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Specialization and promotion in an academic discipline

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Abstract

What does it take to get tenure in an academic discipline? The receipt of tenure has received less attention in the research literature on scientific careers than other career outcomes. To explain variation in the "risk" of receiving tenure, we theorize that the extent of specialization in scholars' research programs should improve promotion prospects, especially for men. Using data on sociology PhD recipients in 1972–1976, we construct a measure of research specialization and add it to a traditional attainment model that includes productivity, visibility, and prestige of specialty area(s). We find that a high degree of specialization actually decreases promotion prospects, at least for men.

Keywords: Promotion; Gender; Professions; Academia; Specialization

Inequality in work is reflected in various arenas: hiring, promotion, and earnings (Peterson & Togstad, 2006), and this is no less true within the profession of academe than in other professions. While various studies of academics have analyzed hiring (Burris, 2004; Furst, 1988) and earnings (Barbezat, 1987a; Bellas, Ritchey, & Parmer, 2001; Burke, Duncan, Krall, & Spencer, 2005; Danziger, 1982; Fox, 1985; Langton & Pfeffer, 1994; Tolbert, 1986), studies of promotion are limited. This neglect is particularly surprising in academe, where promotion takes on a heightened significance because it is typically accompanied by tenure – a status that almost guarantees job security and autonomy. What does it take to get tenure in an academic discipline? When promotion to associate professor with tenure is the outcome of interest, human capital considerations are critical. Productivity and experience are highlighted more than education, which contributes little to promotion disparities as most academics hold a doctoral degree. Apparent in the popular adage "publish or perish," the quantity of scholarly work that academics produce is absolutely critical to their success. Quality of publication has also been shown to matter (Cole & Cole, 1973; Long, 1992; Wanner, Lewis, & Gregorio, 1981). But are there other aspects of scholars' research programs that influence promotion to tenure?

A common viewpoint within academe is that the extent of research specialization affects one's chances of receiving tenure. Disciplinary norms, at least within the discipline of sociology, tend to encourage scholars to specialize at early career stages in order to get tenure. Specializing one's research in one or two specialty areas should promote not only productivity (because it is easier to write successive papers on the same topic than to begin a paper on a new topic) but also visibility, as one gets to know – and be known by – the key players in those specialty areas, through American

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Sociological Association (ASA) section membership and smaller conference attendance. This early career stage link between specialization and tenure prospects has been recognized by the Center for Advanced Study in the Behavioral Sciences at Stanford, which hopes to recruit promising young scholars who have "worked *narrowly* for 6–8 years to get tenure, [and] are now in a position to think more ambitiously about their work and to take greater intellectual risks." (http://www.casbs.org/programs/fellowships/?PHPSESSID=98e3e0561914a258ed43006e9a210304).

Despite this anecdotal evidence that the extent of specialization affects promotion prospects, no study to date has theorized an explanatory role for this construct. When specialization is brought to bear on questions of academic success, it is typically another dimension of specialization – the area(s) of specialization – that is highlighted (Breiger, 1976; Cappell & Gutterbock, 1992; Cole & Cole, 1968; Ennis, 1992; Grant & Ward, 1991; Grant, Ward, & Rong, 1987; Moody, 2004; O'Connor & Meadows, 1976; Small & Griffith, 1974b; Stokes & Hartley, 1989; Wagner-Dobler, 1997). In these studies, the areas of research that scholars engage in, and perhaps the prestige and gender-segregation of those areas, are incorporated into models of academic success. These studies, while taking the "building blocks of science" seriously (Small & Griffith, 1974a) and elucidating the social organization of disciplines (Cappell & Gutterbock, 1992; Ennis, 1992; Stokes & Hartley, 1989), do not close the gap between interest in scientific specialization and the number of concrete empirical investigations on the topic (Wagner-Dobler, 1997). This is largely because they overlook an important dimension of specialization: its extent.[1]

Because we conceive of the extent of research specialization as a form of professional capital, we also expect its effects to vary by gender like other forms of capital (Kanter, 1977; Paglin & Rufolo, 1990; Tam, 1997; Weeden, 2002; Wegener, 1991). Men and women may receive different returns to the same degree of research specialization; specifically, high degrees of specialization may benefit men more than women. We know from previous research that women achieve high academic rank and its prerequisites later than men (Cole & Zuckerman, 1984), and that they are less apt to be promoted (Bayer & Astin, 1975; Cole, 1979) and are promoted more slowly than comparably qualified men (Long, Allison, & McGinnis, 1993; Sonnert & Holton, 1996; Toren & Moore, 1998). We hypothesize that these gender differences have to do, at least partially, with the different ways in which the extent of research specialization operates for men and women. Understanding these differential effects at early career stages is critical, given that advantage and disadvantage are typically compounded over the course of careers.

The goal of this paper is to theorize and operationalize the extent of research specialization in a study of academic career success, and to assess how its impact may vary by gender. We focus on the attainment of tenure by scholars from a single cohort (all received their PhD in the 1970s) and in a single discipline: sociology. Unlike previous studies that have focused on the quantity and quality of publications as the critical predictors, we add the extent of research specialization to this theoretical model. We also pay particular attention to time. That is, we are not merely interested in *whether* scholars receive tenure or not, but how long it takes them to do so. Because of early career achievements, family obligations, and institutional moves, not all scholars go up for tenure 6 years after starting their assistant professorships; as we will see, there is substantial variation in whether and *when* scholars are promoted to associate professor with tenure. By collecting primary data, developing a unique measure of the extent of research specialization, and utilizing an appropriate statistical technique – event-history analysis – we are able to assess whether the extent of research specialization, in addition to the quantity and quality of publications, influences tenure prospects.

1. Promotion as a key reward

Surprisingly, promotion to tenure – or even progression through the academic ranks more generally – has not been emphasized in the research literature on academic rewards. In fact, most studies of promotion are situated in contexts other than academia (Cassirer & Reskin, 2000; DiPrete & Soule, 1988; Ishida, Spilerman, & Su, 1997; Johnsrud, 1991; Peterson & Togstad, 2006; Spilerman & Peterson, 1999). Although we can glean insights from these studies – for example, about glass ceiling effects (Baxter & Wright, 2000), and the influ-

[1] To our knowledge, no study of academics has incorporated the extent of specialization, but some studies of other professions are moving toward this focus. In the field of medicine, Weeks and Wallace (2002) documented that financial returns emanating from additional specialty training are higher for procedure-based medicine than for primary-care medicine. In the health professions, Aiken and Sloane (1997) document the impact of specialization on economic rewards and other outcomes (Styles, 1989). In the discipline of economics, only a few studies have examined the effects of specialized human capital investments (Antel, 1986; Rosen, 1983), and none has explored heterogeneity in individuals' work process and product.

ence of organizational setting (Beckman & Phillips, 2005; Kalleberg & Reskin, 1995) – their application to academic settings is limited. Academic life is structured by universities and by disciplines, and both are unique organizational forms. Universities are atypical because they rarely "die" (Phillips, 2001); disciplines are unique because success within them depends largely on reputation (Bourdieu, 1999; Cole & Cole, 1973; Whitley, 2000).

Research on inequality in academe focuses on rewards that are mostly relevant to tenured professors: the receipt of prestigious awards (Zuckerman, 1977), induction into an esteemed society (e.g., National Academies of Science, Sociological Research Association), visibility (Ferber, 1986; Hamermesh, Johnson, & Weisbrod, 1982), and salary (Barbezat, 1987b; Bellas et al., 2001; Burke et al., 2005; Ferree & McQuillan, 1998; Leahey, 2007). Un-tenured faculty members – the population of interest to us – are rarely eligible for such rewards, or demonstrate less variation in them than tenured faculty do. Moreover, in such studies, gender and rank are often confounded, suggesting the need for a study of another outcome: promotion to other academic ranks (Ferree & McQuillan, 1998). The short time periods covered by these studies also suggest a need for longitudinal studies that assess career processes over time (Toren & Moore, 1998).

The reward of greatest consequence for early career scholars is the receipt of tenure, which typically accompanies promotion to associate professor. Without a tenured position, scholars cannot easily continue their attachment to the field, and are often not eligible for subsequent academic rewards. In this paper we give promotion to associate professor (typically a tenured position) an empirical weight that corresponds to its prominence in the scientific stratification system and its importance to individual career trajectories. We focus specifically on gender differences in the receipt of tenure because they are so consequential for gender parity in academe, especially in terms of salary and promotion to higher academic ranks (Prokos & Padavic, 2005).

While achieving a tenured position, regardless of when it is secured, is an accomplishment in its own right, achieving it sooner than expected is an even greater achievement. This is the case once department prestige and institutional moves are accounted for, because more prominent departments have higher standards for promotion and institutional moves often entail a renegotiation of the tenure clock. Going up early for tenure is typically a sign that the candidate is extremely strong, perhaps because of early career achievements, such as a very prominent publication, a large number of scholarly citations, or receipt of a prestigious grant, award, or external job offer.[2] For this reason, we are interested in not only whether a candidate receives tenure, but how soon he or she receives tenure after completing a PhD. This resonates with Drobnic and Blossfeld's (2004: 140) assertion that "it is not only important which position a person occupies, but how he or she gets access to them, at what time. . .".

2. Determinants of promotion

As is the case for most academic rewards, reputation – which is largely driven by quantity and quality of research – is critical to the receipt of tenure, especially at prestigious research universities, where tenure candidates need to demonstrate that they have established a national reputation within their subfield(s). Apparent in the popular adage "publish or perish," the quantity of scholarly work that academics produce is critical to their success. But the gross number of publications is not always the best measure of scholarly performance in research (Hess, 1997: 78). Impact on the field through scholarship is achieved not only by sheer quantity of research, but by its quality and its usefulness to others – typically indicated by the prestige of the journal of publication or the number of citations the piece has garnered. In other words, high research productivity and the scholarly recognition and visibility that often accompany it (Stephan & Levin, 1992) are critical to academic success. Cole and Cole (1973), among others, argue that more than quantity of publications, the quality, impact, and usefulness of one's research to others is a better indicator of a scientist's contribution to the body of scientific knowledge (Long, 1992; Wanner et al., 1981).

