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Field of Study in College and Lifetime Earnings in the United States

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Abstract

Our understanding about the relationship between education and lifetime earnings often neglects differences by field of study. Utilizing data that matches respondents in the *Survey of Income and Program Participation* to their longitudinal earnings records based on administrative tax information, we investigate the trajectories of annual earnings following the same individuals over 20 years and then estimate the long-term effects of field of study on earnings for U.S. men and women. Our results provide new evidence revealing large lifetime earnings gaps across field of study. We show important differences in individuals' earnings trajectories across the different stages of the work-life by field of study. In addition, the gaps in 40-year (i.e., ages 20 to 59) median lifetime earnings among college graduates by field of study are larger, in many instances, than the median gap between high school graduates and college graduates overall. Significant variation is also found among graduate degree holders. Our results uncover important similarities and differences between men and women with regard to the long-term earnings differentials associated with field of study. In general, these findings underscore field of study as a critical dimension of horizontal stratification in educational attainment. Other implications of the empirical findings are also discussed.

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RESEARCH ETHICS

Our research protocol was reviewed and approved by the University of Kansas Institutional Review Board. Access to SSA data linked to U.S. Census Bureau survey data is subject to restrictions imposed by Title 13 of the U.S. Code. The data are accessible only at a secured site. All data analyses were conducted by a researcher who maintains a Special Sworn Status. All statistical results were reviewed by the disclosure review committee at the Social Security Administration before their release.

The views expressed in this paper are those of the authors and do not represent the views of the Social Security Administration (SSA). For researchers with access to these data, the computer programs used in this analysis are available upon request.

Keywords

lifetime earnings; educational attainment; field of study; semi-synthetic cohort method

INTRODUCTION

Education plays an increasingly important role in shaping social stratification and inequality in the U.S. A large literature shows that college graduates earn more, have higher status jobs, and are more likely to be employed than those without a college degree (Autor 2014; Brand and Xie 2010; Fischer and Hout 2006; Kim and Sakamoto 2008; Oreopoulos and Petronijevic 2013). However, not all college degrees have similar economic returns. Although most studies assume homogeneity in the financial return to education, recent research has increasingly called attention to the role of horizontal stratification in higher education (see Gerber and Cheung [2008] for review). A small, but growing body of evidence shows important labor-market differentials across field of study (e.g., Reed and Miller 1970; Berger 1988; Rumberger and Thomas 1993; Thomas 2000; Song and Glick 2004). As the proportion of population who complete a college degree increases, an important research question is whether horizontal stratification in education is becoming more substantial than vertical stratification in determining financial rewards in the labor market over the life course and, ultimately, life chances.

Lifetime earnings are a critical dimension in the process of social stratification of life chances and well-being (Weber [1922]1978). Lifetime earnings measure the accumulation of rewards in the labor market over a career. They are a consequential determinant of wealth and savings (Engen, Gale, and Uccello 2005; Ruel and Hauser 2013); retirement income security and Social Security benefit levels (Iams, Reznik, and Tamborini 2010); health and mortality (Cristia 2009; Waldron 2013); and various aspects of social mobility (Hendricks 2007). A positive relationship between education and earnings is firmly established. Less understood, although generally recognized, is the extent to which the long-run economic returns to college vary across fields of study. This is partly due to the scarcity of long-term longitudinal data (Elder and Pavalko 1993; Cooke 2003), and also due to the lack of information on field of study in most national surveys. Thus, little is known about the role played by field of study in determining lifetime earnings; how earnings differentials across field of study might evolve differently over work careers; and how these outcomes vary by gender.

To help address these shortcomings, we make use of a rich data set that matches a nationally representative sample of respondents from the *Survey of Income and Program Participation* (SIPP) with their longitudinal earnings based on administrative tax information compiled at the Social Security Administration. Given the lack of research on lifetime earnings, the main objective of this study is to provide baseline estimates of the association between field of study and lifetime earnings. This is the first study to use nationally representative survey data matched to longitudinal earnings data spanning a long stretch of the same individual’s life to document how lifetime earnings vary by field of study. The analysis also extends our knowledge about differences in the lifetime financial returns to graduate education by field of study. We also demonstrate that field of study, not just educational level, is associated with age-differentiated earnings trajectories over the work life. In addition, we highlight important gender differences in the lifetime financial return of college education by field of study. No prior study has investigated how gender differences in horizontal differentiation change over the work career. Taken together, this study advances our understanding of the central role of horizontal stratification in higher education in determining labor market outcomes over the life course.

LITERATURE REVIEW

Rising Importance of the Horizontal Stratification in Education

The most common approach to understand the labor market effects of educational attainment has been to focus on the highest level completed as an ordinal outcome (Mare 1980; Buchmann and DiPrete 2006; Brand and Xie 2010). However, given rising rates of college completion and increases in wage inequality within almost all demographic groups over recent decades (Autor 2014), other dimensions of educational attainment may be becoming increasingly important sources of earnings differentials. The socioeconomic differentiation associated with field of study and college type is now widely recognized as important features of the horizontal dimension of the educational stratification (Daymont and Andrisani 1984; Rumberger and Thomas 1993; Davies and Guppy 1997; Thomas 2000; Song and Glick 2004; Gerber and Cheung 2008; Ma and Savas 2014).

Differences in earnings by field of study over the life course can be thought of as one way horizontal stratification in education has long-run impacts on labor market outcomes. There is no one theory explaining why lifetime earnings would be expected to vary by one's field of study. Human capital perspectives tend to view differences in earnings across college majors as resulting from different types of skills acquired in college programs. These skill sets, in turn, lead to differences in levels of productivity and marketable human capital (Daymont and Andrisani 1984; Shauman 2006). The skill-biased technological change perspective emphasizes the role of technological changes in raising the productivity of certain work-related skills (e.g., computer programming), which become increasingly rewarded by employers over other skills (e.g., cultural understanding). This perspective suggests as technology advances and skill demand increases, the relative importance of horizontal stratification by fields of study will rise as well.

A social closure view (Weeden 2002) attributes earnings differentials by field of study to the control of supply using positional power (i.e., control over the number admitted). As the financially lucrative fields such as engineering have raised the admission bar in many institutions, while the tertiary education expands and thus the bar to higher education becomes lowered, the social closure perspective may predict the rising importance of horizontal dimension by major fields in educational stratification.

In addition, fields of study may effectively sort students by ability. The expansion in higher education has increased differences in mean ability between fields of study, leading to increases in labor market inequality of university graduates from different fields (Reimer et al. 2008). Selection factors into college majors reflect another pathway by which field of study may influence earnings. Students who have strong preferences toward higher earnings may select into certain majors with the anticipation of future higher earnings (Beffy, Fougere, and Maurel 2012; Eide 1994). Individual decisions about how much to invest in higher education and what fields to choose are partially contingent on their expectation of future earnings streams (Arcidiacono, Hotz, and Kang 2012; Oreopoulos, and Petronijevic 2013).

Together, these theoretical views predict substantial gaps in earnings by field of study. A significant issue that has not been addressed adequately is the relative importance of horizontal versus vertical dimensions of educational stratification on long-term labor market outcomes, such as lifetime earnings.

