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The missing women in STEM? Assessing gender differentials in the factors associated with transition to first jobs

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Abstract

Women remain underrepresented in the STEM workforce. We assess explanations for women's underrepresentation in STEM jobs, focusing on a cohort that came of age in the 1980s and 1990s, when women dramatically increased their representation in the scientific labor force. Data are from the NLSY79, and our analysis focuses on members of this cohort who received a college degree, with an emphasis on those who completed a degree in a STEM field. Our analyses test the extent to which college major, expectations to work in STEM, and family expectations shaped transitions into STEM occupations within two years of degree completion. Among those majoring in STEM fields there were no gender differences in transitioning into STEM jobs, though there were sizable differences in transitions to STEM employment by field of study. Of note are gender differences in associations between family expectations and transitions into STEM employment. The most career oriented women, who expected to marry late and limit fertility, were no more likely to enter STEM jobs than were women who anticipated marrying young and having two or more children. The men most likely to enter STEM occupations, in contrast, adhered to significantly more conventional gender ideologies than their female counterparts, expecting to marry at younger ages but also to remain childless. Results of our regression decomposition indicated that marriage and family expectations and gender ideology worked in opposite directions for men and women. Nonetheless, the majority of the gender disparity in transitions into STEM jobs was related to women's underrepresentation in engineering and computer science fields of study.

Keywords

Gender; STEM; Employment; Family and work; Values; Expectations; Intentions

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The underrepresentation of women in the science, technology, engineering, and mathematics (STEM) workforce is increasingly salient to policy makers (e.g. Committee on Maximizing the Potential of Women, 2006; Committee on Prospering in the Global Economy of the 21 st Century, 2007). American women's graduation rates in STEM fields have increased substantially over the last three decades. In 1980, women were awarded 37.2% of all bachelor's degrees in the fields of science and engineering; as of 2010, they received 50.3% of all bachelor's degrees in those fields (National Science Foundation, 2013; Table 3).[1] Yet women's representation in the STEM workforce lags behind their educational gains (Xie and Shauman, 2003). Despite increases in the proportions of women working in natural science and biology, in other occupations women's share of employment has grown only marginally (Michelmore and Sassler, 2016). As of 2013 women accounted for only 12% of all engineers in the country (Corbett and Hill, 2015). And in some rapid growth occupations, such as computer science, women's representation has actually declined in recent years (Corbett and Hill, 2015; Michelmore and Sassler, 2016). Women's continued underrepresentation in well-paid, high demand, prestigious STEM fields perpetuates occupational segregation and contributes to the gender wage gap.

The decline in women's representation throughout their STEM education and professional careers has been coined the “leaking pipeline.”[2] While math and science course-taking has been studied extensively, researchers less often explore the crucial transition from college completion into the STEM labor force. The exception has been work by Xie and colleagues, who apply a life course perspective to the study of women in science (Xie and Killewald, 2012; Xie and Shauman, 2003). They document increases in women's employment in STEM occupations from the mid-1970s to the late 1980s. A burgeoning literature has explored the barriers reported by women in STEM occupations, and factors associated with women's exit from the STEM labor force (Bilimoria et al., 2008; Frehill, 1997; Glass et al., 2013; Miller, 2004; Singh et al., 2013). Studies such as those cited above, however, have generally focused on the retention of women already employed in STEM occupations. A key point in the pipeline – the transition from degree completion into a STEM profession – has received far less attention.

Among women who graduate with degrees in STEM fields, what factors determine employment in STEM occupations? We study women who came of age during the flowering of Second Wave Feminism in the 1980's and early 90's; their full progression through educational institutions and into employment is now visible. Although the experiences of recent college graduates, especially women degree recipients, no doubt differ from the cohort we study, there are intimations that some of the challenges they face in the labor market are not markedly different. Progress in narrowing both occupational segregation and the gender wage gap has been slow (Blau and Kahn, 2007; Mandel & Semyonov, 2014; Michelmore and Sassler, 2016), and while the proportion of women employed in STEM has

[1]Women's representation remains lowest in high growth areas such as engineering and computer science. Women received only 18.4% of bachelors' degrees awarded in engineering in 2010, and in mathematics and computer science their representation declined, from 36.4% in 1980 to 25.6% in 2010 (National Science Foundation, 2013, Table 11).
[2]Women's underrepresentation in STEM is not a global phenomenon (Charles and Bradley, 2002; Charles and Grusky, 2004). Views of occupations deemed compatible with women's roles differ in other countries. Female representation in science programs is strongest in Malaysia, Iran, Uzbekistan, Azerbaijan, Saudi Arabia, and Oman. In those countries, science majors are disproportionately female.

grown over time, recent graduates appear less likely to transition into STEM jobs following degree receipt than earlier cohorts (Xie and Killewald, 2012). Furthermore, the proportional representation of women in many STEM fields has not increased since the 1980s (DiPrete and Buchman, 2013). It is therefore particularly important to assess how existing explanations account for gendered patterns in the transitions into STEM employment. In fact, others (Glass et al., 2013; Mann and DiPrete, 2013; Michelmore and Sassler, 2016; Morgan et al., 2013) have highlighted how our limited understanding of the factors perpetuating gender disparities in STEM employment challenge our ability to tease out change in the broader opportunity structure.

We utilize data from the 1979 National Longitudinal Surveys of Youth (NLSY79) to explore transitions into the labor force of young adults who received a baccalaureate degree. This was the first cohort for whom college completion was more likely among women than men (Buchman and DiPrete, 2006). Graduates also began their careers in the early 1980s, when women's job opportunities were expanding, and when considerable gains in female representation in STEM baccalaureates fields were made (Xie and Killewald, 2012). We begin by reviewing existing exlanations of women's underrepresentation in STEM employment, then present our own empirical results. Our analysis extends prior research by incorporating indicators of young adult's values, expectations, and intentions. We use regression decomposition techniques to investigate what factors account for gender disparities in transitions into STEM employment. Our results highlight the need to better interrogate long-accepted views regarding the association between women's and men's family and work values and actual employment outcomes.

1. Understanding women's underrepresentation in STEM occupations

During the 1970 and early 1980s, women dramatically increased their representation in the scientific labor force (Robinson and McIlwee, 1989; Xie and Killewald, 2012). Yet they remain significantly underrepresented in that workforce, despite the surge of women into other demanding professions such as law and medicine that continues unabated. Opportunities in science related occupations have grown rapidly, and offer high starting salaries for bachelor's degree recipients (Michelmore and Sassler, 2016; Xie and Killewald, 2012), yet sizable and significant gender wage gaps among women working in STEM occupations persist (Michelmore and Sassler, 2016). Furthermore, particular STEM fields remain highly segregated by sex (Michelmore and Sassler, 2016), highlighting ways in which the labor market is structured by gender (Ridgeway, 2011; Tomaskovic-Devey et al., 2006).

Various explanations have been offered for women's underrepresentation in STEM occupations. Among the most common is that women demonstrate less interest in STEM topics, and therefore are less likely to invest in the educational credentials necessary to work in the STEM labor force. Women historically were less likely than men to take math and science classes in high school, though such gaps have narrowed in recent years (DiPrete and Buchman, 2013; Morgan et al., 2013). In the 1980s women also were less likely to major in STEM fields once in college, instead concentrating in the humanities or liberal arts (Shauman, 2006; Xie and Killewald, 2012). But among those interested in STEM, aspirations to work in science occupations were strong predictors of completing a bachelor's degree in science for both sexes (Morgan et al., 2013; Xie and Shauman, 2003). We therefore focus on the question of whether there are gender disparities in post-degree job placement among graduates completing a STEM degree. Based on the literature suggesting the challenges that face women science and engineering professionals (Moss-Racusin et al., 2012; Reuben et al., 2014; Robinson and McIlwee, 1989; Singh et al., 2013), our initial hypothesis (H1) is that women STEM graduates will be less likely to transitions into STEM occupations than their male counterparts.

Regardless of gender, there are significant field differences in the likelihood of transitioning into STEM occupations. Xie and Shauman (2003) found that engineering majors were most likely to enter STEM jobs, whereas graduates in the physical and biological sciences were the least likely to enter the STEM labor force. Others have also suggested that even as the numbers of women majoring in and completing degrees in STEM have increased, women and men differ in how they link college majors to occupational transitions and post-bachelor training, with women more likely to select the biological sciences as a jump-off point for later career decisions outside of narrowly defined STEM fields (Mann and DiPrete, 2013). This suggests field differences in interest in ultimately working in STEM jobs that may be reflected in the initial transition from school into full-time employment. Building on this research, we therefore hypothesize (H2) that transitions into STEM occupations will be most likely among Engineering majors, and lowest among those who graduated with degrees in the hard or life sciences, regardless of gender.