Thus, productivity and recognition of one's work are two important criteria for excellence in research (Toren & Moore, 1998) toward which scholars strive, and on which they are judged when it comes to distributing valued resources and rewards (Reskin, 1977; Ward, Gast, & Grant, 1992; Zuckerman, 1977). They influence bargaining power in the academic marketplace (Ferber, 1986), which in turn affects earnings, the receipt of prestigious appointments (Clemens, Powell, McIlwaine, & Okamoto, 1995; Sonnert & Holton, 1995),

[2] We do not have a measure of the receipt an external job offer, which likely affects the likelihood and timing of promotion to tenure. We capture this potential influence indirectly, by controlling for institutional moves and their relative prestige.

and promotion – the outcome of interest to us. We expect productivity and visibility to have a positive effect on promotion to tenure. Productivity has been more widely studied than visibility, perhaps because of relative ease of data collection and measurement, but both are critical components of scholarly success (Clemens et al., 1995). Because career advancement is dependent on publication productivity and visibility, women's disadvantage in these realms can have serious implications for the advancement of women in academe (Xie & Shauman, 2003: 177).

However, even when women meet men's levels of productivity and visibility, they are still less likely to be promoted. This finding holds in a range of countries (Blau & Devaro, 2007; Kalleberg & Reskin, 1995; Pekkarienen & Vartiainen, 2006; Van der Burg, Siegers, & Winter-Ebmer, 1998; Ward, 2001), decades (Johnsrud, 1991; Kalleberg & Reskin, 1995), and professions (Spilerman & Petersen, 1999; Spurr, 1990), including academia (McDowell, Singell, & Ziliak, 2001; Ward, 2001), even when unmeasured traits and selection processes are controlled. Thus, even after accounting for individual attributes like productivity and visibility, we expect women's risk of promotion to be lower than men's.

Most research on gender in science has focused on gender differences in the levels of productivity and visibility, rather than on how men and women may benefit from the same levels differently; in other words, how gender might shape the advantages that accrue to productivity and visibility. Differentials between male and female scientists in productivity, and to a lesser extent, visibility, have received a fair bit of scholarly attention (Allison & Long, 1990; Allison & Stewart, 1974; Fox, 1992; Fox & Faver, 1985; Grant & Ward, 1991; Leahey, 2006; Long, 1978; Long & McGinnis, 1981; Prpic, 2002; Reskin, 1977, 1978; Wanner et al., 1981; Xie & Shauman, 1998). Results suggest that women are disadvantaged with respect to both productivity (Cole & Zuckerman, 1984; Xie & Shauman, 1998) and visibility (Ferber, 1986, 1988; Long, 1992), as men's citation counts peak higher (Long, 1992) and faster (Ward et al., 1992) than women's. However, given our interest in productivity and visibility as key predictors of tenure, we are more interested in how gender affects, or modifies, these relationships. Research on "reward dualism," or the differential benefits that men and women receive from the same achievements or investments (Cannings, 1988; DiPrete & Soule, 1988; Fox, 1981; Steinpreis, Anders, & Ritzke, 1999), drives our expectation that productivity and visibility will benefit men's tenure prospects more than women's.

3. Incorporating research specialization

Our contribution to this model of academic success, which focuses on productivity and visibility, is to incorporate a heretofore overlooked form of professional capital: the extent of research specialization. This construct distinguishes, in a continuous manner, scholars who work repeatedly in one or a few specialty areas (i.e., subfields) and scholars who choose new topics to investigate with each successive paper. Specialization is intuitively related to productivity and visibility: specializing allows a scholar to gain in-depth knowledge of a body of literature–including its central debates, theories, methods, and key players–making successive papers on the same topic easier to write; and coming to know, and be known by, other scholars in a specialty area improves opportunities for advancement and publication, especially given that double-blind peer review is not always blind in practice. Indeed, in our previous research (Leahey, 2007, 2006) we found that specialization is empirically related to both productivity and visibility. However, we conceive of the extent of research specialization as a distinct construct worthy of empirical investigation.

The extent of specialization is a critical component of much more difficult-to-measure construct – expertise (Collins & Evans, 2002) – and we expect it to reap many of the same benefits. Previous research has found that expertise positively affects legitimacy and credibility (Faulkner, Fleck, & Williams, 1998), power, privilege, and influence (Turner, 2001), status (Aiken & Sloane, 1997), control (Braverman, 1975), authority (Smith, 2002), productivity (Birnbaum, 1981), and recognition (Rifkin et al., 1994). We expect the extent of research specialization to positively influence another key outcome: promotion to tenure. Scholars who restrict their work to one or two specialty areas will be able to produce multiple papers more efficiently and embed themselves within a (more manageably sized) scholarly community more easily, thereby developing a coherent research program and a strong professional identity within a relatively short time period. In other words, specializing should indirectly strengthen a candidate's tenure case. Conversely, scholars who dabble in various research areas peripheral to their primary agenda may have difficulty securing a high level of productivity, visibility, and the professional identity required for promotion to tenure.

Although there are likely several dimensions of the extent of research specialization, we focus on the extent to which a scholar repeatedly engages in research on the same *substantive topic*, for it is the communities

surrounding such substantive research areas that may be critical to producing specialization's benefits. Certainly, other dimensions of specialization are possible. The extent of *teaching* specialization could assess whether faculty members teach the same course(s) repeatedly or diversify their teaching portfolio. The extent of *service* specialization might capture whether a scholar engages in the same kinds of department service (e.g., graduate studies director) year after year, or whether committee assignments are frequently rotated. Even within the realm of scholarship, different kinds of specialization are possible. For example, one could specialize to a great extent by method, by only engaging in experimental work, or only in field work. A scholar could also specialize theoretically by employing the same theoretical framework and premises even when studying a wide variety of substantive topics. However, we choose to investigate the extent of specialization in substantive research areas because these areas best correspond to accepted areas of expertise as delineated by American Sociological Association[3] – few of which embody a single method or a single theoretical perspective. Moreover, it is the "invisible colleges" and communication networks surrounding substantive research topics – rather than methods or theories – that should be most relevant to scholars' chances of being promoted to a tenured position, especially given the heavy reliance on external letters of support for candidates.

We are primarily interested in the extent of specialization, but we also consider another dimension of specialization that has been studied more widely: areas of specialization. Specialty areas, or subfields of a discipline, are related to a host of scholarly practices, including collaboration patterns (Moody, 2004) and reference patterns (Hargens, 2000), and we also expect them to be related to the receipt of tenure. Perhaps more than the size or productivity level of a subfield, its prestige in the discipline is probably most relevant to tenure decisions. Scholars working in popular and prestigious areas at the time they apply for tenure do not have to justify their research interests and areas of expertise, whereas scholars in less prestigious areas have a harder time conveying the value of their research to promotion and tenure committees. Moreover, because prestige of subfields could be confounded with our key construct – the extent of specialization – it is important to take it into account. Women tend to rely on qualitative methods (Grant et al., 1987) and write on gender issues (Grant, Ward, & Bottenfield, 1993; Lutz, 1990) in sociology more often than men, and if these areas are undervalued, women may be encouraged to branch out in order to add legitimacy to their research program. Or perhaps men are more likely to specialize in subfields like comparative-historical work that requires intensive historical knowledge and foreign-language skills, thereby increasing incentives to remain in that subfield and become a specialist.

We are also interested in how specialization and gender might interact. Given that we conceive of the extent of research specialization as a form of professional capital – essentially a resource – and that previous research has documented women's disadvantage in their access to various forms of capital (DiMaggio & Mohr, 1985; Kanter, 1977; Lin, Ensel, & Vaughn, 1981; Paglin & Rufolo, 1990; Wegener, 1991), we expect women to reap fewer benefits from specializing than men. Specifically, we expect specialization to enhance men's chances of gaining tenure more than it enhances women's chances. This hypothesis dovetails with Reskin's (1978) and Fox's (1981) findings that rewards in science are not only distributed unequally across the sexes, but that men gain more than women for comparable investments. In extending Hodson's (1983) insight about how power relations influence the ability to tap resources, Johnsrud (1991) implies that women's disadvantaged status in academic science may limit their ability to tap their professional capital (e.g., the extent of research specialization) even when they possess it, and thereby gain less from it. Thus, a long line of research on "reward dualism," or the differential benefits that men and women receive from the same achievements (Cannings, 1988; DiPrete & Soule, 1988; Fox, 1981; Steinpreis et al., 1999) drives our expectation that men will benefit – in terms of securing a tenured position – more than women from the same degree of research specialization. For example, women not only achieve the prerequisites for high academic rank later than men (Cole & Zuckerman, 1984) and are promoted more slowly than men (Long et al., 1993; Sonnert & Holton, 1996; Toren & Moore, 1998), but they are also less apt to be promoted than comparably qualified men (Bayer & Astin, 1975; Cole, 1979).

4. Other factors relevant to promotion

In order to assess the relative contribution of our construct – the extent of research specialization – we account for not only the potential mediators of productivity and visibility, but we control for other factors as well. Based

[3] See the list of sections (http://www.asanet.org/page.ww?section=Sections&name=Overview) and the newly devised list of specialty areas (http://www2.asanet.org/footnotes/septoct05/fn7.html).

on previous research, we are convinced that institutional environs help shape career outcomes like the promotion to tenure. For example, in the fields of chemistry and bio-chemistry, Reskin (1977), Long (1978), and Long and McGinnis (1981) found that the institutional prestige of scholars' initial academic appointments strongly predicted subsequent productivity, and the same is likely true for the field of sociology as well, given the relevance of department prestige to its hiring practices (Burris, 2004). Indeed, in their study of sociologists, Keith, Layne, Babchuk, and Johnson (2002) find that department prestige is relevant to various career outcomes. And although department prestige ratings remain remarkably stable across time (Keith, 1999), individuals do not. Un-tenured academics often move from one department to another, and such moves are associated with tenure prospects: a scholar with high tenure prospects may be recruited elsewhere (typically an equal or more prestigious department), or a scholar with low tenure prospects may move down the prestige hierarchy. Because moving to another department may "reset the tenure clock," resulting in a delayed application to tenure, it is important to account for department moves as well as the relative prestige of a scholar's academic appointments.

In this paper we contribute in multiple ways to current understandings of academic career attainment. First, we study an understudied aspect of careers – promotion – that is particularly critical in academia. Second, we add to a typical career-attainment model (in which productivity and visibility are the key predictors) by theoretically motivating and developing a measure for a new construct: the extent of research specialization. Although this construct is intuitively and anecdotally relevant to career outcomes such as promotion to tenure, it has never before been theorized, measured, or incorporated into an empirical analysis. Third, we do not limit our study to a single organization, as most studies of promotion do (Kalleberg & Reskin, 1995). Instead we limit our investigation to a single labor market (sociology professors) with a specific and well-defined promotion and job hierarchy, in order to limit the impact of potential confounding factors and unobserved heterogeneity. Fourth, we focus on "reward dualism:" the possibility that men and women invest equally but receive differential returns to such investments; we expect productivity, visibility, and specializing to enhance men's chances of promotion to tenure more than women's. And last, we improve methodologically on previous work by collecting retrospective, time-varying data on scholars in order to examine how over-time changes affect the "risk" of promotion to tenure.

