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Problems in the Pipeline: Gender, Marriage, and Fertility in the Ivory Tower

Introduction

Women have traditionally fared worse than men in the workplace. In few places has this been more apparent than higher education (Jacobs, 1996). In 2003, women received 47% of PhDs awarded (National Center for Education Statistics [NCES], 2005a) but comprised only 35% of tenured or tenure-track faculty (NCES, 2005b). The gender gap widens incrementally higher up on the academic career ladder: among full-time faculty members, 48% of women are tenured compared to 68% of men (Bellas, 2001). Perhaps more striking, just 26% of full professors are women (American Association of University Professors, 2001). In light of these imbalances, concerns regarding Title IX, which prohibits sex-based exclusion from educational programs receiving federal funds, have prompted congressional calls for inquiry (Wyden, 2003).

We thank Richard Ingersoll, Matthew McKeever, Ann Marie Wood, Cathleen Zick, and three anonymous reviewers for helpful suggestions and Sonja Anderson for research assistance. We also express our appreciation to the Alfred P. Sloan Foundation and the Association of Institutional Researchers for funding. The use of NSF data does not imply NSF endorsement of research methods or conclusions contained in this paper. A previous draft of this paper was presented at the 2004 annual meeting of the American Sociological Association, San Francisco; portions were presented at colloquia at Cornell University, Mount Holyoke College, Pomona College, and the University of Virginia.

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The Journal of Higher Education, Vol. 79, No. 4 (July/August 2008)
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This article explores the effects of gender and family formation—namely, marriage and children—on academic employment subsequent to receiving a PhD. Our results show that family and children account for the lower rate at which women obtain tenure-track jobs. Single women without young children fare better than their male counterparts on the market for assistant professorships. However, family formation cannot account for women's difficulties at later career stages—namely, tenure and promotion to full professor. These results provide new insight into why so few women enter the tenure track and ultimately become full professors.

Although women scientists and engineers at major research universities have been the subject of numerous studies (e.g., Ginther, 2001; Long, 2001; The National Academies, 2006; Xie & Shauman, 2003; Zuckerman, Bruer, & Cole, 1991), comparably little attention has been paid to women in the humanities and social sciences. Yet the latter groups comprise the majority of female doctoral recipients in recent years (Sanderson, Dugoni, Hoffer, & Selfa, 1999). In addition, few scholars have examined women at smaller, non-Research I universities. We study the relationship between gender, family formation, and successful academic careers using longitudinal data from the 1981-1995 Surveys of Doctorate Recipients. These data, nationally representative of PhD recipients during the survey years, provide a more comprehensive depiction of women in academia than has been offered by most previous studies.

We treat professional progress as a pipeline. Far more people obtain doctorates than tenure-track jobs. Not all assistant professors get tenure, and fewer still are promoted to full professor. Women “leak” out of this pipeline at far greater rates than men. Although the pipeline metaphor has been applied to gender inequities in academia (e.g., Kulis, Sicotte, & Collins, 2002; Long, 2001), no studies have focused specifically on professional transitions between PhD receipt and subsequent progress within the professoriate. We document attrition in women's academic careers at three distinct stages in the professional pipeline: (1) tenure-track employment; (2) promotion from assistant professor to tenured associate professor; (3) promotion from associate to full professor.

Gender, Marriage, and Family in the Academy

Most explanations for the paucity of women in the professoriate have emphasized discrimination (American Council on Education, 2005; Carr, Szalacha, Barnett, Caswell, & Inui, 2003; Ginther, 2001; Ginther & Hayes, 2001; Hopkins, 1999; The National Academies, 2006; Valian, 1998; West, 1994). In contrast, we hypothesize that the absence of female professors can be attributed to the inflexible nature of the American work-

place, configured around a male career model established in the nineteenth century, that forces women to choose between work and family (Crittenden, 2002; Hochschild, 1997; Hochschild & Machung, 1989; Mason, 2002; Williams, 2000). Thus, women with spouses and children are forced to work less or entirely forsake demanding professions like academia.

Gary Becker (1991) postulates a direct conflict between the resources needed to perform both professional and home duties. Women have less time to devote to their careers when their domestic responsibilities include spouses and children. It has often been shown that women do much more household labor than men (e.g., Hochschild & Machung, 1989; Press & Townsley, 1998; Shelton & John, 1996). It is also well established that work-family conflict has become commonplace in contemporary America (see Glass & Estes, 1997, for a review). Recent research confirms that this conflict extends to academics (Colbeck & Drago, 2005; Comer & Stites-Doe, 2006; Gatta & Roos, 2002; Jacobs & Winslow, 2004; O'Laughlin & Bischoff, 2004; Ward & Wolf-Wendel, 2004; Wolf-Wendel & Ward, 2006), with female professors spending more time on domestic chores than their male counterparts (Suitor, Mecom, & Feld, 2001). It may interfere with a woman's ability to perform the research and teaching necessary for advancement in academia when her domestic responsibilities expand to include child-rearing. Indeed, many female academics report making joint decisions about career and children (Armenti, 2004; Van Anders, 2004).

