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Steady as She Goes?
Three Generations of Students through the Science and Engineering Pipeline *

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EXECUTIVE SUMMARY

A decline in both the quantity and quality of students pursuing careers in science, technology, engineering, and mathematics (STEM) is widely noted in policy reports, the popular press, and by policymakers. Fears of increasing global competition compound the perception that there has been a drop in the supply of high-quality students moving up through the STEM pipeline in the United States. Yet, is there evidence of a long-term decline in the proportion of American students with the relevant training and qualifications to pursue STEM jobs?

In a previous paper, we found that universities in the United States actually graduate many more STEM students than are hired each year, and produce large numbers of top-performing science and math students. In this paper, we explore three major questions: (1) What is the "flow" or attrition rate of STEM students along the high school to career pathway? (2) How does this flow and this attrition rate change from earlier cohorts to current cohorts? (3) What are the changes in quality of STEM students who persist through the STEM pathway?

This analysis has brought together several longitudinal data sets to examine trends in the rates of retention and attrition along three points in the STEM pipeline:

- high school to STEM degree in college (five years after high school),
- completion of a STEM degree to first jobholding (three years after college), and
- completion of a STEM degree to employment in a STEM occupation at mid career (ten years after college completion).

We evaluate the trend in average rates of retention along the pipeline, conditioned on completion of one stage and based on transition status. Further, we evaluate differences in trends among levels of performance at the outset of a transition as captured by math SAT/ACT performance in high school and overall college GPA thereafter.

Our findings indicate that STEM retention along the pipeline shows strong and even increasing rates of retention from the 1970s to the late 1990s. The overall trend of increasingly strong STEM retention rates, however, is accompanied by simultaneous and sometimes sharp declines in retention among the *highest performing* students in the 1990s.

- Overall, STEM retention at the three transition points (high school to college, college to first job, college to mid-career jobs) was:
    - relatively *unchanged* from high school to college from the 1972/77 to the 2000/05 cohort;
    - *higher* from college to first job from the 1977/80 to the 1997/00 cohort (although it dipped markedly in 1997/00 from the peak for 1993/96); and
    - *higher* from college to mid-career job from the 1977/87 to the 1993/03 cohort.

- For the *highest performers*, STEM retention:
  - *initially increased then declined for high school to college transition—increasing* from high school to college from the 1972/77 to the 1992/97 cohort, but then *declining* steeply from the 1992/97 to the 2000/05 cohort;
  - was *no different* from that of average performers between college and first jobholding across all cohorts, but all quintiles shared in an across-the-board *decline* from the 1993/96 to the 1997/00 cohort; and
  - decreased in absolute terms as well as relative to the average trend from college to mid-career jobs from the 1977/87 to the 1993/03 cohort.

It appears that the 1990s marked a turning point in longer-term trends for the best students either in high school or college. The top quintile SAT/ACT and GPA performers appear to have been dropping out of the STEM pipeline at a substantial rate, and this decline seems to have come on quite suddenly in the mid-to-late 1990s (although our cohorts cannot precisely time the break in trend).

What might explain this loss of high-performing students from the STEM pipeline? This question cannot be answered by these data, but this analysis does strongly suggest that students are not leaving STEM pathways because of lack of preparation or ability. Instead, it does suggest that we turn our attention to factors *other than* educational preparation or student ability in this compositional shift to lower-performing students in the STEM pipeline.

The decline in the retention of the top achievers in the late 1990s is of concern. This may indicate that the top high school graduates are no longer interested in STEM, but it might also indicate that a future in a STEM job is not attractive for some reason. The decline in retention from college to first job might also be due to loss of interest in STEM careers, but alternatively top STEM majors may be responding to market forces and incentives.

From this perspective, the problem may not be that there are too few STEM qualified college graduates, but rather that STEM firms are unable to attract them. Highly qualified students may be choosing a non-STEM job because it pays better, offers a more stable professional career, and/or perceived as less exposed to competition from low-wage economies.

It also may be that STEM-prepared students are increasingly being recruited into jobs that are not categorized as STEM according to the occupational categories captured in the surveys examined here but jobs that do require or at least utilize their STEM education. The latter type of explanation suggests that market forces are generating more STEM management jobs not formally classified as "STEM," or even generating more strictly "non-STEM" jobs that require a very strong understanding of STEM. This latter type of explanation, nevertheless, neither rules out nor is inconsistent with the possibility that market forces are reducing the relative attractiveness (earnings) of formal STEM jobs, and it is this possibility that may be discouraging the highest achieving students from continuing down the STEM pipeline.

INTRODUCTION

Rising concern about the state of education in science, technology, engineering, and mathematics (STEM) has many stakeholders decrying a purported decline in both the quantity and quality of students pursuing STEM careers. Fears of increasing global competition compound the perception that there has been a drop in the supply of high-quality students moving up through the STEM pipeline in the United States. We can readily forecast continued demand for STEM workers, although the *robustness* of that demand is still unknown, which suggests that fewer students pursuing STEM careers could well create potential supply bottlenecks. America's competitiveness in tomorrow's knowledge economies might be sorely tested.

Yet, is there evidence of an actual long-term decline in the proportion of American students with the relevant training and qualifications to pursue STEM jobs? We have argued elsewhere that the United States actually supplies more than enough students prepared for STEM jobs and that there is little evidence of a current domestic supply bottleneck (Lowell and Salzman, 2007).[1] We found that universities in the United States actually graduate many more STEM students than are hired each year. We also found that the U.S. education system produces large numbers of top-performing science and math students.[2] The analyses undertaken here examine cross-sectional data about supply and quality at discrete points in the high school to career pathway. Our previous analyses did not examine the supply and attrition of STEM students through high school to career pathway, nor did we examine changes over time in flows of STEM students. Also unanswered were questions about *relative* shifts over time in supply and in quality of STEM students. The arguments currently in vogue, however, casually assert a long-run decline and champion a return to days when the Cold War impelled policymakers to boost STEM education. The technology and economic challenges from other countries do

[1] See B. Lindsay Lowell and Hal Salzman, "Into the Eye of the Storm: Assessing the Evidence on Science and Engineering Education, Quality, and Workforce Demand" (Urban Institute, Oct. 29, 2007) and "Making the Grade" *Nature* (May 2008), for authors' earlier work on this topic.

[2] Hal Salzman and B. Lindsay Lowell. "Making the Grade," *Nature* 453, no. 28-30 (1 May 2008).

not appear to motivate the same nationalist responses as the Sputnik challenges, though a similar type of argument is sometimes invoked to spur interest in STEM careers.

We do not have data here that can tell us about the late 1950s and 1960s, but we can examine six cohorts of students reaching back to the early 1970s. In this paper, we explore three major questions: (1) What is the "flow" or attrition rate of STEM students along the high school to career pathway? (2) How does this flow and attrition rate change from earlier cohorts to current cohorts? (3) What are the changes in quality of STEM students who persist through the STEM pathway? We focus on analyzing the entire course of the STEM pipeline, examining transitions from high school to a STEM major in college, as well as the transition to a first and then mid-career job in a STEM occupation (in this paper we only examine entry into STEM occupations).

We have brought together several sources of quantitative data in order to better understand the pathways or transitions between completed stages in the educational and employment pipeline. We analyze the proportion of students who, having completed one career stage, continue with STEM in a next stage. Changes in the proportion of students staying in the STEM pipeline from one transition point to the next capture the degree to which there is a decline (or increase or stability) in the STEM supply. These proportions are the "STEM retention rate" (or inversely, the "attrition rate") that we use to track trends in the STEM-educated population. We further differentiate students by their "quality," using quintile rankings of their achievement level on college-board exam scores or college grade point average. By examining multiple longitudinal data sets comparing successive cohorts, we are able to track changes in STEM transition rates by level of achievement.

This report will proceed as follows. First, a brief literature review will present several theoretical explanations for the trends in the STEM workforce and of leaks in the pipeline. This will be followed by a discussion of the data and methods. The next section will present the findings, discussing the STEM pipeline rates of retention over time and by STEM achievement levels. We also discuss trends in the relative proportion of students and employees in STEM as opposed to non-STEM. The report will conclude with some possible explanations for the trends identified. There follows detailed appendices that present the individual findings from each of the data sets and for each of the transitions.

LITERATURE REVIEW

Developing a sufficient supply of STEM workers requires an understanding of how to develop flows of students into the pipeline. Our understanding of how this takes place is not well developed. In general, there are three types of explanations of why students choose to pursue STEM courses of study. One perspective is that early exposure to, and proficiency in, math and science induces students to choose to study STEM topics. In this view, it is assumed that science and math ability and performance will translate into a STEM career choice. This view focuses almost exclusively on supply attributes. A second perspective is that career choices are largely idiosyncratic, involving a matching of interests and occupations. In this view, qualifications are necessary but not sufficient to determine career outcomes. The third view focuses on demand factors. In this view, labor markets attract students and workers, at least at the margin, to career paths that will pay them the most given their abilities. In this view, market demand will create sufficient supply, albeit with a lag for the time it takes for skill development (which can be a long time for fields requiring a post-graduate degree, thus leading to spot shortages).

Clearly, the first viewpoint, that preparation in and exposure to science and math induces students to study STEM, is premised on early exposure. This perspective usually focuses on K-12 education of the nation’s children. It often highlights their purported inadequate coursework and deficient performance on international tests in comparison to other highly developed nations. In past work, we have examined in detail some of these concerns and provided evidence shedding doubt on some of the most alarmist claims.[3] It is important to note, however, that this perspective implies that the quality of preparation is important to continued pursuit of STEM education, as well as capacity to be

[3] See Lowell and Salzman 2007.

competitive in STEM innovation. It suggests, at the same time, that well-prepared high school students will be more likely to continue on to graduate in STEM fields of study at the college level. Math education in particular is thought to be important to STEM education and has been shown to be so for engineers.[4] This informs our decision, in the forthcoming analysis, to evaluate the effect of students' performance on the math portion of the SAT on their likelihood to continuing on to STEM majors in college. We note that this perspective focuses on the necessary conditions for STEM careers, namely an adequate level of academic preparation, but not the sufficient conditions that actually motivate those who are prepared to pursue a STEM career. (We also note that even the "necessary" level of preparation is not fully captured by degrees since a sizable portion of STEM jobholders do not have college degrees and/or degrees in STEM majors). Our analysis does examine the "efficiency" of STEM exposure and proficiency in producing STEM degree holders and workers.

A second perspective, drawn from the career counseling and education field, sees career choice as a match of interests, attributes, and capabilities that is largely an individual developmental outcome. Career counseling is then a process of identifying good matches, and increases in particular career choices would only be the result of better matches between student interests (which are developmental outcomes) and jobs. Within the education and career counseling fields, career choice outcomes are posited to result from an interaction between personality traits and job characteristics. More and better career information is thought to increase the quality of the match between job seekers and jobs.[5] Our data do not permit us to examine the effect of personality or cognitive factors on outcomes, nor do we have any particular reason to doubt the value of taking into consideration these individual traits for choice of field of study. More problematic, from our point of view, is the lack of any empirical analysis in this literature about the extent to which career choice can be influenced by educational and market factors or even broader cultural influences. Further, this line of argument typically ignores the empirical work on

[4] Clifford Adelman, "Women and Men of the Engineering Path: A Model for Analyses of Undergraduate Careers," U.S. Department of Education, 1998; Adelman, Clifford, "Answers in the Toolbox: Academic Intensity, Attendance Patterns and Bachelor's Degree Attainment," U.S. Department of Education, 1999.
[5] John L. Holland, *Making Vocational Choices: A Theory of Vocational Personalities and Work Environments*, Psychological Assessment Resources, 1992.

some STEM fields, engineering in particular, about retention in college and in careers. These studies often find students leave engineering majors because they find the quality of teaching low or other subjects more interesting.[6] It seems that these studies are sufficient to direct attention to specific *causes of attrition* rather than amorphous and not well-understood factors of perception and image.

The third approach focuses on market mechanisms and the incentives students and professionals experience. It examines demand and supply factors for setting labor prices and sending market signals that have a lagged effect on supply. From this perspective, the purported problem of a STEM workforce shortage may mean not that there are too few STEM-qualified college graduates, but rather that STEM employers are unable to attract them. Highly qualified students may be choosing a non-STEM job because it pays better, offers a more stable professional career, and/or perceived as less exposed to competition from low-wage economies. These potential alternatives could include business, healthcare, or law. A few labor market studies, notably by Richard Freeman and colleagues,[7] have focused on the quality of STEM jobs. These studies conclude that the decline in the native STEM worker pool may reflect a weakening demand, a comparative decline in STEM wages, and labor market signals to students about low relative wages in STEM occupations. Indeed, research finds that the real wages in STEM occupations declined over the past two decades and labor market indicators suggest little shortage.[8] Some researchers see these demand-side market forces causing highly qualified students to pursue other careers. A well-accepted model of cyclical patterns of student and worker supply is the cobweb model.[9] Research finds, in

[6] Interviewing college students who switch out of engineering or science majors, various studies find students citing the quality of instruction, the "culture" of the discipline, and other curricular issues. Some find that these factors are more important than the student's skill or aptitude. For example, see Elaine Seymour and Nancy M. Hewitt, *Talking About Leaving: Why Undergraduates Leave the Sciences*, Boulder, CO: Westview Press, 1997. Schools such as University of Pittsburg have changed curriculum and implemented programs to increase retention based on these research findings and their own study: Shuman, L.J., C. Delaney, H. Wolfe, A. Scalise, and M. Besterfield-Sacre, "Engineering Attrition: Student Characteristics And Educational Initiatives," Paper presented at the American Society for Engineering Education, Charlotte, North Carolina (June 20-23, 1999).
[7] Op cit. Richard B. Freeman 2004.
[8] Thomas J. Espenshade, "High-End Immigrants and the Shortage of Skilled Labor," Office of Population Research, Working Paper No. 99-5 (1999).
[9] Richard B. Freeman, T*he Overeducated American*, New York: Academic Press, 1976.

accordance with market mechanisms, that an increase in wages leads to an increase of job seekers but, in turn, a large supply of job seekers can depress wages. Declining wages will result in reduced student enrollments, although there is a lag in enrollment response. For example, research finds that a previous decline in mathematics enrollments through 1996 corresponded to this cycle.[10] One implication from this perspective is that we might well expect a decline in students, even students who are well qualified as ascertained from the SAT math exams, who continue on to complete a college degree in STEM. It could also be the case that in response to job market developments, increasing shares of students and workers do not continue on to work in STEM jobs.

Whatever the current zeitgeist that leads many observers to believe that the STEM pipeline is in decay, at least two of these perspectives on career choice do not suggest a causal chain that would lead us to expect long-term changes in the proportion of students on a STEM career track. On the one hand, consider the implied argument that the impulse for pursuing STEM education is found in high schools, which can stress, or not, math and science education. Strictly speaking, the economic incentives of different career outcomes might be totally ignored if early STEM education inspires students to pursue STEM careers. So if the proportion of high school students getting science and math education has increased—as it evidently has, even if some observers wish the quantity and quality to be even better[11]—then we might expect some increase in students continuing on in STEM careers.[12] On the other hand, if the impulse to pursue STEM

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[10] Geoff Davis, "Mathematicians and the Market," Mathematics Department, Dartmouth College (1997).

[11] For detail on math and science course taking and achievement over the past 20 to 30 years, NSF provides the most comprehensive review. The following summary of the research comes from the *NSF Science and Engineering Indicators 2004*: "The NAEP trend assessment shows that student performance in mathematics improved overall from 1973 to 1999 for 9-, 13-, and 17-year-olds…In general, the average performance of both males and females in mathematics improved from the early 1970s to the late 1990s, including the period from 1990 to 1999. In 1982, high school graduates earned an average of 2.6 mathematics credits and 2.2 science credits. By 1998, those numbers grew to 3.5 and 3.2 credits, respectively (National Center for Education Statistics 2001). This expansion of academic coursetaking included all racial/ethnic groups and both male and female students….NAEP data indicate that the proportion of students who take algebra early increased between 1986 and 1999..[the percentage of] 13-year-olds enrolled in algebra and in pre-algebra…had risen [from 16 and 19 percent] to 22 and 34 percent, respectively [increases of 38% and 78%, respectively]."

