Degrees of Inequality:

Horizontal Stratification by Educational Institutions and Fields of Study in the 21st Century

Hunter York
Princeton University

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Abstract

This study leverages a novel dataset linking U.S. graduates' credentials—defined as combinations of educational institutions and fields of study—to individual earnings and industry destinations for cohorts from 2001 onward. It offers the first comprehensive estimates of how horizontal stratification across institutions, fields of study, and their intersections shapes earnings inequality among U.S. bachelor's degree holders over time. I find that field of study is a much stronger predictor of earnings than institutional affiliation, and its importance is growing. This growing importance is largely driven by baseline field of study linkages to industrial sectors that have seen rising average wages like finance, technology, and professional services. While variation between universities explains a smaller share of inequality, it is increasingly associated with observable institutional characteristics like test scores, size, and selectivity. Despite rising college enrollment, there is no evidence that shifts in enrollment patterns by institution or field explain these trends, nor that high- and low-earning credentials are differentially distributed across institutions. Rather, the findings suggest that as economic returns become increasingly concentrated in a small number of high-earnings industries, high-earning fields of study already closely tied to those industries have become even more so, reinforcing and consolidating new 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; Sekhri 2020), by field of study[1] (Altonji, Kahn, and Speer 2016; Kim, Tamborini, and Sakamoto 2015; Kirkeboen, Leuven, and Mogstad 2016), and by their intersections, here termed "credentials." These distinctions—what sociologists refer to as horizontal stratification[2]—shape early-career outcomes through distinct mechanisms, but most research has treated them in isolation using static, cross-sectional frameworks (see reviews by Gerber and Cheung 2008; Reimer and Thomsen 2019), and so we have no knowledge of their relative importance or how these relationships may be changing over time. Figure 1 provides a stylized representation of these forms of horizontal stratification. Further, little is known about the distributional properties of credentials—namely, which fields of study are most commonly pursued at which institutions, and how those combinations relate to labor market outcomes. The relevance of these changing dynamics in higher education unfolds amid expanding college enrollment and shifting labor market structures: technological change, the rise of gig and precarious work, and declining unionization all challenge traditional models of how different kinds of education can generate inequality.

Furthermore, these forms of horizontal stratification raise core sociological questions about how inequality is produced through organizational and categorical differences in

[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 comparisons across levels of education. "Academic program" might be a suitable alternative, though no term is fully satisfactory.

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

higher education, as their various forms operate through analytically distinct mechanisms. Institutional effects often reflect processes of prestige signaling, cultural capital transmission, and social network formation, while field-specific effects are more tightly linked to occupational closure, skill specificity, and professional socialization. The fact that these mechanisms differ so substantially makes horizontal stratification a rich site for examining how different dimensions of education are embedded in broader systems of social reproduction.

In this paper, I examine the dynamic landscape of horizontal stratification among U.S. bachelor's degree recipients and its role in shaping earnings inequality over time using a novel dataset that links educational credentials to labor market outcomes. I quantify the extent to which earnings are structured by (1) fields of study, (2) degree-granting institutions, and (3) their intersections ("credentials"), and I trace the changing importance and distribution of each over successive graduating cohorts. In doing so, I contribute new empirical clarity to a literature that has often treated these axes in isolation, by systematically measuring the distinct and combined effects of each. In addition to documenting patterns across the main forms of horizontal stratification, I examine how the major underlying mechanisms shaping each axis have driven these patterns, guided by theory-informed expectations specific to institutions, fields, and credentials, each of which reflects distinct processes of stratification.

To maintain analytic clarity, I focus on a single level of vertical stratification, bachelor's degree holders. This decision is both practical and theoretical. Bachelor's degrees are the most commonly awarded post-secondary credential in the U.S., with roughly two million conferred annually, and they serve as a key gateway to many labor market opportunities. Despite often being treated as a uniform marker of vertical status, outcomes among bachelor's recipients vary widely based on institutional and field-level characteristics, making this a critical site of horizontal differentiation. This focus is especially appropriate in the U.S. liberal arts system, where students often choose or change fields

after enrolling. Unlike more rigid systems such as Germany's, this flexibility makes it analytically possible and theoretically insightful to ask whether institutional or field-level characteristics matter more for inequality. If horizontal differentiation now plays a dominant role in shaping outcomes among degree-holders, as suggested by the theory of Effectively Maintained Inequality (Lucas 2001), then horizontal stratification may increasingly rival or surpass vertical stratification in its role in reproducing advantage. This would also carry implications for the view of higher education as a "great equalizer," which has highlighted horizontal variation as central to its core findings (Torche 2011; Zhou 2019).

