

WOMEN LEAVING SCIENCE

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The 30-year period from 1970-2000 was the setting for remarkable changes in the educational and labor force achievements of U.S. women. With the passage of Title VII of the Civil Rights Act in 1965 and Title IX of the Educational amendments in 1974, employment and educational discrimination against women were outlawed. Labor force participation of women increased from 43 percent to 60 percent, women became the majority recipients of bachelors and masters degrees, and the once “etched in stone” female to male weekly earnings ratio increased from 0.63 to 0.77. In the male dominated professions of science and engineering public policy designed to increase the number of women in the science and engineering pipeline augmented federal legislation, and the percentage of bachelors, masters, and PhD degrees in the sciences awarded to women increased by 12 percentage points. This marked success in degrees granted to women in the sciences masked a growing problem in the workplace. The number of women leaving science after receiving a science education and starting a science job was high and rising. The following paper gives estimates of the levels of occupational exit of natural scientists, both men and women, and explores factors behind exit, with attention to differences between the two groups.

Data Occupational exit is studied using four complementary data sets. The first data set, the Survey of Natural and Social Scientists and Engineers (SNSSE), 1982-1989, was collected by the National Science Foundation and gives preliminary estimates of exit for a national sample of working scientists. The survey, which asks questions concerning job, demographic, educational, and personal characteristics, was sent in 1982 to a stratified systematic sample of more than 100,000 respondents to the 1980 Census. Based on census information these respondents worked in a set of targeted "science related" occupations and had four or more years of college education or worked in occupations targeted as "engineering" and had two or more

years of college education. All respondents were resurveyed in 1984, 1986, and 1989. Of those surveyed in 1982, only respondents who were employed, who answered “yes” to the question “are you working in a position related to the natural or social sciences?” and whose stated occupation was in the natural sciences or engineering were tracked over time. The assumption is that these individuals were working in science in 1982. Occupational exit had occurred by 1989 if the individual was not employed or if he or she responded “no” to the questions about whether his or her position was related to social or natural sciences in 1989.

In the 1990s NSF's national data collection efforts refocused on SESTAT, a compilation of surveys, including The Survey of Doctorate Recipients, The National Survey of Recent College Graduates, and The National Survey of College Graduates, which aims to identify the science workforce as those with degrees in science and engineering, rather than those working in science. The SESTAT data have information on individuals in 1993, 1995, 1997 and 1999 and, like the earlier SNSSE, give the researcher the potential to track individuals over time. In the SESTAT data an individual was “in science” if he or she was working and if he or she identified an occupation which, according to data compilers, was included in computer and math sciences, life and related sciences, physical and related sciences, or engineering. These major occupational groupings were recoded from 500 potential responses to a detailed occupational location question. As in the case of the SNSSE data, those respondents identified as “in” science in 1993, who also responded to the survey in the final year of the decade, became the sample for which exit is estimated. For this constrained sample, exit occurs if the individual is not working in a science job in the final year of the survey and can be due to unemployment, labor market departure, or work in non-science employment. Employees who retired or who left due to a disability are eliminated from the samples for both the SNSSE data of the 1980s and the

SESTAT data of the 1990s. Because the two data sets differ in terms of sampling procedures and definitions of “in” and “out” of science, they are not totally comparable and changes in exit rates must be interpreted with caution.

The third data set complements the first two by giving more in-depth information on careers of a set of relatively homogeneous individuals. These data are the result of a work history survey sent to the population of active female alumnae and a random sample of active male alumni who received degrees in science, math, or engineering from a large public university in the northeast from the time of its establishment in the mid 1960's until 1991.¹ The survey, implemented between 1992 and 1994, asks questions with the goal of describing the complete educational, personal, and work force histories of the respondents since college graduation. “In” science is defined as in the SNSSE data through self reporting, and follow-up questions ask about reasons for occupational exit. Occupational exit rates are only calculated for graduates with science degrees who actually begin work in science.