Prior Estimates on Lifetime Returns to Education by Field of Study

The theoretical perspectives discussed above point toward field of study as having long-term impacts on the financial rewards in the labor market among college graduates. Very few studies in sociology have even investigated the effects of highest educational level on long-term earnings (see however, Tamborini, Kim, and Sakamoto 2015). Several recent technical reports provide estimates of lifetime earnings by highest level of educational attainment (Day and Newburger 2002; Carnevale, Rose and Cheach 2011; Mitchell 2014). However, previous analyses have not examined differences in lifetime earnings by field of study, with a handful of notable exceptions that have utilized the American Community Survey (ACS) to estimate lifetime earnings by college majors (Julian 2012; Herschbein and Kearney 2014; Carnevale, Cheah, and Hansen 2015). Although useful, the ACS provides information on respondents' undergraduate degree only, and moreover, is cross-sectional in design.

The paucity of research on the relationship between field of study and lifetime earnings is due primarily to the lack of data on long-term earnings and field of study in most surveys. In the extant literature, most analyses use cross-sectional data and employ a synthetic cohort method to generate "lifetime" estimates (e.g., Day and Newburger 2002; Kantrowitz 2007; Baum and Ma 2007; Julian and Kominski 2011; Carnevale et al. 2011). A simple synthetic cohort that cumulates the annual earnings of workers of different ages often assumes that workers are employed full-time and full-year for their entire work careers and that the earnings of older cohorts apply to younger cohorts. This practice neglects the employment issue and thus may lead to measurement errors in dependent variables (Haider and Solon 2006). Lifetime earnings is a function of annual (or other short-term) earnings and stability of employment. Estimates using cross-sectional data can account for the former but neglect the latter. Moreover, the association between short-term earnings and lifetime earnings may vary significantly, particularly at younger ages (Björklund 1993).

Career Volatility and Earnings Differentials by Field of Study

There are additional theoretical and empirical issues revolving around the relationship between lifetime earnings and field of study. Earnings and job mobility vary not only by education but also over the life course (Moffitt and Gottschalk 2011; Riddell and Song 2011). Consequently, extrapolations of cross-sectional data for lifetime outcomes may mistakenly construe career volatility as representing inequality in long-term earnings. In populations with high intra-generational income mobility, individuals' earnings over a short timeframe may differ from a longer timeframe. Previous studies finding lower earnings dispersion when measures account for longer periods of time reinforce this point (Bowlus and Robin 2004; Huggett et al. 2011). Unemployment rates and timing of withdrawal from the labor force differ by level of education (National Center for Education Statistics 2013) and by field of study (Carnevale et al. 2015). Insofar as career volatility varies across fields of study, estimated long-term returns of different fields of study based on cross-sectional data do not accurately reflect the lifetime value of different majors.

Studying lifetime earnings across fields of study also is informed by life course perspectives. A life course perspective emphasizes the trajectories of an age-differentiated life course (Sampson and Laub 1992; Warren et al. 2002), and the role of transitions, such as leaving school, marriage, and childbearing in shaping an individual's life (Elder, Johnson, and Crosnoe 2003). In this study, we examine how the earnings trajectories of the same individuals evolve differently by field of study as they age. We expect that the earnings differential associated with horizontal stratification in education varies by age. This is partly because the horizontal differentials are associated with the timing of life events and transitions.

Age of the college graduation affects labor force status and thus lifetime earnings. Workers who enter the labor market right after high school may have more stable and longer duration of employment at the early stage of work-career than those who enter college, who tend to have limited attachment to labor markets in their early 20s. Furthermore, the length of schooling varies by field of study (Beffy, Fougere, and Maurel 2012). The duration of study, in turn, may affect both the age and period of labor force entrance. Moreover, a lengthy period of schooling suggests that the earnings gains associated with educational attainment may arise later in the life course. Fields of study that require a lengthy period of schooling (e.g., medicine) will have lower or even negative effects at the early stage of work career, but may have positive effects on earnings at the later stage of work-career (e.g., earnings growth or retirement timing may differ by fields of study). A likely consequence is that the earnings differentials by field of study might be larger among some fields at a later stage of work career than the differentials at the early stage.

Childbearing is another important life event, particularly in accounting for gender differences. While male high school graduates often start working after graduation, female high school graduates are more likely to be out of labor force in their 20s due to family-related issues (U.S. Bureau of Labor Statistics 2014). As a result, the relative financial return to higher education for women (relative to high school graduates) is likely to manifest early in their work careers, while the return is delayed for men. Thus, we expect that the gender gap in the relative return to higher education, and differences by field of study, will be the largest in the 20s, and will attenuate with age.

Childbearing may also be associated with gender differences in returns to field of study. The distinction between vertical and horizontal stratification was originally employed to explain the sex segregation in higher education (Charles and Bradley 2002). A large number of sociological studies have analyzed the impact of fields of study on the gender wage gap (e.g., Jacobs 1995; Turner and Bowen 1999; Ramirez and Wotipka 2001; Charles and Bradley 2002, 2009; Roksa 2005; England and Li 2006; Bobbit-Zeher 2007; Morgan et al. 2013). Although these studies identify gender segregation in fields of study as a crucial mechanism behind the gender earnings gap, there is evidence that lucrative fields are equally beneficial for both men and women (e.g., Ma and Savas 2014). Nonetheless, we expect to find some gender differences by field of study. It may be that women who value the traditional gender role specialization (Becker 1981) concentrate in non-professional fields such as humanities and the liberal arts. The relative return to these fields may be lower for women than that for men. Furthermore, we expect the horizontal differentials will be the greatest at the time of childbearing for the highly educated. College educated women start to have children when their work career is on track after completing education (Sawhill 2014). To the extent that the choice of field of study is associated with gender role specialization, we expect that the horizontal differentials among women will be the greatest at the mid-career stage. Overall, in this study we aim to shed new light on the horizontal stratification in education by providing new estimates of the lifetime earnings differentials by fields of study, and by showing how horizontal differentials evolve differently by age and gender.

ANALYTIC STRATEGY

Data

The analysis uses the 2004 and 2008 SIPP matched to the Detailed Earnings Record (DER) file at the Social Security Administration (SSA). The SIPP data provide demographic and socioeconomic characteristics of a nationally representative sample. Wave 2 is selected because it includes a one-time topical module that provides retrospective information about respondents' education. Specifically, we use the SIPP's Educational History Module to measure field of study and to construct partial proxies for respondents' background educational characteristics. We pooled Wave 2 of the 2004 and the 2008 SIPP panels to acquire sufficient sample sizes of fields of study.

The DER file provides respondents' annual taxable earnings from 1982 to 2008 based on their W-2 tax records. These data begin in 1982 because that is when SSA started to collect reliable full earnings information beyond the maximum taxable earnings and Social Security-covered employment. The earnings data end in 2008 to minimize the effects associated with the Great Recession. We henceforth refer to this matched longitudinal data set as the SIPP-IRS. More detailed descriptions of the SSA administrative records and survey matches may be found elsewhere (see McNabb et al. 2009; Tamborini and Iams 2011; Kim and Tamborini 2014).