5. Data and methods

5.1. Sample

Our sample consists of 547 sociologists with a total of 3558 yearly observations. To select scholars for our analysis, we began with the population of individuals ($N = 665$) who received their PhD in sociology between 1972 and 1976 from a North American institution included in the ASA's *Guide to Graduate Departments*. At this point, we imposed two criteria. First, individuals had to have a tenure-track appointment at an academic institution that was listed in the *Guide to Graduate Departments* (indicating that their department offered graduate degrees) at 3 years and/or 8 years after they received their PhD. Because a good number of PhDs do not pursue or get academic jobs, this criterion reduces our sample to 564. Second, individuals had to have at least one peer-reviewed journal publication within 8 years after receiving their PhD. Because not all academics publish, this criterion further reduces our sample to 547.

We impose these criteria for theoretical as well as practical reasons. We focus on cohorts from the 1970s because by that time most PhD-granting departments had come into existence, department ratings by Roose and Anderson were made available (and are also comparable to later ratings), and the American Sociological Association (ASA) began to publish a single volume, the *Guide to Graduate Departments*, on an annual basis (Keith & Babchuk, 1998). Selecting people in same cohort controls for potentially important period effects, such as a booming job academic market in the 1970s, and complements existing cross-sectional studies nicely.[4] We restrict our analysis to academic sociologists so that our results would be comparable to previous studies, most of which also analyze inequality in academia, and also because inequality in academic science is particularly pronounced (Bellas, 1993, 1994, 1997; Etzkowitz, Kemelgor, & Brian, 2000; Fox, 1985, 1999; Fox & Stephan, 2001; Horning, 2003; Langton & Pfeffer, 1994; Long, 1992; Long et al., 1993; Preston, 2004; Reskin, 1976, 1977, 1978; Xie & Shauman, 1998; Zuckerman, Cole, & Bruer, 1991). We include only scholars who have (minimally) published because our measure of the extent of research specialization is derived from keywords used to describe publications, and thus would be

[4] Moreover, we are eager in subsequent analyses to examine promotion to higher ranks (e.g., full professor) and to undertake comparisons with more recent cohorts in order to understand how changes in the structure of the discipline and the academic labor market have affected tenure-attainment processes.

undefined for individuals without at least one publication. Moreover, the first 8 years of scientists' careers are the "tenure-relevant" years (Cole & Zuckerman, 1984), and it is arguable that scholars without at least one journal article publication would not be eligible for receiving tenure at a research university (thus not within the 'risk set' for our analysis).

5.2. Statistical method

We use discrete-time event-history analysis to examine the factors related to whether and when assistant professors are promoted to associate professor, typically with tenure. This is an ideal method for understanding the risk factors associated with an event (Singer & Willett, 2003), albeit in this case a rather positive one: the receipt of tenure. We chose discrete-time over continuous-time event-history analysis because the event of interest to us – promotion to tenure – is inherently discrete, as scholars typically go up for tenure in a given year. Our datafile is organized in a person-year (pooled) format in order to estimate the likelihood of receipt of tenure; thus, the unit of analysis is the individual and the unit of observation is the person-year. Because observations are clustered by person, we assume that observations are independent across, but not necessarily within, people. We do this by using a robust, standard error estimator that recognizes the nested structure of the data. We estimate event-history models using the logistic-regression estimation routine in STATA 9; the possibility of calculating hazard rates through logistic-regression techniques was first noted by Brown (1975) and explained thoroughly by Allison (1982). The discrete-time event-history model can be written as:

$$\ln\left[\frac{P(t)}{1-P(t)}\right] = \alpha + \beta_1\,\text{year} + \beta_2\,\text{year}^2 + \beta_3 X$$

where $P(t)$ denotes the hazard: the probability that an individual has an event at time "t" given that she has not yet had an event and it still at risk. The coefficients β_1 and β_2 capture the change in the baseline hazard over time, and the vector of β_3 coefficients show how that baseline hazard changes as a function of various explanatory variables, some of which vary over time. Thus, the risk of being promoted is dependent upon both time since PhD receipt[5] (year and year^2) and a set of covariates (in the vector X), some of which vary across time. This model estimates the hazard rate (or "risk") of being promoted in each year, conditional upon being at risk for promotion at the beginning of that year. Individuals are at risk, or eligible, for promotion in a given year if they have not yet had the event of interest (i.e., received tenure) or if they have not yet left academia (i.e., were not right-censored in a previous year). Because time ordering is one component to establishing causality, the over-time data used in event-history models are "particularly effective in controlling for sources of invalidity" (Singleton and Straights, 1999: 228–229, 437–438). We capitalize on this advantage by including variables that capture change over time, especially for our key explanatory variable: the extent of research specialization.

5.3. Outcome variable

Our outcome variable of interest is the "hazard" or "risk" of being promoted to associate professor, which incorporates both whether a scholar gets promoted, and if so, the time it took to reach that status. Importantly, this information is constructed from publicly available career histories, not from self-reports, which were used in another study of promotion (Kalleberg & Reskin, 1995). The terms "hazard" and "risk" emanate from event-history analysis, also called survival analysis, which has been used to examine events like death that are less positive than receiving tenure, so it is important to remember that in this study, an increased hazard is actually desirable. For the purposes of this study, the year of PhD receipt is considered to be the first year the person is at risk for receipt of tenure. To determine whether and when scholars are promoted, we collected annual information on their institutional affiliation and academic rank from the ASA's *Guide to Graduate Departments*. Once we determined when and where a scholar achieved the rank of associate professor, we stopped collecting annual data on that person as they were no longer at 'risk' of getting tenure. We continued to collect data on individuals until they either achieved tenure or became right-censored. Right-censored cases are those that no longer appeared as sociology faculty at any academic institution listed in the *Guide* and those who had seemingly permanent non-tenure-track appointments.

5.4. Explanatory variables

5.4.1. The extent of specialization

Because no previous research has conceptualized or operationalized the extent of research specialization, we carefully explain our measurement strategy. We use

[5] We consider individuals to be at risk for getting tenure the year they receive their PhD. This is reasonable given our focus on 1970s cohorts who experienced a booming academic labor market, and it also ensures sufficient information to construct measures of productivity, visibility, and specialization.

keyword descriptors applied to each publication[6] by trained professionals at Sociological Abstracts to identify the specialty areas that each publication covers. From Sociological Abstracts' electronic database, we compiled keywords for every faculty member's multiple publications, weighting co-authored and single-authored pieces equally, as Wagner-Dobler (1997) and others have, because whether one worked on a piece alone or in collaboration with others should not diminish or enhance the prominence of that subfield in one's research program. There are two kinds of keyword descriptors that Sociological Abstracts applies to articles: very detailed major descriptors (there are thousands total and up to nine are applied to each article), and the broader classification codes (there are 127 total and up to three are applied to each article). The entire list of broad classification codes (CCs), including "sociology of education" and "social psychology," is presented in Appendix A. We rely primarily on these broad classification codes, which are closely aligned with what sociologists consider the field's specialty areas to be.[7] However, we also assess the robustness of our findings to a specialization measure constructed from more detailed keywords, called major descriptors in Sociological Abstracts. Because they are more homogenously narrow than CCs, major descriptors may better account for variation in subfield size.

To construct our measure of the extent of research specialization,[8] we examine each scholar's publication record while at risk for tenure, including the cumulative number of publications and the cumulative number of *unique* classification codes. We measure the extent of research specialization as SpecCC = 1 − [# of unique classification codes/# of publications]. An example of how this annual, time-varying measure is constructed from publication-level data is presented in Table 1, in which the "new" unique classification codes that are added to the hypothetical scholar's research program are underlined.

Note that we list each sociologist's publications in chronological order, and that what matters for our purposes is not so much the year of publication, but the academic position held when the paper was published. Because articles receive at the most two classification codes that describe their content, the measure falls between a minimum of −1 and a maximum close to 1, and higher values indicate a greater degree of research specialization. Of the three sociologists, sociologist #3 is the most specialized (working only in the areas of social network analysis and group processes, with a specialization score of 0.83 at the end of his assistant professorship) and sociologist #1 is the least specialized (having published in seven distinct specialty areas, with a specialization score of 0.22) just before going up for tenure.

We recognize that our measure of the extent of specialization is somewhat confounded with productivity, and we modify the measure to alleviate this problem. How close the specialization score is to the theoretical maximum of "1" depends on the number of cumulative publications. Taking for example scholars who have only published on one topic (that is, only one classification code appears in their entire research program), SpecCC = 0.80 ((1 − (1/5)) for scholars with five publications and SpecCC = 0.90 (1 − (1/10)) for scholars with 10 publications, indicating an inflated positive correlation between specialization and productivity. To account for the fact that the theoretical maximum of SpecCC shifts depending on total productivity, we construct a relative measure of specialization that indicates the decile location of one's specialization score, given his or her productivity level. That is, compared to all other observations (i.e. person-years) *with the same number of cumulative publications*, where does the individual's specialization score fall? Values range between 1 and 10, with higher values still indicating greater specialization. Falling in the 1st decile indicates a relatively diverse research program, falling in the 7th decile indicates a relatively specialized research program, and falling in the 10th decile indicates the maximum possible extent of specialization for that individual's productivity level.

This time-varying measure gives us some sense of both between- and within-scholar variability in the extent of research specialization. Some scholars devote a large

[6] Although books are occasionally indexed in Sociological Abstracts, we do not incorporate their keywords into the measure of research specialization. Because method and evidence, not subject matter (embodied by the keywords used here), distinguish books from articles (Clemens et al., 1995), the exclusion of books should not bias the measure of research specialization.

[7] Moreover, there is a high correspondence between Sociological Abstracts' classification codes that we use and the new list of specialty areas recently constructed by the ASA task led by James Ennis (see http://www2.asanet.org/footnotes/septoct05/fn7.html).