The fourth data set contains interview information from roughly 100 of the respondents to the work history survey and was designed to understand more fully the factors behind occupational exit of men and women in the sciences. Twenty six pairs of women from the original university sample were selected to participate in interviews concerning both their education and career experiences. From the willing respondents, the 52 women were initially selected to mirror the age, education, and family distribution of the respondents to the work histories.² Within each pair, the two women are similar in age, degree level, field of degree, and family circumstances. The difference between the two women in each pair is that one of the

1 5200 surveys were sent out, roughly 400 were returned due to out of date addresses, and 1688 were completed, for a response rate of 35%.

2 Only 51 women were interviewed. The 52nd woman had died between the time in which she filled out a survey and the time of the scheduled interview. This woman had a PhD in Physics, and because of the small number of women with PhD's in physics, no similar women could be found.

women has left science and one has stayed. The purpose of this pairing process is to help isolate the important factors behind exiting or continuing scientific careers that cannot be identified using standard statistical techniques. Twenty-six pairs of men were also identified and interviewed. The male pairs were matched to the female pairs so that individuals in the two pairs have the same age, family characteristics, level of degree, and subject of degree.³ Information from the interviews fill in the details, allowing a deeper understanding of the causes and consequences of occupational exit.

Magnitude of Exit from Science Table 1 gives estimates of exit using the three survey data sets. The 1980s national data show that in the seven years of the 1980s about 8.5 percent of the male science workforce left science while twice this percentage of women left. Compared to occupational exit rates for other occupations calculated using the 1987 Current Population Survey, these exit rates are quite high. In particular over the one year period preceding the 1987 survey 0.6 percent of health diagnosing professionals and 0.7 percent of lawyers and judges left their occupations (Markey and Parks, 1989). Both annual estimates point to a 7 year exit rate below 5 percent. The relatively high exit rates of women from science during this period are a result of high rates of labor force departure (row 2, column 1) and high rates of exit to other occupations (row 2, column 3). These patterns in exit are replicated in the university data where exit rates are calculated at the time of the survey. As in the SNSSE data, the exit rates for all female scientists (28.2% -- row 4, column 4) are approximately twice the exit rates for all male scientists (14.3% -- row 3, column 4). Exit rates are naturally higher for the university sample since, on average, respondents had been in the labor force for 12 years.

³ Because of the differing field distributions of men and women where men are relatively over-represented in engineering and women are relatively over represented in biological sciences, there are three pairs of men which have different subject areas than their female counterparts.

Table 1: Exit Rates of All Natural Scientists

	Exit from the Labor Force (1)	Exit to Unemployment (2)	Exit to Non-science Employment (3)	Total Exit (4)
1980s National Sample (7 year period)				
1. Male Scientists (n=17070)	0.5	2.1	6.1	8.7*
2. Female Scientists (n=2468)	6.5	1.7	9.2	17.4
1970-1994 University Sample (12 year period)				
3. Male Scientists (n=519)	1.7	1.7	10.8	14.3*
4. Female Scientists (n=623)	12.0	2.2	14.0	28.2
1990s National Sample (6 year period)				
5. Male Scientists (n=17624)	0.7	0.9	17.6	19.2*
6. Female Scientists (n=4191)	6.0	1.4	21.7	29.1

* Total exit rate for males is significantly different than total exit rate for females at the .01 level.

By the 1990s estimates of occupational exit rates (rows 5 & 6) seem to have risen markedly. These high estimated exit rates might have been due to technical personnel looking for the riches that the dot com boom seemed to promise, especially since the largest increases in exit were for men who, according to interview data, are more likely than women to leave for increased salary and opportunity. On the other hand the change in how “out of science“ was recorded, from self-reporting in the 1980s to tabulation of an occupational question in the 1990s, may have created an artificial elevation of the exit rate to other occupations. However these same statistics for

social scientists do not change much from the 1980s survey to the 1990s survey. For male and female social scientists the percentage leaving increases between the two decades by only 3 and 5 percentage points respectively.