The central advantage of the SIPP-IRS data file is ability to construct an individual's long-term earnings profile over an age-specific period. These data, moreover, have several advantages over other longitudinal data sets. It is not limited to particular birth cohorts and the sample size is fairly large. Moreover, since our base sample comes from Wave 2, sample attrition is minimal. Further, the SIPP-IRS data contain well-measured annual earnings that are not "top-coded." A possible drawback is that not all SIPP respondents were successfully matched with the administrative data. The share of respondents matched successfully, however, is high at around 80 percent (2004 SIPP) to 90 percent (2008 SIPP).

Notwithstanding, we use a SIPP weight that adjusts for non-matched respondents to maintain the national representation of the sample.

Analytic Sample

Our main sample consists of college graduates and persons who completed high school from four birth cohorts: 1962–1969, 1952–1959, 1942–1949, and 1932–1939. We selected these cohorts to construct age-specific 10-year cumulative earnings streams at different career stages (for ages in the 20s, 30s, 40s, and 50s)[1]. We track the annual earnings of the same individual in each cohort over 20 years and compute two 10-year cumulative earnings blocks therein. We do not assess the entire lifetime earnings of one individual because the longitudinal earnings data do not extend further back than 1982.

The 10-year cumulative earnings of individuals in each cohort are age-specific. For example, 10-year cumulative earnings for age 30s reflects the total annual earnings of an individual from ages 30 to 39. For the 1952–1959 birth cohort, the 10-year period for the subset born in 1952 is the sum of annual earnings from 1982 (age 30) to 1991 (age 39). For the subset born in 1953, it is the sum of annual earnings from 1983 (age 30) to 1992 (age 39). We repeat these steps until reaching the final birth year for each cohort. As shown in Table 1, except for the age 20s (due to data availability), each 10-year age group consists of two of our birth cohorts to maximize sample size.

As noted, our analytic sample contains college graduates and high school graduates. We thus excluded high school dropouts and those who have some college education but no bachelor's degree. High school degree holders through the General Educational Developments (GED) tests were also dropped.[2] Additional sample selection rules involved the exclusion of respondents who received a Social Security disability benefit during their 20-year observation period (using an administrative variable merged to our data set).[3] Thus, our lifetime earnings estimates are net of disability before the entrance into labor markets and varying likelihood of disability over a life-course. Second, we limited the sample to persons who had at least two years of positive earnings in each 10-year period, allowing us to remove individuals with very weak labor force attachment.[4] Third, the sample is restricted to the native born to avoid the complication of assimilation processes and the number of eligible working years in the U.S. These selection criteria leave us with a total sample size of 24,320 men and 25,039 women. Among them, 13,014 men and 13,788 women held at least a bachelor's degree.

[1]For example, the 1961 birth cohort is excluded because the earliest available age in our data is 21 in 1983 so that the 10 year cumulative earnings in their 20s cannot be constructed.

[2]We also estimated the 40-year net lifetime earnings for those who have college experience but did not earn a BA degree (not shown). The net lifetime earnings for Some College is closer to HSG than BA. See Tamborini, Kim and Sakamoto (2015) for the detailed estimates of lifetime earnings by level of education. Utilizing the 2004 SIPP-IRS matched data, they provide the 50-year lifetime earnings by levels of education including less than high school, high school graduates, some college, bachelor degree and graduate degree.

[3]Supplementary analyses presented in Online Appendix Table 3 assess how the exclusion of disabled beneficiaries affects our results.

[4]We understand that 2-year restriction is arbitrary. To check whether our results are sensitive to this restriction, we changed the number of positive earnings to one, three and four, finding basically the same results.

Estimation Strategy

We assess 10-year cumulative earnings by field of study over different stages of the life course. The main multivariate model is quantile regression at the median of logged cumulative earnings. Unlike the classical linear model (i.e. OLS), median quantile regression does not assume homoscedasticity and normality. This is advantageous because the shapes of the earnings distribution differ by education and across different stage of work life. Quantile regression estimates also are characterized by linear equivariance (Hao and Naiman 2007:38). Because the conditional mean of log earnings is not equivalent to the log of conditional mean earnings, OLS-based estimates of lifetime earnings will suffer from retransformation bias (Manning 1998). In contrast, conditional quantiles possess a monotone equivariance property so that the estimates of logged earnings can be retransformed to actual dollars. Moreover, given that the distribution of long-term earnings is extremely skewed to the right for college educated workers, median lifetime earnings represent typical workers better than mean earnings. Further, because commonly-cited estimates of lifetime earnings use median earnings, using median regression models facilitates straightforward comparison of our results with previous estimates.

Our model can be written as follows:

$$y_{gi}=\sum \beta_{gf} FS_{gfi}+\sum \gamma_{gj} X_{gij}+\varepsilon_{gi}, \quad (1)$$

in which y_{gi} refers to log transformed 10-year cumulative earnings for age group g, and individual i. The administrative earnings refer to respondents' annual earnings for all jobs subject to federal income tax including uncapped wages, salaries, and other compensation such as bonuses, commissions, tips, and self-employment. All earnings are adjusted to 2010 dollars using the Consumer Price Index (i.e., series CPI-W).

The main independent variable, FS, refers to a set of fifteen binary indicators measuring an individual's field of study at the highest level of educational attainment. For those with a bachelor's degree only, 7 fields of study are identified: (1) business, (2) STEM, (3) health science, (4) social science, history, psychology, and communication, (5) education, (6) liberal arts, humanities, art, and architecture, and (7) others. For advanced degree holders, 8 fields of study are identified: (1) business, (2) STEM, (3) medicine and dentistry, (4) law, (5) social science, history, psychology, and communication, (6) education, (7) liberal arts, humanities, art, and architecture, and (8) others. FS, thus, indicates both a respondent's level of education and his or her field of study at the highest degree.[5] We could not disaggregate graduate degrees by master, professional, and doctoral degrees due to inadequate sample sizes. The reference group of FS (i.e., coded 0) is high school graduates. X is a vector of J control variables which are discussed below.

[5]Some may argue that the undergraduate major is more important than graduate school major. For example, those who majored in arts and science in college may more likely advance to graduate school, and thus their lifetime earnings might not be lower than vocational majors (Goyette and Mullen 2006). To consider this possibility, we estimated models using only field of study in undergraduate school. Those results (available upon request) do not show any appreciably different patterns from the results in Table 2. Throughout this paper, we therefore show the effects of field of study separated by bachelor degree only and graduate degree.

Note that our measures reflect respondents' highest level of education when the survey was conducted. Therefore, for example, the earnings of an advanced degree holder in STEM in the age 20s is not necessarily the earnings of persons with such a degree in their 20s, but rather the earnings of persons who eventually obtained an advanced degree in a STEM area at some point of their life. Because the age of highest degree may differ by the level of education and field of study, we control for the age of the final degree in the regression models.