[8] We also assessed the degree of overlap between scholars' dissertation topics and their subsequent publications, but we do not use this measure in the present analysis for various reasons. First, because Sociological Abstracts does not consistently apply keywords to dissertations, we had to apply the keywords ourselves based on limited information: dissertation titles and abstracts. We only had limited knowledge of the procedures that Sociological Abstracts uses to apply codes to articles and thus we have concerns about validity as well as reliability. Second, this continuous measure, which indicates the percent of dissertation keywords that appear (i.e., are represented) in the scholar's subsequent research program, lacked substantial variability and did not improve the explanatory power of our model.

Table 1
Construction of the time-varying extent of specialization measure from publication-level data.

Position when article was published	Publication outlet	Classification code #1	Classification code #2	#CCs	#pubs	1 − (#CCs/#pubs)
				Cumulative number of *unique* classification codes	Cumulative number of publications	Extent of specialization measure
Hyopthetical sociologist #1						
PhD student	Journal of Marriage and the Family	1941: sociology of the family	1636: sociology of law			
PhD student	Social Science Research	1941: sociology of the family				
Post-doc	Sociological Forum	1636: sociology of law		2	3	0.33
Assistant prof.: year 1	Deviant Behavior	2151: juvenile delinquency				
Assistant prof.: year 2	Social Forces	2151: juvenile delinquency				
assistant prof.: year 2	Law and Society	1636: sociology of law				
assistant prof.: year 3	American Journal of Sociology	2148: social work	2190: family violence			
Assistant prof.: year 4	Sociological Inquiry	2151: juvenile delinquency				
Assistant prof.: year 4	Gender and Society	2983: sociology of gender				
Assistant prof.: year 5	Journal of Marriage and the Family	1941: sociology of the family				
Assistant prof.: year 5	Law and Society	1636: sociology of law				
Assistant prof.: year 6	American Sociological Review	1636: sociology of law	1939: adolescence and youth	7	9	0.22
Hyopthetical sociologist #2						
PhD student	Research in Stratification and Mobility	1020: occupations and professions	2983: sociology of gender	2	1	−1.00
Assistant prof.: year 3	Sociology	1020: occupations and professions				
Assistant prof.: year 3	Work and Occupations	1020: occupations and professions				
Assistant prof.: year 4	Gender and Society	1020: occupations and professions				
Assistant prof.: year 5	Social Forces	2983: sociology of gender		2	5	0.60

Table 1 (*Continued*)

Position when article was published	Publication outlet	Classification code #1	Classification code #2	#CCs	#pubs	1 − (#CCs/#pubs)
				Cumulative number of *unique* classification codes	Cumulative number of publications	Extent of specialization measure
Hyopthetical sociologist #3						
PhD student	Advances in Group Processes	0309: group processes		1	1	0.00
Assistant prof.: year 1	Social Psychology Quarterly	0309: group processes				
Assistant prof.: year 2	Sociological Perspectives	0309: group processes				
Assistant prof.: year 3	Social Forces	0309: group processes	0665: social network analysis			
Assistant prof.: year 3	American Sociological Review	0309: group processes				
Assistant prof.: year 3	Social Networks	0665: social network analysis				
Assistant prof.: year 4	Social Networks	0665: social network analysis				
Assistant prof.: year 5	Social Psychology Quarterly	0309: group processes				
Assistant prof.: year 5	Annual Review of Sociology	0309: group processes	0665: social network analysis			
Assistant prof.: year 6	Sociological Methodology	0665: social network analysis				
Assistant prof.: year 7	American Journal of Sociology	0665: social network analysis	0309: group processes			
Assistant prof.: year 7	Sociological Methods and Research	0665: social network analysis		2	12	0.83

Note: Classification codes that are new to each scholar's research program are underlined.

portion of their research program to a small set of specialty areas (e.g., sociologist #3 in Table 1), whereas others tend to pursue a more diversified research program (e.g., sociologist #1 in Table 1). But even during the short time preceding tenure, scholars' extent of specialization can fluctuate. Because we are interested in change over time (and whether a strategy of specializing or diversifying promotes the likelihood of promotion) and the time-frame for most persons was relatively short (thereby limiting variability), we transformed this time-varying annual measure into two theoretically informed, time-sensitive measures. In our statistical models we use the initial specialization score calculated at the time scholars received their PhD[9] (SpecCC1); for the sociologists in Table 1, this amounts to the relative, productivity-adjusted decile values of 0.33, −1.00, and 0.00, respectively. We also construct a binary variable indicating growth in the extent of specialization during the time they were at risk for receiving tenure (SpecCC-grow = 1 if yes, =0 otherwise). In Table 1, sociologists #2 and #3 become more specialized as their assistant professorships progressed, whereas sociologist #1 pursued a research program that became increasingly diversified.

5.4.2. Area of specialization

We assess one other dimension of specialization aside from its extent: the prestige of scholars' specialty areas. We created a measure that captures the popularity of each scholar's modal specialty area (i.e., most common classification code in their research program).[10] For each specialty area listed in Appendix A, we counted the number of times it was represented in the field's top three journals (*ASR*, *AJS*, and *Social Forces*) in the 2 years preceding and the 2 years following each scholar's date of PhD receipt. This measure, which we call CCprest, ranges from 0 (for subfields that never appeared in the top journals) to 43 (for the most 'fashionable' subfield that appeared dozens of times over the course of 4 years).

5.4.3. Productivity

Previous research provides more guidance with respect to measuring research productivity. Like most scholars examining inequality in scientific careers (Allison & Long, 1987; Ferber & Loeb, 1973; Fox & Faver, 1985; McBrier, 2003; Prpic, 2002; Reskin, 1977, 1978; Wanner et al., 1981; Ward & Grant, 1995; Xie & Shauman, 1998), we rely on publication counts because they are a reasonable indicator of productivity (Fox, 1989). Although no single measure of productivity is adequate or universally accepted (Fox, 1983; Long, 1992), quantity of refereed journal articles is the most commonly used measure, one that is highly correlated with total productivity that might include books, book reviews, and contributions to edited volumes (Reskin, 1977, 1978).[11] This measure taps the most fundamental dimension of publication: frequency (Long, 1992), and is highly correlated with alternative measures (Cole & Zuckerman, 1984), such as one that accounts for co-authorship (Levin & Stephan, 1989; Long, 1992). For our event-history analyses, we employ a cumulative, time-varying measure of productivity (#pubs). Because productivity is likely curvilinearly related to tenure receipt (once one reaches a certain level of productivity, additional publications have less of an influence on tenure), we also include a squared term for productivity (#pubs^2).

5.4.4. Visibility

We use a journal-impact factor (JIF) weighted count of productivity to capture visibility. A journal's impact factor, obtained from the Web of Science's *Journal Citation Reports*, captures the average number of times that its articles are cited within a few years; thus, higher impact journals have articles that are, on average, cited more often than lower impact journals. Journal rankings based on impact factors correspond reasonably well with popular assessments of journal prestige (e.g., *ASR* and *AJS* top the list, and *Social Forces* comes in at a distant third) as well as alternative classification of journal

[9] For individuals who did not publish before receiving their PhD, we used specialization calculated after their first publication. An alternative strategy of omitting these individuals from the analysis made no substantive difference in the results we present.

[10] When a scholar had more than one mode in his or her distribution of keywords, we took the average of their prestige scores.

[11] There are several reasons to focus on journal articles as a measure of research productivity. First, there are few reasons to believe that one sex favors book over article publishing (Cole and Zuckerman, 1984), thereby making biased results unlikely. (One reason, more recently proposed by Linda Grant, is that feminist research that women tend to do may initially have had difficulty gaining access to journal space, thus relying more heavily on particular book presses.) Second, the greater variation in article counts makes articles an ideal unit of measurement for a quantitative study interested in explaining variation (Fox, 1985). Third, although publication in refereed scholarly journals is only one way to disseminate research, it is the means by which scholars become integrated in the citation network and also weighs heavily in scholarly evaluations (Ferber, 1988; Grant and Ward, 1991). Forth, because books rarely preclude the publishing of journal articles on the same topic, including both books and journals might artificially inflate scholars' specialization scores. And even if scholars at private universities prefer books (Clemens et al., 1995), this preference should be controlled for by the inclusion of a binary variable indicating whether the scholar's institution is public or private.

influence (Allen, 1990, 2003). As with our productivity measure we employ a cumulative, time-varying measure of visibility (visib). We feel comfortable using this measure given that is has been used in previous research (Levin & Stephan, 1989) and that it is highly correlated with article-specific citation counts.[12] Moreover, our weighted publication count is a more comprehensive measure of visibility than one that is limited to publications in top-tier journals (Keith et al., 2002; McBrier, 2003). We chose not to rely on citation counts as a measure of visibility, as some previous scholars have (Cole & Cole, 1973; Long, 1992), because citations to particular articles can reflect criticism as well as praise (Ferber, 1986) and may reflect scholars' tendency to cite heavily in order to demonstrate knowledge of the relevant literature. In addition, citations to particular articles take years to accumulate, and we are trying to assess scholars' visibility within their early (and short) career stage.

Thus, our measures of specialization, productivity, and visibility are based on bibliometric data, rather than self-reported data which has been prominent in previous work (Fox & Faver, 1985; Prpic, 2002; Wanner et al., 1981; Xie & Shauman, 1998). Social desirability bias, recall error, and other types of random and systematic error are common problems with self-reported data, and these issues are likely exacerbated when respondents are asked about specialty areas and publications that span their entire career. Instead of relying on self-reports, we obtain this information from publicly available electronic databases, as a few scholars have done (Long, 1992; McBrier, 2003; Reskin, 1977). This, in addition having a single organization – Cambridge Scientific Abstracts – develop and apply classification codes in Sociological Abstracts, reduces systematic and random measurement error.

5.4.5. Gender

The gender of each scholar (female) is coded "1" for female and "0" for males. We made this assessment based on scholars' first names. In ambiguous instances, we determined gender after searching the Internet for pictures and/or gender-specific pronouns in published biographical sketches.