[12] At the same time, some research finds a significant disconnect between high school interests and the choice of college major. This suggests that career aspirations are loosely coupled to the choice of subject that college students study, and it is even less clear that strong performance in these subjects would necessarily lead to STEM careers when there are other options. For example, many women who perform

careers is found in the personality traits of individuals then we might not expect to find much change in the proportion of students pursuing STEM careers over time. In either case, trends in pre-college education or possible shifts in the average personality type, we would not expect a decline in the number of students in the STEM pipeline over the past few decades.[13]

In short, only the economic argument would seem to offer much reason for expecting a substantial long-term decline in the proportion of high school and college students who pursue STEM careers. The data show a softening in STEM wages as compared to other fields, suggesting a decline in the incentive to pursue STEM studies and careers.[14] The changes in the relative market incentives to pursue a STEM career, however, could have a range of different impacts on the "flow" in the STEM pathway. There could be an overall decline in STEM school enrollments to the extent that field of major is tightly coupled with career choice; students might pursue STEM majors but it could affect transition rates at particular points, notably college to career. Alternatively, weakened STEM labor market conditions could have compositional effects in terms of quality, not attracting the best performers, but not changing the overall supply in terms of quantity. That is, the best STEM students might migrate to higher paying careers resulting in a shift in the proportion of lower-performing students entering STEM careers.

The research on career choice does not provide a clear model of how and why STEM careers are developed. The choice of college major is not well understood, except to the extent that research shows it to be somewhat idiosyncratic and not the result of a rational or at least a well-founded choice about education or career. The U.S. education

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well in math fail to study STEM subjects in college because they can, not because they can't compete in STEM.

[13] Then again, changes in overall zeitgeist might impact the choices that different personality types make. The "Sputnik spike" in STEM suggests some evidence for the zeitgeist argument, but no evidence for the "exposure" argument since supply remained constant.

[14] Richard B. Freeman, "Does Globalization of the Scientific/Engineering Workforce Threaten U.S. Economic Leadership?" in *Innovation Policy and The Economy* v.6 NBER/MIT Press (2006); Freeman, Richard B., Emily Jin, Chia-Yu Shen "Where Do New US-Trained Science-Engineering PhDs come from?" NBER Working Paper No. 10554 (June 2004).

system is only loosely coupled to the career development pathway, such that the impact of particular types of education on career outcomes is likely to be weak.

The policy issues and prior research suggest three research questions:

(1) What is the "flow" or attrition rate of STEM students along the high school to career pathway?
(2) How does this flow and attrition rate change from earlier cohorts to current cohorts?
(3) What are the changes in quality of STEM students who persist through the STEM pathway?

To explore these issues further, we designed a study to examine transition points along the education to career pathway using longitudinal data and comparing different cohorts.

ANALYSIS AND DATA

The STEM pipeline can be conceptualized as a pathway from early education, up through college, and then end with STEM employment. Each change in status from one stage to another—from one level of education to another and from one job to another—marks a "transition" point along the pipeline. It is also a pathway that can have many exits and entries, and reentries, along the way. As a first step toward understanding the transitions along this pathway, we identify several major transition points and the changes in transition rates.

In order to examine each of our research questions, we identify key transition points in the STEM pipeline. The pipeline begins with high school graduates, continues on to completion of a college degree, and then moves on to a first job and mid-career jobs in a STEM occupation. The available data permitted us to analyze three major transitions:

- High school to college major (two years and five years post high school graduation),

- Bachelor’s degree to first job (three years post college graduation), and
- Bachelor’s degree to mid career (ten years post college graduation).

In order to examine changes in transition rates over time, we examine six different cohorts using six longitudinal data sets. This approach is described in detail in the section below.

The transition rate can be defined as the percentage of a given cohort that moves from one stage to the next, at each transition point. To calculate the likelihood that individuals move from one stage to another and transit along the STEM pipeline, we use the percentage of individuals who are in STEM at a given stage who then, in turn, end up in STEM at the next stage. The “flow rate” of the pipeline is indicated by changes (or stability) in the flow or transition rate; that is the percent of individuals who continue to transit along the pipeline. The quality of the supply is indicated by academic performance of those who continue along the STEM pathway at each transition point.

We follow the transitions by focusing on end states; that is, to say completed high school, completed college degrees, and employment at a given time after the bachelor’s degree is completed.[15, 16] Each outcome is classified as STEM or non-STEM according to the major occupational codes available on the surveys, in particular: the Life and Physical Sciences, Engineering, Mathematics and Information Technology, and Science and Engineering Technicians.[17] We also divide the population by achievement level or what we also refer to as level of STEM preparation. For high school graduates, this was

[15] Prior research covers relevant concepts, operationalization, and variable coding. See Adelman 1998 and 1999; Burkam, David T. and Valerie E. Lee, “Mathematics, Foreign Language, and Science Coursetaking and The NELSs:88 Transcript Data,” National Center for Education Statistics, Working Paper No. 2003-01 (2003), University of Michigan.

[16] In order to place respondents into different categories, status hierarchies are used. In cases where an individual fell into multiple categories, they are assigned the higher of the priorities. For High School to BA transitions, the status hierarchy is: 1. Full-time graduate school enrollment, 2) Obtained bachelor degree, 3. Full-time employment, 4. Part-time graduate school enrollment, 5. Full-time or part-time undergraduate enrollment, 6. Part-time employment, 7. Unemployed/Not in labor force, 8. Missing. For BA to First Job and BA to Mid Career, the status hierarchy is: 1. Full-time graduate enrollment, 2. Full-time 'other' enrollment, 3. Full-time employment, 4. Part-time graduate enrollment, 5. Part-time 'other' enrollment, 6. Part-time employment, 7. Unemployed/Not in labor force, 8. Missing.

[17] The Social Sciences are excluded from our STEM classification..

measured by their score on the math section of the SAT or ACT college board exams.[18] For college graduates, preparation is measured by their grade point average earned in undergraduate work. We break the test scores and GPA into quintiles with the highest quintile being the "most prepared" and the lowest quintiles the "least prepared."

For simplicity of analysis, our following discussion combines and tracks outcomes over time (comparing cohorts or data sets). We present the detailed tables for multiple outcomes separately for each cohort (data set) in the Appendices to the report. For example, the interested reader can find in the Appendix tables the percentage of high school graduates who complete a BA degree in a STEM field *or* are currently enrolled in a STEM field. We will not, however, discuss these detailed findings but rather combine degree holders *and* enrollees as a single STEM outcome. The body of this report focuses on the comparisons between and within data sets to compare trends over time for STEM/non-STEM outcomes and between STEM preparation levels.

Data Sources and Transitions

We tabulate the microdata from several longitudinal data sets in order to track changes in trends over time. The data sets are the:

- National Longitudinal Study of 1972 (NLS72), U.S. Department of Education
- National Longitudinal Survey of Youth (NLSY79), U.S. Department of Labor
- High School and Beyond (HS&B), U.S. Department of Education
- National Educational Longitudinal Study of 1988 (NELS88), U.S. Department of Education
- Baccalaureate and Beyond Longitudinal Study 1993 (B&B), U.S. Department of

[18] ACT math scores are converted to SAT math scores using the conversion tables in the following report: http://professionals.collegeboard.com/research/pdf/rr9901_3913.pdf. The question of individuals who did not have an SAT or ACT score (whether because they did not take the test or because the score was unavailable), the proportion of which varied between 45 and 65 percent in each of the samples, poses a complication. Due to great variation of the proportion of these individuals across samples, we do not feel confident comparing the samples with them included – especially given how large they are. In our comparison of STEM retention over time, we decide to exclude non-test-takers because their inclusion would skew the average retention rate. We reason that they never intended to attend college and so should not be included in the overall retention rate; that is, by not taking a college entrance exam, they never *entered* the STEM pipeline.

Education

- National Longitudinal Survey of Youth (NLSY97), U.S. Department of Labor

Note that specific details about each data set, including coding criteria and sample size, are available in Appendix I.

The data sets ultimately define a “cohort” of a specific period of time, albeit that cohort is not always neatly defined at a point in time and may include individuals who complete degrees over adjoining years. The data sets do cover 30 years of time and successive cohorts, but because they start with different sampling strategies, they do not all include the same stages or transition points. Table 1 shows which data sets are used to track which sets of transitions.

Table 1. Data Sets for Major Transition Points

Transition Points	Cohorts	Notes
High school to college	NLS72: 1972/77 HS&B: 1982/87 NELS88: 1992/97 NLSY97: 2000/05	Eighty percent of the NLSY97 sample graduated in 1999 or 2000, but this is referred to as the 2000/05 cohort. For NLSY97, SAT scores are re-centered and converted to the pre-1995 scale. See text for details.
College to first job	NLS72: 1977/80 NLSY79: 1986/89 HS&B: 1987/90 B&B: 1993/96 NELS88: 1997/00	The NLSY79 sample includes many different graduation years but 85 percent graduated between 1983 and 1989, so we refer to it as the 1986/89 cohort. *We do not include it in the over-time charts although the results are reported in Appendix Tables 3.3 and 3.4. See text for more detail. No GPA information is available for NLSY79.
College to mid-career job	NLS72: 1977/87 NLSY79: 1986/96 B&B: 1993/03	No GPA information is available for NLSY79.

Defining Transition Cohorts

We put together a collection of data sets for each transition type, and compared their results to track change over time for a given transition. Significant consideration went into deciding which individuals to include in each sample in order to maximize the comparability of the results from different data set samples.

In general, we came as close as we could to isolating the graduates of a particular year within each cohort. Most of the samples isolate a cohort of graduates from one particular graduation year, while two samples include a wider spread of graduates. NLSY97's cohort of high school graduates will be referred to as the "2000" cohort for simplicity's sake, but in fact the sample includes graduates from multiple years: 80 percent of those included graduated in 1999 or 2000, and 50% graduated in 1997. The other spread-out cohort comes from NLS79. This will be referred to as the "1986" cohort of college graduates, but in fact the sample includes graduates from multiple years: 85 percent of those included graduated from college between 1983 and 1989.

Each cohort is tracked for results over the course of the STEM pipeline. While completion marks each stage in the pipeline, we have to set time limits to measure whether a degree was completed or a job obtained at a following stage. In other words, we start with high school graduates but freeze frame our measurement of the next stage of college. We count college completion five years after high school completion because (a) we would otherwise have to consider completion up to an infinite number of years after graduation, (b) the successive waves of most of the longitudinal data sets favored that time frame, and (c) the preponderance of high school graduates complete college within the same general time frame so that rightward censure of time loses little information. Our time frames are as follows:

(1) five years after high school graduation (high school to BA transition),[19]
(2) three years after college graduation (BA to first job transition), and
(3) ten years after college graduation (BA to mid-career transition).

For the rest of this report, transition cohorts will be referred to by their graduation year and the year of the next stage in the transition. So, the five-year transition of the 1972 high school graduates cohort will be referred to as "the 1972/77 cohort," where 1972 dates the year of the high school completion and 1977 dates the year at which we measure their college completion.

Sample Sizes and Tests of Significance

Because STEM is, ultimately, a small share of education and job outcomes, there

[19] We also consider two years after high school graduation to measure the completion of an Associates Degree. However, as will be discussed elsewhere, the available data and sample size for this transition are too small in the most recent data sets to warrant presentation of that analysis.

are rather few cases in the samples. All of the tables presented here are weighted results. Of course, the small sample available is why we also aggregate all STEM fields and occupations, as detailed breakdowns would not have enough sample size for reliable results.

Given the detailed breakdown of each of the samples into transition types and achievement levels, we often end up with categories in the transition tables that have a sample size of less than 30. We decided to include these figures in the transition tables but opted to mark the affected cells in italics. This means that the proportions reported based on insufficient sample size, those in italics, should be understood to be somewhat inconclusive. We feel justified in presenting these values despite the insufficient sample size based on the presence of other sufficiently estimated categories in a given sample. Based on binary deduction, one might assume the other group is being effectively captured.

Still, differences across years and cohorts evident in the tables and figures presented in the findings and appendices do not systematically include tests of statistical significance, so readers should not assume that all differences are significant. Tests of statistical significance have been included for notable differences in proportions in the text of the findings section. Primarily we have focused on testing the difference between retention proportions between observation periods (e.g., was there really a dip in STEM retention between 1993/96 and 1997/00?) and between achievement levels (e.g., is quintile five's retention rate significantly higher than the average retention rate within a given cohort?). Tests of statistical significance are run on sets of proportions that are treated as if they come from independent samples.[20] We have provided the z score and p values corresponding to each significance test in the text of this report.

[20] A standard statistical test comparing two proportions was used to compute the z score:

$$\frac{P_2 - P_1}{\text{sqrt}\,(SD(P_2)+SD(P_1))}$$

FINDINGS ON COHORTS AND TRANSITIONS

This section presents the comparative evidence for each of the three transitions that we examine, and highlights important trends over time and between levels of STEM preparation. We present only the most important transition statuses across cohorts and the detailed transition tables for each of the data samples can be found in the Appendices. For each transition we discuss two measures:

(1) Rates of transition for a given cohort *between* life stages (row percent), e.g., the likelihood that individuals who complete a stage in a particular status end up in the same or a different status at the next stage. For example, we are interested in the likelihood that individuals who complete a bachelor degree in a STEM field are employed in a STEM occupation some years later. By comparing cohorts, we wish to determine whether successive cohorts evince ever lower rates of retention along the STEM pipeline.

(2) Proportional distribution of a given cohort *within* a life stage (column percent), e.g., the percentage of all individuals at a given stage or point in time who are in a particular status. For example, we are interested in the simple proportion of the cohort that is employed in STEM occupations. We wish to know how prevalent STEM graduates, as well as STEM job-holders, are across cohorts and over time, i.e., whether the proportion of STEM-educated or employed Americans is decreasing.

Below we present the findings comparing trends over time with text and illustrative charts, proceeding from the first transition from high school to college, then from college to first job, and finally from college to mid-career employment. For each transition, we include a section on over-time retention between statuses and a section on the cross-sectional distribution within statuses. We conclude the presentation of these transitions with a short summary of the principal findings.