The strongest evidence for these ideas comes from the "Do Babies Matter?" studies (Mason & Goulden, 2002; see also Mason & Goulden, 2004; Mason, Goulden, & Wolfinger, 2006). Using data from the Survey of Doctorate Recipients, Mason and her colleagues compare male and female academics and find that women who have children within 5 years of PhD receipt are less likely to have tenure than either men or women who delay or forsake childbirth. This is evidence that family formation adversely affects women's academic careers.

Academic careers may also conflict with family life by forcing new PhDs to relocate in pursuit of tenure-track positions. Women with children and, especially, husbands often lack this flexibility. Relocation presumably poses greater difficulties for women than men, given that female faculty members are much more likely to have husbands with full-time jobs than vice versa. Fifty-six percent of male faculty members have spouses that are employed full-time, compared to 89% of female faculty members (Jacobs, 2004). Female academics are also more likely to be married to male academics (18%) than vice versa (13%) (Jacobs, 2004), so women may forsake their own academic careers for those of their husbands. It is evidence for these assertions that female academics are more likely than

their male counterparts to reside in large cities and other areas with clusters of colleges and universities (Kulis & Sicotte, 2002). This suggests that dual-career constraints limit women's ability to accept and retain professorships.

Objectives of Current Study

The current study extends the findings of Mason et al. in three ways. First, we examine the effects of family formation at three distinct career stages—getting a tenure-track job, getting tenure, and promotion to full professor—to understand where in the academic pipeline women drop out. Second, we conduct multivariate event history analysis to account for confounding factors in the relationship between family formation and academic careers. Third, we employ an expanded measure of family formation that takes both marriage and children into account.

Method

Data

For more than 40 years all new PhD recipients in the United States have been administered questionnaires, comprising the Survey of Earned Doctorates. Since 1973, approximately 10% of Survey of Earned Doctorates potential respondents have been randomly selected for ongoing biennial interviews that continue until age 76 or relocation outside of the United States. Together, the repeated interviews of new and former PhD recipients comprise the Survey of Doctorate Recipients (SDR) (National Science Foundation, 2003). The result is a large and continually replenished set of panel data on academic careers. We analyze potential respondents queried between 1981 and 1995, inclusive; other years lack necessary data on family formation. Our sample sizes are 30,568 for the analysis of obtaining tenure-track assistant professorships, 10,845 for the analysis of promotion to tenured associate professorships, and 5,766 for the analysis of promotion to full professor. The samples grow progressively smaller as fewer respondents rise to top positions in academia. Response rates are good: For example, nearly 87% of respondents completed the survey in 1991 (National Science Foundation, 1995).

We employ survey weights that adjust for response bias. To avoid artificially inflated t-ratios in our significance tests, we compute Huber-White standard errors (Winship & Radbill, 1994). Missing data are deleted listwise, except when large numbers of missing cases (i.e., sufficient to allow estimation with missing data dummies) may represent substantively meaningful differences between respondents. For these items, including

race, time to complete PhD, quality of degree-granting institution, and type of employing institution (all categorical variables), we code additional dummy variables for missing data. More sophisticated means of handling missing data, such as multiple imputation, do not produce appreciably better estimates of regression coefficients and standard errors (Paul, McCaffrey, Mason, & Fox, 2003).

Variables

We analyze three dependent variables, each representing a distinct career stage between PhD receipt and a full professorship. These measure the likelihood of obtaining a tenure-track position (among all PhD recipients), the likelihood of obtaining tenure (among respondents with tenure-track positions), and the likelihood of promotion to full professor (among all tenured associate professors).

It should be acknowledged that all three variables reflect competing outcomes. For instance, obtaining a tenure-track job represents one of several professional possibilities for new PhDs. They may also obtain nonladder teaching positions, take jobs outside academia, or take no jobs at all. The SDR data show that women, especially those with young children, have disproportionately high chances of taking nonladder teaching positions or leaving the labor force altogether. These results are beyond the scope of the current study, which is to understand how family formation interferes with academic success as traditionally defined: a tenured professorship. Analyzing the likelihood of obtaining a tenure-track job without simultaneously considering the chances of other employment is not problematic, because the likelihood functions can be separated for competing events (Allison, 1984). This also holds true when evaluating the effects of family formation on subsequent advancement within the academic pipeline.

Our primary independent variables are respondent sex, fertility, and marital status. Marital status is measured with a single dummy ascertaining whether a respondent is currently married; unfortunately, it is not possible to know whether unmarried respondents have live-in partners. In addition, since the data only extend through 1995, no respondents list same-sex spouses. Fertility is measured with a pair of dummy variables, assessing the presence of children under six and children between six and eighteen. Children under six pose a greater barrier to employment and professional advancement than do older, school-age offspring. In preliminary analyses, we experimented with variables measuring numbers of children; this did not produce substantially different results. Both marriage and children are time-varying covariates measured at each wave of the SDR.

