Is It *Where* You Study or *What* You Study?
Changing Horizontal Stratification in Bachelor's Degrees in the 21st Century

Hunter York
Princeton University

November 7, 2025

Updated regularly. Click HERE for the most recent version.

Keywords: Earnings, Education, Stratification, Work and occupations, Inequalities

Word count: 15,959 words, 7 figures, 6 tables

* I am grateful to Yu Xie, Adam Goldstein, Shamus Khan, Florencia Torche, Max Fineman, and Megan Kang alongside the participants of the Princeton works-in-progress workshop, the Princeton stratification seminar, the 2025 CAREER workshop in Amsterdam, the 2025 ASA Annual Meeting in Chicago, and the 2025 RC28 Annual meeting in Los Angeles for their helpful comments and suggestions. Any remaining errors are the sole responsibility of the author. Send correspondence to Hunter York, Department of Sociology, Princeton University 107 Wallace Hall, Princeton, NJ 08544 (email: hyork@princeton.com.)

Abstract

A central question in the social stratification literature and for individuals interfacing with the US system of higher education is whether college graduates' earnings depend more on *what* they study or *where* they study. Drawing on a novel dataset linking US bachelor's graduates' educational credentials—defined as the combination of degree level, awarding institution, and field of study—to realized earnings and industry destinations from 2001 onward, this study provides the first comprehensive estimates of the changing roles of horizontal stratification across institutions and fields in structuring earnings inequality. Field of study predicts earnings more powerfully than institutional affiliation, and its influence has modestly increased over time. This growing salience reflects the intensifying alignment between specific fields and high-wage sectors such as finance, technology, and professional services. Although variation across institutions accounts for a smaller share of inequality, it is increasingly correlated with characteristics such as selectivity and enrollment. These patterns are not driven by shifts in enrollment patterns, nor by demographic recomposition, and there is no evidence that high-earning credentials have become increasingly concentrated within high-earning institutions. These patterns suggest that shifting industrial returns, rather than compositional change, underlie emerging forms of labor market inequality.

Introduction

The labor market returns to higher education are well documented (for reviews, see Card 1999; Hout 2012; Meghir and Rivkin 2011; Posselt and Grodsky 2017). Yet these returns vary substantially by institution (Zimmerman 2019; Brand 2006; Sekhri 2020), by field of study[1] (Altonji, Kahn, and Speer 2016; Kim, Tamborini, and Sakamoto 2015; Goyette and Mullen 2006; Kirkeboen, Leuven, and Mogstad 2016), and by their intersections, here termed specific education *credentials* to refer to the unique combination of degree level, awarding institution, and field of study.[2]

However, set against the backdrop of the rapid expansion of higher education, technological change, and industry restructuring, it is unclear how returns to a degree are differentiated by *what* and *where* students study or how these categorical distinctions' relative importance has changed across successive graduating cohorts. The present research is the first to systematically study both forms of *horizontal stratification*[3], or the variation among otherwise equivalent vertically stratified degrees, in tandem and over time.

The changing importance of horizontal stratification has implications for theories of credentialism and social closure as well as models of status-attainment, recasting a bachelor's degree not as a unitary equalizer but as a constantly evolving engine of inequality in which differentiated educational credentials confer advantage among graduates. Fig-

[1] I use the term "field of study" instead of "college major" to account for variation in degree types (e.g., B.A., B.S.N., B.F.A.) and to allow generalizability across vertical levels of education. "Academic program" might be a suitable alternative, though no term is fully satisfactory.

[2] While this notion of "credential" departs slightly from its typical usage (see Collins et al. 1979), it has precedent. I use credential to refer to specific institution- and field-specific degree designations, excluding post-degree licensure and other non-degree certifications. Alternatives like "departments" miss that the same department may issue different degree types (e.g., B.A., B.S.). As in Collins, credentials are labor-market currency—official requirements regulating access to jobs and advanced study—though my scope is narrower and more granular. Here, the field of study- and institution-specific credentials here are nested within Collins's broader concept, preserving its gatekeeping/allocative role while distinguishing, for example, the same degree across universities. This is usage is also consistent with Brown (2001).

[3] I follow the stratification literature in defining horizontal stratification as variation within a given

ure 1 provides a stylized representation of the forms of horizontal stratification discussed in this article as compared to vertical stratification.

In this research, I show that institutional, field-based, and specific credential-based disparities together explain considerable variation in realized earnings among workers with at least a bachelor's degree. However, the contributions of these factors on earnings are neither uniform nor static, showing distinct evolutionary patterns. I find that field of study is a stronger predictor of earnings than institutional affiliation, and its relative importance is growing modestly across recent cohorts. The widening field-of-study differentials are driven primarily by the increasing concentration of high earnings in a few industries to which certain fields of study are tightly linked. Meanwhile, institutional variation accounts for a smaller share of inequality, but it has become more structured by observable characteristics such as test scores and enrollment size. I find little evidence that high-earning fields of study have become concentrated within high-earning institutions, that shifts in enrollments cause these patterns, or that changing demographics at the specific educational credential level offer a competing explanation for these findings.

The present research builds on prior studies that have typically examined each form of horizontal stratification in isolation and from cross-sectional, static perspectives. While prior work documents large and persistent pay gaps across fields and premiums associated with institutional characteristics (for reviews, see Gerber and Cheung 2008; Reimer and Thomsen 2019), analyzing each axis separately can conflate field-of-study and institutional effects because fields are unevenly distributed across institutions in path-dependent and sometimes idiosyncratic ways. Institutional and field differences also interact with sorting across demographic characteristics shaped by changing re-

level of completed education. In this case, that is among individuals who have finished a bachelor's degree. This usage differs from some strands of higher education research, where the term often refers to variation in experiences, resources, or outcomes during college, including between completers and non-completers. My focus is limited to degree recipients, which makes horizontal and vertical stratification analytically separable. Institutional and field of study-level differences in degree completion, being the result of forces that dictate vertical stratification, are important, but they are outside of the scope of this study.

gional population compositions and institution-specific student bodies, underscoring the need for institution-level analyses (Hamilton et al. 2024). Additionally, the predominance of cross-sectional designs obscures how the relative importance of institutions, fields, and their intersections has shifted across cohorts. Table 1 summarizes exemplary research by axis and time horizon.

Along with Bleemer and Quincy (2025), the present study addresses a key gap by jointly analyzing both axes and tracing their combined effects across graduating cohorts. Whereas their study treats horizontal stratification primarily as an input to vertical stratification and relies on survey data that preclude direct analysis of horizontal stratification, I use fine-grained administrative data to trace how specific credentials map to realized earnings and how those payoffs evolve over time.

The mechanisms underpinning the findings described in this paper are central to understanding how employers interpret educational signals in recruitment and job assignment, speaking directly to research on hiring biases and the social processes through which credentials acquire labor-market value. Although this study captures only part of the relational foundations of horizontal stratification, the inequalities documented here point to a broader research agenda tracing how educational credentials are embedded in employer networks and how those ties transmit value through concrete relational linkages. Taken together, the findings I document indicate a shift in how higher education structures inequality. The central question raised here is not who gains access to college but rather how distinctions among programs and institutions create unequal value once students are in college. In terms of the political economy of higher education, this research likely reflects the growing entanglement of universities with market logics, as stratification within higher education mirrors labor-market segmentation and positions institutions as arbiters of economic inequality and credentialing forces for increasingly segmented labor markets. As the college–no-college earnings gap has stabilized (Autor et al. 2020) and the number of bachelor's degrees has nearly doubled since the turn of the century,[4] new forms of inequality have likely emerged within higher education, organized less by vertical access than by the horizontal differentiation of programs and institutions whose ties to labor markets evolve alongside changes in industrial organization, wage-setting, and occupational closure.

To maintain analytical tractability, I focus on a single level of vertical stratification: bachelor's degree holders. The choice is practical and theoretical because the bachelor's is the most common U.S. postsecondary credential and a key gateway to many labor-market opportunities. Although often treated as a uniform marker of status, outcomes among recipients vary widely by institution and field, making this a critical site of horizontal differentiation. The U.S. liberal arts system, where students can choose or change fields after enrolling and schools are rarely specialized, unlike more rigid systems such as Germany's, allows a clear test of whether institutional or field characteristics matter more for inequality. I track outcomes at one, five, and ten years after graduation to capture both the immediate effect of specific credentials and the indirect effects that operate through further study and job moves. I report five-year estimates in the main text, with other time horizons presented in the supplementary appendix.

Thus far, I have established that returns to higher education vary across fields of study, institutions, and their intersections, and that prior work has typically examined these axes separately and at single points in time. This study addresses the absence of joint, longitudinal analyses that treat field of study and institution in tandem and locate specific credentials within relational and organizational linkages to employers as labor markets change. Before proceeding, I review research on horizontal stratification, highlight themes that bear directly on this analysis, and clarify how a relational, organizational perspective extends existing accounts.

*** Figure 1 About Here ***

[4] https://nces.ed.gov/programs/digest/d12_310.asp

Horizontal Stratification by Field of Study and Institution

Having established why field of study and institution matter, the next step is to clarify *how* horizontally stratified educational credentials map onto realized earnings in the labor market. Beginning with fields of study, Carnevale, Cheah, and Strohl (2013) show that earnings gaps across fields of study can exceed the overall college versus high school gap. In a human capital view, fields confer different skill bundles with different market premiums, which separates the *general* value of a bachelor's degree from its *specific* forms (Kinsler and Pavan 2015; Kogan et al. 2021; Kambourov and Manovskii 2009; van de Werfhorst et al. 2001). Yet, it is not clear that field of study effects are reducible to skills alone: certain disciplines also carry prestige value, convey signals of skills that may not actually be had, and channel students into occupationally closed or professionally socialized pathways (Brown 2001). As Brown argues, educational credential hierarchies are rooted in status cultures and organizational practices that institutionalize prestige distinctions within education. Fields of study may thus operate as status-bearing credentials as much as ascriptions of skill (see also Bills 2003).

Educational institutions themselves represent the other main axis of horizontal stratification, shaping outcomes through largely other mechanisms altogether. University prestige, for instance, affects returns to a bachelor's degree net of ability or learning (MacLeod et al. 2017), cultural matching in elite labor markets privileges graduates of high-status universities (Rivera 2012), and even randomized exposure to elite peers can enhance long-run outcomes (Michelman, Price, and Zimmerman 2022). As with field of study, institutional premiums thus reflect a mixture of real and perceived advantages for individuals on the labor market.

Much of the prior literature estimates the effects of fields of study and institutions in isolation, yet in most survey data these estimates are entangled because fields are unevenly distributed across institutions in ways that are unobserved. A measured premium from attending a flagship college may be real in a reduced-form sense, yet it may be driven by specialized programs that exist only at such institutions, which blurs whether the observed return should be attributed to the institution or to the field of study. The data and methods I introduce allow these influences to be separated, but the point is not to stage a contest of magnitudes for its own sake. Rather, institutions and fields are analytically distinct sites where social and human capital are produced, organized, and valued, and they matter through related yet different pathways. Both can operate through prestige signaling, cultural capital, and closure, but the channels differ in content and reach. Institutional prestige communicates social exclusivity, network quality, and a general status that travels as a form of "portable" cultural capital. Field-based prestige communicates domain-specific capital, including legitimate knowledge, cultural knowledge, and occupational socialization that carry meaning within particular labor-market segments. These symbolic processes combine with genuine differences in training and skills that specific educational credentials confer. The contribution of this analysis is to measure how these two axes, and their intersections, jointly structure economic returns, while setting the stage for further work that traces the concrete mechanisms through which those returns are produced.

The aforementioned measurement problem inherent to survey-based research is further compounded by how both axes of horizontal stratification are captured in survey data. Institutions are proxied by observed attributes or collapsed into broad groupings (e.g., average test scores or selectivity tiers), while fields of study are recorded crudely and then aggregated into overly broad categories. These strategies obscure meaningful differences across institutions and flattening the closure-generating processes that distinguish specific fields. For example, surveys often collapse computer science, information systems, and electrical engineering into a single "computer-related" major despite sharp differences in training, prestige, and labor market returns. Similar flattening occurs within medical and engineering programs, whose subfields have widely divergent outcomes but are too complex for many survey instruments. At the institutional level, treating all flagship publics as equivalent ignores sharp cross-state differences in resources, selectivity, and outcomes, just as collapsing private institutions into a single category erases the gulf between elite research universities (e.g., Ivy League schools) and tuition-dependent regional colleges. Prior work rarely models specific educational credentials directly. Where it does, evidence suggests limited institutional variation net of department effects in a Norwegian context (Borgen and Mastekaasa 2018). Even among elite schools, students' experiences and outcomes vary dramatically. As a result, much of the variation most relevant to horizontal stratification among the large percentage of the population not attending elite schools has remained unexplored in prior research.

The value of fields of study and institutions reflects the human and social capitals they confer and the labor-market destinations they open up. Some credentials place graduates in high-paying sectors with limited growth (for example, nursing). Others start lower but yield steeper long-run trajectories (for example, medicine). Still others, such as technology or consulting, combine high entry pay with sustained mobility (Cheng and Song 2019). These life-course patterns are further sorted by differences in graduate-school entry, which makes attention to specific credentials essential. They are also shaped by broader forces as fields and programs adjust to changing occupations, industries, and forms of work, often differently across institutions. Many fields are additionally organized by national academic policies and vocational systems. International research on school-to-work linkages shows that stronger linkages reduce unemployment and improve job outcomes, although they can limit flexibility and increase mismatch (DiPrete et al. 2017; Bol et al. 2019). This framework situates credentials within institutional structures. Most prior work is cross-national, whereas this study examines variation within a single, large national context. Taken together, this perspective shifts attention from individual selection to institutional and labor-market forces that shape credential outcomes.

The aforementioned measurement difficulties have led to research that has hitherto pursued a narrow agenda. Work on institutional effects in the United States has often focused on elite universities even though they educate a small share of students.[5] However, most bachelor's degrees are awarded by colleges that differ in enrollment patterns, residential versus commuter context, online share, and admissions and advising practices, which conventional metrics such as SAT scores or selectivity do not fully capture (Ciocca Eller 2023). Many students attend nearby colleges or face financial and family constraints, which makes variation among non-elite institutions central. In terms of intergenerational mobility, higher selectivity does not uniformly raise returns because many colleges with the highest mobility rates accept most applicants (Chetty et al. 2017).

Beyond institutional selectivity or quality indicators, organizational features of universities and campus ecologies channel students unevenly by class background, producing divergent trajectories even within the same school (Armstrong and Hamilton 2013) and making an attention to specific institutions and credentials paramount. Crucially, outcomes depend both on where students enroll and on what they study there, because institutions differ in disciplinary strengths and students sort into programs in patterned ways. Among research-intensive elites, program mixes are relatively similar, which can mask this interaction. Among the far larger set of non-elite colleges, the specific fields of studies offered at a given institution are first order.[6] Finally, not all educational credentials express the simple additive effects of a field of study and an institution, departmental quality and program reputation vary. For these reasons, an analysis of inequality broadly amongst the full range of institutional flavors must jointly account for institutions and fields of study to capture how these environments should together structure earnings.

[5] By the author's calculation, 21 Ivy Plus colleges account for 1.8% of bachelor's recipients.

[6] For example, many allied health professions (one of the largest groups of professions comprising laboratory technicians, respiratory therapists, dietitians, etc.) require specialty degrees only available at select universities in each state. Likewise, vocationalized bachelor's degrees for careers as accountants, commercial pilots, and police officers are often geographically limited within a given state.

Selection Effects and Measuring the Value Added of Horizontally Stratified Degrees

In the context of horizontal stratification, I use the term *selection effects* to refer to differences in outcomes across institutions, field of study, and their intersections that arise from pre-enrollment sorting. This usage is complementary to *value-added* or causal effects, which capture returns attributable to the training, networks, placement, and other features of the credential itself while holding student characteristics pre-enrollment constant. Distinguishing selection effects from values-added is central because institutions and fields, and college itself, attract systematically different populations along dimensions correlated with earnings, including academic preparation, socioeconomic background, and labor-market aspirations.

Field of study and institutions differ in demographic makeup and in the forces that channel students into them, including preparation, aspirations, and perceived labor-market risk (Altonji, Blom, and Meghir 2012; Zhou 2019; Brewer, Eide, and Ehrenberg 1999; Loury and Garman 1995; Goyette and Mullen 2006). Differential enrollment by demographic characteristics alone does not contaminate causal conclusions from observational data on earnings gaps. Problems arise when imbalances are *correlated with unobserved determinants of earnings* such as pre-college abilities, productivity, or motivation, or when the propensity to choose a specific field of study or college is correlated with the benefit a student would receive from a program (treatment effect heterogeneity bias; Zhou and Xie 2020). When such selection on unobservables is present, cross-credential gaps can reflect sorting rather than credential value added. Evidence for institutional differences is mixed, with some studies attributing gaps to selectivity and others finding little effect once unobserved heterogeneity is addressed (Borgen 2014; Bleemer 2021; Manski and Wise 1983; Dale and Krueger 2002; Brand 2006). By contrast, recent work provides limited support for the view that field-of-study pay gaps primarily reflect selection (Dahl et al. 2023; Bleemer and Mehta 2022; Kim et al. 2015). Put differently, demographic segregation matters for the present study only insofar as it generates the earnings differences observed across credentials. Otherwise it is secondary to the task of describing shifting dynamics of earnings inequality over time, though it has implications for whom such inequalities affect the most.

A recent comprehensive study of the college mobility pipeline by Bleemer and Quincy (2025) puts selectivity in perspective with regards to the present study. Drawing on more than a century of survey data, the authors show that college has become increasingly regressive since 1960 (the benefits of vertical stratification have shifted toward higher-income groups) due to structural changes in higher education. The study also quantifies how much between-institution and between–field of study earnings differences reflect the value added of a degree (the value net of selection). Selection explains only a small share: about 70–80% of institutional differences and nearly 100% of field differences reflect causal effects of credentials rather than preexisting student differences (Bleemer and Quincy 2025). The institutional estimate is consistent with Chetty, Deming, and Friedman (2023).

It is intuitive that selection into institutions and fields explains only a limited share of horizontal inequality. Along the vertical margin, such as college versus high school, selection is strong because groups differ in preparation, resources, and aspirations, all of which correlate with earnings even after accounting for college attendance. Along the horizontal margin, differences across schools, fields, and their intersections arise from more stochastic forces that do not reliably track prior ability in ways tied to potential earnings. Xie et al. (2015) show this for STEM fields of study: family background and individual traits matter for preparation, yet they do not predict choosing a STEM field. Students more often land in programs through advising nudges, personal interests, proximity and commuting constraints, tuition and net price, and frictions such as course availability, lotteries, and enrollment priorities. These processes sort students in ways that are noisy with respect to ability, so observed gaps across credentials largely reflect credential value added and the labor-market destinations those credentials enable (Bleemer and Quincy 2025). Demographic sorting still matters for who gains entry, but the earnings attached to credentials appear more sensitive to processes that occur after students sort into programs. This is consistent with the literature on horizontal stratification and its links to demographic inequality. Hamilton et al. (2024) document how horizontal stratification coincides with racial, class, and gender inequality in access. Their perspective clarifies who gets in, while my analysis focuses on how the value of credentials shifts and how those shifts translate into labor-market outcomes, which helps explain subsequent stratification across demographic groups.

My analysis is possible even though I do not model selection directly. The findings in Bleemer and Quincy (2025) offer a useful benchmark and help situate my results within broader patterns of inequality. My contribution is to center the structure and evolution of horizontal stratification itself, asking how the value of credentials has shifted over time and how these shifts reflect changes in higher education and the labor market. Unlike survey designs, the dataset I use permits fine-grained analysis at the credential level and makes it possible to separate field effects from institutional effects while tracking their joint evolution. To address concerns that composition alone drives the results, I implement several robustness checks, described below. I now turn to the analytical overview, where I lay out the measurement strategies I use to quantify horizontal stratification across fields of study, institutions, and their intersections and to identify the forces undergirding changes within each stratifying domain.

*** Table 1 About Here ***

Analytical Overview

This paper treats field of study, institution, and their intersection as analytically distinct yet interdependent dimensions of horizontal stratification. Each represents a categorical form of differentiation within a single level of education but operates through different underlying mechanisms. Together, they constitute the primary ways in which educational differentiation structures labor market outcomes among bachelor's degree recipients.

Fields of study shape earnings primarily through differential flows to labor-market destinations that vary in work content. Their effects arise from how programs channel graduates into specific industries and occupations, which are themselves characterized by distinct wage-setting regimes, internal labor markets, and opportunities for advancement (DiPrete et al. 2017; Bol et al. 2019; Kalleberg and Lincoln 1988; Tomaskovic-Devey et al. 2020). As between-industry and between-firm dispersion in wages has grown (Song et al. 2019; Wilmers and Aeppli 2021; Haltiwanger et al. 2024), the labor market destinations associated with a field have become an increasingly consequential determinant of its average returns. Therefore, the analyses that follow seek to disentangle the extent to which horizontal stratification by fields of study is due to changes in fields of study, changes in labor markets, and changes in how they are linked to one another.