The regression analyses include other control variables. Socio-demographic controls refer to birth year, race and ethnicity (white, African American, Hispanic, and other), and being born in the South. Age of final degree was included in the models, as well as the survey year since we pool the data. We also utilize several retrospective measures in the education history module as partial proxies for family background attributes. First, we control for private high school attendance because it is closely associated with family income (National Center for Education Statistics 1997). Second, we measure whether the respondent completed college preparation courses and, separately, advanced mathematics and/or science courses in high school. Persons with higher socioeconomic family background are more likely to take advanced placement (AP) and college preparatory classes (Espenshade and Radford 2009:38). In doing so, our results show the detailed association between lifetime earnings and field of study. Our intention is not to estimate the causal effects of education, but rather to help take into account the effects of demographic covariates and to equalize the different effects of these covariates across four cohorts in computing lifetime earnings.

Using our estimates of 10-year cumulative earnings for each age group, we then adopt what we refer to as a semi-synthetic cohort method to estimate 40-year lifetime earnings. More specifically, we use the estimates of the net 10-year cumulative earnings based on the quantile regression at the median (equation 1) as follows:

$$LF_{fs}=\exp(\hat{y}_{20s,f})+\exp(\hat{y}_{30s,f})+\exp(\hat{y}_{40s,f})+\exp(\hat{y}_{50s,f}), \quad (2)$$

where LF_{fs} is a 40-year lifetime earnings estimate of field of study at the highest degree fs, and $\hat{y}_{20s,fs}$, $\hat{y}_{30s,fs}$, $\hat{y}_{40s,fs}$ and $\hat{y}_{50s,fs}$ are the estimates of 10-year cumulative log-earnings at age group by field of study at the highest degree after controlling for X. To estimate $\hat{y}$, we use the gender-specific grand mean value of X_g across all age groups for all control variables.

This approach does not entirely overcome the problems of synthetic cohort methods. Nonetheless, it provides more realistic estimates of lifetime earnings by field of study than purely synthetic cohort calculations based on annual earnings observed in cross-section.

EMPIRICAL FINDINGS

We begin by tracking annual earnings over a 40-year work-life by field of study. Men's earning trajectories demonstrate the well-known inverted U-curve pattern regardless of level of education and field of study, but the depth of curve varies substantially by field of study.

The earnings trajectories for women show the similar inverted U-curve pattern with men but the depth of the curve is much shallower than men.

Using individual annual administrative earnings records, we compute 10-year, cumulative earnings from age 20 to 59 by each individual's field of study.[6] We then estimate a set of median quantile regressions for each 10-year earnings block (logged) by the specified age range, after controlling for demographic and high-school related covariates. Tables 2 and 3 show the results for men and for women respectively

Several findings stand out. First, there are significant differences in logged cumulative earnings by field of study over the life course. Among bachelor degree-only men and women, STEM and business majors were associated with highest cumulative earnings over the life course. Among male graduate degree holders, the highest cumulative earnings were observed in business, STEM, medicine/dentistry, and law fields of study, from the 30s onward.

Second, the effects of field of study on cumulative earnings differ by age and gender. In Tables 2 and 3, a sharp mark (#) indicates a statistically significant age difference at $\alpha = .05$ compared to the coefficients for Age 50s. A dagger mark (†) in Table 2 indicates a statistically significant difference between men's coefficient and the corresponding coefficient for women in Table 3. In terms of age, the effects of field of study for men differ between age 20s and the prime working ages (i.e., age 30–59). For example, among male bachelor's degree only, majoring in education was associated with 30% (=exp(−.361)−1) *lower* cumulative logged earnings in age 20s than HSG, but the effects become positive from age 30 to 59. In contrast, STEM was associated with 34% *higher* cumulative logged earnings in age 20s relative to HSG. For advanced degree holders, there is a large negative effect on cumulative earnings from age 20 to 29 associated with some fields of study, indicating forgone earnings while in school. This implies that estimates of lifetime earnings that do not capture earnings early in life may overstate the net lifetime return to higher education. These results also support the notion that the timing of school completion matters.

From age 30 to 59, men with a bachelor's degree only earn substantially more than HSG, but the extent varies sharply across field of study. In fact, the gaps in cumulative earnings between the highest- and lowest-earning fields of study among those with a BA only are much larger than the gap between HSG and BA.

We find a similar pattern among advanced degree holders. For some majors, such as law and medical/dentistry, advanced degrees are associated with sharply higher earnings. In contrast to these majors, a graduate degree in liberal arts, humanities, arts, and architect does not appear to raise earnings considerably relative to a BA in the same field. Another way to see if the horizontal differentials change over age is to compare the variance of the fifteen estimated coefficients in Table 2 by age groups. Interestingly enough, it steadily increased from .05 in Age 20s to .08 in Age 30s, to.10 in Age 40s, and then to .14 in Age 50s.

[6]Online Appendix Table 2 reports descriptive tabulations of median cumulative earnings by the 10-year age groups.

As shown in Table 3, we also find important variation by field of study for women. Among female bachelor degree holders, STEM, business, and health science are associated with the highest cumulative earnings relative to HSG over the life course. Advanced degrees in STEM, medicine/dentistry, and law were also associated with relatively high cumulative earnings among women particularly in the age 30s and 40s. Like men, the effects of field of study tend to vary across different stages of life for women, but the observed differences between the 20s and the prime working ages are not as sharp as men. Instead, in case of women, many fields exhibit the larger effects of higher education compared to HSG in their 30s than in other ages. When the variances of the fifteen estimated coefficients are computed, the highest differentials are observed in the 30s. The high differentials in the 30s may be associated with the timing of childbearing and labor force status.

Several other differences by gender are notable. The overall net advantage of college education appears larger for women than that for men regardless of field of study. The gender differences in the relative effects of field of study are most prominent in the 20s. Unlike men in their 20s, college-educated women earn more than comparable high school graduates regardless of field of study. During the prime working age, the gender differences are not omnipresent, but there are still statistically significant differences in several fields. When there is a statistically significant difference, almost all of them (except BA-Education and Medicine and Dentistry in Age 50s) show higher coefficients for women than for men.

Estimates of Forty-Year Lifetime Earnings by Field of Study

Using the regression results, we calculated 40-year lifetime earnings (age 20–59). We adopted three different approaches. First, we report the “gross” median lifetime earnings by field of study without taking into account any covariates. Second, we compute the net 40-year lifetime earnings by field of study accounting for the covariates (using the estimates presented in Tables 2 and 3). We fix all covariates to the gender-specific grand mean of the entire sample. Thus, net lifetime earnings refer to the expected earnings net of all demographic and high-school-related covariates. Third, we compute the net present value of lifetime earnings at age 20 to account for the time-value of money, the notion that future earnings are worth less than present earnings. The discount rate is a useful way to calculate the net present value of different fields of study in terms of 40-year earnings. How much people discount earnings far in the future relative to the opportunity costs of current investments in education, i.e. their personal discount rate, depends on their own psychological disposition and the perceived riskiness of their investment. We apply a real discount rate of 4.0 percent, the average annual inflation rate over the last half-century, which we assume might be the average psychological discount rate. Estimates based on alternative discount rates would yield different results.