5.4.6. Other explanatory variables

We rely on standard measures for our control variables. Because we pool data for our discrete-time event-history analysis so that the data are in person-year format, we must include some specification of time. We log time since PhD receipt in years (the variable "year" ranges from 1 to 16), and incorporate a "year^2" term to capture curvilinear effects. For this group of sociologists who received their PhDs between 1972 and 1976, we measure the prestige of first academic appointment (Job1prest) by relying on Roose and Anderson's (1970) ratings; higher values indicate more prestigious departments.[13] Using this same set of prestige ratings, we also include a time-varying variable that assesses changes in each scholar's department prestige that accompanies institutional moves (Prest). In a study of tenure prospects, it is important to account for scholars' institutional transitions, as this is when tenure dates are often renegotiated.[14] First, we include a dichotomous variable (Move) to capture whether a scholar changed departments while at risk for promotion. This variable, combined with one (MoveDown) that indicates the direction of the move along the department prestige hierarchy, captures different standards for promotion and tenure at institutions of varying prestige levels. Because tenure and promotion standards can vary by institutional type, we also include a binary variable (private) that indicates whether each scholar went up for tenure at a private (=1) or public (=0) institution. And to control for potentially important factors such as motivation, preparedness, and labor market conditions, we include a variable (yrs_to_job1) indicating the number of years between PhD receipt and first academic position.

6. Results

Descriptively, we find that several factors influence promotion to associate professor. Table 2 presents descriptive statistics that we calculated using each individual's final year in the dataset (when they were promoted or right-censored). Of the 547 individuals in our sample, 62% (338) receive tenure. Although a greater proportion of women falls in the "non-tenured" category than the "tenured" category (24% and 30%,

[12] For a 10% random sample of scholars in our datafile, we found the correlation between an impact-factor weighted publication count and a citation count to be 0.89.

[13] Following Roose and Anderson, we also tried controlling for prestige of PhD-granting department, but it never reached statistical significance so we omit it for the sake of parsimony. Similarly, we controlled for the number of years, if any, spent outside academia between receipt of PhD and year of first academic position, but it never reached statistical significance and had no effect on our substantive results, so we omit this variable as well.

[14] Unfortunately, we have no information on whether external job offers were received and declined.

Table 2
Descriptive statistics by tenure status.

	Full sample	Tenured		Not tenured
Specialization: extent				
Initial specialization (SpecCC1)	2.1	2.14	n.s.	2.04
Growth in specialization (SpecCCgrow)[a]	38%	44%	***	29%
Specialization: area				
Prestige of modal specialty area (CCprest)	10.8	10.6	n.s.	11.00
Productivity				
Cumulative publications (#pubs)	4.8	5.7	***	3.50
Visibility				
Cumulative JIF weighted publications (visib)	4.8	5.8	***	3.20
Gender				
Female (=1 for women, =0 for men)[a]	0.3	24.0%	n.s.	30.0%
Control variables				
Department prestige of 1st appointment (Job1prest)	31.5	31.3	n.s.	31.9
Department prestige (Prest)[c]	28.8	29.3	n.s.	27.8
Moved to another department (Move)[a]	24.7%	18.1%	***	35.4%
Moved to a lower-prestige department (MoveDown)[a]	12.6%	9.8%	*	17.2%
Private institution (private)[a,c]	22.8%	18.1%	***	30.6%
Years between PhD and first job (yrs_to_job1)	1.7	1.6	n.s.	1.7
Sub-sample size[b]	547	338		209

Note: Unless otherwise noted, statistical significance was assessed using *t*-tests. *$p < .05$; ***$p < .001$.

[a] Statistical significance was assessed using chi-square tests for independence.

[b] Sub-sample of final observations for all persons in the dataset (received tenure or censored).

[c] For these time-varying variables, we used the last observation available before receiving tenure or being censored.

respectively), this difference is not statistically significant. Importantly, there is no statistically significant difference in *initial* specialization levels between those who were eventually tenured and those who were not; but individuals whose research programs become more specialized over time are disproportionately represented in the "eventually tenured" category, and this difference is significant at the 0.001 level. Our measure of another aspect of specialization – prestige of modal specialty area – shows no statistically significant difference between the sub-samples of tenured and non-tenured scholars. As we would expect, scholars who are eventually tenured have higher rates of productivity and higher levels of visibility. Among our control variables, we find that department moves are more critical to tenure than department prestige alone. Those who move – close to 25% of our sample of sociology PhDs from 1972 to 1976 – are well represented (35%) in the sub-sample of scholars who do not receive tenure, and under-represented (18%) in the sub-sample of scholars who do receive tenure. A similar pattern is seen for those who move down the academic prestige hierarchy. This suggests that (a) stability is beneficial, (b) a move down is indicative of a downward trajectory that ultimately ends in a decision to not tenure, and/or (c) a move up may be of no benefit due to more difficult standards for promotion and tenure.

To examine not only the factors related to *whether* a scholar received tenure, but also the factors related to *time until receiving tenure*, we turn to event-history analysis, where the event of interest is promotion to associate professor (typically accompanied by tenure). Recall that the dependent variable essentially incorporates both pieces of information (whether and when), and can be conceptualized as the "hazard" or "risk" of being promoted. Thus, variables with positive coefficients increase the hazard of tenure (a good thing), whereas variables with negative coefficients decrease the hazard of tenure (a bad thing). To understand the effects that the extent of research specialization has on the hazard of being promoted, and to assess whether this effect is mediated by productivity and visibility, we specify a series of increasingly complex models. We begin with a model that only includes our time specification and the specialization measures as explanatory variables, add productivity and visibility as potential intervening variables, and then assess whether these effects of interest remain after additional controls are included. Lastly, we construct and

incorporate statistical interactions to see if effects of interest differ for men and women. The best-fitting and most parsimonious specification for time is curvilinear: coefficients for the variables year and year^2 suggest that the increased risk of tenure over time is initially quite high, but levels off after a certain point. Because our discrete-time dataset is in person-year format (with multiple rows of data for each person, depending on the number of years they were at risk), we use this time specification in every model.

In a multivariate context, we find that the extent of specialization no longer has the positive effect that we hypothesized and found descriptively (Table 2) and in simple models (Table 3, Model 1). Once key intervening variables of productivity and visibility are included (Table 3, Model 2), we find that – contrary to our expectations – growth in specialization has a direct *negative* effect on the risk of tenure. Scholars with increasingly specialized research programs only have a 42% chance of being promoted [odds = 0.71 ($e^{(-0.34)}/1 + e^{(-0.34)}$) and probability = .42 (0.71/1.71)], compared to a 58% chance for scholars whose research programs did not become more specialized [odds = 1/0.71 = 1.41 and probability = .58 (1.41/2.41)]. While these effects control for productivity and visibility, hints of a suppressor relationship demand that the effects of specialization and productivity be considered jointly.[15] A comparison of the size of coefficients (−0.34 for specCCgrow and +0.28 for #pubs) suggests that scholars who become increasingly specialized need to publish two articles more than scholars who do not become increasingly specialized in order to have a comparable chance for tenure. We also find that the limitations imposed by specializing are greater at lower levels of productivity. For example, based on Model 2, compared to those who do not become more specialized, the average predicted probability for those who become more specialized is 20% lower at average productivity levels (between the 25 and 75th percentiles: 2–4 articles) and only 15% lower at high productivity levels (in the top quartile: five or more papers). Specializing is more detrimental for scholars with fewer publications. Because we cannot control for the size and internal heterogeneity of different subfields, it is important to note that these results are robust to the substitution of specialization measures that are based on the more detailed (and more internally homogenous) keywords, called major descriptors.

These effects hold after control variables are introduced (Table 3, Model 3). Department prestige of one's initial or current academic position has no significant effect on one's risk of tenure. Rather, movement between institutions and institutional type are the institutional mechanisms relevant to promotion prospects. Moving to another department carries with it a decrease in risk of tenure, and in fact it appears to be generally detrimental to chances of tenure even if one moves up into departments with the highest prestige.[16] Moving to a less prestigious department offsets this decreased risk somewhat, suggesting that less prestigious departments entice scholars away from more prestigious departments by offering them tenure. Scholars at private institutions have a lower risk of promotion, perhaps due to higher standards and expectations at private institutions, particularly Ivy League institutions. Scholars who take longer to secure an academic position after their PhD also have a decreased risk of promotion to associate professor (as the coefficient associated with yrs_to_job1 is negative and significant).

As expected, women have a lower risk of promotion than men (see Table 3, Model 3). A significant coefficient of −0.28 for the variable female indicates that women's chance of being promoted [36% – derived from odds = 0.57 ($e^{(-0.28)}/1 + e^{(-0.28)}$) and probability = .36 (0.57/1.57)] is just over half of men's chance [63% – derived from odds = 1/0.57 = 1.75 and probability = .63 (1.75/2.75)]. This direct effect is amplified once we include statistical interactions with female, largely to test dual rewards hypotheses (see Table 3, Model 4). Although women are disadvantaged in the promotion process (even after controlling for productivity, visibility, degree of specialization, and a host of other factors), their promotion prospects improve with each additional year they are at risk (the year × female coefficient is +0.16 and significant). Women's disadvantage cannot be attributed to either lower levels of productivity or visibility (as gender remains significant with these variables in the model) or to lesser rewards for similar investments in productivity (as pubs × female does not reach conventional significance levels). In this last model, the only hint of a dual rewards process concerns visibility: the main effect of visibility is significant and positive, and its interaction with female is negative and almost sig-

[15] When specialization is added to a model with only productivity and visibility in it (not shown), we find that specialization amplifies the effect of productivity, with the coefficient increasing from a value of +0.25 (not shown) to the value +0.28 (in Model 2). The unexpected negative sign for the extent of specialization's effect also suggests potential negative suppression (Maasen and Bakker, 2001).

[16] A direct test of this claim, which specifies a statistical interaction between department prestige and a binary variable indicating a move up the department prestige hierarchy, was not statistically significant.

Table 3
Effects on risk of tenure (coefficients and standard errors).