Other explanations for the dearth of women in many STEM occupations point to gender differences in employment expectations, the role of gender ideology in shaping women's and men's notions of desirable or feasible employment given other long-term goals, and the impact of professional role confidence in educational and occupational persistence. Gender scholars have long asserted that attitudes regarding family roles shape women's pursuits in important ways (Bridges, 1989; Okamato and England, 1999). Among young adults coming of age in the last quarter of the 20th century, attitudes towards family obligations and maternal employment were not only associated with school investments and career decisions (Michelmore and Musick, 2014; Okamoto and England, 1999), but also predicted their work hours and earnings (Cha and Weeden, 2014; Corrigall and Konrad, 2000). Others have noted that women's confidence in their ability to fulfill the roles, competencies, and requirements of being a STEM professional results in a diminished likelihood they will persist in STEM training and make the transition into STEM jobs relative to men (Cech et al., 2011).

But whether attitudes will shape employment transitions among those who have invested in obtaining a bachelor's degree in STEM is less well understood. The perception that women will prioritize family over career commitments is quite prevalent in the popular press, and various scholars continue to assert that persistent differences in labor market behaviors are attributable to gender differences in life goals and the relative importance assigned to careers (Ceci and Williams, 2011; Hakim, 2000, 2006; Summers, 2005). According to this perspective, the discrepancy between men's and women's willingness to prioritize work demands over family obligation results in their divergent career paths (Ceci and Williams, 2011; Ferriman et al., 2009; Hakim, 2000, 2003),[3] with women far more likely to be prioritize family life and children than men, while men are far more likely to prioritize employment throughout the life course (Hakim, 2002). Existing research has not, however, established that employment aspirations or gender ideology strongly influence the gender gap in either field of study, occupational choice, or earnings (Frehill, 1997; Hakim, 2002, 2003; Mann and DiPrete, 2013). Hakim (2000, 2002, 2003), for example, found that lifestyle preferences had little impact on women's choice of occupation. Morgan and colleagues (Morgan et al., 2013) and Cech and colleagues (Cech et al., 2011) also find no association between work-family orientation and occupational plans or college major selection. We therefore hypothesize (H3) that women who as adolescents expressed an intention to be working in a STEM field as an adult will be as likely to transition into STEM jobs following college completion as men who expressed such intentions, and more so than women who did not hold such expectations.

The argument that women's work decisions are predominantly the result of their own choices, based on personal preferences, has been met with fierce criticism by those who challenge the assumption that women enter or exit jobs due to lower levels of commitment, or preferences for family caregiving (Crompton and Lyonette, 2005; Halrynjo and Lyng, 2009; McRae, 2003; Stahli et al., 2009). Most such studies focus on women with young children, or those who have completed childbearing (for one exception, see James, 2009). Work orientation, however, is often determined early in life, when women are making the decision to invest in their education, for example by taking advanced mathematics classes. Such decisions may consequently shape their views about whether or when to have children. Furthermore, expectations for work and employment may shape marriage and fertility timing. Studies of young adults who married between the late 1980s and early 1990s found that men who expressed more traditional gender ideologies married earlier, whereas career-oriented women were more likely to delay marriage than women who adhered more strongly to traditional gender ideology (Sassler and Schoen, 1999). If so, occupational preferences, combined with family formation intentions, may be the primary drivers of entrance into demanding STEM occupations following graduation, a time which generally precedes the challenges imposed by family obligations.[4] We therefore hypothesize that expectations to defer or forego marriage and limit fertility should be associated with increased likelihood of entering into STEM employment, especially for women (H4). Such intentions signal that these women are “ideal workers” with no immediate plans to assume the limiting family obligations burdening other women. Because men have not been hampered by expectations that parenting or marriage will affect their career commitment, we do not expect similar associations between their family preferences and employment transitions.[5]

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[3]Women may select particular fields of study because they believe it will be easier to combine work in that area with marriage and childbearing (Becker, 1981). Critics have pointed out that little evidence supports this presumption (England, 1982; Glass, 1990). Predominantly female occupations have no more flexibility in scheduling work hours than more gender balanced occupations (Glass and Camarigg, 1992).

[4]In fact, relying on completed fertility raises problems of causal ordering. Women who experienced barriers in the labor market may have shifted towards home-centeredness and therefore ended up with higher completed fertility. Positive labor force experiences, on the other hand, may have elevated women's labor force commitment, and resulted in marital delay and lower completed fertility. For a discussion of how workplace experiences shape family behaviors (and, subsequently, attitudes), see Gerson (1985). Other researchers have relied on work plans, which are significant independent predictors of actual work behavior (Shaw and Shapiro, 1987), to avoid endogeneity.

[5]Research on a recent cohort of scientists in graduate school and post-doctoral fellowships found that men were also negatively affected by long term work expectations and occupational decision making (Ecklund and Lincoln, 2011). Young male scientists who

Relying on women's preferences in predicting employment paths is viewed by many scholars as too essentialist (Halrynjo and Lyng, 2009; Stahli et al., 2009), given that gendered expectations (by employers, coworkers, and partners) result in women's preferences having less power in the labor market than men's. If this is true, even the most gender egalitarian women and men will find that their preferences matter less than their experiences in the labor market. But ideologies about who should deal with whatever family care obligations arise in the future may matter for initial occupational entry. We therefore test the extent to which young men's and women's gender ideology is associated with transitions into STEM occupations following college completion, expecting that adherence to liberal gender ideology will be associated with transitioning into STEM jobs for women, but perhaps the opposite for men who anticipate traditional breadwinning roles that will not compete with time-intensive STEM jobs. (H5).

The alternative explanation for women's underrepresentation in STEM occupations focuses on a demand side explanation, employer discrimination. Expectations theory (Ridgeway, 2011) posits that the expectations, or cognitive biases, of employers results in implicit bias in evaluations that may hinder women from receiving initial job offers or subsequent promotions, creating and strengthening segregated job networks, and fomenting interpersonal resentment toward women in work teams. Kmec (2011), for example, found that perceptions of women's competence and commitment to the labor force were shaped by “maternal profiling” (see also Correll et al., 2007), where women's abilities were downgraded because they were all perceived as potential mothers. Perceptions that women are less capable or hirable workers remain prevalent, demonstrated by recent work showing bias in assessments of women's competence and qualification for STEM employment, and recommendations that women in STEM receive lower pay than their male counterparts (Moss-Racusin et al., 2012; Reuben et al., 2014). We cannot directly test the presence of discrimination in our data; we do, however, suggest that any gender differences in the association between expectations to work in STEM, limit fertility, or delay marriage, and actual transitions into STEM employment suggest the ongoing operation of gender discrimination in the labor market.

1.1. Other factors shaping gender differentials in STEM employment

Other important factors influence employment transitions as well, particularly the influence of role models and mentors. Parents may encourage children to follow their occupational footsteps, so having a parent employed in STEM may enhance occupational entry (though this may be more true for men than women; see Egerton, 1997). Racial and nativity disparities in those studying science and engineering have long been evident (Ma, 2011; Sana, 2010; Xie and Killewald, 2012), with Blacks and Hispanics underrepresented among those with degrees in STEM fields. In contrast, Asian women and men, as well as the foreign-born, are overrepresented among both college graduates and in the sciences (Sana, 2010; Xie and Killewald, 2012). Accordingly, the lack of role models suggests underrepresented groups will be less likely to make the transition from college graduation

had not reached their desired number of children were more likely to plan to exit science entirely than men who had attained their fertility desires, as well as women who have not reached their fertility goals.

into STEM employment, while those from groups better represented among STEM graduates (i.e., the foreign born) will be more likely to enter into a STEM job.

2. Research strategy

We model the factors predicting entry into STEM occupations following college completion, initially modeling the likelihood that all college graduates enter into STEM jobs and then focusing on the select group of respondents who completed a college degree in a STEM field. Next, we use regression decomposition techniques to examine whether men's and women's attributes affect occupational transitions in similar fashion. This approach enables us to determine the impact of gender differences in measured characteristics (such as family-size preferences) on the gender gap in occupational transitions into STEM jobs, as well as the impact of gender differences in the effect of those attributes (often termed the “unexplained” gap).

3. Methods

3.1. Data and sample

Data for our analyses come from the 1979 National Longitudinal Surveys of Youth (NLSY79). The NLSY employed a multistage stratified random sampling design to construct a representative sample of the population of youth age 14 to 22 residing in the U.S. on January 1, 1979. Data were first collected in 1979 and respondents were re-interviewed annually through 1994 and biennially from 1996 to the present. Response rates for the initial interview of the NLSY79 were high (87%) and retention rates have ranged from 77.5% to 96.1%. A particular strength of the NLSY79 is the availability of information on young adults’ gender orientation and work aspirations during adolescence, detailed information on their fields of study in college, and occupational pursuits over time.

