Why Do Women Leave Science and Engineering? *

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Abstract

I use the 1993 and 2003 National Surveys of College Graduates to examine the higher exit rate of women compared to men from science and engineering relative to other fields. I find that the higher relative exit rate is driven by engineering rather than science, and show that 60% of the gap can be explained by the relatively greater exit rate from engineering of women dissatisfied with pay and promotion opportunities. Contrary to the existing literature, I find that family–related constraints and dissatisfaction with working conditions are only secondary factors. My results differ due to my use of non–science and engineering fields as a comparison group.

American policy analysts are concerned at the declining U.S. share in world patenting and scientific publishing, which many trace to the perceived failure of the United States to educate as many scientists and engineers as "competitor" countries. Possible solutions to this problem are to increase skilled immigration, since skilled immigrants are disproportionately in science and engineering fields, or to increase the number of natives in science and engineering, with the under–represented groups of women and minorities obvious targets. The National Academy of Sciences (2007) and the Institute of Electrical and Electronics Engineers – USA (2007) recommend both immigration–based solutions and domestic solutions such as better K–12 education, more public research funding and special scholarships to encourage natives to study science and engineering. Hewlett et al. (2008) emphasize another strategy: increased retention of women in science and engineering. They identify reasons why women leave science and engineering at a higher rate than men, and propose ways to make science and engineering more friendly to women.

Some of the factual claims made in public discourse may not be reliable (for example, Gereffi et al. 2008 argue that many "engineers" in China have education corresponding to technician education in the United States), and some of the underlying assumptions questionable (a service–based economy would not optimally have the same share of engineers as a manufacturing–based economy). Nevertheless, the debates raise interesting economic questions. In earlier work (Hunt 2009, forthcoming), I assessed the contributions of skilled immigrants to the United States, demonstrating that the college–educated arrivals raised patenting per capita by 12–21% in the 1990s, and showing that they have much higher wages, patenting, and publishing rates than college–educated natives. In this paper, I take up the question of Hewlett et al. (2008), and investigate why women leave science and engineering at higher rates than men. I also provide partial evidence on whether it matters. Scientists and engineers may leave their fields upon discovering their comparative advantage lies elsewhere, or may cease to use their technical knowledge as they are promoted to management. Their loss to science and engineering may not be a loss to society. Conversely, the loss of some scientists and engineers could represent a waste of expensive human capital.

The higher exit rate from science and engineering of women compared to men has been best documented by Preston (1994, 2004, 2006). Women's higher exit rate to non–employment is not surprising, but Preston shows that female scientists and engineers are also more likely than their male counterparts to move to a job outside science and engineering. The considerable literature on women leaving science and engineering highlights the difficulty of balancing long work hours and family in science and engineering, the isolation of being a minority and the associated lack of mentoring and networks, the risk-taking environment, the hostile macho culture and discrimination.[1] However, with the exception of Morgan (2000), the research of which I am aware uses samples of current or former scientists and engineers only, without any comparison to other skilled occupations. To see the limitations of such a focus, consider a common explanation for women quitting science and engineering: long work hours. Long work hours may indeed disproportionately lead women rather than men to leave science and engineering, but long work hours may also disproportionately lead skilled women to leave other fields. Women may simply churn more than men in search of a job with optimal work hours. Thus, while it may be worthwhile for science and engineering employers to implement Hewlett et al. (2008)'s prescription of more flexible working time, eventually they need to identify science and engineering–specific problems with women in order to reduce their disadvantage relative to other fields in recruiting and retaining women.

Using the 1993 and 2003 National Surveys of College Graduates (NSCG), I demonstrate that such science and engineering–specific problems do exist, by showing that the exit rate for women compared to men is higher from science and engineering than from other fields. I show that the problems are concentrated in engineering rather than science and in exits to other fields rather than to non–employment. Furthermore, I show that the problems are not those emphasized by the previous literature. Rather, I find that the most important driver of excess female exits from engineering is dissatisfaction over pay and promotion opportunities, a factor explaining about 60% of the differential gender gap

[1]Hall (2007), Hewlett et al. (2008), Preston (1994, 2004, 2006), Sonnert and Holton (1995), Stephan and Levin (2005); see also Rosser and Taylor (2009).

in exit rates. Concerns about pay and promotions have gone unnoticed by the literature studying only science and engineering fields because women are slightly less likely to leave engineering for this reason than men: however, women are much less likely than men to leave non–science and engineering fields for this reason. Family–related constraints are of marginal importance: while many more women than men cite family issues as the reason for leaving engineering, the gender gap is as large in non–science and engineering fields. I find that working conditions, the unavailability of a job in the field, changes in professional interests and job location play statistically significant but minor roles. In my analysis, I condition on observable characteristics of workers and the importance workers attach to various job attributes, including salary and opportunities for advancement. My analysis goes beyond that of Morgan (2000), who uses the 1993 NSCG to compare exits from full–time employment of women from different fields.

My analysis of wages indicates that workers incur a large wage penalty for leaving their field, one that is particularly large for engineering, and particularly for women leaving engineering. Exits for reasons of pay and promotion, the type of exit of specific concern to engineering, are by contrast generally associated with a pay increase. However, workers leaving engineering for these reasons earn 12% less than workers staying in engineering, a penalty that is equal for men and women. The excess exits of women from engineering, unexplained even by rich covariates, appear to be associated with a waste of human capital and hint at discrimination against women in engineering.

1 Data and descriptive statistics

I use the 1993 and 2003 waves of the National Survey of College Graduates, data collected under the auspices of the National Science Foundation. The surveys are a stratified random sample of respondents to the 1990 and 2000 census long forms who reported having a bachelor's degree or higher. I define someone as having left a field if they state that their current work is not related to the field of study of their highest degree. The surveys ask: "Thinking about the relationship between your work and your education, to what extent was your work on your principal job held during the week of [...] related to your HIGHEST degree field? Was it... closely related/somewhat related/not related?" If the respondent answered "not related", he or she was asked "Did these factors influence your decision to work in an area outside of your HIGHEST degree field?" and given a list of possible factors to check: family–related reasons; working conditions; pay, promotion opportunities; job in highest degree field not available; change in career or professional interests; job location; other reason. He or she was then asked "Which factor in [the list] represents your MOST important reason for working in an area outside of your HIGHEST degree field?".

In addition to conventional variables on salary and demographics, I also take advantage of the question asked of all workers in 2003: "When thinking about a job, how important is each of the following factors to you . . .", a question followed by a list of job attributes: salary, benefits, job security, job location, opportunities for advancement, intellectual challenge, level of responsibility, degree of independence, contribution to society. Workers must indicate whether each factor is very important, somewhat important, somewhat unimportant or not important at all.

The advantage of the data is that they allow identification of who has left their field and why, for all fields. The disadvantage is that the date of the exit is not known, which precludes hazard rate analysis of the type carried out by Preston (1994). Preston (1994, 2004, 2006) uses the 1980s and 1990s longitudinal files associated with the NSCG (in addition to her own survey), but these cover only those working in science and engineering occupations, loosely defined. The cross–sectional nature of my data also imposes the use of field of study of highest degree to determine initial field. Unlike in occupation–based samples, exits thus include exits after the completion of studies and before the first job. I discuss the relation between the two types of exit in the Data Appendix.