Table 4 shows that a college degree is associated with sharply higher lifetime earnings for both men and women. A male HSG earns $1,425,000 over a 40-year work career (i.e., from age 20 to age 59), a male BA earns $2,209,000, and a male GRAD earns $2,787,000 on average. Including covariates changes the 40-year lifetime earnings estimates for men to $1,490,000 for HSG, $2,149,000 for BA, and $2,641,000 for GRAD. For women, a female HSG earns $721,000, a female BA earns $1,257,000, and a female GRAD earns $1,676,000 on average. When covariates are accounted for, the 40-year lifetime earnings become $728,000 for HSG, $1,114,000 for BA, and $1,470,000 for GRAD. These latter figures, when compared to men, are 49%, 56%, and 60%, respectively.[7]

However, differences by level of education obscure sizeable variation by field of study. For men, the gap in cumulative 40-year earnings between BA education majors and HSG is particularly narrow such that after controlling for covariates (column (B)), the lifetime earnings advantage of a BA in education compared to HSG is $45,000 (=$1,535,000–$1,490,000). In contrast, the 40-year earnings gains associated with a BA in STEM is $1,173,000 (=$2,663,000–$1,490,000). Put differently, the gap in cumulative 40-year earnings between a BA in STEM and a BA in education is 26 times larger than the gap between a BA in education and HSG. For female workers, the lifetime earnings gaps across field of study are also quantitatively meaningful, but they are smaller than the gaps for men.

Are the observed lifetime earnings differences across fields of study statistically significant? To illustrate, Figure 1 displays the 95% confidence interval of the difference in 40-year net log-transformed lifetime earnings by field of study relative to HSG. The estimates confirm statistically significant differentials by field of study even though our sample size for each field is rather small. An asterisk in the Female graph (B) indicates that female education premium is statistically higher than male education premium.

Among graduate degree holders, lifetime earnings also sharply vary by field of study. On average, the 40-year lifetime earnings gains associated with an advanced degree compared to a BA is $492,000 for men after making adjustments for the covariates. However, much of this advantage, we find, is driven by the relatively high returns to law, business and medical majors. For other fields, the lifetime financial returns of an advanced degree are more modest. For example, among social science majors, the lifetime return to graduate school is around $114,000 relative to a BA only in that field. Surprisingly, for liberal arts, humanities, arts, and architecture majors, the lifetime financial return to graduate education compared to a BA in the same major is negative (i.e., $1,878,000 for BA versus $1,821,000 for GRAD). This is mainly because the earnings of those who earn an advanced degree in these fields are much lower than others in their 20s and are still negative in the 30s. In regard to this pattern, however, we caution that the composition of detailed fields in liberal arts, humanities, arts, and architecture majors may differ between BA and GRAD, and that the financial return to graduate education often continues to grow after age 60 (Tamborini, Kim, and Sakamoto 2015). Nevertheless, our results do call attention to concerns about the long-term financial return to graduate study in these fields.

Compared to men, women tend to garner more relative total financial return from an advanced degree (Morgan 2008), although statistically insignificant due mainly to small sample sizes of female graduate degree holders. For example, a female graduate degree holder in a social science earns $344,000 more than a female BA in the same major while the gap between BA and GRAD is only $114,000 for men. Surprisingly, female graduate

[7]We did not control for marriage and children related covariates because they could be endogenous with earnings. The estimated lifetime earnings when these covariates are controlled for are reported in Online Appendix Table 3.

degree holders in education enjoy $502,000 additional lifetime earnings compared to a female BA in education and the difference is statistically significant. Such gains are partially because an advanced degree for women not only raises their annual salary and occupational prospects but also raises the likelihood of greater participation in the labor force over the life course. Indeed, our analyses (not shown here) show that the proportions of zero earnings for most BA majors are higher than those for GRAD at least in their 30s.

To calculate the net present value, we apply a 4% real discount rate. As expected, the 40-year earnings differentials between college degree holders and their high school graduate counterparts narrow when using discounted earnings streams. At the same time, substantial variation across field of study remains. For example, the present value of an advanced degree in liberal arts, humanities, arts and architecture at age 20 compared to HSG is $60,000 for men. Surprisingly, the present value of a BA degree in education at age 20 is actually negative compared to HSG ($680,000 for HSG vs. $651,000 for BA in education).

DISCUSSION AND CONCLUSION

We investigated the relationship between field of study and lifetime earnings utilizing a nationally representative sample of SIPP respondents matched to longitudinal earnings records in administrative data. Given the few prior studies on this topic, our primary goal was to generate baseline estimates that would extend our knowledge about the size of lifetime earnings differentials across field of study, and how these differentials vary across age and by gender. Assessing these issues helps advance our understanding of the long-term effects of horizontal stratification in higher education on financial rewards in the labor market, earnings inequality, and life chances.

Our results point toward several conclusions. Overall, we provide new evidence that for college graduates, field of study constitutes a critically important source of lifetime earnings inequality. Our estimates indicate that *horizontal stratification in education across field of study may now be more consequential for long-term rewards in the labor market than vertical stratification*. That is, the lifetime earnings (i.e., age 20 to 59) of college graduates exhibit gaps by field of study that are larger in many instances than the gaps between college and high school graduates. For example, a BA in social science among men is associated with a lifetime earnings gains of $374,000 compared to a high school diploma only, and an advanced degree in social science yields an additional $114,000. However, majoring in STEM instead of social science is associated with much larger gains. Even without obtaining a graduate degree, a BA in STEM is associated with $800,000 higher lifetime earnings compared to a BA in social science. Statistically significant differentials across fields of study also were evident among male advanced degree holders and female BA holders. This suggests that long-term earnings inequality within educational levels may be more important than previously thought. It also suggests that the study of earnings disparities by educational attainment should be expanded to include other dimensions such as field of study.

Our estimates of lifetime earnings across different fields of study, in terms of relative ranking, are fairly consistent with published estimates in previous reports using the ACS to that extent that our field-of-study categories overlap. There are, however, some notable differences. In fact, the estimates contained in two previous reports using the ACS (i.e., Julian 2012; Herschbein and Kearney 2014) are far from being consistent. Julian (2012) reported $1.8 million to $3.5 million 40-year lifetime earnings depending on college major among those whose highest degree is a BA, while Herschbein and Kearney (2014) reported a range of $800,000 to $2.1 million for the same 40-year lifetime earnings. Our findings are in-between those estimates. The substantial discrepancies between those two prior estimates are mainly due to the different sample selection criteria. Julian (2012) used full-time full-year employed respondents only, while Herschbein and Kearney (2014) included anyone who worked for at least one week within the past 12 months. The former may overstate lifetime earnings while the latter may understate it. Our estimates of lifetime earnings by field of study based on long-term longitudinal information on earnings are the first that do not hinge on strong labor force status assumptions.