Our sample is restricted to men and women who completed a Bachelor's degree. Among respondents in the NLSY, 21.5% of the NLSY sample completed college. Women college graduates outnumbered men in the NLSY79 (Buchman and DiPrete, 2006). Our sample includes 1258 women and 1115 men, of which 163 women and 353 men completed degrees in a STEM field. Because we are using data from multiple waves and respondents completed their degrees at different time points, weights for the descriptive analyses were generated using a custom weights calculator provided by the NLSY staff to adjust for multiple years of analysis; our multivariate analyses are also weighted.[6]

3.2. Measures

We measure our *dependent variable*, entering a STEM occupation vs. working in other types of jobs, in the two survey years following the completion of a college degree; this approach is consistent with others (e.g., Xie and Shauman, 2003; Xie and Killewald, 2012). We rely on the 1970, 1980, and 2002 Census Occupational Classification Codes to determine whether respondents entered a STEM occupation within two years of college completion. Respondents in a particular set of occupations (detailed in Appendix A) are classified as

[6]Results from unweighted models show no major differences from weighted models.

STEM workers, and include: computer specialists, engineers, mathematical specialists, life and physical scientists, post-secondary professors, and engineering and science technicians. Not all college graduates enter directly into the work force; we group those who pursue graduate work in STEM following college completion with those who enter the STEM labor force, to be consistent with other studies (e.g., Sana, 2010).[7]

Our primary *independent variables* enable us to test the hypotheses drawn from the literature and include indicators of field of study, near term expectations to work in STEM, fertility and marriage expectations measured in adolescence, and a measure of gender ideology. Our indicators for field of study in college were based on an NLSY question about respondents' majors during school and upon college completion,[8] which enabled us to assign codes for major fields of study and subspecialties. Those who majored in a STEM field were classified as a STEM major. Individuals who reported majoring in multiple areas were assigned their most recent major.

The disciplinary STEM major areas were disaggregated into the life sciences, physical sciences, computer and information sciences, and engineering. A detailed description of all the subfields in our broad categories can be found in Appendix B. The remaining non-STEM majors included health, general studies, architecture and environmental design, area studies, business and management, communications, education, fine and applied arts, foreign languages, home economics, law, letters, library science, psychology, public affairs and services, social sciences, theology, and interdisciplinary studies.

Our indicators of expectations for work and family in the future are based on questions asked at the initial interview, when respondents were adolescents. Our measure of work intentions was based on a question about the occupation respondents expected to hold within 5 years; we then constructed a variable that captured those with expectations to work in a STEM job in the near term. An additional question asked about occupational expectations at age 35, and identified those who planned to be in the paid labor force in mid-life.[9]

Our indicators of family expectations were based on questions asked of respondents at their initial interview (in 1979), when they were adolescents. Our measure of marriage expectations was based on a question on what age respondents' thought they would marry;

[7]This is also the practice of data collections such as the National Survey of College Graduates. Only 52 respondents (and only 11 women) entered graduate school in a STEM field within the first two years of college completion. Results excluding those pursuing graduate school immediately after college are similar to those presented. We also created a trichotomous outcome (entered a STEM occupation, pursued graduate study in a STEM field, relative to worked or pursued graduate study in a non-STEM field) to check for gender differences in transitions to STEM graduate school. The multinomial results indicated tht women from this cohort were only about 30% as likely as men to enter a STEM graduate program, relative to working in STEM or pursuing graduate training in a non-STEM field.

[8]This variable was obtained in various waves of the data, as respondents entered and completed college in different years, depending upon their age at the initial interview and their tempo through the post-secondary system.

[9]We compared short term (within the next 5 years) and long term (at age 35) occupational expectations. Among those who desired to work in STEM occupations, short-term expectations were significantly associated with subsequent employment transitions into STEM for both women and men; longer term expectations (measured at age 35) were only significant for men. We therefore elected to utilize the short term indicator. We also conducted a supplementary analysis of factors shaping expectations to work in STEM, controlling for age at the initial interview, gender ideology, family structure, number of siblings, maternal educational attainment, and paternal STEM employment, and race/ethnicity/nativity. The youngest men (aged 14 to 16) and the men who expressed the most liberal gender ideologies were significantly less likely to expect to work in STEM jobs in the near term. Among women, the only factor to predict expectations to work in STEM was gender ideology; women who expressed the most liberal gender ideology were significantly more likely to expect to work in a STEM occupation.

the NLSY data provided several options: before age 25, between 25 and 29, late (after 30), or never. A dummy variable was constructed to differentiate those who anticipated marrying early (before 25) versus late or never, with the middle group (25–29) serving as the omitted category. We also included an indicator of fertility intentions. Respondents were asked at their initial interview (in 1979) about the number of children they expected to have. We grouped those who wanted no children or one child, and designated them as desiring to limit their fertility.

Our final measure of attitudes assesses respondents' gender ideology in 1979, when panel members were aged 14 to 21. Eight questions on beliefs regarding women's and men's responsibilities in the workforce and family are used. Responses ranged from 1 to 4, where 1 = strongly disagree, and 4 = strongly agree; we reverse coded some items so that higher values always indicate more liberal attitudes. The questions used to construct a measure of gender orientation were: 1) A woman's place is in the home, not the office or shop (reverse coded, RC); 2) A wife with a family has no time for outside employment (RC); 3) A working wife feels more useful than one who doesn't hold a job; 4) Employment of wives leads to more juvenile delinquency (RC); 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 (RC); 7) Men should share the work around the house with women; 8) Women are much happier if they stay home and take care of children (RC). 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. Cronbach's alpha for this scale was 0.703 for women and 0.704 for men.[10]

Other variables include family background, specifically whether the respondent's father worked in a STEM occupation when the respondent was 14, and maternal years of schooling. We also include socio-demographic variables: minority status (combining Black or Hispanic respondents while non-Hispanic Whites and Asians serve as the reference category), foreign-born, and time period of degree receipt. We estimated rough quartiles to capture when respondents completed their degree: completion between 1977 and 1981; 1982 and 1984 (the reference group); 1985 and 1987; and 1988 or later.[11]

Missing responses on the independent variables were imputed to avoid any selection issues. To maintain maximum sample size, all regression models were estimated using multiple imputed data in STATA (Royston, 2006). Complete information was available for most

[10]Supplementary analyses explored whether age at the time of survey differentiated responses for measures of gender ideology. Age was associated with adhering to less traditional gender ideology, though for men only the youngest (those 14 to 16) expressed significantly more conventional gender ideology than the reference (men 20 or older). For women, adherence to traditional gender ideology declines with age; the youngest (14–16) expressed considerably less liberal ideologies than those who were 21 or 22, with those in their late teens being somewhat more traditional than the oldest women interviewed. The number of siblings reduced adherence to liberal gender ideology for women and men, while increased maternal education increased liberal gender ideology for both sexes. Blacks expressed more liberal gender ideologies than whites, regardless of sex, while foreign-born men were more traditional than native born men. While younger respondents adhere to more traditional gender ideologies, their views may shift with increasing age.

[11]We also constructed variables indicating whether respondents were married or a parent (1 = married; 1 = parent) upon graduation. Age at college completion and marital status are highly correlated, as is parental and marital status, and age and parental status. Among women, the correlation coefficient for age at college completion and marital status is 0.45, between age at completion and parental status is 0.62, and between marriage and parental status was 0.43. For men, the correspondent correlations are even greater for age at college completion and marital status (0.49), and somewhat smaller for parental status (0.52). The correlation between marital and parental status is 0.64. We therefore include only year of degree receipt.

variables; imputed values replaced missing information for the gender ideology scale (n = 3), and mother's highest level of schooling (n = 63).

3.3. Analytic approach

Our initial analysis utilizes logistic regression for our dichotomous dependent variable. We analyze men and women separately, as a Chow test indicated substantive differences between model coefficients across groups, and then test for gender differences in the effect of particular independent variables on employment in STEM occupations. Our examination proceeds in three stages. First, we estimate models with college major, occupational expectations, family expectations, gender ideology, and other controls for the entire sample. We then limit our sample to STEM majors, and estimate the same models. For ease of interpretation, we present odds ratios for all these analyses. An odds ratio greater than 1.0 indicates that the odds of working in a STEM job are greater than the odds of the reference group.

Our final analysis uses a regression decomposition technique to assess the extent to which gender differences in transitions into STEM jobs can be explained by differences in the attributes of men and women. The traditional Blinder-Oaxaca decomposition separates the portion of the gap that is due to ‘explained’ differences between the two groups, and the portion due to ‘unexplained’ differences (Blinder, 1973; Oaxaca, 1973). The Blinder-Oaxaca decomposition takes the following form

$$\bar{Y}^M - \bar{Y}^W = [(\overline{X}^M - \overline{X}^W)\hat{\beta}^M] + [\overline{X}^W(\hat{\beta}^M - \hat{B}^W)]$$

where $Y^M - Y^W$ represents the gap in STEM employment between men (M) and women (W). The explained portion $((\overline{X}^M - \overline{X}^W)\hat{\beta}^M)$, is typically thought of as differences in the observed characteristics of the two groups, while the unexplained portion is considered to be attributable to differences in the returns on these characteristics $([\overline{X}^W(\hat{\beta}^M - \hat{B}^W)])$, often discussed as discrimination. We use a modification of this decomposition developed by Fairlie (2005) for non-linear models. This method relies on matching pairs of individuals from two groups and calculating average differences in transition rates between them. We randomize the ordering of variables, using an average of 500 repetitions for each decomposition.