Finally, this paper at times adopts a schooling-to-industry perspective, tracing how graduates from different fields of study are sorted into specific industrial sectors. This approach builds on recent work on school-to-work linkages (DiPrete et al. 2017; Bol and Eller 2019) and responds to a growing body of research showing that rising earnings inequality is driven less by individual traits and more by structural shifts at the firm and industry levels (Song et al. 2019; Wilmers and Aeppli 2021; Haltiwanger et al. 2024). While prior studies have emphasized occupations or individual skills, this analysis centers industry as one means amongst many for understanding horizontal stratification, given its growing role in shaping wage-setting, job quality, and mobility opportunities. In taking this schooling-to-industry perspective enabled by the novel data source I leverage, this paper moves beyond frameworks like Routine- or Skills-Biased Technological Change (RBTC) and STEM/non-STEM binaries, which often obscure how credentials are institutionally linked to labor market outcomes. It also highlights how horizontal stratification reflects not just acquired skills, but also the pathways connecting programs to specific economic sectors. Qualitative research showing substantial earnings variation among graduates with the exact same credential (Streib 2023) further underscores how within-credential forces like industry flows may play a central and underexamined role in the production of inequality.

The remainder of the introduction proceeds in five parts. In the first three, I quickly review existing research on horizontal stratification separately by field of study, by institution, and by their intersection, respectively. In doing so, I highlight the distinct mechanisms at work in each and the limitations of analyzing them in isolation, and I also examine the common challenges posed by data limitations and selection bias that have constrained prior work across all three domains. Then, I situate this study within the broader context of educational expansion and labor market transformation, making the case for an integrated, longitudinal approach to credential-based inequality. Finally, I develop the theoretical and empirical rationale for a dynamic framework that links all three forms of horizontal stratification to underlying institutional and economic structures, with a particular focus on field of study-to-industry linkages.

*** Figure 1 About Here ***

Differential Labor Market Outcomes by Field of Study and Field of Study-to-Work Linkages

Carnevale, Cheah, and Strohl (2013) find that differences in average annual earnings between degree-holders from different fields of study can exceed the overall college/high school earnings gap. In a human capital framework, fields of study differ greatly in the skills they confer to students, and these skills demand different earnings premiums on the labor market, differentiating the *general* human capital afforded by a vertically differentiated level of higher education from its horizontally-stratified *specific* forms (Kinsler and Pavan 2015; Kogan et al. 2021; Kambourov and Manovskii 2009; van de Werfhorst et al. 2001).

However, the economic value of a given major is shaped not only by the skills it immediately imparts upon graduation but also by the labor market destinations it makes possible. Some fields lead to high-paying occupations and industries immediately after

graduation but have limited long-term growth (e.g., nursing). Others may have lower entry-level wages but steeper earning trajectories over time (e.g., medicine), while still others (e.g., technology or consulting) combine high starting pay with long-term mobility. Additionally, majors differ in their likelihood of leading to graduate education, further stratifying outcomes across fields.

Differences in outcomes across fields reflect more than just curricular content. Much of the observed variation reflects selection processes: students choose fields of study based on a mix of individual and family characteristics, academic preparation, career aspirations, and perceived labor market risk (Altonji, Blom, and Meghir 2012; Zhou 2019). Likewise, there is a large literature on the forces that selectively nudge individuals, often differently by gender, into STEM and non-STEM fields of study (Xie and Shauman 2003; Xie et al. 2015). However, the causal arrow may also run in the opposite direction. Majors themselves can shape individuals' values, expectations, and career trajectories, particularly when credentialed knowledge becomes embedded in occupational pathways (Bleemer and Mehta 2022). Outside of labor market returns, different fields of study enable cultural reproduction that can further perpetuate status and economic reproduction (Bourdieu and Passeron 1990; Reimer and Thomsen 2019).

It is important to acknowledge that fields of study are not static, as they evolve in response to changing labor markets. New fields emerge, old ones fade, and others adjust to shifts in occupations, industries, and new forms of work. These fields are also shaped by national academic policies and vocational training systems. Accordingly, a corpus of international comparative research has examined school-to-work linkages, showing that stronger linkages reduce unemployment and improve job outcomes, though they may limit flexibility and increase mismatch (DiPrete et al. 2017; Bol and Eller 2019). This conceptual framework elucidates how educational credentials are embedded within institutional structures, even though most existing research emphasizes cross-national comparisons, in contrast to this study's focus on intra-national dynamics. This systems-level

literature, alongside the present analysis, shifts attention away from individual selection and toward institutional and labor market factors that shape credential outcomes.

In sum, the literature on returns to college by field of study is well developed, but key questions remain. Fields of study clearly influence labor market outcomes, but researchers have yet to examine in depth how these effects interact with school characteristics. As a result, the relative importance of each in explaining overall inequality remains unclear. Existing evidence may also conflate institution-specific effects with the distribution of fields of study across institutions, raising concerns about compositional confounding. Only by considering both dimensions simultaneously can their distinct contributions be clarified. Despite growing recognition of its significance, the evolving role of field-based horizontal stratification remains insufficiently examined, especially in relation to how it shapes and responds to changes in labor market structures over time.

Differential Labor Market Outcomes With Respect to College Selectivity, Prestige, and Institutional Contexts

Aside from field of study, the other primary axis of horizontal stratification among individuals with higher education is the degree-granting institution itself. Horizontal stratification by institutions operates through mechanisms such as teaching quality, prestige signaling, cultural capital transmission, and differential access to social networks, processes that are often decoupled from traditional human capital frameworks. However, the study of differential outcomes based on the characteristics of individual educational institutions has been difficult. Due to small sample sizes, educational institutions are often operationalized based on observable characteristics of the institutions (e.g., institutional prestige, proxied by average college entrance examination scores) or based on institutional groupings, which may obfuscate important variation.