Control variables fall into two categories, measuring academic and demographic characteristics. Any of these may be correlated with both respondent family formation and professional advancement. Academic controls include the National Research Council (NRC) ranking of respondents' PhD programs and time to doctoral degree (for analysis of job procurement), Carnegie classification (Carnegie Foundation for the Advancement of Teaching, 1994) of institution of employment (for analyses of tenure and promotion to full professor), doctoral field, and calendar year of PhD receipt.¹ The first two are coded as sets of dummy variables, representing quartiles of the observed continuous variables; Carnegie classification of the employing institution is coded as a dummy variable measuring whether respondents are employed at Research I universities. Year of PhD receipt is measured with a continuous variable. Field of employment is a trichotomous variable measuring whether respondents are employed in the humanities, social sciences, or STEM (science, technology, engineering, mathematics) fields.² Although far more women obtain PhDs in the humanities and social sciences than in STEM (Sanderson et al., 1999), preliminary analysis suggested that the effects of family formation are essentially the same across academic disciplines.

Demographic controls include race and age. Race is dummy coded with variables measuring whether a respondent is Black, White, Latino, Asian, or other; age is a continuous, time-varying variable.

Analysis

We examine the likelihood of obtaining a tenure-track job, promotion to tenure, and promotion to full professor using three separate discrete time event history models, all estimated via complementary log-log regression. The complementary log-log is a better estimator than logit or probit when discrete data approximate a continuous time process (Allison, 1995, pp. 216–219). Since time-to-event is measured in years, continuous time models would be difficult to estimate.

Data from each wave of the SDR between 1981 and 1995 are used to construct event histories of annual employment status for each of the three analyses: time to tenure-track job, time to tenure, and time to full professor. For each year in any employment status for any given analysis (PhD recipient without a tenure-track position, untenured assistant professor, tenured associate professor), an additional record is created. Time-to-event occurs when respondents obtain tenure-track jobs, are promoted to tenured associate professor, or are promoted to full professor. The baseline hazard function for each analysis is captured by a dummy variable for each year prior to promotion or a tenure-track job. Based on preliminary analyses we top code the hazard functions at 7 (for obtaining a tenure-track position),

10 (for getting tenure), and 10 (for promotion to full professor). Few respondents obtained jobs or promotion after, respectively, 7 and 10 years.

Two complementary log-log models are estimated for each of the three outcomes. The first model in each pair contains measures of sex, family formation, demographic, and academic characteristics. Next, we interact respondent sex with the family formation variables in order to show how marriage and children differentially affect men's and women's academic careers. We observed no statistically significant three-way interactions between sex, marital status, and the presence of children.

Results

Getting a Tenure-Track Job

Table 1 shows the effects of sex, marriage, children, and other variables on the likelihood of obtaining a tenure-track position. According to Model 1, which contains only zero-order measures of sex and family formation, women are less likely to obtain ladder-rank employment ($p < .05$). The presence of children either above or below the age of six does not appear to be related to vocational prospects. Married PhD candidates fare no better than single ones.

Model 2 contains all statistically significant interactions between respondent sex, fertility, and marital status. The interaction between sex and having children under six is negative and significant, indicating that young children have an adverse effect on women's vocational prospects. Compared to her childless counterpart, a woman with a child under six is 22% less likely to obtain a tenure-track position [$100*(1-\exp(.07-.32))$]. Marriage also presents a barrier to securing ladder-rank employment for women, according to the negative and significant interaction between sex and marital status. Compared to a married man, a married woman has 12% lower odds of getting an academic job [$100*(1-\exp(.15-.28))$]. Perhaps married women are more likely to pass up academic careers to accommodate their husbands' vocational aspirations than vice versa, although it is impossible to know with these data. Furthermore, these effects are independent of each other—there is no statistically significant interaction between marriage, sex, and fertility. Both marriage and the presence of young children therefore separately reduce the likelihood that women obtain tenure-track employment.

These results help explain the disadvantage that women face in the academic job market. Recall that Model 1 shows a gender penalty. This disappears in Model 2, which includes interactions between gender, fertility, and marital status. Indeed, single women without children are 16% more likely to get jobs than are unmarried childless men [$100*(\exp(.15) - 1)$].

TABLE 1

Discrete-time event history analyses of tenure-track job procurement on family formation and other factors.