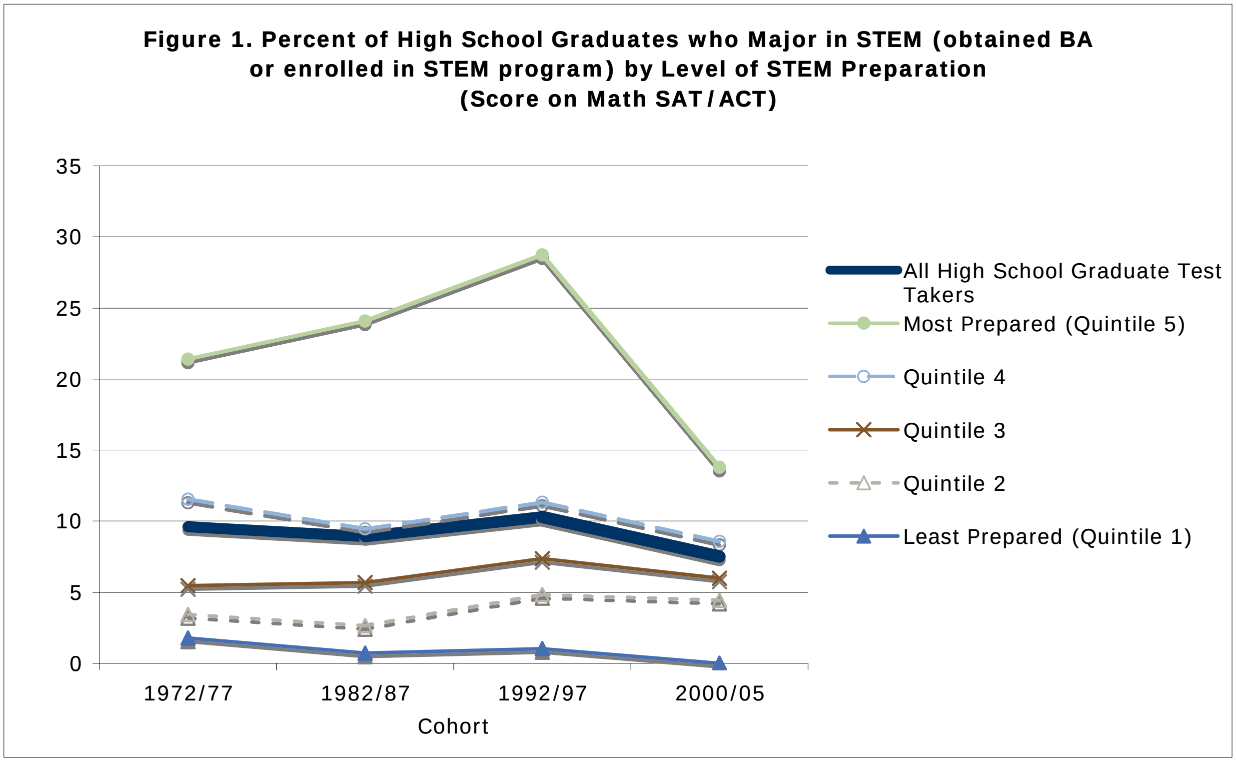
Transition 1: High School to College (Five-Year Transition)[21]

Retention of high school graduates to STEM major

Are high school graduates, particularly those most qualified for STEM careers, becoming less likely to continue on a STEM pipeline in college? We graph the change over time in the percent of high school graduates who have either completed a STEM bachelor's degree (BA) or are enrolled in a STEM BA or graduate program (five years after high school graduation).[22] We exclude high school graduates who did not take the SAT or ACT primarily because we cannot classify them, but also because almost all college-bound students take the exams and those who do not are extremely few; and because their trends tend to mimic the average as graphed (see detailed Appendix tables).

As illustrated in Figure 1, the retention of *all* high school graduates in the STEM pipeline through college has stayed about the same over time. The likelihood that *all* high school graduates are retained in STEM at the college level is quite constant around ten percent: the small decrease for all test-takers from 9.6 percent in 1972/77 to 8.3 percent in 2000/05 is not statistically significant.[23] On average, there has been no substantive change in the proportion of high school graduates who go on to complete or enroll in a STEM field of study.

[21] This study would have ideally fully investigated the transition from high school to associate's degree, an educational credential that increasingly rose in importance in the 1970s and 1980s. Difficulties with data availability led us to initial exploratory research tapping into two cohorts (1972 and 1982 high school graduates), which shows a significant increase in the percentage of high school graduates majoring in STEM between those two cohorts. The percent of all high school graduates majoring in STEM in an associate's degree as of three years after high school graduation rose from .8 percent to 3.3 percent between the 1972/75 and 1982/85 cohorts. Among those pursuing associate's degrees at that point, the percent majoring in STEM went up from 11 percent to 16 percent. This difference in proportions is statistically significant at five percent (p=.0026, z=3.034).
[22] To repeat, the notation in the graph refers to the start and end years of the transition, e.g., the year of high school graduation and the year at which the next stage (college status) is measured. For example, 1972/77 refers to the cohort that graduated from high school in 1972 and whose transition category is measured five years after graduation in 1977.
[23] Not statistically significant at five percent (p=.062, z=1.54).



Notes: The distribution of quintiles is slightly uneven in the 2000/05 cohort because some respondents' test scores were reported as ranges rather than specific scores. Quintile 3, in particular, contains considerably fewer respondents than the other quintiles.

We expect that performance on college exams is correlated with preparatory education and, in turn, that students best prepared in math should be the most likely to continue along in STEM. Indeed, Figure 1 indicates that the highest performers are significantly more likely to major in STEM than the lower performers (those who score in lower quintiles on the math SAT or ACT). As the Figure shows, as math performance goes down, so does the proportion of high school graduates going on into STEM in college.[24] Quintile 5 retention in STEM is substantively higher than average test-taker retention across all cohorts and remains statistically significant even for the last 2000/05 cohort.[25] Note that quintile 4 retention is about equal to retention among all test-takers

[24] Note that the percent of low-scorers (quintiles 1 and 2) majoring in STEM is so low that there were sample size problems in estimating this group.
[25] The difference between quintile 5 and average test-taker retention proportions for the 2000/05 cohort is statistically significant at five percent (p=.0036, z=2.69).

but still nearly 6.5 to 13.5 times greater than retention among students who perform worst on the SAT/ACT.[26]

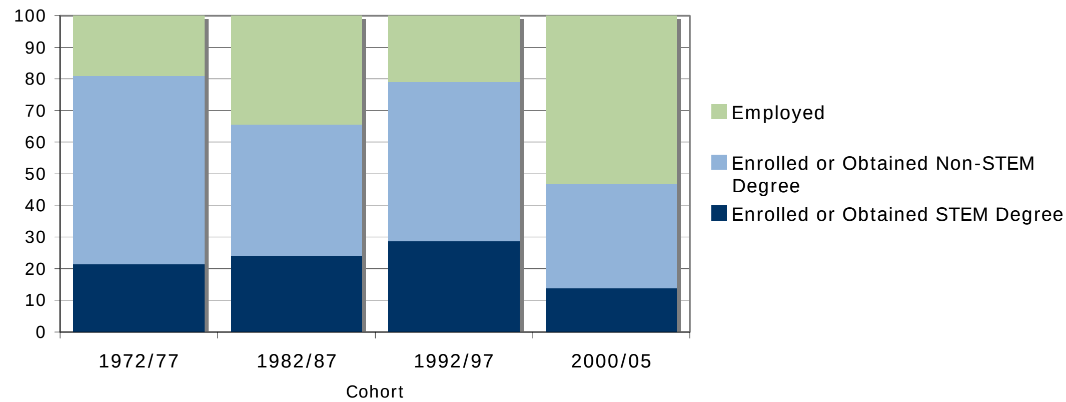
The dramatic drop in quintile 5's retention over the late 1990s is striking, however. The retention rate of the very top achievers rises for the first few cohorts only to then experience a rapid decrease in the late 1990s. The decrease in the retention of quintile 4 students in the STEM pipeline from 1972/77 to 2000/05 is slight but statistically significant, while the decline in quintile 5 retention between these cohorts is statistically significant and considerably larger.[27] In fact, the notably increasing retention of the 5th quintile high school students up through 1992/97 shows a marked reversal, declining from 28.7 percent in the 1992/97 cohort to 13.8 percent in the 2000/05 cohort.[28]

Why might this drop have occurred? Figure 2 shows a breakdown of all of the possible five-year post-high school transition statues for just the top quintile. There are considerable differences between the cohorts in the proportion of the top performers who are employed, enrolled, or college graduates. The greatest difference between the 2000/05 and earlier cohorts includes the decline in STEM retention; and the marked increase in the percentage that is employed in the labor market. Unfortunately, sample sizes are too small to permit us to differentiate whether these individuals are employed in STEM or non-STEM occupations. At the five-year mark, too few post-high school employees find jobs in the relatively small STEM workforce to generate a reliable point estimate. Nevertheless, it is clear that individuals in the 2000/05 cohort were more likely

[26] At the same time, the top quintiles always make up a disproportionate number of high school graduates who are going on to college. The top two quintiles alone make up roughly between 50 and 80 percent of all college enrollees or graduates (STEM and non-STEM fields respectively). Perhaps unsurprisingly, students who test less well are more likely to be employed, making up roughly 70 percent of all high school graduates in the labor force five years after their graduation.
[27] Quintile four's drop from 11.6 to 8.6 percent between 1972/77 and 2000/05 is statistically significant at five percent (p=.036, z=1.796) and quintile five's drop from 21.4 to 13.8 percent over the same period is also statistically significant at five percent (p=.0004, z=3.69). Note that limited sample size did not permit us to test the change in quintiles 1, 2, or 3. Quintile 3 had insufficient sample size for the last observation, while quintiles 2 and 1 had insufficient sample for all four cohorts. The weak presence of lower performers is not surprising given that competition for STEM majors and jobs will weed out low performers. Note that as mentioned above, the decline in the overall group was not statistically significant.
[28] Statistically significant at five percent (p=.000, z=6.35).

to be employed than either retained in the STEM pipeline or, indeed, enrolled in or completing non-STEM college degrees.

Figure 2. High School to BA Transitions of Top Achieving High School Graduates (Top Quintile MATH SAT/ACT Scorers)



Proportional distribution of all high school graduates by collegial field of study

Has there been a decline in the proportion of STEM majors in our nation's universities? We examine the proportion of STEM majors among high school graduates who reported being enrolled in a BA program or having completed a BA degree as of five years after their high school graduation.[29] The results are reported in Figure 3. The percent of those students majoring in STEM versus non-STEM certainly did not decrease over time but rather remained quite constant around 20 percent, echoing the retention numbers reported above. This was not true, however, for the top-achieving high school graduates, once again.

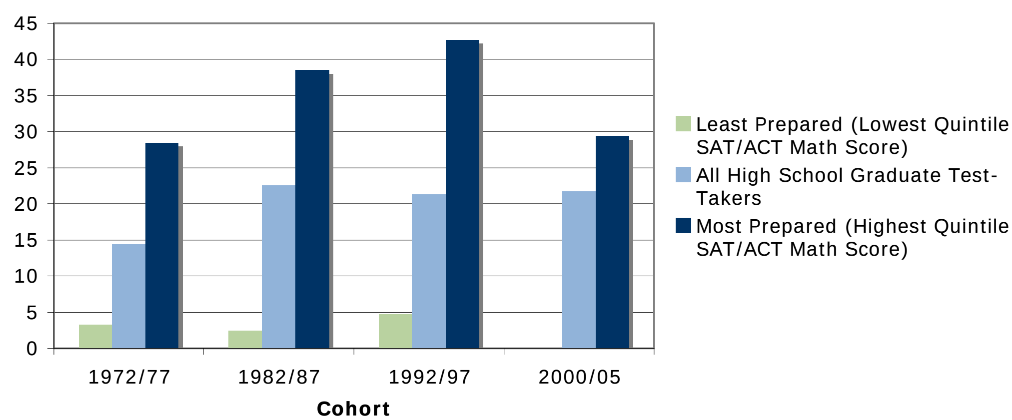
The proportion reported here is different than the retention rate reported in Figure 1 because it calculates the percent of STEM BAs out of all BAs, and does not consider those individuals who did not pursue a college education. As we can see in Figure 3, the percent of STEM degrees among all high school graduates fluctuates around 20 percent

[29] This excludes those students who report being enrolled in graduate programs, which is a relatively small proportion.

for average high school graduates, and is considerably lower for lowest performers (averaging three percent and even down to zero in the most recent cohort) and considerably higher for higher performers (between 30 percent and 40 percent).

The decline among the top quintile in the 2000/05 cohort is once again striking. The decrease in the proportion of top-achieving BA holders majoring in STEM, from 43 percent in the 1992/97 cohort to 29 percent in the 2000/05 cohort, is statistically and substantively significant.[30] This decline shows that the retention decline is not just due to more top performers leaving to go into employment, as we discussed in the retention section above. A larger proportion of those top achievers who finish degrees are choosing to major in non-STEM fields, perhaps responding to signals that they are receiving from the job market about STEM occupations. These possible market disincentives will be discussed in more detail later in this report. So, on average, it appears that we have a relatively constant percent of STEM majors; however, the top achievers are becoming less likely to major in STEM as of the late 1990s. This reinforces our findings on retention above.

Figure 3. Percent of STEM Majors among High School Graduates who are enrolled in or have obtained a Bachelor's Degree Five Years after Graduation



Notes: Sample size was zero for the lowest quintile in the 2000/05 cohort.

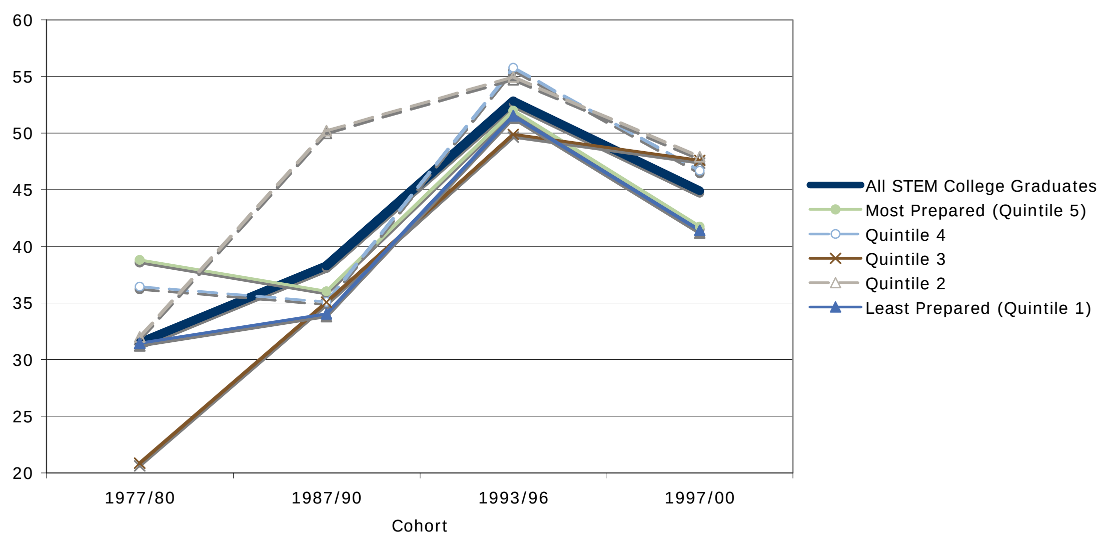
[30] Statistically significant at five percent (p=.001, z=3.15).

Transition 2: College to First Job (Three-Year Transition)

Retention of STEM graduates to first job

What is the likelihood that STEM-prepared college graduates are employed in STEM for their first job? Figure 4 shows that the rate of retention of STEM college graduates in STEM—either working or pursuing graduate studies three years after graduation—showed an upward trend until a statistically significant dip between the 1993/96 and 1997/00 cohorts.[31] Among *all* STEM majors, the average rate of retention in STEM increased from 31.5 percent for the 1977/80 cohort, to 38.3 percent for the 1987/90 cohort, to 52.8 percent for the 1993/96 graduates, but then it fell to 44.9 percent for the 1997/00 cohort.

Figure 4. Percent of STEM College Graduates Enrolled or Employed in STEM Three Years after Graduation by Level of STEM Preparation (College GPA Quintile)



It is reasonable to presume that post-college transitions may vary by college performance and we turn to a measure of college Grade Point Average (GPA) that is, once again, broken into quintiles. Of course, overall GPA is a general measure of achievement and, as such, not as careful a measure of STEM preparation as, say, GPA in a math or science class. Nevertheless, while we have no *a priori* reason to expect GPA to

[31] Statistically significant at five percent (p=.000021, z=4.1).

presage STEM performance as closely as the foregoing analysis of college SAT/ACT math scores, we expect that higher GPA should be associated with higher rates of continuation along the STEM pipeline particularly for students who graduate in STEM.