4. Descriptive results

Means and standard deviations of the variables used in our analyses are presented in Table 1, for the total sample of college graduates and STEM majors. Male college graduates were significantly more likely to complete a degree in a STEM field than their female counterparts (Column A). While 14.8% of women from this cohort obtained a college degree in a STEM field, STEM graduates accounted for nearly one-third (32.6%) of the men who obtained college degrees. As adolescents, men were significantly more likely than women to expect to work in STEM in the near term. Men were also much more likely than women to believe they would work in STEM occupations in mid-life, though this difference was not significant.

A number of gender differences in family expectations and gender ideology were observed. Women were significantly more likely than men as adolescents to expect that they would both wed young and limit their fertility. Over half of women anticipated marriage before age 25, compared with only 39% of men. Men more often anticipated that they would marry in their late twenties or later.[12] But despite their inclinations towards earlier marriage, women were somewhat less traditional than men in their fertility expectations, as a significantly larger proportion of women anticipated as adolescents that they would have no children or would have only one child. Women's gender ideology was also significantly more liberal than men's. There were no significant differences by gender in our indicators of family background or ethnicity/nativity.

There were fewer significant gender differences among STEM majors (Column B) than for college graduates overall. Men remained more likely as adolescents to expect to work in a STEM field, both in the short term and at mid-career. Women STEM majors were more likely than their male counterparts to expect to have no children, while male STEM majors had more traditional gender ideologies than female STEM majors. As for how STEM majors differed from the total sample of college graduates (denoted by superscripts c and d), significantly more men and women STEM majors expected to work in STEM, though it was still a minority. Women STEM majors held more liberal gender ideologies as adolescents than did the overall sample of women college graduates, and were significantly less likely to expect to marry early. STEM majors were significantly more likely than college graduates overall to have had a father who worked in a STEM occupation, while female STEM graduates had mothers with significantly more years of schooling than the overall sample of women.

The distribution of STEM majors across fields, depicted in Table 2, highlights the small proportions of college graduates who majored in STEM fields. There are, however, important differences by field and gender. Men were significantly more likely than women to have graduated with a STEM degree in the life sciences, computer science, and engineering; the gap is largest for engineering. Only among the hard sciences (e.g., mathematics and physics) were there no significant gender differences in the proportion of college graduates.

4.1. Transitions into STEM jobs

Only small proportions of college graduates entered STEM occupations within the first two years of graduation (see Fig. 1). Men are significantly more likely to make that transition – 18.3% of all male college graduates pursued jobs in STEM fields within the first few years of college graduation, compared with only 8.5% of women college graduates. Of those graduating with a STEM degree, 41.4% of women and 53.3% of men were employed in a STEM job within two years of college completion; this difference is statistically significant. Not all college graduates who entered STEM occupations had completed a degree in a

[12]In 1980, the median age at first marriage for women was 22.0 and for men it was 24.7; by 1990, it had risen to 23.9 for women and 26.1 for men (UCSB). Of course, these averages mask considerable heterogeneity by educational attainment. The college educated in the 1980s and 1990s tended to marry later than their less educated counterparts. See http://www.census.gov/population/www/cps/cpsdef.html.

STEM field; 3% of women and 6% of men who were not STEM majors found work in STEM occupations. Even among non-STEM majors, men were significantly more likely to enter STEM jobs. These descriptive findings suggest a male advantage in transitions into STEM jobs, evident among those who majored in STEM, as well as those who did not, and supporting our first hypothesis.

We also graph the proportion of respondents in *each* major who transitioned into a STEM occupation within the first two years after graduation. In contrast to the above finding that male STEM majors were significantly more likely than women to transition into STEM occupations, there are no significant gender differences across specific STEM majors in transitions to STEM employment. The relatively low transition rates into STEM jobs for both women and men who majored in the life sciences are notable. Furthermore, only about 37% of women who majored in the hard sciences, and nearly one-half of similar men, have transitioned into STEM occupations. Transitions into related employment are much more common among those graduating with degrees in computer science and engineering, with over half to three quarters of those majors entering related jobs within two years. Transition rates were highest for women in engineering, and for men in computer science, though in neither case is the gender difference significant.

As has been noted by others (Mann and DiPrete, 2013; Xie and Shauman, 2003), a sizable proportion of those who majored in biology entered into health related fields. If health-related occupations were included in the definition of STEM,[13] the proportion of biology majors who then transitioned into a related occupation would more than triple, to 45.1% among women, while increasing to 32.6% for men. Among women who majored in the hard sciences, including health occupations increased the proportions to 45.4%, and to 55.6% among similar men. Limiting what constitutes "science" occupations to exclude health related jobs may be one way of gendering what is defined as science.

4.2. Multivariate results

The descriptive analyses suggest that some of the discrepancy in transitions into STEM occupations is attributable to sex disparities in specific STEM majors, especially the concentration of women in biological sciences. We turn now to the results of our multivariate analysis in Table 3 to determine the factors associated with transitioning into STEM occupations. We begin with the total sample of college graduates (shown in Model A), since not all who entered STEM occupations completed degrees in STEM fields. Consistent with other studies utilizing different data sources (Xie and Shauman, 2003), initial analyses (not shown) pooling men and women found that women had significantly lower odds of entering STEM occupations than men, prior to including other controls (Odds = 0.373, $p < 0.001$).

Looking first at the association of college major and transition into STEM employment provides support for Hypothesis 2, but not Hypothesis 1. After accounting for major, there was no significant gender difference in transitions to STEM occupation, but among STEM majors, engineering majors were the most likely of all college graduates to become

[13]For example, health technologists and dieticians are among the most common occupations pursued by female STEM majors.

employed in a STEM job. Of note is that the association between majoring in engineering and entering into a STEM occupation was considerably *stronger* among women than men. The few women who completed their degrees in engineering were almost 6 times more likely, and computer science graduates almost 2.5 more likely to pursue related jobs than women majoring in the hard sciences. Women and men who majored in the life sciences were significantly less likely to transitions to STEM employment than those who majored in the hard sciences. Though the odds ratios are large, men who majored in engineering and computer science were not significantly more likely to enter into STEM jobs than men who majored in the hard sciences ($p < 0.10$).

Expectations to work in STEM also operated as hypothesized (H3). Women who expected as adolescents to work in STEM are 2.5 times more likely to enter into STEM occupations following college than respondents who did not have such expectations. Although the odds are smaller and only weakly significant for men, the effect of expectations does not differ by gender. Our work extends other studies focused on college majors to early career transitions (Morgan et al., 2013; Xie and Shauman, 2003). Expectations to work in STEM occupations were strong predictors of actually doing so following completion of a bachelor's degree, particularly for women.

Since much of the literature has asserted that gender differences in transitions into STEM occupations result from women's and men's different preferences for early marriage or children (Ceci and Williams, 2011; Hakim, 2000, 2003), we assess whether gender differences in occupational transitions are reduced by focusing on women who do not expect to engage in conventional family behavior. However, we find no support for Hypothesis 4 that career oriented women who signal intentions to be “ideal workers” with few family obligations were more likely to transition into STEM employment. Women who expected to defer or forego marriage were no more likely to transition into STEM jobs than those who desired towed earlier in life. On the other hand, men who anticipated marrying young were 1.5 times more likely to be working in a STEM job following college than men who expected to marry in their late 20s. We also do not find that women who expected to limit or forego childbearing were any more likely to transition into a STEM job than women who expected to have two or more children. But gender ideology did predict later entrance into a STEM occupation, though only for women, and at weak levels of conventional significance. Overall, then, our results indicate that willingness to delay or forego normative family roles does not elevate women's likelihood of entering STEM occupations. Few of the other controls reach conventional levels of significance, though women with more highly educated mothers were significantly less likely to pursue work in STEM than those with less educated mothers or men.

These associations, however, between expectations and attitudes and transitions into STEM employment are magnified when we limit our focus to STEM majors (Models C & D of Table 3). Among STEM graduates, engineering majors showed the greatest likelihood of transitioning into STEM jobs, at least among women. Women who completed a degree in engineering had odds of entering into a STEM job that were 5.6 times larger than the odds for women who had majored in the hard sciences, while women who had majored in computer science had odds of working in a STEM occupation that were 3.8 times greater than their counterparts who had majored in hard sciences. Male engineering majors were no more likely to be working in STEM occupations within two years of college graduation than were men who majored in the hard sciences or computer sciences. Life science majors were far less likely to transition to work in a STEM occupation than hard science majors, regardless of sex. Again, there were no significant sex differences in the transition odds of those who were STEM majors, providing additional support for our second hypothesis.