I use three samples in my analysis, from all of which I exclude respondents 65 or older. The main sample used to analyze working in the field of study consists of all workers, except those working part–time because they are students, and 197,700 observations. When I analyze earnings I am obliged to exclude all part–time workers, leaving me with

179,166 observations. I measure earnings as annual salaries adjusted to represent full–time full–year work, a constraint imposed upon me by the 1993 data. Finally, I include all respondents, except those who say they are working part–time or not working because they are students, to analyze the probability of working, yielding a sample of 222,870 observations. The Data Appendix describes the samples and the measure of earnings in more detail.

In the top panel of Table 1, I show that about 20% of both men and women report that the work in their current job is unrelated to their field of study of their highest degree. Men and women differ in their distribution between the other two categories, with more women than men saying their work is closely related to their field of study. For those reporting that their work is unrelated to their field of study, I show in the middle panel the distribution of the main reason for this. The main gender differences are the much higher share of women who are working in a different field for family–related reasons (4.1% of women compared to only 1.2% of men), and the smaller share of women who are working in a different field due to concerns about pay and promotion (4.1% of women compared to 6.5% of men). Women are somewhat more likely work in a different field due to dissatisfaction with working conditions. The bottom panel shows the shares of workers citing the various factors behind working in a different field as either the main reason or a secondary reason.

In Table 2, I show that 9.7% of men and 6.0% of women have a highest degree in science, and that 14.2% of men and only 2.9% of women have a highest degree in engineering.[2] Higher exit rates from science than engineering (see below) lead to my education–based sample having a higher share of trained scientists relative to engineers than occupation–based samples: 69% of workers in Preston (2004)'s 1980s sample are engineers. More detail on men and women by field of study is given in Appendix Table 1, while Appendix Tables 2 and 3 show the means of the covariates used in the regressions below.

[2]By "science" I mean natural sciences, excluding social sciences and health fields. I include computer science with engineering and mathematics with science.

2 Method

The approach is a difference–in–differences analysis: to compare, for several outcomes, the gender gap for science and engineering with the gender gap for other fields. I allow separate difference–in–differences for science and engineering, estimating a basic specification using weighted linear probability for the pooled years 1993 and 2003:

$$Y_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 E_{it} + \beta_3 F_{it} + \beta_4 S_{it} \times F_{it} + \beta_5 E_{it} \times F_{it} + \beta_6 X_{it} + \beta_7 F_{it} \times \gamma_t + \gamma_t + \epsilon_{it}, \quad (1)$$

where i indexes individuals and t the year, S is a dummy for the field of study of highest degree being in science, E the equivalent for engineering, and F is a dummy for female. The coefficients of interest are β_4 and β_5. In a more general specification, I replace the dummies for science and engineering with a set of 29 field of study dummies. I calculate robust standard errors. I pool 1993 and 2003 because the effects of interest do not in general differ statistically significantly across the years, though I allow the coefficient on the female dummy to vary by year.

The first outcome Y of interest is the probability of being employed, an outcome I study with the sample of all respondents. The second and third are the probability of working full–time and the probability of the current job being unrelated to the field of study of the highest degree, outcomes I study with the sample of workers. I initially estimate the equation for the various outcomes with no Xs, to establish whether indeed women leave science and engineering at higher rates compared to men than in other fields, as reflected in positive β_4 and β_5 for holding an unrelated job, and negative β_4 and β_5 for being employed or full–time employed. I then see whether adding more controls explains the phenomena. With the sample of workers, I also examine the probability of the current job being unrelated to the field of study for a specific reason. For example, I estimate a linear probability model for the probability of a worker having left his or her field and cited family as the main reason, and a second for the probability of a worker having his or her field and cited family as either the main reason or a secondary reason. Only one of the seven possible reasons can be given as the main reason, but for ease of interpretation I do not use a multinomial or nested logit to examine the choice.

The covariates X comprise dummies for a master's degree (including MBA), doctoral degree or professional degree, five dummies for years since highest degree, six dummies for age, dummies for black, Hispanic and Asian, and dummies for foreign born. If I restrict the sample to 2003, I can also control for three dummies each for the importance the respondent attaches to the nine job attributes listed in the data section. I do this in regressions for outcomes other than employment.

I do not control for fertility in these regressions, since the fertility choice is made jointly with the decision of whether to remain in the field of study (or to remain employed). However, the correlation between fertility and remaining in the field of study may be informative, so I examine it in additional regressions. I do not know the timing of leaving the field of study, so I would ideally use information on lifetime fertility to date. However, I know only the number and ages of children of the respondent living in the household, so I proxy lifetime fertility with a dummy C_{it} for whether any child of the respondent (of any age) is living in the household. I explore gender and field differentials in the relation between fertility and how closely related the respondent's job is to his or her field of study, by adding C, $C \times F$, $C \times S$, $C \times E$, $C \times S \times F$ and $C \times E \times F$ to equation (1). A positive coefficient on the triple interactions in a regression for working in an unrelated job would suggest that women have more difficulty combining work and children in science and engineering than in other fields, relative to men.

I also estimate weighted least squares salary regressions to judge the pecuniary and hence productivity implications of a person not working in the field of study of the highest degree. I estimate, calculating robust standard errors,

$$log\ w_{it} = \alpha_0 + \alpha_1 SR_{it} + \alpha_2 NR_{it} + \alpha_3 F_{it} + \alpha_4 SR_{it} \times F_{it} + \alpha_5 NR_{it} \times F_{it} + \alpha_6 X_{it} + \delta_t + \nu_{it}, \quad (2)$$

where SR is a dummy for the respondent's job being somewhat related to the field of study of the highest degree, and NR is a dummy for the job being unrelated. The coefficients α_4 and α_5 indicate whether the salary penalties indicated by α_1 and α_2 are different for women. I also replace the dummy for unrelated, NR, with the main reasons the respondent could give for the job being unrelated to the field of study, to judge how the salary penalty varies with the main reason for leaving the field. Naturally, there is a selection issue here: people prepared to leave their field of study for family reasons, say, may have unobserved attributes that affect their earning power, probably negatively. These regressions should be taken as merely suggestive of possible consequences of leaving one's field of study, although the selection problem should be mitigated by my ability to control for the job attributes to which the worker attaches importance. For the earnings regressions, the X covariates include, in addition to the covariates used for the earlier regressions, a dummy for tenure of five years or more (continuous tenure is not available for 1993, see Data Appendix), a dummy for self–employment and eight census region dummies.

3 Results

3.1 Are there excess female exits from science and engineering?

I begin by establishing whether science and engineering do have excess female exits compared to other fields employing women with a college education or more. In Table 3, I consider exits to non–employment, using the sample of all respondents. The first three rows indicate, as expected, that for those trained in science, engineering and other fields, the share of women who are employed is lower than the share of men who are employed. What is potentially interesting is how the gender gap differs across the fields. The fourth row shows that if science is compared with other fields, there is no statistically significant difference in the gender employment gap. The fifth row shows that employment disadvantage of women among trained engineers is a statistically significant 2.5 percentage points smaller than the gender disadvantage in others fields: the opposite of what would be expected if women were driven from engineering for engineering–specific reasons. The unreported results for the probability of working part–time rather than full–time are very similar: the gender gap in science is the same as in other fields, while the gender gap in engineering relative to other fields indicates that female engineers are relatively unlikely to work part–time (the difference–in–differences is 4.1 percentage points).