In fact and to the contrary, Figure 4 shows that the retention in the STEM pipeline (STEM job or further enrollment) is *not* significantly higher for STEM college graduates with the highest GPAs. The rate of retention is quite *similar* for all levels of STEM preparedness, especially for the later cohorts in the 1990s. Even though the *highest* achievers seem to be retained in STEM at a lower level than the *average* STEM college major in the 1997/00 cohort, this difference is neither substantively nor statistically significant (44.9 percent for top quintile 1997 graduates versus 41.8 percent for the 1997 average).[32] And although members of the second quintile (the second to lowest GPA quintile) appear to be staying in STEM at a higher rate than the average (significantly so in 1987/90), this difference is also not statistically significant by the 1997/00 cohort.[33] One interesting finding is that those STEM majors in the middle of achievement, those falling in the third quintile of GPA, actually seem to be less likely than the lowest quintile achievers to stay in STEM for some of the cohorts, although this again equalizes out near the end of the observation period. So while there is no simple story, it seems clear that a casual expectation that top performers might be markedly more likely to stay in STEM than the average or even lower quintile achievers is *not* supported by these data.

The relationship between cohorts over *time*, however, does appear clear: there is definitely a drop in retention of college STEM majors along the STEM pipeline over the 1990s. The drop between the 1993/96 cohort and the 1997/00 cohort for all STEM majors is also true of the top achievers. The percent of top quintile GPA STEM majors continuing in STEM decreases from 52 percent to 41.8 percent between the 1993/96 and 1997/00 cohorts. This decrease in the rate of retention of college graduates is statistically significant.[34]

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[32] Not statistically significant at five percent (p=.26, z=.644).
[33] The difference between quintile 2's retention rate of 47.9 percent and the average STEM major retention of 44.9 percent is not statistically significant at five percent (p=.26, z=.645).
[34] Statistically significant at five percent (p=.025, z=1.96).

It may be that GPA is a more useful predictor of ongoing STEM graduate school enrollment than STEM employment. Unfortunately, small sample sizes do not permit us to differentiate enrollments from jobholding. Across cohorts, the data appear to suggest a slight increase in retention in graduate school enrollments particularly for high GPA individuals. In the 1993/96 cohort—the only cohort with enough sample size to run the test—11.5 percent of top quintile STEM college graduates were enrolled in a STEM graduate-level program three years after graduation, compared to only 1.2 percent among average STEM graduates.[35] We can conclude that the top STEM college graduates are more likely than average STEM graduates to be enrolled in STEM graduate school in that cohort. Otherwise, it appears that, following the average trend, there is a significant decrease in STEM retention of top achievers, either in ongoing graduate enrollments or STEM employment, in the 1997/00 cohort of the late 1990s.

Proportional distribution of all first-jobholders

We know that the proportion of the labor force employed in STEM jobs has been steadily increasing for the past 50 years,[36] but do the foregoing results indicate a shrinkage for new job seekers in the most recent cohort? Figure 5 presents the percent of employed individuals holding a bachelor's degree working in a STEM versus a non-STEM occupation. It shows that the proportion of jobs held by bachelor's degree holders that are in STEM versus non-STEM has increased, coming to about 15 percent for our last cohort. This proportion has bounced around from 8.6 percent for the 1977/80 cohort, to 11.1 percent for the 1987/90 cohort, to 16.1 percent for the 1993/96 and 15.7 percent for the 1997/00 cohort. Confirming our understanding of the growing importance of the science and technology field, the percent of new jobholders landing a job in STEM has increased over time and stayed constant in the late 1990s. The difference between the proportions of jobs held by college graduates that are in STEM for the 1977/80 cohort (8.6 percent) versus the proportion for the 1997/00 cohort (15.7 percent) is statistically significant.[37]

[35] The difference between 11.5 and 1.2 percent in these samples is statistically significant at five percent ($p=.001$, $z=3.03$).
[36] Lowell, B. Lindsay and Mark C. Regets, 2006. "A Snapshot of Half of a Century: The STEM Workforce from 1950 to 2000," White Paper for the STEM Workforce Data Project, Center for Professionals in Science and Technology, http://206.67.48.105/index.cfm.
[37] Statistically significant at five percent ($p=.000$, $z=8.09$).

On the other hand, the small decline between the last two cohorts, 1993/96 and 1997/00, is not statistically or substantively significant.[38]

Figure 5. Percent of All Employed College Graduates Working in a STEM Field Three Years after Graduation

Given what we know about the state of economy and the exploding field of STEM occupations in the 1990s, it may seem puzzling to see a decline in retention and a slight decline in the percent of jobs in STEM reported in Figure 5. It is common knowledge that the STEM job market was expanding in that period, so the drop in retention might seem surprising because the jobs were available for the taking. But this drop in retention is significant and is actually *consistent* with the slight decline we see in Figure 5. The drop in retention actually helps to explain the drop in the proportion of STEM jobs we see in Figure 5. Fewer STEM graduates were taking first STEM jobs out of college, dragging down the percent of jobs in STEM occupations despite the booming STEM job market. In other words, we know that the number of STEM employed increased notably during this latter period and the apparent lack of increased first job holding effectively suggests unrealized retention (hence, attrition).

Who did take all of those STEM jobs, if not STEM majors, particularly the top achievers? Part of the explanation is that *non*-STEM BA holders were increasingly taking

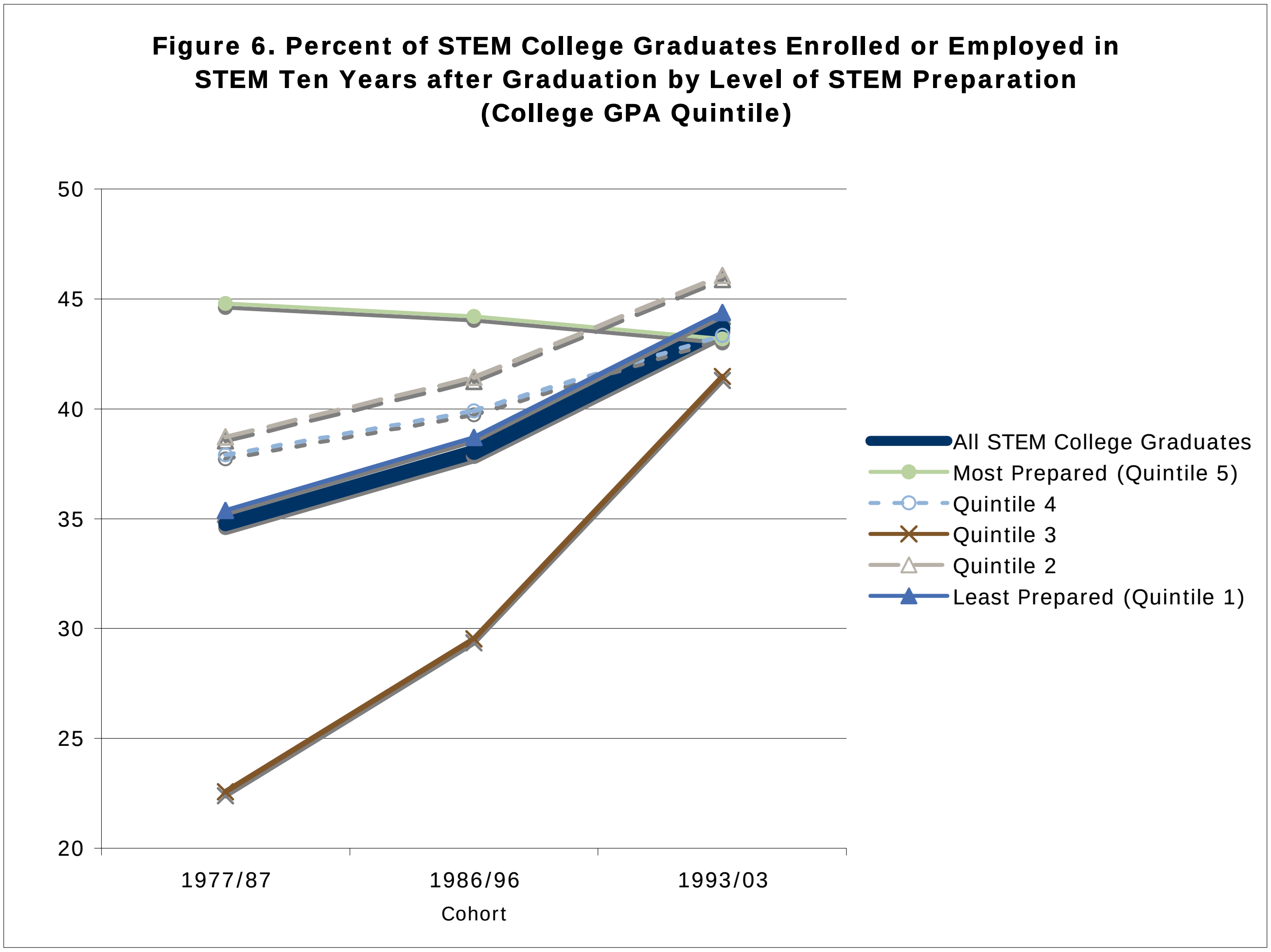
[38] Statistically insignificant at five percent (p=.33, z=.45).

STEM jobs in this period, so their numbers shore up the proportion of first-jobholders in STEM (and do not show up in the declining retention rates of top STEM graduates). We see strong evidence for this movement of non-STEM college graduates into STEM jobs: the percent of non-STEM majors who were employed in a STEM job increased steadily from 2.5 percent in the 1977/80 cohort to 7 percent in the 1997/00 cohort. In fact, a surprisingly large proportion of formal STEM occupations are held by non-STEM graduates, a trend evident since the 1980s. The percent of STEM jobs held by non-STEM majors rose from 16 percent in 1987/90, to 35 percent in 1993/96, to 40 percent in 1997/00. This increase is likely explained by the fact that non-STEM majors make up a substantial proportion of employment in information technology jobs, which was the strongest growing sector of STEM during the 1990s. Additionally, foreign-born individuals were supplying a substantial share of the labor demand in STEM during this boom in the market. Thus, whereas the overall growth of the formal STEM workforce might have led us to expect that a growing share of STEM graduates would be STEM employed in their first jobs, the overall growth was evidently supplied to a large degree not by new STEM graduates but by the foreign born and non-STEM graduates.

Transition 3: College to Mid Career (Ten-Year Transition)

Retention of STEM graduates to mid-career job

Does the recent decrease in the retention of STEM graduates into a STEM occupation at their first job also prefigure a decline in their retention in STEM occupations at mid career? We might expect retention rates to decline even more because graduates would have more time to advance into non-STEM positions, such as in management. In order to capture this mid-career transition, we calculate STEM retention ten years after college graduation. While the NLSY79 permits us to calculate the average retention for the 1986/96 cohort, it does not include GPA information so we impute mid-period GPA by quintile for 1986/96 that trends with the average. This is imperfect, but provides a better visual evaluation of trends by quintile. Results are presented in Figure 6.



There is an upward trend over time in the average retention of STEM college graduates in STEM occupations that is statistically significant: average retention increases from 34.8 percent in the 1977/87 cohort to 43.7 percent in the 1993/03 cohort.[39] The increase across these two cohorts for STEM graduates is statistically significant in three of the five quintiles. Quintile 4 has a statistically insignificant increase, and quintile 5 does not increase but rather stays constant.[40]

Thus, while there is clearly an upward trend in the *average* STEM retention at mid-career employment, this does not apply to the top collegiate performers (quintiles 4

[39] Statistically significant at five percent (p=.00007, z=3.81). The increase from the 1986/96 to the 1993/03 cohort is also statistically significant (p=.08, z=1.44), although the increase from the 1977/87 to the 1986/96 cohort is not statistically significant (p=.217, z=.782).

[40] Quintile 4's change is not statistically significant at five percent (p=.156, z=1.01); but quintile 3's is (p=.00003, z=4.036), as are the change in quintile 2 (p=.08, z=1.396) and quintile 1 (p=.048, z=1.663). Quintile 5 has a statistically insignificant decrease, see footnote 52.

and 5). In fact, we see a statistically insignificant *decrease* in quintile 5's retention across cohorts.[41] This pattern is reinforced by comparison of the within cohort difference between the highest quintile and the average. For the first 1977/87 cohort, the difference between quintile 5 retention and the average retention is 10 percentage points and is statistically significant.[42] Data limitations do not permit us to conduct this calculation for the middle cohort, but in the 1993/03 cohort there is no substantive or statistically significant difference between the quintile 5 rate of retention and average STEM retention.

Given that that the rate of retention in quintile 5 appears to decrease across cohorts—*relative to the average increase* reflected in the other quintiles—we observe a repetition of the findings from the earlier transitions that show declining retention among the top performers. Because we can capture individuals for the mid-career transition graduating no later than 1993, might we expect to see a steeper decrease in retention if we could track a later cohort (say 1997 to 2007)? Of course, that is impossible to say, but the degrading trend in mid-career retention for the 1993/03 cohort mimics the degrading trend in retention among high performers in other transitions that we have seen in the late 1990s. Furthermore, this mid-career trend is captured with different data (B&B93) than the strong dip revealed in the earlier transitions (NLSY97), reinforcing the appearance of an across-the-board drop in retention of the highest performers all along the pipeline during the STEM workforce boom of the New Economy period.

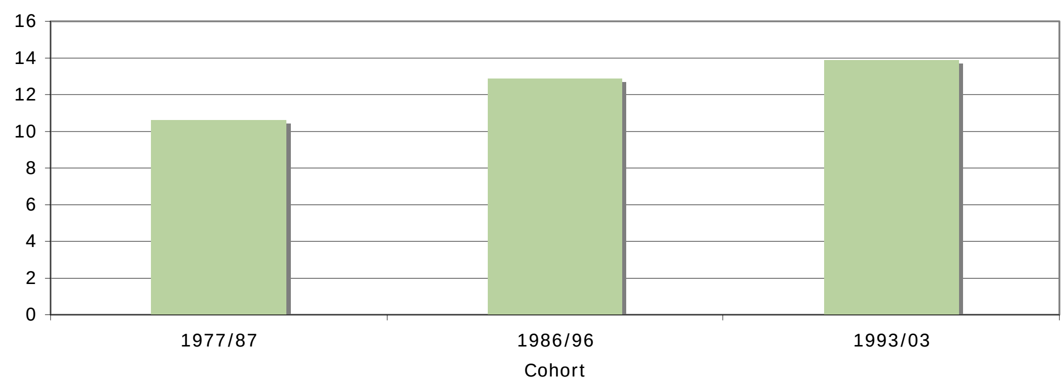
Proportional distribution of the mid-career workforce

At the same time, Figure 7 shows that the proportion of college graduates at mid career who are employed in a STEM field has gradually increased over time. This is quite consonant with the growth of the nation's STEM workforce during the 1990s. The share of mid-career jobs in STEM increases from 10.6 percent for the 1977/87 cohort to 13.9 percent for the 1993/03 cohort. Thus, the increasing average STEM retention through mid career is associated with an increase in STEM employment, and the relatively small

[41] The difference between the retention rates of the top quintile in 1977/87 versus 1993/93 of 44.8 percent and 43.2 percent is not statistically significant at five percent (p=.382, z=.2986).
[42] Statistically significant at five percent (p=.024, z=1.98).

numbers of high-performers who are not retained in STEM have relatively little effect on the growing size of the mid-career labor force. In fact, these percentages represent a very small drop in the proportion of cohorts employed in the STEM workforce between first-jobholding (Figure 5) to mid career of about 2.2 percentage points for the 1993/03 cohort, and actually represent increases of 2 percent for the 1977/87 cohort and 1.8 percent for the 1986/96 cohort.

