (both individual- and

dyadic-level) can be included for attribute data. Figure 3 graphically shows actor attribute

effects that are described next: sender and receiver effects and homophily. ERGMs can

include basic individual-level attributes, such as gender and race, to examine if a certain

attribute makes an actor more active (i.e., sending more ties - sender effects) or more

popular (i.e., receiving more ties - receiver effects). For example, when the outcome has a

positive and significant parameter value for a dichotomous variable (1=woman; 0=man)

for a sender effect of gender, it indicates that being a woman increases the probability of

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[3] The difference of edgewise shared partners from dyadwise shared partners is that there needs to be a tie between two actors for edgewise shared partners whereas dyadwise shared partners can be connected or non-connected two actors.

sending a tie compared to when the actor is a man. As individual-level attributes, I added

basic demographic attributes of an ego (parental status, gender, and race) to my ERGMs

(the model term used: "*nodeofactor*" for sender effects and "*nodeifactor*" for receiver

effects). When researchers want to examine homophily effects, it is especially important

to include the nodeofactor and nodeifactor terms for the attribute that is used to test

homophily (e.g., include nodeofactor and nodeifactor for gender when testing gender

homophily). This allows us to control for sender and receiver effects and prevent a case

where a particular group (e.g., women) is more likely to have ties among themselves

simply because they are more actively sending ties or more receiving ties compared to the

other group(s) (Robins and Daraganova 2012).

Homophily is added to ERGMs as a dyadic-level attribute. There are several

ERGM-terms for homophily, and researchers select different terms depending on the

level of measurement (e.g., whether the dyadic attribute is nominal or continuous)

(Hunter, Goodreau, and Handcock 2008; Morris et al. 2008). One of the homophily

measures for nominal attributes is called *uniform homophily*. With uniform homophily, a

relational attribute of an ego and an alter is dichotomously identified (1=an ego and an

alter are in the same category, 0=otherwise (i.e., an ego and an alter are not in the same

category)). The positive and significant parameter of uniform homophily indicates that

the probability of a tie increases when an ego and alter are in the same category. For

example, uniform homophily can be used when I want to examine rank homophily with

three groups (assistant, associate, and full professors). The positive and significant

parameter of rank uniform homophily indicates that the probability of a tie increases

when an ego and alter are the same rank compared to when they are different rank. With

uniform homophily, it does not matter which rank is shared. Rather, the focus is the comparison against the case where an ego and alter are a cross-category pair (assistant and associate, assistant and full, associate and full).

There is another homophily measure, called *differential homophily*, which is specifically about shared categories. Unlike uniform homophily, differential homophily cares about the categories that are shared between an ego and an alter. With differential homophily, a relational attribute is dichotomized for different categories (1=an ego and an alter are in a specific category, 0=otherwise (i.e., an ego and an alter are not in the specific category)). The positive and significant parameter of differential homophily indicates that the probability of a tie increases when an ego and an alter are both in the specific category compared to when they are not in the same category. With the rank example, I can create a differential homophily variable specifically for assistant professors (1=both an ego and an alter are assistant professors, 0=otherwise) to see if the probability of a tie increases when an ego and an alter are both assistant professors compared to when they are different rank.

Examining Parent Homophily and Homophily across Parental Status and Gender

I selected different ERGM-terms to test parent homophily (for Hypothesis 1) and homophily across parental status and gender (for Hypothesis 2). First, I included parent homophily as uniform homophily in my ERGMs (the model term used: "*nodematch*" without the differential homophily specification, "diff=F[alse]"). The positive and significant parameter for parent homophily indicates that the probability of a tie increases when an ego and alter share parental status (i.e., they are either both parents or both non-parents) compared to when they do not share parental status. I chose uniform homophily

over differential homophily for the test of parent homophily because my intention was to examine if sharing parental status increased the probability of a friendship tie (regardless of whether the pair consists of two parents or two non-parents). Also, when an attribute used to test homophily is measured as dichotomous (e.g., parents vs. non-parents), **R** does not estimate the parameter for differential homophily when the sender and receiver effects of the same dichotomous attribute are included in the same model.

My ERGMs also include homophily across parental status and gender as differential homophily (the model term used: "*nodematch*" with the differential homophily specification, "diff=T[rue]"). To do so, I created four groups for the intersection of parental status and gender (fathers, mothers, non-parent men, non-parent women). Then, homophily was tested for each of these four categories (1=both an ego and an alter are fathers/mothers/non-parent men/non-parent women; 0=otherwise). In this case, a positive and significant parameter for fathers (mothers, non-parent men, or non-parent women) indicates that a tie is more likely to exist between two fathers (mothers, non-parent men, or non-parent women) compared to cross-category pairs (e.g., a father and a mother, a mother and a non-parent man).

ERGM Estimation, Simulation and Goodness of Fit (GOF)

For any ERGM analysis, the first step is to run multiple ERGMs with different combinations of structural properties and actor attributes until a model with good convergence is found. Convergence is attained by identifying the correct structural properties and attributes that describe the observed network. When ERGMs are run to examine the mechanism of network formation, the ultimate goal is to find a model with only structural properties and attributes that significantly explain the observed network;

however, this is not the case for my ERGMs because my research objective was to explore homophily by parent status and the intersection of parental status and gender controlling for dyadic dependence and individual-level attributes. How well the ERGM converges (or fits the observed network) is further explored within Steps 2 and 3.

Using Markov chain Monte Carlo (MCMC) algorithms, I simulated 1000 networks of the same size as the observed networks (Step 2). These simulated networks were constructed from the ERGM parameters estimated in Step 1. In other words, the simulated networks were predicted networks based on the model parameters estimated in Step 1. To assess GOF for the model estimated in Step 1, the simulated networks from Step 2 were compared to the observed network. The goal was to have simulated networks from the ERGM estimation that looked like the observed network. If the observed and simulated networks had similar structural property statistics, then that means we found evidence that the model specified in Step 1 had a good fit to the observed network data. Following standard procedure, this assessment was made through a series of GOF plots that compared statistics (numbers of out- and in-degrees, edgewise shared partner distribution, and proportion of pairs of actors with a minimum geodesic distance between them) between the observed network and the simulated networks (Hunter et al. 2008; Koskinen and Snijders 2012). At this point, plotting is believed to be a more informative way to test GOF than using the Akaike Information Criterion (AIC) or the Bayes Information Criterion (BIC) (Hunter, Goodreau, and Handcock 2008).

Research Objective #2: Multilevel Mixed-Effects Negative Binomial Regression

To examine differences in network size across parental status and the potential moderation effect of gender, I regressed degree centrality on parental status, gender, and

their interaction term with control variables. Because faculty were nested within their departments, it was expected that there was dependence between the data obtained from faculty in the same department. Also, degree centrality was a count variable whose variance was larger than the mean (i.e., overdispersion) (Hoffman 2004). Therefore, I ran multilevel mixed-effects negative binomial regression models using statistical software **Stata**'s command "*menbreg*". Moreover, because the structure of the network data (autocorrelation within each network matrix) violated the assumption of independent observations (Dow, Burton, and White 1982; Krackhardt 1988), I directly estimated the sampling distribution by running 1000 permutations to deal with potential biases in the variance estimates and significance tests (Good [1994] 2000; Hubert 1987).

For my multilevel mixed-effects negative binomial regression models, I considered individual faculty as the individual-level units and departments as the group-level units. Other than the focal independent variables (degree centrality, parental status, and gender), several control variables were included. At the individual-level, race impacts faculty's work experience (Jackson 2004). Specifically, faculty of color are more likely than white faculty to feel socially isolated from their colleagues (Smith and Calasanti 2005). This study also controlled for academic rank because rank plays an important role in faculty's experience of combining work and family roles (especially through the changes in job expectations, such as an increase in service work after obtaining tenure) (Ward and Wolf-Wendel 2012). As for individual family-related characteristics, I controlled for faculty's marital/partner status (i.e., whether or not they were married or partnered) and hours they spent on household work. Presence of a spouse/partner may affect faculty's sociability (Fisher et al. 1989), and faculty might be too busy to build

non-work related connections with colleagues depending on how much time they spend on family responsibilities.

The use of multilevel analysis allowed me to control for department-level factors in addition to individual-level factors (Raudenbush and Bryk 2002). Considering that job characteristics and expectations differ across disciplines (Becher and Trowler 2001; Fox 2001, 2010), it was likely that there was variation in faculty's interaction patterns across academic disciplines. Moreover, the important thing to consider when examining degree centrality is that one's department size can influences its value. This is because faculty in smaller departments are likely to have lower degree centrality compared to faculty in larger departments. Thus, I controlled for department size, which ranged from eight to 41. Percentage of white men and percentage of parents in the departments were added to account for diversity in terms of race/gender and parent compositions. I created these percentage variables from the individual-level data. Lastly, I added the department-level measure of general department collegiality, which was created by aggregating the individual-level general department collegiality index within each department. While workplace social support has a buffering effect on work-related stress among faculty (Lease 1999), collegial work climate can also increase faculty's time stress possibly due to time spent on social interactions (Lindholm and Szelényi 2008). Although previous research has mixed findings on how social relationships at work are associated with stress, it is at least clear that collegial work environment plays a role in determining faculty's stress levels. Considering that stress may affect faculty's sociability (van der Kooij et al. 2014), the tendency to build friendship connections is likely to differ depending on collegial climate in the department. Therefore, I controlled for general

department collegiality to take into account the potential influence of overall work climate on the size of faculty's friendship network.

Table 1 presents descriptive statistics for all the variables used for the second research objective. After dropping cases with missing values on the variables of interest, the analytic sample became 525. Among the faculty who were included in the analysis, the value of degree centrality (i.e., network size) varied from zero to 27. This means that there were social isolates (i.e., faculty without any friendship connection) while the largest network size was 27. The majority of the faculty in the analytic sample were parents (69%), and women and nonwhite faculty were the minority groups (24% and 19% of the sample, respectively). In general, faculty tended to have a high number of family demands; the mean for hours on household work per week was 21.06. There was a large range in the percentage of white men faculty (min.=22%, max.=85%) and parents (min.=29%, max.=100%) across departments. The mean score of general department collegiality also showed large variation (min.=2.53, max.=5.44, on a 6-point scale).

Research Objective #3 Ordinary Least Square (OLS) Regression Models

The purpose of the third research objective was to examine how social network factors were related to perceptions of work-family culture among faculty with children (N=366). The analytic sample included only parents because previous research has shown the differences in work-family experiences and perceptions of work environments between parents and non-parents (Casper, Weltman, and Kwesiga 2007; Young 1999). For the analysis, the supportive work-family culture index was regressed on PBSC (for

parent homophily) and degree centrality (for network size) with control variables.[4] To

explore the moderation effect of gender, I also added its interaction terms with PBSC and

degree centrality. I used Ordinary Least Squares (OLS) regression for these models.

Parents were clustered into different departments, and the autocorrelation within each

network matrix violated the assumption of independent observations (Dow, Burton, and

White 1982; Krackhardt 1988). Therefore, I ran 1000 permutation tests to avoid the

impact of potential biases (Good [1994] 2000; Hubert 1987). I considered using

multilevel analysis for the third objective as well as the second objective, but I decided

not to because preliminary analysis with multilevel mixed-effect linear regression models

showed that the department-level variables, such as department size and the percentage of

parents in each department, were not significantly associated with the dependent variable

in the multilevel analysis. Also, the intraclass correlation (ICC) was .108, which indicates

that only 10.8% of the variance in the supportive work-family culture index was between

departments and the rest was within the departments.

To examine the associations between the social network factors and perceptions

of supportive work-family culture, it was necessary to control for potential confounders.

Besides gender (which is also a focal independent variable to test the moderation effect),

I included race and several job characteristics (academic rank, academic discipline, job

satisfaction) and family-related characteristics (married or partnered, children's age,

hours on household work, work-to-family conflict, and family-to-work conflict) as

control variables. To explain the rationale for including each variable, I selected race

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[4] Although the analytic sample for Objective #3 included only faculty parents, these
network measures (PBSC and degree centrality) were calculated on the maximally
symmetrized binary matrices that included non-parents.

because perceptions of work climate vary across race. Faculty of color tend to report having negative perceptions of work climate (e.g., fairness of tenure process, support and encouragement for career development, and subtle discrimination) (Hurtado et all. 2012; Jackson 2004). Academic rank and disciplines affect faculty's experience of work-family integration (Drago et al. 2006; Ward and Wolf-Wendel 2012). Job satisfaction serves as a job resource and enhances a positive mood for workers in general (Voydanoff 2005b). As such, faculty who are satisfied with their job itself may have a more positive perceptions of work-family culture compared to faculty who are dissatisfied with their job. Family characteristics, such as presence of a spouse/partner, age of children, and household work, are likely to have an influence on work-family integration by increasing/decreasing family demands (Elliot 2003; Fox, Fonseca, and Bao 2011; Voydanoff 2005b). Lastly, work-to-family conflict and family-to-work conflict were added because both directions of work-family conflict affect perceptions of work-family balance (Keene and Quadagno 2004).