Table 2: Exit Rates of PhD Natural Scientists and PhD Chemists

	Exit from the Labor Force (1)	Exit to Unemployment (2)	Exit to Non-science Employment (3)	Total Exit (4)
1980s National Sample				
1. Male PhD Scientists n=2077	0.4	0.7	3.0	4.1
2. Female PhD Scientists n=366	1.6	0.5	1.6	3.7
1970-1994 University Sample				
3. Male PhD Scientists ^a (n=116)	0.9	0.00	7.8	8.7
4. Female PhD Scientists (n=108)	1.9	0.9	4.6	7.4
1990s National Sample				
5. Male PhD Scientists (n=8254)	0.6	0.8	12.8	14.2*
6. Female PhD Scientists (n=1859)	3.6	1.2	14.0	18.8

^a The exit rate from science is calculated for those PhDs who started careers in science.
2.5 % of the male PhDs and 4.4 percent of the female PhDs never entered a science job.

* Total exit rate for males is significantly different than total exit rate for females at the .01 level.

Over the period from 1993 to 1999, 19 (row 5, column 4) percent of the male scientists had left science and 17.6 percent left to work outside of science (row 5, column 3). Female scientists' exit rates increased to 29.1 percent for the six year period (row 6, column 4), and in comparison to the 1980's, the big increase was in the percent of women scientists working

outside of science. These high exit rates for natural scientists continue to stand in contrast to exit rates in the social sciences where 12.8% of men and 15.5 % of women left social science work from 1993 to 1999.

Table 2 gives occupational exit rates for PhD scientists estimated with the same samples. As expected, occupational exit rates should be lower for scientists with PhD's since they have invested in high levels of education. The educational investment itself is a signal of commitment, and the resulting high level of skills and knowledge and the salary they can command create high costs of leaving science. Most interesting is the fact that the gap between male and female exit rates disappears once one focuses on the PhD scientists in the first two data sets. While there is still a small percent of female PhDs who leave the labor force (column 1), presumably to care for family, in these data sets, that exit is offset by the smaller percent of female PhDs, relative to men, leaving for non-science employment. The 1990s data is again surprising in the large number of PhD scientists exiting to non-science employment as well as the relatively large percent of PhD women exiting the labor market. Interestingly estimates of occupational exit rates for female social science PhD's using these same data are half as high as these estimates for natural scientists.

Tables 1 and 2 reveal that occupational exit rates for scientists are high and potentially rising. Women are more likely to leave than men except at the PhD level where in some instances women are more tied to science than men.

Why Do Scientists Leave? The complementary data sets each present a piece of the answer to this question, and analyzing them together gives a fairly complete picture.

Statistical Analyses Statistical analyses of the probability of leaving science using the national and university data are helpful in identifying correlations between individual or

work characteristics and the probability of leaving science. The results of the analyses, which are consistent across all data sets, identify educational, field, and personal characteristics which affect the probability of leaving in a marginal manner-- tipping the scales a little bit one way or another towards staying or leaving.

Most noticeable is the effect that level of education and type of education have on the probability of exit. Exit rates vary by major of degree and by level of degree most likely because of differences in the extent to which different educational degrees train recipients for a job or a career. In this context the distinction between engineering degrees and science degrees is important. Relative to a bachelor degree in science, which develops a body of knowledge and a way of thinking that can be helpful in a variety of careers, the engineering degree, regardless of level, is a more narrow, professional degree, one that prepares the graduate for a job and a career specifically in engineering. Of the graduates who never spent a day working in science, 90 percent were science majors while only 10 percent studied engineering. Likewise, the exit rate of engineering majors is less than the exit rate of science majors for men, while comparisons for women give no definitive results. As noted earlier, respondents with PhD degrees were less likely to leave science possibly because the skills learned in a PhD program, regardless of whether they are in a science or engineering field, are directly transferable to the jobs and career paths expected of this elite group of scientists. Furthermore those individuals selecting to pursue a PhD are the science students who are most talented and most excited about their fields.