Our findings also provide new evidence that field of study can have age-differentiated effects on the careers of men and women. For example, persons in fields such as medicine/dentistry and law, exhibit distinct life-course patterns in earnings, such as relatively steep earnings growth at later stages of the career. If earnings growth evolves differently over the life course by field of study, then horizontal dimensions of education stratification may be increasingly important for the sequencing of wealth formation, social mobility, and ultimately, retirement savings and income in later life. Through direct and indirect pathways, field of study may furthermore influence the timing of life transitions, including withdrawal from the labor force as well as the pace of health decline in old age. These results demonstrate the usefulness of a life course perspective when examining the returns to education by field of study.

Several findings relating to gender are notable. We found significant gender differences in the association between field of study and earnings by age. For men in many fields of study, the cumulative returns to college education over age 20s were negative, but they were positive for women regardless of field of study. This is partly due to the fact that highly educated men are *less* likely to be in labor force than HSG in the early 20s, while highly educated women are *more* likely to be in labor force than their less educated counterparts. Though not conclusive, this implies that the short-term opportunity cost of a college education is substantially higher for men than for women.

Our findings also show higher relative long-run returns to higher education across most fields of study for women than men. Despite small sample sizes, half of the observed gender differences across fields of study are statistically significant, and most gaps are substantial. It may be noteworthy that education and health majors, fields in which women are concentrated, show statistically significant gender differences. For example, a BA in education is associated with an additional $140,900 over a lifetime for men, but an extra $308,400 for women relative to their high school graduate counterparts. In part, this is because traditionally female concentrated fields such as education provide a higher likelihood of staying in labor markets for women and thus the lifetime monetary value of these fields for women is not as low as that measured using annual earnings or hourly wages. Along with the opportunity cost in the 20s discussed above, this larger relative long-run return to higher education could be a reason why women might be more likely to go to college than men. Further research on this possibility is warranted.

Finally, our findings shed light on the highly relevant question of whether a college education is worth its monetary cost. On average, our estimates indicate that the lifetime return to college clearly offsets the initial investment for men and women, no matter the person's field of study. However, the extent of the "payoff" depends on one's field of study and gender. With the average price of tuition and required fees of a 4-year college per year rising to about $12,967 in 2010 (National Center for Education Statistics 2012), the total average cost is about $52,000. Applying a 4 percent real discount rate, the net present value of different college degrees varied from 2 to 23 times higher than $52,000 for most major fields. In some instances, however, the value of a bachelor's degree (i.e. education), and an advanced degree (i.e., liberal arts, humanities, arts, and architecture) among men fell short of the $52,000 threshold. Yet, our measure of lifetime earnings does not account for total compensation, including pensions, health insurance, and other benefits. Because jobs requiring a college degree are more likely to offer generous benefits (e.g., secondary school teachers), using total compensation would alter the net present value of some fields of study, such as education majors, relative to a high school diploma. Furthermore, the total benefit of education is not limited to its direct pecuniary gain (Hout 2012; Oreopoulos and Salvanes 2011).

Several limitations are noteworthy. First, due to smaller sample sizes among older respondents, we limited the age range to 59. To the extent that labor force participation and earnings after age 59 differ by educational level or field of study, then our lifetime estimates could be somewhat altered. Second, we do not measure the entire lifetime earnings of a single birth cohort because the longitudinal earnings data do not extend further back than 1982. We reiterate that estimates of real-cohort lifetime earnings may yield different results than those based on the semi-synthetic cohort method. Further, the relationship between field study and labor market outcomes may differ for future cohorts. Lower educated groups were more negatively affected by the recent economic downturn than higher educated groups (Sum and Khatiwada 2010), and unemployment can be a life-changing event that has long-run costs for affected workers' earnings (Couch et al. 2013). Third, because of sample sizes, we could not estimate the earnings of master, professional, and doctoral degree holders separately. As the share of master degrees and more advanced degrees varies by fields, the implication of our estimates of the advanced degree may differ by fields. Fourth, although college quality is beyond this study's scope and no information on this is available in our data, it represents another important dimension of horizontal stratification (Zhang 2005; Ma and Savas 2014). Finally, as a cautionary note, the results do not reflect causal impacts of field of study. Unobserved individual heterogeneity (e.g., reflecting variation in such traits as ambition, intelligence, creativity, differences in preferences for income versus leisure or intrinsic job rewards) may contribute to the relationships between field of study and earnings observed here.

Nonetheless, this study has provided new evidence that highlights substantial differences in the lifetime earnings returns to education by field of study. These results represent an important insight into the critical, and perhaps increasing, role of a horizontal dimension in educational stratification in shaping life-course patterns in the labor market and the accumulation of earnings over a lifetime. We close our discussion by noting additional directions for research. The labor market mechanisms that generate earnings differences by field of study are an area of research worth exploring further. For example, research on the effect of occupational sorting by field of study is warranted.[8] Many sociologists have implicitly equated occupation with lifetime earnings (Blau and Duncan 1967; Hauser and Warren 1997; Wilkinson 1966), particularly among those studying inter-generational social mobility (Featherman and Hauser 1978). This association has never actually been systematically evaluated. While field of study has been theorized as a dimension of horizontal stratification, occupational sorting has been considered as a process of vertical stratification. How to resolve this contradiction in social stratification theory remains unresolved. Several recent studies highlight the linkages between level of education, field of study and occupation (e.g., Morgan et al. 2013; Reynolds et al. 2006; Roksa and Levey 2010), but more studies on how lifetime earnings are differentiated jointly by field of study and occupation would be beneficial.

Our analysis also has important implications for the study of intergenerational mobility. Despite the widely shared belief that an increase in earnings inequality lowers intergenerational income mobility (Corak 2013) and concerns about the rising influence of family background on the probability of obtaining higher education (Reardon 2011), other evidence suggests that intergenerational earnings mobility may not have declined significantly in recent decades (Chetty et al. 2014). Large earnings differentials across field of study may represent an unacknowledged channel of upward mobility (Ma and Savas 2014). Evidence suggests that students with low household socioeconomic resources are more likely to choose financially more rewarding areas such as business or engineering over financially less rewarding liberal arts majors (Goyette and Mullen 2006). In regard to racial differentials in earnings, field of study may help to explain the apparently high upward mobility of Asian Americans (Sakamoto, Goyette and Kim 2009) and the lack of it among recent cohorts of African Americans (Bloome and Western 2011). This topic merits further investigation in future research.

Our results also suggest the possibility that the increase in the college premium over recent decades is concentrated in a small number of fields rather than being universal. A clear avenue for future research to consider is the extent to which the returns to education over historical time vary by field of study. Differential earnings growth rates over the life course by fields of study (following the same individuals over time) is also worthy of consideration. As the population ages and a college degree becomes more important, topics of particular policy relevance include how field of study can have long-term consequences on a wide range of outcomes including job stability, wealth formation, retirement behavior, and health.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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[8]The lack of longitudinal information on occupation in the administrative data precludes us from examining occupational sorting. The SIPP provides information on occupation but only for the length of the survey panel.