The various control variables explained above were included across my OLS regression models to isolate their potential association with perceptions of supportive work-family culture. Table 2 presents the descriptive statistics for all of the variables used for Objective #3. The final size of the analytic sample was 336 after dropping non-parents and cases with missing values on the variables of interest. The mean of the supportive work-family culture index was 3.84 on a 5-point scale.[5] The mean value of the parent homophily measure (PBSC) was .03, which indicates that on average, the faculty

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[5] Although they do not pertain to the hypotheses that this study is testing, I examined gender differences in the dependent variable. There was no significant gender difference in the mean of the supportive work-family culture index (fathers: 3.88, mothers: 3.66).

parents had almost equal representation of parents and non-parents in their friendship networks. Degree centrality (network size) ranged from one to 26 with the mean of 5.45. All faculty parents in the analytic sample had at least one friendship connection within their department. Among the parent sample, 21% were mothers and 13% were nonwhite faculty. Considering that the maximum value of the job satisfaction index was six, the parents reported high job satisfaction (mean=5.30). The majority (98%) of the parents were either married or partnered. Looking at the age of children, 18% of the parents had at least one child under the age of five. The largest parent group was the parents of children 19 and older or children who were not living together (45%). The parent sample spent the average of 23.03 hours per week on household work and reported higher work-to-family conflict (mean=3.56) than family-to-work conflict (mean=2.74).

CHAPTER 5: HOMOPHILY ACROSS PARENTAL STATUS AND

GENDER IN FACULTY FRIENDSHIP NETWORKS

For the first research objective, I used ERGMs to examine whether faculty parents tend to have friendship connections with other parents while non-parents tend to have friendship connections with other parents. Specifically, I developed a hypothesis that (H1) parents would tend to interact with other parents and non-parents with other non-parents more often than expected due to chance. Considering the gender differences in both work and family roles, I also proposed the second hypothesis: (H2) The tendency for parental homophily would be stronger among women (i.e., mothers) than men (i.e., fathers).

ERGMs with a Joint Network

Before I ran ERGMs, I first had to exclude departments that did not meet the minimum requirements to use an ERGM. The majority of the sampled departments (N= 36) were not large enough to attain the necessary level of gender and parental diversity (the number of mothers was particularly low in many departments) to test the specified hypotheses. Among 42 departments, six departments were selected because they had at least two fathers, two mothers, two non-parent men, and two non-parent women. The departments included two Biological Science departments (N=16 and N=31), one Physical Science department (N=29), and three Business, Education, and Social Sciences departments (N=20, N=16, and N=15). Figure 4 visualizes the friendship networks for these six departments. The actors (dots) are color-coded by parental status and gender.

When there are multiple networks to study, researchers often run ERGMs separately for each network and combine the results using meta-analysis (Pauksztat,

Steglich, and Wittek 2011; Snijders and Baeverldt 2003). In the currently study, this was not a feasible strategy again due to the small department size and limited gender and parental diversity within departments. In other words, the specific hypotheses within this research could not be tested (i.e., would not run or have enough statistical power) unless all six networks were analyzed simultaneously. In order to analyze each department separately, it would be necessary to have at least three cases within each category (i.e., three fathers, three mothers, three non-parent men, and three non-parent women) in each department network. Only one department met this more stringent diversity requirement (this department is surrounded by the dashed line in Figure 4).

Analyzing all six departments within a single ERGM model, however, provides a feasible and appropriate method to examine the study hypotheses. Thus, I ran one ERGM combining 127 faculty in six departments. Table 3 shows the descriptive statistics for all the faculty included in this joint network. It is important to recognize that this approach assumes that the pattern of associations among variables within each department is the same. For this reason, I conducted supplementary analyses running an ERGM on the one department that met the most stringent diversity requirement criteria.

Also, although all six departments were analyzed as a joint network, ties between departments were not possible because the network mapping question in the FNWS measured friendship ties within the department. Therefore, I needed to prohibit cross-department ties in the ERGM models for the joint network. Limiting ties between specific groups of actors is called fixing "structural zeros" (Kalish and Luria 2012). Structural zeros are ties that can never be present due to design effects (e.g., in this case nonoverlapping networks). I made adjustment for structural zeros by first creating a joint

adjacency matrix of all six departments (127 rows and 127 columns) and another matrix

which had 0 for all ties within the department and 1 for all ties across departments. Then,

I fed the second matrix into the ERGM model and fixed the edge covariate for ties across

departments to infinity (the ERGM-term used: *edgecov*).

Table 4 shows the results of the ERGMs for the joint network. First, Model 1

included only the variables for the structural effects. After exploring the network

structure, the attribute variables were added in Model 2 and Model 3. Model 2 included

uniform homophily to examine the presence of parent homophily (i.e., the tendency to

interact with others who share parental status). Model 3 included differential homophily

to examine homophily for each of the four groups created based on the intersection of

parental status and gender (fathers, mothers, non-parent men, non-parent women). Using

differential homophily, I was able to see if mothers had a particularly strong tendency to

be friends with other mothers in the department compared to fathers' tendency to be

friends with other fathers.

For the models in Table 4, the structural properties were selected after trying

different combinations of multiple ERGM-terms and attribute variables. Careful

comparison of GOF plots revealed that edges, reciprocity, activity, popularity, and triad

closure best described the observed network. As can be seen in Figure 5, the networks

that were simulated based on the ERGM parameters in Model 1 were generally consistent

with the observed network in terms of numbers of out- and in-degrees, edgewise shared

partner distribution, and proportion of pairs of actors with a minimum geodesic distance

between them. GOF plots showed similar patterns for Model 2 and Model 3 (see Figure 6

and Figure 7). This indicates that the specified model did a good job of capturing the properties of the observed network.

Across all models in Table 4, the parameters of the structural properties did not significantly change. A parameter of edges pertains to the density of the observed network (i.e., proportion of ties that actually exist among all possible ties within the network). The significantly negative parameters of edges in Table 4 indicate that taking into account all possible friendship ties within the network, edges (ties) occurred relatively rarely. The significantly positive parameters of reciprocity in Table 4 suggest that the ties in the observed networks had a greater-than-chance likelihood of reciprocity. The activity and popularity measures pertain to network centralization, which is the tendency of ties to be formed around certain actors. Active actors send out many ties and have large out-degrees while popular actors receive many ties and have large in-degrees. The negative parameters of activity in Table 4 indicate that the observed network was not centralized on activity (out-degrees) (i.e., the levels of activity were similar for the majority of the actors). On the other hand, the positive parameter of popularity suggested that the observed network was centralized on popularity (in-degrees) (i.e., the levels of popularly were different across actors). Lastly, triad closure deals with the level of clustering. The significantly positive parameters of triad closure in Table 4 indicate that there was a higher degree of closure in the observed network than we would expect by chance. In other words, there were more clusters of triangles than expected due to chance.

The structural properties were included in the ERGM models to control for dyadic dependence, which allowed for a more rigorous test of the extent of homophily in the network. Model 2 of Table 4 begins to enter the homophily variables along with

individual attribute variables. I will first review the results of the homophily analysis.

First, the positive and significant parameter of uniform homophily (Model 2) by parental

status (estimate=.22, p<.001) means that the probability of a friendship tie increased

when an ego and an alter shared parental status relative to mixed attribute dyads (i.e.,

parent and non-parent pairs). In the instance of uniform homophily, the pair who shared

parental status were either both parents or both non-parents. The odds ratio of 1.25

indicates that when an ego and an alter shared parental status, the odds of a friendship tie

being present were 1.25 times greater compared to when the pair did not share parental

status. This ERGM result provided evidence of parent homophily in the observed

network and thus supported Hypothesis 1.

Model 3 in Table 4 replaced uniform homophily by parental status with

differential homophily by the four groups across parental status and gender (fathers,

mothers, non-parent men, and non-parent women). The cross-group dyads (e.g., father to

mother dyads, mother to non-parent man dyads) were the reference group. Generally, a

significantly positive (negative) differential homophily parameter indicates that the

probability of a tie increases (decreases) when an ego and an alter are both in the specific

group compared to when they are in different groups.

The significantly positive parameter of differential homophily for mothers in

Model 3 of Table 4 (estimate=.70, p<.01) suggests that a friendship tie was more likely to

exist when the dyad was a mother-mother pair compared to any cross-group pairs. At the

same time, the result shows that fathers (estimate=.25, p<.05) also had a tendency to form

friendship ties with other fathers. The effect, however, was stronger among mothers

compared to among fathers (a post-hoc Wald test revealed that there was a significant

difference between the two parameters at p<.10). The odds ratio of differential homophily was 2.02 for mothers while it was 1.28 for fathers. Among non-parents, non-parent men were likely to be friends with other non-parent men (estimate=.41, odds ratio [or]=1.50, p<.05). We need to be careful that the homophily among non-parent women was not statistically significant despite the larger parameters (estimate=.30, or=1.35) than among fathers. There seems to be a problem with statistical power due to the gender and parental compositions in the joint network. Despite the problem, homophily variables in Model 3 show that mothers tend to be friends with other mothers and also that the homophily effect was larger for mothers compared to fathers. Therefore, Hypothesis 2 was supported.

Next I will review the results for the individual level attributes in the model. Using a dichotomous attribute variable, a positive and significant sender (or receiver) effect indicates that having a characteristic increases the probability of sending (or receiving) a tie compared to lacking the characteristic. Thus, the significant and negative receiver effect of parental status (estimate=-.30, or=.74, p<.05) in Model 3 of Table 4 means that an actor who was a parent received fewer ties compared to non-parents. Similarly, the significant negative receiver effect of race (estimate=-.46, or=.63, p<.05) shows that nonwhites received fewer ties compared to whites. Gender did not have a significant effect on the probability that an actor sent or received a tie.

ERGMs with a Single Department

As I mentioned before, there was one department whose parent and gender compositions met ERGM's requirement to run models on a single department. This department was the largest department among the sampled 42 departments, and its

academic discipline was under the Biological Sciences category (hereafter this department is called Department A). In Figure 4, Department A is surrounded by the dashed line. In addition to the joint network of six departments, I also ran ERGMs for Department A. Table 5 shows the demographic characteristics of faculty in Department A.

The structural properties that were used for the joint network described the observed network relatively well for Department A. Thus, the same combination of the variables for the structural effects was used (Figure 8, Figure 9, and Figure 10 show the GOF plot for Department A). Although there were differences in the level of statistical significance, the structural features of the friendship network in Department A had the same patterns as the joint network in terms of the direction of the estimated parameters (Model 1 in Table 6). Accounting for the structural effects and other attribute variables, uniform homophily by parent status had a significantly positive parameter in Model 2 (estimate=.43, or=1.54, p<.05). This result supported the presence of parent homophily in the friendship network among faculty in Department A, and Hypothesis 1 was supported again.

Looking at differential homophily by the four groups in Model 3 of Table 6, a friendship tie was more likely to exist between father-father pairs (estimate=1.05, p<.01) and mother-mother pairs (estimate=1.26, p<.05) compared to cross-group pairs. The odds ratio was higher for the differential homophily variable for mothers (or=3.54) than for fathers (or=2.85), but a post-hoc Wald test did not show a significantly stronger homophily effect among mothers. Therefore, the analysis of Department A did not support Hypothesis 2. The homophily effect was not significant among non-parent men

and among non-parent women. Although it was not statistically significant, the parameter of differential homophily for non-parent women was negative for Department A. The effect was positive (statistically insignificant) with the analysis with the joint network.

Comparing the results from ERGMs with the joint network and Department A, I found that parents and non-parents tended to form friendship ties among themselves (i.e., parent homophily existed). Also, mothers were particularly likely to be friends with other mothers in the joint network. Overall, the ERGM results revealed a clear gender dynamic in homophily among parents. Although this study found significant parent homophily in both the joint and single networks, it was not because mothers were connecting with fathers. Rather, homophily existed among parents because mothers tended to have friendship connections with other mothers while fathers tended to have connections with other fathers. That is, faculty friendship was not well-integrated across gender among faculty parents. There appears to be a friendship divide between fathers and mothers. For non-parents, however, the gender divide was less clear. The homophily effect among non-parent men was statistically significant only in the joint network, and the homophily effect was significant among non-parent women in neither the joint network nor the single network.

CHAPTER 6: THE EFFECT OF PARENTAL STATUS BY GENDER IN

THE SIZE OF FACULTY FRIENDSHIP NETWORKS

My second research objective was to answer a research question, "do parents, especially mothers, have smaller friendship networks (i.e., hold marginalized network positions) within the departments compared to non-parents?" I tested two hypotheses to pursue this question: (H3) Parents would have smaller friendship networks in the department than non-parents; (H4) Mothers would have smaller friendship networks compared to fathers. In other words, I expected that parental marginalization would be stronger for women than it would be for men.