Next, I compare the gender gap in how closely job and field of study are related for trained scientists and engineers compared to workers trained in other fields. In the upper panel of Table 4, I consider the share of workers whose job is not related to their field of study of highest degree. 23–24% of both men and women who studied science have an unrelated job, larger shares than the 21% of both men and women who studied something other than science and engineering who are working in a job not related to their field of study. The difference in the gender gap is therefore not large: a statistically insignificant 1.1 percentage points excess exit rate of women from science. This is not necessarily at odds with the existing literature, which typically does not separate science and engineering, and uses samples dominated by engineers. The panel shows that the exit rate from engineering is very low for men: only 9.8% of men trained as engineers are doing unrelated work. While the exit rate is also low for women, at 12.9% it is considerably higher than for men. The comparison of the gender gap in engineering with non–science and engineering fields therefore shows a statistically significant 3.2 percentage point excess exit rate of women from engineering.

In the lower panel, I check the robustness of these results by examining shares of workers reporting a job closely related to their field of study. The difference–in–differences measures are statistically significant for both science (-4.7 percentage points) and engineering (-6.7 percentage points). Stated differently, if leaving the field is measured by having a job either not related or only somewhat related to the field of study, there are excess female exits from both science and engineering. However, this is because lower exit rates for women relative to men are less pronounced in science and engineering than in other fields.

3.2 Consequences of leaving the field of study of highest degree

I next provide evidence for the consequences of full–time workers' leaving the field of study of their highest degree. Because the results differ considerably by field of study, I estimate the log earnings regressions (equation 2) separately for science, engineering and other fields. I present the basic results in columns 1–3 of Table 5, in specifications where I control for all variables except job preferences. Column 1 indicates that holders of a science degree who perform somewhat related work earn 3.1% more than those who do closely related work (the interaction with female has a statistically insignificant coefficient), while columns 2–3 show that for non–scientists, performing somewhat related work has a statistically significant but small wage penalty: 4.2–4.4% for holders of non–science and engineering degrees and for men trained as engineers, and 8.2% for women trained as engineers.

The more serious penalties are associated with doing work unrelated to the highest degree. These are particularly high for workers leaving engineering (column 2), who earn 31 log points (36%) less than stayers if male and 41 log points (51%) less if female. The penalties for science are smaller, at 9.9% for men and 15.2% for women, while the penalties for those trained in neither science nor engineering lie between the engineering and science values. These results suggest that the main policy concern should be trained scientists and engineers whose job is completely unrelated to their field of study. Given the results of the previous section, the implication of this is that the principal concern regarding excess female exits lies with engineering, rather than science. Wage losses for leavers may be exaggerated, however, by an overrepresentation of less motivated workers or workers whose career is progressing unexpectedly poorly.

In columns 4–6, I replace the single dummy for unrelated work with seven dummies for the main reason the work is unrelated. Doing unrelated work is associated with a large wage penalty for most reasons, though the wage outcomes are always worst for engineering and usually best for science. The exceptional exit reason is pay and promotion concerns: leaving science and non–science and engineering for these reasons is associated with wage increases of 10.6% and 2.1% respectively. By contrast, workers who leave engineering for these reasons experience a 11.6% wage decline.

Columns 4–6 also show that, after controlling for the reason for exiting a field, the wage penalty for unrelated work is statistically significantly greater for women leaving engineering (by 8.5%), smaller for women leaving non–science and engineering, and similar for women leaving science. In unreported regressions I have allowed the regression coefficients to vary by gender as well as by field. This permits a calculation of the difference–in–differences effect of each reason for doing unrelated work. This effect is statistically insignificant for both science and engineering women for the pay and promotions reason which will be of particular interest below.[3]

The results are similar to those in Table 5 when the sample is restricted to 2003 or to workers whose highest degree was received in 1980 or later (not reported). So far I have not controlled for the importance workers attach to various job attributes, which are available for 2003 only. When I add these dummies to the specification of columns 4–6 using the 2003 samples, the coefficients on exiting for the various reasons change only by a few percentage points, despite the fact that the job attribute coefficients are very significant (these results are not reported).[4] For the coefficients on the pay and promotion dummy, the changes are large enough in percent terms to be worth noting. The coefficients become less favorable to leavers, since workers for whom pay is important earn more in general and are more likely to quit for pay and promotion reasons: the coefficient falls from 0.12 to 0.08 for science, from -0.12 to -0.14 for engineering, and from -0.005 to -0.03 for non–science and engineering.

I have run unreported equivalent regressions for the probability of being granted a patent, to see the loss in patents caused by men and women with highest degrees in science and engineering doing unrelated or somewhat related work. I find that for women, the losses are small and statistically insignificant, since women patent so little: only 11% of patent–holders in the data are women, and female patent–holders have only two–thirds the number of patents that male patent–holders do.

[3]Women have statistically significantly greater penalties for exits from engineering for family reasons and because no job is available in the field of study, and for exits from science for working conditions reasons.

[4]The unreported coefficients indicate that workers valuing independence, intellectual challenge and especially pay earn more, while those valuing job security and especially societal contribution earn less. This is consistent with Fortin (2008).

3.3 Why do women leave science and engineering?

I now turn to attempting to explain the existence of excess female exits from science and engineering. Although the raw data suggest they exist principally for engineering and only for exits to a job in another field, I nevertheless also examine science and exits to non–employment in case there are excess female exits conditional on covariates.

I first estimate equation (1) with employment as the dependent variable. The first column of Table 6 presents a specification almost equivalent to the simple difference–in–differences in the Table 3, except that a year dummy and its interaction with female are also controlled for. The coefficients on the two interaction terms represent the difference–in–differences effects. In column 2, I add 29 field of study dummies, and in column 3 the remaining covariates. In column 3, the gender gaps between science and engineering and other fields are small and insignificant: the high employment rate of women trained as engineers in column 1 is explained by detailed field of study (column 2) and age and years since highest degree. Restricting the sample to 2003 (column 4) or to respondents who received their highest degree in 1980 or later (column 5) also yields small and insignificant coefficients on the interaction terms.

It is possible that the lack of differential employment patterns by gender and field masks informative differences in the reasons for non–employment. I therefore repeat the regressions seven times, each time using as the dependent variable the probability of not working for one of seven possible reasons respondents can give.[5] Appendix Table 4 shows that, conditional on covariates, the only statistically significant effect is that women trained as engineers are less likely to be non–employed because they have no need to work or do not want to work.[6]

I have also estimated the regressions for workers, with full–time work as the outcome, to see if science and engineering women are pushed to work part–time. The unreported

[5] As I have dropped people not working because they are students, I do not examine the eighth possible reason, being a student.