Figure 7. Percent of All Employed College Graduates Working in a STEM Field Ten Years after Graduation



<u>Review of Principal Findings</u>

Transition 1: High School to College

<u>Overall</u>, there has been little change in the proportion of high school graduates who go on to enroll in, or complete, a STEM degree in college. Yet, for the top high school graduates—those testing the highest on their SAT/ACT math exams—the rate of retention in the STEM pipeline increased from the 1972/77 cohort (21.4 percent) to the 1992/97 cohort (28.7 percent), but then declined steeply between the 1992/97 and the 2000/05 cohort (13.8 percent). Further, while the top-performing high school graduates are significantly more likely than the average high school graduate to major in STEM, this advantage decreased in the late 1990s.

Transition 2: College to First Job

The retention of STEM college graduates in a STEM occupation for their "first" job increased *overall* from the 1977/80 cohort (31.5 percent) to the 1993/96 cohort (52.8 percent), but then declined significantly from the 1993/96 to the 1997/00 cohort (44.9 percent). The top (GPA) achieving STEM college graduates are no more likely than average STEM majors to be employed in a STEM occupation for their first job. There has been no strong affinity for the top STEM college achievers to find STEM employment, and all GPA quintiles show the same steep decline in retention between graduation and first jobholding.

Transition 3: College to Mid Career

The retention of STEM college graduates into STEM occupations at mid career increased significantly from the 1977/87 cohort (34.8 percent) to the 1993/03 cohort (43.7 percent). The increase in retention, however, did not occur for the highest achievers (GPA). In fact, the highest college achievers appear to be less well retained in STEM at mid career over time—relative to the upward trend for the average collegiate achiever across cohorts, as well as the loss of any significant difference at mid career between the high and average achiever within the 1993/03 cohort (quintile 5 at 43.2 percent versus the average 43.7 percent). Surprisingly, college achievement does not predict STEM retention. Higher achievers are *not* more likely to stay in the STEM pipeline, either at the first job or at mid career, than average STEM college graduates.[43]

CONCLUSION

This analysis has brought together several longitudinal data sets to examine trends in the rates of retention and attrition along three points in the STEM pipeline: high school to STEM degree in college, completion of a STEM degree to first jobholding, and completion of a STEM degree to employment in a STEM occupation at mid career. We evaluate the trend in average rates of retention along the pipeline, conditioned on completion of one stage and based on transition status. Further, we evaluate differences

[43] However, at least in the 1993/03 cohort, the most STEM-prepared are still significantly more likely than average STEM majors to be enrolled in a STEM graduate program. Sample size limitations permitted us to run this test on only this one cohort.

in trends among levels of performance at the outset of a transition as captured by math SAT/ACT performance in high school and overall college GPA thereafter.

Our findings indicate that while STEM retention along the pipeline shows strong rates of retention *overall* from the 1970s to the late 1990s, these overall strong STEM retention rates are accompanied by simultaneous declines in retention among the *highest performing* students in the 1990s.

- Overall, STEM retention at the three transition points (high school to college, college to first job, college to mid-career jobs) was:

  - relatively *unchanged* from high school to college from the 1972/77 to the 2000/05 cohort,
  - *higher* from college to first job from the 1977/80 to the 1997/00 cohort (although it dipped markedly in 1997/00 from the peak for 1993/96), and
  - *higher* from college to mid-career job from the 1977/87 to the 1993/03 cohort.

- For the *highest performers,* STEM retention:

  - *initially increased then declined for high school to college transition*—*increasing* from high school to college from the 1972/77 to the 1992/97 cohort, but then *declining* steeply from the 1992/97 to the 2000/05 cohort;
  - was *no different* from that of average performers between college and first jobholding across all cohorts, but all quintiles shared in an across-the-board *decline* from the 1993/96 to the 1997/00 cohort; and
  - decreased in absolute terms as well as relative to the average trend from college to mid-career jobs from the 1977/87 to the 1993/03 cohort.

It appears that the 1990s marked a turning point in longer-term trends, at least for the best students either in high school or college. The top quintile SAT/ACT and GPA performers appear to have been dropping out of the STEM pipeline at a substantial rate, and this decline seems to have come on quite suddenly in the mid-to-late 1990s (although our cohorts cannot precisely time the break in trend).

What might explain this loss of high-performing students from the STEM pipeline? We can only conjecture given the lack of specifics in these data, nor can we rule out unrecognized problems in the data that may magnify the trend. The sampling properties of these various longitudinal data sets are well known, however, and all are considered reliable. The trend also shows up at different transitions in the pipeline, as well as in different data sets. So it is likely that the trend is real and not an artifact of measurement.

Likely explanations follow from different assumptions and theoretical models of career choice. Arguments that students are not *prepared* for majors and careers in STEM are not supported by this data. The trends indicating increased proportions of students majoring in STEM show that students are interested in and/or sufficiently prepared to major in STEM fields. The decline in the retention of the top achievers in the late 1990s is of concern, however. This may indicate that the top high school graduates are no longer interested in STEM, but it might also indicate that a future in a STEM job is not attractive for some reason.

The decline in retention from college to first job might also be due to loss of interest in STEM careers, but alternatively top STEM majors may be responding to market forces and incentives. From this perspective, the problem may not be that there are too few STEM qualified college graduates, but rather that STEM firms are unable to attract them. Highly qualified students may be choosing a non-STEM job because these other occupations are higher paying, offer better career prospects such as advancement, employment stability, and/or prestige, as well as less susceptible to offshoring. Potential alternatives include business, healthcare, and law. There are numerous accounts of financial firms hiring top-performing STEM graduates at much higher salaries than those offered by STEM employers.[44]

Another potential complication for this type of study is that STEM-prepared students may be using their STEM skills and knowledge in the context of jobs that would not be categorized as STEM according to the occupational categories captured in these types of surveys. For example, some graduates do STEM-related work in a job such as a patent lawyer, medical salesperson, or manager in a technology firm. The strong growth of the STEM workforce during the 1990s may have supported the creation of STEM-relevant occupations that we do not track and that may have lured the best-performing STEM students. (Another, forthcoming, component of this research project examines this possibility as we examine alternative data resources that permit us to tap into these occupational details).

This analysis does strongly suggest that students are not leaving STEM pathways because of lack of preparation or ability. Instead, it does suggest that we turn our attention to factors other than educational preparation or student ability in this compositional shift to lower-performing students in the STEM pipeline.

[44] See, for example, Dennis Overbye, "They Tried to Outsmart Wall Street" (2009) New York Times, p. D.1, March 9; Emanuel Derman *My Life as a Quant: Reflections on Physics and Finance* (2007) New York: Wiley; Jeremy Bernstein ***Error! Main Document Only.****Physicists on Wall Street and Other Essays on Science and Society* (2008) New York: Springer

Appendix I. Description of Data Sets

National Longitudinal Study of 1972 (NLS72), U.S. Department of Education

NLS72 followed the 1972 cohort of high school seniors (21,000 individuals) through 1986, or fourteen years after most of this cohort completed high school. Participants in the study were selected when they were seniors in high school in the spring of 1972, and in a supplementary sample drawn in 1973. The records include the initial survey; follow-up surveys in 1973, 1974, 1976, 1979, and 1986; high school records; and postsecondary transcripts (collected in 1984).

High School to BA Transition: We include all respondents who graduated from high school before age 20 (n=7,747).[45] The vast majority graduated in 1972, constituting our 1972 cohort. We measure outcomes five years after high school graduation. We also use the NLS72 data for the high school to associate's degree transition, measuring outcomes two years after high school graduation (n=10,229).[46]

BA to First Job Transition: We include all respondents who graduated from college in or before 1977, constituting our 1977 cohort (n=3,193).[47] The vast majority graduated in 1977. We examine the outcomes three years after college graduation for the transition categories. Graduation dates, majors, and SAT/ACT scores are recorded and GPAs are calculated from respondent transcripts.

BA to Mid-Career Transition: We again include all respondents who graduated from college in or before 1977, constituting our 1977 cohort (n=2,916).[48] Outcomes ten years after college graduation are recorded for the transition categories.

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[45] Total sample size including unemployed/NILF was 10,267.
[46] Total sample size including unemployed/NILF was 10,809.
[47] Total sample size including unemployed/NILF was 3,281.
[48] Total sample size including unemployed/NILF was 3,372.

Non-response was a serious problem at the later stages; 43 percent of survey participants did not respond to the 1986 follow-up wave of the National Longitudinal Survey.

National Longitudinal Survey of Youth (NLSY79), U.S. Department of Labor

The NLSY79 was administered annually starting in 1979, then biennially since 1994. 12,686 individuals participated in the first wave, and they were interviewed annually until 1994, by which time the sample comprised 9,964 people. NLSY79 includes high school transcript information, but only for a portion of its starting sample of 14- to 22-year-olds; and its data on college outcomes are poorer than the Department of Education data sets. But the NLSY79 tracks its starting cohorts through the year 2004, so high school graduates would be age 40 at the end of the survey. The occupational information is strong, so we are able to use NLSY79 for the later transitions.

> *BA to First Job Transition*: We include all respondents who graduated before age 24. Eighty-five percent of those included in our analysis graduated from college between 1983 and 1989, so we have referred to the cohort by its median year, 1986 (n=1,045).[49] We record outcomes three years after college graduation for the transition categories. We choose not to include this sample in the over-time trend calculations because of the wide spread of graduation dates, and the fact that we already have a measure of 1980s trends with the HS&B data.

> *BA to Mid-Career Transition*: We again include all respondents who graduated before age 24, constituting the 1986 cohort, and examine outcomes ten years after college graduation for the transition categories (n=842).[50] Graduation dates and majors are self-reported, and college GPA information is not available. We opt to include these values in the over-time trend calculations for the BA to mid-career transition in order to represent the decade of the 1980s.

[49] Total sample size including unemployed/NILF was 1,116.
[50] Total sample size including unemployed/NILF was 966.

High School and Beyond (HS&B), U.S. Department of Education

The HS&B survey included two cohorts: the 1980 senior class, and the 1980 sophomore class. Both cohorts were surveyed every two years through 1986, and the 1980 sophomore class was also surveyed again in 1992. The base year survey included over 30,000 sophomore and 28,000 senior participants; 14,670 participants were in the sample for all five waves.

> *High School to BA Transition:* For this transition, we include all respondents who graduated from high school before age 20, the vast majority of whom graduated in 1982 (the 1980 sophomores) (n=8,849),[51] and examine outcomes five years later. This constitutes our 1982 cohort. We also use the HS&B data for the high school to associate's degree transition, measuring outcomes two years after high school graduation (n=6,790).[52]

> *BA to First Job Transition:* For this transition, we include all respondents who graduated from college in or before 1987, constituting our 1987 cohort (n=2,462).[53] Outcomes in 1990 are recorded for the transition categories. Graduation dates and majors are recorded from respondent transcripts. SAT/ACT scores are provided on the transcripts. For this data set, occupational categories are based on verbatim responses because the recorded occupational categories were too vague.

National Educational Longitudinal Study of 1988 (NELS88), U.S. Department of Education

NELS88 started with a cohort of students who were in the eighth grade in 1988 (nearly 25,000 participants), and these students have been surveyed every two years since that time. The NELS88 data also include excellent transcript information of class work, grades, and college test scores both for high school and college, including the field of

[51] Total sample size including unemployed/NILF was 9,569.
[52] Total sample size including unemployed/NILF was 7,355.
[53] Total sample size including unemployed/NILF was 2,516.

final degree.

High School to BA Transition: For this transition, we include all respondents who graduated from high school before age 20, the vast majority of whom graduated in 1992, thus constituting our 1992 cohort (n=9,323).[54]

BA to First Job Transition: For this transition, we include all respondents who graduated from college in or before 1997, and outcomes are recorded as of 2000 for the transition categories (n=2,998).[55] The vast majority graduated in 1997, constituting our 1997 cohort. Graduation dates, majors, SAT/ACT scores, and GPAs are recorded from respondent transcripts.

Baccalaureate and Beyond Longitudinal Study 1993 (B&B), U.S. Department of Education

B&B included 11,000 students who completed their college degrees in the 1992-93 academic year, and followed up with interviews in 1994, 1997, and 2003. In addition to student interview data, B&B collected postsecondary transcripts covering the undergraduate period. The B&B has somewhat minimal information on high school factors, but solid information on college and beyond college outcomes.

BA to First Job Transition: For this transition, we include all respondents who graduated college in 1993, thereby constituting our 1993 cohort. We examine their 1997 outcomes for this transition (n=7,834).[56]

BA to Mid-Career Transition: For this transition, we take the 1993 cohort and examine their 2003 outcomes (n=6,919).[57] The transcripts provide the data on graduation dates, majors, and GPAs.

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[54] Total sample size including unemployed/NILF was 9,991.
[55] Total sample size including unemployed/NILF was 3,177.
[56] Total sample size including unemployed/not in labor force (NILF) was 8,347.
[57] Total sample size including unemployed/NILF was 7,885.

National Longitudinal Survey of Youth (NLSY97), U.S. Department of Labor

The NLSY97 surveyed 8,984 individuals born between 1980 and 1984 and conducted return waves on an annual basis through 2005.

> <u>*High School to BA Transition*</u>: We include all respondents who graduated from high school before age 20. Eighty percent of those included graduated in 1999 or 2000 (50 respondents graduated in 1997, and none from 1998 were included), but for simplicity's sake we call this our 2000 cohort (n=2,633).[58] Graduation dates are self-reported, and SAT/ACT scores are a mix of transcript and self-reported scores.[59] Many of the test scores were reported by range rather than specific score, and the median values are used in those cases. This leads to a slightly uneven distribution of individuals across quintiles, notably skewing down the size of quintile 3.

[58] Total sample size including unemployed/NILF was 3,075.

[59] In the case of the NLSY97, SAT scores had to be re-centered and converted to the pre-1995 scale using the conversion tables found in the following report: http://professionals.collegeboard.com/data-reports-research/sat/equivalence-tables/sat-score.