The dependent variable, degree centrality (number of friendship ties or network size), was a network measure created based on the network mapping question on the FNWS. When conducting a network analysis, the network level response rates are of utmost importance. Ideally the relational response rate for the network (i.e., department) will be above 70% in order to calculate reliable social network measures (Knoke and Yang 2008). The formula for the relational response rate of a directed network is:

$$RR = 1 - \frac{\frac{M!}{2!\,(M-2)!}}{\frac{N!}{2!\,(N-2)!}}$$

where *M* is the number of missing actors and N is the network size. Although survey response was high overall, one of the 42 departments in the sample had a relational response rate lower than 70%. Therefore, faculty in this department (5 cases with known parental status) was dropped from the analysis. Among faculty in the other 41 departments, 531 faculty had values for parental status. After losing six cases due to missing data on the other variables of interest, the final analytic sample for the second

objective became 525. There were 360 parents (287 fathers and 73 mothers) and 165 non-parents (111 men and 54 women). Table 7 shows the relationship between parental status and gender.

Table 8 provides the results of the multilevel mixed-effects negative binomial regression models. As I have explained in the data analysis strategy section in Chapter 4, I ran 1000 permutation tests to avoid bias in in the variance estimates and significance tests. Standard errors are not reported in Table 8 because statistical significance was not calculated based on standard errors. First, I ran a model with only parental status and gender to explore differences in network size by parental status and gender (Model 1 in Table 8). Although being a parent had a negative association with degree centrality, the coefficient was not statistically significant. Model 2 added the interaction term between gender and parental status. The interaction effect was not statistically significant. Mothers did not have a particularly strong tendency to have a small friendship network compared to fathers.

Next, I ran a model including all of the control variables at the individual- and department-level (Model 3 in Table 8). Hours on household work, department size, percentages of white men and parents, and general department collegiality were grand-mean centered in the analysis. When the control variables were added, all of the department level control variables had a significant association with degree centrality, and the department-level random effect (variance component) was reduced from .21 to .09. For example, compared to faculty in Biological Sciences, faculty in Physical Sciences (coefficient [b]=.25, incident risk ratio [irr]=1.28, p<.01) and faculty in Business, Education, and Social Sciences (b=.36, irr=1.44, p<.001) tended to have higher

degree centrality. Higher percentage of parents in the department was also associated with lower degree centrality (b=-.01, irr=.99, p<.05). Accounting for the effects of the control variables, parental status was still not significantly associated with degree centrality. That is, being a parent did not explain variation in the size of friendship networks among faculty. This finding did not support Hypothesis 3, which stated that faculty parents would have a smaller friendship network compared to non-parents. Lastly, I added the interaction term between gender and parental status to Model 3 (Model 4 in Table 8). The interaction term was not statistically significant even with the control variables, and thus Hypothesis 4 was not supported.

For my second research objective, I examined the size of friendship networks focusing on parental status and gender. In terms of parental status, my goal was to contrast parents with non-parents. Previous research suggests that faculty parents face different parenting responsibilities as their children grow older (e.g., taking care of various physical needs for babies, managing after-school activities for school-age children) (Ward and Wolf-Wendel 2012). Therefore, I supplementally ran the regression models in Table 8 separating parents into three groups based on the age of their children. Table 9 shows the relationship between parental status (non-parents and three subgroups of parents) and gender. As you can see, women were overrepresented among non-parents while they were underrepresented in the third group of parents (parents of children 19 and older or parents of children who were not living together).

Table 10 presents the results of the supplemental analysis. Although I did not observe a significant difference in degree centrality between parents and non-parents when I grouped all parents together (see Table 9), parents of children 19 and older or not

living together had significantly lower degree centrality (b=-.20, irr=.82, p<.05) compared to non-parents holding the other variables constant (Model 3 in Table 10). This finding is somewhat surprising. If parents of grown-up children and nonresidential parents had less parenting responsibilities compared to parents living with young children (Rothausen 1999), they could have had more time for socializing with their colleagues. Although FNSW asked faculty about hours per week they spent on overall household work, it did not specifically ask the level of parenting responsibilities. Therefore, I can only speculate as to why parents of grown-up children and nonresidential parents were particularly likely to have significantly smaller friendship networks compared to non-parents. One possible explanation is that this group of parents dedicated their time and energy to activities other than parenting, such as elderly care and administrative duties at work. Even when I separated parents into three groups, the interaction terms between gender and parental status were not statistically significant with and without the control variables (Model 2 and Model 4 in Table 10).

Overall, the results from this section showed that contrary to my expectation, parents in general did not have a tendency to have smaller friendship networks compared to non-parents. Although I found through my supplemental analysis that parents of grown-up children and nonresidential parents had smaller friendship networks compared to non-parents, I did not observe clear patterns of parental marginalization in faculty friendship networks when I treated parents as one group. Also, there was no gender difference in the tendency of parental marginalization. Mothers were not more likely than fathers to have small friendship networks in the department.

CHAPTER 7: FRIENDSHIP NETWORKS (PARENT HOMOPHILY AND NETWORK SIZE) AND PERCEPTIONS OF SUPPORTIVE WORK-FAMILY CULTURE

My last research objective was to explore how social network factors (parent homophily and network size) were related to faculty parents' perceptions of work-family culture in the department. I did not develop a specific directional hypothesis for parent homophily. Rather, I expected that greater parent homophily would be associated with either more positive or negative perceptions of supportive work-family culture. I also expected that there might be a gender difference in the association between parent homophily and perceptions of supportive work-family culture. For network size, I developed two hypotheses: (H5) Having more friendship connections to colleagues (i.e., less marginalization) would be associated with more positive perceptions of work-family culture among faculty parents; (H6) The positive association between friendship connections and perceptions of work-family culture would be stronger for mothers compared to fathers.

The OLS regression models contained network measures (PBSC for parent homophily and degree centrality) as focal independent variables. Thus, for the same reason as for the multilevel mixed-effects negative binomial regression models in the previous chapter, I excluded faculty in one department with a low relational response rate ($< 70\%$) from the analysis. Then, after dropping non-parents (167 cases) and those who were missing values on the variables of interest (28 cases), the final analytic sample was 336. In this parent sample, there were 265 (79%) fathers and 71 mothers (21%).

As I mentioned in Chapter 4, the overall mean of PBSC was .03. This value indicates that on average, the faculty parents had an even mix of parents and non-parents in their friendship networks. I also examined PBSC by gender. Although the mean was slightly higher among faculty mothers (.08) compared to among faculty fathers (.01), the difference was not statistically significant. Looking at the distribution of PBSC by gender, however, there was an interesting gender difference (see Figure 11 for fathers and Figure 12 for mothers). The maximum value was 1 (complete homophily, which means parents had friendship ties only to other parents) for both fathers and mothers. One father had friendship ties only to non-parents, and therefore the minimum value was -1 (complete heterophily) for fathers. On the other hand, the minimum value was -.64 for mothers, which indicates that no mother had a completely heterophilous friendship network in terms of parental status (i.e., all mothers were friends with at least one parent in their department). While there was a gender difference in the minimum values, both fathers and mothers were represented across the range of values. For the majority of cases, fathers (89%) and mothers (89%) fell within the -.5 to +.5 range.

The results of the OLS regression models for supportive work-family culture are shown in Table 11 (hours on household work were included in the models after grand-mean centering). Because I ran permutation tests to obtain statistical significance, standard errors are not reported in Table 11. First, I found that taking into account the influence of the control variables, parental homophily was not significantly associated with perceived supportive work-family culture (Model 1). Thus, parent homophily did

not have a main effect in explaining perceptions of supportive work-family culture.[6]

Next, Model 2 added the interaction term between gender (fathers vs. mothers) and

parent homophily to test the moderation effect of gender on the association between

parent homophily and perceived supportive work-family culture. The moderation effect

was statistically significant (b=-.69, beta=-.13, p<.05). Although I did not develop a

directional hypothesis for the moderation effect of gender, this result met my expectation

that there might be a gender variation in the association between parent homophily and

perceptions of supportive work-family culture.

Figure 13 present the predicted perceptions of supportive work-family culture

calculated based on the results from Model 2 (the height of the graph is reduced to one

standard deviation above and below the mean of the dependent variable). Other than the

gender and parent homophily variables, all the variables were held at their means in the

calculation of the predicted values. The blue dashed line indicates the predicted values for

fathers and the red solid line is used for mothers. The figure clearly shows that while

greater parent homophily was associated with more negative perceptions of supportive

work-family culture for mothers, the relationship was null for fathers (post-hoc tests

revealed that the overall effect of parent homophily was significant at p<.10 for mothers

but insignificant for fathers). To be specific, the change from the minimal value (-.64) to

the maximum value (1) in parent homophily would decrease the predicted perceptions of

supportive work-family culture by .68 (from 3.93 to 3.25) for mothers. Considering that

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[6] I also tested the curvilinear effect of parent homophily to explore the possibility that greater parent homophily was associated with more positive perceptions of work-family culture but too much homophily had a negative influence. The results, however, did not support this possibility.

the supportive work-family index was a five-point scale (maximum value was five) with a standard deviation of .96, a decrease by .68 is a substantial change.

To understand the significantly negative association between parent homophily and perceived supportive work-family culture among mothers, it is important to think about the context of their friendship formation. Given that there were much more fathers than mothers in the sample departments, mothers with high parent homophily in their friendship networks probably had gender-mixed ties to fathers as well as to mothers. Thus, for mothers, having high parent homophily did not necessarily mean that they were forming social support groups with other mothers. For fathers, on the other hand, it is likely that they were able to have high parent homophily by having friendship ties primarily to other fathers (rather than by having cross-gender ties to mothers). The gender and parental compositions of the departments might explain part of the reason why parent homophily was significantly associated with perceptions of work-family culture only for mothers. It is also possible that cross-group interactions with non-parents had positive impact on perceived work-family culture for mothers but not for fathers.

In contrast to parent homophily, greater degree centrality was associated with more positive perceptions of work-family culture (b=.06, p<.001) in Model 1 of Table 11. This positive association supported Hypothesis 5. Compared to faculty parents who had fewer connections (i.e., more marginalized) in the friendship networks, parents who had more connections (i.e., less marginalized) tended to perceive that their department was more work-family supportive. The interaction effect between gender and degree centrality was also tested (Model 3 in Table 11). The result, however, did not show a significant moderation effect of gender on the association between degree centrality and

perceived supportive work-family culture. The insignificant moderation effect suggests that having a larger friendship network within the department was associated with better perceptions of work-family culture for both fathers and mothers. Thus, Hypothesis 6 was not supported.

Comparing the *beta* (or standardized coefficients) for all the variables included in Table 11, degree centrality was the strongest predictor of perceived work-family culture. Model 1 shows that it had the largest beta (beta=.24) followed by job satisfaction (b=.28, beta=.22, p<.001). As a job resource (Voydanoff 2005b), it makes sense that job satisfaction had a positive and significant association with perceptions of supportive work-family. Among other control variables, higher work-to-family conflict was associated with more negative perceptions of supportive work-family culture (b=-.14, beta=-.19, p<.01). Faculty parents who experienced negative spillover effects of work on their family role were less likely to report that their department was work-family supportive. Age of children also significantly predicted perceptions of work-family culture. Compared to parents of children above 19 or not living together, parents of children under the age of five (b=.52, beta=.21, p<.05) and between the age of five and 18 (b=.31, beta=.16, p<.05) tended to have more positive perceptions of work-family culture.

To summarize the findings, parent homophily or having friendship connections primarily with other parents in the department was associated with more negative perceptions of work-family culture for faculty mothers. For faculty fathers, on the other hand, the association between parent homophily and perceptions of work-family culture was not statistically significant. Overall, the results from this chapter suggest that

meanings of parent homophily were different between fathers and mothers. Friendship within parents and friendship across parenthood played a significant role in how mothers perceived work-family culture in the department, but parental status of friends was not as important for fathers.

In terms of network size, I found that friendship connections were positively associated with perceptions of work-family culture. This finding implies that having more colleagues to discuss personal matters or spend free time together might potentially improve how faculty parents perceive work-family culture in the department. Also, the insignificant moderation effect of gender suggests that this strategy might work not only for mothers but also for fathers.

CHAPTER 8: DISCUSSION AND CONCLUSION

Work-family integration remains a critical issue for faculty. Previous research repeatedly shows serious incompatibility between faculty work and family life (Hurtado et al. 2012; Jacobs and Winslow 2004a; O'Laughlin and Bischoff 2005; Ward and Wolf-Wendel 2004). High drop out rates of women faculty from tenure track academic positions demonstrate the problem of work-family conflict in academia. Combining work and family life is particularly difficult for women faculty because they are more likely than men faculty to be primarily responsible for housework and caregiving (Misra, Lundquist, and Templer 2012). Therefore, women are more likely than men to leave a tenure track position and take an alternative career option (e.g., part-time or adjunct academic position, nonacademic position) when work-family conflict worsens (Goulden, Mason, and Frasch 2011; Mason and Ekman 2007). As such, an effort to create academic work environments that are supportive of faculty who have involvements outside of work is necessary to retain more women and achieve gender diversity in the US faculty population. Besides retaining women, fostering supportive work-family culture should benefit young men faculty who struggle with work-family conflict (Marotte, Raynolds, and Savarese 2010; Reddick et al. 2012; Sallee 2012).

Given this trend, the general goal of this study was to pursue the possibility of retaining more faculty parents by exploring factors that contribute to more positive perceptions of work-family culture. Work-family culture is an important component of the job demands-resources model, which is frequently used in work-family research (Bianchi and Milkie 2010). To attain my goal, I focused on faculty friendship connections (non-work related social interactions) and conducted social network analysis.

