Published in final edited form as:

Soc Forces. 2013 ; 92(2): 723–756. doi:10.1093/sf/sot092.

What's So Special about STEM? A Comparison of Women's Retention in STEM and Professional Occupations

Jennifer L. Glass,
University of Texas–Austin

Sharon Sassler,
Cornell University

Yael Levitte, and
Cornell University

Katherine M. Michelmore
Cornell University

Jennifer L. Glass: jennifer-glass@austin.utexas.edu

Abstract

We follow female college graduates in the National Longitudinal Survey of Youth 1979 and compare the trajectories of women in science, technology, engineering, and mathematics (STEM)-related occupations to other professional occupations. Results show that women in STEM occupations are significantly more likely to leave their occupational field than professional women, especially early in their career, while few women in either group leave jobs to exit the labor force. Family factors cannot account for the differential loss of STEM workers compared to other professional workers. Few differences in job characteristics emerge either, so these cannot account for the disproportionate loss of STEM workers. What does emerge is that investments and job rewards that generally stimulate field commitment, such as advanced training and high job satisfaction, fail to build commitment among women in STEM.

Given substantial federal investments in science training, and the evidence of a "leaky pipeline" among women that produces significant gender differences in persistence, the retention of women in the science, technology, engineering, and mathematics (STEM) labor force has become a pressing issue. The majority of research in this area, however, compares women's employment trajectories to those of men in STEM fields, seeking to uncover the factors that explain the disproportionate loss of women in STEM employment over time relative to men. Some researchers further delineate this question by examining differences in women's retention relative to men's in different STEM fields (biological sciences versus engineering, for example). A handful of researchers, focusing on subsectors, have begun looking more systematically at the factors that determine women's retention (e.g., Smith-Doerr 2004 on biotechnology workers, and Stephan and Levin 2005 or Gray and James 2007

Correspondence to: Jennifer L. Glass, jennifer-glass@austin.utexas.edu.

on IT workers). Others focus on the particularly low rate of women's STEM employment relative to men in academia and on evaluating programs to advance women in educational institutions (e.g., Committee on Maximizing the Potential of Women in Academic Science and Engineering 2006; Long 2001; Preston 2004; Williams 2000; Williams and Ceci 2012). Yet most of the STEM labor force is not employed in academic science, and most trained STEM workers will spend little time there.

These analyses beg the question of whether male scientists and engineers are the appropriate referent for understanding women's persistence in STEM careers. Restricting analyses to STEM workers and focusing on male–female comparisons deflects attention from the larger question of the particular challenges in the STEM work environment for women that might produce lower retention among women there than in other professional and managerial job sectors. Analyses of STEM workers frequently find, for example, that women are more retention-sensitive to parenthood, long work hours, and residential moves than men (Bailyn 2003; Ceci and Williams 2011). But these accounts tell us little about how STEM work environments differ from the many other work environments with similar issues (described in Mason and Goulden 2002; Shauman and Noonan 2007; Stone 2007; Williams 2000). After all, women workers in a variety of professional fields show lower persistence than otherwise comparable men, and face ever increasing time demands from their employers that interfere with the involved motherhood that most highly educated women prefer (Stone 2007). Why, then, would women in STEM be even less likely to persist than women in other professional and managerial jobs? This question suggests that the appropriate referent for understanding women's retention in STEM employment should be other women with similarly high skill levels in non-STEM employment.

In this paper, we seek to remedy this exclusion, focusing on female college graduates in the National Longitudinal Survey of Youth 1979 (NLSY79) panel and comparing the experiences of women in STEM occupations to those in non-STEM professional occupations. This cohort entered the labor force in the late 1980s and 1990s, are currently mid-career, and have mostly completed their childbearing, enabling us to view (if in hindsight) the effects of family care responsibilities on STEM careers. We acknowledge that this cohort may imperfectly reflect current employment issues in STEM fields, but delayed marriage and parenthood make later longitudinal data less suitable for analysis.

We first examine whether women's retention in STEM fields really is distinctively lower than in other professional occupations, and whether their destination status (non-STEM job or out of the labor force) differs from professional women when they leave their field. Our models then identify factors contributing to the exodus of women from the STEM workforce, conditional on their destination status (whether they moved to a non-STEM employer, or exited the workforce altogether) since different factors might affect different destinations. Women who leave the labor force often do so to create a longer maternity leave, and motherhood/child parity figures prominently in such decisions (although very few of these mothers remain out of the labor force permanently; see Goldin 2006). We look at work and family attitudes in young adulthood, current marital status and childbearing behavior, as well as firm-level factors such as work hours, benefits, wages, and flexible work practices. We assess how family and institutional configurations contribute to or impede retention in STEM occupations relative to their effects on professional workers. These configurations serve as proximal mechanisms shaping women's ability to successfully remain in STEM occupations relative to other professional occupations.

Background

Few prior researchers have systematically compared women in STEM occupations to women with similarly high skill levels in non-STEM fields (exceptions include Herr and Wolfram 2009; Hewlett et al. 2008). However, some researchers have suggested little difference between the processes occurring in STEM fields and those in other professional occupations. For example, Williams and Ceci (2012), in considering the substantial attrition of women STEM PhD recipients from the STEM labor force, note that similar drops occur for women in other fields such as medicine, law, and business, particularly following motherhood, and believe the origins of these persistence gaps can all be found in the constraints of physical childbearing and family care. In their view, the problems that plague women in STEM are simply more noticeable because those fields begin with a smaller "pipeline" of qualified women to begin with and have fewer replacement women recruits available in the labor pool. Hunt (2010), although noting lower persistence among STEM professionals than women employed in other fields, similarly finds no evidence that STEM fields are any more or less family responsive than other professional fields.

Other scholars argue, however, that women in science and engineering exhibit markedly lower retention in their fields over time than women in other professional fields (Hunt 2010; Preston 2004), and suspect that science/technology-specific processes may be at work.[1] Preston's (2004) work shows that women in STEM fields not only disproportionately leave the labor force compared to men in STEM, but also leave for jobs in other occupational fields at higher rates than men. Hunt (2010) analyzed this gender *gap* in employment persistence across STEM and non-STEM fields, and found that the larger gap in STEM was almost entirely due to lower persistence among women engineers, who disproportionately moved to other fields but not out of the labor force compared to women in other professions. In multivariate analyses of field variation in the male–female "persistence gap," she found that the excess engineering gap was almost entirely due to dissatisfaction with pay and promotion prospects, not family constraints or workplace inflexibility. While work-family factors did play an important role in women's exits from engineering, they played a substantively similar role in women's exits from other careers. Motherhood and family constraints explained a somewhat larger share of the lower retention of women scientists relative to men, but Hunt considered the result substantively small. While Hunt does not dismiss the importance of workplace culture, long weekly work hours, and inflexible schedules, she believes these factors have been overrated relative to pay and promotion issues among women in explaining the gender gap in STEM retention. Fouad and Singh's (2011) study of women engineers came to somewhat similar conclusions. Nearly half the women in their sample of women with engineering degrees said they left engineering because of lack of advancement or low salary, along with other working conditions.

[1]Morgan (2000) finds little difference in retention for women with engineering degrees compared to other degrees, but this may be because Morgan defines retention only as staying in the full-time labor force, not remaining specifically in engineering.

Our study differs from Hunt's in that we are not studying field variation in the gender gap in retention between women and men, but directly comparing the retention of women across fields. In Hunt's analysis, women's retention in one field (science) could be remarkably lower than another (medicine), but the gender gap in retention could be the same, that is, both men and women could exit science at a faster rate than men and women exit medicine. Our goal is to understand differences in women's retention across occupational fields irrespective of whether these differences occur for men as well. We include as many previously hypothesized factors as we can that might explain women's lower retention in STEM, including early work-family attitudes and expectations, actual family formation and spousal support, long hours and workplace inflexibility, job earnings, and token status in the workplace.

Conceptual Framework

We focus on three factors, in particular, that may differentiate STEM professions from other professions and have been articulated but not developed by earlier scholars. First, we consider the token status of women, especially mothers, in STEM employment. Not only are women themselves still rare in many STEM workplaces, but mothers are even more so. Mason and Goulden (2002) and Monosson (2008) both note the extent to which women scientists understand their tokenism as mothers, and end up either foregoing children altogether or having fewer children than they desire. Having children not only exacerbates women's needs for reasonable work hours and flexible work schedules (similar to other professional women), but accentuates their token status in the STEM workforce. We unfortunately have few measures of tokenism in our data, however. We consider two primary indicators as proxies—the proportion of women reported in the 1990 Census for each three-digit occupation, and women's status as mothers. We expect higher proportions of women in an occupation to increase retention for both groups but perhaps not linearly—STEM workers might show greater sensitivity since they reside in the bottom portion of the distribution of percent female. We also believe motherhood will accentuate women's tokenism in STEM but not professional jobs, and therefore disproportionately increase their turnover.