	Model 1		Model 2		Model 3		Model 4	
	Specialization		Productivity and visibility		With controls		With interactions	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Baseline hazard specification								
Time since PhD (year)	1.63***	0.18	1.38**	0.18	1.31***	0.18	1.32***	0.18
Time since PhD squared (year^2)	−0.11***	0.01	−0.09***	0.01	−0.08***	0.01	−0.08***	0.01
Extent of research specialization								
Initial specialization (SpecCC1)	0.04*	0.02	0.00	0.02	0.003	0.02	−0.001	0.03
Growth in specialization (SpecCCgrow, yes = 1)	0.04	0.13	−0.34*	0.14	−0.41*	0.14	−0.39*	0.15
Area of research specialization								
Prestige of modal specialty area (CCprest)	−0.01	0.01	−0.01	0.01	−0.01	0.01	−0.007	0.008
Productivity								
Cumulative publications (#pubs) [a]			0.28***	0.04	0.24***	0.04	0.22***	0.04
Cumulative publications squared (#pubs^2) [a]			−0.01***	0.001	−0.01***	0.00	−0.004*	0.002
Visibility								
Cumulative JIF weighted publications (visib)[a]			−0.01	0.02	0.02	0.02	0.03*	0.02
Gender								
Gender (female)					−0.28+	0.14	−1.53*	0.62
Control variables								
Department prestige of 1st appointment (Job1prest)				−0.005	0.004	−0.006	0.004	
Department prestige (Prest)[a]					0.001	0.004	0.001	0.004
Moved to another department (yes = 1) (Move)					−1.64***	0.26	−1.61***	0.25
Moved to a lower-prestige department (yes = 1) (MoveDown)			0.61+	0.35	0.62+	0.35		
Private institution (private)					−0.28+	0.16	−0.28+	0.17
Years Between PhD and first job (yrs_to_job1)					−0.31***	0.06	−0.31***	0.06
Interactions								
Year × female							0.16+	0.08
Initial specialization × female							0.05	0.06
Growth in specialization × female							−0.03	0.37
Prestige of modal specialty area × female							0.006	0.02
Cumulative publications × female							0.10	0.14
Cumulative JIF weighted publication × female							−0.05	0.03
Intercept	−7.32***	0.53	−7.15***	0.50	−6.13***	0.53	−6.03***	0.54
Sample size	3558		3558		3558		3558	
Pseudo-R^2	0.156		0.201		0.247		0.25	
Log pseudolikelihood	−943.10		−892.74		−840.89		−837.29	
Wald chi-square	175.88 (5 df)		285.17 (8 df)		379.39 (15 df)		384.08 (22 df)	

[a] Variable is time-varying.
* $p < .05$.
** $p < .01$.
*** $p < .001$.
+ $p < .10$.

nificant ($p = .12$), suggesting that men benefit more than women from the same levels of visibility.

7. Discussion

The primary goal of this study was to examine whether and how the extent of research specialization influences a critical point in academic careers: promotion to associate professor. We theorized that specialization, like other forms of capital, would be beneficial to assistant professors' tenure prospects, largely because it enhances productivity, visibility, and contributes to the development of a professional identity that is part and parcel of a coherent research program. To test this hypothesis, we developed a measure of the extent of research specialization and added it to a more traditional scientific attainment model that also accounts for productivity, visibility, and a commonly recognized dimension of specialization: the prestige of specialty area(s). We found that specialization has strong and significant effects on the "risk" of tenure, but not in the way we expected: specializing over the course of one's assistant professorship actually decreases one's risk of tenure, which encompasses both the likelihood of tenure and time until tenure, if it is granted. Contrary to common opinion and anecdotal evidence that specializing early is advantageous, focusing on a limited set of subfields early in one's career does not confer advantage in the tenure process. Rather, it is scholars who branch out and conduct research on multiple topics who have the highest probability of obtaining tenure.

Why does specializing hinder tenure chances? There are several possible interpretations of this unexpected finding. First, specializing may pigeonhole scholars and lead others to perceive them as too narrow in focus (Zuckerman, Kim, Ukanwa, & Rittmann, 2003). Perhaps breadth, more than depth, signals intellectual creativity and the possibility of broader impact to promotion and tenure committees. Second, scholars with diverse research programs may be able to appeal to individuals with diverse interests and areas of expertise, both within their department and more broadly within their college, university, and discipline; all of these bodies contribute to promotion and tenure decisions. Third, perhaps a diverse research program promotes the perception that the scholar's work is integrative and spans specialty areas, and has the potential to be ground-breaking. Our concurrent work suggests that integrative work is perceived as more innovative and potentially ground-breaking. Fourth, *diversity* in substantive research areas – what we have captured with our measure – may reflect *specialization* in another realm, such as theoretical perspective or methodological approach, that is highly valued. Fifth, scholars who diversify may have more extensive professional networks and collaborative ties, which are critical when external reviewers are asked to discuss a tenure candidate's prospects.

We find that few determinants of promotion operate differently for men and women, indicating limited support for the dual rewards hypothesis. Specialization reduces tenure chances for both men and women; productivity increases tenure chances for both men and women. Only time serves women more than men: with each additional year on the tenure clock, women's chances of being promoted improve. This may indicate that women do better at institutions with longer tenure clocks, and/or when their tenure clock is extended, likely due to childbearing. Although the coefficient is small and only comes close to reaching significance ($p = .012$), we find that visibility assists men in the tenure process more than it does women This is the only indication of dual rewards in effect. Overall, our findings concur with Kalleberg and Reskin's (1995) conclusion that the processes by which individual characteristics affect promotions are generally similar for males and females.

However, we find strong support for a female disadvantage in the tenure process during the period under study (late 1970s and early 1980s). Even though women weren't rewarded differently than men for equal investments, they were disadvantaged in the tenure process even when their levels of specialization, productivity, and visibility were comparable to men's. The significant and negative gender coefficient, apparent even among a host of important statistical controls, suggests that (1) other, currently unmeasured factors are needed to explain this gender difference in promotion, and/or (2) female sociologists were discriminated against during this timeframe. Perhaps the prevailing attitude of the day was that women, despite being equally prepared for promotion, were simply less committed to an academic career than men, and this perception – consciously or not – influenced both women's decisions to remain in academia as well as tenure committees' decisions to tenure female candidates. Our findings about gender differences in promotion are not unique; indeed, a male advantage in promotion processes has been found in a variety of countries, professions, and periods (Blau & Devaro, 2007; Kalleberg & Reskin, 1995; Spilerman & Petersen, 1999). However, like McDowell et al.'s (2001) study of academic economists, which found that women's promotion prospects improved significantly by the late 1980s, we anticipate that unexplained gender differences in promotion would be much weaker for more recent cohorts.

We do not expect these results to generalize to other academic disciplines, let alone other professions. Indeed, we did not select one discipline in order to represent broader work processes relevant to all labor markets, but rather to limit the confounding influence of unobserved heterogeneity – unmeasured ways in which individuals differ from each other. A single labor market is an ideal context for investigating a newly theorized process: how specializing helps or hinders promotion prospects. Familiarity and data availability weighed into our decision to study the discipline of sociology – a relatively small but very diverse discipline. In other disciplines – particularly the larger and more capital intensive natural sciences – specializing may not hinder tenure chances as it does in sociology. Indeed, in other fields, specializing and "carving out a niche" may be critical for success.

As an initial empirical investigation of the extent of research specialization on promotion prospects in academia, this research provides a strong foundation for future work. Extensions of this work will ideally include developing ways to measure of extent of methodological and theoretical (in addition to substantive) specialization; assessing the generalizability of these results by collecting data on other disciplines besides sociology; examining subsequent career outcomes, such as promotion to full or distinguished professor; and studying later cohorts to understand changes in promotion and tenure standards over time and their effect on individuals' careers. To contribute to a larger theory of how the extent of specialization influences promotion processes, we are developing measures of the extent of specialization for other kinds of professionals (e.g., lawyers), and are eager to assess whether diversity enhances men's promotion prospects in those fields as well. In addition, we plan to elaborate the contextual effects identified as relevant here; organizations are "conduits of attainment," but only a few studies have examined how organizational environments affect the career trajectories, and promotion prospects, of their members (Phillips & Sorensen, 2003; Phillips, 2001).

Appendix A. Classification Codes used to describe articles in Sociological Abstracts

0100	**Methodology and research technology**	**1500**	**Sociology of religion**
0103	Methodology (conceptual and epistemological)	1535	Sociology of religion
0104	Research methods/tools	**1600**	**Social control**
0105	Statistical methods	1636	Sociology of law
0161	Models: mathematical and other	1653	Police, penology, and correctional problems
0188	Computer methods, media, and applications	**1700**	**Sociology of science**
0200	**Sociology: history and theory**	1734	Sociology of science
0202	Of professional interest (teaching sociology)	1772	Sociology of technology
0206	History and present state of sociology	**1800**	**Demography and human biology**
0207	Theories, ideas, and systems	1837	Demography (population studies)
0267	Macrosociology: analysis of whole societies	1844	Human biology/sociobiology
0285	Comparative and historical sociology	1864	Genetic engineering/reproductive biotechnology
0300	**Social psychology**	**1900**	**The family and socialization**
0309	Interaction within (small) groups	1938	Sociology of the child
0312	Personality and social roles	1939	Adolescence and youth
0373	Cognitive/interpretive sociologies	1940	Sociology of sexual behavior
0394	Life cycle and biography	1941	Sociology of the family, marriage, and divorce
0400	**Group interactions**	1976	Socialization
0410	Social group identity, intergroup relations (race, age, and sexuality)	1977	Birth control (abortion, contraception, fertility)
0491	Refugees	1978	Sociology of death and dying
0500	**Culture and social structure**	**2000**	**Sociology of health and medicine**
0513	Culture	2046	Social psychiatry (mental health)
0514	Social anthropology	2045	Sociology of medicine and health care

Appendix A (*Continued*)

0600	**Complex organization**	2079	Substance use/abuse and compulsive behaviors
0621	Jobs, work organization, workplaces, and unions	**2100**	**Social problems and social welfare**
0623	Military sociology	2143	Social gerontology
0624	Bureaucratic structure/organizational sociology	2147	Sociology of crime
0665	Social network analysis	2148	Social work and welfare services
0671	Sociology of business and entrepreneurism	2151	Juvenile delinquency
0674	Voluntary associations/philanthropy	2187	Social service programs/delivery systems
0700	**Social change and economic development**	2190	Victimology (rape, family violence, and child abuse)
0715	Social change and economic development	2192	Sociological practice (clinical and applied)
0749	Market structures and consumer behavior	**2200**	**Sociology of knowledge**
0770	Capitalism/socialism – world systems	2233	Sociology of knowledge
0800	**Mass phenomena**	2252	History of ideas
0826	Social movements	**2300**	**Community/regional development**
0827	Public opinion	2317	Sociology of communities and regions
0828	Communication	**2400**	**Policy, planning, forecasting**
0829	Collective behavior	2454	Planning and forecasting
0842	Sociology of leisure/tourism	2460	Social indicators
0850	Popular culture	2462	Policy sciences
0868	Transportation systems and behaviors	2496	Negotiation, dispute settlements
0869	Sociology of sports	2499	Sociology of ethics and ethical decision making
0900	**Political sociology/interactions**	**2500**	**Radical sociology**
0911	Interactions between societies, nations, and states	2555	Marxist and radical sociologies
0925	Sociology of political systems, politics, and power	2580	Critical sociology
0989	Welfare state	**2600**	**Environmental interactions**
0995	Nationalism	2656	Environmental interactions
1000	**Social differentiation**	2681	Disaster studies
1019	Social stratification/mobility	2682	Social geography
1020	Sociology of occupations and professions	2697	Famine, hunger, and malnutrition
1022	Generations/intergenerational relations	**2700**	**Studies in poverty**
1100	**Rural sociology and agriculture**	2757	Studies in poverty
1116	Rural sociology (village, agriculture)	2793	Homelessness
1200	**Urban sociology**	**2800**	**Studies in violence**
1218	Urban sociology	2858	Studies in violence
1300	**Sociology of language and the arts**	2884	Terrorism
1330	Sociology of language/sociolinguistics	2898	Genocide
1331	Sociology of art (creative and performing)	**2900**	**Feminist/gender studies**
1375	Sociology of literature	2959	Feminist studies
1400	**Sociology of education**	2983	Sociology of gender and gender relations
1432	Sociology of education		

References

Aiken, L. H., & Sloane, D. M. (1997). Effects of specialization and client differentiation on the status of nurses: The case of AIDS. *Journal of Health and Social Behavior*, *38*(3), 203–222.