Despite these limitations, a small but growing literature has examined how institu-

tional differences shape labor market outcomes. Observational studies found evidence of a wage premium associated with attending selective institutions, even after controlling for family background and academic ability (Brewer, Eide, and Ehrenberg 1999; Loury and Garman 1995). These findings, however, are complicated by strong selection effects: students who attend more selective schools tend to differ systematically from those who do not. Causal identification strategies that attempt to account for this endogenous selection process have produced mixed results. Some studies confirm the returns to selectivity (Borgen 2014; Bleemer 2021; Manski and Wise 1983), while others find little or no effect after adjusting for unobserved heterogeneity (Dale and Krueger 2002). In terms of intergenerational mobility, attending a more prestigious college does not uniformly yield higher returns, particularly across the broad range of less selective institutions. Administrative data show that many colleges with the highest intergenerational mobility rates are not highly selective (Chetty et al. 2017), underscoring the need to examine institutional outcomes individually as apposed to in aggregate based on institution-level observables. Such variation points to the significance of local context, industry links, and state-level policy environments.

While the full mechanisms remain unclear, institutional characteristics can shape individuals' futures in a variety of ways. For instance, institutional prestige shapes outcomes net of individual ability or academic learning (MacLeod et al. 2017), and cultural matching in elite labor markets privileges those with degrees from high-status universities (Rivera 2012). Social networks may also play a role: exposure to elite peers, even when randomized, can enhance future economic outcomes (Michelman, Price, and Zimmerman 2022).

Furthermore, research on institutional effects in U.S. higher education often centers on elite universities, emphasizing distinctions between elites and non-elites. Yet such institutions represent a small fraction of the broader system of higher education. Most degrees are conferred by colleges that differ along other institutional dimensions, such as

enrollment patterns, the residential nature of the school, and admissions and advising practices, rendering conventional metrics like SAT scores or selectivity insufficient for capturing this broader variation (Ciocca Eller 2023). Further, beyond these observable traits, institutional contexts vary in ways that shape students' experiences and interact with class and family background (Armstrong and Hamilton 2013). Finally, as the previous section showed, variation in student outcomes is not only shaped by which institution one attends, but also by what one studies within that institution. Because institutions vary in their strengths across disciplines, and because students sort into programs in patterned ways, the institutional context cannot be understood apart from the fields it offers and supports. This makes it essential to analyze credentials as composite educational experiences, shaped jointly by institution- and field-specific environments, rather than treating either as isolated influences.

Credential-Specific Horizontal Stratification and Simultaneously Accounting for Multiple Axes of Horizontal Stratification

While this paper has thus far examined field of study and degree-granting institution as separate axes of horizontal stratification, there is compelling evidence that their intersection—the institution-by-field combination, or "credential"—has effects that go beyond the additive influence of each dimension alone. Yet by analyzing each dimension in isolation, research often overlooks how the value of a field depends on where it is studied in unpredictable ways. Two similarly ranked institutions can yield very different outcomes in fields that, on average, command similar premiums. For instance, one may have a stronger mathematics program while the other excels in economics. Moreover, as discussed earlier, most studies rely on broad institutional groupings, which further obscures important variation when attempting to examine the field-by-institution intersection. Only a small body of literature has examined both axes simultaneously, and

most of it faces limitations due to small sample sizes or measurement constraints. For example, Thomas and Zhang (2005) use the Baccalaureate and Beyond Study to analyze both dimensions, while Kirkeboen et al. (2016) and Borgen and Mastekaasa (2018) leverage Norwegian administrative data. Only Borgen and Mastekaasa explicitly model institution-by-field intersections at the finest level, finding limited institutional variation beyond department-level effects. Related work by Eide, Hilmer, and Showalter (2016) explores variation in selectivity across majors, revealing greater within-field inequality for some disciplines, though without institution-level resolution.

As the data landscape changes in the United States, there is a clear solution to the missing data on credential-specific outcomes—administrative data. In the American context, some aforementioned studies have engaged specific states in partnerships that allow researchers access to data on institutional contexts, specific fields of study, and individual characteristics (Bleemer 2021; Bleemer and Mehta 2022; Zimmerman 2014), though these are limited in scope and limited to public institutions. Administrative data solve several problems faced in previous research on horizontal inequality in higher education. First, measurement error is largely eliminated since institution names and precise fields of study are known. Second, having exhaustive data allows for even small fields of study to be described accurately. Finally, there are possibilities for novel linkages that come about as a result of administrative data, allowing individuals to be followed-up in a manner that might not be possible with survey data. Although a fully integrated administrative data infrastructure is still being developed in the U.S., the data used in this study represent a major step toward that goal, enabling credential-level analyses with a longitudinal perspective and coverage across the broader national labor market.