Institutions, in contrast, influence labor market outcomes largely through prestige signaling, resource endowments, and social capital formation. Institutional prestige conveys general status and exclusivity that may operate independently of any particular field of study, and institutional environments vary in peer composition, advising quality, and access to employer networks, all of which shape post-graduation opportunities (Rivera 2012; MacLeod et al. 2017; Michelman et al. 2022; Ciocca Eller 2023; Armstrong and Hamilton 2013). While selectivity and observable characteristics such as tuition or test scores proxy parts of these mechanisms, a substantial portion of institutional value remains embedded in organizational practices and campus cultures that produce portable but often intangible advantages. A key task of this analysis is to measure how much of variation in institutional outcomes is due to observable differences in institutions as opposed to unobservable differences in institutions.

The intersections of field and institution, institution- and field of study-specific educational credentials, combine these mechanisms in distinctive ways. Certain departments at particular universities possess well-developed linkages to specific employers or industries, creating pipelines that cannot be explained by either institutional prestige or field-level skill specificity alone. Such credential-level linkages can consolidate new forms of inequality by directing graduates toward high- or low-wage sectors in systematically different ways. For this reason, I take the institution-by-field of study combination as an operative unit alongside its margins. In addition to measuring how such combinations systematically dictate earnings in college graduates, I also seek to understand how fields of study are differentially distributed across institutions in patterned ways to see if certain colleges and universities have been better able to adapt their course offerings in a changing labor market.

The empirical design I employ below follows from these mechanisms. In the first part of the analysis, I reconstruct individual-level earnings from aggregated PSEO credential statistics to recover within-credential dispersion and decompose total earnings inequality across cohorts into components attributable to institutions, fields of study, and their intersections. This approach also distinguishes changes arising from shifts in credential-specific earnings premiums from those due changes in overall enrollment patterns. In the second part, I disentangle each major axis of horizontal stratification independently. For fields of study, I analyze changes in average earnings through field-to-industry flows and the earnings structures of destination industries, decomposing whether trends are driven by reallocation across industries or by changes in industry pay. I also benchmark these changes against what would be expected from demographic recomposition within fields. For institutions, I assess the extent to which observable characteristics such as selectivity, size, tuition, and enrollment explain variation in outcomes net of field composition and how these associations evolve over time. For credentials, I examine whether field–institution pairings have become more stratified—specifically, whether high-earning fields have become increasingly concentrated in high-earning institutions—thereby indicating consolidation of advantage at the intersection of prestige and field-specific specialization.

Data

Across both parts of the analysis, this study draws primarily on the U.S. Census Bureau's experimental Post-Secondary Employment Outcomes (PSEO) dataset, which links college graduation records to employer-reported earnings via the Longitudinal Employer–Household Dynamics (LEHD) system. To my knowledge, this study represents the first use of these data in sociology research. The LEHD provides near-complete coverage of annual earnings reported for unemployment insurance purposes in participating states, and the PSEO links these earnings to graduates by institution, field of study (four-digit CIP code), and graduation year. The result is a dataset that captures labor market outcomes at the credential level for up to ten years after graduation. This structure enables direct measurement of horizontal stratification along the dimensions outlined in the introduction.

The PSEO contains two core components. The "earnings" dataset reports average earnings for each credential one, five, and ten years after graduation, alongside the 25th and 75th percentiles of the earnings distribution. The "flows" dataset tracks the number of graduates from each credential entering different industries, aggregated at the two-digit NAICS level, at the same intervals. The data also include counts at the credential level of workers not employed in the workforce, based on the observed gap between the number of graduates and the number of workers found in the LEHD. Although the data are aggregated, they allow partial reconstruction of earnings distributions and analysis of how field–industry linkages evolve over time, which I discuss below. I focus on five-year post-graduation outcomes, which reflect earnings after one has established their career and avoid the limited cohort coverage in the ten-year data. Five-year post-graduation data includes earnings even for individuals who have continued their education, so long as they are in the workforce at the time of follow-up. Otherwise put, the effects shown here represent the *reduced form effect* of a bachelor's degree or the total effect of a bachelor's degree, even if it is mediated by continued education within five years of graduation. While a number of students may not have finished their schooling five years after they graduate with a bachelor's degree, most have if they are going to. For comparison's sake, one- and ten-year outcomes are used in supplementary analyses that double as robustness checks to the extent that these results are mediated by continued graduate education. Because of this decision, results in the main analyses are only available for cohorts up to 2013–2015, as they must be observed five years after graduation, and the raw underlying data extend through 2019. More recent results are available in the appendix for a one year time horizon.

Because the PSEO is based on voluntary state and institution agreements, its coverage is incomplete but diverse, spanning public and private universities, community colleges, online colleges, and flagship state institutions. While not nationally representative on their own, the breadth of institutions allows for rich analyses of variation in credential outcomes. The fact that many states' participating institutions represent over 80% of these states' total graduates allows the sample to credibly reflect a representative sample nationwide of college graduates after reweighting.[7] I adjust for imbalances in institutional representation in the original data using an entropy balancing reweighting method discussed in the supplementary appendix, and I revisit these limitations later in the paper. Appendix Figure A1 maps institutional coverage.

One important limitation is that the PSEO does not report earnings by industry at the credential level. While I observe the average earnings for each credential and the distribution of its graduates across industries, I cannot observe earnings within industries conditional on credential. To approximate this, I supplement with industry-

[7] https://lehd.ces.census.gov/data/pseo_experimental.html

level earnings data from the American Community Survey (ACS), which reports average annual earnings by industry for bachelor's degree holders. These estimates are used only in analyses where industry flows and sectoral average wages are central, which are just a subset of all analyses. The PSEO data also do not disaggregate credential-level earnings by demographic characteristics: race, ethnicity, and gender. I undertake a sensitivity analysis using NCES data, which contain cohort-by-cohort credential-level statistics of degrees conferred by race/ethnicity and gender.

Finally, I incorporate data from the Department of Education's College Scorecard to characterize institutional attributes such as mean SAT scores, tuition, undergraduate enrollment, and selectivity. These variables are used to evaluate whether observable institutional traits help explain differences in graduate earnings net of field composition. They are also used in the reweighting of the data to ensure representativeness. The Scorecard covers nearly all institutions in the PSEO, though some variables are missing for a subset of schools. As with the ACS data described in the previous paragraph, these data are used in supplementary analyses that examine institutional-level variation and are not central to the paper's headline findings.

Part I - Decomposing Variation in Earnings Inequality Amongst College Graduates

Methods

Generating Income Distributions From Observed and Scenario-Based Credential-Level Earnings Summary Statistics

I begin by simulating individual-level income data from specific educational credential-specific and cohort-specific earnings distributions. This allows me to contextualize categorical distinctions within the broader earnings distribution and compare inequality between credentials to inequality among individuals within the same credential. To do so, I simulate individual-level income data from the aggregate statistics provided in the PSEO dataset.[8] This allows the importance of between-field, -institution, and -credential variation to be compared relative to variation within these groupings.

In the earnings dataset, for each specific credential (field of study-by-school combination) and graduation cohort combination, four statistical moments are known: the number of graduates, and the 25th, 50th, and 75th earnings percentiles (π). Graduation cohorts are grouped into three-year spans for bachelor's degrees (e.g. 2001–2003, 2004–2006, 2007–2009, etc.). This aggregation is necessary to protect individual privacy as many credentials only graduate a few individuals each year, and sample sizes for each cohort-credential observation must be large enough to protect graduates' privacy. Conversely, this allows the inclusion of even small fields of study.[9] Using these points of information, one can recover a simulation of the original microdata that produced them. To do so, I assume that within each cell (specific educational credential–graduation cohort combination), incomes are distributed log-normally. For each cell, the density function of the distribution is calculated as is shown below in equation 1, which calculates a singular standard deviation (equation 3) from the 25th and 75th percentiles. As incomes are assumed to be log normal, the logged median and logged mean are assumed to be the same (equation 2).

$$f(x) \sim \mathcal{N}(\mu, \sigma^2) \sim \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{(x-\ln(\mu))^2}{2\sigma^2}} \tag{1}$$

$$\mu = \pi_{50}(X) \tag{2}$$

$$\sigma = \frac{\ln(\pi_{75}(X)) - \ln(\pi_{25}(X))}{2 \times 0.674} \tag{3}$$

[8] While a parametric variance decomposition is possible when distributions are presumed to be log-normal, it provides similar results to the approach taken here and is less flexible than a simulation-based approach. The simulation-based approach allows for flexibility in specifying the robustness tests, in particular varying distributional forms and adding in non-earners, as specified later in the methods section.

[9] Noise is also added to the data to keep them differentially private, though it is not expected that this process will substantively affect my results.

Using the above functional forms, I simulate individual earnings from the reconstructed distribution for each credential, generating a dataset that approximates the original underlying microdata. This simulated dataset serves as the basis for most subsequent analyses. The method carries limitations: most notably, it assumes log-normality and no skew within each distribution. While deviations from log-normality could affect the tail behavior, this assumption is well supported in the literature (Gibrat 1931; Battistin, Blundell, and Lewbel 2009). To ensure the robustness of this assumption, I implement an alternative specification using a piecewise log-normal/Pareto distribution, assigning a Pareto tail to the top 2% of the distribution, capturing greater income inequality among high earners in line with previous work. These approaches assume that individuals within each credential are interchangeable. Given that my analysis relies exclusively on aggregated data and not individual characteristics, this assumption is analytically appropriate.

In addition to simulating observed distributions, I generate counterfactual, scenario-based datasets that allow me to isolate the drivers of inequality over time. In creating simulated datasets of individuals for each credential, I hold constant at the earliest observation either the number of individuals in each credential or the credential-specific distribution of income across cohorts in what amounts to effectively a "Das Gupta" decomposition (1993). Using these simulated scenario-based datasets in the following sections allows me to determine whether it is shifting allocation of individuals across institutions, fields of study, and specific credentials that may be driving changes in stratification or if it is simply different average earnings attached to each that are driving the effects.

Variance Decomposition

With these simulated individual-level earnings data in hand, I next decompose the total variance in earnings to estimate how much is attributable to different forms of horizontal stratification: field of study, institution, and specific credentials. This variance decomposition approach allows me to assess the relative importance of each component and track how their contributions to inequality evolve across cohorts. I perform a variance decomposition of logged annual earnings at the individual level $ln(\omega_{i,u,f}|Y)$ wherein I, separately for each graduation cohort (y) and year of followup (X), iteratively add fixed effects for field of study (F_f), institution/university (U_u), and institution-field of study interactions $\Big(\gamma(U_u \times F_f)\Big)$. The differential increase in R^2 is the percent of the total variance explained by each additional term with respect to all previous terms. In comparing these estimates over time and across cohorts, one can recover the extent to which each axis of horizontal stratification matters among degree holders in determining annual earnings. The model specification is as follows, and fixed effects components are added step-wise from left to right in equation 4[10]:

$$ln(\omega_{i,u,f}|Y = y + X) = F_{f,y} + U_{u,y} + \gamma(U_{u,y} \times F_{f,y}) + \epsilon_{i,y} \tag{4}$$

While the order of the components will affect the results, particularly given that fields of study are unevenly distributed across universities and change over time, I address this concern through a sensitivity analysis in the supplementary appendix by reversing the order in which fixed effects are entered. Alternative approaches to this issue do exist, though they are generally designed either for settings with more than two primary fixed effects or for contexts where the primary object of interest is a single "main" regression coefficient (see, for example, Xie and Zhou 2014; Gelbach 2016). In contrast, my approach provides a transparent set of bounds: one in which field of study premiums precede institutional premiums in importance, and one in which the reverse is true. I present the former in the main text, while also discussing the latter in the results

[10]The full model with field of study, institution, and their intersection fixed effects is not technically identifiable because the interaction term is nested within its main effects. This does not pose a problem for the present analysis because the variance of each component and its contribution to total explained variance are identified. The decomposition relies on the incremental change in R^2 as each set of fixed effects is added rather than on the absolute value of the coefficients themselves.

section and presenting its results in the supplementary appendix. However, the ordering I have chosen for the main results is not arbitrary; it reflects the reasonable view that institutional wage premiums are layered on top of, rather than independent from, field of study premiums, such that an institutional premium is meaningfully interpreted in relation to a given field of study premium. Otherwise put, a credential is associated with three additive premiums: one based on field of study and the skills and capital conferred with it, one based on institutional prestige and the various forms of capital that come with it (net of field of study), and one based on specific departmental- or credential-level traits (net of the prior two premiums).

*** Figure 2 About Here ***

Results

Data Coverage, Representativeness, and Descriptive Statistics

Figure A1 shows the geographic distribution of degree-granting institutions in the PSEO data. Inclusion is not based on a probabilistic sample but on voluntary partnerships between states, institutions, and the federal government. Figure 2 further illustrates this selectivity by plotting all U.S. universities by 2016 undergraduate enrollment, with in-state tuition, average SAT scores, and admission rates where available. Included and omitted schools are distinguished by color. While many private universities are missing, this is not a major concern: within public and private sectors, included schools largely mirror the full population in their institutional characteristics, though coverage varies. In this sense, the data are structurally representative, though compositional reweighting is necessary. One exception is the underrepresentation of Ivy League and similarly selective private colleges, which appear as outliers in the lower portions of the facets on selectivity and size. Given their small enrollments relative to large public institutions, their exclusion likely has limited effect on overall trends, though it constrains generalizability at the very top of the institutional earnings hierarchy, as discussed in the discussion.

*** Table 2 About Here ***

To make the data more closely reflect the actual target population of all U.S. institutions granting bachelor's degrees, I reweight the included PSEO institutions using an entropy balancing technique so that, on observables, the weighted PSEO sample more closely matches the full universe of colleges and universities. Specifically, drawing covariates from the College Scorecard (public/private, enrollment, tuition, selectivity, and average SAT scores), I calculate weights to match first moments of these covariates in the target population while minimizing divergence from uniform weights. I apply the resulting weights in all analyses in this paper where appropriate. Covariate balance before/after weighting is shown in Table 2. Balance is largely achieved, but there is a slight mismatch in in-state tuition due to missingness of the most prestigious private colleges. Though highly selective publics like the University of Michigan are present in the data, these have lower tuition rates, making achieving perfect balance infeasible. For full details of these methods, see the supplementary appendix. To qualify and foreshadow further results below, many results are not changed dramatically by this reweighting exercise, and so imperfect balance is not much cause for alarm. This likely reflects three stylized facts: 1) Most students attend public schools (which are well represented in the PSEO data); 2) Even when they attend private schools, they are non-elite private schools (which are well represented in the PSEO data); and most importantly 3) Much meaningful variation between schools transcends typical metrics of school prestige and selectivity and comes down to more nuanced variation based on instruction type, resources, school environment, and advising structures, which makes rebalancing the data on these characteristics not have much impact. I provide direct evidence of the last point in Part II of the analysis.

*** Table 3 About Here ***

Table 3 shows the number of included units in the data, stratified by cohort. Because the PSEO aggregates credential-cohort combinations into into multi-year credential-cohort combinations, the data are reported in three-year spans for bachelor's degrees (2001–2003, 2004–2006, etc.). In 2014, roughly 1.8 million individuals earned a bachelor's degree in the United States. By comparison, my cumulative sample size of earnings five years post-graduation for the 2013–2015 graduating cohorts is 1,309,057, which represents slightly less than one-quarter of all U.S. bachelor's recipients. This shortfall reflects both the non-coverage of certain institutions (as discussed above) and the fact that not all graduates are observed with earnings in the LEHD system. The PSEO does not track unemployment directly, but it does report the gap between the number of degrees conferred and the number of graduates with matched earnings records. This discrepancy reflects all individuals not linked to the LEHD as employees—a group that may include the unemployed, those out of the labor force (e.g., those engaged in full-time caregiving, pursuing further schooling, or working in informal workor work abroad), and those working in uncovered sectors. Because these individuals have no observed earnings, the analyses in the main text implicitly condition on labor-force attachment. As a result, my main estimates potentially mismeasure total inequality across all graduates if unemployment is considered. I account for this by simulating non-attached workers, as reported by the PSEO data for each specific credential-cohort combination, as having zero annual earnings in a sensitivity analysis, even though it is likely that many non-workers are not employed by choice. These results are presented in supplementary appendix Figure A4 and are discussed where appropriate below.

In Table 3, it is clear that the number of individuals, fields of study, schools, and their intersections are increasing over the time period shown in the data, however colleges also begin being represented in the data at different points in time. To accommodate this, most of my analyses use a restricted set of institutions that appear in the data every year, amounting to 270 degree-granting institutions in total. In the restricted set, the number of college graduates increases by over 50% in the observed time period, which is commensurate with the growth of college attendance and population growth in this time period. As the number of fields of study at the four-digit level is increasing over time, I also conduct sensitivity analyses using two-digit CIP codes, the number of which does not increase similarly over the period in question, and I use a middle ground between two- and four-digit CIP codes, which is detailed in the supplementary appendix. Furthermore, the Das Gupta-inspired analysis holds constant enrollments, allowing me to ensure that the creation and elimination of fields of study within and across institutionsare not driving the results.

*** Table 4 About Here ***

*** Figure 3 About Here ***

Finally, to orient the reader to the structure of the original data before proceeding to my analytical results, Table 4 shows the top and bottom ten credentials in terms of earnings five years post-graduation for the bachelor's degrees graduating cohorts 2001–2003 and 2013–2015, the earliest and most recent cohorts of the sample. Even from this simple summary table alone, several notable phenomena stand out. For both sets of cohorts, the level of structured horizontal stratification is staggering. The lowest-earning credentials earn less than one-fifth of what the highest earning credentials earn. While the interquartile range of pay within each credential is large, it appears dwarfed by this between-credential variability in earnings. For earlier cohorts, engineering and pharmacy majors monopolized the highest earning credentials, while in later time periods it is dominated by a mixture of computer science, health professions, engineering and pharmacy. Also, the highest earning credentials appear to be much larger than the highest earning credentials in the earlier time period, with larger cohort sizes. Finally, the righthand-most column shows the percent of workers in the largest industry as a function of each credential. This is a simplified way of rendering the industry share distribution for each credential since there are 20 possible industries, but it shows that the highest earning credentials appear to have stronger credential-to-work linkages than the lowest-earning credentials. Figure 3 shows this variation in an alternative manner across the entire distribution of credentials, displaying each credential as a point on the graphs, stratified by the parent-level two-digit field of study.

*** Figure 4 About Here ***

Earnings Variance Decomposition Analysis

Results for the variance decomposition are shown in the left-most panel of Figure 4. Over the period studied, the share of variance in log earnings explained by degree characteristics increased from about 25 to 30 percent five years after graduation. In other words, earnings among bachelor's recipients have become more structured by observable features of their degrees and less by within-credential individual differences.

Several striking findings emerge. First, most of the variation in earnings is explained by what people study—not where they study. The magnitude is notable: for the 2013–2015 cohorts, 21% of variation is attributable to field of study, compared to just 5% for institution, and 4% for specific credentials. Second, the rising importance of degree characteristics is primarily driven by the growing influence of field of study. There is also slight evidence of increasing institutional importance, though to a much smaller extent. Third, the contribution of specific credentials has remained largely stable over time. That is, changing characteristics of individual departments, net of school and field effects, are not driving the results. These findings are robust to multiple sensitivity tests. Appendix Figure A4 shows consistent results across alternative specifications: using two-digit CIP codes, including non-earners as zeroes, applying a piecewise log-normal/Pareto distribution, estimating models without log transformation, estimating unweighted models, and using different weights to upweight only private institutions to match the national bachelor's degree-holding population. Across all approaches, field of study remains the dominant and increasingly important predictor of earnings. I draw the reader's attention specifically to the robustness check that reorders the fixed effects to allow institutions to come before fields of study. Even here, where the institutional effect is measured first, allowing it to include the effect caused by institution-level differences in fields of study offered, the explanatory power of field of study prevails. Indeed, it is impossible to fully disentangle the two, but the main effect and this robustness check provide the lower and upper bounds of the importance of field of study and institution, with both scenarios highlighting the explanatory power of field of study.

*** Table 5 About Here ***

A natural follow-up to the previous results is whether observed changes are driven by changing enrollments across credentials or by shifts in credential-specific average annual earnings. To address this, I decompose the results from the left-most panel of Figure 4 using two counterfactual scenarios: one holding credential-specific earnings constant at their earliest observation, and another holding constant the size of graduating cohorts by credential. This Das Gupta-style decomposition shows that most of the change is due to shifting average earnings across credentials, not changing enrollments. In fact, such allocative forces appear to slightly offset the earnings-based trend across the first four cohorts observed. That is, students have not disproportionately moved into high- or low-earning credentials in ways that would explain the increasing inequality, nor has the creation or disappearance of specific credentials driven the results. Instead, the credentials themselves have changed in what they yield in the labor market. The causes of these shifts are unclear but are taken up in later sections. Table 5 shows that the flight from high-earning fields of study like business and computer science (discussed further below) is likely partially to blame for this. Appendix Figure A2 replicates the decomposition at both one and ten years post-graduation, with consistent findings at both intervals. The trend of growing explanatory power, as driven by fields of study, also holds for one–year outcomes. While only three cohorts allow ten–year follow-up, these results show no deviations that would call earlier findings into question, and the consistent findings between the three different periods of follow-up indicate that the primary findings are likely not entirely mediated by graduate schooling.