First, I investigated how parental status and gender played a role in shaping the structures of faculty friendship networks. This study treated composition (e.g., homophily) and network size as different measures of social capital (or social support). Then, I examined how the different measures of social capital (parent homophily and network size) were associated with perceptions of supportive work-family culture. After summarizing the findings of this study, this closing chapter will discuss the implications for faculty retention efforts, the limitations of this study, and my suggestions for future research.

Research Objective #1 Findings

This study first investigated the presence of homophily across parental status and gender within faculty's departmental friendship networks. Through the network analysis using ERGMs, I found that taking into account network structures (e.g., dyadic dependence) and individual-level attributes, parent homophily existed. Parents tended to interact with other parents while non-parents tended to interact with other nonparents more often than expected due to chance. At the same time, this study also identified a clear role of gender in parent homophily. The ERGM results showed that mothers and fathers were likely to have homophilous friendships within each group. That is, mothers and fathers preferred to have friendship connections to parents who also shared their gender (mother-to-mother connections and father-to-father connections). Compared to fathers' tendency to be friends with other fathers, however, mothers had a stronger tendency to choose other mothers as friends (based on the analysis of the joint network).

The observed parent homophily supports social identity theory and homophily theory. The faculty in my sample showed a preference for similar others (i.e., those who shared parental status) over dissimilar others. The gender divide in parents' friendships

further suggests that parents categorized and chose friends based on gender in addition to parental status. Cross-gender interactions are sometimes viewed as inappropriate or suspect outside the context of marriage or other family relationships (Rubin 1990; Williams 2000). Therefore, it is possible that faculty parents avoided cross-gender friendship ties worrying about negative reaction from other colleagues and students. Previous research has identified various disadvantages that women face in the academic workplaces, such as stereotyping, biased evaluation (Valian 1998; Williams 2004), and social isolation. (Monroe et al. 2008; Roos and Gatta 2009; Yen et al. 2007). These disadvantages might also explain why mothers were particularly likely to be friends with other mothers who were likely to have similar experiences and offer a mutual understanding and support.

Research Objective #2 Findings

For the second part of the study, I tested whether parents had smaller friendship networks (i.e., held marginalized network positions) within the departments compared to non-parents and the moderation effect of gender in the association between parental status and network size. Childrearing and other family demands can limit time and energy that parents can spend for social activities (Ishii-Kuntz and Seccombe 1989; Knoester and Eggebeen 2006; Munch, McPherson, and Smith-Lovin 1997). This should be especially true for women faculty who are more likely than men faculty to experience work-family conflict (DeAngelo et al. 2009; Drago et al. 2006; Fox, Fonseca, and Bao 2011). Thus, for the gender moderation effect, I expected mothers to have smaller friendship networks compared to fathers.

Contrary to expectation, being a parent (or a mother in particular) did not affect the likelihood of marginalization in the department. Parents did not have a tendency to have smaller friendship networks compared to non-parents (i.e., parental marginalization did not exist). At the structural level, however, the percentage of parents in the department was negatively associated with network size. The results of the multilevel mixed-effects negative binomial regression models suggest that the department-level characteristics, such as percentage of parents, department size, and general department collegiality, were stronger predictors of network size compared to the individual-level characteristics. As far as I know, no study had taken a social network approach to explore the role of one's parental status in coworker friendship networks. Although this study did not find parent marginalization to be significant, the use of complete network made it worth trying and the findings unique.

Research Objective #3 Findings

The last part of this study examined how the structures of friendship networks (parent homophily and network size) were associated with perceptions of work-family culture in the department for faculty parents. It explored gender variation in these associations as well. One of the major findings from Objective #3 was that parent homophily had a significant relationship with perceptions of supportive work family culture for faculty mothers but not for faculty fathers. For mothers, greater parent homophily (being primarily friends with parents) was associated with more negative perceptions of supportive work-family culture. In other words, greater parent heterophily (being primarily friends with non-parents) was associated with more positive perceptions.

Among mothers, friendship *across* parental status (parent heterophily), rather than

within parents (parent homophily), predicted positive perceptions of work-family culture.

Cross-group interactions can change stereotypical views on out-group members (Allport

1957; Brown and Hewstone 2005; Pettigrew 1998; Pettgrew and Tropp 2006, 2008).

Therefore, it is possible that friendship with non-parents helped mothers overcome the

negative perception that non-parents did not understand what it was like to juggle work

and childrearing. From this perspective, it is understandable that parent heterophily in

their friendship networks was associated with a sense of support and positive perceptions

of work-family culture.

Another major finding from Objective #3 was the positive association between

network size and perceptions of supportive work-family culture (there was no significant

gender difference in this association). Compared to faculty parents who had fewer

friendship connections, parents who had more friendship connections tended to have

more positive perceptions of work-family culture in their department. Because of the

traditional academic work culture (e.g., the ideal worker norms and the individualistic

norms) faculty are often under pressure to hide family commitment in the workplace

(Colbeck and Drago 2005; Drago et al. 2006; Rice, Sorcinelli, and Austin 2000; Ward

and Wolf-Wendel 2004). The observed positive association between network size and

perceived work-family culture suggests that both mothers and fathers have a potential to

have more positive perceptions of work-family culture when they have more friends (i.e.,

colleagues to share personal matters and free time) in the department. Larger networks

are usually associated with more resources (Burt 1992). Therefore, I argue that parents

may have easier access to work-family support (including information about work-family

policies) when they have friendship connections to multiple colleagues compared to when they are marginalized in the departmental friendship networks.

Integration of the Findings across Objectives

Based on the findings from the three research objectives, I can draw several conclusions. First, not only parental status but also fatherhood and motherhood status was a key in understanding faculty friendship connections (from Objective #1). Second, parent homophily in friendships played a complex role in shaping perceptions of work-family culture among faculty parents. Although mothers tended to be friends with other mothers (from Objective #1), they were likely to have positive perceptions of work-family culture when they had friendship across parental status (being friends with non-parents) (from Objective #3). Friendship with parents and non-parents might have different meanings between mothers and fathers because parent homophily did not have a significant association with perceptions of work-family culture among fathers (from Objective #3). Lastly, although parental status and gender did not affect network size (from Objective #2), the number of friendship connections was strongly related to how faculty parents perceived work-family culture. For both mothers and fathers, having more friends in the department contributed to more positive perceptions of work-family culture (from Objective #3). When parents felt comfortable having non-work related interactions with multiple colleagues (regardless of colleagues' parental status), they were likely to perceive their department as work-family supportive. We need to keep in mind, however, that building friendship primarily with other parents may have a negative impact on perceived work-family culture for mothers (from Objective #3).

Implications for Faculty Retention Efforts

The findings of this study are clear enough to show that administrators need to pay more attention to academic work environments at the interaction level. One of the major findings is especially helpful for future programming to reduce faculty turnover due to work-family issues: Having more colleagues with whom to share personal matters and free time was associated with more positive perceptions of work-family culture among faculty parents. It implies that academic institutions might be able to foster supportive work-family culture by encouraging non-work related interactions among faculty in the same department. If work-family culture in the department becomes more positive, it should increase the use of work-family policies (Allen 2001; Blair-Loy and Wharton 2002; O'Meara and Campbell 2011) and reduce faculty's struggles juggling work and family responsibilities (Beauregard 2011; Voydanoff 2004; Wayne, Casper, Matthews, and Allen 2013). Now that work-family policies are widely available at academic institutions, it is time to place stronger emphasis on work culture, especially work-family specific coworker support.

Compared to other occupations, building friendship networks among colleagues might be particularly profitable for faculty parents. Parents in general tend to rely on relatives for childcare help (Moore 1990). Academic career developments, however, typically require a few geographic moves following receiving the Ph.D. (e.g., postdoctoral positions) (Frieze and Hanusa 1984; Preston 2004). Consequently, faculty parents have an increased likelihood of living away from their relatives (and their childcare help) when they are junior faculty with young children. Thus, they would greatly benefit from having a work environment where they can comfortably raise personal matters and seek for understanding and support from colleagues.

There seems to be advantages of integrating faculty's personal life into work. The next step is to think about how to encourage open conversations about work-family issues in academic work environments. Specifically, what can be done to bring more light to faculty's personal life at work? Would it help to make formal arrangements that provide opportunities for faculty to introduce their personal life to each other (e.g., department events involving families, work-family integration workshops)? A potential problem with this approach, however, is that some faculty may prefer to separate professional and personal lives and dislike attending such social events. Although the attempt to intervene with faculty's non-work related interactions might generate ill feelings for some faculty, it might be worth trying in order to foster supportive work-family culture, increase the use of work-family policies, and reduce faculty turnover due to work-family issues. It is beyond the scope of this study, but there might be potential benefits of supportive work-family culture on work-related outcomes, such as morale, productivity, and organizational commitment. I would suggest starting with small changes, such as encouraging senior faculty to talk about their family and non-work life at work. It should alleviate junior faculty's concern that there are career penalties for bringing up private matters in front of colleagues (Drago et al. 2006)

Limitations of the Current Study

While the conclusions of this study are applicable to faculty friendship networks, this highlights some of the limitations of this study/methodology. First, drawing my sample from one university limits the generalizability of the findings. Because the academic work conditions (e.g., tenure system, flexibility, autonomy) and organizational structure are unique, researchers should be especially cautious when applying the

findings of this study to workers in nonacademic work settings. Nevertheless, I believe that there are advantages of using single university data. For example, the faculty in my study were under similar circumstances in terms of residence (e.g., housing market, rent, commute), childcare availability, and work conditions (e.g., salary, office location, academic levels of student). Thus, I did not have to control for the complex influence of these conditions that I would have to do when I use data from multiple universities.

Secondly, the use of cross-sectional data prohibits me from making causal claims, especially for the results from Objective #3. For example, I found that more friendship connections within the department were associated with more positive perceptions of work-family culture for faculty parents. This study treated friendship connections as an independent variable that predicted perceptions of work-family culture. Yet it is also possible to interpret that faculty parents who had negative perceptions of work-family culture were reluctant to have non-work related interactions with their colleagues. For Objective #1 and Objective #2, causality is less problematic because I can expect the parental status (and gender) to be present prior to the reported friendship interactions for most faculty.

Besides the data being cross-sectional, the lack of gender and parental diversity in the sample limited the network analyses I could run. In my ERGMs for Objective #1, for example, I was able to use only six departments out of 42 departments on which we collected the network data through the FNWS. Also, the lack of gender and parental diversity did not allow me to measure individual-level homophily for the intersection of parental status and gender (fathers, mothers, non-parent men, non-parent women). The PBSC used for Objective #3 was a network measure of homophily only by parental status

(parents vs. non-parents). Knowing mothers and fathers' tendency to form friendship connections within their own group from Objective #1, it would have been interesting to see if and how homophily among mothers and homophily among fathers were related to their perceptions of work-family culture for Objective #3.

Finally, my conclusions would have been stronger if I had access to measures of personal characteristics and agency. For example, perceptions of work-family issues can vary depending on individual-level factors, such as temperament, negative affect, and coping mechanisms. Work-family researchers suggest controlling for these individual-level factors in studying work-family integration (Bianchi and Milkie 2010; Kelly et al. 2008; Voydanoff 2005b).

Despite these limitations, this study has strengths that are noteworthy. The unique use of complete network data is one of them, and the network analyses focusing on parental status add originality to my conceptual approach. In the work-family literature, coworker support is rarely studied compared to organizational and supervisor support (Kossek et al. 2011; Thompson and Prottas 2005). My measure of supportive work-family culture pertained to work-family specific support by other faculty in the department. My investigation indicates that friendship networks are important part of improving perceptions of work-family specific coworker support.

Future Research

With the findings and the limitations of the current study in mind, I will make several suggestions for future research. First, we need a further exploration of the relationship between parent homophily (more specifically, homophily among mothers and homophily among fathers) and perceptions of work-family culture. Future research

should measure homophily across parental status and gender on faculty's ego networks more meticulously to address the gender dynamics in parent homophily. It will require larger networks with greater gender and parental diversity.

Second, it should be useful to include measures of personal characteristics and agency. In this study, for example, it is possible that two faculty members who were in the same department and had similar values for the independent and control variables reported their perceptions of work-family culture differently because one had a higher tolerance to difficulties combining work and family compared to the other. I was not able to isolate the impact of potential cases where the respondents had different perceptions of work-family culture due to their personality.

Third, this study limited the sample to faculty with children for Objective #3. There is increasing interest in singles-friendly work culture, which is defined as "the shared assumptions, beliefs, and values regarding the extent to which an organization supports integration of work and nonwork that is unrelated to family, and the degree to which equity is perceived in the support an organization provides for employees' nonwork roles, irrespective of family status" (Casper, Weltman, and Kwesiga 2007: 480). By adding measures that capture various aspects of personal life (e.g., volunteer activities, hobbies, and activities for personal development), future research should investigate how friendship connections with colleagues are associated with perceptions of work-family/work-nonwork culture for all faculty.