Second, we emphasize the importance of workplace demands and accommodations since research suggests that women in STEM perceive a less positive and supportive climate, and this may differentiate them from other professional workers (Gunter and Stambach 2005). We define work demands and accommodations as those conditions that make family building and egalitarian marriage easier or harder, given Williams and Ceci's (2012) suggestion that STEM employment is less conducive to family building than other professions, as well as intimations that male STEM coworkers hold more conventional gender expectations relative to other college-educated men (Sassler et al. 2012). Because of the lack of a critical mass of women in STEM fields, especially at higher levels of authority, women entering STEM occupations are particularly vulnerable to the ideologies of gender-conservative men. As Ridgeway (2011) and Correll (2001) have shown, beliefs about performance have strong effects on evaluations of performance, holding actual objective performance constant.

Perceptions of gendered ability are particularly salient for employees in science and technology jobs (Robinson and McIlwee 1991). At early career stages, men are assessed by employers as being more capable, worthy of career mentoring, and deserving of higher salaries than equivalent women (Moss-Racusin et al. 2012), and with increasing duration in the job are also more likely to be promoted rapidly and enter supervisory positions than women with similar characteristics (Robinson and McIlwee 1991). Not only are performance expectations likely to be lower for women workers among their male colleagues in STEM, but the organization of STEM work may be designed in ways that stimulate men's but not women's productivity, particularly women with family care responsibilities (Stone 2007). This might explain why women in STEM fields feel less confident in their ability to successfully fulfill the role of STEM professional when benchmarked against male colleagues (Babcock and Laschever 2003; Cech et al. 2011).

Workplaces can make accommodations to those with family needs, by offering paid parental leave or allowing employees to work flexible schedules or work some hours from home (Blair-Loy and Wharton 2002; Goldin and Katz 2011). Providing such policies sends a message that companies recognize the need to balance work and life, and may indicate a climate more supportive of family needs (Glass and Estes 1997). Nonetheless, many women express concern about taking advantage of these benefits, and men are less likely to make use of such benefits (Blair-Loy and Wharton 2002; Blau and Kahn 2013), suggesting the continued stigmatization of care work. The qualitative evidence, furthermore, suggests that women who request such accommodations often report that they are then seen as less committed, receive less rewarding work, and face continued pressure to increase work hours (Stone 2007). In other words, women may feel penalized for taking advantage of these accommodations, and may therefore feel that their attempts to balance work and family needs are not worth the effort.

We operationalize workplace demands and accommodations with a number of indicators available in the NLSY79. One is the respondent's own gender ideology, which we hypothesize might *increase* turnover out of field among the more gender-liberal women in STEM. The inconsistency between expectations of equal treatment and the reality of workplaces dominated by gender-traditional men may propel women into more congenial jobs. Because the NLSY79 asks very little about compensation systems or interpersonal experiences on the job, we include traditional indicators of job demands and rewards, such as the amount of overtime usually worked per week, job satisfaction, and annual earnings. These serve as proxies for the organization of labor on the job more generally. We also consider a number of measures that indicate ways employers may try to accommodate family needs, including whether the job allows flexible scheduling and offers paid parental leave, and whether the respondent usually works any hours from home.

Finally, we emphasize women's own commitment to staying in science and technology employment, primarily operationalized as investments in STEM-specific human capital and delayed or deferred family formation. Preparing with years of study for a particular expertise makes leaving that field more costly, while creating a personal life that supports rather than competes with the demands of a scientific career encourages retention. We focus on the measurable educational, workplace, and family factors that may disproportionately solidify women's commitment to science careers given their tokenism more generally compared to professional women. These include majoring in STEM in college, receiving advanced training/degrees, and marrying a supportive spouse who also works in STEM, in particular.

We believe spousal support is important in STEM workers' lives because of the aforementioned climate issues and competitive demands of STEM workplaces. More so than workers in other fields, a spouse who understands the dictates of the work and can accommodate a wife's career may be especially influential in women's STEM retention. We include the amount of overtime hours worked by married spouses as one indicator of such support, since women feel more pressure to handle domestic tasks when their spouses are unavailable (Cha 2010; Stone 2007). As well, women married to fellow scientists can sometimes share work or join the same scientific team, creating work-family synchronization rather than competitive conflict. Increases in recent decades in the tendency to wed a partner with similar levels of educational attainment (Mare and Schwartz 2005), as well as the possibility that occupations with time-intensive demands also serve as marriage markets for young adults, suggest the growing importance of occupational homogamy in shaping workplace retention among women.

We include other personal and family characteristics that might enhance women's commitment to STEM as well—expecting to marry late or not at all, actually marrying late or not at all, expecting not to have children, actually not having children or having them later in life, and holding more liberal gender ideology. Note that gender traditionalism may make women feel more comfortable around their gender-traditional workmates, but diminish their commitment to employment once they have children themselves. So, from the perspective of women's commitment to STEM work, liberal gender ideology should help rather than hurt women's retention in STEM.

While our analyses differentiate job exits to another occupational field from labor force exits, we make no specific predictions about which factors differentiate field exits from labor force exits. However, it makes sense conceptually that indicators of tokenism and workplace sexism would affect exits from the field more than exits from the labor force, while indicators of commitment might affect both types of exits, especially those relating to marriage and childbearing while employed in demanding careers.

Method

Data for our analysis come from the NLSY79. The NLSY79 (1979–2008) is an ongoing panel survey of a nationally representative sample of 12,686 young men and women who were aged 14–22 in 1979, sponsored by the Bureau of Labor Statistics (BLS), US Department of Labor. Data were first collected in 1979, and respondents were reinterviewed annually through 1994 and biennially from 1996 to the present. Response rates for the initial interview of the NLSY79 were high (87 percent), and retention rates have ranged from 77.5 to 96.1 percent.

A particular strength of the NLSY79 is the availability of information on young adults' work aspirations, detailed information on their fields of study, and occupational pursuits over time. We were able to follow this cohort as they transitioned into occupations and family roles. In addition, by 2008 the survey offered a long enough time span to follow women into mid-career, and covered the bulk of decision-making regarding marriage and children.

Sample

From the original sample of 12,686 individuals, we limit our analysis to women who have completed a four-year college degree, which leaves 1,258 individuals. For our analytic purposes, we transformed the individual longitudinal records of female college graduates in the NLSY into person-year records for each wave of data. Each person-year record contains historical information on that respondent, as well as the current time-varying characteristics of the person, their job, and their household. We then exclude all jobs that were neither in STEM fields nor in professional/managerial jobs. In total, we accrued 501 job spells in STEM from 258 separate respondents, and 1613 job spells from 842 separate respondents in professional/managerial occupations. These job spells yielded 4,993 person-year records, 4,078 of which represented women working in non-STEM professional jobs, and 915 person-years of women working in STEM jobs.

Measures

For this analysis, we are interested in exploring differential exit rates from STEM careers compared to other professional occupations. Our analysis distinguishes between exits out of the labor force and exits from a STEM or professional occupation into a non-STEM or non-professional occupation, respectively. Women who remain in their original occupation (STEM or professional) provide the comparison group. Women who change employers but remain within their respective career fields are considered part of the comparison group. We rely on the 1970, 1980, and 2002 Census Occupational Classification Codes to determine whether a job is within STEM or professional occupation classifications. STEM jobs include computer specialists, engineers, life and physical science occupations, and technicians. Following other researchers, we do not include doctors, nurses, or other health professionals as part of the core STEM labor force unless they are academic researchers (Hill, Corbett, and St. Rose 2010; Xie and Killewald 2012). Professional jobs include financial operators, doctors, health technologists, social scientists, non-STEM postsecondary professors, managers, and lawyers. A full list of occupations in each group is provided in appendix A.

We model exits from STEM and professional occupations using a multinomial logistic framework. All models reflect characteristics of women in the present time period, and analyze how these variables affect the likelihood of leaving STEM or a professional occupation by the next interview. We control for various tempo effects, college major and advanced-degree status, family expectations in adolescence, current marital status and children, spouse characteristics, and job characteristics. We model exits from STEM and professional occupations separately and then pool all jobs to test significant differences between STEM career paths and other professional occupations.

Covariates

Tempo—We include various tempo covariates in our analysis to control for changes in exit rates over time and over one's career path. We implement a linear time trend to capture macro-level changes in employment patterns over time, as well as a linear age trend to analyze how exit patterns change over the career path. We also control for the number of person-years contributed to the sample, to test if individuals with more time spent in STEM or professional jobs drive the results. Finally, we measure job tenure to control how longevity in a specific job affects exit rates. We divide tenure into a dichotomous indicator for whether the respondent is in their first year on the job, and a continuous measure of full job tenure in years, since many bad job matches end quickly in the first year of employment.

Education

Individuals who major in STEM should be more invested in STEM careers, so we measure whether the individual majored in STEM (engineering, computer and information science, natural sciences, physics, and mathematics), or in a business, social science, or health major. Individuals who major in arts and humanities or any other majors serve as the control group. We also control for whether an individual has an advanced degree at the time of each survey wave, separating advanced degrees into those from STEM fields and those from non-STEM fields, assuming that advanced training strengthens the investment and commitment to a professional field, whether STEM or non-STEM.