While these results do not necessarily reflect the causal "premium" offered by specific fields of study, institutions, and credentials, or the "value added" of choosing one credential over another, prior studies of the causal effects of institutions and fields of study can benchmark the findings reported here. As mentioned in the introduction, Bleemer and Quincy (2025) synthesized the evidence on this subject and found that earnings differences in fields of study reflect 100% of the value added of attending different majors. For institutions, earnings differences may be attenuated by 20% when accounting for selection effects. Otherwise put, accounting for differential selection into fields of studies and institutions only would attenuate the findings reported here for institutions, and the importance of fields of study would remain, strengthening my main finding of the increased importance of field of study. There are no causal studies at the credential level on earnings differences, but they are likely somewhere between fields of study and institutions in representing the "value added" effect of credentials.

Finally, one might worry that the results are mechanistic as there are many more fields of study than one might expect. Even when repeating the analysis at the 2 digit CIP code level, which juxtaposes 36 fields of study against 270 institutions, fields of study retain their explanatory power (supplementary appendix Figure A4), though its power is slightly attenuated.

*** Figure 5 About Here ***

Part II - Understanding the Drivers of Each Axis of Horizontal Stratification

The methods and results described up to this point have enabled me to paint an overview of the relative importance of each kind of horizontal stratification in driving earnings inequality among college graduates over time. However, the fundamental forces driving these changes require further study. The following methods will tackle each source of horizontal stratification—field of study, degree-granting institution, and specific credentials—one at a time to understand the underlying forces dictating the importance of each.

Methods

Analyzing Changing Average Annual Earnings by Field of Study Over Time

To understand how and why and how field of study-based inequality in earnings is changing, I examine the shifting relationship between fields of study and industries. As argued in the introduction, field-to-industry flows are central to understanding horizontal stratification in the modern labor market. This section uses decomposition techniques to assess whether changes in average earnings by field of study are driven by where graduates end up (industry placement), how well those industries pay, or both. For legibility, and because flow data are only available for aggregated fields of study, this is done at the two-digit CIP code level.

While the earlier decomposition shows how much fields, institutions, and their intersections contribute to overall inequality, identifying what drives those changes requires an additional step. As discussed in the introduction, industry dynamics are central to understanding horizontal stratification over time. To examine this, I analyze flows from fields of study into industries, alongside changes in industry-level earnings for college graduates. Because the PSEO data do not report earnings by industry, I use ACS data on industry-level earnings among college-educated 27–29-year-olds, in combination with average earnings by field and field-to-industry flows. Assuming additivity in logged components, this enables estimation of average earnings by field net of industry, and by industry net of field. Further methodological detail fo deriving these estimates is provided in the supplementary appendix.

These estimates may then be used to estimate expected field of study average wages based on changing industry flows. Moving beyond such simple comparisons and to formally disentangle the contributions of changing industry composition and changing industry-specific average earnings to field of study-level earnings trends, I decompose changes in $ln(\omega_{f,y})$, logged average earnings for each graduating cohort in a given field of study, using an extended version of a Kitagawa-Oaxaca-Blinder Decomposition (Oaxaca and Sierminska 2023; Kitagawa 1955). The following equation (equation 5) describes a basic Kitagawa-Oaxaca-Blinder Decomposition using two time points, y_1 and y_2, which are equivalent to the earliest and most recent cohorts in my sample. Average shares and average annual earnings (equations 6 and 7, respectively) are based on the simple means of the two time points. There is also an residual component reflecting the difference in the observed change in field of study-specific average annual earnings and what is predicted by industry shifts and changing industry premiums alone (equation 8).

$$\Delta \ln(\omega'_f) = \sum_{ind} \overbrace{S^*_{ind,f}\left(\ln(\omega_{ind,f,y_2}) - \ln(\omega_{ind,f,y_1}) \right)}^{\substack{\Delta \text{ due to changing} \\ \text{industry annual earnings}}} + \overbrace{\ln(\omega^*_{ind,f})\left(S_{ind,f,y_2} - S_{ind,f,y_1} \right)}^{\substack{\Delta \text{ due to changing} \\ \text{industry shares}}} \tag{5}$$

$$S^*_{ind,f} = \frac{S_{ind,f,y_1} + S_{ind,f,y_2}}{2} \tag{6}$$

$$\ln(\omega^*_{ind,f}) = \frac{\ln(\omega_{ind,f,y_1}) + \ln(\omega_{ind,f,y_2})}{2} \tag{7}$$

$$\Delta \ln(\omega_f) = \Delta \ln(\omega'_f) + \varepsilon_f \tag{8}$$

Holding shares at their average amount between the two time points $S^*_{ind,f}$ and annual earnings at the average level between the two time points $\ln(\omega^*_{ind,f})$, one can decompose the extent to which overall changes in average annual earnings by field of study are due to each component. However, since industry changes are affecting the entire labor market to some extent, I further decompose the change due to industry shares to a "global" and a "local" effect, where the former is the shift due to industry growth in the overall labor market of college graduates, and the latter is any industry shifts net of that.

Expanding the second term in equation 5, I arrive at the following expression:

$$\ln(\omega^*_{ind,f})\left(\overbrace{(S_{ind,y_2} - S_{ind,y_1})}^{\text{Global effect}} + \overbrace{[(S_{ind,f,y_2} - S_{ind,f,y_1}) - (S_{ind,y_2} - S_{ind,y_1})]}^{\text{Local effect}}\right) \tag{9}$$

In sum, the above "extended" Kitagawa-Oaxaca-Blinder Decomposition allows me to decompose the extent to which changes in observed field of study average annual earnings are due to three components: global growth and decreases in industry representation of working college graduates, local field of study-specific growth and decreases in industry flows, and changes to average industry-specific average annual earnings among college graduates. Any residual differences (ε_f) between observed and predicted changes in annual earnings over the time period in question are presumed to be due to interactive effects between fields of study and industry, within-field heterogeneity in four-digit CIP codes since CIP codes are measured at the two-digit level, or due to individual variation. None of these sources of variation can be modeled directly using the data, but the magnitude of the residual changes in total are shown for comparison.

Just because industry flows may predict field of study-level earnings, does not mean it is the primary cause. While this research is in not causal, it is important to acknowledge that changing field of study average earnings may simply reflect demographic compositional change within fields of study. Even if this were the case, it would not invalidate these methods and any findings that come about because of them, but it would be a prudent way to qualify my results. In order to test this possibility, I devise a simple test to predict cohort-to-cohort changes in average wages based on within-field of study demographic composition as opposed to industry flows. I employ within-field of study and within-credential fixed effects models wherein the predictors are alternatively demographic composition (which is available at the field of study and credential level in the NCES data) or industry flows and use the within-unit predictive power to understand how well each phenomenon describes changing earnings. I present these robustness checks as additional methods and results in the supplementary appendix, and I discuss these results in the main paper's results section below. I also directly compare predicted earnings changes based on each method to realized changes in earnings in the supplementary appendix.

The primary decomposition methods presented in this section highlight how much of field-based earnings change is driven by industrial flows and average wages. However, the same logic may not apply to institutions. Whereas field of study stratification is often closely linked to occupational closure and industry placement, institutional stratification may reflect different mechanisms, such as prestige signaling, resource disparities, and social capital, that are less directly tied to specific sectors. As a result, changes in institutional earnings may follow a different pattern than those observed for fields. In the following section, I examine whether and how institutions have changed position within the earnings hierarchy over time.

Analyzing Changing Average Annual Earnings by Degree-Granting Institution Over Time

Because institutional stratification operates through mechanisms largely distinct from those of field of study, such as prestige, teaching quality, resources, and student composition, it requires a different analytical approach. Net of the distribution of fields of study within a degree-granting institution, there are several variables along which institutions may be stratified: commuter vs. non-commuter schools, flagship vs. other state universities, private vs. public universities, average SAT score, tuition fees, and more. To understand changes in institution-specific average earnings over time, I assess whether observable characteristics, such as selectivity or size, predict institutional differences in earnings, net of field of study, and I assess these changing relationships over time.

With College Scorecard data, I use average SAT scores at the institution level, logged undergraduate tuition, the logged number of graduate students, the logged number of undergraduate students, and the undergraduate admission rate as indicators of college quality and prestige. As all variables are continuous in nature, they likely explain more variation in the data than do binary or categorical indicators representing institutional characteristics. To assess the degree to which they are associated with earnings after graduation, I regress them on adjusted average annual earnings for each university in a given year, $\Omega_{u,y}$, which are normalized for the distribution of fields of study within that institution. Otherwise put, $\Omega_{u,y}$ represents the average earnings of all graduates from a given university, adjusting for field of study level differences in earnings. It is calculated as follows:[11]

$$\Omega_{u,y} = \sum_{i} \frac{N_{f,u,y}}{N_{u,y}} \left(\omega_{i,f,u,y} - \overline{\omega}_{f,y}\right) \tag{10}$$

Estimates of $\Omega_{u,y}$ are then regressed separately against each institutional characteristic, stratified by different graduation cohorts. The R^2, or the percentage of overall variance explained by the predictor variables, is then used to determine the extent to which inequality on the basis of measurable institution-level characteristics, net of fields of study, is changing over time. This approach provides insight into whether institutional stratification is increasingly shaped by quantifiable dimensions of prestige or status. I now turn to the credential level—the intersection of field and institution—to examine how their joint distribution is evolving.

[11]This is actually the same result as the university-level fixed effects from a two-way fixed effects regression such as that described in equation **??**. It is simply rewritten here in this manner for clarity.

Analyzing Changing Average Annual Earnings by Credential Over Time

The final component of horizontal stratification I examine is the credential itself. While earlier sections analyzed how each axis contributes independently to inequality, this section addresses a distinct but related question: are high-earning fields of study increasingly concentrated in high-earning institutions? This form of consolidation would suggest a deepening structural alignment between educational sorting and labor market inequality, and would echo recently described phenomena in the labor market wherein high-earnings occupations are more concentrated in high-earnings firms (Wilmers and Aeppli 2021) and high-earnings workers are more concentrated in high-earnings firms (Song et al. 2019).

While the decomposition analysis in the first part of the analysis tests whether individuals are shifting across fields of study and institutions by recovering the level of overall variation due to the interaction effect of these two axes of horizontal stratification, that is a slightly different question from what this proposed analysis addresses. This analysis analyzes whether fields of study themselves are differentially distributed across schools over time. Moving from having the analytical unit be at the level of the individual to having it be at the level of the specific educational credential tests a distinct concept of institutional consolidation as opposed to more basic allocative and distributional forces.

To test the consolidation of high-earnings fields of study in high-earnings institutions and the co-location of low-earnings fields in low-earnings institutions, and how this is changing over time, I again return to the basic earnings equation in which credential-specific average annual earnings are operationalized as the additive effects of field of study-specific effects, institution-specific effects, and an interaction effect (equation 4). Using the fixed effects estimated for each field of study $F_{f,y}$ and institution $U_{u,y}$, I measure the changing correlation and covariance of each over time, weighted by cell size. By assessing the changing covariance of institutional and field-specific earnings effects, this analysis reveals whether horizontal stratification at the credential level is becoming more concentrated, creating a novel variety of inequality at a structural level, which is net of the other forms of inequality described in this paper.

Results

Understanding Changing Average Annual Earnings by Field of Study

The previous analysis showed two major findings. First, field of study is the primary axis of horizontal stratification with regards to annual earnings after five years of graduation, and its impact appears to be growing for successive graduation cohorts. Second, this finding is also driven by changes in credential average annual earnings and not distributional changes across fields of study. So the question remains: what is causing changing average annual earnings by field of study to lead to greater between-field inequality?

Figure 5 shows the observed changes in the average annual earnings, adjusted for inflation, of bachelor's degree-holders five years after graduation, by field of study. There are clearly large discrepancies in which fields of study have secured earnings gains, with "Computer & Information Sciences" and "Mathematics and Statistics" capturing over $20,000 and $10,000 in earnings increases, respectively. Likewise, fields of study like "Liberal Arts," "Homeland Security & Law," and "Education" have seen more modest decreases in average annual earnings. In this figure, I also show predicted changes in field of study average annual earnings based on changing field of study-to-industry flows alone, as measured in the data. As the figure shows, these predictions largely line up with observed changes in average annual earnings, indicating changing industry flows and changing industry-level average annual earnings play a potentially large role in explaining observed changes in average annual earnings by field of study. Importantly, the two fields of study "Computer & Information Sciences" and "Mathematics and Statistics" with the largest observed growth in average annual earnings are well-explained by industry. Likewise, "Liberal Arts," "English," and "Protective Services," with the largest decreases in average earnings are also well-explained by industry. Some larger fields of study such as "Health Professions," "Education," and "Psychology" do not fit as perfectly, though it is worth noting that the direction of the change in earnings is correct for all but one field of study, "Architecture."

*** Figure 6 About Here ***

These changes reflect a mixture of changing industry composition within the entire labor market sector composed of students with bachelor's degrees, shifting industry flows within fields of study, and changing average annual earnings by industry for college graduates. An extended Kitagawa-Oaxaca-Blinder decomposition, shown in Figure 6, parses these differences in the predicted earnings changes. The re-composition of flows from fields of study to industry due to global shifts in industry representation among college-educated workers has little bearing on overall changes in field of study average annual earnings, as gains in certain industries are often offset by losses in others. Nevertheless, some findings are striking. Globally, there is clearly a shift away from "Educational Services" and "Public Services" towards "Professional, Scientific, and Technical Services," "Information," "Health Care and Social Assistance," and "Management of Companies and Enterprises." There is also consolidation of lucrative industries net of overall shifts in industry flows for specific fields of study. "Professional, Scientific, and Technical Services," "Information," and "Finance and Insurance" industries are increasingly industry destinations for bachelor's degree-holders with degrees like "Computer Science/IT Support," "Mathematics and Statistics," and "Business." These same industries are less represented as destinations for degree holders coming from "Engineering," "Engineering Technologies," and "Liberal Arts" fields of study, among others. Otherwise, put, not only are there global changes in flows from school to industry for all Bachelor's degree-holders that reflect a shift to a service economy rooted in white-collar industry, high-tech, and management services, but there is also a consolidation of these lucrative industries among a select subset of fields of study. This does not follow the typical RBTC and STEM/non-STEM split, as fields of study like "Engineering," "Health Professions," and "Biology" have been largely left in the lurch.

Moving away from changes in field of study-to-industry flows, it is clear that baseline flows to industries has contributed most meaningfully to changing average annual earnings by field of study. Fields of study with preexisting greater flows to industries that saw large increases in earnings obviously benefited more. Thus, once again "Computer Science/IT Support," "Mathematics and Statistics," and "Business" saw increased average annual earnings due to simple baseline connections to these industries, notwithstanding the global and local shifts towards these industries that they also saw.

Of course, changes in average annual earnings by field of study are not fully explained by shifts in industry placement or industry-level average wages; the decomposition leaves a relatively small amount of earnings change unaccounted for by these factors alone. These may be due heterogeneity within two-digit CIP codes within smaller, more specific fields of study. For instance, the two-digit CIP code encompassing "Health Professions" contains a wide variety of programs, with widely differing post-college outcomes and levels of perceived prestige. Likewise, there are certainly some synergistic earnings effects between fields of study and industry that cannot be captured here, due to the lack of industry-by-field of study specific wages. Nevertheless, the residuals, for the most part, are much smaller than the overall changes, indicating that an industry-level explanation is a decent analytical lens for describing such changes over time.

In sum, several industries saw large increases in average annual earnings for college graduates over the period in question. Fields of study, due to baseline school-to-work linkages to these industries also saw large gains in average annual earnings by field of study. This complements global shifts among bachelor's degree-holders into more lucrative industries and field of study-specific shifts into these lucrative industries. Of course, as this is an observational analysis, it is difficult to say that this effect is causal.

Indeed, there may be large shifts in sorting into universities and field of study, complemented by a preference for these higher-quality workers by certain industries, resulting in increased compensation owing to levels of skills. However, such speculation and analyses are far beyond the scope of this paper. Nevertheless, I undertake an additional set of analyses (described and reported in the Appendix) to test whether the observed changes in field of study-level average earnings are better explained by shifting demographic composition within majors or by evolving industry flows. These models show that demographic change accounts for only a modest share of the observed trends (28%), whereas industry-based measures consistently explain the bulk (86%) of the variation (supplementary appendix Table A1). I also report predicted field of study-specific average earnings based on the two sets of predictors as a modified version of Figure 5 in supplementary appendix Figure A5. These findings reinforce the conclusion that the rising salience of field of study reflects the importance of field of study-to-industry linkages and industry wage structures, with demographic compositional shifts in who enters particular fields being secondary.

*** Figure 7 About Here ***

Understanding Changing Average Annual Earnings by Degree-Granting Institution

Though between-university stratification only explains a small amount of overall variation in annual earnings among bachelor's degree-holders, it remains the first line of stratification for many high school students as they choose where to attend university. Figure 7 shows institution-level average annual earnings, after adjusting for the distribution of fields of study within educational institutions, regressed against five different continuous characteristics of degree-granting institutions for graduating cohorts 2001–2003 and 2013–2015. Remarkably, school characteristics associated with student quality and instruction like average SAT scores and the number of graduate and undergraduate students show stronger and steeper relationships with earnings over time. The relationship with indicators that may be more closely linked to concepts of prestige, like tuition fees for in-state students and the admission rate, do not show the same patterns. While all of these characteristics reflect both latent concepts of quality and prestige to some extent, these patterns are suggestive and merit further exploration in future research.

The strongest and most dynamic relationship is that of average SAT Score and institution-level average annual earnings, with the R^2 increasing from 0.12 to 0.35 between the two cohort spans. Likewise, the variance explained by the logged number of graduate students increased from 0.05 to 0.12 and the logged number of undergraduates increased from 0.01 to 0.05. Of course, these relationships are associational only, and there is no causal component to this part of the analysis. However, it could easily be proposed that degree-granting institutions are becoming more stratified along observable characteristics. While between-school disparities in outcomes is not a main driver of overall inequality, it is nevertheless striking that the institutional differences we can observe are becoming more tightly aligned with dimensions that sociologists have long associated with stratification. Further, this relationship is not mechanically caused by the inflation of university characteristics over time and changing leverage of certain data points. Repeating the analysis holding constant university characteristics by taking their mean value across all cohorts and simply allowing university premiums to change shows substantively similar results (Appendix Figure A3).

Finally, this evidence of the changing interrelationship of the characteristics of educational institutions and institutions' average outcomes calls into the standard practice of grouping educational institutions based on observable characteristics. Although the relationship between observable characteristics and institutional earnings has grown stronger over time, these features still explain only a modest share of the variation. Most of the inequality in institutional outcomes remains unexplained by commonly used metrics, suggesting that the deeper sources of institutional stratification lie in less visible organizational processes, historical positioning, and localized industry linkages. This final point should also give researchers pause when using survey data to assess horizontal inequality among institutions, as it is clear that outcomes are highly variable even among nominally similar institutions.

*** Table 6 About Here ***

Understanding Changing Average Annual Earnings by Credential

The final research question moves beyond the analysis of field of study effects and institution effects in isolation to look at their intersection. Specifically, this analysis answers the question of whether high- or low-earning fields of study are increasingly consolidated in high- or low-earning institutions. Table 6 shows that this is not the case. To begin with, both the correlation and covariance of institutional effects and field of study effects are close to zero, indicating there is little baseline consolidation. Furthermore, there is no discernible pattern over time in either of these indicators. Thus, while specific credentials from specific academic departments explain 3–4 percent of overall earnings variation, there is little evidence that the dynamics of how it comes about are being dramatically reorganized.

Discussion

This study provides new evidence on how horizontal stratification among bachelor's degree recipients has evolved over time. Strikingly, variation in pay is becoming more explainable by degree characteristics, meaning that college and field of study choice are becoming more and more consequential. Of the three primary axes examined—field of study, institution, and their intersection—field of study stands out as the most important for earnings inequality. From graduating cohorts from 2001 to 2015, it explains a growing share of post-graduation earnings variation, while institutional and credential effects remain smaller and more stable.