The association of expectations and transitions into STEM jobs is considerably amplified among STEM graduates. Women who as adolescents expected to work in STEM had odds of entering into the STEM labor force that were 4.3 times larger than the odds for women without such clear career expectations. Career expectations were only weakly associated with transitions into STEM jobs for male STEM graduates, though the gender difference is not significant. Support for Hypotheses 3 among STEM graduates is therefore even stronger than among all college graduates. In contrast, there is no evidence that women's family expectations matter for employment transitions as hypothesized. Women STEM majors who expressed desires to defer marriage or limit childbearing were no more likely to enter STEM occupations after graduation than women who anticipated following more conventional trajectories of marriage and motherhood. In fact, those who anticipated limiting their fertility to one or no children were significantly *less* likely than men with identical expectations to enter into STEM occupations.

It is *men's* family preferences, surprisingly, that predict their entrance into demanding STEM occupations. Men who expected to marry young and limit childbearing have greater odds of working in STEM than men who expressed more conventional family expectations (odds-ratios of 2.5 and 2.7, respectively). Furthermore, the underlined coefficients for family size reveal how men's transitions into STEM occupations are advanced by desires to reduce their fertility, while not affecting women's transitions into STEM jobs. Finally, we find no evidence that gender ideology is associated with STEM majors' odds of entering into STEM jobs, for either women or men. Women STEM majors' more liberal gender ideology did not facilitate transitions into STEM employment, perhaps because of limited variation in their attitudes.

4.3. Accounting for gender differences in returns to attributes

If women were more like men, how would that influence their likelihood of transitioning into STEM employment following graduation? Our next analysis relies on regression decomposition techniques to estimate what proportion of women would have transitioned into STEM occupations had their characteristics been identical to their male counterparts. Fig. 2 depicts the simulated probabilities of entering into STEM jobs for the full sample of college graduates, generated from the regressions presented in Model A of Table 3. We first generated predicted probabilities of entering into STEM occupations for women (men) utilizing their own characteristics; we then simulated what the probability of entering into STEM would be were they to have the characteristics of men (women). The difference between the average man and the average woman in transitioning into a STEM job is 12.3 percentage points (21.7%–9.4%). If men had the same characteristics as their female counterparts, their probability of transitioning into a STEM occupation (holding their model coefficients constant) would drop to 12.6%. If women had the same characteristics as men, on the other hand, their probability of entering a STEM occupation would increase, to 20.6%. Varying the characteristics of men and women represents approximately 74% of the total gender gap in transition rates into STEM occupations ((0.217 − 0.126)/12.3). In other words, only 26% of the gender difference in STEM employment following graduation was due to other factors.

These other factors accounted for a larger share of the gender gap among STEM majors (Fig. 3). The average male STEM graduate had a 53.3% chance of transitioning into a STEM job. This decreased to 47.5% if male STEM majors had the same average characteristics as women STEM majors. In contrast, women STEM majors benefitted more if they had the same average characteristics as their male counterparts. To reiterate, only 41.4% of women entered into a STEM job within two years of college graduation. Were women STEM majors to possess the average characteristics of male STEM graduates, this probability would rise to 56.8%. Among STEM majors, almost half (48.7%) of the gender difference in entrance into STEM jobs was due to other factors ((53.3–47.5)/11.9), when the men's model is the standard.

But which specific characteristics contributed to the gender gap in transitions into STEM occupations? Results from our regression decomposition are shown in Table 4, which details the percent of the gap in transition rates into STEM occupations between men and women that can be attributed to differences in observable characteristics between men and women. For the sake of parsimony, we present models only for STEM majors. As with all regression decompositions, results can be calculated by using the model coefficients of either group as the standard. We show results alternately using the male and female coefficients as the standard, varying the mean characteristics of men and women.

Recall that the total difference in the probability of transitioning to STEM occupations was 11.9 percentage points, reflecting the fact that men were more likely to enter STEM jobs than women. Using the female model as the standard, over 100% of this gap can be attributed to differences in the average characteristics between male and female STEM majors. It is possible to explain more than 100% of the gap using differences in characteristics, because some characteristics operate differently for men and women. In contrast, when the male model serves as the standard, differences in average characteristics between male and female STEM majors accounts for only 40 percent of the gap in transition rates into STEM occupations, given how men's characteristics are rewarded. The unexplained portion of the gap in employment transitions (59.9%) is often used as a proxy for discrimination (Mandel and Semyonov, 2014).

The largest contributor to compositional difference is gender disparities in majors, regardless of whether male or female coefficients are used as the reference. Variation in the shares of men and women who majored in engineering accounts for 69.4% of the total difference in the proportions employed in STEM when using the model coefficients from the women's model (Model A), but only 20.8% of the difference using model coefficients from the men's regression (Model B). This is because female engineering majors were more likely to transition into STEM jobs than other STEM majors.[14] Women's underrepresentation in engineering therefore accounts for a sizable share of the total gender gap in transitions into STEM employment. Life science majors also contribute a good deal to the gender difference in STEM transitions (21.3% for women, 24.1% for men), in part because those who graduated with life science degrees were far less likely to take jobs defined as STEM and in part because life sciences represented a larger proportion of the pool of female than male STEM majors.

Attitudes, expectations and gender ideology account for a much smaller share of the gender gap in transitions into STEM occupations than do field of study. Expectations to work in STEM account for 13.3% of the total gender difference in transitioning into STEM occupations when using the model coefficients from women. Of note is that family attitudes often work in opposing directions for men and women STEM majors. Men are less likely to anticipate marrying before age 25, but using men as the standard *narrows* the gap in transitions into STEM occupations by nearly 7%, while increasing it slightly if women's coefficients are the standard. Similarly, women STEM majors were significantly more likely than their male counterparts to intend to limit their fertility, but this expectation *increased* the gap in transitions into STEM occupations by 5.4%, whereas using men's coefficients as the standard *narrowed* transition disparities by nearly 9%. Finally, liberal gender ideology increases transitions into STEM occupations among women, *but decreases transitions into STEM among men*. Using the women's model as the standard, the differences in gender ideology *narrows* the gap in transitions into STEM occupations by nearly 6%, while *increasing* the gap by 9.4% using the men's model. The differences in attitudes and family expectations between men and women cannot account for differences in transitions into STEM occupations, because these characteristics operate differently for men and women in the STEM workforce. Characteristics that are advantageous for men are not advantageous for women. Preferences do matter, but not in the way the literature posits. Men's preferences for fertility limitation and early marriage predict transitions into STEM; women's preferences do not. Liberal gender ideology facilitates women's transitions into STEM employment but hampers men's.

5. Discussion and conclusions

The dearth of women in STEM occupations today reflects a historical legacy in which women were not encouraged to pursue scientific and technical education and occupations. Our results reveal a good deal of gender similarity in STEM majors' occupational transitions within fields, suggesting that the current focus on increasing the pool of women majoring in STEM fields is most important for addressing the under-representation of women in STEM occupations. In fact, the majority of the gender disparity in transitions into STEM jobs was related to women's underrepresentation in particular fields of study, such as engineering and computer science. Still, several decades after our study cohort completed college, engineering and computer science remain the fields with the lowest representation of women, both as college majors and in employment (Michelmore and Sassler, 2016), despite

[14]Table 3 shows that female engineering majors are nearly 6 times more likely to transition into STEM compared to women in hard sciences, while that figure is only 1.6 for male engineers.

being the fields with the highest odds of transitioning from college major directly into STEM employment.

Our results also reveal how gender framed the occupational trajectories of young adults coming of age in the 1980s (Ridgeway, 2011). The most career oriented women, who expected to marry late and limit fertility, were no more likely to enter STEM jobs than were women who anticipated marrying young and having two or more children. These are the missing women in STEM. Our findings challenge the assertion that equal opportunity legislation shifted the source of gender segregation to women's preferences (Hakim, 2002). For this generation, perceptions of women's competence and commitment to the labor force were shaped by “maternal profiling” (Kmec, 2011), as hegemonic gender beliefs undergirded employers' views of men's and women's abilities, and shaped how women were evaluated (Ridgeway and Correll, 2004; Ridgeway, 2011). We therefore propose an alternative explanation for the shortage of women in STEM occupations – the expectations, or cognitive biases, of employers as predicted by status characteristics theory (Ridgeway, 2011). As our regression decomposition results show, women and men did not benefit equally from their family building intentions. Women who expected to perform as “ideal workers” without family encumbrances did not gain the STEM employment bonus that men did. A sizable share of the gender difference in transitions into STEM employment was unexplained, suggesting the operation of discrimination against women seeking to enter into STEM occupations.[15] Such findings highlight the need for further attention to the demand side of processes that perpetuate gender inequality.