The Evolution of Trends in Horizontal Stratification Over Time

Prior sections have outlined the main axes of horizontal stratification—fields of study, institutions, and their intersections—as treated in existing research. Most of this literature is cross-sectional, offering a static snapshot of inequality within a given cohort or time period. Less attention has been paid to how the structure of horizontal stratification itself has evolved. This limitation is partly data-driven, but it has had broader implications for the theoretical foundations of work in social stratification. The majority of the extant empirical literature is built on survey data, which tend to focus on individual-level traits and outcomes, due to having insufficient sample sizes to make credible claims about larger institutions, groups, or organizations. Survey data have revealed micro-level sorting mechanisms, such as how family background shapes choices, but they are poorly suited to identifying broader stratification patterns. These limitations stem from small sample sizes and narrow timeframes, which make it difficult to disaggregate outcomes by credential or institution or to discern patterns over time. As a result, we have rich portraits of individual inequality-generating processes but lack a cohesive picture of macro-level change.

There are some exceptions to this phenomenon, though each is limited to addressing either one form of horizontal stratification at a time or vertical stratification. Brewer et al. (1999) use time-series data to estimate the growing earnings premium of elite college attendance, adjusting for selection. Araki (2020) shows that as education expands, the returns to higher credentials diminish, though without disaggregating by field or institution. Bloome, Dyer, and Zhou (2018) use NLSY79 and NLSY97 to examine why income persistence between vertically-stratified degree levels has remained stable despite educational shifts. These studies offer valuable insights into vertical or single-axis stratification but lack the granularity to trace how multiple forms of credential-based differentiation evolve and interact with labor market change.

A further exception is the RBTC literature, which traces shifts in labor demand induced by technological change and corresponding adaptations in education (see Katz and Autor 1999; Goldin and Katz 2008; Autor, Goldin, and Katz 2020). In this vein, Altonji, Kahn, and Speer (2014) provide a somewhat similar analysis to what I propose here by taking a longitudinal perspective in comparing the payoffs to certain college majors over time, though they do not attend to horizontal stratification by degree-granting institution, and they only attend to differentiation based on routine skills. While valuable, this framing captures only part of the picture in a context of growing institutional and industrial complexity. RBTC emphasizes aggregate shifts and vertical stratification but overlooks how specific credentials are embedded in institutional and industrial structures. Moreover, technology and routine skill substitution are potentially no longer the only—or even the dominant—drivers of labor market change. In the next section, I discuss how recent transformations in firm organization, industry structure, and occupational sorting are reshaping how credentials translate into earnings, often in ways not well-captured by RBTC's original formulations.

Taken together, these developments underscore the need for a dynamic analytical framework that captures not only the role of horizontal stratification at a given moment, but also how its structure and consequences evolve in response to broader changes in higher education and the labor market. The Effectively Maintained Inequality (EMI) framework provides a key theoretical foundation, showing how advantaged groups respond to educational expansion by securing access to qualitatively superior opportunities, such as more selective institutions or higher-paying fields of study, in order to maintain their relative position (Lucas 2001). This framework has been especially powerful for explaining how horizontal forms of inequality emerge and persist under conditions of educational expansion. My approach builds on this insight but shifts the emphasis from individual strategies of differentiation to the evolving structural context in which educational credentials acquire value. Whereas EMI focuses on how families respond to

expanding access, I examine how the institutional and industrial landscapes themselves are changing, reconfiguring the pathways through which different forms of horizontal stratification shape economic outcomes. The final section of this introduction develops the theoretical and empirical rationale for this approach, highlighting why the multiple forms of horizontal stratification must be understood in relation to their fundamental organizing forces: the changing structure of labor markets, the evolving linkages between education and work, and the shifting landscape of higher education.

Understanding the Underlying Drivers of Changing Patterns of Horizontal Stratification

In addition to assessing the relative importance of competing axes of horizontal stratification in shaping labor market outcomes over time, it is also necessary to examine how these axes are embedded in broader systems of social and economic change. Institutions, fields of study, and their intersections reflect distinct mechanisms of inequality, each structured by different organizing forces that themselves evolve over time. At the institutional level, characteristics such as size, selectivity, and location shape labor market returns, especially as the higher education landscape diversifies. At the credential level, shifts in the distribution of fields across institutions may signal a growing alignment between institutional prestige and field-based advantage. Field of study must be understood in relation to transformations in the labor market, particularly the restructuring of industries, occupations, and employment systems. This final form of stratification warrants special attention because of its dynamic nature and its direct responsiveness to labor market change. The remainder of this section motivates the paper's field of study-to-industry perspective by emphasizing the co-evolution of higher education and work, and the implications of that relationship for understanding how field-level differentiation emerges, persists, and transforms. As higher education has expanded, the organization

of work has undergone profound change, shaped by technological innovation, shifting industrial composition, and evolving policy regimes. These changes have influenced not only which credentials students pursue, but also the sectors and roles those credentials make accessible. A dynamic account of field-based stratification must therefore attend to how the meaning and value of educational credentials shift in tandem with the broader structure of the labor market.