The growing importance of field of study as a source of horizontal stratification is not explained by the reallocation of students across majors or institutions, nor by changes in the number or distribution of credentials and fields of study alone. It also appears not to be primarily a function of changing demographics within fields. This does not invalidate ample research showing that fields of study are gendered and racialized, impacting their value on the labor market, especially in the patterned ways that they lead to gendered or racialized occupations (e.g., England et al. 2007; Alon and DiPrete 2015; Goyette and Mullen 2006). Rather, it indicates that the changing importance of degree characteristics described in this paper are not driven by changes in these forces. Substantively, the results suggest that broader structural shifts in the labor market, particularly the expansion of high-wage service industries like technology, finance, and professional services, may be contributing to the rising returns associated with certain fields of study. Notably, this transformation does not uniformly reward traditionally "technical" majors like engineering or health sciences. Fields such as business, social sciences, and communications/journalism, which are often peripheral in frameworks based on RBTC, have experienced substantial earnings growth, largely due to their alignment with high-paying sectors whose wage structures continue to diverge from the rest of the labor market. These patterns imply that credentials increasingly derive value from where they are positioned in an evolving industrial wage structure, not simply from changes in student composition.

These patterns are visible due to the recency and granularity of the data, which capture labor market outcomes through 2020. This extended temporal scope is critical, as it allows the analysis to include the post-recession period, a time marked by deep restructuring in the labor market, the maturation of the tech sector, and growing divergence in industrial wage structures. Unlike earlier periods shaped by the initial waves of changes due to computers, the post-2008 landscape reflects a new stage of labor market change, in which a narrower set of industries increasingly concentrates economic returns.

In most cases, observed earnings gains reflect rising wages within industries already associated with particular fields of study; in others, they stem from a tighter clustering of lucrative sectors around a smaller subset of fields of study. This dynamic suggests that education policy, career advising, and labor market interventions must grapple with a world in which the labor market value of a degree is increasingly determined not by content alone, but by how credentials are absorbed into an evolving and uneven industrial structure.

Universities themselves account for only a small amount of variation in annual earnings, and yet this variation is increasingly explainable based on observable university characteristics. This finding contrasts with the findings of Borgen and Mastekaasa (2018), who finds that universities play no role in dictating labor market outcomes in excess of the individual department (specific educational credential). This discrepancy is likely linked to comparative differences in the U.S. and Norwegian context and motivates future work on school-to-work linkages in a comparative setting. Though their analyses include individual-level characteristics, they report supplementary analyses that omit such characteristics that are consistent with the key assumptions of this research based on the synthesis of Bleemer and Quincy (2025): differential sorting into programs does not appear to attenuate effects of fields of study, and it only slightly attenuates the effects of institutions.

The two-pronged increase in stratification along the axes of fields of study and institutions makes salient an increasingly important source of inequality in society—what and where one studies during their bachelor's degree—but this increasing stratification in outcomes opens doors for increased inequality to come about due to other, allocative factors. For instance, differential sorting into different fields of study on gendered and racialized lines (e.g., Lepage, Li, and Zafar 2025) would exacerbate known sources of horizontal stratification based on selection into fields of study and institutions. Further, research has documented a pattern of an increased prevalence of GPA-restricted majors within colleges, and these internal gatekeeping mechanisms limit access to high-return fields, often along lines of prior preparation and social background, reinforcing inequality even within institutions (Bleemer and Mehta 2024). Increasingly divergent returns across fields of study only heighten the stakes of such mechanisms, as access to lucrative majors then becomes an additional channel through which educational systems reproduce broader social inequalities.

Although specific credentials account for a similar share of overall earnings inequality as educational institutions, there is no clear evidence that high- or low-earning fields of study are becoming increasingly concentrated within correspondingly high- or low-earning institutions, respectively. The overall distribution of majors across institutions has remained remarkably stable, suggesting that the growing influence of field of study is not being driven by credential-level consolidation. Nor do patterns of field emergence and obsolescence appear confined to particular types of institutions. Instead, the rise in horizontal stratification reflects broader changes in the economic value of fields themselves, shaped by evolving industrial wage structures and shifting pathways from education to work. These findings not only clarify the empirical contours of horizontal stratification but also raise important questions for how sociologists conceptualize the education–labor market relationship moving forward.

Finally, an enduring concern is selection: to what extent do the observed differences in fields of study, institutions, and credentials reflect value added versus sorting by ability, preferences, or background? While the design here does not identify causal effects, three pieces of evidence help calibrate interpretation. First, the demographic fixed-effects analyses in the supplementary appendix indicate that within-field shifts in gender and race/ethnicity explain only a modest share of changes in field premiums, whereas industry-linked measures account for substantially more variation over time. Second, robustness checks that reweight institutions and reorder fixed effects suggest that the growing role of fields is not an just an artifact of compositional shifts in the mix of majors across campuses. Third, recent causal evidence implies that field of study differences largely represent value added (on the order of 100%), while institutional differences are attenuated by selection but still predominantly causal (roughly 80%), with estimates for institutions consistent with Chetty et al. (2023) and Bleemer and Quincy (2025). Finally, recent qualitative work by Moss-Pech (2025) also finds that within-institution stratification by field of study at a major Midwestern flagship university does not represent differences in ambition or talent, but that most of the between-field differences in employment outcomes are mediated largely by ties to specific sectors of work. While the evidence in support of the key assumptions employed in my analyses is robust to multiple specifications across several papers, more evidence using large scale administrative data like what is used in this paper would be welcome, especially since the importance of selection may change over time. Nevertheless for the time being, the decomposition results should be read as nearly equal to the causal importance of fields of study and as an upper bound for institutions. Substantively, selection concerns do not overturn the main conclusion: the dominant driver of horizontal inequality lies in field-linked positioning within an evolving industrial wage structure; institutional effects remain secondary, and their interpretation should be tempered slightly by concerns over selection processes and by the underrepresentation of the most selective private institutions in these data.

Implications for Research on Education and Labor Market Inequality

These findings suggest that sociological research on education and labor markets must further integrate perspectives from the school-to-work literature and the literature on labor market polarization. The increasing differentiation of field of study-based average annual earnings aligns with research on firm segregation and industry polarization (Wilmers and Aeppli 2021; Godechot et al. 2024; Haltiwanger et al. 2024). These findings highlight the importance of considering how industry-level transformations may interact with educational credentials. Rather than treating industry and education as separate domains, future research should consider how the stratification of earnings across credentials and across industries may be increasingly intertwined.

Evidence that industry dynamics are driving changes in horizontal stratification underscores the need to examine the institutional mechanisms that reinforce or mitigate these trends. This study documents a form of sectoral stratification: a macro-level shift in which earnings inequality is shaped by the consolidation of capital, wage growth, and economic power within a small set of high-value industries (Haltiwanger et al. 2024). These industries likely encode patterns of occupational closure and firm-level compensation differences that also operate via field-to-industry linkages, positioning fields of study as conduits into evolving configurations of work. This pattern reflects not only a response to exogenous technological change, as in the RBTC literature, but also an endogenous restructuring of opportunity through educational credentials. As wage gaps between industries widen, access to high-paying sectors may become increasingly dependent on specific credentials or fields of study, narrowing mobility and deepening inequality. Understanding how universities, employers, occupations, and policy shape these linkages is critical. Relational inequality theory (Tomaskovic-Devey and Avent-Holt 2019) offers a framework for analyzing how these patterns are maintained at both the meso level, through ties between academic departments and firms, and the macro level, through the institutional alignment of higher education and labor markets. While this study cannot observe these mechanisms directly, access to linked credential and firm-level microdata would significantly advance this research agenda. Beyond empirical trends, these results invite a reconsideration of dominant theoretical frameworks in the for contending with labor market change in the contemporary period.

Connections to Theories of Educational Stratification

This study also suggests that sociologists must further refine theories of educational stratification to account for the increasing importance of horizontal distinctions. Much of the literature on education and inequality has focused on vertical stratification (e.g., high school versus college, or bachelor's versus master's degrees). However, this study provides further evidence that horizontal distinctions—especially field of study—are becoming just as important as, if not more important than, vertical distinctions in shaping labor market outcomes.

These results partially align with the Effectively Maintained Inequality (EMI) framework (Lucas 2001), which emphasizes how educational expansion leads advantaged groups to secure qualitatively better credentials. EMI focuses primarily on educational sorting and how families respond to changes in access, with less emphasis on the role of labor market dynamics in shaping the value of those credentials. The findings here suggest that growing differentiation in earnings outcomes is influenced not only by patterns of sorting into fields and institutions, but also by structural shifts in the labor market. In particular, the link between fields of study and industries with diverging wage trajectories appears to be a key driver of horizontal stratification. At the same time, the increasing correlation between institutional earnings and characteristics such as selectivity and graduate enrollment is consistent with the patterns that EMI anticipates. A more direct test of the framework would require data on family background and its relationship to enrollment decisions in response to changes in labor market returns, and the findings presented here of increasing horizontal stratification do beg the question of how individuals and families respond to changing inequality dynamics. Further, although some institutional characteristics, such as selectivity and graduate enrollment, are increasingly associated with graduates' earnings, a substantial amount of variation across institutions remains unexplained. This suggests that the labor market value of institutional credentials may depend on broader organizational dynamics or embedded institutional roles that are not captured by conventional indicators like prestige or test scores. These findings underscore the need to theorize horizontal stratification not only in terms of credential content but also in terms of how colleges are positioned within larger systems of economic and organizational inequality. This perspective also reframes the view of higher education as a "great equalizer" (Torche 2011; Zhou 2019) in light of contemporary structural change. As the college–no college earnings gap has leveled off (Autor et al. 2020) and the number of bachelor's degrees has nearly doubled since the turn of the century, inequality has increasingly shifted inside higher education itself.

Beyond EMI, this study also connects directly to Collins's theory of credentialism and the broader cultural tradition in the sociology of education. Collins (1979) argues that educational institutions are not merely sites of skill acquisition but arenas of status competition, where credentials operate as signals of cultural membership and social closure. Yet Collins treats credentials primarily at the level of broad degree categories and professional licenses. The patterns documented here suggest that these closure processes now operate at a finer level of granularity—within degree levels, across fields of study, and between institutions—as the labor market has become more differentiated and education more specialized. Horizontal stratification thus represents a contemporary extension of the credentialist logic. Not only do degrees regulate access to occupations, but specific institutional and disciplinary credentials regulate access to particular segments of the labor market. In this sense, horizontally stratified credentials form an infrastructure through which status cultures may be reproduced and translated into economic advantage, linking Collins's emphasis on symbolic boundaries to the concrete organizational and industrial mechanisms through which those boundaries are enacted.

The increasing salience of horizontal stratification also raises pressing policy concerns. As earnings gaps across fields widen, expanding access to college alone may not reduce inequality unless students from marginalized backgrounds also gain access to higher-earning fields and more prestigious colleges. For instance, existing research suggests that students from lower socioeconomic backgrounds are less likely to enroll in or persist in high-earning STEM and business majors (Bleemer and Mehta 2022; Monaghan and Jang 2017). Addressing these disparities could involve targeted recruitment into certain fields of study, firm-credential partnerships to alter flows into certain industries, and changed advising and student support structures. Finally, the growing correlation between institutional characteristics, such as SAT scores or graduate enrollment, and graduate earnings raises concerns about increasing prestige-driven exclusion. If labor market returns are increasingly tied to institutional reputation rather than skills imparted, opportunities may diverge sharply across college types. Even when these patterns reflect sorting by student ability, they raise normative questions about the role of higher education as a public institution committed to expanding opportunity.

Limitations

To contextualize my findings and guide future research, it is important to acknowledge several limitations, some of which have been alluded to in earlier sections. First, the analyses rely on summary statistics rather than individual-level data. Although these statistics are highly granular, capturing credential-cohort combinations with as few as 30 graduates, they necessarily obscure within-cell variation and do not allow for the identification of micro-level selection mechanisms or causal pathways related to individual characteristics such as race, gender, parental education, or academic preparation. Nonetheless, sensitivity checks (Appendix Figure A4) suggest that the patterns identified are robust across specifications that may be related to such mechanisms. Moreover, this design tradeoff is what enables the study to provide a rare, macro-level perspective on how horizontal stratification unfolds across institutions and fields of study over time.

Second, this analysis focuses on three analytically tractable forms of horizontal stratification: institution, field of study, and their intersection. Other important dimensions such as intra-field specialization, co-curricular experiences, and informal academic tracking are not examined here, though they likely shape labor market outcomes and interact with the patterns observed. Rather than cataloging all forms of horizontal inequality, this paper traces how credentials have become increasingly differentiated in economic value amid structural labor market change. Future research should explore these finer-grained dynamics as richer data become available.

Third, as noted in the results, Ivy League and similarly highly-selective private institutions are underrepresented in the dataset. While the broader underrepresentation of private universities is addressed through compositional reweighting and sensitivity checks, the absence of Ivy League and their peer institutions poses a distinct limitation. Nevertheless, these schools enroll relatively few students compared to large public universities, so their exclusion likely has minimal impact on overall trends. However, it does constrain generalizability at the top of the institutional earnings distribution, where the labor market returns to elite prestige may be most pronounced. As a result, this study may understate the extent of institutional stratification at the highest levels of the college hierarchy.

Focusing on annual earnings five years after graduation has limitations. While robustness checks (Appendix Figure A2) show similar patterns of horizontal stratification at one and ten years and comparable dynamic trends at one year, income is an imperfect proxy for social position, well-being, and long-term mobility. Still, it remains a uniquely valuable measure: it reflects actual economic standing, avoids measurement bias, and is especially relevant for recent graduates navigating economic precarity. For many, particularly those from non-elite backgrounds, earnings serve as a proxy for broader labor market outcomes. Early-career income also aligns with experiences common to this key life stage, such as student loan repayment and household formation, making it a salient indicator of inequality. Other dimensions of stratification like non-monetary compensation, occupational prestige, or long-term growth are harder to measure (Cheng 2014;

Cheng and Song 2019) and likely correlate with earnings, suggesting my results may understate overall horizontal stratification. The data also exclude individuals still in school. Those who later complete graduate degrees enter the analysis only upon labor market participation, making it difficult to isolate the effects mediated through the pursuit of an advanced degree. Nevertheless, sensitivity checks affirm that the main findings are robust to different periods of follow-up post-graduation. Future research with richer labor market indicators and linked microdata would help clarify these mechanisms.

Additionally, this analysis cannot disentangle how much of the observed stratification reflects worker–firm sorting. Because firms are nested within industries, rising industry premiums could partly reflect shifts toward higher-paying firms within those industries rather than changes common to all firms. And since the PSEO data used in these analyses do not include firm identifiers or characteristics, one cannot analyze firm-level phenomena such as wage-setting or recruiting pipelines. Access to microdata linking education records to employer-level data would clarify the extent to which horizontal stratification reflects institutional value added versus sorting into higher-wage firms.

In addition, this analysis necessarily excludes individuals who begin but do not complete a bachelor's degree. As noted earlier, the study defines horizontal stratification as variation within the population of bachelor's degree recipients, which allows for clear analytical separation from vertical processes such as degree attainment. As a result, the findings reflect patterns of inequality among graduates only, and do not capture the potentially large disparities generated by differential rates of completion by field of study and institution. Because non-completion is strongly patterned by background characteristics and institutional context, the earnings differences reported here are likely conservative. Future research should examine how institutional and field-level differences in retention and completion interact with vertical stratification and shape access to the types of credentials studied here.

Finally, there is question of industry as the appropriate labor market stratifying force to explain the inequalities described here. Other indicators, like RBTC at the occupation level or deindustrialization more broadly are alternative lenses through which this analysis could have been performed. While the data limit me to focusing on industrial change, I believe this is also a principled choice. Other research has pointed out the realignment of industries in the labor market as a primary source of changing dynamics of inequality (Wilmers and Aeppli 2021; Haltiwanger et al. 2024). Wilmers and Aeppli (2021) in particular outline how changing occupational dynamics coincide with changing industry dynamics, though the question of which precedes the other remains an open question that should be addressed with further research.

Future Research Directions

While this study provides a broad overview of the changing landscape of horizontal stratification in higher education, it also raises several key questions that future research should address. One of the most pressing concerns is the causal mechanism behind the school-to-work linkages discussed here, and their knock-on effects for selection into college and fields of study in the first place. This study demonstrates that industry-level dynamics play a crucial role in shaping earnings stratification across fields of study, but it does not pinpoint whether these effects stem from employer preferences, student self-selection, or university-side institutional steering.

Future work should examine how these trends vary across demographic groups. Prior research suggests that access to high-return majors like STEM and finance is stratified by race, gender, and class (Xie and Shauman 2003; Gaddis 2015). As the field described here increasingly shape earnings, horizontal stratification may reinforce existing inequalities. Investigating whether industry practices or educational interventions can offset this stratification is essential.

An additional avenue for future research involves examining the role of school-to-work linkages themselves. Prior work has shown that stronger linkage systems, typically analyzed in cross-national comparisons, shape employment outcomes by more tightly connecting educational credentials to specific labor market destinations (DiPrete et al. 2017; Bol et al. 2019). While this study does not center on linkage strength, the fine-grained credential-level structure of the data, combined with detailed information on industry destinations, offers a novel opportunity to do so. This creates the possibility of extending the original framework to examine variation in linkage strength across institutions, fields of study, and credentials within the U.S. context. Such an approach would allow researchers to test whether more tightly coupled credentials produce more stable or more unequal outcomes in a causal framework, and to investigate how linkage strength itself evolves alongside changes in industrial structure and institutional positioning.

Graduate education also warrants closer attention. While this study focuses on bachelor's degree holders, similar patterns in horizontal stratification may be simultaneously occurring, or even intensifying, at the master's and doctoral levels. As advanced degrees are often viewed as mobility pathways, understanding whether certain graduate credentials are consolidating economic advantages while others lag is critical. In addition, future research should explore how post-baccalaureate education moderates the patterns observed here, particularly for those whose earnings outcomes reflect the combined value of undergraduate and graduate training.

Finally, a comparative perspective is necessary to assess to what extent these trends are unique to the United States. The U.S. higher education system is characterized by its flexibility and relatively weak school-to-work linkages compared to other nations, where vocational training and credentialing structures may create different trajectories for students. If similar patterns of growing horizontal stratification are observed in other countries, it may suggest a global strengthening of school-to-work linkages due to specific industrial relations rather than being due to the specific institutional features of U.S. higher education. Indeed the only study remotely comparable to this, which was conducted in a Norwegian context, found that there was no effect of educational institutions in excess of credential-specific effects, highlighting the importance of national context (Borgen and Mastekaasa 2018). Future research should explore cross-national comparisons to determine whether the increasing importance of field of study and institutional prestige in shaping earnings outcomes is a universal phenomenon or whether it is shaped by national policies, labor market structures, and educational institutions.

Conclusion

In sum, this study provides new evidence that horizontal stratification in higher education—particularly stratification by field of study—plays a large and increasingly important role in shaping economic inequality, as measured by earnings inequality after entry into the labor market. Unlike prior research, which has primarily examined horizontal stratification in a static framework, this study takes a longitudinal approach and finds that the role of horizontal stratification is growing over time. Further, these trends are largely driven by shifting industry structures and to a lesser extent changing patterns of school-to-work linkages. While institutions also contribute to earnings disparities among graduates, their importance remains secondary to that of field of study. Nevertheless, their effects are increasingly structured by observable characteristics.

Although increasing horizontal stratification by field of study raises concerns about inequality, it could plausibly also be interpreted as reflecting a labor market that rewards acquired skills and productive specialization more directly than one centered on institutional prestige or individual characteristics. In this sense, the rising importance of what graduates study relative to where they study may indicate that economic outcomes increasingly track substantive competencies and human capital rather than reputational advantages. If this interpretation holds, the growth of field of study-based stratification could represent a partial shift toward a more meritocratic linkage between education and work, where skill-based differentiation outweighs credential-based gatekeeping. Further study of the mechanisms conferring field of study-level differences in earnings is needed, however.

A central contribution of this study lies in its use of temporally rich, credential-level data that span over fifteen years and include nearly a variety of U.S. higher educational institutions. Prior research has often been limited to single cohorts, broad institutional groupings, or narrow timeframes. By contrast, this study captures how stratification unfolds dynamically, in tandem with structural shifts in the labor market. This level of temporal and institutional granularity allows for a more empirically grounded account of how educational inequality is produced and reproduce, not just through individual sorting, but through evolving relationships between education and work.

These findings suggest that higher education researchers must integrate insights from the literature on industrial change, firm segregation, and relational inequality to better understand the shifting landscape of educational stratification. The job market for bachelor's recipients is no longer characterized by guaranteed job security, as earned income is increasingly dependent on from where one received their degree and what they studied. Likewise, industry shifts to a knowledge-intensive economy have benefited some fields of study more than others, though in ways that defy typical frameworks of RBTC or deindustrialization.

These findings point to the need for a reconceptualization of how educational stratification interacts with broader processes of labor market change. Horizontal and vertical stratification cannot be understood merely as a reflection of individual preferences or institutional sorting mechanisms, but as parts of a dynamic system in which educational and economic structures co-evolve. As the boundaries between educational categories and labor market positions become increasingly structured by industry-level transformations, the conceptual frameworks used to study stratification must evolve in kind. Attending to these shifting alignments will be essential for advancing theories of education, stratification, and inequality.