Allen, M. P. (1990). The "centrality" of journals in sociology. *Foonotes November*,

Allen, M. P. (2003). The: "Core influence" of journals in sociology revisited. *Foonotes December*.

Allison Paul, D. (1982). Discrete time methods for the analysis of event histories. In *Sociological Methodology*. San Francisco: Jossey-Bass Publishers.

Allison, P. D., & Long, J. S. (1987). Interuniversity mobility of academic scientists. *American Sociological Review*, *52*(5), 643–652.

Allison, P. D., & Long, J. S. (1990). Departmental effects on scientific productivity. *American Sociological Review*, *55*(4), 469–478.

Allison, P., & Stewart, J. (1974). productivity differences among scientists: Evidence for accumulative advantage. *American Sociological Review*, *39*, 596–606.

Antel, J. J. (1986). Human capital investment specialization and the wage effects of voluntary labor. *The Review of Economics and Statistics*, *68*(3), 477–483.

Barbezat, D. A. (1987a). Salary differentials by sex in the academic labor market. *Journal of Human Resources*, *22*(3), 422–428.

Barbezat, D. A. (1987b). Salary differentials or sex discrimination? Evidence from the academic labor market. *Population Research and Policy Review*, *6*(1), 69–84.

Baxter, J., & Wright, E. O. (2000). The glass ceiling hypothesis: A comparative study of the United States, Sweden, and Australia. *Gender & Society*, *14*(2), 275–294.

Bayer, A. E., & Astin, H. S. (1975). Sex differentials in the academic reward system. *Science*, *188*(4190), 796–802.

Beckman, C. M., & Phillips, D. J. (2005). Interorganizational determinants of promotion: Client leadership and the attainment of women attorneys. *American Sociological Review*, *70*(4), 678–701.

Bellas, M. L. (1993). Faculty salaries: Still a cost of being female? *Social Science Quarterly*, *74*(1), 62–75.

Bellas, M. L. (1994). Comparable worth in academia: The effects on faculty salaries of the sex composition and labor market conditions of academic disciplines. *American Sociological Review*, *59*(6), 807–821.

Bellas, M. L. (1997). Disciplinary differences in faculty salaries: Does gender bias play a role? *Journal of Higher Education*, *68*(3), 299–321.

Bellas, M. L., Ritchey, P. N., & Parmer, P. (2001). Gender differences in the salaries and salary growth rates of university faculty: An exploratory study. *Sociological Perspectives*, *44*(2), 163–187.

Birnbaum, P. H. (1981). Integration and specialization in academic research. *The Academy of Management Journal*, *24*(3), 487–503.

Blau, F. D., & Devaro, J. (2007). New evidence on gender differences in promotion rates: An empirical analysis of a sample of new hires. *Industrial Relations*, *46*(3), 511–550.

Bourdieu, P. (1999). The specificity of the scientific field and the social conditions of the progress of reason. In M. Biagioli (Ed.), *The science studies reader*. New York: Routledge.

Braverman, H. (1975). *Labor and monopoly capital: The degradation of work in the twentieth century*. New York: Monthly Review Press.

Breiger, R. (1976). Career attributes and network structure: A Blockmodel study of a biomedical research specialty. *American Sociological Review*, *41*, 117–135.

Brown, C. C. (1975). On the use of indicator variables for studying the time-dependence of parameters in a response-time model. *Biometrics*, *31*, 863–872.

Burke, K., Duncan, K., Krall, L., & Spencer, D. (2005). Gender differences in faculty pay and faculty salary compression. *Social Science Journal*, *42*(2), 165–181.

Burris, V. (2004). The academic caste system: PhD prestige hierarchies. *American Sociological Review*, *2*(69), 239–264.

Cannings, K. (1988). Managerial problems: The effects of socialization, specialization, and gender. *Industrial and Labor Relations Review*, *42*(1), 77–88.

Cappell, C., & Gutterbock, T. M. (1992). Visible colleges: The social and conceptual structure of scientific specialties. *American Sociological Review*, *57*, 266–2736.

Cassirer, N., & Reskin, B. (2000). High hopes: Organizational position, employment experiences, and women's and men's promotion aspirations. *Work and Occupations*, *27*(4), 438–463.

Clemens, E. S., Powell, W. W., McIlwaine, K., & Okamoto, D. (1995). Careers in print: Books, journals, and scholarly reputation. *American Journal of Sociology*, *101*(2), 433–494.

Cole, J., & Cole, S. (1973). *Social stratification in science*. Chicago: University of Chicago Press.

Cole, J. R. (1979). *Fair science: Women in the scientific community*. New York: Free Press.

Cole, J. R., & Zuckerman, H. (1984). The productivity puzzle: Persistence and change in patterns of publication of men and women scientists. *Advances in Motivation and Achievement*, *2*, 217–258.

Cole, S., & Cole, J. (1968). Visibility and the structural bases of awareness in scientific research. *American Sociological Review*, *33*(3), 397–413.

Collins, H. M., & Evans, R. (2002). The third wave of science studies: Studies of expertise and experience. *Social Studies of Science*, *32*(2), 235–296.

Danziger, N. (1982). Patterns of earnings in the academic system: The case of economics. *Sociological Focus*, *15*(3), 203–217.

DiMaggio, P., & Mohr, J. (1985). Cultural capital, educational attainment, and marital selection. *American Journal of Sociology*, *90*(6), 1231–1261.

DiPrete, T. A., & Soule, W. T. (1988). Gender and promotion in segmented job ladder systems. *American Sociological Review*, *53*, 26–40.

Drobnic, S., & Blossfeld, H.-P. (2004). Career patterns over the lifecourse: Gender, class, and linked lives. *Research in Social Stratification and Mobility*, *21*, 139–164.

Ennis, J. G. (1992). The social organization of sociological knowledge: Modeling the intersection of specialties. *American Sociological Review*, *57*, 259–265.

Etzkowitz, H., Kemelgor, C., & Brian, U. (2000). *Athena unbound: The advancement of women in science and technology*. Cambridge: Cambridge University Press.

Faulkner, W., Fleck, J., & Williams, R. (1998). Exploring expertise: Issues and perspectives. In W. Faulkner, J. Fleck, & R. Williams (Eds.), *Exploring expertise: Issues and perspectives* (pp. 1–27). London: Macmillan Press.

Ferber, M. (1986). Citations: Are they an objective measure of scholarly merit? *Signs*, *11*(2), 381–389.

Ferber, M. (1988). Citations and networking. *Gender & Society*, *2*(1), 82–89.

Ferber, M. A., & Loeb, J. W. (1973). Performance, rewards and perceptions of sex discrimination among male and female faculty. *American Journal of Sociology*, *78*(4), 995–1002.

Ferree, M. M., & McQuillan, J. (1998). Gender-based pay gaps: Methodological and policy issues in university salary studies. *Gender & Society*, *12*(1), 7–39.

Fox, M. F. (1981). Sex, salary, and achievement: Reward-dualism in academia. *Sociology of Education*, *54*(2), 71–84.

Fox, M. F. (1983). Publication productivity among scientists: A critical review. *Social Studies of Science*, *13*, 285–305.

Fox, M. F. (1985). Location, sex-typing, and salary among academics. *Work and Occupations*, *12*(2), 186–205.

Fox, M. F. (1989). Disciplinary fragmentation, peer review, and the publication process. *The American Sociologist*, *20*(2), 188–191.

Fox, M. F. (1992). Research, teaching, and publication productivity: Mutuality versus competition in academia. *Sociology of Education*, *65*(4), 293–305.

Fox, M. F. (1999). Gender, hierarchy, and science. In J. S. Chafetz (Ed.), *Handbook of the sociology of gender*. New York: Kluwer Academic/Plenum.

Fox, M. F., & Faver, C. A. (1985). Men, women, and publication productivity: Patterns among social work academics. *The Sociological Quarterly*, *26*(4), 537–549.

Fox, M. F., & Stephan, P. E. (2001). Careers of young scientists: Preferences, prospects, and realities by gender and field. *Social Studies of Science*, *31*(1), 109–122.

Furst, E. L. (1988). *Kvinner i akademia*. Oslo, Norway: NAVFs sekretariat for kvinneforskning.

Grant, L., & Ward, K. B. (1991). Gender and publishing in sociology. *Gender & Society*, *5*(2), 207–223.

Grant, L., Ward, K. B., & Bottenfield, D. (1993). *Women's sociological research and writing in the pre-WWII era as reflected in journals*. Miami, FL: American Sociological Meetings.

Grant, L., Ward, K. B., & Rong, X. L. (1987). Is there an association between gender and methods in sociological research? *American Sociological Review*, *52*, 856–862.

Hamermesh, D. S., Johnson, G. E., & Weisbrod, B. A. (1982). Scholarship, citations, and salaries: Economic rewards in economics. *Southern Journal of Economics*, *49*(2), 472–481.

Hargens, L. (2000). Using the literature: The social structure of scholarship in the sciences and humanities. *American Sociological Review*, *65*(6), 846–865.

Hess, D. J. (1997). *Science studies: An advanced introduction*. New York: New York University Press.

Hodson, R. (1983). *Workers' earnings and corporate economic structure*. New York: Academic Press.