My approach differs from existing explanations of labor market change, which have often centered on technological drivers, particularly through the lens of RBTC. These accounts highlight how technological advances have reshaped labor demand by altering the substitutability of occupational tasks (Katz and Autor 1999; Goldin and Katz 2008; Autor et al. 2020). Relatedly, studies of STEM versus non-STEM pathways tend to adopt similar assumptions about the primacy of skill-biased change (Xie and Shauman 2003). While these perspectives have yielded important macro-level insights, they often focus on a single explanatory axis and risk overlooking how institutions, credentials, and labor markets interact in more complex and evolving ways.

Understanding how horizontal stratification evolves over time requires a perspective that extends beyond individual skills or occupational sorting. This study highlights the relationship between higher education and industry as a valuable, if underused, lens for analyzing field-level differentiation. While this emphasis is partly shaped by data structure (discussed below), it is also grounded in classic stratification theory and recent work in organizational sociology and labor economics. A growing literature shows that rising inequality is driven less by individual traits and more by structural changes in where and how people work, particularly increasing wage dispersion between firms (Wilmers and Aeppli 2021; Song et al. 2019). Because firms are embedded in industries—with shared regulatory, geographic, and market characteristics—industries have become increasingly consequential in shaping life outcomes (Haltiwanger et al. 2024). High-wage sectors like tech and finance have absorbed much of recent productivity growth, while

low-wage industries such as food service and retail have expanded with little improvement in earnings. In this context, industry offers a tractable and theoretically grounded unit of analysis for understanding how credentials are rewarded, complementing—but not displacing—occupation- and skill-based perspectives.

While occupations have long anchored stratification research in sociology (Blau and Duncan 1967; Grusky and Weeden 2002; Erikson and Goldthorpe 1992), industry offers a complementary lens that highlights the institutional and structural contexts in which occupations are situated. Industries shape wage-setting regimes, hiring practices, and regulatory environments, all of which affect how educational credentials are converted into labor market outcomes. As occupational boundaries grow more fluid and firm-level data remain difficult to access, industry provides a convenient and theoretically grounded perspective for analyzing horizontal stratification. This approach builds on dual labor market theory (Kalleberg and Lincoln 1988; Sakamoto and Powers 1995) and more recent organizational and relational accounts of inequality (Wright 1998; Avent-Holt and Tomaskovic-Devey 2014), and aligns with empirical work showing how firm and industry characteristics contribute to inequality (Tomaskovic-Devey et al. 2020; Avent-Holt et al. 2020; Godechot et al. 2024). For example, Godechot et al. (2024) documents how sectoral shifts such as deindustrialization, financial expansion, and geographic clustering have reshaped the structure of inequality. Without denying the relevance of occupations, this perspective offers a justified alternative, well suited to a moment of particularly momentous industry-level transformations. I therefore treat industry as the key site for tracing how fields of study link to labor market destinations. This allows for a dynamic account of horizontal stratification that links educational credentials to evolving institutional and economic structures, contributing to broader sociological understandings of how higher education generates inequality.

Methods

Analytical Overview

This paper treats field of study, institution, and their intersection as analytically distinct but theoretically interdependent dimensions of horizontal stratification. Each represents a categorical form of differentiation within a single level of education, but operates through largely different mechanisms: fields of study shape earnings through occupational and industrial linkages; institutions structure outcomes via prestige, resources, and social capital; and credentials reflect the interactive effects of both. Together, these axes form the core of how horizontal stratification shapes labor market outcomes among bachelor's degree holders.

The empirical analysis unfolds in several steps. First, I generate simulated individual-level earnings data from the aggregated credential-level statistics provided in the PSEO. This enables estimation of the full distribution of earnings within and across credentials, allowing for the application of variance decomposition techniques that incorporate within- and between-group variation. I then decompose total earnings inequality across cohorts to estimate the share attributable to each axis of horizontal stratification, including the degree to which it is driven by changing average earnings within credentials and distributional changes of credentials themselves.

Building on this foundation, the next set of analyses examines each domain in turn, using methods suited to its underlying mechanisms. For fields of study, I analyze changes in average earnings through the lens of field-to-industry flows and industry wage structures, using decomposition techniques to isolate whether observed trends are driven by changes in industry placement, changing industry wages, or both. For institutions, I assess whether observable characteristics such as selectivity, size, tuition, and enrollment explain variation in earnings net of field composition, and how those relationships have

evolved over time. For credentials, I evaluate whether field–institution pairings have become more stratified, testing whether high-earning fields are increasingly concentrated in high-earning institutions, consistent with a deeper consolidation of educational advantage.

Data

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. Although aggregated, these data allow partial reconstruction of earnings distributions and analysis of how field–industry linkages evolve over time. I focus on five-year post-graduation outcomes, which reflect mid-career earnings and avoid the limited cohort coverage in the ten-year data. One- and ten-year outcomes are used in robustness checks.

Because PSEO is based on voluntary state agreements, its coverage is incomplete

but diverse, spanning public and private universities, community colleges, online colleges, and flagship state institutions. While not nationally representative, the breadth of institutions allows for rich analyses of variation in credential outcomes. I adjust for imbalances in institutional representation where relevant, and 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-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 analyses secondary to my primary findings.

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. 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.

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

While the relative importance of field of study, institution, and credential-level effects can be estimated using aggregated data alone, I simulate individual-level income data from

credential-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 must simulate individual-level income data from the aggregate statistics provided in the PSEO dataset. In the earnings dataset, for each 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).[3,4] 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, 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).