References

Alon, Sigal and Thomas A. DiPrete. 2015. "Gender Differences in the Formation of a Field of Study Choice Set." *Sociological Science* 2:50–81.

Altonji, Joseph G., Erica Blom, and Costas Meghir. 2012. "Heterogeneity in Human Capital Investments: High School Curriculum, College Major, and Careers." National Bureau of Economic Research, http://dx.doi.org/10.3386/w17985.

Altonji, Joseph G., Lisa B. Kahn, and Jamin D. Speer. 2016. "Cashier or Consultant? Entry Labor Market Conditions, Field of Study, and Career Success." *Journal of Labor Economics* 34:S361–S401.

Armstrong, Elizabeth A. and Laura T. Hamilton. 2013. *Paying for the Party: How College Maintains Inequality*. Cambridge, UNITED STATES: Harvard University Press.

Autor, David, Claudia Goldin, and Lawrence F. Katz. 2020. "Extending the Race between Education and Technology." *AEA Papers and Proceedings* 110:347–351.

Autor, David H. 2014. "Skills, education, and the rise of earnings inequality among the "other 99 percent"." *Science* 344:843–851.

Battistin, Erich, Richard Blundell, and Arthur Lewbel. 2009. "Why Is Consumption More Log Normal than Income? Gibrat's Law Revisited." *Journal of Political Economy* 117:1140–1154.

Bills, David B. 2003. "Credentials, Signals, and Screens: Explaining the Relationship Between Schooling and Job Assignment." *Review of Educational Research* 73:441–469.

Bleemer, Zachary. 2021. "Top Percent Policies and the Return to Postsecondary Selectivity. Research & Occasional Paper Series: CSHE.1.2021." Technical report, Center for Studies in Higher Education. ERIC Number: ED613769.

Bleemer, Zachary and Aashish Mehta. 2022. "Will Studying Economics Make You Rich? A Regression Discontinuity Analysis of the Returns to College Major." *American Economic Journal: Applied Economics* 14:1–22.

Bleemer, Zachary and Aashish Mehta. 2024. "College Major Restrictions and Student Stratification." National Bureau of Economic Research, http://dx.doi.org/10.3386/w33269.

Bleemer, Zachary and Sarah Quincy. 2025. "Changes in the College Mobility Pipeline Since 1900." National Bureau of Economic Research, http://dx.doi.org/10.3386/w33797.

Bol, Thijs, Christina Ciocca Eller, Herman G. Van De Werfhorst, and Thomas A. DiPrete. 2019. "School-to-Work Linkages, Educational Mismatches, and Labor Market Outcomes." *American Sociological Review* 84:275–307.

Borgen, Nicolai T. 2014. "College quality and hourly wages: Evidence from the self-revelation model, sibling models and instrumental variables." *Social Science Research* 48:121–134.

Borgen, Nicolai T and Arne Mastekaasa. 2018. "Horizontal Stratification of Higher Education: The Relative Importance of Field of Study, Institution, and Department for Candidates' Wages." *Social Forces* 97:531–558.

Brand, Jennie E. 2006. "The effects of job displacement on job quality: Findings from the Wisconsin Longitudinal Study." *Research in Social Stratification and Mobility* 24:275–298.

Brand, Jennie E. and Yu Xie. 2010. "Who Benefits Most from College? Evidence for Negative Selection in Heterogeneous Economic Returns to Higher Education." *American Sociological Review* 75:273–302.

Brewer, Dominic J., Eric R. Eide, and Ronald G. Ehrenberg. 1999. "Does It Pay to Attend an Elite Private College? Cross-Cohort Evidence on the Effects of College Type on Earnings." *The Journal of Human Resources* 34:104.

Brown, David K. 2001. "The Social Sources of Educational Credentialism: Status Cultures, Labor Markets, and Organizations." *Sociology of Education* 74:19.

Card, David. 1999. "Chapter 30 - The Causal Effect of Education on Earnings." In *Handbook of Labor Economics*, edited by Orley C. Ashenfelter and David Card, volume 3, pp. 1801–1863. Elsevier.

Carnevale, Anthony P., Ban Cheah, and Jeff Strohl. 2013. "Hard Times: College Majors, Unemployment and Earnings: Not All College Degrees Are Created Equal." .

Cheng, Siwei. 2014. "A Life Course Trajectory Framework for Understanding the Intracohort Pattern of Wage Inequality." *American Journal of Sociology* 120:633–700.

Cheng, Siwei and Xi Song. 2019. "Linked Lives, Linked Trajectories: Intergenerational Association of Intragenerational Income Mobility." *American Sociological Review* 84:1037–1068.

Chetty, Raj, David J. Deming, and John N. Friedman. 2023. "Diversifying Society's Leaders? The Determinants and Causal Effects of Admission to Highly Selective Private Colleges." National Bureau of Economic Research, http://dx.doi.org/10.3386/w31492.

Chetty, Raj, John Friedman, Emmanuel Saez, Nicholas Turner, and Danny Yagan. 2017. "Mobility Report Cards: The Role of Colleges in Intergenerational Mobility." Technical Report w23618, National Bureau of Economic Research, Cambridge, MA.

Ciocca Eller, Christina. 2023. "What Makes a Quality College? Reexamining the Equalizing Potential of Higher Education in the United States." *American Journal of Sociology* 129:637–714.

Collins, Randall, Tressie McMillan Cottom, and Mitchell L. Stevens. 1979. *The Credential Society: An Historical Sociology of Education and Stratification*. Columbia University Press.

Dahl, Gordon B., Dan-Olof Rooth, and Anders Stenberg. 2023. "High School Majors and Future Earnings." *American Economic Journal: Applied Economics* 15:351–382.

Dale, Stacy Berg and Alan B. Krueger. 2002. "Estimating the Payoff to Attending a More Selective College: An Application of Selection on Observables and Unobservables*." *The Quarterly Journal of Economics* 117:1491–1527.

Das Gupta, Prithwis. 1993. *Standardization and Decomposition of Rates: A User's Manual*. Washington, DC: US Government Printing Office.

Dillon, Eleanor Wiske and Jeffrey Andrew Smith. 2020. "The Consequences of Academic Match between Students and Colleges." *Journal of Human Resources* 55:767–808.

DiPrete, Thomas A., Thijs Bol, Christina Ciocca Eller, and Herman G. van de Werfhorst. 2017. "School-to-Work Linkages in the United States, Germany, and France." *American Journal of Sociology* 122:1869–1938.

England, Paula, Paul Allison, and Yuxiao Wu. 2007. "Does bad pay cause occupations to feminize, Does feminization reduce pay, and How can we tell with longitudinal data?" *Social Science Research* 36:1237–1256.

Gaddis, S. Michael. 2015. "Discrimination in the Credential Society: An Audit Study of Race and College Selectivity in the Labor Market." *Social Forces* 93:1451–1479.

Gelbach, Jonah B. 2016. "When Do Covariates Matter? And Which Ones, and How Much?" *Journal of Labor Economics* 34:509–543.

Gerber, Theodore P. and Sin Yi Cheung. 2008. "Horizontal Stratification in Postsecondary Education: Forms, Explanations, and Implications." *Annual Review of Sociology* 34:299–318.

Gibrat, Robert. 1931. *Les inégalités économiques: applications aux inégalités des richesses, à la concentration des entreprises... d'une loi nouvelle, la loi de l'effet proportionnel*. Libr. du Recueil Sirey.

Godechot, Olivier, Donald Tomaskovic-Devey, István Boza, Lasse Folke Henriksen, Are Skeie Hermansen, Feng Hou, Jiwook Jung, Naomi Kodama, Alena Křížková, Zoltán Lippényi, Silvia Maja Melzer, Eunmi Mun, Halil Sabanci, Max Thaning, Paula Apascaritei, Dustin Avent-Holt, Nina Bandelj, Alexis Baudour, David Cort, Marta M. Elvira, Gergely Hajdu, Aleksandra Kanjuo-Mrčela, Joseph King, Andrew

Penner, Trond Petersen, Andreja Poje, Anthony Rainey, Mirna Safi, and Matthew Soener. 2024. "The Great Separation: Top Earner Segregation at Work in Advanced Capitalist Economies." *American Journal of Sociology* 130:439–495.

Goldin, Claudia and Lawrence F. Katz. 2008. *The Race between Education and Technology*. Harvard University Press.

Goyette, Kimberly A. and Ann L. Mullen. 2006. "Who Studies the Arts and Sciences? Social Background and the Choice and Consequences of Undergraduate Field of Study." *The Journal of Higher Education* 77:497–538.

Grogger, Jeff and Eric Eide. 1995. "Changes in College Skills and the Rise in the College Wage Premium." *The Journal of Human Resources* 30:280–310.

Haltiwanger, John, Henry R. Hyatt, and James R. Spletzer. 2024. "Rising Top, Falling Bottom: Industries and Rising Wage Inequality." *American Economic Review* 114:3250–3283.

Hamilton, Laura T., Caleb E. Dawson, Elizabeth A. Armstrong, and Aya Waller-Bey. 2024. "Racialized Horizontal Stratification in US Higher Education: Politics, Process, and Consequences." *Annual Review of Sociology* 50:475–499.

Hout, Michael. 2012. "Social and Economic Returns to College Education in the United States." *Annual Review of Sociology* 38:379–400.

Kalleberg, Arne L. and James R. Lincoln. 1988. "The Structure of Earnings Inequality in the United States and Japan." *American Journal of Sociology* 94:S121–S153.

Kambourov, Gueorgui and Iourii Manovskii. 2009. "Occupational Mobility and Wage Inequality." *The Review of Economic Studies* 76:731–759.

Kim, ChangHwan, Christopher R. Tamborini, and Arthur Sakamoto. 2015. "Field of Study in College and Lifetime Earnings in the United States." *Sociology of Education* 88:320–339.

Kinsler, Josh and Ronni Pavan. 2015. "The Specificity of General Human Capital: Evidence from College Major Choice." *Journal of Labor Economics* 33:933–972.

Kirkeboen, Lars J., Edwin Leuven, and Magne Mogstad. 2016. "Field of Study, Earnings, and Self-Selection*." *The Quarterly Journal of Economics* 131:1057–1111.

Kitagawa, Evelyn M. 1955. "Components of a Difference Between Two Rates." *Journal of the American Statistical Association* 50:1168–1194.

Kogan, Leonid, Dimitris Papanikolaou, Lawrence DW Schmidt, and Bryan Seegmiller. 2021. "Technology, vintage-specific human capital, and labor displacement: Evidence from linking patents with occupations." Technical report, National Bureau of Economic Research.

Lepage, Louis-Pierre, Xiaomeng Li, and Basit Zafar. 2025. "Anticipated Discrimination and Major Choice." National Bureau of Economic Research, http://dx.doi.org/10.3386/w33680.

Loury, Linda Datcher and David Garman. 1995. "College Selectivity and Earnings." *Journal of Labor Economics* 13:289–308.

Lucas, Samuel R. 2001. "Effectively Maintained Inequality: Education Transitions, Track Mobility, and Social Background Effects." *American Journal of Sociology* 106:1642–1690.

MacLeod, W. Bentley, Evan Riehl, Juan E. Saavedra, and Miguel Urquiola. 2017. "The Big Sort: College Reputation and Labor Market Outcomes." *American Economic Journal: Applied Economics* 9:223–261.

Manski, Charles F. and David A. Wise. 1983. *College Choice in America*. Cambridge, MA: Harvard University Press. Google-Books-ID: jNajTyWX3DUC.

Meghir, Costas and Steven Rivkin. 2011. "Econometric Methods for Research in Education." In *Handbook of the Economics of Education*, edited by Eric A. Hanushek, Stephen Machin, and Ludger Woessmann, volume 3, pp. 1–87. Elsevier.

Michelman, Valerie, Joseph Price, and Seth D Zimmerman. 2022. "Old Boys' Clubs and Upward Mobility Among the Educational Elite*." *The Quarterly Journal of Economics* 137:845–909.

Monaghan, David and Sou Hyun Jang. 2017. "Major Payoffs: Postcollege Income, Graduate School, and the Choice of "Risky" Undergraduate Majors." *Sociological Perspectives* 60:722–746.

Moss-Pech, Corey. 2025. *Major Trade-Offs: The Surprising Truths about College Majors and Entry-Level Jobs*. Chicago, IL: University of Chicago Press.

Oaxaca, Ronald L. and Eva Sierminska. 2023. "Oaxaca-Blinder Meets Kitagawa: What is the Link?" Social Science Research Network, http://dx.doi.org/10.2139/ssrn.4464602.

Posselt, Julie R. and Eric Grodsky. 2017. "Graduate Education and Social Stratification." *Annual Review of Sociology* 43:353–378.

Reimer, David and Jens-Peter Thomsen. 2019. "Vertical and horizontal stratification in higher education." In *Research Handbook on the Sociology of Education*, pp. 308–328. Edward Elgar Publishing. Section: Research Handbook on the Sociology of Education.

Rivera, Lauren A. 2012. "Hiring as cultural matching: The case of elite professional service firms." *American Sociological Review* 77:999–1022.

Sekhri, Sheetal. 2020. “Prestige Matters: Wage Premium and Value Addition in Elite Colleges.” *American Economic Journal: Applied Economics* 12:207–225.

Song, Jae, David J Price, Fatih Guvenen, Nicholas Bloom, and Till von Wachter. 2019. “Firming Up Inequality*.” *The Quarterly Journal of Economics* 134:1–50.

Tomaskovic-Devey, Donald and Dustin Avent-Holt. 2019. *Relational Inequalities: An Organizational Approach*. Oxford University Press. Google-Books-ID: pwJ6DwAAQBAJ.

Tomaskovic-Devey, Donald, Anthony Rainey, Dustin Avent-Holt, Nina Bandelj, István Boza, David Cort, Olivier Godechot, Gergely Hajdu, Martin Hällsten, Lasse Folke Henriksen, Are Skeie Hermansen, Feng Hou, Jiwook Jung, Aleksandra Kanjuo-Mrčela, Joe King, Naomi Kodama, Tali Kristal, Alena Křížková, Zoltán Lippényi, Silvia Maja Melzer, Eunmi Mun, Andrew Penner, Trond Petersen, Andreja Poje, Mirna Safi, Max Thaning, and Zaibu Tufail. 2020. “Rising between-workplace inequalities in high-income countries.” *Proceedings of the National Academy of Sciences* 117:9277–9283.

Torche, Florencia. 2011. “Is a College Degree Still the Great Equalizer? Intergenerational Mobility across Levels of Schooling in the United States.” *American Journal of Sociology* 117:763–807.

van de Werfhorst, Herman G. 2002. “Fields of Study, Acquired Skills and the Wage Benefit from a Matching Job.” *Acta Sociologica* 45:286–303.

van de Werfhorst, Herman G., Nan Dirk de Graaf, and Gerbert Kraaykamp. 2001. “Intergenerational Resemblance in Field of Study in the Netherlands.” *European Sociological Review* 17:275–293.

Wilmers, Nathan and Clem Aeppli. 2021. “Consolidated Advantage: New Organizational Dynamics of Wage Inequality.” *American Sociological Review* 86:1100–1130.

Xie, Yu, Michael Fang, and Kimberlee Shauman. 2015. “STEM Education.” *Annual Review of Sociology* 41:331–357.

Xie, Yu and Kimberlee A. Shauman. 2003. *Women in science : career processes and outcomes*. London: Harvard University Press.

Xie, Yu and Xiang Zhou. 2014. “Income inequality in today’s China.” *Proceedings of the National Academy of Sciences* 111:6928–6933.

Zhou, Xiang. 2019. “Equalization or Selection? Reassessing the “Meritocratic Power” of a College Degree in Intergenerational Income Mobility.” *American Sociological Review* 84:459–485.

Zhou, Xiang and Yu Xie. 2020. “Heterogeneous Treatment Effects in the Presence of Self-Selection: A Propensity Score Perspective.” *Sociological Methodology* 50:350–385.

Zimmerman, Seth D. 2019. "Elite Colleges and Upward Mobility to Top Jobs and Top Incomes." *American Economic Review* 109:1–47.

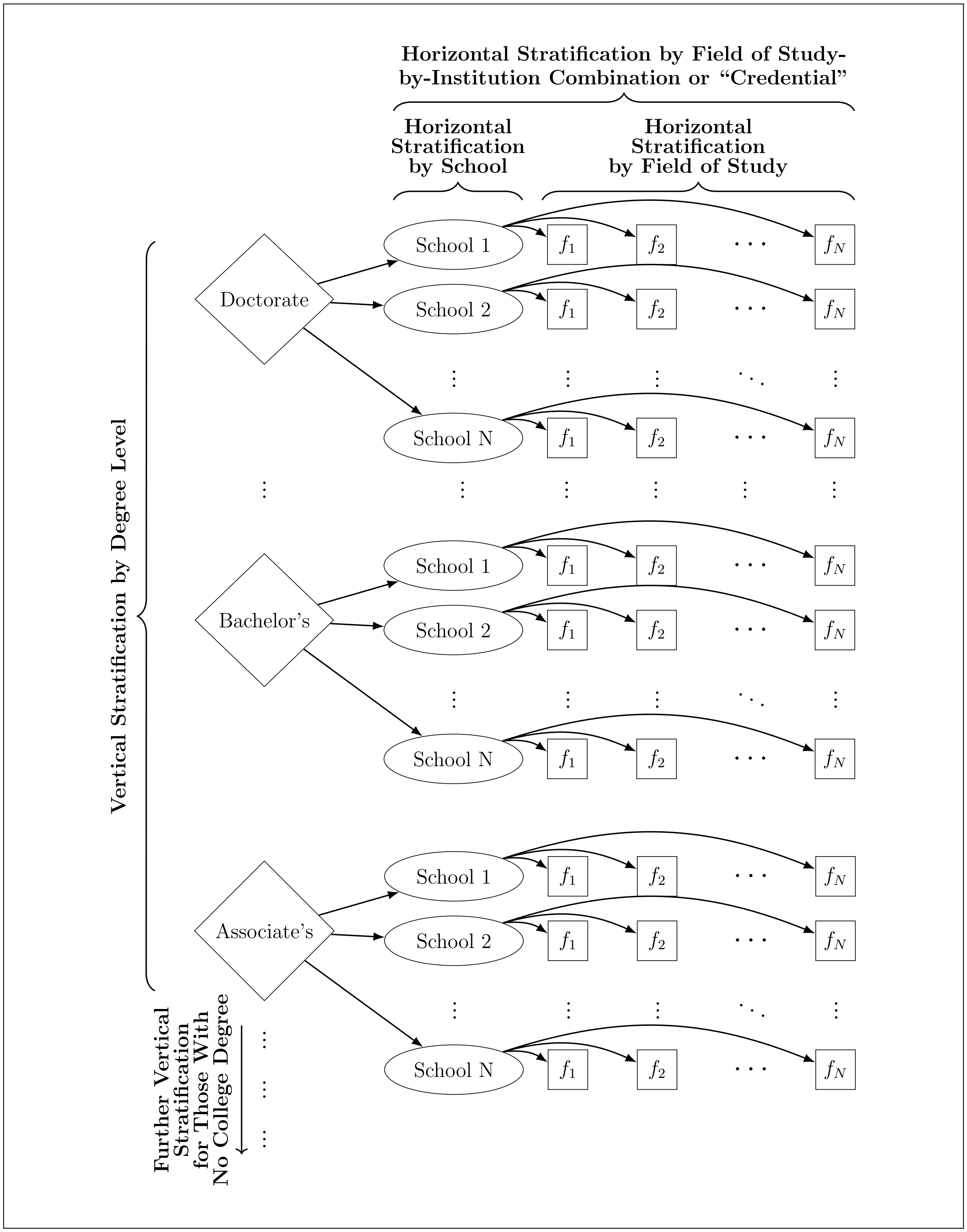

Figure 1: Schematic Showing Vertical Stratification and Horizontal Stratification by Both School and Field of Study

Notes: Only vertical stratification at the two-year college level and above is shown. There is unshown vertical stratification for those with high school, less than high school, and no schooling. Whether or not these exhibit meaningful horizontal stratification by school is unknown, and there is no field of study specialization below the college level.