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Figure 1: Network Mapping Question for Friendship (Fictional Department)

Third, we would like to ask about how often you <u>spend your free time or discuss personal matters</u> with departmental colleges in the current academic year. By "free time" we mean time you have chosen to spend with another faculty member that <u>does not entail</u> a work function or activity. It can take many forms: having coffee or sharing a meal; leisure or exercise activities (e.g., attending a play or playing golf); etc. "Discussing personal matters" entails talking about the people in your life, your social activities, your joys or struggles, etc.

13. <u>**During the current academic year,**</u> **how often have you spent free time or discussed personal matters with each of the following faculty members from your tenure home department?** *Please leave the row with your own name blank and check "not in this academic year" when applicable. Again, to maintain confidentiality all names will be recorded as numbers, including your own.*

	Not in This Academic Year	Once or Twice This Year	Once or Twice a Semester	Once or Twice a Month	Once a Week or More Often
James Smith	☐	☐	☐	☐	☐
Mary Johnson	☐	☐	☐	☐	☐
John Williams	☐	☐	☐	☐	☐
Patricia Brown	☐	☐	☐	☐	☐
Robert Jones	☐	☐	☐	☐	☐
Pablo Lopez	☐	☐	☐	☐	☐
Michael Davis	☐	☐	☐	☐	☐
Linda Bolling	☐	☐	☐	☐	☐

Figure 2: Structural Properties

Density

Directed tie

Reciprocity

Centralization

Activity (out-degree)
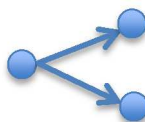
Popularity (in-degree)
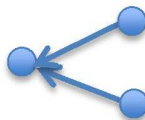
Clustering

Transitive triple

Cyclic triple

Figure 3: Actor Attribute Effects

Individual-level attribute

    Sender

    Receiver

Dyadic-level attribute

    Homophily
    (an ego and an alter are similar to each other)

Figure 4: Visualization of Friendship Networks Color-Coded by Parental Status and Gender

- Fathers
- Mothers
- Non-parent men
- Non-Parent women
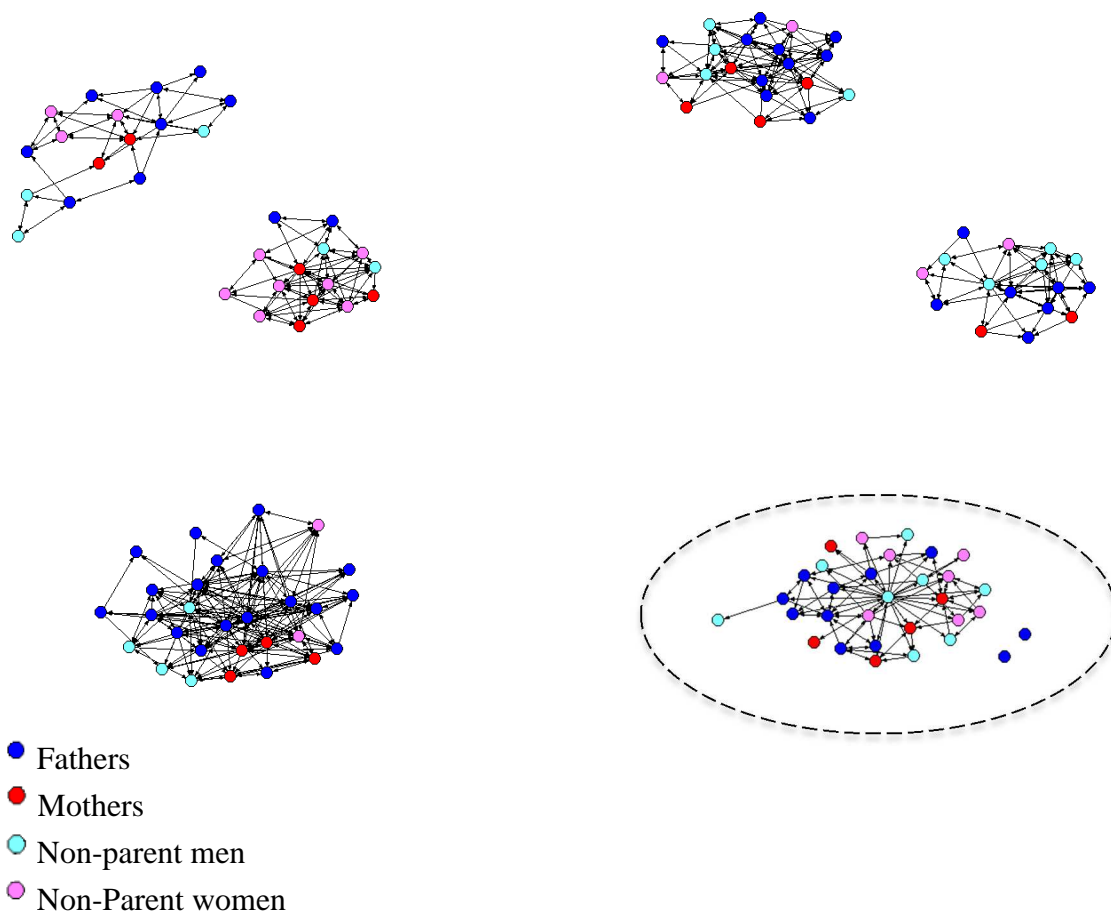
Notes: The department on the lower-right corner (surrounded by the dashed line) was the only department that had at least three cases for each of the four categories.

Figure 5: Goodness of Fit Plots for the Structural Effect Model (Model 1 in Table 4)
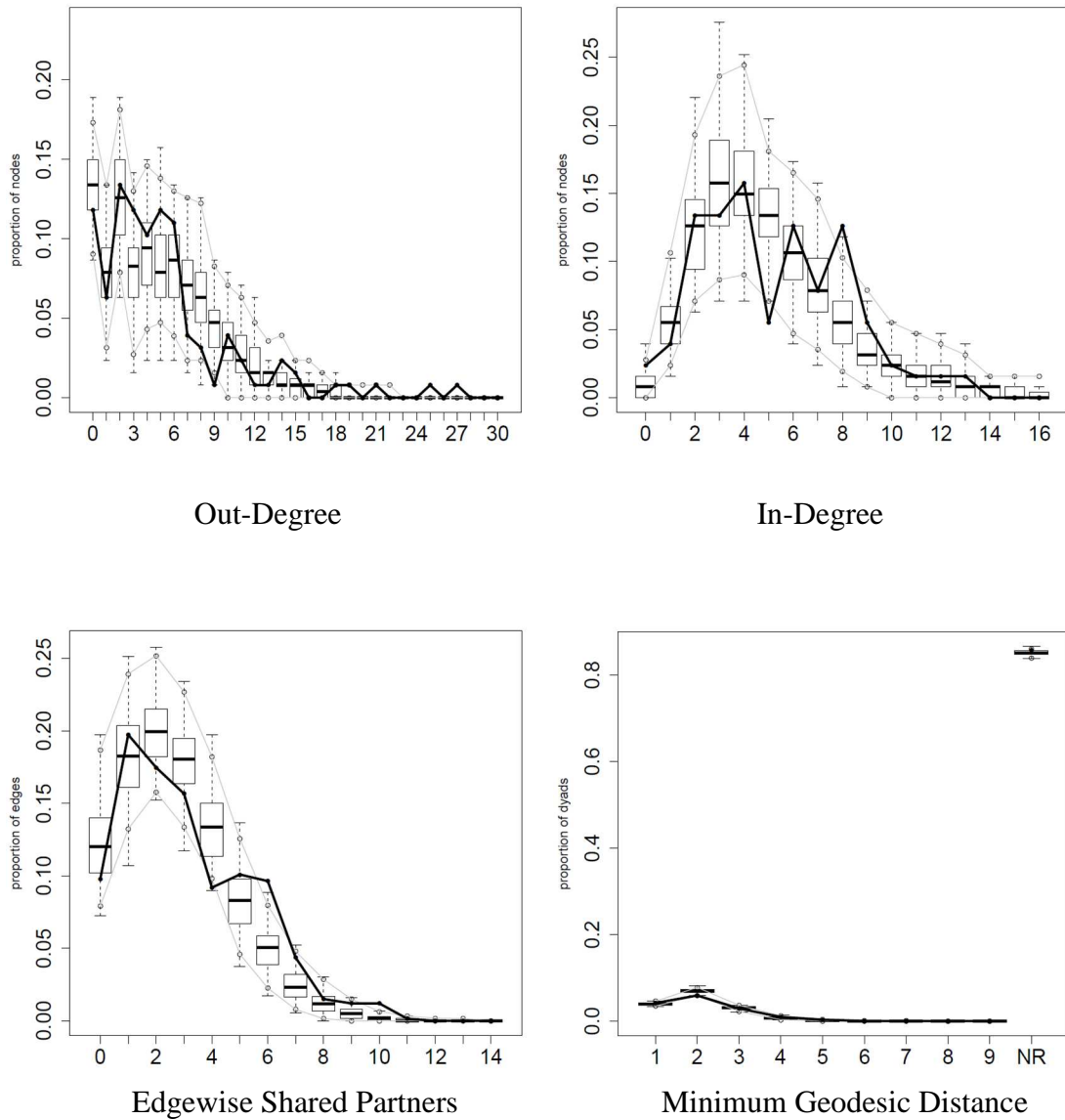
Out-Degree

In-Degree

Edgewise Shared Partners

Minimum Geodesic Distance

Note: The dark line represents the observed statistic, and the boxplots summarize the statistic for the 1000 simulated networks (median, interquartile range), and the light-gray lines represents the range within which 95% of simulated observations fell.

Figure 6: Goodness of Fit Plots for the Parent Homophily Model (Model 2 in Table 4)
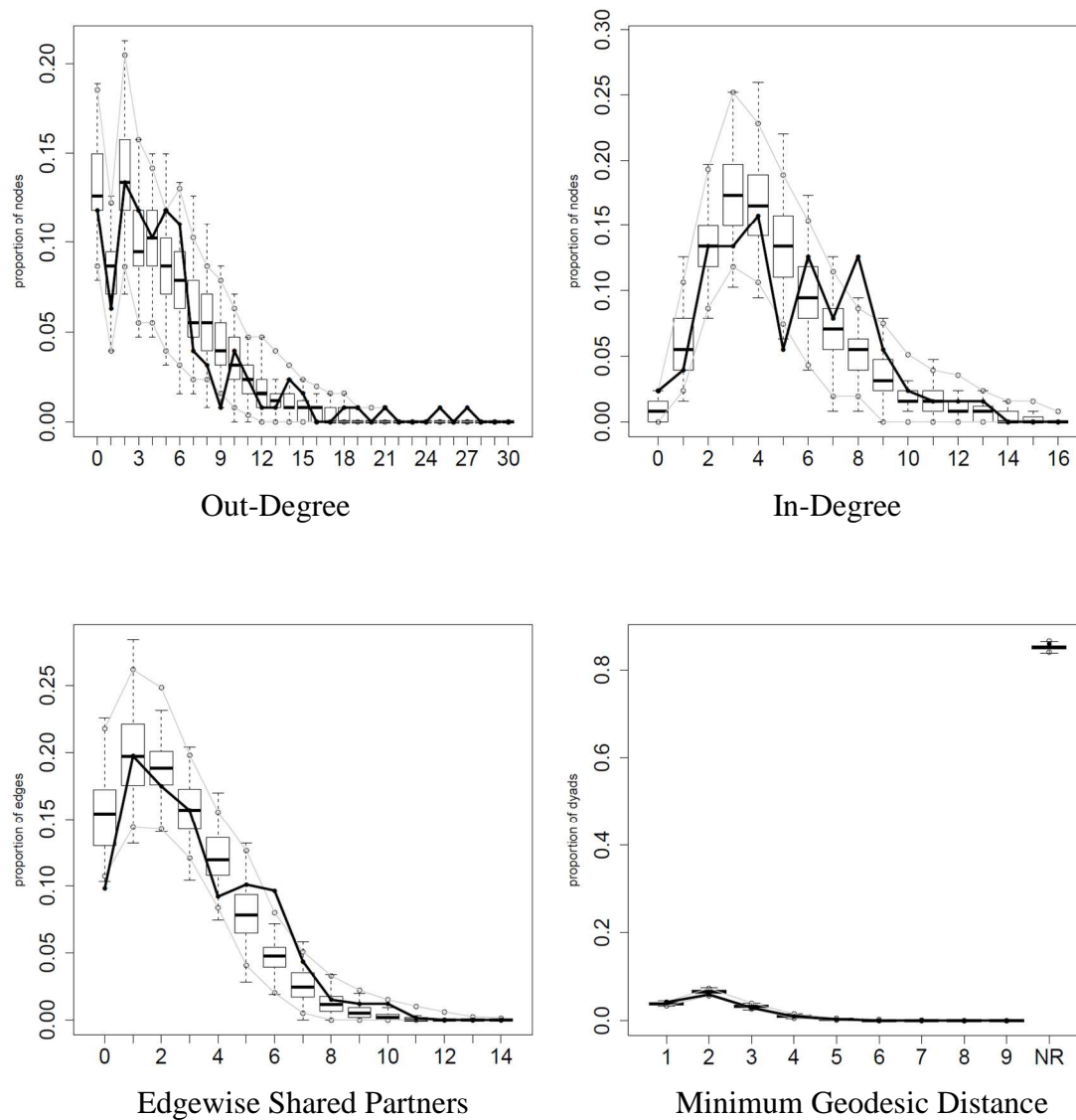
Out-Degree

In-Degree

Edgewise Shared Partners

Minimum Geodesic Distance

Note: The dark line represents the observed statistic, and the boxplots summarize the statistic for the 1000 simulated networks (median, interquartile range), and the light-gray lines represents the range within which 95% of simulated observations fell.