Appendix II. List of Detailed Tables

IV. Bachelor's Degree to Mid Career

Appendix Table 1-1. High School Graduates of 1972 and Transitions to Associate's Degree, Number of High School Graduates

High School Graduates by SAT Math Quintile	Status Three Years After Graduation							
	STEM			Non-STEM				
	Total	Obtained/ Enrolled Associate's Degree	Enrolled Bachelor's Program	Total	Obtained/ Enrolled Associate's Degree	Enrolled in Bachelor's Program	Employed	Total Excluding Unemployed/ NILF
Total	**32,912**	**12,102**	**20,810**	**582,146**	**94,815**	**487,331**	**946,831**	**1,561,889**
Total Test Takers	**24,599**	**8,273**	**16,326**	**450,650**	**62,762**	**387,888**	**491,959**	**967,208**
Quintile 5 (Highest)	8,435	*1,685*	6,750	112,882	7,373	105,509	86,442	207,759
Quintile 4	6,504	*2,716*	*3,788*	109,153	8,936	100,217	100,004	215,661
Quintile 3	*4,848*	*2,064*	*2,784*	88,908	14,099	74,809	97,253	191,009
Quintile 2	*3,464*	*1,808*	1,656	77,850	18,890	58,960	99,602	180,916
Quintile 1 (Lowest)	*1,348*	*0*	1,348	61,857	13,464	48,393	108,658	171,863
No SAT/ACT Math Score	8,313	*3,829*	4,484	131,496	32,053	99,443	454,872	594,681

Source: U.S. Department of Education, National Longitudinal Study of 1972

Notes: Includes all respondents who graduated from high school before age 20, the vast majority in 1972. Outcomes three years after high school graduation are recorded for the transition categories. Graduation dates, majors, and SAT/ACT scores are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 1-2. High School Graduates of 1972 and Transitions to Associate's Degree, Percent of High School Graduates

High School Graduates by SAT Math Quintile	Status Three Years After Graduation						
	STEM			Non-STEM			
	Total	Obtained/ Enrolled Associate's Degree	Enrolled Bachelor's Program	Total	Obtained/ Enrolled Associate's Degree	Enrolled in Bachelor's Program	Employed
Total	**2.1**	**0.8**	**1.3**	**37.3**	**6.1**	**31.2**	**60.6**
Total Test Takers	**2.5**	**0.9**	**1.7**	**46.6**	**6.5**	**40.1**	**50.9**
Quintile 5 (Highest)	4.1	*0.8*	3.2	54.3	3.5	50.8	41.6
Quintile 4	3.0	*1.3*	*1.8*	50.6	4.1	46.5	46.4
Quintile 3	*2.5*	*1.1*	*1.5*	46.5	7.4	39.2	50.9
Quintile 2	*1.9*	*1.0*	0.9	43.0	10.4	32.6	55.1
Quintile 1 (Lowest)	*0.8*	*0.0*	0.8	36.0	7.8	28.2	63.2
No SAT/ACT Math Score	1.4	*0.6*	0.8	22.1	5.4	16.7	76.5

Source: U.S. Department of Education, National Longitudinal Study of 1972

Notes: Includes all respondents who graduated from high school before age 20, the vast majority in 1972. Outcomes three years after high school graduation are recorded for the transition categories. Graduation dates, majors, and SAT/ACT scores are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 1-3. High School Graduates of 1982 and Transitions to Associate's Degree, Number of High School Graduates

High School Graduates by SAT Math Quintile	Status Three Years After Graduation							
	STEM			Non-STEM				
	Total	Obtained/ Enrolled Associate's Degree	Enrolled Bachelor's Program	Total	Obtained/ Enrolled Associate's Degree	Enrolled in Bachelor's Program	Employed	Total Excluding Unemployed/ NILF
Total	**188,144**	**61,359**	**126,785**	**750,187**	**322,070**	**428,117**	**908,305**	**1,846,636**
Total Test Takers	**133,582**	**35,252**	**98,330**	**525,225**	**181,769**	**343,456**	**305,117**	**963,924**
Quintile 5 (Highest)	68,735	11,515	57,220	113,175	18,418	94,757	40,498	222,408
Quintile 4	28,339	6,901	21,438	126,992	31,099	95,893	48,105	203,436
Quintile 3	20,903	8,157	12,746	110,990	35,796	75,194	63,425	195,318
Quintile 2	9,615	*4,095*	*5,520*	93,606	46,391	47,215	72,581	175,802
Quintile 1 (Lowest)	5,990	*4,584*	*1,406*	80,462	50,065	30,397	80,508	166,960
No SAT/ACT Math Score	54,562	26,107	28,455	224,962	140,301	84,661	603,188	882,712

Source: U.S. Department of Education, High School and Beyond

Notes: Includes all respondents who graduated from high school before age 20, the vast majority in 1982. Outcomes three years after high school graduation are recorded for the transition categories. Graduation dates, majors, and SAT/ACT scores are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 1-4. High School Graduates of 1982 and Transitions to Associate's Degree, Percent of High School Graduates

High School Graduates by SAT Math Quintile	Status Three Years After Graduation						
	STEM			Non-STEM			
	Total	Obtained/ Enrolled Associate's Degree	Enrolled Bachelor's Program	Total	Obtained/ Enrolled Associate's Degree	Enrolled in Bachelor's Program	Employed
Total	**10.2**	**3.3**	**6.9**	**40.6**	**17.4**	**23.2**	**49.2**
Total Test Takers	**13.9**	**3.7**	**10.2**	**54.5**	**18.9**	**35.6**	**31.7**
Quintile 5 (Highest)	30.9	5.2	25.7	50.9	8.3	42.6	18.2
Quintile 4	13.9	3.4	10.5	62.4	15.3	47.1	23.6
Quintile 3	10.7	4.2	6.5	56.8	18.3	38.5	32.5
Quintile 2	5.5	*2.3*	*3.1*	53.2	26.4	26.9	41.3
Quintile 1 (Lowest)	3.6	*2.7*	*0.8*	48.2	30.0	18.2	48.2
No SAT/ACT Math Score	6.2	3.0	3.2	25.5	15.9	9.6	68.3

Source: U.S. Department of Education, High School and Beyond

Notes: Includes all respondents who graduated from high school before age 20, the vast majority in 1982. Outcomes three years after high school graduation are recorded for the transition categories. Graduation dates, majors, and SAT/ACT scores are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 2-1. High School Graduates of 1972 and Transitions to Bachelor's Degree, Number of High School Graduates

High School Graduates by SAT Math Quintile	Status Five Years After Graduation									
	STEM				Non-STEM					STEM
	Total	Enrolled		Obtained Bachelor's Degree	Total	Enrolled		Obtained Bachelor's Degree	Employed	Total
		Bachelor's	Graduate			Bachelor's	Graduate			
Total	**91,659**	**11,883**	**17,745**	**62,031**	**552,302**	**183,759**	**79,202**	**289,341**	**572,132**	**1,216,093**
Total of Test Takers	**75,692**	**7,578**	**14,096**	**54,018**	**433,044**	**113,091**	**67,978**	**251,975**	**280,253**	**788,989**
Quintile 5 (Highest)	38,953	*3,127*	8,029	27,797	108,275	20,992	30,562	56,721	34,839	182,067
Quintile 4	21,247	*1,188*	*3,718*	16,341	113,906	24,465	17,829	71,612	48,735	183,888
Quintile 3	8,334	*609*	*927*	6,798	89,073	21,667	8,972	58,434	55,628	153,035
Quintile 2	*4,890*	*1,933*	*856*	*2,101*	67,365	24,597	6,214	36,554	69,797	142,052
Quintile 1 (Lowest)	*2,268*	*721*	*566*	*981*	54,425	21,370	*4,401*	28,654	71,254	127,947
No SAT/ACT Math Score	*15,967*	*4,305*	*3,649*	8,013	119,258	70,668	11,224	37,366	291,879	427,104

Source: U.S. Department of Education, National Longitudinal Study of 1972

Notes: Includes all respondents who graduated from high school before age 20, the vast majority in 1972. Outcomes five years after high school graduation are recorded for the transition categories. Graduation dates, majors, and SAT/ACT scores are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 2-2. High School Graduates of 1972 and Transitions to Bachelor's Degree, Percent of High School Graduates

High School Graduates by SAT Math Quintile	Status Five Years After Graduation								
	STEM				Non-STEM				
	Total	Enrolled		Obtained Bachelor's Degree	Total	Enrolled		Obtained Bachelor's Degree	Employed
		Bachelor's	Graduate			Bachelor's	Graduate		
Total	**7.5**	**1.0**	**1.5**	**5.1**	**45.4**	**15.1**	**6.5**	**23.8**	**47.0**
Total of Test Takers	**9.6**	**1.0**	**1.8**	**6.8**	**54.9**	**14.3**	**8.6**	**31.9**	**35.5**
Quintile 5 (Highest)	21.4	*1.7*	4.4	15.3	59.5	11.5	16.8	31.2	19.1
Quintile 4	11.6	*0.6*	*2.0*	8.9	61.9	13.3	9.7	38.9	26.5
Quintile 3	5.4	*0.4*	*0.6*	4.4	58.2	14.2	5.9	38.2	36.3
Quintile 2	*3.4*	*1.4*	*0.6*	*1.5*	47.4	17.3	4.4	25.7	49.1
Quintile 1 (Lowest)	*1.8*	*0.6*	*0.4*	*0.8*	42.5	16.7	*3.4*	22.4	55.7
No SAT/ACT Math Score	3.7	*1.0*	*0.9*	1.9	27.9	16.5	2.6	8.7	68.3

Source: U.S. Department of Education, National Longitudinal Study of 1972

Notes: Includes all respondents who graduated from high school before age 20, the vast majority in 1972. Outcomes five years after high school graduation are recorded for the transition categories. Graduation dates, majors, and SAT/ACT scores are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 2-3. High School Graduates of 1982 and Transitions to Bachelor's Degree, Number of High School Graduates

High School Graduates by SAT Math Quintile	Status Five Years After Graduation									
	STEM				Non-STEM				Employed	Total Excluding Unemployed/ NILF
	Total	Enrolled		Obtained Bachelor's Degree	Total	Enrolled		Obtained Bachelor's Degree		
		Bachelor's	Graduate			Bachelor's	Graduate			
Total	**131,870**	**25,005**	**10,694**	**96,171**	**469,369**	**89,216**	**53,352**	**326,801**	**1,934,122**	**2,535,361**
Total of Test Takers	**102,694**	**18,465**	**9,161**	**75,068**	**364,514**	**60,659**	**44,654**	**259,201**	**682,961**	**1,150,169**
Quintile 5 (Highest)	59,751	*5,042*	*6,534*	48,175	102,988	13,499	18,017	71,472	85,252	247,991
Quintile 4	22,459	*5,233*	*593*	16,633	96,262	9,513	12,363	74,386	118,533	237,254
Quintile 3	13,345	*4,930*	*745*	7,670	83,610	12,672	8,466	62,472	137,718	234,673
Quintile 2	*5,603*	*2,696*	*516*	*2,391*	49,480	11,306	*4,110*	34,064	156,366	211,449
Quintile 1 (Lowest)	*1,536*	*564*	*773*	*199*	32,174	13,669	*1,698*	16,807	185,092	218,802
No SAT/ACT Math Score	29,176	*6,540*	*1,533*	21,103	104,855	28,557	8,698	67,600	1,251,161	1,385,192

Source: U.S. Department of Education, High School and Beyond

Notes: Includes all respondents who graduated from high school before age 20, the vast majority in 1982. Outcomes five years after high school graduation are recorded for the transition categories. Graduation dates, majors, and SAT/ACT scores are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 2-4. High School Graduates of 1982 and Transitions to Bachelor's Degree, Percent of High School Graduates

High School Graduates by SAT Math Quintile	Status Five Years After Graduation								
	STEM				Non-STEM				Employed
	Total	Enrolled		Obtained Bachelor's Degree	Total	Enrolled		Obtained Bachelor's Degree	
		Bachelor's	Graduate			Bachelor's	Graduate		
Total	**5.2**	**1.0**	**0.4**	**3.8**	**18.5**	**3.5**	**2.1**	**12.9**	**76.3**
Total of Test Takers	**8.9**	**1.6**	**0.8**	**6.5**	**31.7**	**5.3**	**3.9**	**22.5**	**59.4**
Quintile 5 (Highest)	24.1	*2.0*	*2.6*	19.4	41.5	5.4	7.3	28.8	34.4
Quintile 4	9.5	*2.2*	*0.2*	7.0	40.6	4.0	5.2	31.4	50.0
Quintile 3	5.7	*2.1*	*0.3*	3.3	35.6	5.4	3.6	26.6	58.7
Quintile 2	*2.6*	*1.3*	*0.2*	*1.1*	23.4	5.3	*1.9*	16.1	73.9
Quintile 1 (Lowest)	*0.7*	*0.3*	*0.4*	*0.1*	14.7	6.2	*0.8*	7.7	84.6
No SAT/ACT Math Score	2.1	*0.5*	*0.1*	1.5	7.6	2.1	0.6	4.9	90.3

Source: U.S. Department of Education, High School and Beyond

Notes: Includes all respondents who graduated from high school before age 20, the vast majority in 1982. Outcomes five years after high school graduation are recorded for the transition categories. Graduation dates, majors, and SAT/ACT scores are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 2-5. High School Graduates of 1992 and Transitions to Bachelor's Degree, Number of High School Graduates

High School Graduates by SAT Math Quintile	Status Five Years After Graduation									
	STEM				Non-STEM				Employed	Total Excluding Unemployed/ NILF
	Total	Enrolled		Obtained Bachelor's Degree	Total	Enrolled		Obtained Bachelor's Degree		
		Bachelor's	Graduate			Bachelor's	Graduate			
Total	**145,704**	**46,533**	**8,886**	**90,285**	**625,318**	**176,460**	**80,570**	**368,288**	**1,467,731**	**2,238,753**
Total of Test Takers	**109,934**	**31,844**	**6,511**	**71,579**	**445,258**	**117,639**	**64,327**	**263,292**	**513,862**	**1,069,054**
Quintile 5 (Highest)	55,561	12,808	*3,257*	39,496	97,254	11,149	27,139	58,966	40,514	193,329
Quintile 4	24,653	7,154	*1,582*	15,917	122,906	26,347	16,069	80,490	70,019	217,578
Quintile 3	15,523	*3,697*	*889*	10,937	93,485	22,710	10,225	60,550	101,563	210,571
Quintile 2	12,232	6,583	*783*	*4,866*	89,622	34,099	8,481	47,042	151,928	253,782
Quintile 1 (Lowest)	*1,965*	*1,602*	*0*	*363*	41,991	23,334	*2,413*	16,244	149,838	193,794
No SAT/ACT Math Score	35,770	14,689	*2,375*	18,706	180,060	58,821	16,243	104,996	953,869	1,169,699

Source: U.S. Department of Education, National Educational Longitudinal Study of 1988

Notes: Includes all respondents who graduated from high school before age 20, the vast majority in 1992. Outcomes five years after high school graduation are recorded for the transition categories. Graduation dates, majors, and SAT/ACT scores are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 2-6. High School Graduates of 1992 and Transitions to Bachelor's Degree, Percent of High School Graduates

High School Graduates by SAT Math Quintile	Status Five Years After Graduation								
	STEM				Non-STEM				Employed
	Total	Enrolled		Obtained Bachelor's Degree	Total	Enrolled		Obtained Bachelor's Degree	
		Bachelor's	Graduate			Bachelor's	Graduate		
Total	**6.5**	**2.1**	**0.4**	**4.0**	**27.9**	**7.9**	**3.6**	**16.5**	**65.6**
Total of Test Takers	**10.3**	**3.0**	**0.6**	**6.7**	**41.6**	**11.0**	**6.0**	**24.6**	**48.1**
Quintile 5 (Highest)	28.7	6.6	*1.7*	20.4	50.3	5.8	14.0	30.5	21.0
Quintile 4	11.3	3.3	*0.7*	7.3	56.5	12.1	7.4	37.0	32.2
Quintile 3	7.4	*1.8*	*0.4*	5.2	44.4	10.8	4.9	28.8	48.2
Quintile 2	4.8	2.6	*0.3*	*1.9*	35.3	13.4	3.3	18.5	59.9
Quintile 1 (Lowest)	*1.0*	*0.8*	*0.0*	*0.2*	21.7	12.0	*1.2*	8.4	77.3
No SAT/ACT Math Score	3.1	1.3	*0.2*	1.6	15.4	5.0	1.4	9.0	81.5

Source: U.S. Department of Education, National Educational Longitudinal Study of 1988

Notes: Includes all respondents who graduated from high school before age 20, the vast majority in 1992. Outcomes five years after high school graduation are recorded for the transition categories. Graduation dates, majors, and SAT/ACT scores are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 2-7. High School Graduates of 2000 and Transitions to Bachelor's Degree, Number of High School Graduates

High School Graduates by SAT Math Quintile	Status Five Years After Graduation									
	STEM				Non-STEM				Employed	Total Excluding Unemployed/ NILF
	Total	Enrolled		Obtained Bachelor's Degree	Total	Enrolled		Obtained Bachelor's Degree		
		Bachelor's	Graduate			Bachelor's	Graduate			
Total of all Graduates	**340,944**	***51,111***	***2,844***	**286,989**	**1,374,861**	**288,326**	***20,152***	**1,066,383**	**5,650,523**	**7,366,328**
Total of Test Takers	**314,344**	***38,608***	***2,844***	**272,892**	**1,138,475**	**174,047**	***20,152***	**944,276**	**2,726,075**	**4,178,894**
Quintile 5 (Highest)	144,556	*4,449*	*2,844*	137,263	345,132	*28,374*	*4,726*	312,032	559,496	1,049,184
Quintile 4	111,874	*10,652*	*0*	101,222	465,649	*78,954*	*7,845*	378,850	725,564	1,303,087
Quintile 3	*25,320*	*3,966*	*0*	*21,354*	106,818	*22,403*	*7,581*	*76,834*	290,085	422,223
Quintile 2	*32,594*	*19,541*	*0*	*13,053*	135,847	*18,278*	*0*	117,569	569,294	737,735
Quintile 1 (Lowest)	*0*	*0*	*0*	*0*	85,029	*26,038*	*0*	*58,991*	581,636	666,665
No SAT/ACT Math Score	*26,600*	*12,503*	*0*	*14,097*	236,386	114,279	*0*	122,107	2,924,448	3,187,434