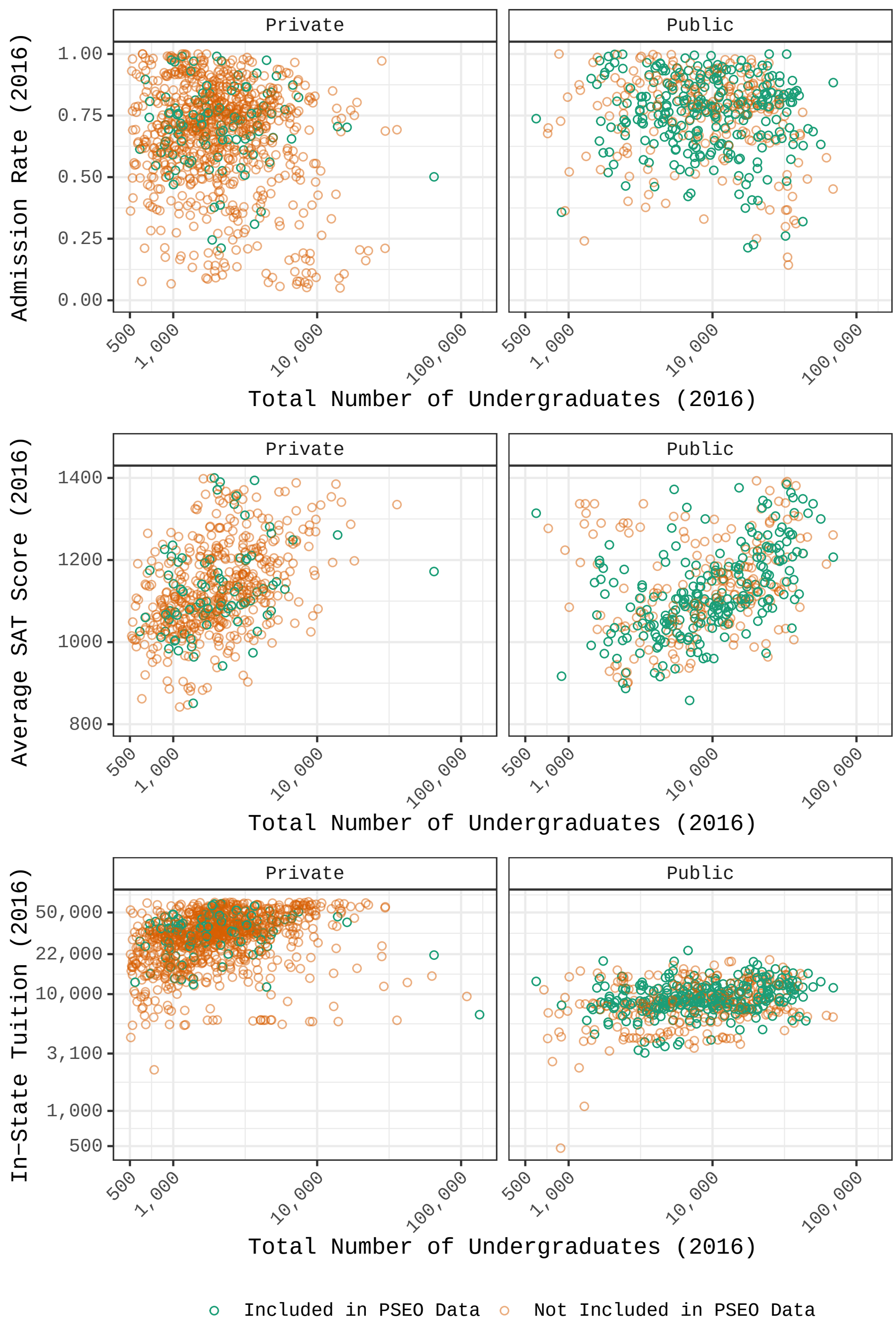

Figure 2: Scatter Plot of All Universities and Universities Included in PSEO Data, By Total Number of Undergraduate Students, In-State Tuition, Admission Rates, and Average SAT Scores

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes; The U.S. Department of Education's College Scorecard.
Notes: Only universities are shown that have at least 500 undergraduate students. Among all four-year degree-granting institutions in the College Scorecard data, undergraduate in-state tuition fees are missing for 49 institutions, average SAT scores are missing for 573 institutions, and admission rates are missing for 231 institutions.

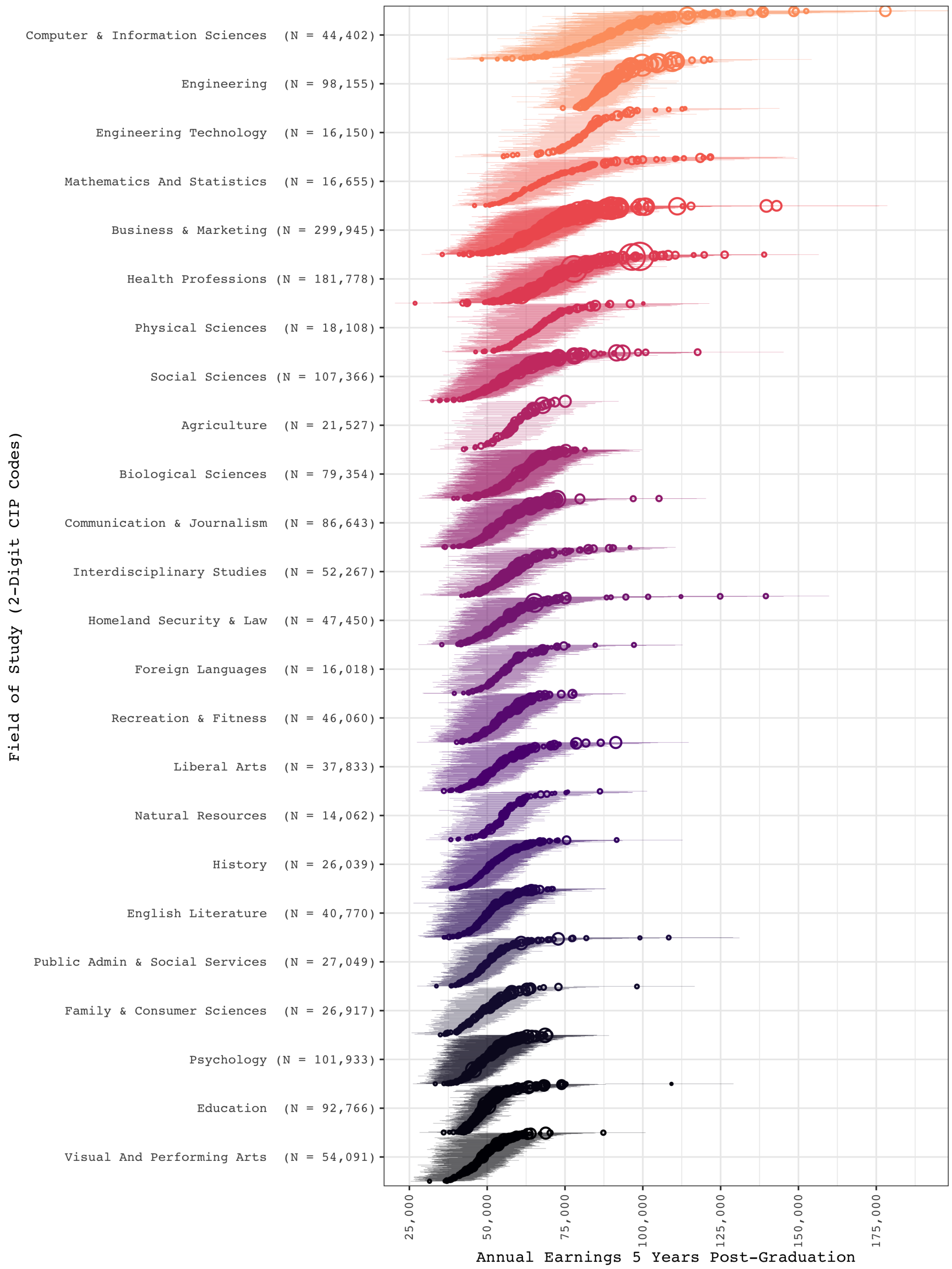

Figure 3: Distributions of Average Annual Earnings, Five Years Post-Graduation, for Specific Credentials (Fields of Study Within Specific Degree-Granting Institutions), By Aggregate Field of Study; Students Graduating 2013–2015

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes.
Notes: Groupings refer to CIP codes aggregated at the two-digit level, though each data point represents a credential (degree-granting institution and field of study combination) at the four-digit level. Colors are to help visually distinguish fields of study.

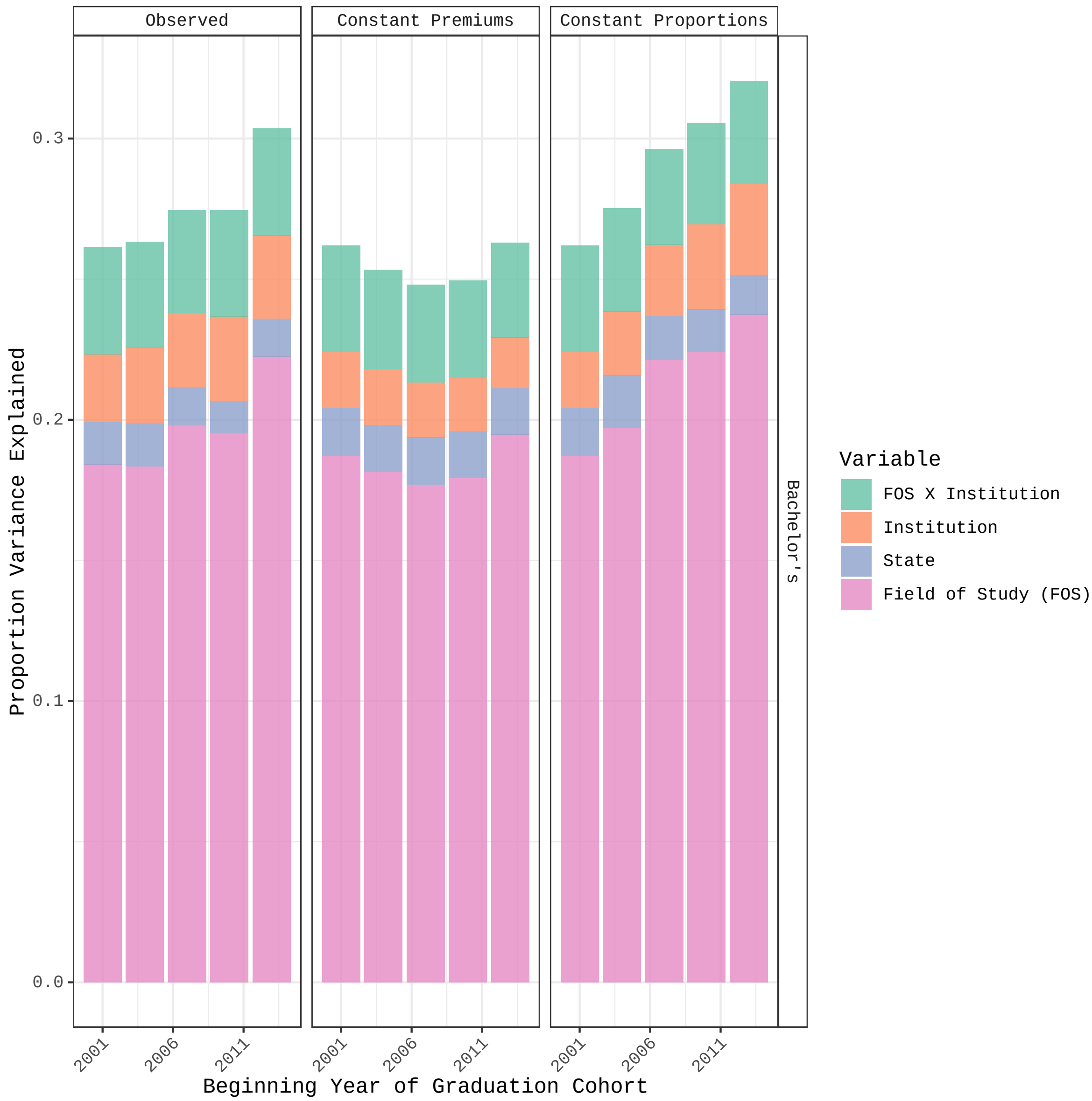

Figure 4: Variance Decomposition of annual earnings Five Years Post-Graduation by Field of Study (Major), Educational Institution, and Their Intersection Alongside Scenarios Assuming Constant Allocations Across Fields and Universities or Constant Average Annual Earnings Across Fields and Universities

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes.
Notes: "Constant Proportions" refers to the scenario in which all enrollments by field of study and degree-granting institutions are held constant at their 2001–2003 numbers, and "Constant Average Earnings" refers to the scenario in which enrollments are allowed to vary, but credential-specific average earnings are held constant.
Results reflect data reweighted to more closely represent all U.S. universities and colleges.

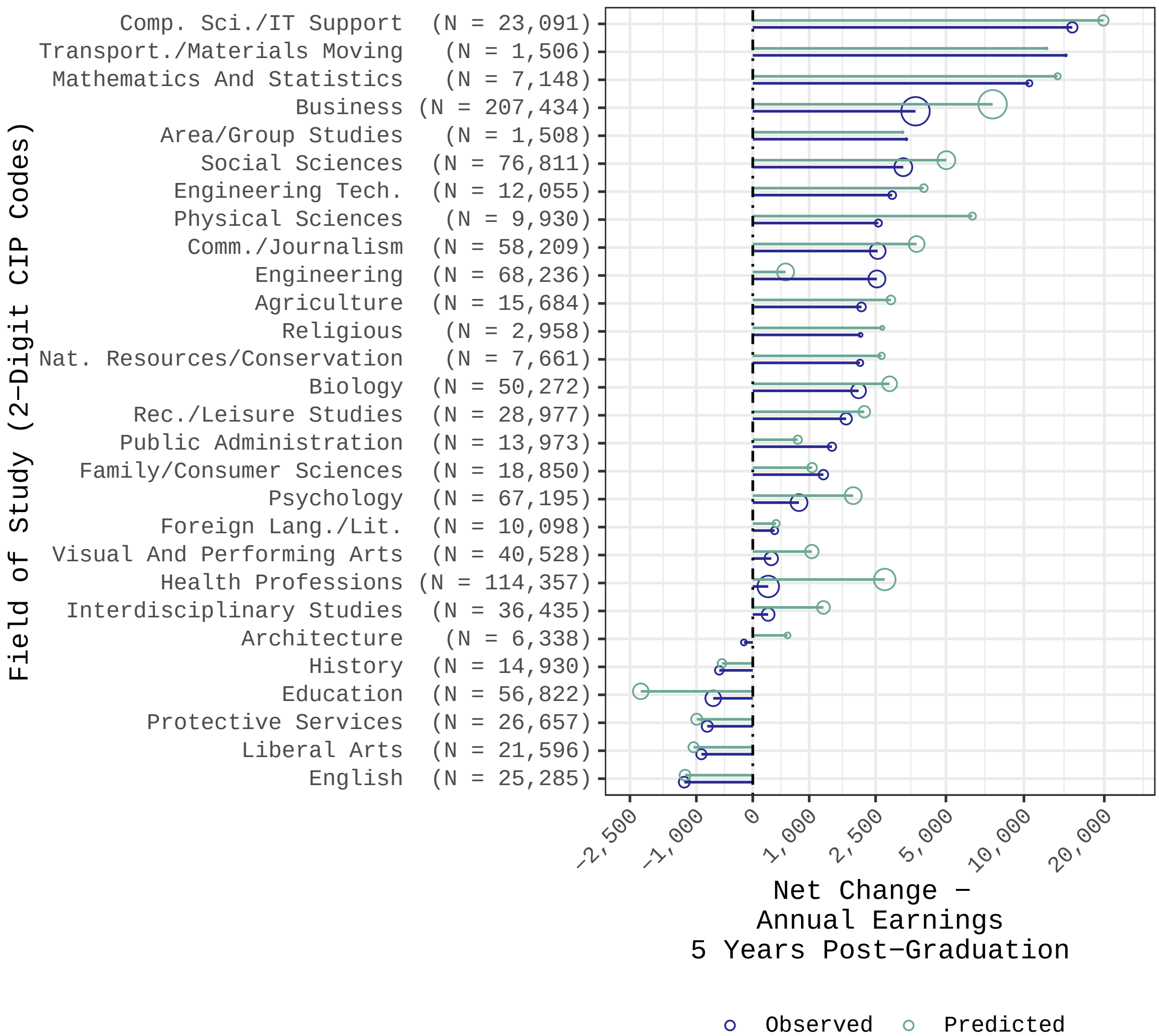

Figure 5: Change In Observed Average Field of Study (Two-Digit CIP Codes) Annual Earnings Five Years Post Graduation, Comparing Cohorts 2013–2015 to Cohorts 2001–2003

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes; The American Community Survey.
Notes: Only fields of study with at least 1,000 graduates per year (3,000 per cohort span) are shown. Size of circles is correlated with the number of students graduating in each cohort. ‘N =” for each cohort refers to their absolute sizes for graduating cohorts 2013–2015.

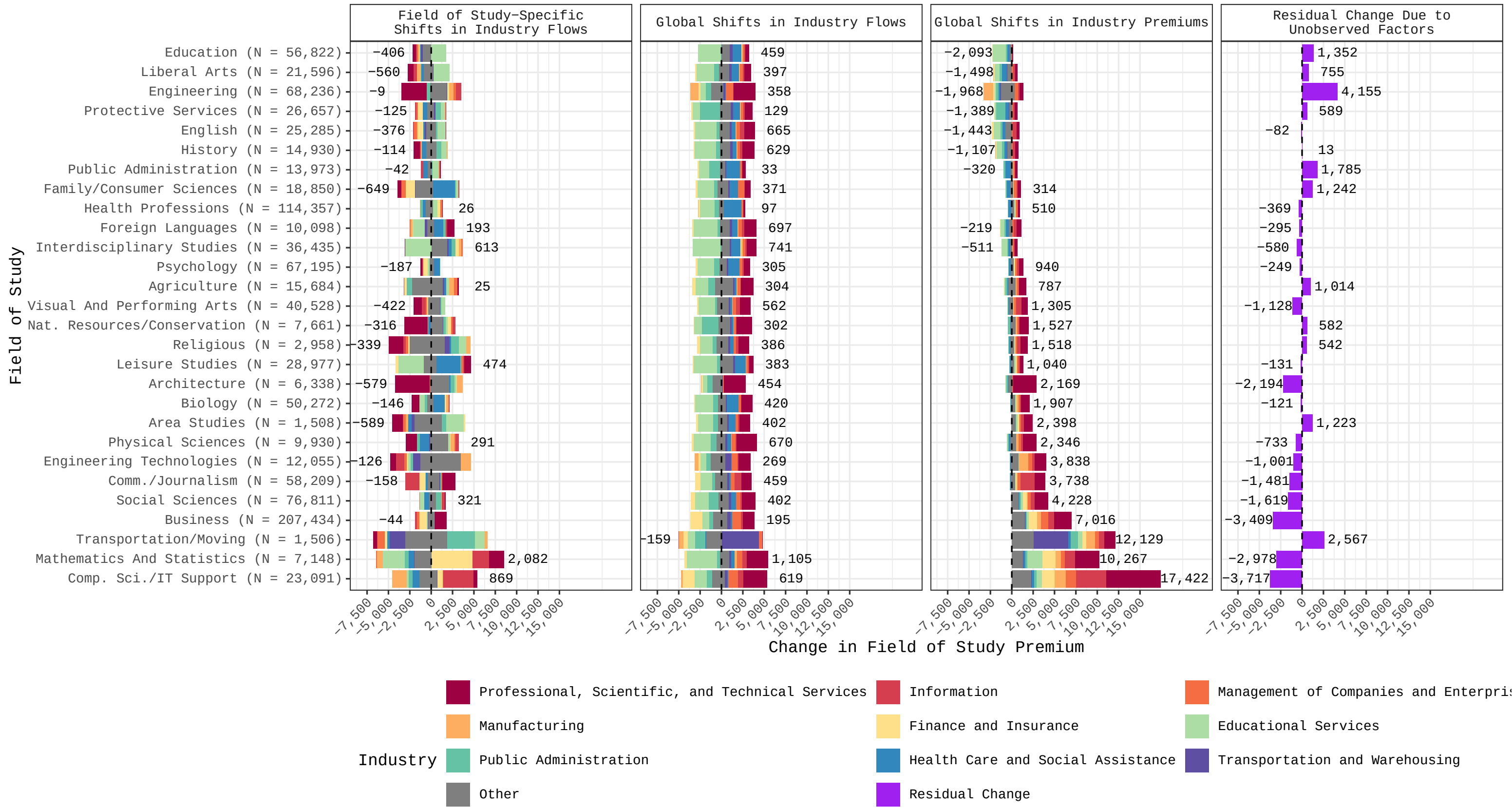

Figure 6: Kitagawa-Oaxaca-Blinder Decomposition of Observed Changes Between 2001–2003 and 2011–2013 Graduates in Field of Study average annual earnings at the Bachelor's Level, Using Observed Changes in FOS-Industry Flows Changes in Calculated Industry-Level Average Annual Earnings

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes, The American Community Survey.
Notes: Numbers next to each set of stacked bars represent the total change in average earnings for a given field of study, summed across all industry contributions of a given kind, be they positive or negative. The nine industries with the largest contributions are shown explicitly, while the others are labeled "Other."