[6] The results for 2003 and for recipients of highest degrees in 1980 or later suggest female engineers are more likely not to be working because no suitable job is available.

results indicate no difference in the gender gap between science and other fields, and a wrongly–signed positive difference–in–differences of 2.5 percentage points, in the specification with the full covariates. I conclude that excess female exits from science and engineering are present only in exits to another job, and therefore turn to explaining the differences in how closely related a worker's job is to his or her field of study.

In Table 7, I analyze the probability of having a job not related to the field of study of the highest degree. The specification of column 1 is nearly equivalent to the difference–in–differences analysis of Table 4, except that a year dummy and its interaction with female are controlled for. In column 2, I replace the science and engineering dummies with 29 field of study dummies; in column 3 I add the other covariates (other than job preferences). The addition of the covariates makes little difference to the insignificant coefficient for women in science, but increases the difference–in–differences coefficient on women in engineering to 6.4 percentage points in column 3, indicating excess female exits from engineering. The unreported regressions analyzing the probability of a job's being closely related to the highest degree paint a similar picture, as the female excess exits from science are explained by detailed field of study.

In column 4, I restrict the sample to 2003 (which increases the difference–in–differences coefficient for engineering), in order to add the dummies for the importance of job attributes in column 5: possibly the initial selection of men and women into fields of study leads to differences in job preferences across fields of study, which then influence field exit rates. A comparison of columns 4 and 5 shows this is not the case, despite the joint significance of the job preferences coefficients: the excess exits of women from engineering are not explained by any of the available covariates.[7] In column 6, I show that the results for workers who received their degrees in 1980 or later are similar to the results for the full sample.

[7]The addition of the job preferences dummies cuts almost in half the negative coefficient on the main female effect: women's generally lower tendency to leave their field of study conditional on their characteristics is in part explained by their different valuations of job attributes. For example, workers valuing societal contribution are much less likely to leave their field and are much more likely to be female.

In Table 8, I consider whether correlations between children and job relatedness by gender and field of study hint at differences in the difficulty of combining family and career for women trained in engineering. Column 1 reproduces the full–sample results of Table 7 column 3. Column 2 shows that, while having a child in the household is associated with a 2.6 percentage point lower probability of a job unrelated to field of study, the interactions with female, science and engineering have insignificant coefficients, and the addition of the child covariates has not changed the difference–in–differences coefficients compared to column 1. Column 3 shows that women trained as engineers have a 4.0 percentage point more positive association between having a child and having an unrelated job than other workers, suggesting that combining children and career may be more difficult in engineering than other fields. The coefficient on the interaction of female and engineering now represents the effect for childless women: although the coefficient of 4.3 percentage points is one third smaller than the column 1 value for all women, it remains sizeable. The results for the 2003 sample in columns 4 and 5 show no additional effect of children for female engineers, nor do the column 6 results for respondents who received their degree in 1980 or later. The 2003 coefficient on the triple interaction of child, engineering and female is statistically significantly smaller than the 1993 coefficient, suggesting women's child responsibilities are no longer an engineering–specific (nor science–specific) problem.

I pursue the analysis of the causes of women leaving science and engineering by using the reasons given by respondents whose job is not related to their field of study. I focus initially on the main reason, and I initially group workers who studied science and engineering, so as to provide some initial, concise, difference–in–differences results in Table 9. In Panel A, I show that 0.9% of men who studied science and engineering are working outside their field of study mainly for family reasons, compared to 5.0% of women. It is this gender gap that has been emphasized in earlier studies. However, women who did not study science and engineering are also more likely than men to leave their field mainly for family reasons: 1.3% of men and 4.0% of women who studied other fields did so. To find the excess family–induced exits of female scientists and engineers, the 2.7 percentage point gender gap outside science and engineering must be subtracted from the 4.1 percentage point gap within science and engineering, to yield 1.4 percentage points. This difference–in-differences is statistically significant, so the qualitative result accords with earlier studies. However, the magnitude is much smaller than the magnitude calculated with no comparison to fields outside science and engineering.

I perform the same calculation for each of the other main reasons for leaving the field of study. Panel B shows that while among those who studied science and engineering, women are more likely to leave the field due to working conditions, the gender gap is similar outside science and engineering, leaving only a small and insignificant difference–in–differences effect. The largest excess female exits are found to be for reasons of pay and promotion, in Panel C. Within science and engineering, women are slightly less likely to exit for this reason than men (3.5% of women compared to 4.2% of men). Because of this, the existing literature focusing on scientists and engineers only has paid pay and promotion little attention. However, in non–science and engineering fields, women are much less likely to exit for this reason: 4.1% of women compared to fully 7.2% of men. Thus, women scientists and engineers are surprisingly likely to exit their field for pay and promotion concerns: the difference–in–differences effect is a statistically significant 2.4%, large compared with the excess exit rate of 3.2% for engineering in Table 4. Among the remaining panels, the difference–in–differences effect is only statistically significant for "some other reason".

In the odd columns of Panel A of Tables 10 and 11, I repeat this analysis in regression form, with the addition of a year dummy and its interaction with female, and separating science and engineering, while in the even columns I control for worker characteristics (except job preferences). Column 1 of Table 10 shows that there are statistically significant excess female exits in science for family–related reasons, of 1.6 percentage points, but not for engineering. The addition of covariates reduces the coefficients on the interaction term for science to 1.3 percentage points (column 1).

Columns 3 and 4 suggest that working conditions play no role in excess female exits from science or engineering. Column 5 shows that the difference–in–differences effect found in Table 9 for pay and promotion opportunities is driven by engineering: while the coefficient on the science interaction term is small and insignificant, the coefficient on the engineering interaction term indicates a 2.8 percentage point effect, accounting for most of the total engineering excess female exits of 3.3 percentage points (in Table 7 column 1). The coefficient increases to 3.8 percentage points covariates are added in column 6, accounting for 60% of the total conditional excess exits of 6.4 percentage points (in Table 7, column 3).

The difference–in–differences effects for the unavailability of a job in the field of study, in columns 7 and 8, are insignificant for both science and engineering. Panel A of Table 11 shows that the difference–in–differences effects for the remaining exit reasons, change in professional interests, job location and other reason, are small and statistically insignificant, except for the combination of engineering and other reason.

I conclude from Panel A of Tables 10 and 11 that the most important reason for women leaving engineering at higher rates than men is concern over pay and promotion opportunities. Women trained in science are affected to a smaller extent by family–related reasons, which is offset by all the other reasons, though none is individually statistically significant. In Panel B of Tables 10 and 11 I search for more minor causes, by estimating the probability of a reason being mentioned at all, whether it is the most important reason or not. For engineering, in the odd columns where the full covariates are included, the difference–in–differences effect is positive and statistically significant for every reason (at the 10% level only for family reasons, which is also the smallest effect). This points to there being many reasons that lead women to leave engineering at higher rates than men, but the conclusion based on Panel A that the most important reason is pay and promotion is reinforced by the fact that the largest coefficients in Panel B are for pay and promotion (Table 10, columns 5 and 6). For science, the difference–in–differences effect for family–related reasons is similar in Panel B to Panel A (columns 1 and 2). Of the remaining reasons, only working conditions (columns 3 and 4) matter, and the magnitude is similar to the engineering working conditions effect.