	Model 1	Model 2
Female	-0.07*	0.15**
Married	-0.01	0.09*
Female*married	—	-0.28***
Children < 6	0.00	0.07
Children 6-17	-0.02	-0.07
Female*children < 6	—	-0.32***
Female*children 6-17	—	0.17*
Ethnicity		
White	—	—
African American	0.37***	0.36***
Asian American	-0.20***	-0.21***
Latino	0.30***	0.30***
Other/unknown	-0.02	-0.02
Age	-0.03***	-0.03***
PhD calendar year	0.02***	0.02***
Discipline		
STEM fields	—	—
Social sciences	0.32***	0.33***
Humanities	0.89***	0.90***
Rank of graduate program		
Best quartile	—	—
2nd quartile	-0.08*	-0.08*
3rd quartile	-0.14**	-0.14**
Worst quartile	-0.31***	-0.31***
Program unranked	-0.25***	-0.26***
Field not ranked	0.22***	0.21***
Time to degree		
Fastest quartile	—	—
2nd quartile	0.09*	0.09*
3rd quartile	0.03	0.03
Slowest quartile	-0.12+	-0.11
Data missing	0.23*	0.24*
Constant	-33.64***	-34.58***
Log-Likelihood	-335840.46	-335321.48

SOURCE: Survey of Doctorate Recipients, 1981-1995

NOTES: Analyses are weighted. N is 6,250; 27,137 person years.

Duration dependence terms omitted from table.

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Thus, the penalty for women suggested by Model 1 is not strictly related to inherent gender differences but rather to family formation behavior. In other words, women suffer at the beginning of their academic careers because they marry and have children, not because they are women.

Older children, age six to eighteen, have no negative effect on the likelihood of obtaining a tenure-track job for either men or women. In fact,

mothers with older children, irrespective of marital status, have an increased chance of an academic appointment. This is shown by the positive and statistically significant interaction between sex and the presence of older children. Perhaps these offspring exert a stabilizing effect on women that more than offsets the time lost in caring for them. Their presence may signify that women are more settled into adult roles or simply that mothers of older children may be concerned with obtaining employment that is potentially lifelong. Although younger children might provide similar benefits, they are apparently outweighed by their additional need for parenting.

In most other respects, the results are predictable. Respondents who attended top graduate programs have higher rates of tenure-track employment, as do those who finished graduate school neither too quickly nor too slowly. Younger job candidates fare better. PhD recipients in the humanities and social sciences are more likely to obtain tenure-track academic positions than are recipients in the STEM fields, probably because the former have fewer options outside academia. Furthermore, African Americans and Latinos get jobs more frequently than Whites, but Asian Americans do not.

Getting Tenure

Table 2 shows the effects of gender, fertility, and other variables on the likelihood of promotion from assistant professor to tenured associate professor. According to Model 1, women have difficulty moving up the academic ladder. The coefficient for sex, negative and statistically significant, indicates that women are 21% less likely than men to obtain tenure [$100 \times (1 - \exp(-.24))$]. Children six and over continue to have a positive effect on respondents' academic careers, and this now holds for both men and women. Irrespective of sex or marital status, assistant professors with an older child have 16% greater odds of getting tenure in comparison to their counterparts without children in this age range [$100 \times (\exp(.15) - 1)$].

Model 2 contains various interactions between sex and family formation. None are statistically significant, suggesting that family formation does not adversely affect women's tenure decisions in the same way that it affects their chances of getting a job. For both men and women, neither marriage nor the presence of a child under six has any effect on the odds of promotion. In contrast to the transition from doctorate receipt to tenure-track employment, there appears to be an intrinsic gender penalty. Women obtain ladder-rank assistant professorships at lower rates than men due to the negative effects of marriage and children. When they come up for tenure, women are disadvantaged for reasons unrelated to family formation.

The control variables have far fewer effects on tenure decisions than they do on the initial likelihood of getting a ladder-rank position. Faculty

TABLE 2

Discrete-time event history analyses of tenure attainment on family formation and other factors.

	Model 1	Model 2
Female	-0.24***	0.23*
Married	0.00	-0.02
Female*married	—	0.05
Children < 6	0.07	0.11
Children 6–17	0.15*	0.14*
Female*children < 6	—	-0.17
Female*children 6–17	—	0.02
Ethnicity		
White	—	—
African American	-0.12	-0.12
Asian American	0.35**	0.35**
Latino	0.05	0.06
Other/unknown	-0.14	-0.14
Age	0.00	0.00
PhD calendar year	0.02**	0.02**
Discipline		
STEM fields	—	—
Social sciences	-0.05	-0.05
Humanities	0.05	0.05
Employing institution Carnegie rank		
Not Research I	—	—
Research I	-0.12*	-0.12*
Data missing/unranked	-1.72***	-1.72***
Constant	-50.36	-50.71***
Log-Likelihood	-105733.47	-105715.81

SOURCE: Survey of Doctorate Recipients, 1981–1995

NOTES: Analyses are weighted. N is 30,568; 95,070 person years.

Duration dependence terms omitted from table.

* $p < .10$; ** $p < .05$; *** $p < .01$; **** $p < .001$

at Research I universities are somewhat less likely to get tenure than are those employed at other types of institutions. The humanities, social sciences, and STEM fields have equal tenure rates. Asian Americans have higher tenure rates than do White, Black, and Latino junior faculty, but there are no other ethnicity effects. Respondent age makes no difference, although the odds of tenure have been increasing for recent PhD cohorts. These results suggest that measured respondent characteristics, gender excluded, have much larger effects on the chances of getting an academic job than they do on the likelihood of keeping it.