Family Expectations

The NLSY79 asks a number of questions in the first survey year that are designed to capture future expectations toward family and work. All measures are collected when the individuals are 14–21, before the majority of them have completed schooling. We control for whether an individual expects to ever have children, whether she expects to marry after age 30 or to never marry, and a composite score of her *gender ideology*. The *gender ideology* score comprises eight questions designed to capture attitudes toward traditional family roles.[2] Responses ranged from 1 to 4, where 1 = strongly disagree, and 4 = strongly agree; several of the measures were reverse coded (noted). Measures were summed and divided by the number of questions for which there was a response to retain the 1–4 range of the scale, with higher values indicating more liberal attitudes. Cronbach's alpha for this scale was .735 for the pooled sample of STEM and professional women (.72 for women in STEM and .74 for professional women when estimated separately).

Family Characteristics

To capture the effects of family obligations that might either highlight women's token status on the job, or weaken commitment and encourage exits from careers, we control for whether an individual is married in a given year, whether she marries by the next time period if currently single, and whether she has a child by the next time period. We differentiate first births from second- or higher-order births, since some research suggests that additional

NIH-PA Author Manuscript

NIH-PA Author Manuscript

[2]The following questions were used to construct a measure of gender orientation: (1) A woman's place is in the home, not the office or shop (reverse coded); (2) A wife with a family has no time for outside employment (reverse coded); (3) A working wife feels more useful than one who does not hold a job; (4) Employment of wives leads to more juvenile delinquency (reverse coded); (5) Employment of both parents is necessary to keep up with the high cost of living; (6) It is much better if the man is the achiever outside the home and the woman takes care of the home and family (reverse coded); (7) Men should share the work around the house with women; and (8) Women are much happier if they stay home and take care of children (reverse coded).

children exponentially increase the probability of job exits while having only one child may be manageable even in long-hours professions (Stone 2007).

Spouse Characteristics

If a woman is married, we measure whether her spouse also works in the same field (STEM or professional job) and the share of the family's income from her earnings (Shafer 2011) as indirect measures of spousal support. However, we were not able to include income share in the final models because it was too highly correlated with marital status among our sample of women. The spouse occupation variable is coded as 1 if the respondent works in STEM (professional occupation) and her spouse also works in the same two-digit Census occupational classification (whether STEM or professional), and 0 if the respondent is unmarried or her spouse works in another field. Following Cha (2010), we also measure the spouse's number of hours of overtime, defined as usual weekly hours worked over 40, since spouses with long overtime hours are less able to participate in family care.

Job Characteristics

Finally, we include a number of job characteristics from each wave that measure either job demands or accommodations. These include the log of annual earnings in constant 2000 dollars, job satisfaction (measured as "very satisfied" versus all other categories on a five-point scale because of the extreme skew in its distribution), number of usual hours worked (from which we derive a measure of usual overtime hours worked above 40 per week), and employment benefits. We measure whether the employer offers parental leave and whether the respondent can work a flexible schedule, both family care accommodations; but are unable to observe whether the individual actually utilizes parental leave or work a flexible schedule. We also measure the number of hours usually worked at home per week. Unfortunately, the NLSY79 does not ask more details about flexible work options, and the items measuring parental leave, flexible schedules, and hours worked at home are asked only from 1989 on. Consequently, we exclude these variables from our full model to maximize sample size. We then run a restricted model using only the observations from 1989 to 2006 that include these flexible work items and report their coefficients in appendices B1 and B2 wherever significant in the model specifications.

We initially also measured "tokenism on the job" by using the 1990 Census classifications to determine the percentage of women in each three-digit occupational code observed in our effective sample. This variable was merged to each job record in each year observed, and then included in all preliminary models, despite the fact that it is a rather poor proxy for the actual workplace-level gender integration that our respondents faced. It nevertheless distinguishes the most gender-segregated STEM fields from more integrated professional and managerial jobs, and is a reasonable approximation of the degree of male dominance in the respondent's occupational field.

We had very little missing data on our core variables in the NLSY (less than 3 percent); most missing data occurred for the job characteristics we measured. Because jobs were nested in job spells, we replaced missing data in one year with the appropriate measure in

NIH-PA Author Manuscript

NIH-PA Author Manuscript

the immediately prior or subsequent year whenever respondents reported working in the same job.

Survival Analysis

We employ discrete-time event history modeling to analyze the duration of each job spell in which the respondent reported working in a STEM (professional)- related occupation until either (1) they transitioned out of STEM (professional occupation); (2) they exited from the workforce; or (3) they reached the final survey interview (i.e., their job spell was censored in 2008). We base our models on person-years of risk assessed from the completion of a four-year degree and entrance into the labor force. Our survival analysis treats transitioning out of the labor force and transitioning into a job outside the current occupational sector as competing risks using multinomial logit models (Allison 1995). For all respondents who entered a STEM (professional) occupation, we included a record for each subsequent wave in which they were still in a STEM (professional) occupation until they either left for an non-STEM (non-professional) occupation, exited the labor force, or the panel ended, after which that individual was censored.[3] We included the duration of employment in the current job as a time-varying covariate at each wave, as well as a control variable measuring the number of times a respondent appears in the sample to preserve the representativeness of the sample. We did not use sample weights in the analyses presented here; since our analyses include only college graduates, they contain very few of the oversampled demographic groups in the NLSY design. However, we repeated all analyses using the individual longitudinal weights provided by the NLSY as a precautionary step and found no substantive differences in results.

Models incorporated time-invariant and time-varying covariates (including children born or added to the respondents' household between survey waves) and took the following form for each of the two destination statuses of interest:

$$Log\left[\frac{\mathrm{P}\,(\mathrm{t}{+}1)}{(1-\mathrm{P}\,(\mathrm{t}{+}1))}\right]=\mathrm{a}\,(\mathrm{t})+\beta_1\mathrm{X}_1+\beta_2\mathrm{X}_2\,(\mathrm{t})\,,$$

where x_1 represents time-constant covariates, x_2 represent time-varying covariates, log [P(t)/(1−P(t))] is the logit transformation of the probability that an individual experiences a job exit for a particular destination status by time t +1, and the intercept varies with time in the spell. Next, we estimate proportional hazards models that formally test whether STEM and professional women workers differ in their timing to job departure, before and after controlling for background aspirations, family formation, and job characteristics.

[3]In a very small number of cases (*N* = 69), women working initially in a STEM job both left STEM and then subsequently returned to STEM employment. They appear in the analysis as STEM employees twice: once for the original job ending in a move out of the field and a second time as a STEM employee in a censored job spell. They appear in the analysis as professional employees once, while between STEM jobs, in a job spell that ends with a move out of the field back into STEM.

Results

Table 1 describes the breakdown of major occupation groups in each of our primary categories of employment, STEM and professional. As is clear from this table, female college graduates working in STEM are predominantly information technology (IT) or engineering workers, while professionals are predominantly managers and administrators, financial operators, and nurses.

Table 2 presents descriptive statistics on the variables in our analytic sample, separately by whether the job is a STEM occupation or a professional occupation. Overall, the two samples are very similar to each other, with the main differences being that they majored in different subjects in school, that women in STEM score slightly more liberal on the gender ideology scale and are more likely to have a spouse in the same occupational field (who works less overtime), and that professional women are more likely to hold advanced degrees. There is also some evidence that women in STEM work fewer hours than women in professional occupations and have more flexible schedules; women in professional occupations, in contrast, are more likely to work more than 45 hours per week, and work slightly more hours at home. Otherwise, women in STEM and women in professional occupations marry at similar rates, have a similar number of children, earn similar salaries, and are equally satisfied with their jobs. When asked about their expectations for future childbearing and marriage in 1979, these women are equally likely to report not wanting to have children and to defer or forego marriage. In short, there are no obvious differences between the two groups that might significantly discourage STEM women's retention relative to professional women.

While table 2 does not indicate any difference in average job tenure between women in STEM and women in professional occupations, a Kaplan–Meier graph of the survival rate within STEM and professional occupations indicates quite a different story. Figure 1 illustrates the survival rate in a STEM or professional career by the number of years spent in their occupation. Survival here indicates that an individual remains in her respective occupational field, but does not necessarily mean that she stayed in the same job the entire time. Results indicate that women in STEM are far more likely to exit STEM than professional women are to exit professional fields. After about twelve years, 50 percent of women who originally worked in STEM have exited and are employed in other fields. In contrast, only about 20 percent of the professional women exit professional occupations throughout the course of the study, which spans almost thirty years for some women.

Table 2 shows these differences as well in the proportions of our observations that end with either a move out of their professional field or a move out of the labor force for STEM and non-STEM job holders. While moves out of the labor force show virtual parity between STEM and other professional jobholders (2.7 versus 2.2 percent), STEM jobholders are significantly more likely to move out of their scientific and technical jobs into another field of work compared to non-STEM professionals (31.5 versus 6 percent). Thus, the disparity in retention between STEM and non-STEM professionals is almost entirely due to STEM women switching out of STEM fields but *not* out of the labor force. These differences are graphically displayed in figure 2.