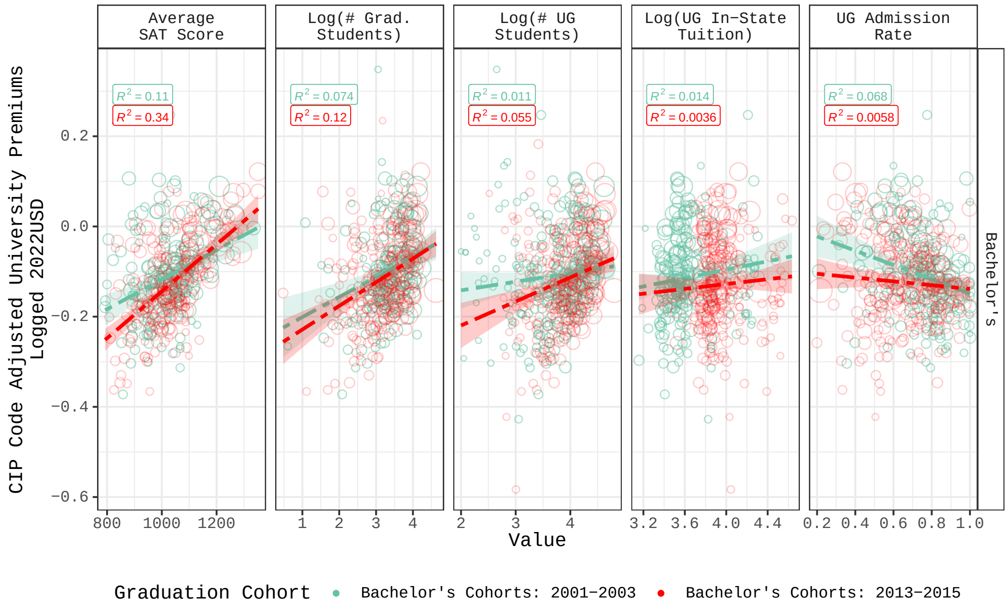

Figure 7: Degree-Granting Institution Average Premiums, After Adjusting for Distribution of Fields of Studies, Regressed on Institutional Characteristics for Two Cohorts

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes; The U.S. Department of Education's College Scorecard.

Table 1: Table displaying exemplars of existing literature on horizontal and vertical stratification in income based on education, separated into point-in-time and change-over-time accounts.

<table>
<tr><th colspan="2"></th><th>Within Cohorts (point-in-time)</th><th>Across Cohorts (change-over-time)</th></tr>
<tr><td colspan="2">Vertical Stratification
(between degree-level)</td><td>• Heterogeneous returns to college (Brand and Xie 2010)
• College as equalizer (Torche 2011; Zhou 2019)</td><td>• Education–technology race framework (Goldin and Katz 2008)
• Task polarization and wage trends (Autor 2014)
• College premium plateau (Autor et al. 2020)</td></tr>
<tr><td rowspan="3">Horizontal Stratification
(within degree-level)</td><td>Field of study</td><td>• Causal field of study effects, Norway (Kirkeboen et al. 2016)
• field of study channeling and stratification (van de Werfhorst 2002)
• Earnings by major (Carnevale et al. 2013)
• ∗See bottom-right cell.∗</td><td>• Changes in College Skills and the Rise in the College Wage Premium (Grogger and Eide 1995)
• ∗See bottom-right cell.∗</td></tr>
<tr><td>Institution</td><td>• Effects of elite college attendance (Brewer et al. 1999)
• Estimating the returns to elite colleges (Dale and Krueger 2002)
• Effects of college prestige (Brand 2006)
• ∗See bottom-right cell.∗</td><td>• Changes in college match in NLSY (Dillon and Smith 2020)
• ∗See bottom-right cell.∗</td></tr>
<tr><td>Field & institution</td><td>• Horizontal Stratification in Norway (Borgen and Mastekaasa 2018)
• ∗See bottom-right cell.∗</td><td>• Changing Regressivity of College Degree (Bleemer and Quincy 2025)
• Changing Horizontal Stratification (The present study)</td></tr>
</table>

Notes: ∗ Change-over-times accounts necessarily always overlap with point-in-time accounts. Likewise, accounts of horizontal stratification by field of study and institution always overlap with accounts separately by field of study or institution. Studies that do so are only included in their most specific cell in the above table to avoid needless repetition.

Table 2: Characteristics of PSEO Sample, All U.S. 4-Year Colleges, and the Reweighted PSEO Sample, By Instituion

	Admission Rate	Average SAT	In-State Tuition	Graduates	Undergraduates	% Private
Target	71.3 %	1,169	16,612	1,231	7,643	38.9 %
Sample	74.3 %	1,127	12,939	3,276	11,894	14.7 %
Reweighted	70.6 %	1,161	13,197	1,279	8,176	34.0 %

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes.

Notes: Methods for weighting data are detailed in the supplementary appendix.

Table 3: Summary Characteristics of Workers Five Years After Graduation Included In Data

Graduation Cohort	Individuals	Schools	FOS (4 Digit)	FOS (2 Digit)	FOS-School (4 Digit)	FOS-School (2 Digit)	Average Salary (2022USD)
Full Data							
2001-2003	586,872	275	227	34	4,890	2,849	58,427
2004-2006	902,432	338	251	36	6,310	3,620	57,494
2007-2009	932,181	376	256	36	7,379	4,156	55,410
2010-2012	1,134,101	434	273	36	8,888	4,941	58,497
2013-2015	1,309,057	460	274	36	9,808	5,387	61,311
Restricted Set							
2001-2003	579,723	270	227	34	4,842	2,818	58,354
2004-2006	801,515	270	247	36	5,523	3,134	57,342
2007-2009	746,814	270	247	35	5,703	3,197	55,310
2010-2012	818,058	270	258	35	6,161	3,378	57,967
2013-2015	900,124	270	261	36	6,635	3,555	60,646

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes.

Notes: The restricted data set only contains those schools which are present in all five cohorts.

Table 4: Top and Bottom Ten University-Fields of Study Combinations by Median Earnings Five Years Post-Graduation

University	Field of Study	Earnings Rank	Median Annual Pay (2022USD)	25th and 75th Annual Pay Percentiles (2022USD)	Number Graduates	% of Grads in Major Ind.
Top and Bottom 10 Credentials - Bachelor's - Graduates 2001-2003						
TX Tech Univ.	Engineering	1	192,914	[150,091, 250,007]	32	0.32
TX A&M Univ.	Engineering	2	166,293	[128,850, 220,166]	99	0.30
Univ. of TX - Austin	Engineering	3	164,801	[126,484, 220,373]	66	0.32
Colorado School of Mines	Engineering	4	156,629	[125,880, 213,300]	53	0.40
Montana Technological Univ.	Engineering	5	153,211	[108,199, 197,490]	52	0.27
OR State Univ.	Pharmacy	6	150,091	[135,781, 166,639]	54	0.33
Purdue Univ.	Pharmacy	7	142,605	[117,974, 163,485]	114	0.53
LA State Univ. & A&M Colg.	Engineering	8	140,944	[113,341, 171,849]	35	0.31
Univ. of LA at Monroe	Pharmacy	9	137,486	[119,561, 160,715]	33	0.85
Univ. of Montana (The)	Pharmacy	10	132,068	[112,895, 152,543]	145	0.48
Fort Lewis Colg.	Anthropology	4,881	32,304	[24,601, 43,164]	31	0.16
North Greenville Univ.	Religious	4,882	32,304	[25,573, 41,247]	58	0.19
Kent State Univ.	Drama/Theatre	4,883	32,219	[25,944, 44,441]	49	0.16
Univ. of OR	Ethnic, Cultural Minority, Gender, And Group Studies	4,884	32,004	[25,476, 45,923]	53	0.29
McNeese State Univ.	Fine And Studio Arts	4,885	31,462	[25,726, 46,077]	30	0.31
LA State Univ. & A&M Colg.	Drama/Theatre	4,886	30,499	[22,705, 47,315]	38	0.18
Univ. of Northern Colorado	Music	4,887	30,132	[21,188, 49,171]	59	0.25
Shenandoah Univ.	Drama/Theatre	4,888	29,535	[18,267, 43,942]	63	0.31
Univ. of WI - Madison	Music	4,889	29,471	[19,726, 52,390]	42	0.18
Univ. of Colorado Boulder	Religious	4,890	27,929	[20,809, 41,247]	31	0.23
Top and Bottom 10 Credentials - Bachelor's - Graduates 2013-2015						
Univ. of IL Urbana-Champaign	Computer Science	1	166,721	[112,653, 254,204]	602	0.40
Univ. of IL Urbana-Champaign	Math and Comp. Science	2	159,898	[115,503, 215,797]	48	0.27
CUNY York Colg.	Health Professions	3	155,421	[123,532, 180,099]	66	0.63
Univ. of MI	Engineering	4	152,543	[105,327, 217,603]	185	0.32
TX A&M Univ.	Engineering	5	152,452	[100,629, 196,714]	434	0.29
Univ. of MI	Comp. Sci./IT Support	6	149,209	[100,201, 219,616]	937	0.33
Univ. of IL Urbana-Champaign	Engineering	7	139,026	[102,524, 193,422]	354	0.31
Univ. of TX - Austin	Engineering	8	138,198	[93,492, 176,053]	310	0.31
Univ. of HI at Hilo	Pharmacy	9	136,317	[115,039, 158,518]	173	0.48
Univ. of VA	Comp. Sci./IT Support	10	133,589	[104,328, 194,440]	239	0.44
VA Commonwealth Univ.	Dance	9,799	29,535	[23,235, 47,728]	33	0.17
Southeast MO State Univ.	Visual/Performing Arts	9,800	29,357	[22,629, 41,247]	46	0.27
Univ. of WI - Superior	Fine And Studio Arts	9,801	29,214	[23,506, 37,919]	41	0.21
S. OR Univ.	Fine And Studio Arts	9,802	29,097	[21,314, 40,050]	48	0.22
Univ. of Montana (The)	Drama/Theatre	9,803	28,630	[21,459, 42,445]	64	0.19
GA S. Univ.	Drama/Theatre	9,804	28,357	[20,809, 34,799]	35	0.18
Kennesaw State Univ.	Drama/Theatre	9,805	28,143	[21,871, 42,845]	49	0.14
Shenandoah Univ.	Drama/Theatre	9,806	28,126	[20,947, 37,683]	60	0.20
Central CT State Univ.	Drama/Theatre	9,807	26,002	[18,608, 37,919]	33	0.13
Morris Colg.	Health Professions	9,808	24,449	[18,677, 33,810]	37	0.25

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes.

Notes: Numbers of graduates are cumulative over three graduating cohorts for bachelor's degrees. "% of Grads in Major Ind." refers to the proportion of grads in a given credential who work in the most common industry. Because of data limitations, these refer to the parent 2-digit CIP code of the credential in question. All other statistics are calculated at the 4-digit CIP code level.

Table 5: Top 10 Fields of Study for Cohorts 2001-2003 and 2013-2015, By CIP Code Aggregation Level

CIP Code	CIP Description	Percent Share	Rank	CIP Code	CIP Description	Percent Share
2 Digit CIP Codes						
52	Business & Related Services	29.9 %	1	52	Business & Related Services	24.5 %
13	Education	8.2 %	2	51	Health Professions	9.1 %
45	Social Sciences	6.9 %	3	42	Psychology	6.5 %
51	Health Professions	5.9 %	4	13	Education	6.5 %
42	Psychology	5.7 %	5	45	Social Sciences	6.4 %
11	Comp. Sci. & Info. Support.	5.5 %	6	9	Comm, Journalism & Related	4.9 %
9	Comm, Journalism & Related	4.7 %	7	26	Biological & Biomedical Sci.	4.5 %
30	Multi/Interdisc. Studies	3.5 %	8	14	Engineering	3.9 %
14	Engineering	3.5 %	9	11	Comp. Sci. & Info. Support.	3.9 %
26	Biological & Biomedical Sci.	3.4 %	10	50	Visual & Performing Arts	3.8 %
4 Digit CIP Codes						
52.02	Business Admin, Mgmt & Ops	9.1 %	1	52.02	Business Admin, Mgmt & Ops	8.0 %
13.12	K-12 Education	5.4 %	2	42.01	Psychology (General)	5.6 %
42.01	Psychology (General)	5.0 %	3	51.38	Nursing	5.3 %
52.13	Mgmt. Sciences & Quant. Methods	4.1 %	4	13.12	K-12 Education	4.2 %
52.03	Accounting & Related Services	3.9 %	5	26.01	Biology (General)	3.6 %
30.99	Multi/Interdisc., Other	3.2 %	6	52.03	Accounting & Related Services	3.6 %
52.08	Finance & Financial Mgmt	3.1 %	7	24.01	Liberal Arts & (General) Studies	3.0 %
51.38	Nursing	2.7 %	8	52.08	Finance & Financial Mgmt	2.4 %
26.01	Biology (General)	2.7 %	9	23.01	English Lang. & Lit. (General)	2.3 %
45.11	Sociology	2.7 %	10	43.01	Criminal Justice	2.3 %

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes.

Notes: Percent shares are based on weighted sample.

Table 6: Variance, Covariance, and Correlations of Institution and Field of Study Fixed Effects Across Graduating Cohorts

Graduation Cohort	Covariance Institution-FOS	Correlation Institution-FOS	Variance Institution	Variance FOS	Total Variance
2001–2003	0.0010	0.0629	0.0083	0.0322	0.1904
2004–2006	0.0009	0.0514	0.0089	0.0322	0.1902
2007–2009	0.0010	0.0553	0.0092	0.0376	0.2052
2010–2012	0.0009	0.0483	0.0096	0.0372	0.2052
2013–2015	0.0012	0.0624	0.0098	0.0405	0.1990

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes.
Notes: All metrics are with respect to inflation-adjusted logged average earnings.

Supplemental Appendix

Is It *Where* You Study or *What* You Study?

Changing Horizontal Stratification in Bachelor's Degrees in the 21st Century

Contents

Supplementary Methods A1

Comparing the Representativeness of PSEO Data to All United States Institutions of Higher Education A1

Calculating Industry-Level Average Earnings from ACS Data A2

Calculating Average Annual Earnings by Field of Study Adjusting for Industry Shares A2

Assessing Changes in Field of Study Premiums Alongside Underlying Demographic Changes and Changes to Industry Flows A3

Robustness Checks Specifications A5

Supplemental Figures A7

Figure A1 - Map of Included Degree-Granting Institutions Showing Unequal Coverage by State A7

Figure A2 - Replication of Primary Analysis, Visualized by Cohort and Year of Follow-Up A8

Figure A3 - Reanalysis of Main Text Figure 7: Institution Average Premiums, After Adjusting for Distribution of Fields of Studies, Regressed on Constant Institutional Characteristics (Average Institutional Characteristics Across All Cohorts) for Two Cohorts A9

Figure A4 - Various Robustness Checks of the Primary Decomposition Analysis, Variably Alternating the Level of CIP Code Aggregation, Logged and Unlogged Outcomes, the Distribution Functional Form, Weights for Missingness, and the Presence of Non-Workers A10
Figure A5 - Figure 5 With Added Comparison for Expected Changes in Earnings Based on Demographic Recomposition by Field of Study. . . A11

Supplemental Tables A12
Table A1 - Fixed Effects Models Comparison - Field of Study Average Earnings Predicted By Demographics or Industry A12

Supplementary Methods

Comparing the Representativeness of PSEO Data to All United States Institutions of Higher Education

The PSEO data are based on state-, agency-, and institution-level agreements with the U.S. Census Bureau, the IRS, and the LEHD. As such, the data are not representative of all institutions of higher education that offer bachelor's degrees. To quantify this discrepancy and adjust for it, I use an entropy balancing procedure that reweights the observed PSEO sample so that it matches the broader population of universities and colleges on a set of observable characteristics.

Using the Department of Education's College Scorecard (also used in the main analysis), institutional attributes such as mean SAT scores, whether it is public or private, undergraduate tuition, undergraduate enrollment, graduate enrollment, and selectivity can be gleaned for the near-universe of U.S. institutions of higher education.

Formally, let the "target" group be institutions not included in the PSEO for the entire temporal span of the dataset and the "sample" group be institutions included throughout. Entropy balancing chooses nonnegative weights w_u for the included (sample) institutions to minimize the Kullback–Leibler divergence from uniform weights subject to first moment-matching constraints on observed covariates. Denoted by $\mathbf{X}_u$ in equation 1 is the vector of institution-level characteristics:

$$\mathbf{X}_u = \left[\text{Private}_u,\ N_u^{\text{gr}},\ \log N_u^{\text{gr}},\ N_u^{\text{ug}},\ \log N_u^{\text{ug}},\ \log(\text{Tuition}_u),\ \text{SAT}_u,\ \text{AdmRate}_u\right]^\top \quad (1)$$

Equation 2 shows the optimization problem.

$$\min_{\{w_u \geq 0\}} \sum_{u \in \text{Sample}} w_u \log w_u \quad \text{s.t.} \quad \sum_{u \in \text{Sample}} w_u \, \mathbf{X}_u = \frac{1}{N_{\text{Target}}} \sum_{u' \in \text{Target}} \mathbf{X}_{u'}, \ \sum_{u \in \text{Sample}} w_u = 1 \quad (2)$$

Intuitively, this assigns more weight to included institutions whose characteristics are underrepresented relative to the target and less weight to those that are overrepresented, while preserving as much of the original distribution as possible.

I limit extreme weights to their values at the 2.5th and 97.5th percentiles to mitigate the influence of outliers. The resulting weights are applied to the included institutions in all reweighted summaries and figures. The effectiveness of the reweighting (i.e., balance on the covariates listed above before and after weighting) is displayed in the main text in Table 2.

Calculating Industry-Level Average Earnings from ACS Data

Since graduation year is not observed in the ACS, I assume that all graduates were on average 23-years-old upon graduation, and I used the annual earnings of all workers working full time who are aged 27-29 at the time of the survey. While not a perfect solution, the methods described below will show that it only matters for calculating annual earnings relative to each other since the primary datasource remains the PSEO-based distributions of annual earnings by field of study.

Calculating Average Annual Earnings by Field of Study Adjusting for Industry Shares

These average annual earnings by field of study and industry net of each other $\alpha_{f,y}$ and $\beta_{ind,y}$, respectively, in a given year (y) can be computed based on share of flows from field of study to industry as a proportion of total graduating students $S_{f,ind,y}$. We may assume the following additive decomposition model (equations 3 and 4):

$$\omega_{f,y} = \alpha_{f,y} + \sum_{ind} S_{f,ind,y} \cdot \beta_{ind,y} \tag{3}$$

$$\omega_{ind,y} = \beta_{ind,y} + \sum_{f} S_{f,ind,y} \cdot \alpha_{f,y} \tag{4}$$

Where $\omega_{f,y}$ is the observed average annual earnings for a field of study in a given year, known from the LEHD/PSEO data, and $\omega_{ind,y}$ is the average annual earnings in an industry in a given year for all college graduates, known from the ACS data. To solve the above system of equations, I must simply add a constraint that the mean industry effects are mean zero:

$$\sum_{ind,y} \beta_{ind,y} = 0 \tag{5}$$

This system of three equations (equations 3-5) may then be solved using least squares, performed separately for each year. With the final estimates of $\hat{\alpha}_{f,y}$ and $\hat{\beta}_{ind,y}$, which correspond to the industry-adjusted field of study-specific average wages and the field of study-adjusted industry-specific average wages respectively, it is possible to calculate average expected annual earnings by field of study and industry combination.

Using the estimates of $\hat{\alpha}_{f,y}$ and $\hat{\beta}_{ind,y}$ from above combined with flows data, the predicted aggregate average annual earnings for a given field of study in a particular year (${\omega'}_{f,y}$) can be compared to their observed values ($\overline{\omega}_{f,y}$), giving a sense of the extent to which observed shifts in annual earnings are due to changing flows to industry and industry-level expansion and contraction. It is worth noting at this moment that this analysis relies on the additivity of industry effects and field of study effects and that there be no interactive effects between the two. Otherwise put, a student with a computer science degree and a liberal arts degree, both working in the same industry of "Information" would earn salaries commensurate with the additive effects of their fields of study and industries. This would not allow for any synergistic effects for computer science majors, given they are working in a industry that is especially proximate to their field of study. While this is a strong assumption, it once again makes my estimates an underestimate of the total effect of industry in the following analysis since interactive effects are disregarded. Further, in the following analysis, I explicitly quantify this residual effect for comparison and interpretation.

Assessing Changes in Field of Study Premiums Alongside Underlying Demographic Changes and Changes to Industry Flows

It is not mutually incompatible that changing field of study average wages may reflect changing industry destinations and industry-level average wages and that fields of study may be changing demographically, which in turn changes the prestige or desirability of a given field of study. Indeed, these two processes may be happening simultaneously and/or because of each other without being necessarily competing explanations. Nevertheless, comparing how parsimonious each is in explaining changing field of study-level premiums is a natural first step in understanding which question is more first-order.