Source: U.S. Department of Labor, National Longitudinal Survey of Youth 1997

Notes: Includes all respondents who graduated from high school before age 20. Eighty percent of those included above graduated in 1999 or 2000. Fifty respondents (unweighted) graduated in 1997, and none from 1998 are included. Outcomes five years after high school graduation are recorded for the transition categories. Graduation dates are self reported. SAT scores come from either transcripts or are self-reported; and are re-centered and converted to the pre-1995 scale. Many of the test scores were reported by range rather than specific score, and the median values are used in those cases. This leads to a slightly uneven distribution of individuals across quintiles. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 2-8. High School Graduates of 2000 and Transitions to Bachelor's Degree, Percent of High School Graduates

High School Graduates by SAT Math Quintile	Status Five Years After Graduation								
	STEM				Non-STEM				Employed
	Total	Enrolled		Obtained Bachelor's Degree	Total	Enrolled		Obtained Bachelor's Degree	
		Bachelor's	Graduate			Bachelor's	Graduate		
Total of all Graduates	**4.6**	***0.7***	***0.0***	**3.9**	**18.7**	**3.9**	***0.3***	**14.5**	**76.7**
Total of Test Takers	**7.5**	***0.9***	***0.1***	**6.5**	**27.2**	**4.2**	***0.5***	**22.6**	**65.2**
Quintile 5 (Highest)	13.8	*0.4*	*0.3*	13.1	32.9	*2.7*	*0.5*	29.7	53.3
Quintile 4	8.6	*0.8*	*0.0*	7.8	35.7	*6.1*	*0.6*	29.1	55.7
Quintile 3	*6.0*	*0.9*	*0.0*	*5.1*	25.3	*5.3*	*1.8*	*18.2*	68.7
Quintile 2	*4.4*	*2.6*	*0.0*	*1.8*	18.4	*2.5*	*0.0*	15.9	77.2
Quintile 1 (Lowest)	*0.0*	*0.0*	*0.0*	*0.0*	12.8	*3.9*	*0.0*	*8.8*	87.2
No SAT/ACT Math Score	*0.8*	*0.4*	*0.0*	*0.4*	7.4	3.6	*0.0*	3.8	91.7

Source: U.S. Department of Labor, National Longitudinal Survey of Youth 1997
Notes: Includes all respondents who graduated from high school before age 20. Eighty percent of those included above graduated in 1999 or 2000. Fifty respondents (unweighted) graduated in 1997, and none from 1998 are included. Outcomes five years after high school graduation are recorded for the transition categories. Graduation dates are self reported. SAT scores come from either transcripts or are self-reported; and are re-centered and converted to the pre-1995 scale. Many of the test scores were reported by range rather than specific score, and the median values are used in those cases. This leads to a slightly uneven distribution of individuals across quintiles. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 3-1. College Graduates of 1977 and Transitions to First Job, Number of College Graduates

College Graduates by STEM BA and GPA Quintile	Status Three Years After Graduation						
	STEM			Non-STEM			Total Excluding Unemployed/ NILF
	Total	Enrolled Student	Employed	Total	Enrolled Student	Employed	
Total	**47,903**	**8,992**	**38,911**	**465,041**	**49,290**	**415,751**	**512,944**
STEM total	**30,830**	***2,191***	**28,639**	**67,061**	**19,114**	**47,947**	**97,891**
Quintile 5 (Highest)	8,181	*576*	7,605	12,907	*5,166*	7,741	21,088
Quintile 4	6,982	*311*	6,671	12,166	*4,669*	7,497	19,148
Quintile 3	5,066	*558*	*4,508*	19,214	6,204	13,010	24,280
Quintile 2	5,934	*746*	5,188	12,599	*2,259*	10,340	18,533
Quintile 1 (Lowest)	4,667	*0*	4,667	10,175	*816*	9,359	14,842
Non-STEM total	**17,073**	**6,801**	**10,272**	**397,980**	**30,176**	**367,804**	**415,053**
Quintile 5 (Highest)	*3,846*	*1,668*	*2,178*	76,393	11,159	65,234	80,239
Quintile 4	*4,377*	*1,646*	*2,731*	84,588	6,484	78,104	88,965
Quintile 3	*4,256*	*1,830*	*2,426*	90,541	8,220	82,321	94,797
Quintile 2	*1,473*	*892*	*581*	75,504	*2,791*	72,713	76,977
Quintile 1 (Lowest)	*3,121*	*765*	*2,356*	70,954	*1,522*	69,432	74,075

Source: U.S. Department of Education, National Longitudinal Study of 1972

Notes: Includes all respondents who graduated from college in or before 1977; outcomes three years after college graduation are recorded for the transition categories. Graduation dates and majors are recorded and GPAs are calculated from respondent transcripts. "Enrolled Student" includes both enrolled bachelor's and graduate students. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 3-2. College Graduates of 1977 and Transitions to First Job, Percent of College Graduates

College Graduates by STEM BA and GPA Quintile	Status Three Years After Graduation					
	STEM			Non-STEM		
	Total	Enrolled Student	Employed	Total	Enrolled Student	Employed
Total	**9.3**	**1.8**	**7.6**	**90.7**	**9.6**	**81.1**
STEM total	**31.5**	***2.2***	**29.3**	**68.5**	**19.5**	**49.0**
Quintile 5 (Highest)	38.8	*2.7*	36.1	61.2	*24.5*	36.7
Quintile 4	36.5	*1.6*	34.8	63.5	*24.4*	39.2
Quintile 3	20.9	*2.3*	*18.6*	79.1	25.6	53.6
Quintile 2	32.0	*4.0*	28.0	68.0	*12.2*	55.8
Quintile 1 (Lowest)	31.4	*0.0*	31.4	68.6	*5.5*	63.1
Non-STEM total	**4.1**	**1.6**	**2.5**	**95.9**	**7.3**	**88.6**
Quintile 5 (Highest)	*4.8*	*2.1*	*2.7*	95.2	13.9	81.3
Quintile 4	*4.9*	*1.9*	*3.1*	95.1	7.3	87.8
Quintile 3	*4.5*	*1.9*	*2.6*	95.5	8.7	86.8
Quintile 2	*1.9*	*1.2*	*0.8*	98.1	*3.6*	94.5
Quintile 1 (Lowest)	*4.2*	*1.0*	*3.2*	95.8	*2.1*	93.7

Source: U.S. Department of Education, National Longitudinal Study of 1972

Notes: Includes all respondents who graduated from college in or before 1977; outcomes three years after college graduation are recorded for the transition categories. Graduation dates and majors are recorded and GPAs are calculated from respondent transcripts. "Enrolled Student" includes both enrolled bachelor's and graduate students. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 3-3. College Graduates of 1986 and Transitions to First Job, Number of College Graduates

College Graduates by STEM BA	Status Five Years After High School Graduation						
	STEM			Non-STEM			Total Excluding Unemployed/ NILF
	Total	Enrolled Student	Employed	Total	Enrolled Student	Employed	
Total	**575,515**	***18,275***	**557,240**	**3,562,741**	**189,783**	**3,372,958**	**4,138,256**
STEM	**386,299**	***14,418***	**371,881**	**455,821**	***26,074***	**429,747**	**842,120**
Non-STEM	**189,216**	***3,857***	**185,359**	**3,106,920**	**163,709**	**2,943,211**	**3,296,136**

Source: U.S. Department of Labor, National Longitudinal Survey of Youth 1979

Notes: Includes all respondents who graduated before age 24. Eighty-five percent of those included graduated from college between 1983 and 1989. Outcomes three years after college graduation are recorded for the transition categories. Graduation dates and majors are self-reported, and college GPA information is not available. "Enrolled Student" includes both enrolled bachelor's and graduate students. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 3-4. College Graduates of 1986 and Transitions to First Job, Percent of College Graduates

College Graduates by STEM BA	Status Five Years After High School Graduation					
	STEM			Non-STEM		
	Total	Enrolled Student	Employed	Total	Enrolled Student	Employed
Total	**13.9**	***0.4***	**13.5**	**86.1**	**4.6**	**81.5**
STEM	**45.9**	***1.7***	**44.2**	**54.1**	***3.1***	**51.0**
Non-STEM	**5.7**	***0.1***	**5.6**	**94.3**	**5.0**	**89.3**

Source: U.S. Department of Labor, National Longitudinal Survey of Youth 1979

Notes: Includes all respondents who graduated before age 24. Eighty-five percent of those included graduated from college between 1983 and 1989. Outcomes three years after college graduation are recorded for the transition categories. Graduation dates and majors are self-reported, and college GPA information is not available. "Enrolled Student" includes both enrolled bachelor's and graduate students. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 3-5. College Graduates of 1987 and Transitions to First Job, Number of College Graduates

College Graduates by STEM BA and GPA Quintile	Status Three Years After Graduation						
	STEM			Non-STEM			Total Excluding Unemployed/ NILF
	Total	Enrolled Student	Employed	Total	Enrolled Student	Employed	
Total	**67,324**	***4,577***	**62,747**	**546,528**	**45,092**	**501,436**	**613,852**
STEM total	**56,583**	***4,007***	**52,576**	**91,095**	**12,425**	**78,670**	**147,678**
Quintile 5 (Highest)	15,094	*631*	14,463	26,783	*6,084*	20,699	41,877
Quintile 4	8,450	*578*	7,872	15,630	*2,077*	13,553	24,080
Quintile 3	10,455	*276*	10,179	19,361	*2,231*	17,130	29,816
Quintile 2	15,273	*1,881*	13,392	15,150	*1,083*	14,067	30,423
Quintile 1 (Lowest)	7,311	*641*	6,670	14,171	*950*	13,221	21,482
Non-STEM total	**10,741**	***570***	**10,171**	**455,433**	**32,667**	**422,766**	**466,174**
Quintile 5 (Highest)	*4,528*	*447*	*4,081*	83,712	7,900	75,812	88,240
Quintile 4	*1,441*	*0*	*1,441*	93,442	11,057	82,385	94,883
Quintile 3	*1,108*	*0*	*1,108*	95,192	*4,430*	90,762	96,300
Quintile 2	*2,544*	*123*	*2,421*	97,777	*5,866*	91,911	100,321
Quintile 1 (Lowest)	*1,120*	*0*	*1,120*	85,310	*3,414*	81,896	86,430

Source: U.S. Department of Education, High School and Beyond

Notes: Includes all respondents who graduated from college in or before 1987; 1990 outcomes are recorded for the transition categories. Graduation dates and majors are recorded from respondent transcripts. Occupational categories are based on verbatim responses. "Enrolled Student" includes both enrolled bachelor's and graduate students. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 3-6. College Graduates of 1987 and Transitions to First Job, Percent of College Graduates

College Graduates by STEM BA and GPA Quintile	Status Three Years After Graduation					
	STEM			Non-STEM		
	Total	Enrolled Student	Employed	Total	Enrolled Student	Employed
Total	**11.0**	***0.7***	**10.2**	**89.0**	**7.3**	**81.7**
STEM total	**38.3**	***2.7***	**35.6**	**61.7**	**8.4**	**53.3**
Quintile 5 (Highest)	36.0	*1.5*	34.5	64.0	*14.5*	49.4
Quintile 4	35.1	*2.4*	32.7	64.9	*8.6*	56.3
Quintile 3	35.1	*0.9*	34.1	64.9	*7.5*	57.5
Quintile 2	50.2	*6.2*	44.0	49.8	*3.6*	46.2
Quintile 1 (Lowest)	34.0	*3.0*	31.0	66.0	*4.4*	61.5
Non-STEM total	**2.3**	***0.1***	**2.2**	**97.7**	**7.0**	**90.7**
Quintile 5 (Highest)	*5.1*	*0.5*	*4.6*	94.9	9.0	85.9
Quintile 4	*1.5*	*0.0*	*1.5*	98.5	11.7	86.8
Quintile 3	*1.2*	*0.0*	*1.2*	98.8	*4.6*	94.2
Quintile 2	*2.5*	*0.1*	*2.4*	97.5	*5.8*	91.6
Quintile 1 (Lowest)	*1.3*	*0.0*	*1.3*	98.7	*4.0*	94.8

Source: U.S. Department of Education, High School and Beyond

Notes: Includes all respondents who graduated from college in or before 1987; 1990 outcomes are recorded for the transition categories. Graduation dates and majors are recorded from respondent transcripts. Occupational categories are based on verbatim responses. "Enrolled Student" includes both enrolled bachelor's and graduate students. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 3-7. College Graduates of 1993 and Transitions to First Job, Number of College Graduates

College Graduates by STEM BA and GPA Quintile	Status Three Years After Graduation						
	STEM			Non-STEM			Total Excluding Unemployed/ NILF
	Total	Enrolled Student	Employed	Total	Enrolled Student	Employed	
Total	**141,431**	**13,679**	**127,752**	**763,459**	**99,374**	**664,085**	**904,890**
STEM total	**94,373**	**10,948**	**83,425**	**84,295**	**23,589**	**60,706**	**178,668**
Quintile 5 (Highest)	18,174	4,015	14,159	16,792	7,380	9,412	34,966
Quintile 4	19,148	*2,252*	16,896	15,198	5,873	9,325	34,346
Quintile 3	18,663	*1,276*	17,387	18,747	5,751	12,996	37,410
Quintile 2	21,281	*2,952*	18,329	17,462	2,555	14,907	38,743
Quintile 1 (Lowest)	17,107	*453*	16,654	16,096	2,030	*14,066*	33,203
Non-STEM total	**47,058**	**2,731**	**44,327**	**679,164**	**75,785**	**603,379**	**726,222**
Quintile 5 (Highest)	10,673	*708*	9,965	135,612	20,751	114,861	146,285
Quintile 4	8,006	*826*	7,180	136,009	16,697	119,312	144,015
Quintile 3	10,398	*617*	9,781	129,849	16,129	113,720	140,247
Quintile 2	9,038	*449*	8,589	134,375	13,442	120,933	143,413
Quintile 1 (Lowest)	8,943	*131*	8,812	143,319	8,766	134,553	152,262

Source: U.S. Department of Education, Baccalaureate and Beyond Longitudinal Study 1993

Notes: Includes all respondents who graduated from college in 1993; 1997 outcomes are recorded for the transition categories. Graduation dates, majors, and GPAs are recorded from respondent transcripts. "Enrolled Student" includes both enrolled bachelor's and graduate students. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 3-8. College Graduates of 1993 and Transitions to First Job, Percent of College Graduates