In additional analyses not shown here due to space constraints, we estimated various sample selection models to ascertain whether the lower rate at which women—and particularly women with spouses and young

children—get tenure-track jobs has an effect on their lower tenure rates. Controlling for selection does not affect our results: Women fail to get tenure for reasons unrelated to family formation.

Promotion to Full Professor

Table 3 evaluates the effects of sex, family formation, and other respondent characteristics on the chances of promotion from associate to full professor. Model 1 shows that women continue to suffer a gender penalty, being 21% less likely to gain promotion [$100*(1-\exp(-.24))$] than men. In contrast to the earlier stages of career advancement considered here, children of all ages exert neither negative nor positive effects on the odds of becoming a full professor. However, marriage increases the likelihood of promotion by 23% [$100*(\exp(.21) - 1)$] for both men and women. Model 2 of Table 3 presents various interactions between respondent sex, marital status, and fertility; none are statistically significant. As was the case for promotion to tenure, women appear less likely to become full professors for reasons not related to family formation.

Some of the control variables affect the likelihood of promotion to full professor. In recent years promotion has occurred less than it did in the past. In addition, there continues to be evidence of ethnic inequality with respect to academic careers. Although African Americans are more likely than Whites to obtain tenure-track positions and equally likely to get tenure, they have lower rates of promotion to full professor. On the other hand, Asian Americans continue to be promoted at higher rates.

Conclusion

We have conceptualized progress in academia as a pipeline or a set of sequential transitions. The first major career transition typically encountered by newly minted PhDs—the procurement of a tenure-track professorship—is the “leak in the pipeline” affected by family formation. Marriage and young children have strong and independent negative effects on the likelihood that women obtain ladder-rank positions.

It has long been known that women fare worse on the academic job market than do men (e.g., Welch & Lewis, 1980). Our study is the first to provide a firm answer as to why this is the case: Marital status and the presence of children under six account for the gender difference in obtaining tenure-track positions. The zero-order relationship between sex and job market success shows that women fare worse than men. However, a single woman with no children under six is 16% more likely to get a ladder-rank academic position than is a single and childless man. At this juncture in the academic pipeline, women do not suffer from sex-based

TABLE 3

Discrete-time event history analyses of promotion to full professor on family formation and other factors.

	Model 1	Model 2
Female	-0.24**	-0.42*
Married	0.21*	0.16
Female*married	—	0.19
Children < 6	-0.02	0.02
Children 6–17	-0.02	-0.06
Female*children < 6	—	-0.31
Female*children 6–17	—	0.24
Ethnicity		
White	—	—
African American	-0.51*	-0.52*
Asian American	0.61**	0.62**
Latino	-0.09	-0.10
Other/unknown	-0.22+	-0.23*
Age	-0.01	-0.01
PhD calendar year	-0.03**	-0.03**
Discipline		
STEM fields	—	—
Social sciences	-0.07	-0.07
Humanities	-0.17+	-0.17+
Employing institution Carnegie rank		
Not Research I	—	—
Research I	0.06	0.06
Data missing/unranked	-2.03***	-2.04***
Constant	44.34+	44.23+
Log-Likelihood	-67485.74	-67440.22

SOURCE: Survey of Doctorate Recipients, 1981–1995

NOTES: Analyses are weighted. N is 6,250; 27,137 person years.

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

discrimination (unless prejudicial hiring practices extend to female job candidates with spouses or children.) It can also no longer be argued that female doctoral recipients eschew academic careers based on differential gender socialization, given that single women without young children fare better on the job market than do men. Instead, dual-career constraints likely prevent married women from taking tenure-track professorships; women with young children sometimes opt to pursue other career opportunities (cf., Van Anders, 2004).

These findings do not extend to later career transitions. Irrespective of marriage and children, women remain less likely to get tenure and less likely to be promoted to full professor. Furthermore, women's lower rate of tenure cannot be attributed to decreased selection of married women and/or women with young children into the pool of tenure-track assistant

professors. In accordance with our results, recent research by Donna Ginther suggests that measured respondent characteristics cannot account for why women still fare worse than men in securing tenure (Ginther, 2001; Ginther & Hayes, 2001; Ginther & Kahn, 2004).

Children over five exert a positive effect for women on the chances of obtaining a tenure-track job and positive effects for both sexes on the likelihood of tenure. There is no effect of children—either young or old, or for male or female academicians—on the transition from associate to full professor. This discrepancy may explain why children benefit academics at the earlier stages of their careers. The need to provide for children may motivate young doctoral recipients to obtain jobs and to ensure virtually permanent employment by getting tenure. In contrast, economic need does not motivate tenured associate professors to secure further promotion; it is already assured that their children will be provided for. If older children benefited academic careers for reasons besides the need to secure ongoing employment—for instance, by providing a more stable home life—they would probably also facilitate promotion from associate to full professor.