I have repeated the regressions for the year 2003 only, and for recipients of highest degrees in 1980 or later. The only noteworthy differences are that in both these samples, compared to men, the women trained as engineers are statistically significantly more likely than women trained in other fields to give a change in career interests as their main reason for leaving their field, and that for the recent degree recipients, women scientists are statistically significantly less likely to to name field job unavailability as the main reason. Pay and promotion remains the most important factor for engineering. For the regressions using the 2003 sample I can add controls for job preferences, and the results are robust to this addition.

It is possible that women report dissatisfaction with pay and promotion opportunities in engineering because they are more likely to be sidelined upon returning from a career break than in other fields, due to the rapid advancement of technology. Preston (2004) shows that among former scientists and engineers who re–enter science and engineering, those re–entering the fastest–evolving fields have the lowest wages compared to those who never left science and engineering. If this explanation were correct, pay and promotion dissatisfaction should be equally salient in science, which is not the case. Nevertheless, I investigate this possibility further, using the 1993 data which include actual experience. I define a dummy to represent a career break of more than five years, using actual experience and year of highest degree. Naturally, a career break could be the outcome of leaving a field rather than the cause, but as for children, the correlations could prove informative. I take the pay and promotion specification of Table 10 Panel A, column 6, and add a quadratic in actual experience, the career break dummy, and its interaction with science and with engineering. The addition of the controls does not affect the difference–in–differences coefficients, although the coefficient on the career break dummy is positive and significant, as is the coefficient on the interaction with science (these results are not reported). This appears to cast doubt on the career break explanation for female pay and promotion concerns in engineering.

4 Conclusion

The large existing literature on retention of women in science and engineering focuses almost exclusively on comparisons of male and female scientists and engineers. In this paper, I compare gender differences across fields in order to establish the ways in which science and engineering are unique. This reveals that although women trained as scientists and engineers are less likely to be employed than their male counterparts, the gap is as large in other fields. Science and engineering do not drive women out of the work force, nor do they drive women to part–time jobs. Further, while women leave engineering at greater rates than men for jobs in other fields, they leave science and other fields at similar rates to men. Only engineering appears to have peculiar characteristics that drive women away. The excess female exits from engineering are not explained by worker characteristics or preferences over job attributes including salary and opportunities for advancement, but 60% of the excess exits are attributable to concerns of women engineers regarding pay and promotion opportunities. The factors stressed in the literature, such as family considerations and work conditions, play minor roles. Science employers should note, however, that family considerations are a negative factor for women trained as scientists, even though they are counterbalanced by positive factors.

One possible explanation for the relative importance of pay and promotion concerns is that female engineers are sidelined after returning from a career break, due to the rapid evolution of technology. However, the absence of such an effect in science and other evidence casts doubt upon this explanation, leaving discrimination against female engineers as a residual possibility. The analysis of wages shows that exits from engineering for pay and promotion reasons are associated with a wage loss, contrary to exits from other fields including science, suggesting that the excess exits from engineering are indeed associated with an inefficient use of human capital. Women leaving engineering for these reasons do not have relatively more beneficial wage outcomes than their male counterparts, however, which seems inconsistent with their relatively higher exits for pay and promotion reasons.

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Data Appendix

I use individual–level data from the 1993 and 2003 National Surveys of College Graduates (NSCG). The data may be downloaded at sestat.nsf.gov/datadownload/. The surveys are stratified random samples of respondents to the 1993 and 2000 census long forms who reported having a bachelor's degree or higher. I drop respondents who live outside the United States or in U.S. territories, or who are aged 65 or older. I include in all samples those who are self–employed on their principal job. I would like to exclude full–time students, but I cannot identify students in 1993, except those who say they are either working part–time or not working because they are students. I therefore exclude in both years all these students from the analysis of the probability of employment, and the part–time worker students from the analysis of working in the field of study of highest degree. As I explain below, I exclude all part–time workers from the earnings analysis. I scale the weights from the 1993 and 2003 surveys so the sum of weights is equal for each year. I define science as natural science, including mathematics, and excluding social science and health fields. I define engineering to include computer science.

The surveys ask for "basic annual salary" on the principal job, and instruct "Do not include bonuses, overtime or additional compensation for summertime teaching or research". The self–employed are directed to "estimate earned income, excluding business expenses". There are no negative salary values. The raw data gathered in response to the earnings questions from the 1993 survey are not available. The only variable provided is "annualized" salary on the principal job (no further explanation is given), and a full–time worker variable. The salary is missing for part–time workers. I attempt to replicate this variable for 2003 by computing hourly wages and multiplying them by 40 hours and 52 weeks, and by excluding those who say they work part–time. I compute 2003 hourly wages by dividing the annual salary by the number of weeks it was based on and by the usual weekly hours on this job. I drop 1636 observations with missing or zero wage values and 1457 observations with hourly wage values below $5.15, the federal minimum wage in 2003. I also drop observations with a high hourly wage for respondents who looked likely to have confused annual weeks and months, or weekly and daily hours (the heaping patterns suggest such confusion exists): I drop observations with hourly wages of more than $100 if weekly hours are nine or less or annual weeks are twelve or less (739 observations). I cannot drop observations with imputed values, as these are not flagged. However, I drop from the wage sample the 379 remaining observations with an annual salary of $565,172, a value I strongly suspect is imputed (the next largest annual salary is $360,000). I can make none of these adjustments for the 1993 salary variable.

The 1993 survey does not ask for tenure on the current job. However, the respondent is asked if he or she was working at the same job five years previously, and this question was also asked in 2003, so I can define a consistent dummy for five or more years job tenure.

I can follow the existing literature by basing exit from a field on occupation rather than job relatedness to highest degree, though I cannot then associate a reason with the field change, and there is not an obvious equivalent to leaving science and engineering for workers trained in other fields. Of workers with a highest degree in science and engineering, who said their current job was unrelated to their field of study, 89% and 82% respectively were not working in a science or engineering occupation.

Table 1: Relation Between Job and Highest Degree (%)

	Male workers	Female workers	All workers
Closely related	52.5	58.3	55.1
Somewhat related	28.1	21.1	25.0
Not related	19.4	20.6	19.9
	100%	100%	100%
Not related; main reason is:			
Family related	1.2	4.1	2.5
Work conditions	1.8	2.4	2.1
Pay, promotion	6.5	4.1	5.4
No job in field	3.1	3.2	3.1
Change in career interests	3.7	3.8	3.8
Job location	1.0	0.9	0.9
Other reason	2.1	2.1	2.1
	19.4%	20.6%	19.9%
Not related; one reason is:			
Family related	4.1	8.2	5.9
Work conditions	8.3	10.9	9.5
Pay, promotion	11.8	9.4	10.7
No job in field	6.3	6.7	6.5
Change in career interests	9.3	9.3	9.3
Job location	8.0	9.3	8.6
Other reason	2.7	2.7	2.7

Notes: Shares are weighted with survey weights. The sample size is 197,700. Respondents were asked "… to what extent was your work on your principal job related to your highest degree? Was it…". Respondents who answered "not related", were asked "Did these factors influence your decision to work in an area outside of your HIGHEST degree field?". In 2003, the working conditions option specifies "e.g. hours, equipment, working environment" and the family-related option specifies "e.g. children, spouse's job moved".