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

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

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

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 all 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

[3]Graduation cohorts are grouped into three-year spans for bachelor's degrees. This aggregation is necessary to protect individual privacy as many credentials only graduate a few individuals each year.

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

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 and fields of study that may be driving changes in stratification or if it is simply different premiums attached to credentials that are driving the effects.

Decomposing Earnings Inequality Along Axes of Horizontal Stratification

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 their interaction. 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:

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

While the order of the components may affect the results, especially if fields of study are differently distributed across universities over time, I test this with a sensitivity analysis in the supplementary appendix by simply changing the order in which the effects are added. Further, as subsequent analyses will show, this is not a major problem in these data. While other methods exist for dealing with this problem, they are used for analyses with more than two primary fixed effects (see examples by Xie and Zhou 2014 and Gelbach 2016).

The methods described up to this point will 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.

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 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).

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

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

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

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

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.

This decomposition highlights how much of field-based earnings change is driven by sectoral dynamics. 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, resources, and student composition, it requires a different analytic 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.

Using 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. 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:[5]

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

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.

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

[5]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 4. It is simply rewritten here in this manner for clarity.

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 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.

*** Figure 2 About Here ***

Results

Data Coverage 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.

Nevertheless, because private institutions are underrepresented in the data, some estimates in the following analyses likely understate true levels of inequality. As such, my results can be interpreted as lower-bound estimates of credential-level earnings disparities under full institutional coverage. To assess the impact of this limitation, I conduct a sensitivity analysis that upweights private university observations based on their rate of underrepresentation in the dataset.[6]

[6]Public universities account for 43% of degree recipients and are covered at that rate in the PSEO data; private universities are covered at a rate of 11%. In the sensitivity analysis, private institutions are upweighted by a factor of 3.8.

*** Table 1 About Here ***

Table 1 shows the number of included units in the data, stratified by cohort. A quirk of the structure of the data, which is necessary to allow for sufficient cell sizes for credentials with small cohort sizes, is that data are reported for multi-cohort periods. For bachelor's degrees, cohorts cover 3-year periods (2001–2003, 2004–2006, etc.). In 2014, roughly 1.8 million individuals earned a bachelor's degree in the United States.[7] As the data show that my cumulative sample size of earnings five years post-graduation for the graduating cohorts of 2013–2015 is 1,309,057, these data capture slightly less than 1/4 of all graduates in the US. This drop in coverage comes from both non-coverage of certain degree-granting institutions, as has already been discussed. However, it also comes from non-attachment to the labor force. A limitation of these data is that they do not represent the unemployed, who by definition have zero earnings from labor force participation. While this is lamentable, it is unavoidable due to the nature of the LEHD, and it also qualifies my findings as an underestimate of overall inequality, as it does not include those unable to enter the workplace. I account for this by simulating non-attached workers as having zero annual earnings in a sensitivity analysis of the results presented below, even though it is likely that many non-workers are not employed by choice—either working in an informal context, performing caregiving duties, or continuing their schooling.

In Table 1, 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

[7] https://nces.ed.gov/programs/digest/d12/tables/dt12_310.asp

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. Furthermore, the Das Gupta-inspired analysis holds constant enrollments, allowing me to ensure that the creation and elimination of fields of study are not driving the results.

*** Table 2 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 2 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 is 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 two-digit field of study.

Earnings Variance Decomposition Analysis

*** Figure 4 About Here ***

Results for the variance decomposition are shown in the left-most panel of Figure 4. The first striking finding is that over the relatively short time period in question, the percent of overall variance explained (R^2) increased from 25% to 31% for earnings one year after graduation. Mechanically, this means that within institutions and fields of study, the role of individual variation decreased from explaining 75% to 69% of total variance in log earnings. Otherwise put, conditional on having a bachelor's degree, the importance of observable degree characteristics for earnings is increasing and individual variation in outcomes net of one's degree characteristics is decreasing proportionally.

Several striking findings emerge. First, most of the variation in earnings is explained by what people study—not where they study. This pattern holds at the aggregate level and does not imply that field always outweighs institution for individuals. Still, the magnitude is notable: for the 2013–2015 cohorts, 23% of variation is attributable to field of study, compared to just 5% for institution, and 4% for 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 A3 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, and upweighting 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.

A natural follow-up to the previous results is whether observed changes are driven by allocation 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 allocation. In fact, allocative forces appear to slightly offset the earnings-based trend. 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. 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.

*** Figure 5 About Here ***

Understanding Changing Average Annual Earnings by Field of Study

The previous analysis showed two major findings: 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. Further, 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?

*** Table 3 About Here ***

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. Table 3 shows these simulations and predicted earnings outcomes in a more detailed manner, alongside information on the distribution of fields of study in aggregate over time. 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.

*** 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 of prestige like tuition fees for in-state students and the admission rate do not show the same patterns.