Of course, one could argue that “professional employment” is a very broad category, maximizing the likelihood that a woman leaving an unmanageable professional job can find some other form of professional work elsewhere. STEM workers may simply face a more limited occupational field, and more homogeneous work environments across these occupations, implying that workers must leave STEM in order to create an alternative career. Moreover, job moves into management or administrative jobs *within* a professional or STEM field (as an avenue of upward mobility) leave a respondent coded as staying in the professional sector but not in the STEM sector. To make sure these processes do not account for our results, we estimated the percentages in each *detailed* occupation in the STEM and professional groups that remained in the same detailed occupation throughout the time span observed (data not shown). The results show that retention in the detailed professional occupations is higher than the detailed STEM occupations. The overall percentage of STEM workers sticking with their same detailed occupation is 52.3 percent. The overall percentage of professional workers sticking with their same detailed occupation is 62 percent. Even after disaggregating the two broad groups into individual occupations, the data reveal a pattern of lower retention in the STEM fields.

Turning to our multivariate models of the determinants of this turnover difference, we first display separate models of job leaving for STEM and professional women workers, then pool both populations to test for significant differences in the determinants (not the levels) of job quitting by destination status. We focus primarily on moves out of the current occupation to another field since these are the dominant sources of movement for both STEM and non-STEM professionals. Our tables present odds-ratios for the coefficients linking each independent variable to the dependent outcome of job leaving.

Table 3 displays the summary results for moves into a new job out of the field or out of the labor force altogether.[4] We initially estimated models including variables for motherhood and the percent female in the respondents’ three-digit Census occupational classification, to test for effects of tokenism on retention. We found no significant effects of either motherhood or female representation on either retention in field or the labor force. We tried a number of alternative specifications for percent female, including a nonlinear semi-log function and a spline at 25-percent female or less since that portion of the distribution indicates serious female underrepresentation of the kind frequently found in STEM fields. But no specification yielded any significant effects of tokenism, so these variables were dropped in all subsequent models because their inclusion altered the behavior of other significant covariates. The possibility still exists that tokenism exerts indirect influence on retention by affecting work demands or field commitment, however, so we turn to those direct indicators next.

The results displayed in table 3 for the work demands/accommodations and commitment variables show that there are several substantive differences in the determinants of field leaving across the two groups of employees. The most provocative results deal with the

[4]Appendices B1 and B2 include more detailed model specifications for moves out of the field and out of the labor force, respectively. The first model in each shows the baseline model without spouse or job characteristics, the second model adds spouse and job characteristics, and the third model adds work-family benefits that were asked only from 1989 onward (hence the sample sizes for model 3 are smaller).

commitment variables, which show that the odds of STEM jobholders leaving their field are 166 percent *higher* if they have an advanced degree in a STEM field (despite our belief that advanced training would increase commitment to the field) and 195 percent higher if they have an advanced degree in a non-STEM field, but 70 percent lower if their spouse is also employed in STEM. Neither factor (advanced-degree receipt or partner employed in field) affects professional women's moves out of the field. We also found, as predicted, that adolescent expectations to marry later in life and have no children increase retention in STEM (odds of leaving STEM decrease by 57 and 45 percent, respectively), while professional women are *more* likely to leave their field if they expected to have no children (odds increase of 75 percent) and are unaffected by plans to marry later in life or not at all. Finally, actually getting married is more likely to propel women out of STEM careers than professional careers, with STEM women increasing their odds of leaving by 84 percent upon marriage, while the odds increase is not significant for professional women (although the difference between groups is not statistically significant). We tested the interactions between age and getting married as well as (liberal) gender ideology and getting married, to see whether being older or less gender traditional at marriage diminishes this negative effect on retention in the field among STEM women, but neither interaction was significant.

Several of our commitment variables do not seem to affect retention in the field for either group, however. Spouses' overtime hours, gender ideology, and the births of either first or later parity children have no impact on retention in the field for either STEM or professional women. We again tested interactions between age and childbirth (first and later parity) and liberal gender ideology and childbirth to make sure that younger and/or more gender-traditional women are not disproportionately leaving STEM for other fields upon becoming mothers, but neither interaction was significant.

Turning to workplace demands and accommodations, surprisingly few differences in the determinants of field leaving could be uncovered. Neither aging nor high job satisfaction affect retention among STEM women, while aging reduces field leaving by about 15 percent per year and high job satisfaction reduces field leaving by about 34 percent for professional women. Parental leave is the only work-life amenity that significantly reduces field leaving but does so equally across both groups (39- and 44-percent decreases, respectively, in the odds of leaving for STEM and professional women). Just as important are the work characteristics that do not affect field leaving among either group—respondents' earnings, overtime hours, gender ideology, and work-life amenities such as flexible scheduling and telecommuting (see block 3 of appendix B1).

Taken together, the differential effects uncovered here provide some clues to the disproportionate loss of women from STEM careers. First, the combination of advanced degrees increasing field exits and age and job satisfaction failing to slow the pace of job leaving among women in STEM suggests that the difficulties women perceive in STEM fields do not disappear at higher levels of skill or maturity as they appear to among professional women. Many theories of career development point to the "settling" effects of age as workers make better matches between their skill levels and aspirations and the characteristics of the jobs they hold (Gardecki and Neumark 1998; Jovanovic 1979). This process, which tends to stabilize job holding following a period of job churning early in the career, may be short-circuited somehow among women in STEM occupations, resulting in mismatches throughout the career that are not ameliorated by advanced training.

The second clue comes from the combination of increased field leaving among STEM women who get married but decreased field leaving if those spouses are also STEM workers. The two effects seem to cancel each other out, so that initial marriage to another STEM worker is benign and continued partnering with a STEM worker reduces field leaving. But getting married to a spouse in a non-STEM occupation seems to initiate field leaving for a number of STEM women. Neither of these patterns appears for professional women, for whom marriage and spouses' choice of occupation seem irrelevant for field retention.

We turn now to the results for moves out of the labor force (table 3). We recognize the limited number of moves out of the labor force among the job spells in the data (especially among the STEM workers), and exercise caution in interpreting the results because of the lesser statistical power and potentially greater influence of outliers in these parts of the multinomial logit models. We also note that the descriptive statistics show little difference in labor force exit rates between STEM and professional women. With those caveats in mind, table 3 shows few differences in the determinants of leaving the labor force across STEM and professional workers attributable to workplace demands and accommodations, but larger differences in the impact of variables affecting work commitment, especially family formation. In terms of workplace demands and accommodations, higher earnings, longer work hours, satisfying work, longer job tenure, and (to a lesser extent) the presence of parental leave diminish labor force exits across both groups. The overtime-hours effect is unexpected—longer hours seem to deter labor force exits rather than encourage them. We believe longer work hours may be tapping unmeasured dimensions of work commitment rather than poor working conditions, particularly among mothers. Part-time hours in professional jobs are often an intermediate stage for women with caregiving responsibilities before they exit completely for full-time homemaking (Stone 2007).

The few differences that do emerge are glaring and suggestive of dissimilar effects of family formation on labor force exits. First, adolescent expectations to remain childfree in adulthood radically suppress labor force exits among STEM but not professional workers. None of these women subsequently went on to have children while employed in a STEM field, suggesting the presence of a small pool of women in STEM fields strongly committed to avoiding the career conflicts of parenthood early in life.

Actual family formation also disproportionately influences the decisions of women in STEM to leave the labor force compared to professional women who show remarkably smaller effects of marriage and childbearing. While the act of getting married decreases the odds of a STEM labor force exit by about 85 percent in the subsequent year (though increasing exits from the field, as explained above), staying married is associated with dramatically *increased* odds of exiting the STEM labor force. This "pull" or demand for home production is exacerbated as spouses work more overtime among both groups, but STEM women look slightly more reactive to their partner's overtime work hours. Here, as in the competing risk of leaving the field, having a spouse employed in the same STEM field dramatically reduces labor force exits (a near 100-percent reduction in the risk of exiting the labor force, although caution must be exercised because of the limited sample of exits among STEM workers here) and nullifies the negative effects of being married and having a spouse who works overtime. In contrast, having a spouse in a professional field does not affect the odds of leaving the labor force for professional women.

Having children, particularly a second or higher parity child, increases labor force exits among both groups of workers, but much more noticeably for STEM workers. A second child results in a 395-percent increase in the odds of leaving the labor force for STEM women but only a 147-percent increase for professional women. This pattern suggests a life course process in which the arrival of children may alter the earnings, hours, and job satisfaction of STEM women more than non-STEM women in ways that increase the attractiveness of exiting the labor force. This is true even though STEM employees are more likely than other professional workers to work in public sector jobs (23 versus 18 percent), which are often thought to be more hospitable to women.

Finally, we pool both groups of workers and run a unified multinomial logit model to pinpoint the residual effect of being employed in a STEM field on both field leaving and labor force exits. Table 4 clearly shows the large residual impact of being employed in a STEM occupation on field leaving, but no significant residual impact on labor force exits. Women employed in STEM are 807-percent more likely to leave their field than professional women (odds ratio = 9.07), *even after* accounting for early adolescent career and family expectations, actual marriage and childbearing, spouse characteristics, and job characteristics. In fact, the job and family characteristics included in our retention models explain little of the difference in retention between STEM and professional occupations, reducing the residual impact of being in a STEM career on field leaving by only 31 percent (odds-ratio = 9.38 without job and family independent variables in the model). Clearly, STEM and professional women do not encounter vastly different family and job situations when measured in objective terms, but their reactions to these and other unmeasured conditions vary enough to produce a large STEM retention deficit.