Table 2: Men and Women with Highest Degree in Science or Engineering

	Male workers	Female workers	All workers
Science	9.7	6.0	6.5
Engineering	14.2	2.9	10.8
Other field of study	76.2	91.0	82.8
	100%	100%	100%

Note: The sample size is 197,700. Computer science is included in engineering, mathematics in science. Shares are weighted with survey weights.

Table 3: Employment Rate by Gender and Field of Highest Degree (%)

	Men	Women	Difference
Science	92.4	81.5	-10.9
Engineering	92.6	84.0	-8.7
Other field of study	92.6	81.4	-11.2
Difference: science versus other	--	--	0.3 (0.7)
Difference: engineering versus other	--	--	2.5** (0.8)

Note: Weighted mean of dummy for whether working in survey week. Computer science is included in engineering, mathematics in science. Fields refer to the field of study of the highest degree. The sample size is 222,870. Standard errors in parentheses. ** indicates significance at the 5% level, * at the 10% level.

Table 4: How Job is Related to Highest Degree, by Gender and Field of Highest Degree (%)

	Male workers	Female workers	Difference
A. Job is unrelated			
Science	23.4	24.4	1.0
Engineering	9.8	12.9	3.1
Other field of study	20.7	20.6	-0.1
Difference: science versus other	--	--	1.1 (1.0)
Difference: engineering versus other	--	--	3.2** (0.8)
B. Job is closely related			
Science	46.9	49.3	2.4
Engineering	60.3	60.7	0.4
Other field of study	51.7	58.8	7.1
Difference: science versus other	--	--	-4.7** (1.0)
Difference: engineering versus other	--	--	-6.7** (1.1)

Note: Weighted mean of dummy for whether job is unrelated to highest degree. Computer science is included in engineering, mathematics in science. Fields refer to the field of study of the highest degree. The sample size is 197,700. Standard errors in parentheses. ** indicates significance at the 5% level, * at the 10% level.

Table 5: Annual Salary Penalty for Having a Job Unrelated to Highest Degree

	(1) Science	(2) Engineering	(3) Other	(4) Science	(5) Engineering	(6) Other
Somewhat related	0.031**	-0.042**	-0.044**	0.031**	-0.042**	-0.043**
	(0.013)	(0.008)	(0.006)	(0.013)	(0.008)	(0.006)
Not related	-0.099**	-0.306**	-0.163**	--	--	--
	(0.017)	(0.019)	(0.007)			
Female* Somewhat related	-0.024	-0.040*	-0.006	-0.024	-0.040*	-0.007
	(0.023)	(0.021)	(0.008)	(0.023)	(0.021)	(0.008)
Female* Not related	-0.053*	-0.103**	0.004	-0.020	-0.085**	0.040**
	(0.029)	(0.042)	(0.010)	(0.028)	(0.039)	(0.010)
Not related; main reason is:						
Family related	--	--	--	-0.273**	-0.381**	-0.315**
				(0.042)	(0.070)	(0.016)
Work conditions	--	--	--	-0.170**	-0.385**	-0.263**
				(0.048)	(0.067)	(0.016)
Pay, promotion	--	--	--	0.106**	-0.116**	0.021**
				(0.025)	(0.029)	(0.009)
No job in field	--	--	--	-0.254**	-0.504**	-0.334**
				(0.028)	(0.033)	(0.012)
Change in career interests	--	--	--	-0.083**	-0.221**	-0.164**
				(0.030)	(0.038)	(0.012)
Job location	--	--	--	-0.231**	-0.360**	-0.348**
				(0.056)	(0.069)	(0.020)
Other reason	--	--	--	-0.254**	-0.386**	-0.303**
				(0.040)	(0.052)	(0.015)
R^2	0.25	0.27	0.31	0.27	0.28	0.32
Other covariates	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,929	34,571	123,666	20,929	34,571	123,666

Note: Dependent variable is log annual salary. Full-time workers only. Weighted least squares coefficients with robust standard errors in parentheses. Science, engineering and other refer to the field of study of the highest degree. All regressions include a year dummy and a female*1993 dummy and a female*1993 dummy, dummies for a master's degree, a doctoral degree or a professional degree (bachelor's degree is omitted), a dummy for gender, five dummies for years since highest degree, six dummies for age, a dummy for at least 5 years tenure, a dummy for self employed, dummies for black, Hispanic, Asian, dummies for foreign born, 29 field of study dummies and 8 census region dummies. ** indicates significance at the 5% level, * at the 10% level.

Table 6: Effect of Field of Study and Gender on Probability of Working

	(1)	(2) Full sample	(3)	(4) 2003 only	(5) Highest degree 1980 or later
Female*science	0.003	-0.001	0.001	0001	-0.006
	(0.007)	(0.007)	(0.007)	(0.012)	(0.009)
Female*engineering	0.027**	0.017**	0.007	0.005	-0.001
	(0.008)	(0.008)	(0.008)	(0.012)	(0.008)
Female	-0.112**	-0.111**	-0.122**	-0.121**	-0.128**
	(0.003)	(0.004)	(0.002)	(0.004)	(0.003)
Science degree	-0.002	--	--	--	--
	(0.003)				
Engineering degree	0.000	--	--	--	--
	(0.002)				
R^2	0.03	0.03	0.08	0.08	0.06
Field of study	--	Yes	Yes	Yes	Yes
Other covariates	--	--	Yes	Yes	Yes
Observations		222,870		90,204	128,200

Note: Dependent variable is a dummy for working in the survey week. Weighted linear probability coefficients with robust standard errors in parentheses. All regressions except that in column 5 include a year dummy and a female*1993 dummy. Field of study controls are 29 dummies. Other covariates are dummies for a master's degree, a doctoral degree or a professional degree, five dummies for years since highest degree, six dummies for age, dummies for black, Hispanic, Asian, and dummies for foreign born. The sample in column 5 contains respondents whose highest degree was received in 1980 or later. Science and engineering refer to the field of study of the highest degree. ** indicates significance at the 5% level, * at the 10% level.