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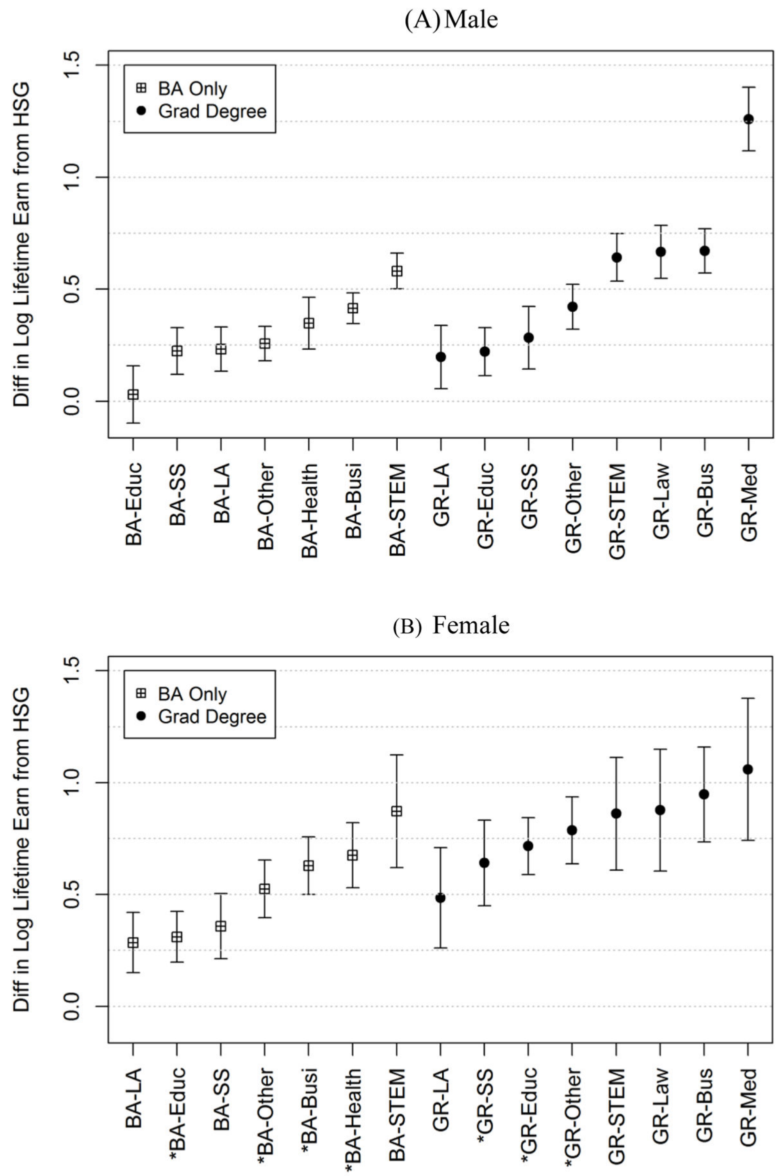

Figure 1.
Difference in 40-year Net Log Lifetime Earnings from High School Graduates
Notes: The error bars indicate the 95% confidence interval for the estimates of 40-year lifetime earnings. The asterisk mark (*) in (B) Female indicates that female education premium is statistically higher than male education premium. To compute the 95% confidence interval, first we computed the lower (and upper) bound estimates of four 10-year long-term earnings using the results of Table 2 and then added them together.

Table 1

Description of Sample by Cohorts

	Total	Cohort 1	Cohort 2	Cohort 3	Cohort 4
Year of Birth	1932–1969	1962–1969	1952–1959	1942–1949	1932–1939
Age in the 2004 SIPP	35–72	35–42	45–52	55–62	65–72
Age in the 2008 SIPP	39–76	39–46	49–56	59–66	69–76
Total Covered Ages	20–59	20–39	30–49	40–59	50–59
Covered Age in the 1st 10-year Cumulative Earnings	20–59	20–29	30–39	40–49	50–59
Starting Year of the 1st 10-year Cumulative Earnings	1982–1989	1982–1989	1982–1989	1982–1989	1982–1989
Ending Year of the 1st 10-year Cumulative Earnings	1991–1998	1991–1998	1991–1998	1991–1998	1991–1998
Covered Age in the 2nd 10-year Cumulative Earnings	30–59	30–39	40–49	50–59	-
Starting Year of the 2nd 10-year Cumulative Earnings	1992–1999	1992–1999	1992–1999	1992–1999	-
Ending Year of the 2nd 10-year Cumulative Earnings	2001–2008	2001–2008	2001–2008	2001–2008	-
Sample Size by Age Group: Men					
Age 20s	4,023	4,023	-	-	-
Age 30s	8,272	4,035	4,237	-	-
Age 40s	7,360	-	4,215	3,145	-
Age 50s	4,665	-	-	3,121	1,544
Total (20s–50s)	24,320				
Sample Size by Age Group: Women					
Age 20s	4,237	4,237	-	-	-
Age 30s	8,537	4,147	4,390	-	-
Age 40s	7,550	-	4,408	3,142	-
Age 50s	4,715	-	-	3,028	1,687
Total (20s–50s)	25,039				

Table 2

Median Regressions of 10-year Cumulative Log-transformed Earnings by Age Group, Men

		Age 20s		Age 30s		Age 40s		Age 50s	
		Coeffi.	**(S.E.)**	**Coeffi.**	**(S.E.)**	**Coeffi.**	**(S.E.)**	**Coeffi.**	**(S.E.)**
(Ref = High School Graduate)									
BA	Business	0.154	(0.039) ***†#	0.638	(0.027) ***†#	0.561	(0.031) ***	0.494	(0.043) ***
	STEM	0.294	(0.041) ***†#	0.760	(0.030) ***†	0.709	(0.038) ***	0.731	(0.052) ***
	Health Science	0.001	(0.065) †#	0.538	(0.046) ***†	0.471	(0.053) ***†	0.534	(0.074) ***
	Social Sci, History, Psychology, Comm	−0.002	(0.051) †#	0.439	(0.038) ***	0.310	(0.048) ***	0.329	(0.072) ***
	Education	−0.361	(0.086) ***†#	0.210	(0.057) **	0.185	(0.057) **†	0.216	(0.073) **†
	Liberal Arts/Humanities, Art, Architect	−0.165	(0.052) **†#	0.397	(0.038) ***†	0.353	(0.046) ***	0.431	(0.063) ***†
	Others	0.027	(0.043) †#	0.498	(0.030) ***†#	0.387	(0.035) ***†	0.323	(0.052) ***
Grad	Business	0.356	(0.060) ***†#	1.016	(0.041) ***†	0.899	(0.045) ***†	0.919	(0.061) ***
	STEM	0.250	(0.071) ***†#	0.896	(0.048) ***†	0.853	(0.049) ***	0.924	(0.060) ***
	Medicine, Dentistry	−0.253	(0.098) **†#	1.336	(0.061) ***#	1.484	(0.063) ***#	1.715	(0.084) ***†
	Law	−0.011	(0.074) †#	0.932	(0.050) ***†	0.828	(0.053) ***	0.968	(0.071) ***
	Social Sci, History, Psychology, Comm	0.045	(0.093) †#	0.574	(0.072) ***†	0.503	(0.064) ***†	0.519	(0.071) ***
	Education	−0.005	(0.077) †#	0.533	(0.051) ***†	0.480	(0.049) ***†	0.456	(0.057) ***†
	Liberal Arts/Humanities, Art, Architect	−0.404	(0.088) ***†#	0.445	(0.061) ***†	0.458	(0.065) ***	0.499	(0.083) ***
	Others	−0.041	(0.065) †#	0.773	(0.044) ***†	0.698	(0.046) ***†	0.631	(0.059) ***†
[Variance of the 15 Estimated Coefficients]		[0.049]		[0.083]		[0.102]		[0.139]	
Sample Size		4,023		8,272		7,360		4,665	
Pseudo R-squared		0.061		0.157		0.144		0.135	

Notes: Numbers within parentheses are standard errors. Estimates use SIPP weights adjusted for non-matched respondents. All models control for race/ethnicity, birth year, region of birth, high school type, years since the highest degree, college preparation courses, math/science AP courses, and year of survey.