The beneficial effect of older children on employment and tenure decisions may also represent selection effects. In many cases, these children were under six when scholars were completing their doctorates or searching for academic positions. Academics, especially women, who manage to finish graduate school and obtain tenure-track employment while simultaneously caring for young children may be especially skilled in balancing the conflicting demands of work and family. They may have received more support from their partners or simply may be more successful at managing their time. Since these academics survived the initial cuts by finishing their doctorates and, for some, procuring tenure-track positions, they may reflect a subpopulation of female academics that is somehow predisposed to reconcile work and family. This would account for why older children increase the chances of getting ladder-rank jobs (for women) and tenure (for both sexes).

This raises a more general point regarding endogeneity in the relationship between family formation and academic success. Economists have long posited a connection between fertility and women's labor force participation, although there has been little consensus about the direction of causality (for an overview, see Macunovich, 1996). Recent research suggests that causality runs both ways, with pregnancy hastening exits from the labor force and employment reducing fertility (Budig, 2003). As we noted earlier, some women make future decisions about career and children jointly (Armenti, 2004; Van Anders, 2004). Thus, the decision to delay or avoid family formation may sometimes be the consequence of a

choice to pursue an academic career rather than a necessary precursor to obtaining a tenure-track professorship. Be that as it may, our results still show that women are more successful in obtaining academic careers if they delay or forsake marriage and children. Single women fare better in academia, a reality sharply at odds with the fact that most Americans desire both marriage and children (Thornton & Young-DeMarco, 2001).

The connection between our results and the literature on gender differences in research productivity is not clear.³ Although the gap has declined over time, men's research productivity still outstrips women's (Long, 1990, 1992; Long, Allison, & McGinnis, 1993; Xie & Shauman, 1998, 2003; for a review, see Creamer, 1998). In particular, Long (1990) shows that women with young children have lower rates of publication than do their childless counterparts, although this finding was not upheld by a recent study of economists' careers (Ginther & Kahn, 2004). Long, Allison, and McGinnis (1993) demonstrate that publication history accounts for about half of the gender gaps in rates of promotion from assistant to associate professor and promotion from associate to full professor. It is unknown whether this finding, based on biochemists prior to 1968, has held true across all disciplines in more recent years. Newer studies attribute gender differences in productivity to structural factors like academic rank rather than to personal characteristics: Men typically hold more senior academic positions, which in turn allows them to publish more (Long, 2001; Xie & Shauman, 1998).

Research productivity probably plays different roles in accounting for gender differences in hiring and promotion. First, publication is less important in getting an academic job than in keeping it, although this varies by discipline. Second, and more important, is the fact that our results suggest no intrinsic difference in research productivity between men and women, given that single childless women fare better than their male counterparts on the academic job market. Our study always compares men and women at the same academic rank, so it is unclear whether productivity is driving our results.

Given that marriage increases publication rates for female academics (Astin & Davis, 1985; Cole & Zuckerman, 1987), its negative effect on women's job procurement likely has more to do with dual-career constraints than with research productivity. Since female academics are far more likely than male academics to be married to full-time workers and, more notably, to academic spouses (Astin & Milem, 1997; Jacobs, 2004), marriage probably reduces the rate at which women get tenure-track positions by imposing geographic constraints on dual-career families.

Although the majority of American women—married and single, raising children and childless—now work, inequities persist both in

household labor and the relative importance placed on men's and women's careers. Our results point to both dual-career issues and child-rearing obligations as affecting women's struggles to achieve equality in academia. We expect these issues will become more salient in the years to come, as the number of women with doctoral degrees continues to rise.

Notes

¹Newer Carnegie classifications are available. We use the 1994 coding because our data only extend to 1995. Thus, newer Carnegie classifications would be inappropriate, because they would be describing institutional conditions that did not yet exist.

²In preliminary analyses we experimented with a more elaborate 12-category coding scheme for field of study. The results were not affected, so we use the simpler scheme for ease of presentation.

³The SDR does not include data on research productivity adequate for the analyses performed here.