Discussion

Our results suggest that there are few significant differences in the demographic and family characteristics of women in STEM jobs compared to women in non-STEM professional jobs, or in the measured work conditions they face (hours, job satisfaction, and job flexibility). Despite stereotypical notions about women in STEM not having families, our sample of women in STEM jobs are just as likely to be married and bear children as women in professional jobs. Women in STEM jobs do show slightly more egalitarian gender attitudes, higher earnings, and better work-life amenities, but this should make them less likely to leave STEM employment relative to women in professional jobs, especially for non-market pursuits like homemaking. Yet our findings reveal that women in STEM fields are dramatically less likely to persist in them over time compared to women in other professional fields and that this occurs because women in STEM move to non-STEM jobs at very high rates, not because women in STEM fields disproportionately move out of the labor force. Moves out of the labor force are in fact quite rare for both groups, confirming analyses that show growing labor force attachment among professionals in all fields over time, particularly when workplace supports for parenting exist (Herr and Wolfram 2009; Percheski 2008).

Moreover, the women who leave STEM occupations are unlikely to return; only a handful of women ever moved back into a STEM job following a job move out of the field. However, some of these STEM women could be moving from scientific or technical work into the management of scientific or technical work. To check, we looked at the distribution of jobs taken following the last STEM job and report the results in appendix C. Only about 21 percent of moves out of STEM are moves into managerial or administrative ranks; the vast majority are not. While some move into health professions (4 percent become health technologists, 1 percent become dietitians, and 1 percent become physicians) or teaching (11 percent), most go into non-professional jobs (50 percent).

One reason that so few moves led to management careers may be that these moves occurred early in the respondent’s STEM career, most in the first five years of employment. This suggests not only that promotions into management are unlikely to be the sources of moves out of the field, but that marriage and children are not the primary propellants of moves out of STEM either. We turn to our multivariate models for clues about this early erosion from STEM employment into other fields among women who have persevered through the educational process to get STEM degrees.

While we expected that women’s token status in STEM fields could be isolating and lead to dissatisfaction with STEM work environments, neither of our measures of tokenism (occupation proportion female or motherhood status) significantly affect retention in our multivariate models. In addition, results show that most of the workplace characteristics, including hours of work, earnings, and parental leave policies, affect retention in similar ways for women in STEM and professional employment. However, women in STEM fields do not react as positively to increasing job satisfaction, job tenure, and advancing age, suggesting that climate issues or lack of “fit” between worker and job persist for longer periods of time in STEM careers. This helps explain the widening retention deficit that STEM women experience over time relative to professional women.

The effects of educational credentials on retention, which we initially considered to be another indicator of commitment to STEM, bolster this interpretation. While holding an advanced degree does not affect the odds of leaving professional employment for either destination status (different type of job or labor force exit), increasing educational investment in STEM actually decreases retention and increases the odds of leaving STEM employment, suggesting that the STEM jobs held by advanced-degree holders are either more noxious or more isolating than those held by bachelor’s degree recipients. While unexpected, this is consistent with both the competition/demands and token status explanations proffered for the weaker retention of women in STEM employment. Whatever the origin of these effects, the fact that advanced training, increasing job tenure, job satisfaction, and aging do not deepen commitment to STEM fields as they do for most other workers in most other fields is particularly troubling.

Family formation events and family characteristics that might decrease occupational commitment appear to be more closely associated with leaving STEM employment than with leaving professional employment. Early aspirations to avoid or postpone family obligations emerge as important for STEM employees' retention in the field while having neutral or negative impacts on field leaving among professionals. Actually getting married negatively affects retention in the field for STEM employees, but having a spouse employed in the same field emerges as surprisingly important in discouraging both changing fields and exiting the labor force among women in STEM, while having virtually no effect on field leaving among professional women.

The patterning of these results supports the perspective that there may be peculiar unmeasured features of STEM jobs that are difficult to combine with family life, and that these are exacerbated as one goes up the hierarchy of skill and authority in STEM employment. But we hesitate to exaggerate the importance of these indicators of occupational commitment (family statuses and spouse characteristics) because the biggest problems in STEM retention occur so early in STEM careers. The large residual unexplained difference in moves out of field between STEM and professional women eludes explanation by family factors and simple job characteristics like earnings or work hours. Even work-life amenities such as flexible scheduling and telecommuting matter little in accounting for the lower retention rates of STEM workers. We suspect that the retention deficit in STEM may be due to the team organization of scientific work combined with the attitudes and expectations of coworkers and supervisors who hold more traditional beliefs about the competencies of women in these rapidly changing fields. The token status of women at higher skill levels, which we could not test, may also contribute to their disproportionate loss compared to skilled professionals.

We acknowledge that our longitudinal data on a single cohort of highly educated women at mid-career cannot capture possible trends in reactions to STEM work environments among women college graduates from the mid-1990s and beyond. Younger women in STEM may differ from the pioneering cohorts of the 1980s and early 1990s, and may hold more conventional desires for marriage and family that discourage continuity in STEM careers. This may be counterbalanced, however, by the fact that attitudes toward mothers' employment, nonmarital childbearing, and cohabitation have liberalized among women at all levels of education and occupation since the early 1980s. Perhaps women in STEM jobs are more conventional now than in the past, and their family attitudes are more salient in explaining why women leave STEM employment in contemporary cohorts. Recent evidence from college-bound women in 2002, however, shows little evidence that the family plans of young women deter either majoring in STEM or aspiring to STEM occupations (Morgan, Gelbgiser, and Weeden 2013).

The focus for future work should be, we believe, on the first few years of employment in STEM jobs, when the greatest attrition out of the field occurs. Our analysis suffers from a lack of detailed information on the characteristics of jobs and the organizational environment in which STEM women labor postgraduation. The interaction patterns between new STEM entrants and supervisors and coworkers may be especially relevant, along with the skill content of the job and the prospects for future upward mobility. The distinction between organizational provision of work-life amenities and the ability of employees to actually use amenities without negative consequence may also be important in understanding why women might leave fields that initially seem to have better pay and benefits and greater flexibility.

Acknowledgments

This research was supported by Grant Number 5R01NR011988-02 from the National Institute of Nursing Research (NIH), and by Grant Number 5R24HD042849 awarded to the Population Research Center at the University of Texas at Austin by the Eunice Kennedy Shriver National Institute of Child Health and Human Development. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Appendix

Appendix A

List of STEM and Professional Occupation Codes

1970 Occupation Codes		Number of Observations
STEM Occupations		
	Computer specialists	**432**
3	Computer programmers	154
4	Computer systems analysts	104
5	Computer specialists, n.e.c.	142
55	Operations and systems researchers and analysts	32
	Engineers	**135**
6	Aeronautical and astronautical engineers	5
10	Chemical engineers	1
11	Civil engineers	10
12	Electrical and electronic engineers	12
13	Industrial engineers	26
14	Mechanical engineers	12
15	Metallurgical and materials engineers	1
20	Mining engineers	
21	Petroleum engineers	
22	Sales engineers	2
23	Engineers, n.e.c.	63
24	Farm and management advisors	3
	Mathematical specialists	**11**
34	Actuaries	2
35	Mathematicians	5
36	Statisticians	4
	Life and physical sciences	**85**
42	Agricultural scientists	2
43	Atmospheric and space scientists	2

1970 Occupation Codes		**Number of Observations**
44	Biological scientists	25
45	Chemists	23
51	Geologists	16
52	Marine scientists	
53	Physicists and astronomers	
54	Life and physical scientists, n.e.c.	17
	Science teachers	**36**
102	Agriculture teachers	1
103	Atmospheric and earth teachers	2
104	Biology teachers	3
105	Chemistry teachers	1
110	Physics teachers	2
111	Engineering teachers	
112	Mathematics teachers	27
	Engineering and science technicians	**153**
150	Agriculture and biological technicians	7
151	Chemical technicians	14
152	Draftsmen	27
153	Electrical and electronic engineering technicians	21
154	Industrial engineering technicians	5
155	Mechanical engineering technicians	5
156	Mathematical technicians	6
161	Surveyors	3
162	Engineering and science technicians, n.e.c.	65
	Other technicians	**62**
163	Airplane pilots	15
164	Air traffic controllers	5
170	Flight engineers	1
171	Radio operators	1
173	Technicians, n.e.c.	40
	Farm managers	
802	Farm managers	1
	Total	**915**
Professional Occupations		
	Financial Operators	**833**
1	Accountants	654
2	Architects	1
201	Assessors, controllers, and treasurers	9
202	Bank officers and financial managers	169