Figure 7: Goodness of Fit Plots for the Homophily across Parental Status and Gender Model (Model 3 in Table 4)

Note: The dark line represents the observed statistic, and the boxplots summarize the statistic for the 1000 simulated networks (median, interquartile range), and the light-gray lines represents the range within which 95% of simulated observations fell.

Figure 8: Goodness of Fit Plots for the Structural Model (Model 1 in Table 6) –
Department A
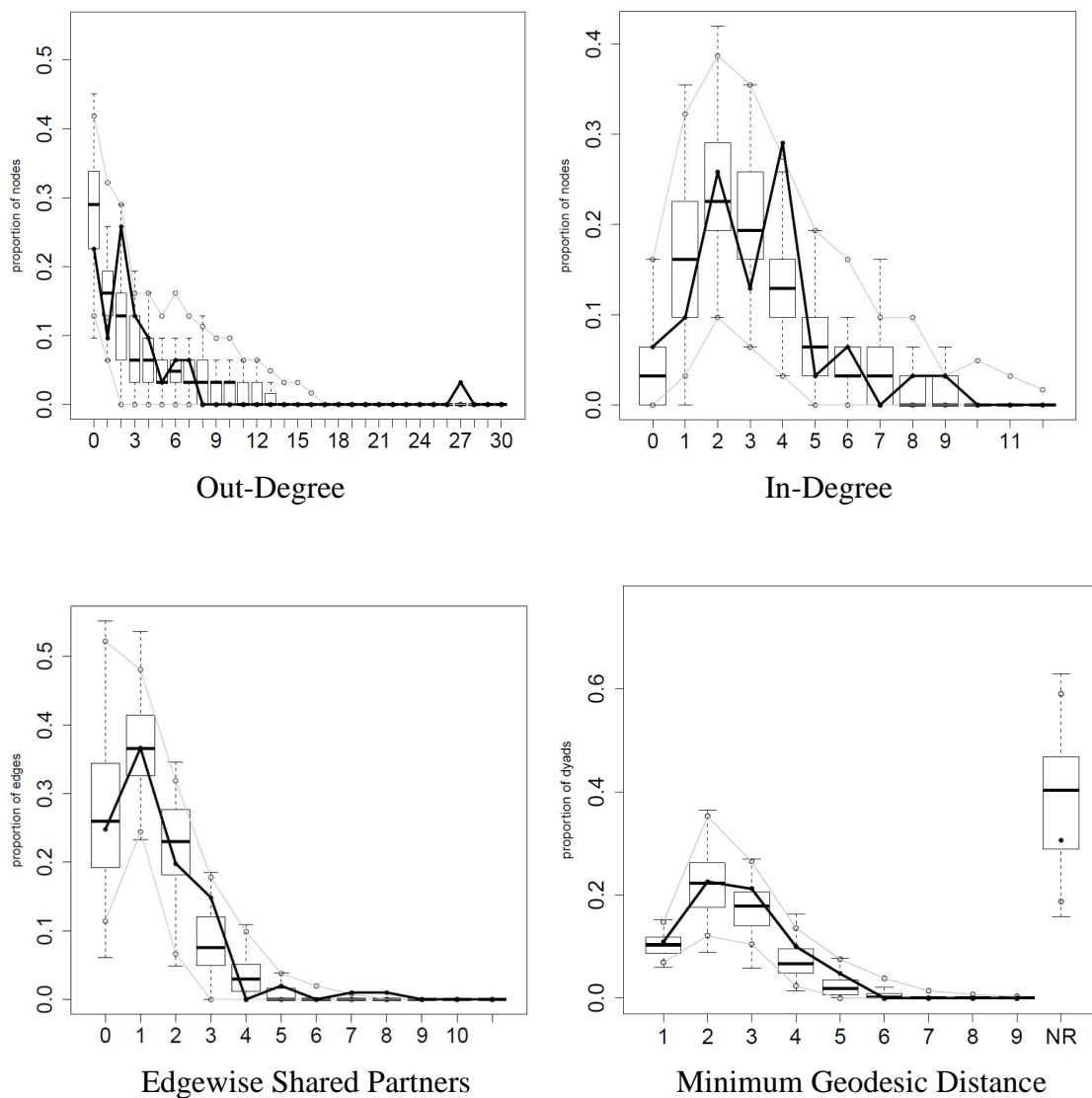
Note: The dark line represents the observed statistic, and the boxplots summarize the
statistic for the 1000 simulated networks (median, interquartile range), and the light-gray
lines represents the range within which 95% of simulated observations fell.

Figure 9: Goodness of Fit Plots for the Parent Homophily Model (Model 2 in Table 6) – Department A
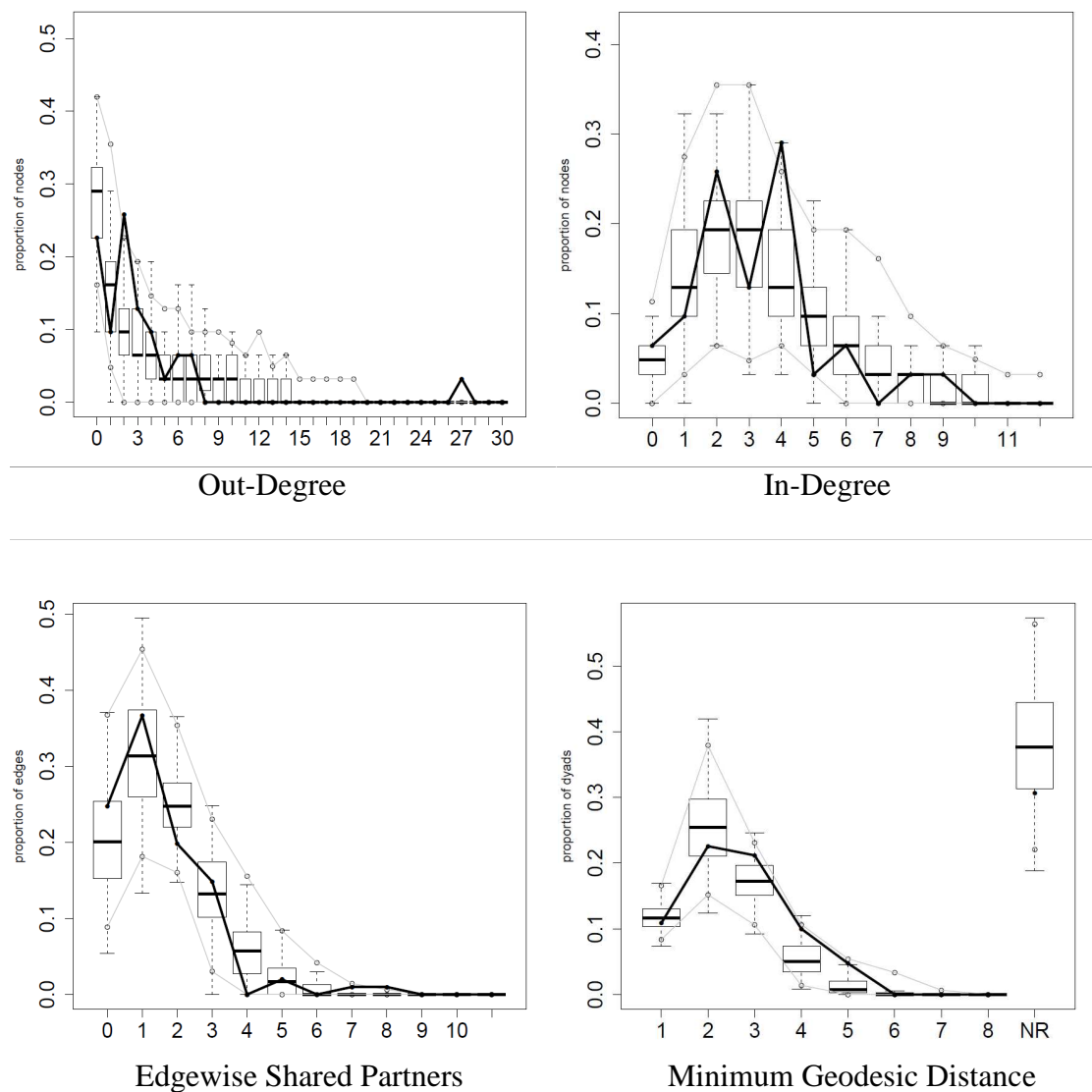
Note: The dark line represents the observed statistic, and the boxplots summarize the statistic for the 1000 simulated networks (median, interquartile range), and the light-gray lines represents the range within which 95% of simulated observations fell.

Figure 10: Goodness of Fit Plots for the Homophily across Parental Status and Gender Model (Model 3 in Table 6) – Department A
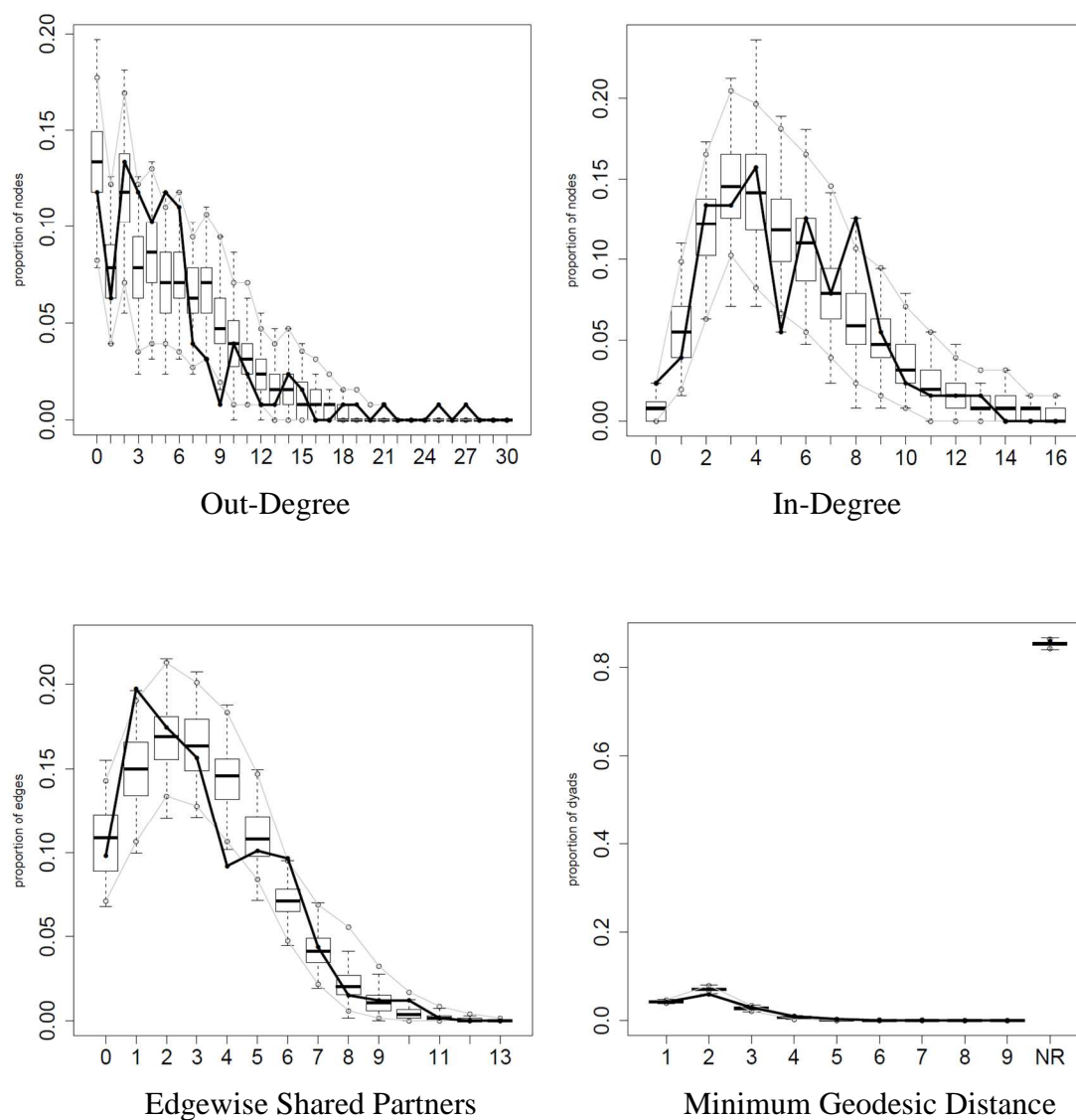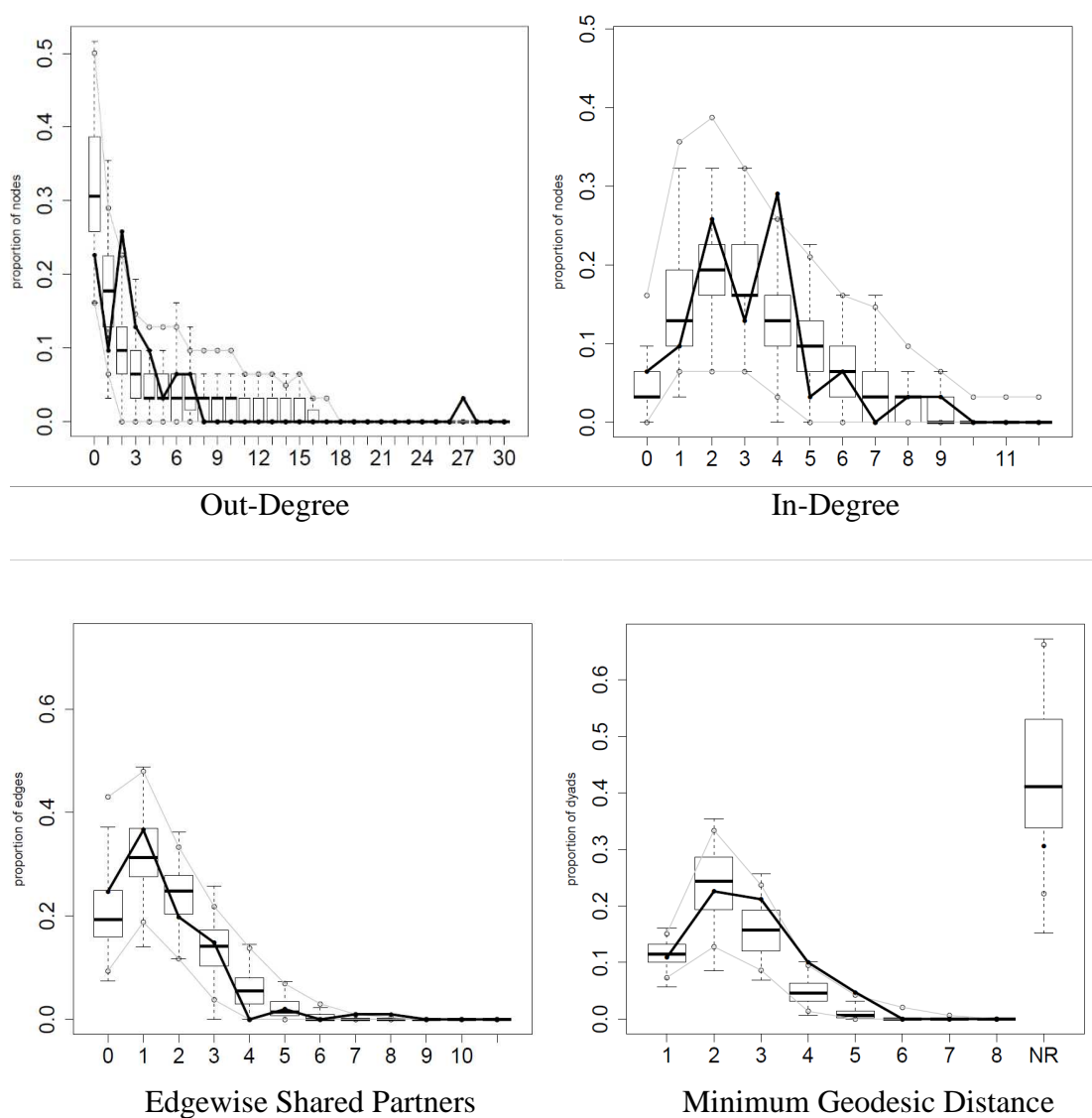