The men most likely to enter STEM occupations were those who expected spousal support but few family responsibilities that might impede their employment. They also adhered to significantly more conventional gender ideologies than their female counterparts, expecting to marry at younger ages but also to remain childless. Women simply could not benefit to the same extent from family expectations as men did, even if they adhered to identical goals, perhaps because women were not expected to have any spousal “backstage” support for their demanding profession. These results highlight the importance of paying closer attention to the climate established by men's gender ideology within STEM occupations. Women who major in STEM are substantially different in their views regarding appropriate roles for women than their male counterparts in STEM occupations. If non-traditional women, many with aspirations for late marriage and small families, seek to advance in fields dominated by married men without domestic responsibilities who have conventional views of women's family roles, a clash of cultures could impede the career progression of women in STEM.

Recent research on organizational practices suggests that gender is a complex set of social relations, enacted across a range of social practices in work sites (Ely and Meyerson, 2010; Kmec, 2011; Peterson, 2010). Increasing women's presence in STEM occupations may therefore require a more concerted effort at “undoing” gender, starting by making the culture of STEM work less “masculine” (Cech, 2013). Such attempts could have important

[15]Another, more conservative, interpretation is that there may be unobservable differences between men and women that we cannot capture in our analysis, though we also explored gender variation in decisions to major and complete majors in STEM and other factors that might reveal differences.

ramifications for the STEM pipeline – from increasing the proportion of women completing degrees in STEM fields like engineering, to elevating the odds of transitioning into first occupations, and reducing transitions out of the STEM field (Ayre et al., 2013; Glass et al., 2013). Such efforts may also help retain family oriented male scientists, who express reservations about remaining in STEM if that requires sacrificing their family involvement (Ecklund and Lincoln, 2011).

Our study does have limitations. Our sample size is small and selective, drawn as it was from respondents who received college degrees in STEM fields mostly in the 1980s, when gender ideology was changing rapidly (Cotter et al., 2011). Furthermore, while we focus on testing the association between attitudes expressed in adolescence and subsequent employment transitions, we can only infer demand side factors, such as the market mechanisms and (dis)incentives experienced by STEM majors as they initially searched for jobs. We are also unable to assess whether low transition rates are due to the nature of STEM jobs themselves. Such jobs may be in short supply, pay less well, be less prestigious, or less interesting than alternatives such as financial and business occupations (Lowell and Salzman, 2007). Some have suggested that declines in the STEM worker pool, at least among native-born U.S. citizens, reflects a weakening labor demand and low relative wages in STEM occupations (Hunt, 2016; Lowell and Salzman, 2007; Xie and Killewald, 2012). Alternatively, low transition rates may be due to climate factors, such as mentoring differences (Moss-Racusin et al., 2012), work-place interactions, or status-based discrimination (Correll et al., 2007).

To date, attempts to increase women's presence in the STEM labor force have focused on the K-12 environment, or attracting women to STEM majors at the university level. Our results show that this is a vital first step, since no significant overall gender difference in transitioning into STEM employment could be found among STEM majors. Our results also suggest that encouraging young girls to imagine employment in STEM areas is an important step towards improving their representation. Strong expectations of working in STEM may be required to persist through grueling course-work, and, in some fields, in classes that remain disproportionately male. But our results also provide some tantalizing hints that women who seek to enter STEM occupations may have a difficult time fitting into the climate established by the majority of men in STEM (Glass et al., 2013), who hold more conservative world views than their female counterparts entering into the labor force following college.

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Appendix A. Occupations Utilized to Determine Work in a STEM Occupation

Occupational classification codes from the 1970, 1980, and 2002 Censuses were utilized to determine whether respondents' first job was in a STEM occupation. The classification schema changed slightly across the years, from 1970, to 1980, to 2002. We therefore detail the occupations (and the numbers assigned to group related occupations) by year.

- Computer Specialists: (1970: 003–005, 055; 1980: 064, 065; 2002: 100–111).
- Engineers: (1970: 006–024; 1980: 044–063; 2002: 131–153).
- Mathematical Specialists: (1970: 034–036; 1980: 066–068; 2002: 120–124).
- Life and Physical Scientists: (1970: 042–054; 1980: 069–083; 2002: 160–176).
- Postsecondary Teachers/Professors: (1970: 102–112; 1980: 113–117; 127–129; 136; 2002: 220).
- Engineering and Science Techs: (1970: 150–162; 1980: 213–281; 2002: 154–156, 190–196).
- Other Technicians: (1970: 163, 164, 170, 171, 173; 1980: 223–229, 235; 2002: 903, 904).

Appendix B. Codes for Major Fields of Study and Subspecialties

The NLSY asks several questions about fields of study for up to three most recent schools. If a STEM major was mentioned in any of these schools, respondents were classified as STEM majors. If multiple STEM majors were reported, the most recent major reported was used. Major fields of study often include numerous subspecialties, which we detail below. A detailed listing of codes for fields of study and subspecialties can be found at: http://www.nlsinfo.org/nlsy79/docs/79html/codesup/att4htm.

1. Biological Sciences (0400) includes: General biology, general botany, bacteriology, plant pathology, plant pharmacology, plant physiology, general zoology, human and animal pathology, human and animal pharmacology, human and animal physiology, microbiology, anatomy, histology, biochemistry, biophysics, molecular biology, cell biology, marine biology, biometrics and statistics, ecology, entomology, genetics, radiobiology, scientific nutrition, neurosciences, toxicology, embryology, pre-med, pre-vet, pre-dentistry, immunology, and other.
2. Agriculture and natural resources (0100) includes: General agriculture, agronomy, animal science, poultry science, horticulture, and forestry.
3. Computer and Information Sciences (0700) includes: General computer and information sciences, information sciences and systems, data processing, computer programming, systems analysis, other.
4. Engineering (0900) includes: General engineering, aerospace/aeronautical/astronautical engineering, agricultural engineering, architectural engineering, bioengineering and biomedical engineering, chemical engineering, petroleum

engineering, civil/construction/and transportation engineering, electrical/ electronics/communications engineering, mechanical engineering, geological engineering, geophysical engineering, industrial and manufacturing engineering, metallurgical engineering, materials engineering, ceramic engineering, textile engineering, mining and mineral engineering, engineering physics, nuclear engineering, engineering mechanics, environmental and sanitary engineering naval architecture and marine engineering, ocean engineering, engineering technologies, and other.

5. Mathematics (1700) includes: General mathematics, Mathematical and theoretical statistics, applied mathematics, and other.

6. Physical sciences (1900) includes: General physical sciences, general physics, molecular physics, nuclear physics, general chemistry, inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry, pharmaceutical chemistry, astronomy, astrophysics, geophysics and seismology, general earth sciences, paleontology, oceanography, metallurgy, industrial chemistry, other earth sciences, other physical sciences.

7. Interdisciplinary studies (4900) includes: biological and physical sciences, and engineering and other disciplines.

Because of sample size issues, agriculture and natural resources, and the one respondent in biological and physical sciences (interdisciplinary studies) were grouped with those in biological sciences, for our Life Sciences classification. We also combine those who majored in mathematics and physical sciences, which we classify as Hard Sciences.