1970 Occupation Codes		Number of Observations
	Physicians, dentists, etc.	**186**
61	Chiropractors	
62	Dentists	22
63	Optometrists	8
64	Pharmacists	68
65	Physicians, medical and osteopathic	68
71	Podiatrists	1
72	Veterinarians	11
73	Health practitioners, n.e.c.	8
	Dietitians, therapists, etc.	**261**
74	Dietitians	54
76	Therapists	207
	Health technologists	**294**
80	Clinical laboratory technicians	150
81	Dental hygienists	1
82	Health record technologists	1
83	Radiologic technologists	17
84	Therapy assistants	1
85	Health technologists, n.e.c.	124
	Social scientists	**138**
91	Economists	68
92	Political scientists	
93	Psychologists	22
94	Sociologists	1
95	Urban and regional planners	14
96	Social Scientists, n.e.c.	33
	Post-secondary teachers/professors	**94**
114	Psychology teachers	
115	Business and commerce teachers	12
116	Economics teachers	4
120	History teachers	18
121	Sociology teachers	
122	Social science teachers	1
134	Trade, industrial, and technical teachers	2
135	Miscellaneous teachers, college and university	17
140	Teachers, college and university, n.e.c.	18
	Health teachers	
113	Health specialties teachers	22
	Managers and administrators	**1,408**

1970 Occupation Codes		Number of Observations
212	Health administrators	98
213	Construction inspectors, public administrators	2
215	Inspectors, except construction, public administration	6
216	Managers and superintendent building	20
220	Office managers, n.e.c.	75
221	Officers, pilots, and pursers; ship	
222	Officials and administrators, public administration	62
235	School administrators, college	40
240	School administrators, elementary and secondary	62
245	Managers and administrators, n.e.c.	1,043
	Nurses	**669**
75	Registered nurses	669
924	Lay midwives	
	Lawyers	**195**
30	Judges	10
31	Lawyers	185
	Total	**4,078**

Appendix B1

Stepped Multinomial Regressions Predicting Exits Out of Career Path, STEM Women Compared to Women in Professional Jobs, Odds-Ratios

	Block 1		Block 2		Block 3	
	STEM	Professional/ Managerial	STEM	Professional/ Managerial	STEM	Professional/ Managerial
Number of person-years contributed	0.984	1.014	0.983	1.005	0.984	0.973
Calendar year	0.956	1.040	0.960	1.036	0.966	1.078*
Age	1.006	0.838***	0.999	0.847***	1.008	0.894*
Education						
STEM major	0.237***	0.666	0.241***	0.670	0.248***	0.692
Business, social science, health major	0.490**	0.295***	0.515*	0.301***	0.566*	0.283***
Advanced degree in STEM	2.554†	n/a	2.655†	n/a	2.519	n/a

	Block 1		Block 2		Block 3	
	STEM	**Professional/ Managerial**	**STEM**	**Professional/ Managerial**	**STEM**	**Professional/ Managerial**
Advanced degree in non-STEM	2.933*	0.701	2.953*	0.754	3.263†	0.695
Expectations						
Expect to have no children	0.606	1.812*	0.550†	1.750*	0.581	1.425
Expect to marry after 30 or never marry	0.596	1.210	0.434*	1.226	0.416*	1.554
Gender orientation	0.858	1.254	0.919	1.242	0.948	1.031
Marital Status and Children						
Married	0.760	0.915	0.899	0.910	0.919	1.604
Got married between t1 and t2	1.714†	1.169	1.836*	1.128	1.972*	0.858
Had first child in t2	0.499	0.670	0.494	0.702	0.546	0.906
Had second or higher-order child in t2	0.700	0.473	0.508	0.518	0.538	0.557
Spouse Characteristics						
Spouse works in field			0.301**	0.839	0.302**	0.833
Number of hours spouse works above 40/week			1.017	1.013	1.016	0.999
Job Characteristics						
Job tenure (in years)	0.925*	0.880**	0.926*	0.865**	0.924*	0.884**
Indicator for first year on the job	1.734†	1.453†	1.875†	1.452†	1.628	1.093
Very satisfied with job			0.874	0.664*	0.785	0.729†
Log of annual earnings			1.059	1.008	1.071†	1.025
Hours worked above 40 hours/ week			1.016	0.997	1.022	0.993
Employer offers parental leave					0.614*	0.560**
Flexible work hours					0.934	1.357
Hours worked at home					0.989	1.016
Number of Observations	915	4,078	864	3,834	825	3,641

Source: NLSY79 sample of college-educated individuals who ever work in a STEM or professional occupation.

Note:

*** indicates significance at .001 level,

** .01 level,

* .05 level,

† .10 level.

Underlined terms indicate values are significantly different between STEM women and women in professional jobs at the *p* < .05 level.

Appendix B2

Stepped Multinomial Regressions Predicting Exits Out of the Labor Force, STEM Women Compared to Women in Professional Jobs, Odds-Ratios

	Block 1		Block 2		Block 3	
	STEM	**Professional/ Managerial**	**STEM**	**Professional/ Managerial**	**STEM**	**Professional/ Managerial**
Number of person-years contributed	1.155†	1.015	1.272	1.005	1.235	1.004
Calendar year	1.074	0.930	1.020	0.963	1.025	0.931
Age	0.913	1.116†	0.955	1.052	0.842	0.987
Education						
STEM major	0.965	1.110	1.046	1.223	0.671	1.238
Business, social science, health major	0.890	0.809	0.903	0.785	0.841	0.767
Advanced degree in STEM	1.988	n/a	7.657	n/a	7.168	n/a
Advanced degree in non-STEM	1.460	0.931	1.255	1.011	1.022	1.030
Expectations						
Expect to have no children	0.000***	0.799	0.000***	0.922	0.000***	1.290
Expect to marry after 30 of never marry	1.200	0.651	1.205	0.575	3.020	0.607
Gender orientation	0.578	0.962	0.647	1.073	0.629	1.020
Marital Status and Children						
Married	4.915*	1.600	10.398*	0.982	16.011*	0.753
Got married between t1 and t2	0.259*	1.512	0.134*	1.843	0.077†	1.943
Had first child in t2	2.528	1.883	1.549	2.009†	2.437	1.721
Had second or higher-order child in t2	7.438**	2.617**	5.186†	2.461*	6.443	2.458*
Spouse Characteristics						
Spouse works in field			0.000***	1.040	0.000***	1.025

	Block 1		Block 2		Block 3	
	STEM	Professional/ Managerial	STEM	Professional/ Managerial	STEM	Professional/ Managerial
Number of hours spouse works above 40/week			1.094**	1.053***	1.090**	1.045***
Job Characteristics						
Job tenure (in years)	0.842	0.911*	0.848	0.919†	0.881	0.948
Indicator for first year on the job	<u>1.900</u>	<u>0.286</u>*	<u>2.085</u>	<u>0.305</u>†	0.896	0.318†
Very satisfied with job			0.369†	0.796	0.425	0.792
Log of annual earnings			0.827*	0.878***	0.833†	0.907***
Hours worked above 40 hours/ week			0.798†	0.901*	0.917	0.911*
Employer offers parental leave					0.398	0.363***
Flexible work hours					0.625	0.458**
Hours worked at home					1.012	0.987
Pseudo *R*-squared	0.121	0.105	0.168	0.134	0.195	0.217
Number of Observations	915	4,078	864	3,834	825	3,641

Source: NLSY79 sample of college-educated individuals who ever work in a STEM or professional occupation.

Note:

*** indicates significance at .001 level,

** .01 level,

* .05 level,

† .10 level.

Underlined terms indicate values are significantly different between women in STEM and women in professional jobs at the $p < .05$ level.

Appendix C

Occupation in Next Time Period for Individuals Who Transition Out of Their Career Field, in Person-Years

	STEM Job Years		Professional Job Years	
	Number of Observations	Share of Sample (%)	Number of Observations	Share of Sample (%)
Non-professional, non-STEM occupation	145	50.3	205	85.2
Computer specialists	0	0.0	3	1.2
Life and physical sciences	0	0.0	5	2.1
Engineering and science technicians	0	0.0	6	2.5

	STEM Job Years		Professional Job Years	
	Number of Observations	Share of Sample (%)	Number of Observations	Share of Sample (%)
Other technicians	0	0.0	4	1.6
Financial operators	14	4.9	0	0.0
Physicians, dentists, etc.	3	1.0	0	0.0
Dietitians, therapists, etc.	2	0.7	0	0.0
Health technologists	11	3.8	0	0.0
Social scientists	10	3.5	0	0.0
Post-secondary professors (social sciences)	6	2.1	0	0.0
Managers and administrators	60	20.8	0	0.0
Nurses	2	0.7	0	0.0
Lawyers	2	0.7	0	0.0
Teachers, non-university	33	11.5	18	7.4
Total	288	100.0	244	100.0

References

Allison, Paul D. Survival Analysis Using the SAS System: A Practical Guide. Cary, NC: SAS Institute; 1995.

Babcock, Linda; Laschever, Sara. Women Don't Ask: Negotiation and the Gender Divide. Princeton, NJ: Princeton University Press; 2003.

Bailyn, Lotte. Academic Careers and Gender Equity: Lessons Learned from MIT. Gender, Work, and Organization. 2003; 10(2):137–53.

Barrow, Lisa. An Analysis of Women's Return-to-Work Decisions Following First Birth. Economic Inquiry. 1999; 37(3):432–51.