Note: The dark line represents the observed statistic, and the boxplots summarize the statistic for the 1000 simulated networks (median, interquartile range), and the light-gray lines represents the range within which 95% of simulated observations fell.

Figure 11: PBSC Distribution for Fathers
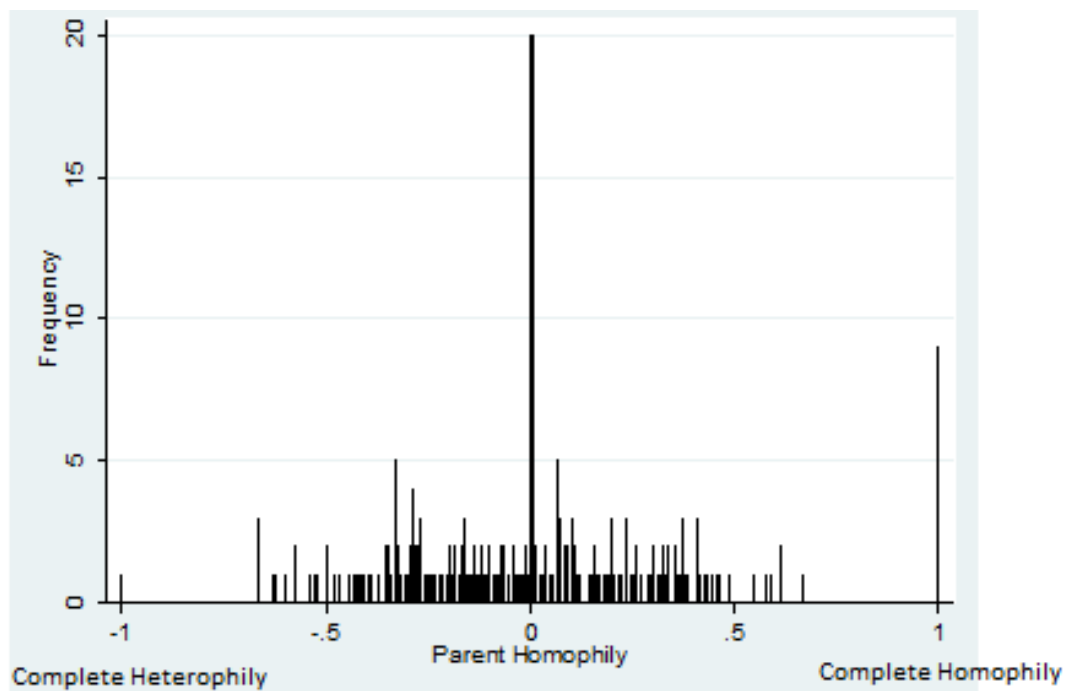
Figure 12: PBSC Distribution for Mothers
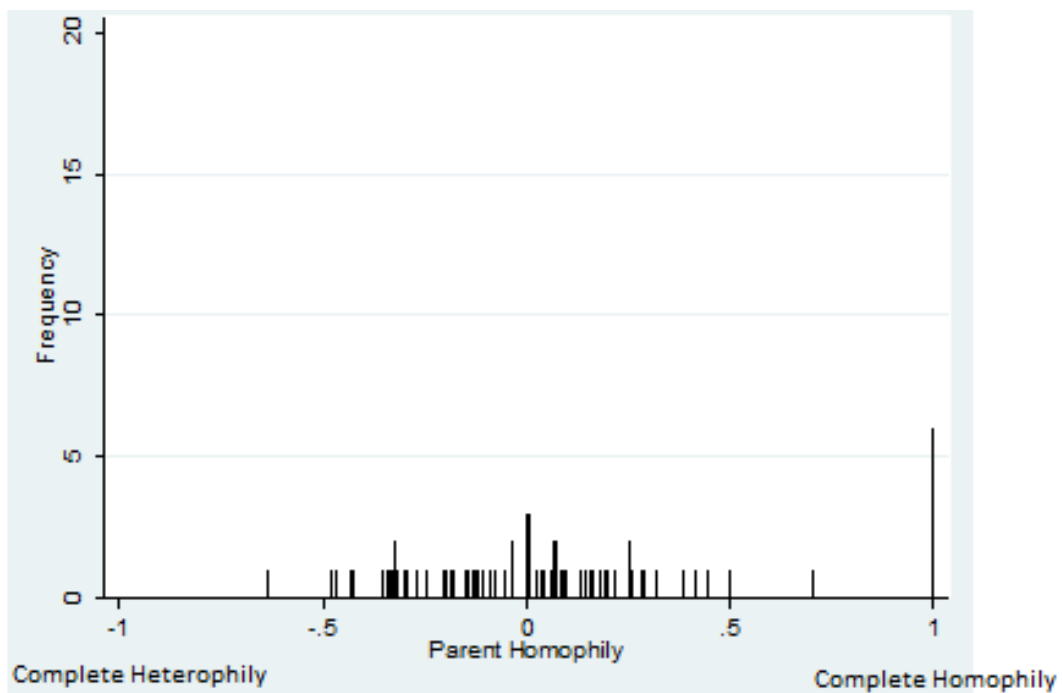
Figure 13: Predicted Perceptions of Supportive Work-Family Culture
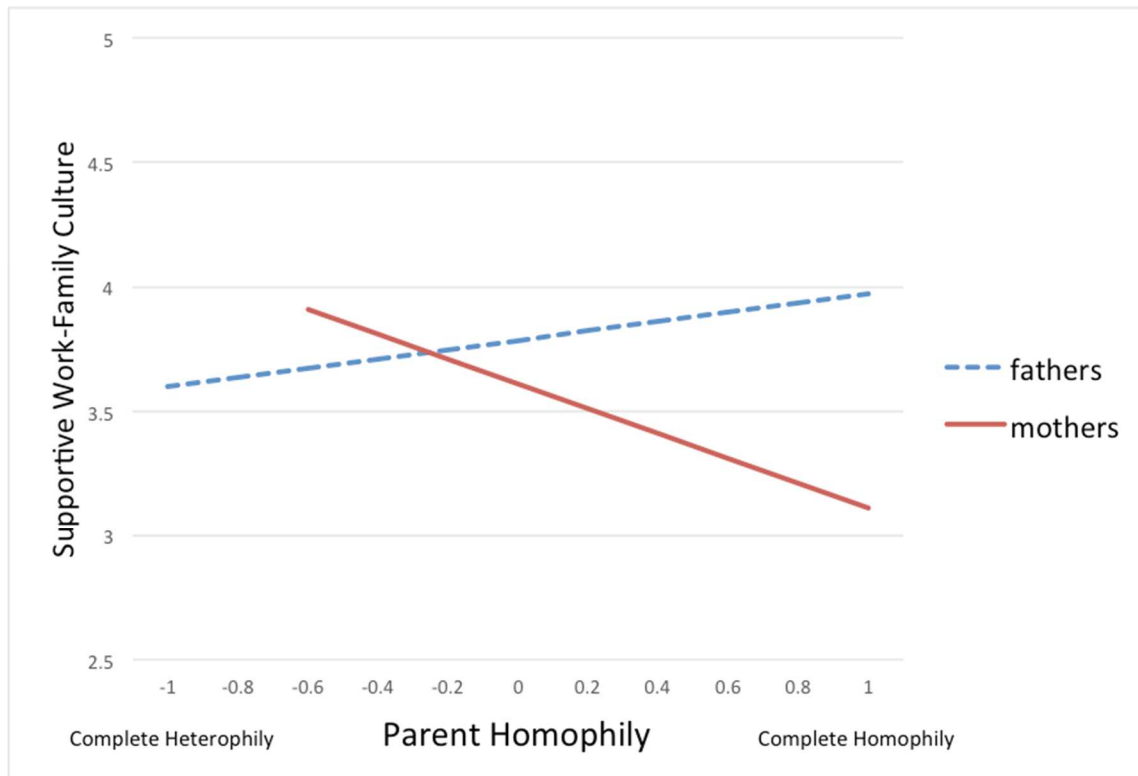
Note: The height of the graph is reduced to one standard deviation above and below the mean of the dependent variable

Table 1: Descriptive Statistics for Objective #2

Individual-Level Variables (N=525)	Mean	S.D.	Min.	Max.
Dependent Variable				
Degree Centrality	5.45	3.77	.00	27.00
Focal Independent Variables				
Parental Status (1=parent)	.69		.00	1.00
Gender (1=woman)	.24		.00	1.00
Control Variables				
Race (1=nonwhite)	.19		.00	1.00
Academic Rank				
Assistant Professor	.26		.00	1.00
Associate Professor	.23		.00	1.00
Full Professor	.51		.00	1.00
Married/Partnered	.91		.00	1.00
Hours on Household Work	21.06	13.29	.00	70.00
Department-Level Variables (N=41)				
Control Variables				
Academic Disciplines				
Biological Sciences	.36		.00	1.00
Physical Sciences	.32		.00	1.00
Business, Education, and Social Sciences	.31		.00	1.00
Department Size	22.42	10.40	8.00	41.00
Percentage of White Men	62.67	16.95	22.22	85.00
Percentage of Parents	68.48	14.23	28.57	100.00
General Department Collegiality	4.10	.61	2.53	5.44