The strongest and most dynamic relationship is that of average SAT Score and institution-level average annual earnings, with the R^2 increasing from 0.11 to 0.35 between the two cohort spans. Likewise, the variance explained by the logged number of graduate students increased from 0.06 to 0.17 and the logged number of undergraduates increased from 0.01 to 0.09. 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. Finally, this evidence of the changing interrelation-

ship 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.

*** Table 4 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 4 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. This is despite the aforementioned finding of increasing explained variance due to field of study and rather constant explained variance owing to institutions.

Discussion

This study provides new evidence on how horizontal stratification among bachelor's degree recipients has evolved over time. Of the three primary axes examined—field of study, institution, and their intersection—field of study stands out as the most consequential for earnings inequality. From 2001 to 2015, it explains a growing share of post-

graduation earnings variation, while institutional and credential effects remain smaller and more stable. While the measurement of the relative importance of different axes of horizontal stratification represents an important contribution in its own right, it also raises further questions about the forces driving these patterns. To address this, the analysis turns to each axis in detail, drawing on existing literature to examine the structural and institutional mechanisms that may be shaping their evolving relationship to labor market outcomes.

The growing importance of field of study as a source of horizontal stratification is not due to different allocation of students to different fields of study or institutions, or even changing dynamics of fields of study within institutions. Nor is it apparently due to intrinsic changes in fields of study themselves or the skills that they impart on their pupils. Rather, 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 are visible alongside more expected increases in fields closely tied to the high-tech industry, such as computer science and mathematics.

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 consolidation, 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 credentials. 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 (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.

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. 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.

Finally, 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 emer-

gence 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.

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 that flow through 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 sug-

gest 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. Further, although some institutional characteristics, such as selectivity and graduate enrollment, are increasingly associated with graduate 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.

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 discussed 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. As such, the paper does not attempt to identify micro-level selection mechanisms or causal pathways related to individual characteristics. Nonetheless, sensitivity checks (Appendix Figure A3) 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. The finding that field-of-study inequality closely tracks changes in industry structure further reduces the likelihood that compositional selection alone accounts for the observed trends.

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.

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 indicator to explain the stratification 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 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). If these fields increasingly shape earnings, horizontal stratification may reinforce existing inequalities. Investigating whether industry practices or educational interventions can offset this stratification is a key next step.

An additional avenue for future research involves examining the role of school-to-work linkages within a single national context. 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 and Eller 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.

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.

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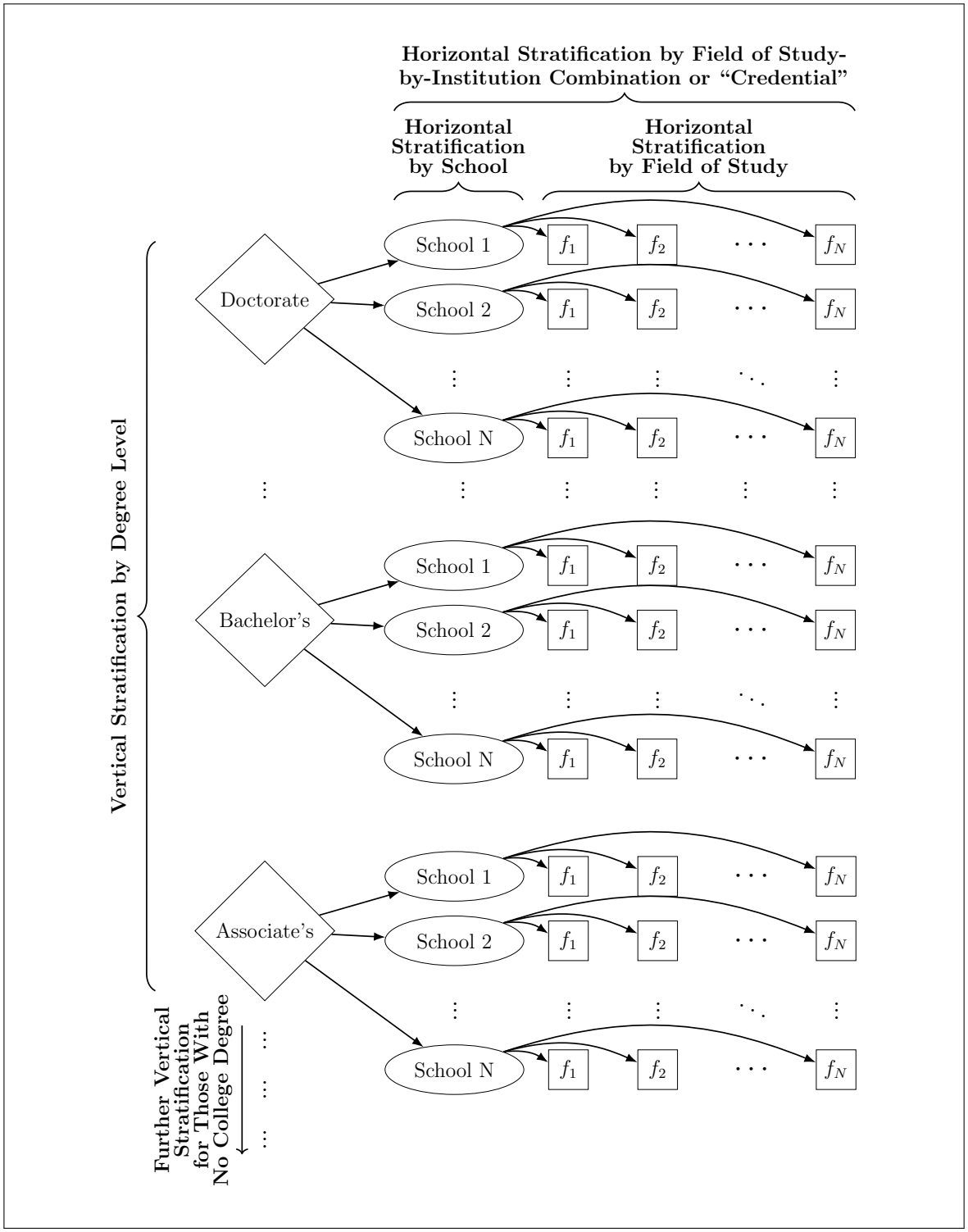