Blau, Francine D.; Kahn, Lawrence M. NBER Working Paper 18702. National Bureau of Economic Research; 2013. Female Labor Supply: Why Is the US Falling Behind?.

Cech, Erin; Brian, Rubineau; Susan, Silbey; Carroll, Seron. Professional Role Confidence and Gendered Persistence in Engineering. American Sociological Review. 2011; 76:641–66.

Ceci, Stephan J.; Williams, Wendy M. Understanding Current Causes of Women's Underrepresentation in Science. Proceedings of the National Academy of Sciences of the United States of America. 2011; 108(8):3157–62. [PubMed: 21300892]

Cha, Youngjoo. Reinforcing Separate Spheres: The Effect of Spousal Overwork on Men's and Women's Employment in Dual-Earner Households. American Sociological Review. 2010; 75:303–29.

Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering. Washington, DC: National Academies Press; 2006. Committee on Maximizing the Potential of Women in Academic Science and Engineering (US) & Committee on Science Engineering and Public Policy (US).

Correll, Shelley J. Gender and the Career Choice Process: The Role of Biased Self-Assessments. American Journal of Sociology. 2001; 106:1691–730.

Fouad, Nadya; Romila, Singh. Stemming the Tide: Why Women Leave Engineering, Executive Summary. University of Wisconsin; Milwaukee: 2011.

Gardecki, Rosella; Neumark, David. Order from Chaos? The Effects of Early Labor Market Experiences on Adult Labor Market Outcomes. Industrial and Labor Relations Review. 1998; 51(2):299–322.

Glass, Jennifer L.; Beth Estes, Sarah. The Family Responsive Workplace. Annual Review of Sociology. 1997; 23:289–313.

Goldin, Claudia. The Quiet Revolution that Transformed Women's Employment, Education, and Family. AEA Papers and Proceedings; May: 1–21; 2006.

Goldin, Claudia; Katz, Lawrence F. The Cost of Workplace Flexibility for High-Powered Professionals. Annals of the American Academy of Political and Social Science. 2011; 638:45–67.

Gray, Mia; James, Al. Connecting Gender and Economic Competitiveness: Lessons from Cambridge's High-Tech Regional Economy. Environment and Planning A. 2007; 39(2):417–36.

Gunter, Ramona; Stambach, Amy. Differences in Men and Women Scientists' Perceptions of Workplace Climate. Journal of Women and Minorities in Science & Engineering. 2005; 11(1):97–116.

Herr, Jane; Wolfram, Catherine. NBER Working Paper No 14717. National Bureau of Economic Research; 2009. Work Environment and 'Opt-Out' Rates at Motherhood across High-Education Career Paths.

Hewlett, SA.; Buck Luce, C.; Servon, LJ.; Sherbin, L.; Shiller, P.; Sosnovich, E.; Sumberg, K. Harvard Business Review Research Report. Harvard Business Publishing; 2008. The Athena Factor: Reversing the Brain Drain in Science, Engineering, and Technology.

Hill, Catherine; Corbett, Christianne; St Rose, Andresse. Why So Few? Women in Science, Technology, Engineering, and Mathematics. Washington, DC: American Association of University Women; 2010.

Hunt, Jennifer. NBER Working Paper No 15853. National Bureau of Economic Research; 2010. Why Do Women Leave Science and Engineering?.

Jovanovic, Boyan. Job Matching and the Theory of Turnover. Journal of Political Economy. 1979; 87(5):972–90.

Long, Scott J. From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers. Washington, DC: National Academies Press; 2001. National Research Council (US) Committee on Women in Science and Engineering, and National Research Council (US) Panel for the Study of Gender Differences in the Career Outcomes of Science and Engineering PhDs.

Mare, Robert; Schwartz, Christine R. Trends in Educational Assortative Marriage from 1940 to 2003. Demography. 2005; 42(4):621–46. [PubMed: 16463914]

Mason, Mary Ann; Goulden, Marc. Do Babies Matter? The Effect of Family Formation on the Lifelong Careers of Academic Men and Women. Academe. 2002 Nov-Dec;88(6)

Monosson, Emily. Motherhood, the Elephant in the Laboratory: Women Scientists Speak Out. Ithaca, NY: ILR Press/Cornell University Press; 2008.

Morgan, Laurie A. Is Engineering Hostile to Women? An Analysis of Data from the 1993 National Survey of College Graduates. American Sociological Review. 2000; 65(2):316–21.

Morgan, Stephen L.; Gelbgiser, Dafna; Weeden, Kim A. Feeding the Pipeline: Gender, Occupational Plans, and College Major Selection. Social Science Research. 2013. Available online at http://dx.doi.org/10.1016/j.ssresearch.2013.03.008

Moss-Racusin, Corinne A.; Dovidio, John F.; Brescoll, Victoria L.; Graham, Mark J.; Handelsman, Jo. Science Faculty's Subtle Gender Biases Favor Male Students. PNAS (Proceedings of the National Academy of Sciences of the United States of America). 2012; 109(41):16474–9.

Percheski, Christine. Opting Out? Cohort Differences in Professional Women's Employment Rates from 1960 to 2005. American Sociological Review. 2008; 73(3):497–517.

Preston, Anne E. Leaving Science: Occupational Exit from Scientific Careers. New York: Russell Sage Foundation; 2004.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Ridgeway, Cecilia L. Framed by Gender: How Gender Inequality Persists in the Modern World. Oxford, UK: Oxford University Press; 2011.

Robinson, J Gregg; McIlwee, Judith S. Men, Women, and the Culture of Engineering. Sociological Quarterly. 1991; 32:403–21.

Sassler, Sharon; Levitte, Yael; Glass, Jennifer L.; Michelmore, Katherine M. Working paper. Cornell University; 2012. The Missing Women in STEM? Accounting for Gender Differences in Entrance into STEM Occupations.

Shafer, Emily F. Wives' Relative Wages, Husbands' Paid Work Hours, and Wives' Labor Force Exit. Journal of Marriage and Family. 2011; 73:250–63.

Shauman, Kimberlee A.; Noonan, Mary C. Family Migration and Labor Force Outcomes: Sex Differences in Occupational Context. Social Forces. 2007; 85(4):1735–64.

Smith-Doerr, Laurel. Women's Work: Gender Equality versus Hierarchy in the Life Sciences. Boulder, CO: Lynne Rienner Publishers; 2004.

Stephan, Paula E.; Levin, Sharon G. Leaving Careers in IT: Gender Differences in Retention. Journal of Technology Transfer. 2005; 30(4):383–96.

Stone, Pamela. Opting Out? Why Women Really Quit Careers and Head Home. Berkeley, CA: University of California Press; 2007.

Williams, Joan. Unbending Gender: Why Family and Work Conflict and What to Do about It. New York: Oxford University Press; 2000.

Williams, Wendy; Ceci, Stephen. When Scientists Choose Motherhood. American Scientist. 2012; 100:138–45. [PubMed: 24596430]

Xie, Yu; Killewald, Alexandra A. Is American Science in Decline?. Cambridge, MA: Harvard University Press; 2012.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

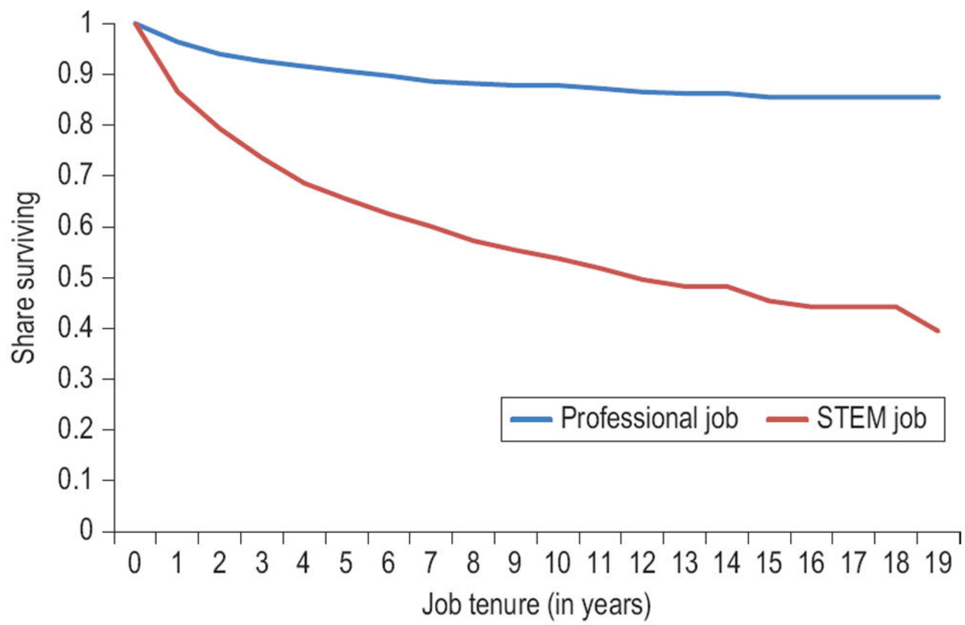

Figure 1. Kaplan–Meier survival estimates of all exits out of career field or labor force, by job type and tenure