College Graduates by STEM BA and GPA Quintile	Status Three Years After Graduation					
	STEM			Non-STEM		
	Total	Enrolled Student	Employed	Total	Enrolled Student	Employed
Total	**15.6**	**1.5**	**14.1**	**84.4**	**11.0**	**73.4**
STEM total	**52.8**	**6.1**	**46.7**	**47.2**	**13.2**	**34.0**
Quintile 5 (Highest)	52.0	11.5	40.5	48.0	21.1	26.9
Quintile 4	55.8	*6.6*	49.2	44.2	17.1	27.2
Quintile 3	49.9	*3.4*	46.5	50.1	15.4	34.7
Quintile 2	54.9	*7.6*	47.3	45.1	6.6	38.5
Quintile 1 (Lowest)	51.5	*1.4*	50.2	48.5	*6.1*	42.4
Non-STEM total	**6.5**	**0.4**	**6.1**	**93.5**	**10.4**	**83.1**
Quintile 5 (Highest)	7.3	*0.5*	6.8	92.7	14.2	78.5
Quintile 4	5.6	*0.6*	5.0	94.4	11.6	82.8
Quintile 3	7.4	*0.4*	7.0	92.6	11.5	81.1
Quintile 2	6.3	*0.3*	6.0	93.7	9.4	84.3
Quintile 1 (Lowest)	5.9	*0.1*	5.8	94.1	5.8	88.4

Source: U.S. Department of Education, Baccalaureate and Beyond Longitudinal Study 1993

Notes: Includes all respondents who graduated from college in 1993; 1997 outcomes are recorded for the transition categories. Graduation dates, majors, and GPAs are recorded from respondent transcripts. "Enrolled Student" includes both enrolled bachelor's and graduate students. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 3-9. College Graduates of 1997 and Transitions to First Job, Number of College Graduates

College Graduates by STEM BA and GPA Quintile	Status Three Years After Graduation						
	STEM			Non-STEM			Total Excluding Unemployed/ NILF
	Total	Enrolled Student	Employed	Total	Enrolled Student	Employed	
Total	**99,082**	**9,020**	**90,062**	**545,215**	**63,437**	**481,778**	**644,297**
STEM total	**59,878**	**5,623**	**54,255**	**73,435**	**17,426**	**56,009**	**133,313**
Quintile 5 (Highest)	9,980	*1,857*	8,123	13,918	5,893	8,025	23,898
Quintile 4	10,249	*1,883*	8,366	11,718	4,442	7,276	21,967
Quintile 3	12,276	*1,204*	11,072	13,518	*3,853*	9,665	25,794
Quintile 2	13,530	*306*	13,224	14,707	*2,172*	12,535	28,237
Quintile 1 (Lowest)	13,843	*373*	13,470	19,574	*1,066*	18,508	33,417
Non-STEM total	**39,204**	***3,397***	**35,807**	**471,780**	**46,011**	**425,769**	**510,984**
Quintile 5 (Highest)	7,559	*403*	7,156	89,881	12,694	77,187	97,440
Quintile 4	*5,712*	*260*	*5,452*	94,508	11,260	83,248	100,220
Quintile 3	9,830	*1,251*	8,579	97,840	10,886	86,954	107,670
Quintile 2	6,999	*422*	6,577	90,692	*6,871*	83,821	97,691
Quintile 1 (Lowest)	9,104	*1,061*	8,043	98,859	*4,300*	94,559	107,963

Source: U.S. Department of Education, National Educational Longitudinal Study of 1988

Notes: Includes all respondents who graduated from college in or before 1997; 2000 outcomes are recorded for the transition categories. Respondents were in eighth grade when this survey began in 1988. Graduation dates, majors, and GPAs are recorded from respondent transcripts. "Enrolled Student" includes both enrolled bachelor's and graduate students. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 3-10. College Graduates of 1997 and Transitions to First Job, Percent of College Graduates

College Graduates by STEM BA and GPA Quintile	Status Three Years After Graduation					
	STEM			Non-STEM		
	Total	Enrolled Student	Employed	Total	Enrolled Student	Employed
Total	**15.4**	**1.4**	**14.0**	**84.6**	**9.8**	**74.8**
STEM total	**44.9**	**4.2**	**40.7**	**55.1**	**13.1**	**42.0**
Quintile 5 (Highest)	41.8	*7.8*	34.0	58.2	24.7	33.6
Quintile 4	46.7	*8.6*	38.1	53.3	20.2	33.1
Quintile 3	47.6	*4.7*	42.9	52.4	*14.9*	37.5
Quintile 2	47.9	*1.1*	46.8	52.1	*7.7*	44.4
Quintile 1 (Lowest)	41.4	*1.1*	40.3	58.6	*3.2*	55.4
Non-STEM total	**7.7**	***0.7***	**7.0**	**92.3**	**9.0**	**83.3**
Quintile 5 (Highest)	7.8	*0.4*	7.3	92.2	13.0	79.2
Quintile 4	*5.7*	*0.3*	*5.4*	94.3	11.2	83.1
Quintile 3	9.1	*1.2*	8.0	90.9	10.1	80.8
Quintile 2	7.2	*0.4*	6.7	92.8	7.0	85.8
Quintile 1 (Lowest)	8.4	*1.0*	7.4	91.6	*4.0*	87.6

Source: U.S. Department of Education, National Educational Longitudinal Study of 1988

Notes: Includes all respondents who graduated from college in or before 1997; 2000 outcomes are recorded for the transition categories. Respondents were in eighth grade when this survey began in 1988. Graduation dates, majors, and GPAs are recorded from respondent transcripts. "Enrolled Student" includes both enrolled bachelor's and graduate students. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 4-1. College Graduates of 1977 and Transitions to Mid Career, Number of College Graduates

College Graduates by STEM BA and GPA Quintile	Status Ten Years After Graduation: STEM Total	STEM Bachelor's Student	STEM Graduate Student	STEM Employed	Non-STEM Total	Non-STEM Bachelor's Student	Non-STEM Graduate Student	Non-STEM Employed	Total Excluding Unemployed/ NILF
Total	**51,669**	***0***	***344***	**51,325**	**434,663**	***243***	***2,007***	**432,413**	**486,332**
STEM total	**33,092**	***0***	***344***	**32,748**	**62,111**	***0***	***397***	**61,714**	**95,203**
Quintile 5 (Highest)	8,208	*0*	*99*	8,109	10,113	*0*	*271*	9,842	18,321
Quintile 4	6,410	*0*	*0*	6,410	10,506	*0*	*126*	10,380	16,916
Quintile 3	5,887	*0*	*245*	5,642	20,194	*0*	*0*	20,194	26,081
Quintile 2	6,940	*0*	*0*	6,940	10,981	*0*	*0*	10,981	17,921
Quintile 1 (Lowest)	5,647	*0*	*0*	5,647	10,317	*0*	*0*	10,317	15,964
Non-STEM total	**18,577**	***0***	***0***	**18,577**	**372,552**	***243***	***1,610***	**370,699**	**391,129**
Quintile 5 (Highest)	*2,778*	*0*	*0*	*2,778*	63,907	*148*	*207*	63,552	66,685
Quintile 4	*5,840*	*0*	*0*	*5,840*	82,062	*0*	*256*	81,806	87,902
Quintile 3	*2,383*	*0*	*0*	*2,383*	84,549	*95*	*535*	83,919	86,932
Quintile 2	*1,364*	*0*	*0*	*1,364*	69,828	*0*	*344*	69,484	71,192
Quintile 1 (Lowest)	*6,212*	*0*	*0*	*6,212*	72,206	*0*	*268*	71,938	78,418

Source: U.S. Department of Education, National Longitudinal Study of 1972

Notes: Includes all respondents who graduated from college in or before 1977; outcomes ten years after college graduation are recorded for the transition categories. Graduation dates and majors are recorded and GPAs are calculated from respondent transcripts. Non-response is a serious problem at this stage; forty-three percent of survey participants did not respond to the 1986 follow-up wave of the National Longitudinal Survey. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 4-2. College Graduates of 1977 and Transitions to Mid Career, Percent of College Graduates

College Graduates by STEM BA and GPA Quintile	Status Ten Years After Graduation: STEM Total	STEM Bachelor's Student	STEM Graduate Student	STEM Employed	Non-STEM Total	Non-STEM Bachelor's Student	Non-STEM Graduate Student	Non-STEM Employed
Total	**10.6**	***0.0***	***0.1***	**10.6**	**89.4**	***0.0***	***0.4***	**88.9**
STEM total	**34.8**	***0.0***	***0.4***	**34.4**	**65.2**	***0.0***	***0.4***	**64.8**
Quintile 5 (Highest)	44.8	*0.0*	*0.5*	44.3	55.2	*0.0*	*1.5*	53.7
Quintile 4	37.9	*0.0*	*0.0*	37.9	62.1	*0.0*	*0.7*	61.4
Quintile 3	22.6	*0.0*	*0.9*	21.6	77.4	*0.0*	*0.0*	77.4
Quintile 2	38.7	*0.0*	*0.0*	38.7	61.3	*0.0*	*0.0*	61.3
Quintile 1 (Lowest)	35.4	*0.0*	*0.0*	35.4	64.6	*0.0*	*0.0*	64.6
Non-STEM total	**4.7**	***0.0***	***0.0***	**4.7**	**95.3**	***0.1***	***0.4***	**94.8**
Quintile 5 (Highest)	*4.2*	*0.0*	*0.0*	*4.2*	95.8	*0.2*	*0.3*	95.3
Quintile 4	*6.6*	*0.0*	*0.0*	*6.6*	93.4	*0.0*	*0.3*	93.1
Quintile 3	*2.7*	*0.0*	*0.0*	*2.7*	97.3	*0.1*	*0.6*	96.5
Quintile 2	*1.9*	*0.0*	*0.0*	*1.9*	98.1	*0.0*	*0.5*	97.6
Quintile 1 (Lowest)	*7.9*	*0.0*	*0.0*	*7.9*	92.1	*0.0*	*0.3*	91.7

Source: U.S. Department of Education, National Longitudinal Study of 1972

Notes: Includes all respondents who graduated from college in or before 1977; outcomes ten years after college graduation are recorded for the transition categories. Graduation dates and majors are recorded and GPAs are calculated from respondent transcripts. Non-response is a serious problem at this stage; forty-three percent of survey participants did not respond to the 1986 follow-up wave of the National Longitudinal Survey. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 4-3. College Graduates of 1986 and Transitions to Mid Career, Number of College Graduates

College Graduates by STEM BA	Status Ten Years After Graduation								
	STEM				Non-STEM				Total Excluding Unemployed/ NILF
	Total	Bachelor's Student	Graduate Student	Employed	Total	Bachelor's Student	Graduate Student	Employed	
Total	**499,704**	***13,159***	***46,795***	**439,750**	**3,187,888**	***32,061***	**179,388**	**2,976,439**	**3,687,592**
STEM	**306,371**	***0***	***24,884***	**281,487**	**498,920**	***7,527***	***34,718***	**456,675**	**805,291**
Non-STEM	**193,333**	***13,159***	***21,911***	**158,263**	**2,688,968**	***24,534***	**144,670**	**2,519,764**	**2,882,301**

Source: U.S. Department of Labor, National Longitudinal Survey of Youth 1979

Notes: Includes all respondents who graduated before age 24. Eighty-five percent of those included graduated from college between 1983 and 1989. Outcomes ten years after college graduation are recorded for the transition categories. Graduation dates and majors are self-reported, and college GPA information is not available. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 4-4. College Graduates of 1986 and Transitions to Mid Career, Number of College Graduates

College Graduates by STEM BA	Status Ten Years After Graduation							
	STEM				Non-STEM			
	Total	Bachelor's Student	Graduate Student	Employed	Total	Bachelor's Student	Graduate Student	Employed
Total	**13.6**	***0.4***	***1.3***	**11.9**	**86.4**	***0.9***	**4.9**	**80.7**
STEM	**38.0**	***0.0***	***3.1***	**35.0**	**62.0**	***0.9***	***4.3***	**56.7**
Non-STEM	**6.7**	***0.5***	***0.8***	**5.5**	**93.3**	***0.9***	**5.0**	**87.4**

Source: U.S. Department of Labor, National Longitudinal Survey of Youth 1979

Notes: Includes all respondents who graduated before age 24. Eighty-five percent of those included graduated from college between 1983 and 1989. Outcomes ten years after college graduation are recorded for the transition categories. Graduation dates and majors are self-reported, and college GPA information is not available. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 4-5. College Graduates of 1993 and Transitions to Mid Career, Number of College Graduates

College Graduates by STEM BA and GPA Quintile	Status in 2003							
	STEM			Non-STEM				
	Total	Graduate Student	Employed	Total	Graduate Student	Employed	Bachelor's Student	Total Excluding Unemployed/ NILF
Total	**109,233**	***2,338***	**106,895**	**685,075**	**22,301**	**662,774**	***1,771***	**796,079**
STEM total	**68,333**	***1,586***	**66,747**	**87,710**	***3,216***	**84,494**	***385***	**156,428**
Quintile 5 (Highest)	13,828	*552*	13,276	18,199	*857*	17,342	*0*	32,027
Quintile 4	14,040	*129*	13,911	18,364	*156*	18,208	*0*	32,404
Quintile 3	12,945	*440*	12,505	18,268	*931*	17,337	*0*	31,213
Quintile 2	14,821	*263*	14,558	17,124	*329*	16,795	*232*	32,177
Quintile 1 (Lowest)	12,699	*202*	12,497	15,755	*943*	14,812	*153*	28,607
Non-STEM total	**40,900**	***752***	**40,148**	**597,365**	**19,085**	**578,280**	***1,386***	**639,651**
Quintile 5 (Highest)	6,797	*347*	6,450	128,298	4,391	123,907	*0*	135,095
Quintile 4	7,008	*317*	6,691	123,034	5,099	117,935	*287*	130,329
Quintile 3	9,134	*88*	9,046	114,191	3,364	110,827	*0*	123,325
Quintile 2	9,199	*0*	9,199	111,542	3,540	108,002	*568*	121,309
Quintile 1 (Lowest)	8,762	*0*	8,762	120,300	*2,691*	117,609	*531*	129,593

Source: U.S. Department of Education, Baccalaureate and Beyond Longitudinal Study 1993

Notes: Includes all respondents who graduated from college in 1993; 2003 outcomes are recorded for the transition categories. Graduation dates, majors, and GPAs are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.

Appendix Table 4-6. College Graduates of 1993 and Transitions to Mid Career, Percent of College Graduates

College Graduates by STEM BA and GPA Quintile	Status in 2003						
	STEM			Non-STEM			
	Total	Graduate Student	Employed	Total	Graduate Student	Employed	Bachelor's Student
Total	**13.7**	***0.3***	**13.4**	**86.1**	**2.8**	**83.3**	***0.2***
STEM total	**43.7**	***1.0***	**42.7**	**56.1**	***2.1***	**54.0**	***0.2***
Quintile 5 (Highest)	43.2	*1.7*	41.5	56.8	*2.7*	54.1	*0.0*
Quintile 4	43.3	*0.4*	42.9	56.7	*0.5*	56.2	*0.0*
Quintile 3	41.5	*1.4*	40.1	58.5	*3.0*	55.5	*0.0*
Quintile 2	46.1	*0.8*	45.2	53.2	*1.0*	52.2	*0.7*
Quintile 1 (Lowest)	44.4	*0.7*	43.7	55.1	*3.3*	51.8	*0.5*
Non-STEM total	**6.4**	***0.1***	**6.3**	**93.4**	**3.0**	**90.4**	***0.2***
Quintile 5 (Highest)	5.0	*0.3*	4.8	95.0	3.3	91.7	*0.0*
Quintile 4	5.4	*0.2*	5.1	94.4	3.9	90.5	*0.2*
Quintile 3	7.4	*0.1*	7.3	92.6	2.7	89.9	*0.0*
Quintile 2	7.6	*0.0*	7.6	91.9	2.9	89.0	*0.5*
Quintile 1 (Lowest)	6.8	*0.0*	6.8	92.8	*2.1*	90.8	*0.4*

Source: U.S. Department of Education, Baccalaureate and Beyond Longitudinal Study 1993

Notes: Includes all respondents who graduated from college in 1993; 2003 outcomes are recorded for the transition categories. Graduation dates, majors, and GPAs are recorded from respondent transcripts. Data with unweighted sample sizes less than 30 are reported in italics for reasons of data reliability.