Horning, L. S. (2003). *Equal rites, unequal outcomes: Women in American research universities*. New York: Kluwer Academic/Plenum Publishers.

Ishida, H., Spilerman, S., & Su, K.-H. (1997). Educational credentials and promotion chances in Japanese and American organizations. *American Sociological Review*, *62*, 866–882.

Johnsrud, L. K. (1991). Gender and returns to promotion. *Social Science Research*, *20*(4), 369–396.

Kalleberg, A. L., & Reskin, B. F. (1995). Gender differences in promotion in the United States and Norway. *Research in Social Stratification and Mobility*, *14*, 237–264.

Kanter, R. M. (1977). *Men and women of the corporation*. New York: Basic Books.

Keith, B. (1999). The institutional context of departmental prestige in American higher education. *American Educational Research Journal*, *36*, 409–445.

Keith, B., & Babchuk, N. (1998). The quest for institutional recognition: A longitudinal analysis of scholarly productivity and academic prestige among sociology departments. *Social Forces*, *76*, 1495–1533.

Keith, B., Layne, J. S., Babchuk, N., & Johnson, K. (2002). The context of scientific achievement: Sex status, organizational environments, and the timing of publication on scholarship outcomes. *Social Forces*, *80*(4), 1253–1282.

Langton, N., & Pfeffer, J. (1994). Paying the professor: Sources of salary variation in academic labor markets. *American Sociological Review*, *59*, 236–256.

Leahey, E. (2006). Gender differences in productivity: Research specialization as a missing link. *Gender & Society*, *20*(6), 754–780.

Leahey, E. (2007). Not by productivity alone: How visibility and specialization contribute to academic earnings. *American Sociological Review*, *72*(4), 533–561.

Levin, S. G., & Stephan, P. E. (1989). Age and research productivity of academic scientists. *Research in Higher Education*, *30*(5), 531–549.

Lin, N., Ensel, W. M., & Vaughn, J. C. (1981). Social resources and strength of ties: Structural factors in occupational status attainment. *American Sociological Review*, *46*, 393–405.

Long, J. S. (1978). Productivity and academic position in the scientific career. *American Sociological Review*, *43*, 889–908.

Long, J. S. (1992). Measures of sex differences in scientific productivity. *Social Forces*, *71*(1), 159–178.

Long, J. S., Allison, P., & McGinnis, R. (1993). Rank-advancement in scientific careers: Sex differences and the effects of productivity. *American Sociological Review*, *58*, 703–722.

Long, J. S., & McGinnis, R. (1981). Organizational context and scientific productivity. *American Sociological Review*, *46*, 422–442.

Lutz, C. (1990). The erasure of women's writings in sociocultural anthropology. *American Ethnologist*, *17*, 611–627.

Maasen, G. H., & Bakker, A. B. (2001). Supressor variables in path models. *Sociological Methods and Research*, *30*(2), 241–270.

McBrier, D. B. (2003). Gender and career dynamics within a segmented professional labor market: The case of law academia. *Social Forces*, *81*(4), 1201–1266.

McDowell, J. M., Singell, L. D., Jr., & Ziliak, J. P. (2001). Gender and promotion in the economics profession. *Industrial and Labor Relations Review*, *54*(2), 224–244.

Moody, J. (2004). The structure of a social science collaboration network: Disciplinary cohesion from 1963 to 1999. *American Sociological Review*, *69*(2), 213–238.

O'Connor, J. G., & Meadows, A. J. (1976). Specialization and professionalization in British geography. *Social Studies of Science*, 77–89.

Paglin, M., & Rufolo, A. M. (1990). Heterogeneous human capital, occupational choice, and male–female earnings differences. *Journal of Labor Economics*, *8*(1), 123–144.

Pekkarienen, T., & Vartiainen, J. (2006). Gender differences in promotion on a job ladder: Evidence from finnish metalworkers. *Industrial and Labor Relations Review*, *59*(2), 285–301.

Peterson, T., & Togstad, T. (2006). Getting the offer: Sex discrimination in hiring. *Research in Social Stratification and Mobility*, *24*, 239–257.

Phillips, D. J., & Sorensen, J. B. (2003). Competitive position and promotion rates: Commercial television station top management, 1953–1988. *Social Forces*, *81*(3), 819–842.

Phillips, D. J. (2001). The promotion paradox: Organizational mortality and employee promotion chances in Silicon Valley law firms, 1946–1996. *American Journal of Sociology*, *106*(4), 1058–1098.

Preston, A. E. (2004). *Leaving science: Occupational exits from scientific careers*. New York: Russell Sage Foundation.

Prokos, A., & Padavic, I. (2005). An examination of competing explanations for the pay gap among scientists and engineers. *Gender & Society*, *19*(4), 523–543.

Prpic, K. (2002). Gender and productivity differentials in science. *Scientometrics*, *55*(1), 27–58.

Reskin, B. (1976). Sex differences in status attainment in science: The case of the postdoctoral fellowship. *American Sociological Review*, *41*(4), 597–612.

Reskin, B. (1977). Scientific productivity and the reward structure of science. *American Sociological Review*, *42*(3), 491–504.

Reskin, B. (1978). Scientific productivity, sex, and location in the institution of science. *American Journal of Sociology*, *83*(5), 1235–1243.

Rifkin, W. D., Dow, J., Carbaugh, D., Brunk, C. G., Brent, D., Brannigan, V. M., et al. (1994). Who need not be heard: Deciding who is not an expert. *Technology Studies*, *1*(1), 60–96.

Roose, K. D., & Anderson, C. J. (1970). *An assessment of quality in graduate education*. Washington, DC: American Council on Education.

Rosen, S. (1983). Specialization and human capital. *Journal of Labor Economics*, *1*(1), 43–49.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis*. Oxford, England: Oxford University Press.

Singleton, Royce A., & Straights, Bruce C. (1999). *Approaches to social research*. Oxford: Oxford University Press.

Small, H. G., & Griffith, B. C. (1974). The structure of scientific literatures: Identifying and graphing specialties. *Science Studies*, *1*, 445–461.

Small, H., & Griffith, B. C. (1974). The structure of scientific literatures I: Identifying and graphing specialties. *Science Studies*, *4*, 17–40.

Smith, R. A. (2002). Race, gender, and authority in the workplace: Theory and research. *Annual Review of Sociology*, *28*, 509–542.

Sonnert, G., & Holton, G. (1995). *Who succeeds in science? The gender dimension*. New Brunswick, NJ: Rutgers University Press.

Sonnert, G., & Holton, G. (1996). Career patterns of women and men in the sciences. *American Scientist*, *84*(1), 63–71.

Spilerman, S., & Petersen, T. (1999). Organizational structure, determinants of promotion, and gender differences in attainment. *Social Science Research*, *28*(2), 203–227.

Spilerman, S., & Peterson, T. (1999). Organizational structure, determinants of promotion, and gender differences in attainment. *Social Science Research*, *28*, 203–227.

Spurr, S. J. (1990). Sex discrimination in the legal profession: A study of promotion. *Industrial and Labor Relations Review*, *43*(4), 406–417.

Steinpreis, R. E., Anders, K. A., & Ritzke, D. (1999). The impact of gender on the review of curricula vitae of job applicants and tenure candidates. *Sex Roles*, *41*(7/8), 509–520.

Stephan, P. E., & Levin, S. G. (1992). *Striking the mother lode in science: The importance of age, place, and time*. New York, NY: Oxford University Press.

Stokes, T. D., & Hartley, J. A. (1989). Coauthorship, social structure, and influence within specialties. *Social Studies of Science*, *19*, 101–125.

Styles, M. (1989). *On specializing in nursing: Toward a new empowerment*. Washington, DC: American Nurses' Foundation.

Tam, T. (1997). Sex segregation and occupational gender inequality in the United States. *American Journal of Sociology*, *102*(6), 1652–1692.

Tolbert, P. (1986). Organizations and inequality: Sources of earnings differences between male and female faculty. *Sociology of Education*, *59*, 227–235.

Toren, N., & Moore, D. (1998). The academic "hurdle race": A case study. *Higher Education*, *35*(3), 267–283.

Turner, S. (2001). What is the problem with experts? *Social Studies of Science*, *31*(1), 123–149.

Van der Burg, B., Siegers, J., & Winter-Ebmer, R. (1998). Gender and promotion in the academic labour market. *Labour*, *12*(4), 701–713.

Wagner-Dobler, R. (1997). Self-organization of scientific specialization and diversification: A quantitative case study. *Social Studies of Science*, *27*, 147–170.

Wanner, R. A., Lewis, L. S., & Gregorio, D. I. (1981). Research productivity in academia: A comparative study of the sciences, social sciences, and humanities. *Sociology of Education*, *54*(4), 238–253.

Ward, K. B., Gast, J., & Grant, L. (1992). Visibility and dissemination of women's and men's sociological scholarship. *Social Problems*, *39*(3), 291–298.

Ward, K. B., & Grant, L. (1995). Gender and academic publishing. *Higher Education: Handbook of Theory and Research*, *11*, 172–212.

Ward, M. E. (2001). Gender and promotion in the academic profession. *Scottish Journal of Political Economy*, *48*(3), 283–302.

Weeden, K. A. (2002). Why do some occupations pay more than others? Social closure and earnings inequality in the United States. *American Journal of Sociology*, *108*(1), 55–101.

Weeks, W. B., & Wallace, A. E. (2002). Long-term financial implications of specialty training for physicians. *American Journal of Medicine*, *113*(5), 393–399.

Wegener, B. (1991). Job mobility and social ties: Social resources, prior job, and status attainment. *American Sociological Review*, *56*(1), 60–71.

Whitley, R. (2000). *The intellectual and social organization of the sciences*. Oxford: Oxford University Press.

Xie, Y., & Shauman, K. A. (1998). Sex difference in research productivity: New evidence about an old puzzle. *American Sociological Review*, *63*(6), 847–870.

Xie, Y., & Shauman, K. A. (2003). *Women in science: Career processes and outcomes*. Cambridge, Mass: Harvard University Press.

Zuckerman, E. W., Kim, T.-Y., Ukanwa, K., & von Rittmann, J. (2003). Robust identities or nonentities? Typecasting in the feature-film labor market. *American Journal of Sociology*, *108*(5), 1018–1074.

Zuckerman, H. (1977). *Scientific elite: Nobel laureates in the United States*. New York: Free Press.

Zuckerman, H., Cole, J. R., & Bruer, J. T. (1991). *The outer circle: Women in the scientific community*. New Haven: Yale University Press.