Table 7: Effect of Field of Study and Gender on Having a Job Unrelated to Highest Degree

	(1)	(2)	(3)	(4)	(5)	(6)
		Full sample		2003 only		Highest degree 1980 or later
Female*science	0.011	0.009	0.012	0.010	0.013	-0.009
	(0.010)	(0.010)	(0.010)	(0.016)	(0.016)	(0.013)
Female*engineering	0.033**	0.049**	0.064**	0.082**	0.075**	0.052**
	(0.008)	(0.009)	(0.009)	(0.014)	(0.014)	(0.009)
Female	-0.015**	-0.014**	-0.026**	-0.025**	-0.014**	-0.020**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Science degree	0.028**	--	--	--	--	--
	(0.006)					
Engineering degree	-0.109**	--	--	--	--	--
	(0.003)					
R^2	0.01	0.06	0.10	0.10	0.12	0.09
Field of study	--	Yes	Yes	Yes	Yes	Yes
Other covariates	--	--	Yes	Yes	Yes	Yes
Job preferences	--	--	--	--	Yes	--
Observations		197,700		79,213		117,022

Note: Dependent variable is a dummy for working in a job unrelated to the highest degree. Weighted linear probability coefficients with robust standard errors in parentheses. Regressions in columns 1-3 and 6 include a year dummy and a female*1993 dummy. Other covariates are three education dummies, five dummies for years since highest degree, six dummies for age, dummies for black, Hispanic, Asian, and dummies for foreign born. The job preferences controls are three dummies each (very important, somewhat important, somewhat unimportant) for how important the following attributes are "when thinking about a job": salary, benefits, job security, job location, opportunities for advancement, intellectual challenge, level of responsibility, degree of independence, contribution to society. The sample in column 6 contains workers whose highest degree was received in 1980 or later. Science and engineering refer to the field of study of the highest degree. ** indicates significance at the 5% level, * at the 10% level.

Table 8: Effect of Children on Having a Job Unrelated to the Highest Degree

	(1)	(2)	(3)	(4)	(5)	(6)
		Full sample		2003 only		Highest degree 1980 or later
Female*science	0.012	0.012	0.000	0.010	0.013	-0.016
	(0.010)	(0.010)	(0.014)	(0.024)	(0.023)	(0.018)
Female* engineering	0.064**	0.064**	0.043**	0.081**	0.078**	0.043**
	(0.009)	(0.009)	(0.012)	(0.021)	(0.021)	(0.013)
Female	-0.026**	-0.029**	-0.027**	-0.035**	-0.021**	-0.026**
	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)
Child in household	--	-0.026**	-0.025**	-0.026**	-0.024**	-0.023**
		(0.004)	(0.004)	(0.007)	(0.007)	(0.005)
Child*female	--	0.004	0.001	0.016*	0.010	0.009
		(0.005)	(0.005)	(0.009)	(0.009)	(0.007)
Child*science	--	0.013	0.005	0.004	0.007	-0.001
		(0.009)	(0.011)	(0.020)	(0.019)	(0.016)
Child*engineering	--	0.004	-0.003	0.001	0.000	0.001
		(0.006)	(0.007)	(0.012)	(0.012)	(0.008)
Child*science*female	--	--	0.022	0.002	0.002	0.013
			(0.019)	(0.032)	(0.031)	(0.024)
Child*engineering*female	--	--	0.040**	0.002	-0.005	0.018
			(0.017)	(0.027)	(0.028)	(0.018)
R^2	0.10	0.10	0.10	0.10	0.12	0.09
Job preferences	--	--	--	--	Yes	--
Observations		197,700		79,213		117,022

Notes: Dependent variable is a dummy for working in a job unrelated to the highest degree (columns 1-3) and for working in a job closely related to the highest degree (columns 4-6). Weighted linear probability coefficients with robust standard errors in parentheses. Columns 1-3 and 6 include a year dummy and a female*1993 dummy. All regressions include 29 field of study dummies, three education dummies, five dummies for years since highest degree, six dummies for age, dummies for black, Hispanic, Asian, and dummies for foreign born. Science and engineering refer to the field of study of the highest degree. ** indicates significance at the 5% level, * at the 10% level.

Table 9: Whether Job is Unrelated to Highest Degree Mainly for Particular Reason, by Gender and Field of Highest Degree (%)

	Male workers	Female workers	Difference
A. Family-related reasons (e.g. children, spouse's job moved)			
Science and engineering	0.9	5.0	4.1
Other field of study	1.3	4.0	2.7
Difference in differences	--	--	1.4**
			(0.4)
B. Working conditions (e.g. hours, equipment, working environment)			
Science and engineering	1.2	1.9	0.7
Other field of study	2.0	2.5	0.5
Difference in differences	--	--	0.2
			(0.2)
C. Pay, promotion opportunities			
Science and engineering	4.2	3.5	-0.7
Other field of study	7.2	4.1	-3.1
Difference in differences	--	--	2.4**
			(0.3)
D. Job in highest degree field not available			
Science and engineering	3.2	3.6	0.4
Other field of study	3.0	3.1	0.1
Difference in differences	--	--	0.3
			(0.3)
E. Change in career or professional interests			
Science and engineering	3.3	3.8	0.5
Other field of study	3.9	3.8	-0.1
Difference in differences	--	--	0.5
			(0.3)
F. Job location			
Science and engineering	0.9	0.9	0.0
Other field of study	1.1	0.9	-0.2
Difference in differences	--	--	0.1
			(0.2)
G. Some other reason			
Science and engineering	1.7	2.0	0.3
Other field of study	2.3	2.1	-0.2
Difference in differences	--	--	`0.5**
			(0.2)

Note: Weighted mean of dummy for whether job is unrelated to highest degree for a particular reason. The sample size is 197,700. Standard errors in parentheses. ** indicates significance at the 5% level, * at the 10% level.

Table 10: Effect of Field of Study and Gender on Job Unrelated to Highest Degree for Various Reasons

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Family-related reasons		Working conditions		Pay, promotion opportunities		Field job not available	
A. Main reason								
Female*science	0.016**	0.013**	-0.002	-0.002	0.003	0.004	-0.007	-0.005
	(0.005)	(0.005)	(0.003)	(0.003)	(0.005)	(0.006)	(0.005)	(0.005)
Female* engineering	0.001	0.004	-0.000	0.004	0.028**	0.038**	0.004	0.005
	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Female	0.029**	0.029**	0.005**	0.006**	-0.032**	-0.040**	-0.002	-0.005**
	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Science degree	0.003	--	-0.001	--	-0.002	--	0.017**	--
	(0.002)		(0.002)		(0.004)		(0.003)	
Engineering degree	-0.008**	--	-0.012**	--	-0.049**	--	-0.009**	--
	(0.001)		(0.001)		(0.002)		(0.002)	
R^2	0.01	0.02	0.00	0.01	0.01	0.04	0.00	0.01
B. Any reason								
Female*science	0.020**	0.019**	0.019**	0.015*	-0.005	-0.003	-0.005	-0.001
	(0.007)	(0.007)	(0.008)	(0.008)	(0.007)	(0.008)	(0.006)	(0.007)
Female* engineering	0.001	0.010*	0.003	0.016**	0.027**	0.047**	0.012**	0.017**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
R^2	0.01	0.04	0.01	0.05	0.01	0.07	0.00	0.03
Other covariates	--	Yes	--	Yes	--	Yes	--	Yes

Note: Dependent variable is a dummy for working in a job unrelated to the highest degree. Weighted linear probability coefficients with robust standard errors in parentheses. The sample size is 197,700. All regressions include a year dummy and a female*1993 dummy. Panel B also includes dummies for female, science and engineering. Other covariates are 29 field of highest degree dummies, three education dummies, five dummies for years since highest degree, six dummies for age, dummies for black, Hispanic, Asian, and dummies for foreign born. Science and engineering refer to the field of study of the highest degree. ** indicates significance at the 5% level, * at the 10% level.