The characteristics associated with the scientific field from which the worker graduated influence exit. Multivariate analysis of the national data show that the probability of exit decreases in fields where salaries are increasing. In addition in fields where the rates of growth of knowledge are accelerating, scientists are more likely to leave, possibly to avoid the

increasing amounts of retraining and skill update that such a fast changing field requires. Characteristics of the worker's situation also affect exit. Part time workers are more likely to leave science than those on a full-time schedule. Being married significantly reduces the probability of exit for all reasons for men and has no significant effects on the probability of exit for women except in the instance of exit from the labor force where marriage increases that probability significantly. Having children increases the probability of exit to other occupations for both men and women. However, women with children are more likely to leave the labor force than their childless counterparts, while the opposite is true for men.

Responses to Survey Questions In the retrospective work histories, those individuals employed outside of science at the time of the survey were asked specifically why they had left science. Each respondent had the opportunity to cite at most three reasons for exit from the sciences. The results, presented in Table 3, show that men overwhelmingly focused on the low pay in science jobs (68%) and the lack of opportunities to advance (64%). However, in decreasing order of importance, they also cited other fields being more interesting (36%), the lack of science and engineering positions (34%), a preference for non-science positions (23%), and promotion out of science and engineering (18%). While low pay and lack of science opportunities were also important to women with roughly a third of the women citing each of these reasons, a large number of women also identified: a preference for other positions (35%), other fields are more interesting (30%), a lack of science and engineering positions (21%), the difficulty of having a family and working in science and engineering (21%), length of hours required of a science and engineering position (20%), and unfriendliness of the science and engineering fields to women (19%). Thus while men exit science, overwhelmingly because of a lack of opportunities and low pay, women leave for multiple reasons.

Table 3: Reasons Why Men and Women Left Science
(Work History Sample: n=330)

Percent who cited:	Men	Women
Pay better in non-science and engineering positions	68.0	33.0
Career opportunities lacking	64.0	34.0
Other fields more interesting	36.0	30.0
Science and engineering position not available	34.0	21.4
Preferred other Positions	23.0	35.0
Promoted out of science	18.0	2.9
Impossible to have a family and work in S&E	4.5	21.4
Demands of the career are too severe	4.5	2.9
Hours required too long	0	20.0
Science and engineering unfriendly to women	0	19.0

Source: Preston, Leaving Science.

Interview Data Interview data focus even more specifically on the overriding reason behind exit. As noted earlier, the interview sample of 104 men and women chosen from the 1688 respondents to the work history survey was constructed as a set of pairs where individuals differed only according to whether they had exited or stayed in science. The results from the interviews are very similar to the results from the survey responses. Table 4 gives a summary of the results. The men left science primarily to find better career options in terms of higher pay and better advancement opportunities. Of the 19 pairs of men for whom a primary

(and sometimes secondary) factor differentiating the pairs could be identified, 15 (79%) of the exiting men left in response to salary or career opportunity. In contrast, only in one pair of women was the desire for greater pay and more promising career opportunities the major differentiating factor behind the leaver and the stayer.

Table 4: Factors Differentiating Leaver From Stayer in Interview Pairs

	Men	Women
Discontent with Income and Opportunity in science		
Primary Factor	15	1
Secondary Factor	0	1
Looking for More Interesting Work Outside of Science		
Primary Factor	3	8
Secondary Factor	6	1
Lack of Mentor or Guidance		
Primary Factor	0	7
Secondary Factor	0	1
Difficulty Shouldering Familial and Career Responsibilities		
Primary Factor	1	6
Secondary Factor	0	1
Number of Pairs for which a Factor Differentiating Leaver from Stayer could be Identified	19	22

Source: Preston, Leaving Science.