In order to compare how well each source of variation predicts changes in average wages in the time period examined, I pursue a fixed effects model that fully accounts for between-unit heterogeneity and adds within-unit continuous regressors. I then examine the within-unit R^2 in order to understand how well each does. As with most primary analyses, this is performed on wages for recipients of bachelor's degrees, five years after they graduated. For each field of study-specific average wage $\overline{\omega}_f$, observed separately for each graduation year y, X years after graduation, I regress it on field of study-specific fixed effects F_f. To test the predictive power of demographic change, I add a vector of field of study-specific demographic variables $\xi_{f,y}$, which includes the percentage in each field of study that is male or female and either white, black, asian, and hispanic (the intersection thereof). This is eight continuous variables in total. To test the predictive power of industry flows, I simply add the expected average income based on the industry-weighted average of industry-specific average wages, as explained in the main text. This is a singular variable.

As this is a fixed effects model, the static characteristics of each field of study will be captured by the field of study fixed effect. Baseline values of either expected wages based on industy composition or demographic characteristics will be "netted out," so the only source of variation will be within-unit changes in these continuous indicators. Thus, I will use the within-unit R^2 to understand the predictive power of $\xi_{f,y}$ and $ln(\overline{\omega}^*_{f,Y})$, alternatively. A value of 1 would indicate 100% explanatory power of either to explain wage changes over the period observed, as compared to 0, which would indicate no predictive power. Using these methods, I can also create an alternative version of the main text's Figure 5, which shows predicted changes in field of study average wages based on demographic changes.

$$ln(\overline{\omega}_f|Y = y + X) = F_f + \xi_{f,y} + \epsilon_{f,y} \tag{6}$$

$$ln(\overline{\omega}_f|Y = y + X) = F_f + ln(\overline{\omega}^*_{f,Y}) + \epsilon_{f,Y} \tag{7}$$

Regression estimates are shown in in Appendix Table A1, and an alternative version of Figure 5 is shown in Appendix Figure A5, below.

Robustness Checks Specifications

Appendix Figure A4 displays eight robustness checks. Below, each is detailed in the order that it appears in the figure.

- **2 Digit CIP Codes + Log-Normal Distribution** – I replace 4 digit CIP Codes (N = 267) with parent 2 digit CIP Codes (N = 36). As in the primary analysis, the outcome (earnings) is logged.
- **2 Digit CIP Codes Without Logged Outcomes** – I replace 4 digit CIP Codes (N = 267) with parent 2 digit CIP Codes (N = 36). The outcome (earnings) is untransformed.
- **2 Digit CIP Codes WIthout Logged Outcomes** – I replace 4 digit CIP Codes (N = 267) with parent 2 digit CIP Codes (N = 36). The outcome (earnings) is untransformed. I include non-workers as earners with an income of $0. The number of workers not employed is available at the credential-cohort level for 2 digit CIP Codes, though it is not available at the 4 digit Level.
- **4 Digit CIP Codes + Log-Normal Distribution** – This is the primary analysis, where the outcome is log-normalized, and 4 digit CIP Codes are used.
- **4 Digit CIP Codes + Pareto Distribution** – I replace the assumed log-normal distribution within each credential with a piecewise log-normal/Pareto distribution. This distribution is identical for all workers below the 98th percentile. For those above the 98th percentile, I replace the assumed log-normal distribution within each credential with draws from a Pareto distribution with an α value of 2.
- **4 Digit CIP Codes + Reordered Fixed Effects** – This specification is identical to the primary analysis but reverses the order of inclusion of fixed effects, with institutional fixed effects added before those for field of study. In practice, this approach necessarily attributes a larger share of earnings variation to institutions, since differences by field are only measured after controlling for where students

studied. In this scenario, the institutional effects also capture differences that may in fact be attributable to variation in fields of study.

- **4 Digit CIP Codes + Unweighted** – This analysis uses the same specification as the primary model but does not weight use the weights calculated to make the sample more closely match the target population of all U.S. schools offering 4-year degrees.

- **Semi-Aggregated (N = 64) 4-Digit CIP Codes + Log-Normal Distribution** – This analysis uses the same specification as the primary model but replaces the 267 CIP codes with a more aggregated set of 64 CIP codes. As opposed to using 2 digit CIP codes, this uses the 30 largest 4 digit CIP codes alongside "remainders." For instance, CIP code 13.12 or "K-12 Education" is used, and a new "remainder" CIP code is created for all CIP codes that begin with 13 but are not 13.12. For 2 digit parent CIP codes with multiple children 4 digit CIP codes that are in the top 30 CIP codes, all get separate entries before calculating the remainder. 2 digit CIP codes with no children 4 digit CIP codes constituting the top 30 are still included. This condition is created to show that it is not merely mechanistic that fields of study capture so much variation compared to institutions, as much of the result can be replicated with a restricted set of CIP codes.

Supplemental Figures

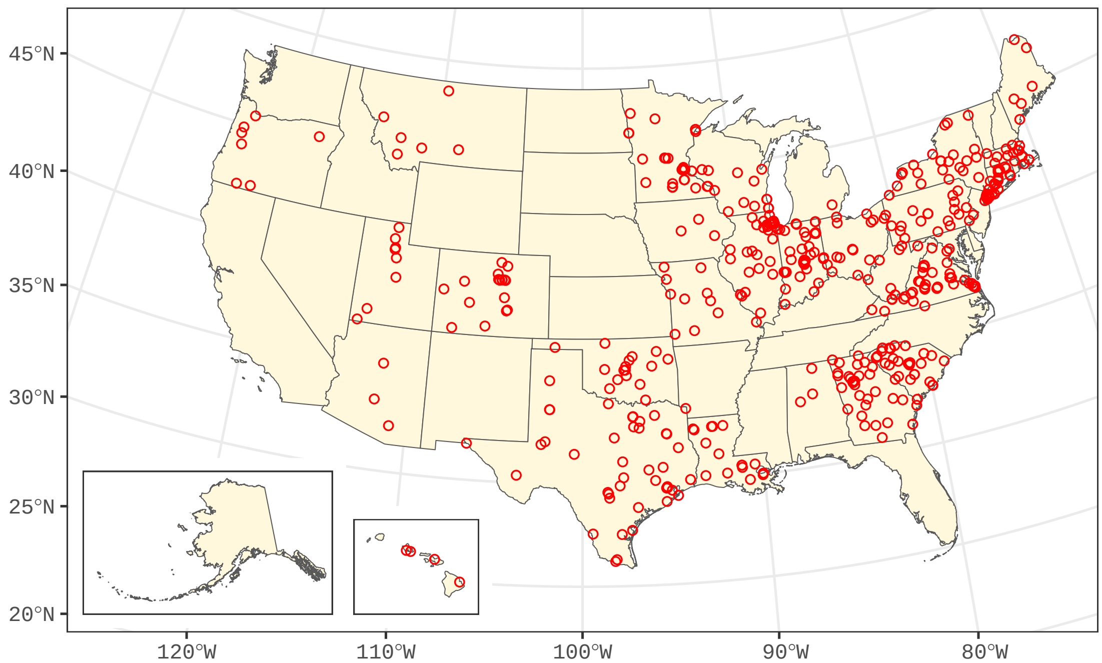

Figure A1. Map of Included Degree-Granting Institutions Showing Unequal Coverage by State

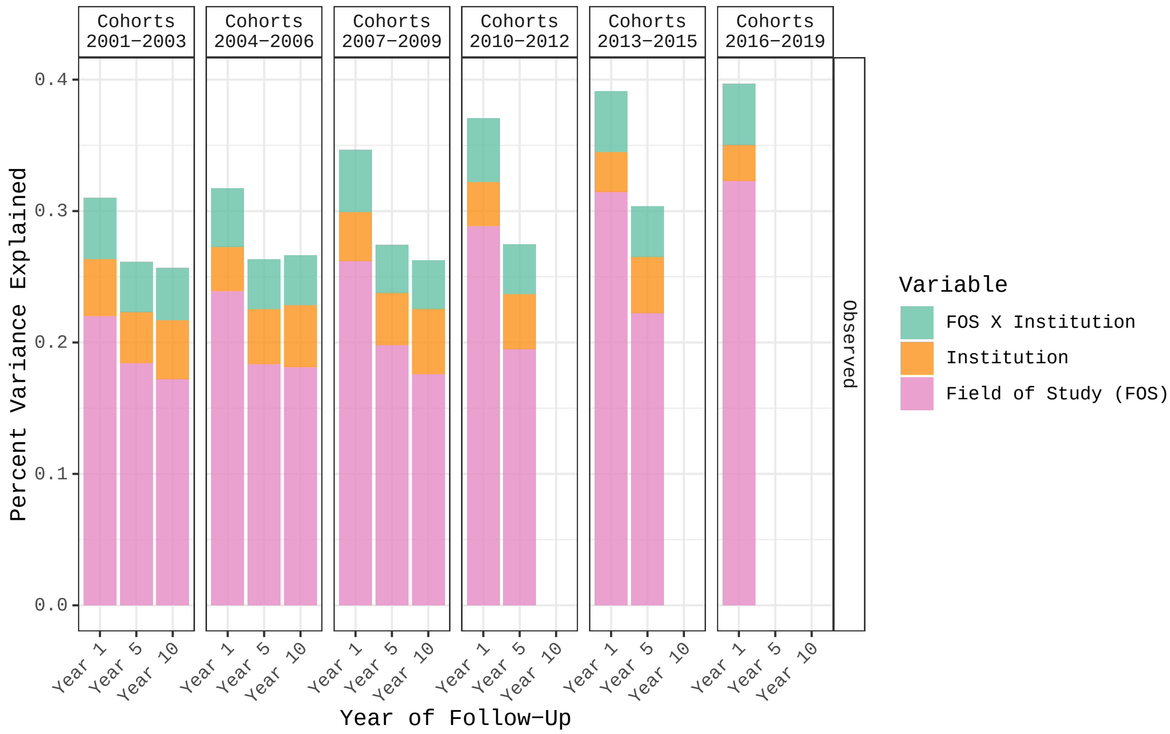

Figure A2. Replication of Primary Analysis, Visualized by Cohort and Year of Follow-Up

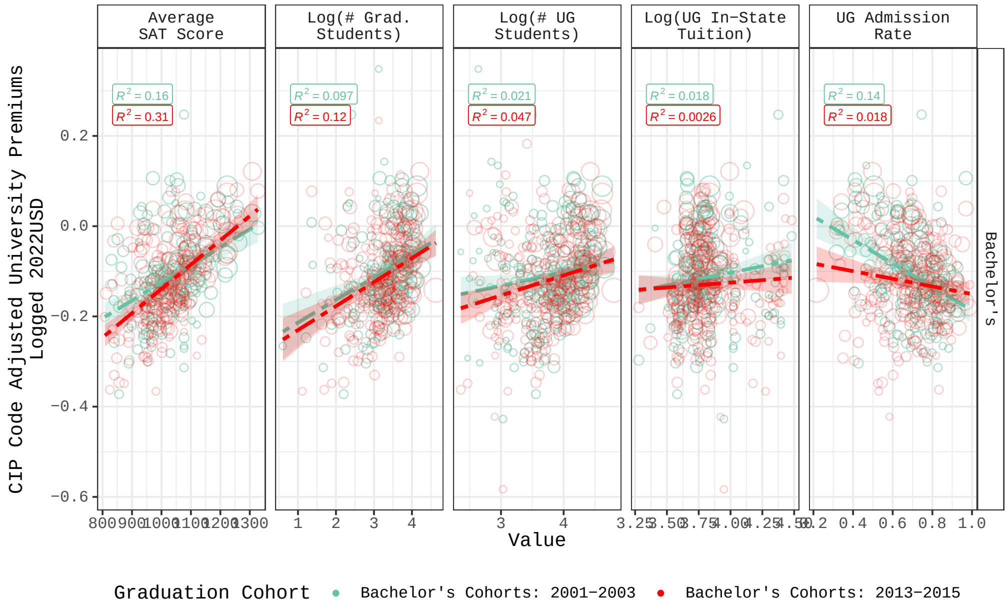

Figure A3. Reanalysis of Main Text Figure 7: Institution Average Premiums, After Adjusting for Distribution of Fields of Studies, Regressed on Constant Institutional Characteristics (Average Institutional Characteristics Across All Cohorts) for Two Cohorts

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes; The U.S. Department of Education's College Scorecard.

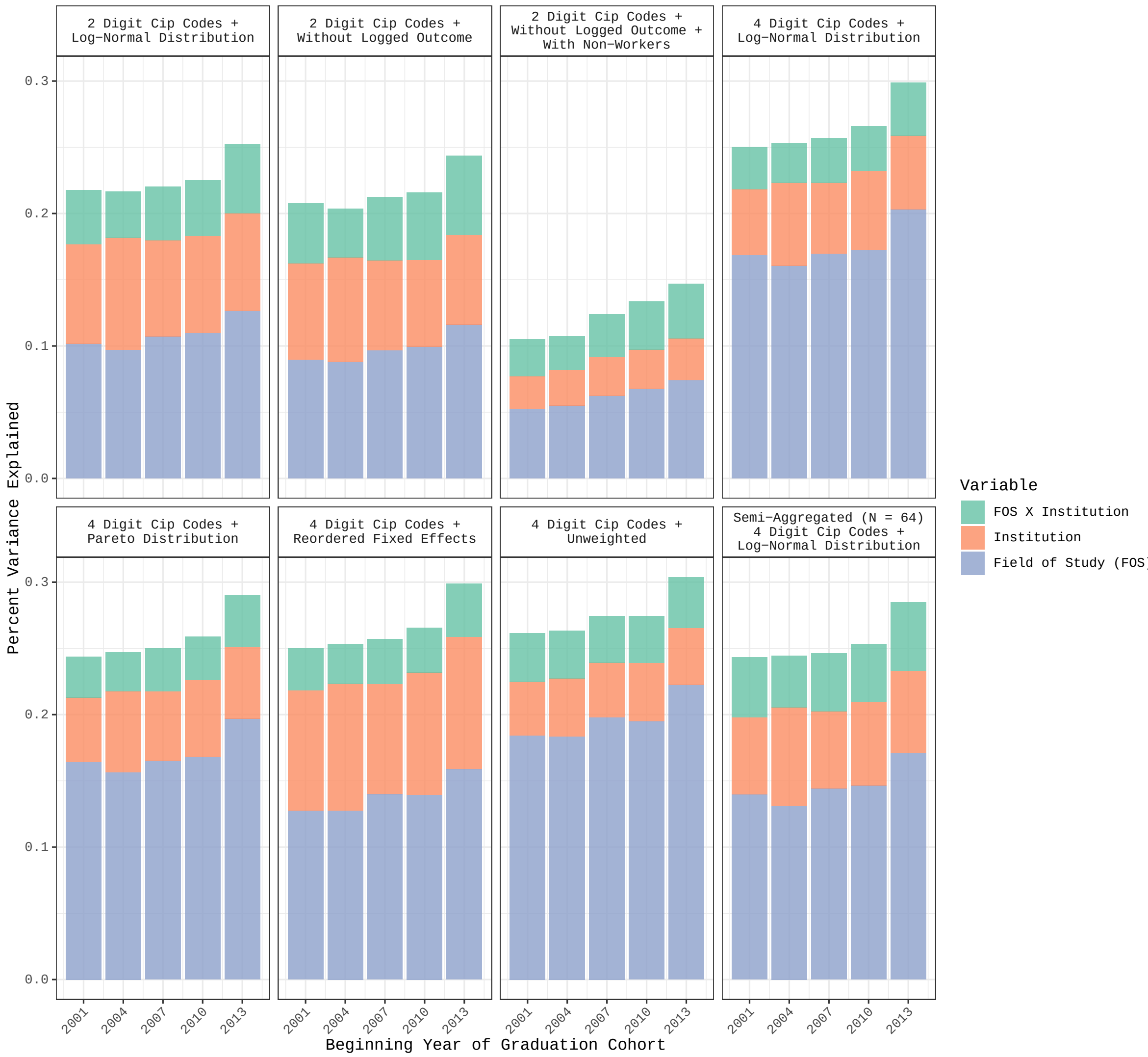

Figure A4. Various Robustness Checks of the Primary Decomposition Analysis, Variably Alternating the Level of CIP Code Aggregation, Logged and Unlogged Outcomes, the Distribution Functional Form, Weights for Missingness, and the Presence of Non-Workers

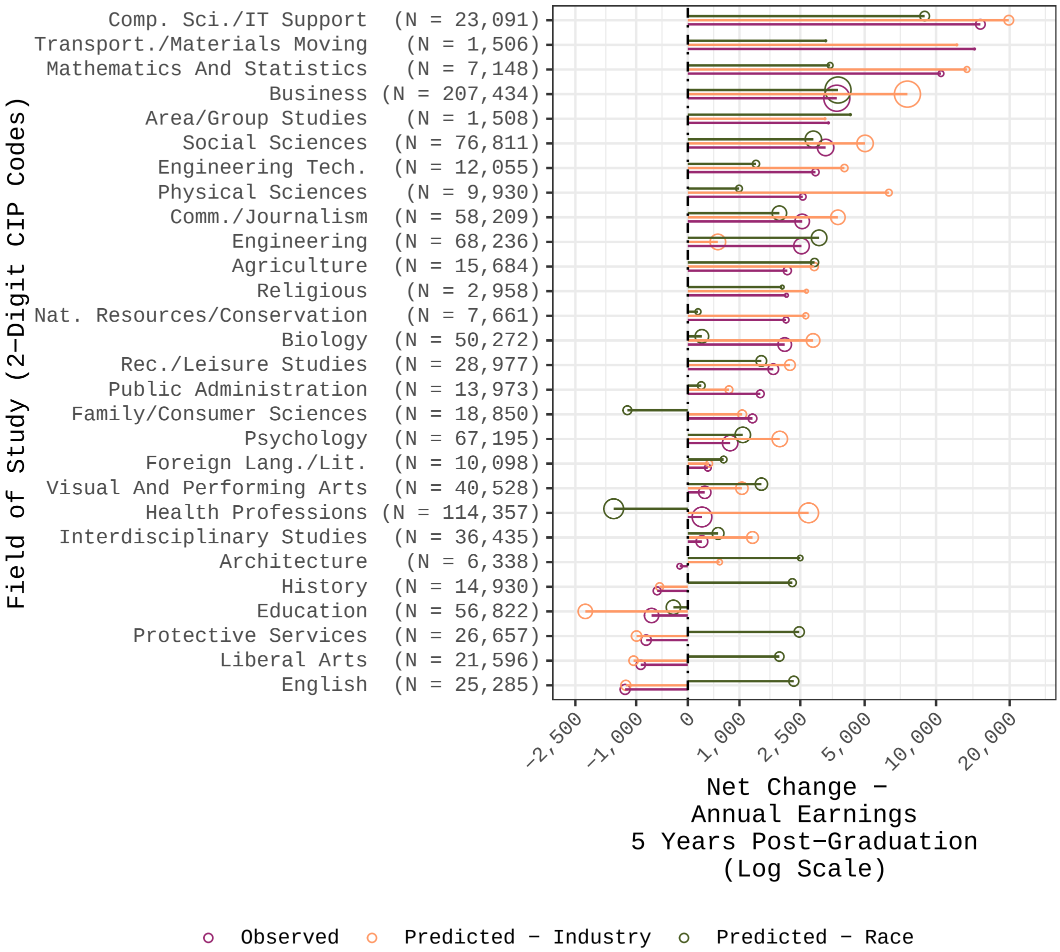

Figure A5. Figure 5 With Added Comparison for Expected Changes in Earnings Based on Demographic Recomposition by Field of Study.

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes, American Community Survey, National Center for Education Statistics, The College Scorecard.

Notes: Only fields of study with at least 1,000 graduates per year (3,000 per cohort span) are shown. Size of circles is correlated with the number of students graduating in each cohort. “N = ” for each cohort refers to their absolute sizes for graduating cohorts 2013–2015.

Supplemental Tables

Table A1. Fixed Effects Models Comparison - Field of Study Average Earnings Predicted By Demographics or Industry

	Log(Average Earnings)	
Model:	(1)	(2)
Variables		
Pred. Earnings Based on Industry (Logged)	0.7980***	
	(0.0552)	
White Men		-0.2922
		(0.3656)
White Women		0.0472
		(0.2120)
Black Non-Hispanic Women		-0.9098
		(0.9289)
Black Non-Hispanic Men		-0.0610
		(1.4813)
Asian Men		1.7255*
		(0.8260)
Asian Women		-2.9202**
		(1.0579)
Hispanic Women		-0.1739
		(0.5425)
Hispanic Men		0.6782**
		(0.2433)
Fixed-effects		
2-Digit CIP Code (32)	Yes	Yes
Graduation Cohort (5)	Yes	Yes
Fit statistics		
Observations	160	160
R^2	0.99623	0.98104
Within R^2	0.85615	0.27669

Clustered (2-Digit CIP Code) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes, American Community Survey, National Center for Education Statistics, The College Scorecard.
Notes: Demographics are the percent of each field of study that belong to each category. They do not sum to one, as there is a remainder that belong to one or more races and American Indian and Alaska Natives.