Table 2: Descriptive Statistics for Objective #3

	Mean	S.D.	Min.	Max.
Dependent Variable				
Supportive Work-Family Culture	3.84	.96	1.00	5.00
Focal Independent Variables				
Social Network Factors				
Parent Homophily - PBSC	.03	.35	-1.00	1.00
Degree Centrality	5.45	3.83	1.00	26.00
Gender (1=mothers)	.21		.00	1.00
Control Variables				
Race (1=nonwhite)	.13		.00	1.00
Academic Rank				
Assistant Professor	.17		.00	1.00
Associate Professor	.26		.00	1.00
Full Professor	.57		.00	1.00
Academic Discipline				
Biological Sciences	.35		.00	1.00
Physical Sciences	.32		.00	1.00
Business, Education, and Social Sciences	.33		.00	1.00
Job Satisfaction	5.30	.76	1.50	6.00
Married/Partnered (1=married or partnered)	.98		.00	1.00
Age of Children				
Under 5 at Home	.18		.00	1.00
5-18 at Home	.36		.00	1.00
19+ or Not Living Together	.45		.00	1.00
Hours on Household Work	23.03	14.37	.00	70.00
Work-to-Family Conflict	3.56	1.27	1.00	6.00
Family-to-Work Conflict	2.74	1.08	1.00	6.00

Note: N=336

Table 3: Descriptive Statistics for Objective #1 – Joint Network

	N	%
Parental Status		
Parents	78	61%
Non-Parents	49	39%
Parental Status by Gender		
Fathers	57	45%
Mothers	21	17%
Non-Parent Men	26	20%
Non-Parent Women	23	18%
Race		
Whites	109	86%
Nonwhites	18	14%

Note: N=127

Table 4: ERGM Parameter Estimates for Friendship Ties – Joint Network

	Model 1		Model 2		Model 3	
	estimate	or	estimate	or	estimate	or
Structural Effects						
Edges	-4.40 *** [.17]	.01	-4.38 *** [.18]	.01	-4.32 *** [.20]	.01
Reciprocity	1.77 *** [.16]	5.89	1.74 *** [.16]	5.68	1.72 *** [.16]	5.57
Activity	-.87 * [.43]	.42	-.84 * [.42]	.43	-.86 * [.43]	.42
Popularity	3.23 *** [.28]	25.32	3.36 *** [.31]	28.71	3.24 *** [.32]	25.47
Triad Closure	.61 *** [.04]	1.83	.58 *** [.03]	1.78	.58 *** [.04]	1.78
Attribute Effects						
Uniform Homophily - Parental Status			.22 *** [.07]	1.25		
Differential Homophily - Father to Father Dyad [a]					.25 * [.10]	1.28
Differential Homophily - Mother to Mother Dyad [a]					.70 ** [.23]	2.02
Differential Homophily - Non-Parent Man to Non-Parent Man Dyad [a]					.41 * [.19]	1.50
Differential Homophily - Non-Parent Woman to Non-Parent Woman Dyad [a]					.30 [.20]	1.35
Sender Effect - Parental Status (1=parent)			.13 [.08]	1.14	.13 [.10]	1.14
Receiver Effect - Parental Status (1=parent)			-.30 * [.12]	.74	-.28 * [.13]	.75
Sender Effect - Gender (1=woman)			-.01 [.09]	.99	.01 [.10]	1.01
Receiver Effect - Gender (1=woman)			.15 [.12]	1.16	.15 [.13]	1.17
Sender Effect - Race (1=nonwhite)			-.02 [.12]	.98	-.03 [.12]	.97
Receiver Effect - Race (1=nonwhite)			-.46 * [.18]	.63	-.44 * [.18]	.64

Note: N=127 faculty members in 6 departments. Standard errors in brackets, or=odds ratios.
[a] Cross-group dyads were the reference group.
†p<.10, *p<.05, **p<.01, ***p<.001

Table 5: Descriptive Statistics for Objective #1 – Department A

	N	%
Parental Status		
Parents	16	52%
Non-Parents	15	48%
Parental Status by Gender		
Fathers	11	35%
Mothers	5	16%
Non-Parent Men	8	26%
Non-Parent Women	7	23%
Race		
Whites	23	74%
Nonwhites	8	26%

Note: N=31

Table 6: ERGM Parameter Estimates for Friendship Ties – Department A

	Model 1		Model 2		Model 3	
	estimate	or	estimate	or	estimate	or
Structural Effects						
Edges	-3.34 ***	.04	-3.22 ***	.04	-2.84 ***	.06
	[.66]		[.77]		[.80]	
Reciprocity	2.63 ***	13.81	2.93 ***	18.80	2.88 ***	17.89
	[.44]		[.47]		[.49]	
Activity	-1.72 **	.18	-2.07 **	.13	-2.28 ***	.10
	[.61]		[.68]		[.68]	
Popularity	1.84 ***	6.32	2.08 †	8.00	2.05 †	7.78
	[.99]		[1.18]		[1.19]	
Triad Closure	.79 ***	2.20	.71 **	2.04	.69 **	1.99
	[.22]		[.23]		[.24]	
Attribute Effects						
Uniform Homophily - Parental Status			.43 *	1.54		
			[.17]			
Differential Homophily - Father to Father Dyad [a]					1.05 **	2.85
					[.34]	
Differential Homophily - Mother to Mother Dyad [a]					1.26 *	3.54
					[.57]	
Differential Homophily - Non-Parent Man to Non-Parent Man Dyad [a]					.03	1.03
					[.42]	
Differential Homophily - Non-Parent Woman to Non-Parent Woman Dyad [a]					-.53	.59
					[.65]	
Sender Effect - Parental Status (1=parent)			-.52 **	.59	-.83 ***	.44
			[.19]		[.25]	
Receiver Effect - Parental Status (1=parent)			.62 *	1.87	.18	1.20
			[.30]		[.35]	
Sender Effect - Gender (1=woman)			-.49 *	.61	-.37	.69
			[.20]		[.25]	
Receiver Effect - Gender (1=woman)			.72 *	2.06	.91 **	2.48
			[.30]		[.33]	
Sender Effect - Race (1=nonwhite)			-.38	.69	-.28	.75
			[.34]		[.30]	
Receiver Effect - Race (1=nonwhite)			-.70	.49	-.71	.49
			[.48]		[.47]	

Note: N=31 faculty members. Standard errors in brackets, or=odds ratios.
[a] Cross-group dyads were the reference group.
†p<.10, *p<.05, **p<.01, ***p<.001

Table 7: Parental Status by Gender

		Gender		Total
		Men	Women	
Parental Status	Non-Parents	111	54	165
		67%	33%	100%
	Parents	287	73	360
		80%	20%	100%
	Total	398	127	525
		76%	24%	100%

Table 8: Multilevel Mixed-Effects Negative Binomial Regressions with Random Effects for Degree Centrality

	Model 1		Model 2		Model 3		Model 4	
	b	irr	*b*	irr	*b*	irr	*b*	irr
Fixed Effects								
Parental Status (1=parent)	-.06	.94	-.11	.89	-.10	.90	-.15	.86
Women	.00	1.00	-.12	.89	.03	1.03	-.08	.92
Women X Parental Status			.20	1.22			.19	1.20
Nonwhite					-.15 †	.86	-.15 †	.86
Assistant Professor [a]					-.04	.96	-.05	.96
Associate Professor [a]					-.03	.97	-.04	.96
Married/Partnered					.08	1.08	.06	1.07
Hours on Household Work [c]					.00	1.00	.00	1.00
Model for Department Means								
Intercept	1.52		1.56		1.30		1.34	
Physical Sciences [b]					.25 **	1.28	.25 **	1.28
Business, Education, and Social Sciences [b]					.36 ***	1.44	.36 ***	1.44
Department Size [c]					.03 ***	1.03	.03 ***	1.03
Percentage of White Men [c]					.00 *	1.00	.00 *	1.00
Percentage of Parents [c]					-.01 **	.99	-.01 ***	.99
General Department Collegiality [c]					.21 ***	1.23	.21 ***	1.23
Random Effect	vc		vc		vc		vc	
Department Mean	.21		.21		.09		.09	

Note: N=525 faculty members in 41 departments. *b*=coefficient, irr=incident risk ratios, vc=variance components.
[a] Full professors are the omitted reference group.
[b] Biological Sciences is the omittted reference group.
[c] Grand-mean-centered.
†p<.10, *p<.05, **p<.01, ***p<.001

Table 9: Parental Status by Gender (Separating Parents by Age of Children)

		Gender		Total
		Men	Women	
Parental Status	Non-Parents	111	54	165
		67%	33%	100%
	Parents with Children under 5 at Home	43	24	67
		64%	36%	100%
	Parents with Children 5-18 at Home	101	29	130
		78%	22%	100%
	Parents with Children 19+ or Not Living Together	143	20	163
		88%	12%	100%
	Total	398	127	525
		76%	24%	100%

Table 10: Multilevel Mixed-Effects Negative Binomial Regressions with Random Effects for Degree Centrality (Separating Parents by Age of Children)

	Model 1		Model 2		Model 3		Model 4	
	b	irr	*b*	irr	*b*	irr	*b*	irr
Fixed Effects								
Parents with Children under 5 at Home [a]	-.03	.97	-.10	.90	-.02	.98	-.08	.92
Parents with Children 5-18 at Home [a]	.01	1.01	-.05	.95	-.03	.97	-.08	.93
Parents with Children 19+ or Children Not Living Together [a]	-.13 †	.87	-.16 †	.85	-.20 *	.82	-.23 *	.79
Women	-.02	.98	-.12	.89	.03	1.03	-.08	.92
Women X Parents with Children under 5 at Home			.22	1.24			.20	1.22
Women X Parents with Children 5-18 at Home			.22	1.25			.22	1.25
Women X Parents with Children 19+ or Children Not Living Together			.05	1.06			.08	1.08
Nonwhite					-.17 *	.84	-.17 *	.84
Assistant Professor [b]					-.09	.92	-.09	.92
Associate Professor [b]					-.07	.93	-.08	.92
Married/Partnered					.06	1.07	.05	1.06
Hours on Household Work [d]					.00	1.00	.00	1.00
Model for Department Means								
Intercept	1.53		1.56		1.34		1.38	
Physical Sciences [c]					.25 **	1.28	.24 **	1.28
Business, Education, and Social Sciences [c]					.37 ***	1.44	.36 ***	1.43
Department Size [d]					.03 ***	1.03	.03 ***	1.03
Percentage of White Men [d]					.00 *	1.00	.00 †	1.00
Percentage of Parents [d]					-.01 **	.99	-.01 ***	.99
General Department Collegiality [d]					.19 ***	1.21	.19 ***	1.21
Random Effect	vc		vc		vc		vc	
Department Mean	.21		.20		.09		.09	

Note: N=525 faculty members in 41 departments. *b*=coefficient, irr=incident risk ratios, vc=variance components.

[a] Non-parents are the omitted reference group.

[b] Full professors are the omitted reference group.

[c] Biological Sciences is the omittted reference group.

[d] Grand-mean-centered.

†p<.10, *p<.05, **p<.01, ***p<.001

Table 11: Ordinary Least Squares Regressions for Supportive Work-Family Culture

	Model 1		Model 2		Model 3	
	b	beta	b	beta	b	beta
Parent Homophily - PBSC	.03	.01	.19	.07	.06	.02
Degree Centrality	.06 ***	.24	.06 ***	.23	.05 **	.20
Mother (0=father)	-.23	-.10	-.18	-.08	-.53 *	-.23
Mother X Parent Homophily			-.69 *	-.13		
Mother X Degree Centrality					.05	.17
Nonwhite	-.29 †	-.10	-.27	-.09	-.28 †	-.10
Assistant Professor [a]	.00	.00	-.03	-.01	.00	.00
Associate Professor [a]	-.11	-.05	-.14	-.06	-.10	-.05
Physical Sciences [b]	.11	.06	.11	.05	.10	.05
Business, Education, and Social Sciences [b]	.08	.04	.08	.04	.07	.03
Job Satisfaction	.28 ***	.22	.27 ***	.21	.28 ***	.22
Married/Partnered	.03	.01	-.06	-.01	.01	.00
Children under 5 at home [c]	.52 *	.21	.51 *	.21	.50 *	.20
Children 5-18 at home [c]	.31 *	.16	.33 *	.17	.31 *	.15
Hours on Household Work [d]	.00	-.01	.00	.00	.00	.00
Work-to-Family Conflict	-.14 **	-.19	-.14 **	-.19	-.13 **	-.18
Family-to-Work Conflict	-.05	-.06	-.06	-.06	-.06	-.07
Constant	2.47		2.67		2.58	
R^2	.26		.27		.27	

Note: N=336 faculty parents. b=coefficient.
[a] Full professors are the omitted reference group.
[b] Biological Sciences is the omittted reference group.
[c] Children 19+ or not living together are the omittted reference group.
[d] Mean-centered.
†p<.10, *p<.05, **p<.01, ***p<.001 (p-values are obtained using permutation tests)

Appendix A: A Sample Contingency Table

		Attribute Similarity	
		1	0
Network	1	a	b
Tie	0	c	d

a = # of ego's ties to alters who have the same attribute

b = # of ego's ties to alters with a different attribute

c = # of ties that do not actually exist but could have existed between ego and potential alters who have the same attribute

d = # of ties that do not actually exist but could have existed between ego and potential alters with a different attribute