For women the reasons behind their decisions to exit were more varied, and three important reasons for exit surfaced. In eight of the twenty-two pairs of women for whom a primary factor differentiating the stayer from the leaver could be identified, the reason for exit was a mismatch of interests. The woman who stayed found the scientific field interesting relative to other opportunities while the women who left did not. A mismatch of interests was also a primary or secondary factor differentiating the men in nine of the pairs. In seven of the twenty-two pairs of women, the positive guidance of a strong mentor was the primary difference between the women who stayed and those who left. Finally, family responsibilities were the major factor behind occupational exit in six (less than a third) of the twenty-two pairs of women.

The construction of the interview sample, which was designed to identify a factor differentiating the leaver from the stayer, necessarily downplays some important issues that affect careers of scientists regardless of whether they stay or leave. In particular, to conclude that men's preoccupation with money and career swamps family concerns would not be fair to these men, many of whom see income and career growth as the best way to provide for their families. In addition many men who stay in science do so because their concerns for the security and stability of their families prevent them from undergoing risky career moves. The relatively small number of women in the interview sample who leave science because of family concerns does not mean that family issues were easily solved by women who were balancing work and family. Rather almost every woman was grappling with these issues so that it was not a factor that could differentiate many stayers from leavers. Similarly, perceptions by women of sex discrimination and double standards were prevalent among the interviewed women. However sex discrimination and double standards were only secondary factors in exit decisions as they contributed to low levels of mentoring, a mismatch of interests, and difficulties in shouldering the double burdens of family and career. Furthermore many of these women had dealt with perceived sex discrimination since high school and had found strategies to persist in science in spite of unequal treatment.

More on the Factors Causing Women to Leave Science

Discontent with Science The one common thread in all the discussions with men and women who leave science because of discontent with the field was the narrowness of science. Many scientists found the work itself very narrow and specialized, while other exiting scientists, especially those at the PhD level, expressed concern that in order to succeed in science the scientists themselves have to become very narrow. Women, more than men, were

dissatisfied with the isolation associated with working in science, unhappy that the work environment involved little personal contact with colleagues either within or outside of science and that the substance of the work did not connect to real life issues that they found important.

Not only were women more likely than men to exit science because of discontent with science, but of those individuals remaining in science, women were more likely than men to voice concerns about the nature of the work. This discrepancy might occur for a variety of reasons. Women may be more likely to act in response to this disillusionment with science because they are less likely to be the family bread winner and have more freedom than men to leave a job if it does not work out. Without an exit option, men may be less likely to criticize the work that they perform. Alternatively the typical structure of a man's scientific career may result in a broadening of responsibilities that satisfies expanding interests. Women's careers may remain more narrow because of lesser opportunities and more non-work obligations. Finally, women, because of social and familial roles, may have different expectations about paid work. Astin (1979) notes that when students were asked about career interests, women were more likely than men to answer that their future work would contribute to society, help others, give them the opportunity to work with people and ideas and to express themselves. While it is possible that all these factors contribute to the high number of women leaving science in response to discontent, it is also true that in the interview data women leaving for this reason entered careers with nurturing components such as high school teacher, lay minister and clinical psychologist.

Family Formation and Responsibilities

Familial responsibilities affect career outcomes in very different ways for men and women as traditional roles of women continue to exist even in this population of highly educated scientists and engineers. Many men talked about

their early careers as a time when they put in lots of work hours to earn higher salaries and greater career opportunities; they were specializing in work for the sake of family at the same time that women were compromising work for the sake of family. The two to one ratio of female to male exit rates extended to many of the familial patterns. According to the work

Table 5: Family Responsibilities by Sex

	Women	Men
% of household chores spouse is responsible for	34.8* (649)	65.1 (479)
% of child care spouse is responsible for	15.1* (449)	67.0 (363)
% of child care individual is responsible for	60.2* (449)	17.6 (363)

* Percentage for women is significantly different than percentage for men at the 0.01 level.
Numbers in parentheses give the sample size for which the percentage was calculated.