References

- Allison, P. D. (1984). *Event history analysis: Regression for longitudinal data* (Sage University Papers on Quantitative Applications in the Social Sciences No. 07-046). Newbury Park, CA: Sage.
- Allison, P. D. (1995). *Survival Analysis using the SAS system: A practical guide*. Cary, NC: SAS Institute.
- American Association of University Professors. (2001). *Statement of principles on family responsibilities and academic work*. Retrieved March 8, 2005, from <http://www.aaup.org/statements/REPORTS/re01fam.htm>
- American Council on Education (2005). *An agenda for excellence: Creating flexibility in tenure-track faculty careers*. Westport, CT: Greenwood.
- Armenti, C. (2004). May babies and posttenure babies: Maternal decisions of woman professors. *The Review of Higher Education*, 27, 211–231.
- Astin, H. S., & Davis, D. (1985). Research productivity across the life and career cycles: Facilitators and barriers for women. In M. F. Cox (Ed.), *Scholarly writing and publishing: Issues, problems and solutions* (pp. 147–160). Boulder, CO: Westview Press.
- Astin, H. & Milem, J. F. (1997). The status of academic couples in U.S. institutions. In M. A. Ferber & J. W. Loeb (Eds.), *Academic couples: Problems and promises* (pp. 128–155). Urbana: University of Illinois Press.
- Becker, G. S. (1991). *A treatise on the family*. Cambridge, MA: Harvard University Press.
- Bellas, M. (2001). *AAUP faculty salary and faculty distribution fact sheet, 2000–01*. Retrieved March 9, 2005, from <http://www.aaup.org/Wbellas.htm>
- Budig, M. J. (2003). Are women's employment and fertility histories interdependent? An examination of causal order using event history analysis. *Social Science Research*, 32, 376–401.
- Carnegie Foundation for the Advancement of Teaching. (1994). *A classification of institutions of higher education*. Princeton, NJ: Author.

- Carr, P. L., Szalacha, L., Barnett, R., Caswell, C., & Inui, T. (2003). A "ton of feathers": Gender discrimination in academic medical careers and how to manage it. *Journal of Woman's Health, 12*, 1009–1018.
- Colbeck, C. L., & Drago, R. (2005). Accept, avoid, resist: How faculty members respond to bias against caregiving . . . and how departments can help. *Change: The Magazine of Higher Learning, 37*, 10–17.
- Cole, J. R., & Zuckerman, H. (1987). Marriage, motherhood, and research performance in science. *Scientific American, 255*, 119–125.
- Comer, D. R., & Stites-Doe, S. (2006). Antecedents and consequences of faculty women's academic-parental role balancing. *Journal of Family and Economic Issues, 27*, 495–512.
- Creamer, E. G. (1998). *Assessing faculty publication productivity: Issues of equity* (ASHE-ERIC Higher Education Report Vol. 26, No. 2). Washington, DC: George Washington University.
- Crittenden, A. (2002). *The price of motherhood: Why the most important job in the world is still the least valued*. New York: Owl Books.
- Gatta, M. L., & Roos, P. A. (2002). Balancing without a net in academia: Integrating family and work lives. Unpublished manuscript, Rutgers University, Center for Women and Work.
- Ginther, D. K. (2001). *Does science discriminate against women? Evidence from academia, 1973–97* (Working Paper 2001-2). Atlanta: Federal Reserve Bank of Atlanta.
- Ginther, D. K., & Hayes, K. J. (2001). *Gender differences in salary and promotion for faculty in the humanities, 1977–95* (Working Paper 2001-7). Atlanta: Federal Reserve Bank of Atlanta.
- Ginther, D. K., & Kahn, S. (2004). Women in economics: Moving up or falling off the academic ladder? *Journal of Economic Perspectives, 18*, 193–214.
- Glass, J. L., & Estes, S. B. (1997). The family responsive workplace. *Annual Review of Sociology, 23*, 289–313.
- Hochschild, A. (1997). *The time bind: When work becomes home and home becomes work*. New York: Metropolitan Books.
- Hochschild, A., & Machung, A. (1989). *The second shift*. New York: Avon Books.
- Hopkins, N. (1999). Special edition: A study on the status of women faculty in science at MIT. *The MIT Faculty Newsletter, 11*, 4.
- Jacobs, J. A. (1996). Gender inequality and higher education. *Annual Review of Sociology, 22*, 153–185.
- Jacobs, J. A. (2004). The faculty time divide. *Sociological Forum, 9*, 3–27.
- Jacobs, J. A., & Winslow, S. E. (2004). Overworked faculty: Jobs, stresses, and family divides. *Annals of the American Academy of Political and Social Science, 496*, 104–129.
- Kulis, S., & Sicotte, D. (2002). Women scientists in academia: Geographically constrained to big cities, college clusters, or the coasts? *Research in Higher Education, 43*, 1–30.
- Kulis, S., Sicotte, D., & Collins, S. (2002). More than a pipeline problem: Labor supply constraints and gender stratification across academic science disciplines. *Research in Higher Education, 43*, 657–690.
- Long, J. S. (1990). The origins of sex differences in science. *Social Forces, 68*, 1297–1316.
- Long, J. S. (1992). Measures of sex differences in scientific productivity. *Social Forces, 71*, 159–178.