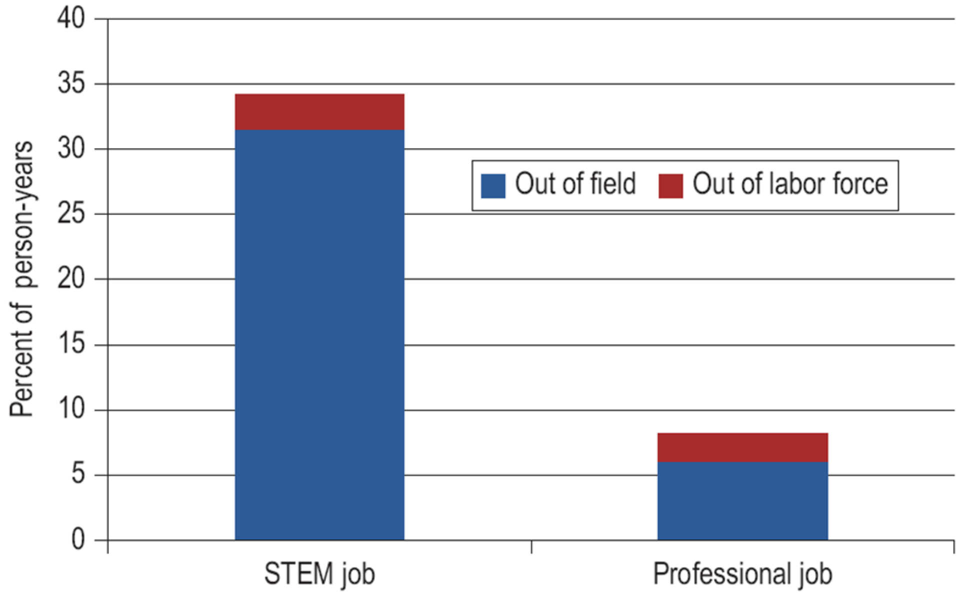

Figure 2. Percent of person-years that end in job exits by field, 1979 NLSY women, college graduates

Table 1
Distribution of Occupations, STEM and Professional Jobs

	STEM Job Years		Professional Job Years	
Occupation	**Number of Observations**	**Share of Sample (%)**	**Number of Observations**	**Share of Sample (%)**
Computer specialists (IT)	432	47.2	0	0.0
Life and physical sciences	85	9.3	0	0.0
Mathematical specialists	11	1.2	0	0.0
Engineers	135	14.8	0	0.0
Engineering and science technicians	153	16.7	0	0.0
Other technicians	62	6.8	0	0.0
Farm managers	1	0.1	0	0.0
Financial operators	0	0.0	833	20.4
Physicians, dentists, etc.	0	0.0	186	4.6
Dietitians, therapists, etc.	0	0.0	261	6.4
Health technologists	0	0.0	294	7.2
Social scientists	0	0.0	138	3.4
Post-secondary professors	36	3.9	94	2.3
Managers and administrators	0	0.0	1,408	34.5
Nurses	0	0.0	669	16.4
Lawyers	0	0.0	195	4.8
Total	915	100.0	4,078	100.0

Source: NLSY79 sample of college-educated women who ever work in a STEM or professional occupation.

Table 2

Descriptive Statistics: Differences between STEM Jobs and Professional/Managerial Jobs, by Person-Year Observations

	Overall Means	
	STEM Job	**Professional/Managerial Job**
Calendar year	1991.8	1992.1
Age	30.34***	31.02
Percent remaining in field	65.8***	91.8
Percent leaving field	31.5***	6.0
Percent leaving labor force	2.7	2.2
Education		
STEM major	50.3%***	7.3%
Business, social sciences, or health major	30.3%***	66.2%
Advanced degree in STEM	2.1%***	0.4%
Advanced degree in non-STEM	3.6%***	12.7%
Expectations		
Expect to have no children	11.8%	10.7%
Expect to marry after 30 or never marry	6.1%	5.6%
Gender orientation	3.27***	3.15
Marital Status and Children		
Married	59.3%	58.9%
Married in t2	65.0%	63.6%
Had first child in t2	4.0%	4.6%
Had second or higher order child in t2	3.6%	4.5%
Spouse Characteristics		
Spouse works in field	10.3%***	6.0%
Number of hours spouse works over 40/week	2.31***	3.11
Job Characteristics		
Job tenure (in years)	4.010	3.848

	Overall Means	
	STEM Job	Professional/Managerial Job
Share of occupation held by women	30.2%***	53.5%
Indicator for first year on the job	8.3%	9.3%
Very satisfied with job	52.1%	52.1%
Annual earnings	$29,688	$28,265
Hours worked above 40/week	2.219***	3.162
Share with parental leave	78.3%	75.4%
Flexible work hours[a]	65.6%***	59.1%
Hours worked at home[a]	1.52***	2.07
Number of people	258	826
Number of person-years	915	4161

Source: NLSY79 sample of college-educated women who ever work in a STEM occupation or professional occupation.

[a]Flexible work hours and hours worked at home were only asked starting in 1989, so missing data comes from respondents who were working between 1979–1988.

***$p < .01$

Table 3

Odds-Ratios for Multinomial Logistic Regressions, Women in STEM and Professional Occupations

	STEM		Professional	
	Left STEM	**Out of Labor Force**	**Left Field**	**Out of Labor Force**
STEM job				
Number of person-years contributed	0.983	1.272	1.005	1.005
Calendar year	0.960	1.020	1.036	0.963
Age	0.999	0.955	0.847***	1.052
Education				
STEM major	0.241***	1.046	0.670	1.223
Business, social science, health major	0.515*	0.903	0.301***	0.785
Advanced degree in STEM	2.655†	7.657	n/a	n/a
Advanced degree in non-STEM	2.953*	1.255	0.754	1.011
Expectations				
Expect no kids	0.550†	0.000***	1.750*	0.922
Expect to marry after 30 or never marry	0.434*	1.205	1.226	0.575
Gender orientation	0.919	0.647	1.242	1.073
Marital Status and Children				
Married	0.899	10.398*	0.910	0.982
Got married t1–t2	1.836*	0.134*	1.128	1.843
Had first child in t2	0.494	1.549	0.702	2.009†
Had second or higher-order child in t2	0.508	5.186†	0.518	2.461*
Spouse Characteristics				
Spouse works in field	0.301**	0.000***	0.839	1.040
Number of hours spouse works above 40/week	1.017	1.094**	1.013	1.053***
Job Characteristics				
Job tenure (in years)	0.926*	0.848	0.865**	0.919†

	STEM		Professional	
	Left STEM	Out of Labor Force	Left Field	Out of Labor Force
Indicator for first year on the job	1.875†	2.085	1.452†	0.305†
Very satisfied with job	0.874	0.369†	0.664*	0.796
Log of annual earnings	1.059	0.827*	1.008	0.878***
Hours worked above 40 hours/week	1.016	0.798†	0.997	0.901*
Pseudo *R*-squared	0.164		0.130	
Number of Observations	864		3,834	

Source: NLSY79 sample of college-educated women who ever work in a STEM or professional occupation.

Note: Underlining indicates significant difference between leaving the field and leaving the labor force.

*** $p < .001$

** $p < .01$

* $p < .05$

† $p < .10$

Table 4

Pooled Multinomial Logistic Regressions for Women in STEM and Professional Occupations

	Pooled STEM and Professional	
	Left Field	**Out of Labor Force**
STEM job	9.067***	1.440
Number of person-years contributed	0.985	1.027
Calendar year	1.000	0.975
Age	0.914**+	1.029
Education		
STEM major	0.236***−	1.016
Business, social science, health major	0.367***	0.787
Advanced degree in STEM	2.663	0.972
Advanced degree in non-STEM	1.016+	1.011
Expectations		
Expect no kids	1.185−	0.635−
Expect to marry after 30 or never marry	0.807	0.670
Gender orientation	1.043	1.005
Marital Status and Children		
Married	0.885	1.389+
Got married between t1 and t2	1.409	1.098−
Had first child in t2	0.645	1.957†
Had second or higher-order child in t2	0.522†	2.733**
Spouse Characteristics		
Spouse works in field	0.514*−	0.753−
Number of hours spouse works above 40/week	1.011	1.056***
Job Characteristics		
Job tenure (in years)	0.911***	0.908*
Indicator for first year on job	1.584*	0.522 +

NIH-PA Author Manuscript
NIH-PA Author Manuscript

	Pooled STEM and Professional	
	Left Field	**Out of Labor Force**
Very satisfied with job	0.725**	0.721
Log of annual earnings	1.029	0.872***
Hours worked above 40 hours/week	1.003	0.898*
Pseudo *R*-squared		0.1815
Number of Observations		4,698

Source: NLSY79 sample of college-educated women who ever work in a STEM or professional occupation.

Note: +/− indicates that STEM jobs are significantly more (+) or less (-) likely to leave their job than non-STEM jobs. Underlining indicates significant difference between leaving the field and leaving the labor force.

*** $p < .001$

** $p < .01$

* $p < .05$

† $p < .10$