Source: Preston, Leaving Science.

history data women were roughly twice as likely as men to marry a spouse with an advanced degree, have a full time working spouse, and sacrifice own career for spouse's career. Responses to question concerning responsibility for household chores and childcare for preschool children, which are displayed in Table 5, reveal that men and women agreed that the woman of the family took on roughly two thirds of household chores and childcare responsibilities while the man took on only a sixth of the responsibility for childcare. For women, the most common response to the difficulties of shouldering family and career responsibilities was not occupational exit but a lower level career compromise such as limiting job search to a specific geographical location, working part-time, or forgoing promotions that required travel. In the interview data, 80 percent of married women with children and 50 percent of childless married women engaged in this type of career compromise.

Interestingly the most difficult balancing acts occurred at different stages of family

formation for men and women with different levels of education and career aspirations. For PhD scientists the career track, which requires early geographical mobility as the developing scientist moves from undergraduate institution to graduate institution to first post doctoral position to first job, puts stress on the dual career couple as they navigate this career route along with the often conflicting career route of the professional spouse. Not only is the academic scientist moving frequently early in the career, but academic institutions in which he or she locates are often located in rural settings where land is inexpensive and work opportunities outside the institution are sparse. Because female scientists are more likely to be part of a dual career couple than male scientists, they are more likely to feel this stress. Not all relationships succeed, but in those that do, career compromise is a necessity, and because women are likely to be the younger, less established partner in a relationship, they are likely to be the ones who make the compromise. Every married woman with a PhD in the interview sample narrowed the geographic scope of her job search to accommodate her husband's career. Many of these women felt that they did not have the right to ask their husbands and families to move for their jobs, and they preferred not to carry the added responsibility and potential guilt associated with such a move.

Women who terminated their science education with a bachelors or masters degree found that the greatest difficulty balancing work and family comes with the birth of children. These women had more plentiful job opportunities than their counterparts with PhDs since their education is less specialized and they can turn to private industry or government as well as the nonprofit sector for employment. Therefore job location for the dual career couple was not usually a stumbling block to the relationship or the career. Meeting the conflicting demands of young children and an often inflexible work environment, however, posed difficult hurdles to these women. Some women expected that one parent would stay at home with the pre-school

child, but most looked for a work environment which allowed a comfortable shouldering of the double burden of work and family. Opportunities for part-time work, flexible hours, minimal travel and overtime hours, and no relocation requirements fit the bill. Generally it was the woman who sacrificed career opportunity for comfort either because the husband was more established and his participation would generate large financial sacrifices or because the woman felt that the family sphere was her responsibility.

Lack of Mentoring From comments of respondents in the interview sample, the role of mentor in both men's and women's careers is less as a role model or one who inspires and more as one who teaches and shows the way. In a productive mentoring relationship there is a definite transfer of human capital from mentor to mentee. Therefore it should not be surprising that mentoring stands out as an extremely important factor influencing career decisions and dictating career outcomes of science educated women in the university sample. Mentoring early in the science career had an immediate impact on the woman's probability of continuation and success in science. On the other hand, mentoring of men, while more prevalent, especially in the academic arena, had a less pronounced effect on short-term career outcomes. The apparent differences in extent and impact of mentoring for men and women are not unexpected since science is a male dominated field. Mentoring relationships may develop naturally for men because a large majority of the potential mentors in science are men, but the guidance may be knowledge that the men could gather from interactions with peers. At the same time female scientists may perceive the science workplace as a foreign landscape where any guidance is helpful.