- Long, J. S., ed. (2001). *From scarcity to visibility: Gender differences in the careers of doctoral scientists and engineers*. Washington, DC: National Academy Press.
- Long, J. S., Allison, P. D., & McGinnis, R. (1993). Rank advancement in academic careers: Sex differences and the effects of productivity. *American Sociological Review*, *58*, 703–722.
- Macunovich, D. J. (1996). Relative income and price of time: Exploring their effects on US fertility and female labor force participation. *Population and Development Review, Supplement: Fertility in the United States: New Patterns, New Theories*, *22*, 223–257.
- Mason, M. A. (2002). *The equality trap*. Somerset, NJ: Transaction.
- Mason, M. A., & Goulden, M. (2002). Do babies matter?: The effect of family formation on the lifelong careers of academic men and women. *Academe*, *88*, 21–27.
- Mason, M. A., & Goulden, M. (2004). Marriage and baby blues: Redefining gender equity in the academy. *Annals of the American Academy of Political and Social Science*, *596*, 86–103.
- Mason, M. A., Goulden, M., & Wolfinger, N. H. (2006). Babies matter: Pushing the gender equity revolution forward. In S. J. Bracken, J. K. Allen, & D. R. Dean (Eds.), *The balancing act: Gendered perspectives in faculty roles and work lives* (pp. 9–29). Sterling, VA: Stylus.
- The National Academies Committee on Maximizing the Potential of Women in Academic Science and Engineering and Committee on Science, Engineering, and Public Policy. (2006). *Beyond bias and barriers: fulfilling the potential of women in academic science and engineering*. Washington, DC: The National Academies Press.
- National Center for Education Statistics. (2005a). *Postsecondary institutions in the United States: Fall 2003 and degrees and other awards conferred: 2002-03* (NCES 2005-154). Washington, DC: Author.
- National Center for Education Statistics. (2005b). *Integrated Postsecondary Education Data System (IPEDS), Winter 2003-04, Table 228*. Washington, DC: Author.
- National Science Foundation. (1995). *Changes to the survey of doctorate recipients in 1991 and 1993: Implications for data users*. Washington, DC: Author.
- National Science Foundation. (2003). *Survey of doctorate recipients*. Retrieved November 28, 2003, from <http://www.nsf.gov/sbe/srs/ssdr/start.htm>
- O'Laughlin, E. M., & Bischoff, L. G. (2004). Balancing parenthood and academia: Work/family stress as influenced by gender and tenure status. *Journal of Family Issues*, *26*, 79–106.
- Paul, C., McCaffrey, D., Mason, W. M., & Fox, S. A. (2003). *What should we do about missing data? A case study using logistic regression with data missing on a single covariate*. Unpublished manuscript. RAND, Santa Monica, CA.
- Press, J. E., & Townsley, E. (1998). Wives' and husbands' housework reporting: Gender, class, and social desirability. *Gender and Society*, *12*, 188–218.
- Sanderson, A. R., Dugoni, B., Hoffer, T., & Selfa, L. (1999). *Doctorate recipients from United States universities: Summary report 1998*. Chicago: National Opinion Research Center.
- Shelton, B. A., & John, D. (1996). The division of household labor. *Annual Review of Sociology*, *22*, 299–322.
- Suitor, J. J., Mecom, D., & Feld, I. S. (2001). Gender, household labor, and scholarly productivity among university professors. *Gender Issues*, *19*, 50–67.

- Thornton, A., & Young-DeMarco, L. (2001). Four decades of trends in attitudes toward family issues in the United States: The 1960s through the 1990s. *Journal of Marriage and Family*, 63, 1009–1037.
- Valian, V. (1998). *Why so slow?: The advancement of women*. Cambridge, MA: The MIT Press.
- Van Anders, S. M. (2004). Why the academic pipeline leaks: Fewer men than women perceive barriers to becoming professors. *Sex Roles*, 51, 511–521.
- Ward, K., & Wolf-Wendel, L. (2004). Academic motherhood: Managing complex roles in research universities. *The Review of Higher Education*, 27, 233–257.
- Welch, M. R., & Lewis, S. (1980). A mid-decade assessment of sex biases in placement of sociology Ph.D.s: Evidence for contextual variation. *American Sociologist*, 15, 120–127.
- West, M. S. (1994). Gender bias in academic robes: The law's failure to protect women faculty. *Temple Law Review*, 67, 67–178.
- Williams, J. (2000). *Unbending gender: Why family and work conflict and what to do about it*. Oxford: Oxford University Press.
- Winship, C., & Radbill, L. (1994). Sampling weights and regression analysis. *Sociological Methodology and Research*, 23, 230–257.
- Wolf-Wendel, L., & Ward, K. (2006). Faculty work and family life. In S. J. Bracken, J. K. Allen, & D. R. Dean (Eds.), *The balancing act: Gendered perspectives in faculty roles and work lives* (pp. 51–72). Sterling, VA: Stylus.
- Wyden, R. (2003). Title IX and women in academics. *Computing Research News*, 15, 1–8.
- Xie, Y., & Shauman, K. A. (1998). Sex differences in research productivity: New evidence about an old puzzle. *American Sociological Review*, 63, 847–870.
- Xie, Y., & Shauman, K. A. (2003). *Women in science: Career processes and outcomes*. Cambridge, MA: Harvard University Press.
- Zuckerman, H., Bruer, J. T., & Cole, J. R. (1991). *The outer circle: Women in the scientific community*. New York: W. W. Norton.