*< .05;

**< .01;

***< .001 (two-tailed tests).

[#]indicates a statistically significant age difference compared to Age 50s at alpha=.05.

[†]indicates a statistically significant gender difference at alpha=.05 compared to the corresponding coefficients in Table 3.

Table 3

Median Regressions of 10-year Cumulative Log-transformed Earnings by Age Group, Women

		Age 20s		Age 30s		Age 40s		Age 50s	
		Coeffi.	(S.E.)	Coeffi.	(S.E.)	Coeffi.	(S.E.)	Coeffi.	(S.E.)
(Ref = High School Graduate)									
BA	Business	0.691	(0.056)***	0.832	(0.053)***#	0.686	(0.060)***	0.600	(0.089)***
	STEM	0.966	(0.088)***	0.990	(0.092)***	0.825	(0.123)***	0.963	(0.182)***
	Health Science	0.705	(0.068)***	0.838	(0.060)***	0.669	(0.065)***	0.748	(0.097)***
	Social Sci, History, Psychology, Comm	0.471	(0.064)***	0.528	(0.062)***	0.373	(0.071)***	0.346	(0.096)**
	Education	0.271	(0.069)***	0.299	(0.057)***	0.390	(0.052)***	0.424	(0.060)***
	Liberal Arts/Humanities, Art, Architect	0.487	(0.068)***#	0.625	(0.062)***#	0.316	(0.066)***#	−0.030	(0.082)
	Others	0.616	(0.060)***#	0.757	(0.055)***#	0.613	(0.061)***#	0.367	(0.086)***
Grad	Business	0.993	(0.096)***	1.312	(0.085)***#	1.205	(0.098)***#	0.721	(0.161)***
	STEM	0.859	(0.122)***	1.281	(0.115)***#	0.855	(0.125)***	0.846	(0.150)***
	Medicine, Dentistry	0.531	(0.162)**	1.564	(0.138)***#	1.327	(0.146)***#	0.759	(0.228)**
	Law	0.693	(0.110)***	1.210	(0.104)***	0.966	(0.123)***	0.886	(0.200)***
	Social Sci, History, Psychology, Comm	0.590	(0.107)***	0.861	(0.090)***	0.805	(0.085)***	0.729	(0.112)***
	Education	0.695	(0.077)***	0.972	(0.064)***#	0.886	(0.058)***	0.773	(0.068)***
	Liberal Arts/Humanities, Art, Architect	0.537	(0.120)***	0.699	(0.110)***	0.656	(0.104)***	0.491	(0.127)***
	Others	0.676	(0.079)***#	0.981	(0.069)***	0.897	(0.069)***	0.946	(0.087)***
[Variance of the 15 Estimated Coefficients]		[0.036]		[0.108]		[0.082]		[0.074]	
Sample Size		4,237		8,537		7,550		4,715	
Pseudo R-squared		0.087		0.095		0.092		0.102	

Notes: Numbers within parentheses are standard errors. Estimates use SIPP weights adjusted for non-matched respondents. All models control for race/ethnicity, birth year, region of birth, high school type, years since the highest degree, college preparation courses, math/science AP courses, and year of survey.

* < .05;

** < .01;

*** < .001 (two-tailed tests).

# indicates a statistically significant age difference compared to Age 50s at alpha=.05.

Table 4

Estimated Median 40-year Lifetime Earnings by Field of Study Using the Semi-Synthetic Cohort Method

		Men			Women		
		(A)	(B)	(C)	(A)	(B)	(C)
		Gross Lifetime Earnings	Net Lifetime Earnings	Net Present Value at Age 20	Gross Lifetime Earnings	Net Lifetime Earnings	Net Present Value at Age 20
High School Graduate		$1,425,195	$1,489,656	$679,885	$721,108	$734,662	$339,328
BA	Business	$2,308,898	$2,255,050	$987,449	$1,442,296	$1,377,781	$631,985
	STEM	$2,797,436	$2,663,359	$1,149,086	$1,811,564	$1,757,279	$800,417
	Health Science	$2,171,387	$2,109,116	$900,435	$1,518,012	$1,443,341	$652,117
	Social Sci, History, Psychology, Comm	$1,946,944	$1,863,586	$818,671	$1,100,490	$1,050,886	$486,080
	Education	$1,566,094	$1,535,131	$650,920	$1,029,495	$1,001,804	$441,623
	Liberal Arts/Humanities, Art, Architect	$1,889,523	$1,878,207	$795,301	$1,002,475	$977,333	$478,869
	Others	$1,940,772	$1,925,376	$849,080	$1,281,613	$1,242,303	$583,706
	(Average)	($2,208,771)	($2,148,556)	($933,236)	($1,257,109)	($1,210,476)	($556,940)
Grad	Business	$3,027,151	$2,914,196	$1,238,332	$2,030,029	$1,893,831	$867,556
	STEM	$3,020,020	$2,829,947	$1,182,468	$1,823,752	$1,738,367	$792,526
	Medicine, Dentistry	$5,563,507	$5,251,212	$1,962,536	$2,166,711	$2,118,263	$944,416
	Law	$3,157,032	$2,902,453	$1,185,789	$1,822,950	$1,765,090	$781,409
	Social Sci, History, Psychology, Comm	$2,110,262	$1,977,528	$845,792	$1,503,241	$1,394,857	$605,143
	Education	$1,955,046	$1,858,827	$795,015	$1,591,857	$1,503,325	$657,305
	Liberal Arts/Humanities, Art, Architect	$1,821,236	$1,814,653	$740,359	$1,292,311	$1,193,295	$531,665
	Others	$2,391,955	$2,268,759	$955,212	$1,719,616	$1,613,854	$690,683
	(Average)	($2,786,890)	($2,640,750)	($1,092,931)	($1,676,073)	($1,579,473)	($694,259)

Notes: A semi-synthetic cohort method is used to estimate lifetime earnings. Gross earnings are based on descriptive statistics without controlling for any covariates. For the estimates of net lifetime earnings and its present value, race/ethnicity, birth year, region of birth, high school type, years since the highest degree, college preparation courses, math/science AP courses, and year of the survey are controlled for in median regression models. The present value is calculated at age 20 using a real discount rate of 4 percent.