Table 6 reveals the stark differences in mentoring experienced by the male and female interview respondents. As undergraduate science students, 40 percent of the men reported

having a mentor compared to only 13.5 percent of the women. The difference was amplified in graduate school where two thirds of the men and only one fifth of the women reported having a mentor. As noted earlier, the effect of mentoring was much greater for women. Only 60 percent of the women without mentors graduated while every women mentored as a graduate student earned the graduate degree. The probability of graduating for men was not affected by mentoring. Men and women were equally likely to be mentored in an early employment situation, largely because mentoring in industry is the result of institutionalized programs. But again the effects of mentoring were much greater for women. An early employment outcome was defined to be positive if the individual experienced salary or opportunity growth, while the outcome was defined as negative if the job was dead-end, the individual's career stagnated, the individual was laid off, or the job led to scientific exit. All the women who had been mentored had positive employment outcomes early in the career while only 52 % of the women without mentors had positive employment outcomes. Mentoring increased the probability of a positive outcome for men, from 70 % to 83 %, but by smaller amounts.

**Table 6: Mentoring Statistics by Sex
(Interview Sample--- n=102)**

	Women	Men
% with mentor as an undergraduate	13.5%	40.0%
% with a mentor as a graduate student	20.5%	65.7%
Difference in probability of earning graduate degree "No mentor" to "With mentor"	0.6 to 1.0	No change
% with a mentor in nearly employment	52%	51%
Difference in probability of successful early employment outcome "No mentor" to "With mentor"	0.52 to 1.0	0.70 to 0.83

Source: Preston, Leaving Science.

Earnings and Opportunity Salary regressions estimated with any of the three quantitative data sets give similar results. Controlling for education, experience, and family

characteristics, full time female scientists earn about 12-15% lower salaries on average than their male counterparts, and the differential increases to close to 20% when part time employees are included in the analysis. In addition, according to interview data, a large number of the interviewed women perceived that they had been treated unfairly at some point in their career solely because of their sex. Blatant or illegal treatment was not commonly cited, but many women found that their male counterparts were at a loss as to how to treat them, and the perceived result was a resumption of stereo-typical sex roles in which women were relegated to secondary status. Because child bearing seemed to confirm these sex-roles, pregnancies were hidden as long as possible to prevent closed doors and lost opportunities. Yet even faced with perceptions of unequal opportunities and real salary differentials women were not leaving science for better pay and opportunities.

Analysis of salaries of men and women who leave science highlights an interesting comparison. Women who leave science earn salaries within science that are on average lower than predicted with salary regressions, and this difference persists in the three data sets. Objective measures of success show that women scientists who leave are not especially successful within science. On the other hand the success within science of the men who leave is more varied. According to the 1980s data and the work history data, men who leave science in search of higher income tend to have higher than predicted salaries within science while those who leave for other reasons have lower than predicted salaries within science. Further the SESTAT data reveal that men leaving science in the 1990s are in the upper end of the science earnings distribution and have higher than predicted salaries.

Without investment in another degree, it is not clear that scientific exit increases earnings. Analysis of salary after exit shows that, using either the 1980s data or the work history

data, the only group that profits from exit from science is the group of men who left with the goal of increased income and opportunity. These men experienced a short term increase in salary (4% in the NSF data and 9% in the work history data), and tracking these men's salary growth for a longer period shows a temporary reduction in growth of salary as new human capital is being developed but ultimately an increase in both growth and level of salary. Exit does seem to increase lifetime earnings. But the same can not be said about women or men who left for non-monetary concerns. The NSF data show that salary upon exit falls for these groups, by 10% for women and 12% for men. The work history data reveal that while there is a small jump in salary immediately following exit, growth in salary is stalled markedly and does not recover until late in the career. These individuals are also those who were not successful in science so their salary profiles never reach the levels of an average science salary profile. Women leaving science, even those who leave for income and opportunity, do not seem to be able to transfer their human capital to non science activities in a profitable manner.

Conclusion Women are more likely to leave science than men, and they leave for different reasons. The reasons are largely due to a sense of alienation in which these women feel separated from their potential mentors, their colleagues, the workplace institutions, or the work itself. Salary analyses show that the factors leading to dissatisfaction with science and ultimate exit have profound impacts on the productivity and lifetime earnings of these women both within science and outside of science. Therefore policies to make the science workplace more welcoming of scientifically trained women are likely to increase the private and social returns to investments in science education.

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