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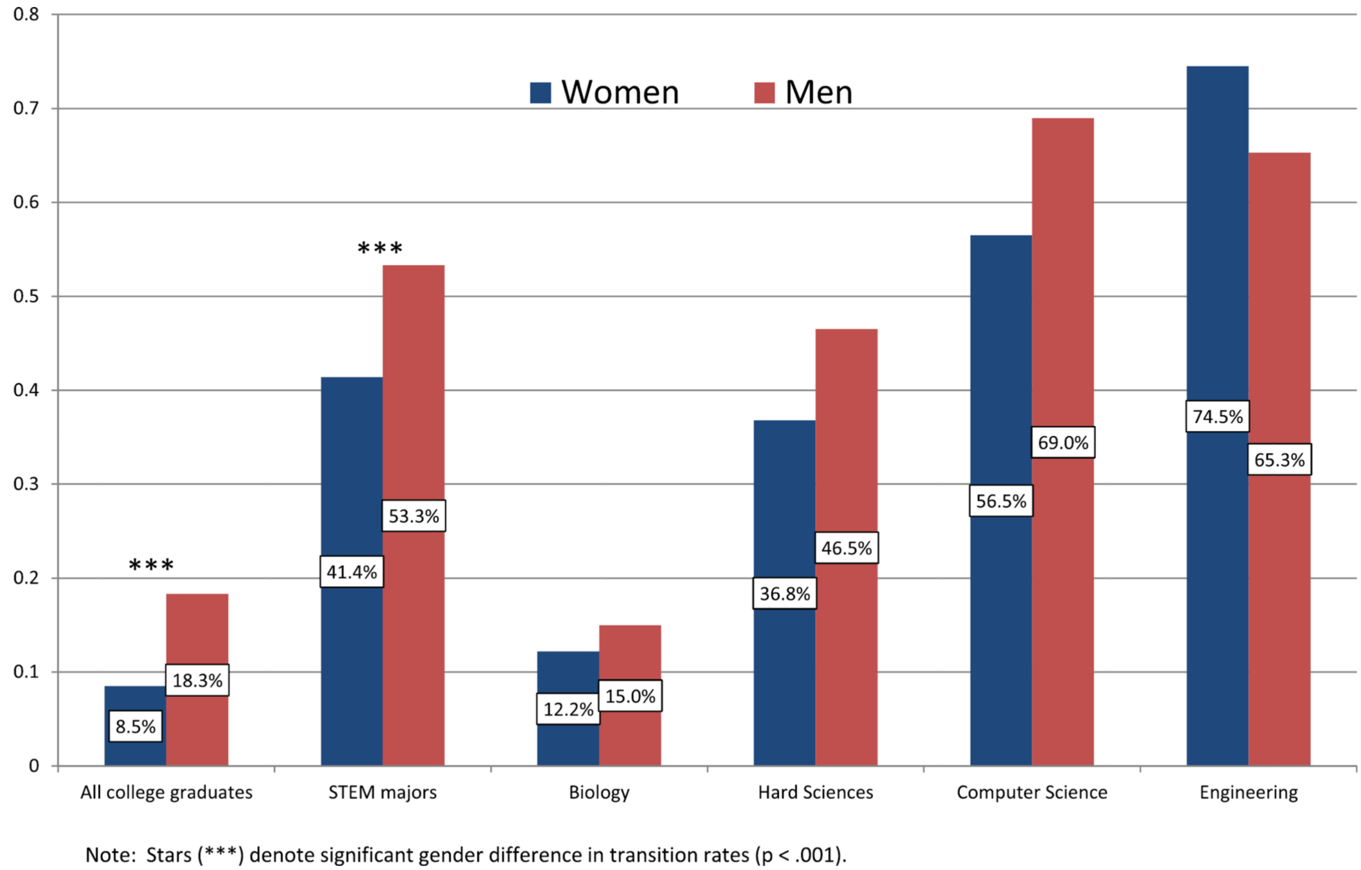

Fig. 1.
Percent transitioning into STEM occupation, overall, for STEM majors, & by field of study.

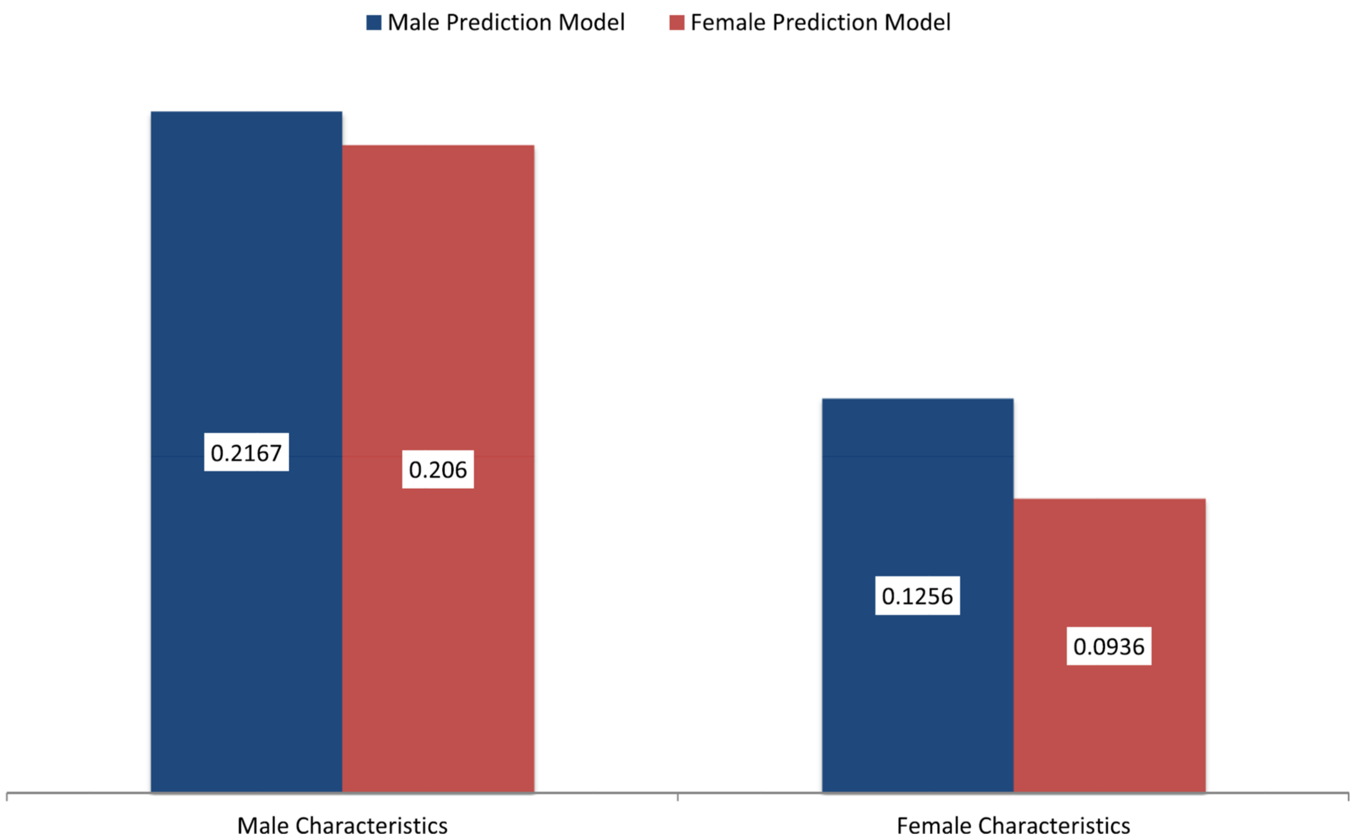

Fig. 2.
Probabilities of entering a STEM job following degree completion for average men and women.

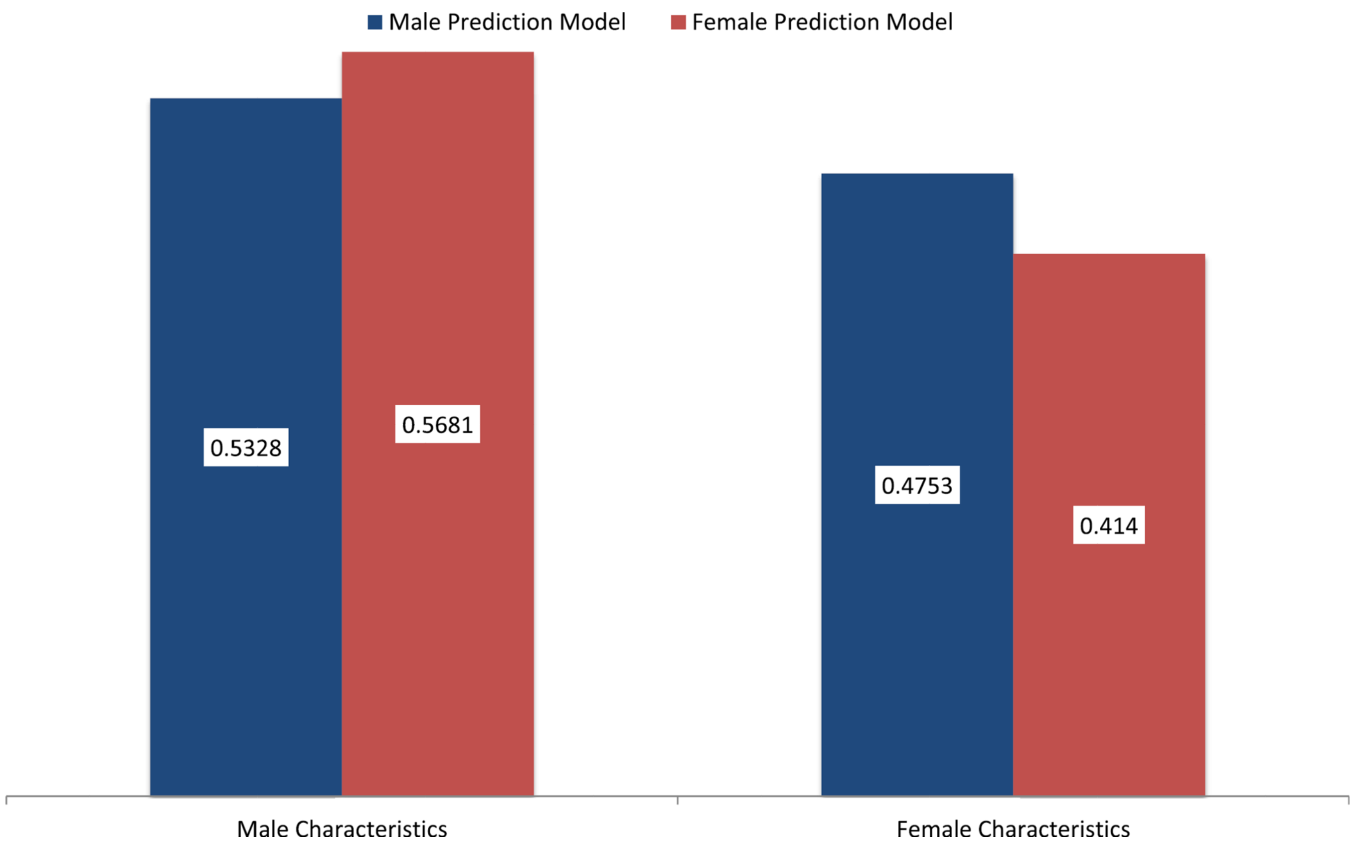

Fig. 3.
Probabilities of entering a STEM job following degree completion for average men and women: STEM majors only.