Table 11: Effect of Field of Study and Gender on Job Unrelated to Highest Degree for Various Reasons

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in career interests		Job location		Some other reason	
A. Main reason						
Female*science	-0.002	-0.001	0.000	0.000	0.002	0.002
	(0.005)	(0.005)	(0.002)	(0.003)	(0.003)	(0.003)
Female* engineering	-0.001	0.007*	-0.001	0.000	0.003	0.007**
	(0.004)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)
Female	-0.007**	-0.008**	-0.004**	-0.003**	-0.004**	-0.004**
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Science degree	0.010**	--	0.002	--	-0.001	--
	(0.003)		(0.002)		(0.002)	
Engineering degree	-0.017**	--	-0.004**	--	-0.009**	--
	(0.002)		(0.001)		(0.001)	
R^2	0.00	0.02	0.00	0.01	0.00	0.01
B. Any reason						
Female*science	-0.004	0.000	0.004	0.003	0.002	0.002
	(0.007)	(0.007)	(0.007)	(0.007)	(0.004)	(0.004)
Female* engineering	0.010*	0.031**	0.007	0.019**	0.005	0.009**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.003)	(0.004)
R^2	0.00	0.04	0.00	0.05	0.00	0.01
Other covariates	--	Yes	--	Yes		Yes

Note: Dependent variable is a dummy for working in a job unrelated to the highest degree. Weighted linear probability coefficients with robust standard errors in parentheses. The sample size is 197,700. All regressions include a year dummy and a female*1993 dummy. Panel B also includes dummies for female, science and engineering. Other covariates are three education dummies, five dummies ofr years since highest degree, six dummies for age, dummies for black, Hispanic, Asian, and dummies for foreign born. Science and engineering refer to the field of study of the highest degree. ** indicates significance at the 5% level, * at the 10% level.

Appendix Table 1: Fields of Study of Highest Degree, by Gender (%)

	(1) Male workers	(2) Female workers	(3) All workers	(4) Job not related	(5) Job closely related
A. Science					
Biological sciences	4.6	3.7	4.2	26.1	48.9
Physical sciences and mathematics	5.0	2.3	3.8	21.4	45.9
B. Engineering					
Computer science	2.8	1.5	2.3	7.6	72.2
Other engineering	11.3	1.4	6.9	11.1	56.5
C. Non science/engineering					
Medicine	4.5	1.9	3.3	2.4	95.0
Nursing	0.3	5.5	2.6	4.9	85.0
Other science/engineering-related	4.8	6.5	5.6	13.3	68.8
Social sciences	9.5	10.7	10.0	34.1	34.3
Legal studies	4.7	2.5	3.7	7.6	83.0
Business, accounting, finance	24.1	13.3	19.3	15.2	48.1
Other non-science/engineering	28.5	50.6	38.3	24.8	54.1
D. All	100.0%	100.0%	100.0%	19.9	55.1
Observations	118,197	79,503		197,700	

Notes: Shares weighted with survey weights. In the regressions, dummies for more detailed fields of studied are controlled for. Column 4 contains the share in the field reporting that their work in the current job is not related to their highest degree of study, column 5 the share reporting their work is closely related to their highest degree of study.

Appendix Table 2: Means of Covariates by Gender

	Male workers or men	Female workers or women	All workers or all	All workers or all 2003	All workers or all Highest degree 1980 or later
Gender	--	--	0.45	0.47	0.49
Bachelor's degree	0.62	0.65	0.63	0.63	0.60
Master's degree (incl. MBA)	0.24	0.28	0.26	0.26	0.29
Doctoral degree	0.05	0.02	0.04	0.04	0.04
Professional degree	0.09	0.04	0.07	0.07	0.07
Age	43.5	42.0	42.8	43.8	38.0
	(9.5)	(9.4)	(9.4)	(9.7)	(8.0)
Years since highest degree	16.7	14.8	15.9	16.6	9.8
	(9.4)	(9.2)	(9.4)	(9.9)	(5.5)
Black	0.05	0.08	0.06	0.07	0.07
Hispanic	0.04	0.04	0.04	0.05	0.05
Asian	0.06	0.06	0.06	0.07	0.06
Foreign-born	0.10	0.09	0.10	0.12	0.11
Born abroad U.S. citizen	0.01	0.01	0.01	0.01	0.01
Born in U.S. territory	0.00	0.01	0.01	0.01	0.01
Year 2003	0.38	0.42	0.40	1	0
Child in household	0.57	0.53	0.56	0.55	0.54
Observations	118,197	79,503	197,700	79,213	117,022
Working	0.93	0.81	0.87	0.86	0.90
Observations	127,991	94,879	222,870	90,204	128,200
Log annual salary -nominal $	10.84	10.57	10.73	10.88	10.70
	(0.56)	(0.51)	(0.56)	(0.54)	(0.53)
Tenure at least 5 years	0.55	0.50	0.53	0.52	0.42
Self employed	0.16	0.09	0.13	0.15	0.10
Observations	112,833	66,333	179,166	70,298	106,855

Note: Shares and means weighted with survey weights. Standard deviations in parentheses.

Appendix Table 3: Workers Attaching Very High Importance to Particular Job Attribute 2003 (%)

	Male workers	Female workers	All workers
Salary	58.4	56.5	57.5
Benefits	63.5	66.3	64.8
Job security	61.9	67.1	64.3
Job location	48.8	57.3	52.8
Opportunities for advancement	45.0	38.9	42.2
Intellectual challenge	60.5	65.4	62.8
Level of responsibility	47.2	47.8	47.5
Degree of independence	62.5	65.6	63.9
Contribution to society	43.0	58.6	50.3
Observations	46,364	32,849	79,213

Note: Shares weighted with survey weights. The question asked is "When thinking about a job, how important is each of the following factors to you…". The possible answers are very important, somewhat important, somewhat unimportant, not important at all. In the regression, the full set of dummies is controlled for.

Appendix Table 4: Effect of Field of Study and Gender on Probability of Not Working for Various Reasons

	(1) Retired	(2) On layoff from a job	(3) Family responsibilities	(4) Chronic illness, disability	(5) No suitable job available	(6) No need, do not want to work	(7) Other
Female*science	-0.003	0.003	0.009	0.004*	0.002	-0.005	-0.004*
	(0.003)	(0.002)	(0.005)	(0.002)	(0.002)	(0.004)	(0.002)
Female* engineering	-0.001	-0.002	0.003	0.002	0.004	-0.010**	-0.002
	(0.002)	(0.003)	(0.006)	(0.002)	(0.003)	(0.004)	(0.002)
Female	0.006**	-0.002**	0.091**	0.002	0.002*	0.054**	0.005**
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
R^2	0.14	0.01	0.06	0.01	0.00	0.04	0.01

Note: Dependent variable is a dummy for not working in the survey week for the reason given in the column heading. 222,870 observations. Weighted linear probability coefficients with robust standard errors in parentheses. All regressions include a year dummy and a female*1993 dummy, 29 field of study dummies, three education dummies, five dummies for years since highest degree, six dummies for age, dummies for black, Hispanic, Asian, and dummies for foreign born. Science and engineering refer to the field of study of the highest degree. ** indicates significance at the 5% level, * at the 10% level.