Table 1

Descriptive statistics for male and female college graduates.

	Column A		Column B	
	All college graduates		STEM majors	
	Women	Men	Women	Men
STEM majors	14.8%	32.6% ***	100.0% [c]	100.0% [d]
Expect to work in STEM occupation in 5 years	9.8%	14.6% ***	20.8% [c]	30.3% ***[d]
Expect to work in STEM occupation at 35	12.1%	21.7%	23.0% [c]	41.4% ***[d]
Attitudes (Measured in 1979)				
Family expectations				
Expect to marry early (before age 25)	53.9%	39.0% ***	45.1% [c]	40.3%
Expect to marry in late twenties (ages 25 to 29)	40.7%	52.1% ***	47.5%	49.4%
Expect to delay marriage (past age 30)	5.4%	8.9% ***	7.5%	10.3%
Expect to have no children	7.6%	4.9% ***	8.1%	3.2% ***
Expect to have one child	7.7%	3.6% ***	5.2%	4.3%
Expect to have two children	57.4%	60.6%	41.5% [c]	45.2% [d]
Expect to have three or more children	27.3%	30.9%	31.0%	34.3%
Gender Ideology (mean value)[b]	3.03	2.84 ***	3.11 [c]	2.84 ***
Family socialization				
% with father in a STEM field[a]	11.8%	11.0%	19.3% [c]	15.4% [d]
Mother's mean years of school	13.15	13.26	13.59 [c]	13.27
Indvidual attributes				
Race/Ethnicity/Nativity				
% Non-Hispanic White	83.9%	85.1%	84.4%	92.7% [d]
% Black	8.2%	7.1%	10.1%	3.3% ***
% Hispanic	3.7%	3.1%	5.5%	4.0%
% Foreign-Born	4.2%	4.7%	6.6%	5.4%
Age (Mean)	24.82	24.36 ***	24.65	24.07
Married at degree completion	17.8%	15.4%	21.5%	12.2% ***
Have children by degree completion	12.1%	7.4% ***	11.3%	6.7%
Degree year				
1977–1981	21.4%	21.0%	15.4% [c]	20.4% ***
1982–1984	32.0%	33.8%	34.6%	37.1%
1985–1987	23.3%	27.4% **	32.9% [c]	28.9%
1988 or later	23.3%	17.8% ***	17.1%	13.6% [d]
N	1258	1115	163	353

Note: Gender differences within category, with

*** significant at 0.001 level,

** significant at 0.01 level,

* significant at 0.05 level (two-tailed test).

Note: NLSY 1979 sample of college graduates, All values are weighted by 1979 cross-sectional weights.

[a] For STEM occupations, see Appendix A.

[b] Higher values indicate more liberal attitudes.

[c] Indicates significant difference between total women and female STEM majors.

[d] Indicates significant difference between total men and male STEM majors.

Table 2

Distribution of fields of study for men and women.

Field of study	Women		Men		Sig.	t-statistic
	%	N	%	N		
Life sciences	4.3%	51	6.6%	61	***	2.49
Computer science	3.9%	38	7.1%	73	***	3.39
Engineering	2.6%	34	14.4%	165	***	10.08
Hard sciences	4.0%	40	4.5%	54		0.54
Total STEM	14.8%	163	32.6%	353	***	10.35
Health	7.6%	95	3.4%	46	***	4.88
Nursing	6.9%	103	0.0%	0	***	7.62
Social sciences	11.8%	149	10.2%	126		1.07
Business	22.8%	287	27.9%	286	***	2.67
Other major?	36.3%	470	25.6%	320	***	6.52
Total N	1258		1115			

Note:

*** significant at 0.001 level,

** significant at 0.01 level,

* significant at 0.05 leve (two-tailed test).

Note: NLSY 1979 sample of college graduates, All values are weighted by 1979 cross-sectional weights.

Table 3

Odds ratios from logistic regression on transition to occupation in STEM with two years after bachelors' degree.

Independent Variables	**All college graduates**		**STEM majors only**	
	Model A		**Model B**	
	Women	**Men**	**Women**	**Men**
College major				
STEM major				
Engineering	5.836 **	1.741	5.612 **	1.557
Computer science	2.759 *	1.997	3.778 *	2.056
Life sciences	0.272 *	0.205 ***	0.222 *	0.194 ***
Non-STEM major	0.074 ***	0.065 ***		
Hard sciences (Reference)[a]	1.000	1.000	1.000	1.000
Expect to work in STEM (in 5 years)	2.462 **	1.585	4.036 **	1.654
Family expectations (measured in 1979)				
Expect to marry before age 25	0.991	1.486 *	0.931	2.538 ***
Expect to marry after age 30 or never	1.520	0.928	1.533	1.068
Expect no or only one child	0.925	1.491	0.525	2.767 *
Attitudes (measured in 1979)				
Gender Ideology[b]	1.742	0.916	1.195	0.818
Family socialization				
Father worked in STEM occupation	1.347	0.637	0.779	0.586
Mothers years of schooling	0.868 **	1.006	0.878	0.933
Individual attributes				
Race/Ethnicity (0 = Non-Hispanic White)				
Minority (Black or Hispanic)	0.817	1.119	0.479	1.792
Foreign-born	0.204	0.894	0.219	1.571
Degree year (0=1982–1984)				
1977–1981	0.514	0.824	0.837	0.988
1985–1987	0.587	1.374	1.203	1.582 *
1988 or later	0.372 **	1.820 *	0.070 ***	1.156
−2 Log likelihood(−2LL)	533.59	861.90	163.56	441.57
Likelihood ratio	214.67	361.23	77.48	86.06
N	1258	1115	163	353

Note:

*** significant at 0.001 level,

** significant at 0.01 level,

* significant at 0.05 leve (two-tailed test).

Note: NLSY 1979 sample of college graduates, All values are weighted by 1979 cross-sectional weights.

Note: Underlining denotes significant differences between male and female coefficients ($p < 0.05$).

[a]Hard Science includes physical sciences and mathematics.

[b]Higher values indicates more liberal attitudes.

Table 4

Decomposition of components of gender difference in the expected log odds of STEM employment.

% Of total gender difference due to difference in key covariate means	STEM majors only	
	Model A	Model B
	Women as standard	Men as standard
College major		
Engineering Major	69.4%	20.8%
Computer Science Major	−2.3%	−5.4%
Life Sciences Major	21.3%	24.1%
Non-STEM Major	0.0%	0.0%
% due to differences in field of study	**88.4%**	**39.5%**
Attitudes & expectations		
Expect to work in STEM in 5 years	13.3%	7.2%
Family Expectations		
Expect to marry before age 25	0.4%	−6.9%
Expect to marry after 30	1.1%	0.2%
Expect no or one child	5.4%	−8.7%
Gender Ideology	−5.8%	9.4%
% due to differences in attitudes, expectations, & ideology	**14.4%**	**1.3%**
Family socialization		
Father worked in STEM field	2.0%	3.8%
Mother's Highest Grade	5.7%	5.0%
Race/Ethnicity		
Minority	5.1%	−6.7%
Foreign Born	0.8%	−0.7%
Degree year		
1977–1981	−0.8%	0.0%
1985–1987	−0.6%	−1.3%
1988 or later	13.1%	−0.6%
Total compositional difference	128.2%	40.1%
Total unexplained differences	−28.2%	59.9%
Total difference in probability of transitioning into STEM	0.119	

Note: NLSY 1979 sample of college graduates, All values are weighted by 1979 cross-sectional weights.

Method: Fairlie method for Binary Outcome Models, 500 repetitions.