Figure 1: Schematic Showing Vertical Stratification and Horizontal Stratification by Both School and Field of Study

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.

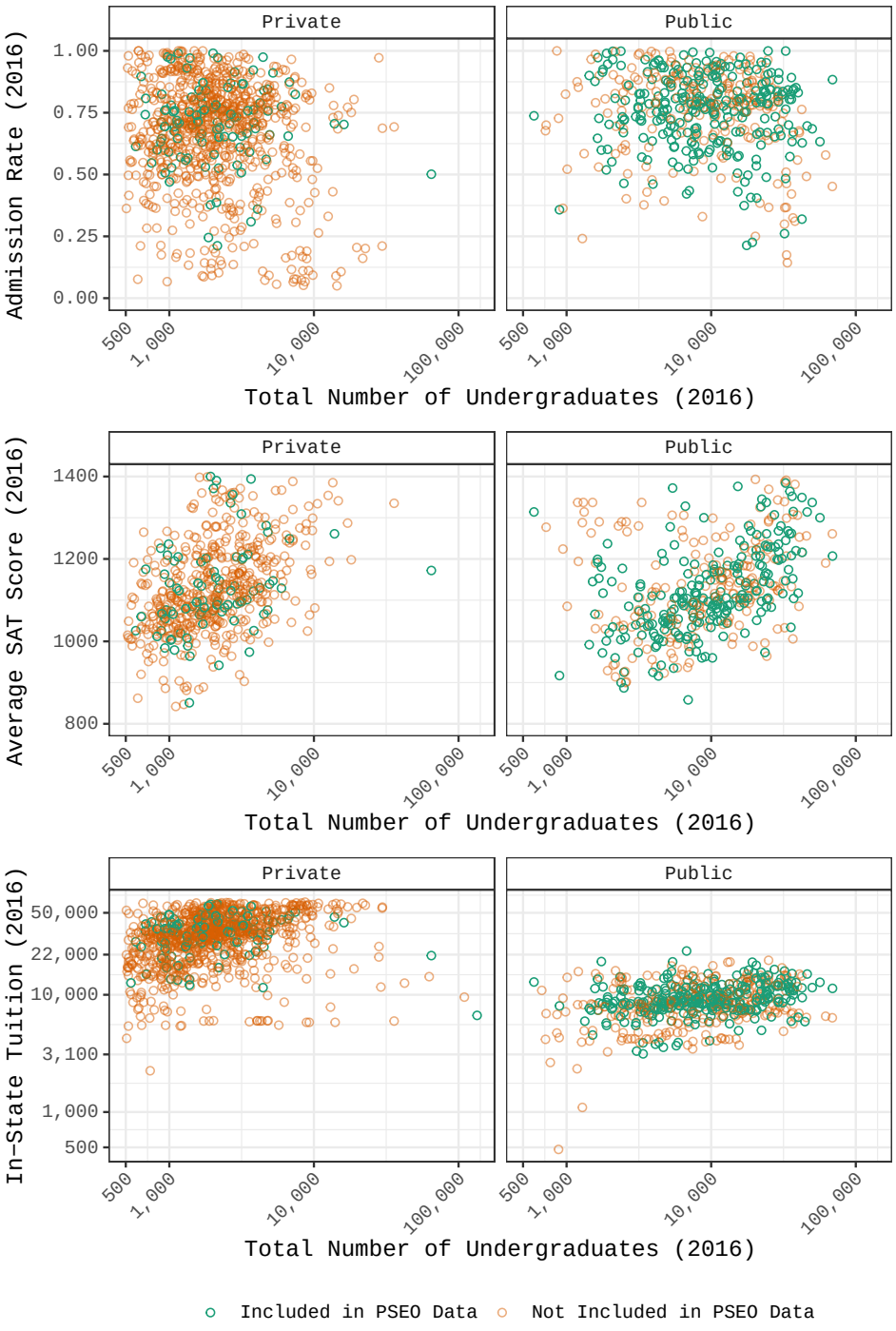

Figure 2: Scatter Plot of All Universities and Universities Included in PSEO Data, By Total Number of Undergraduate Students, In-State Tuition, Admission Rates, and Average SAT Scores

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.

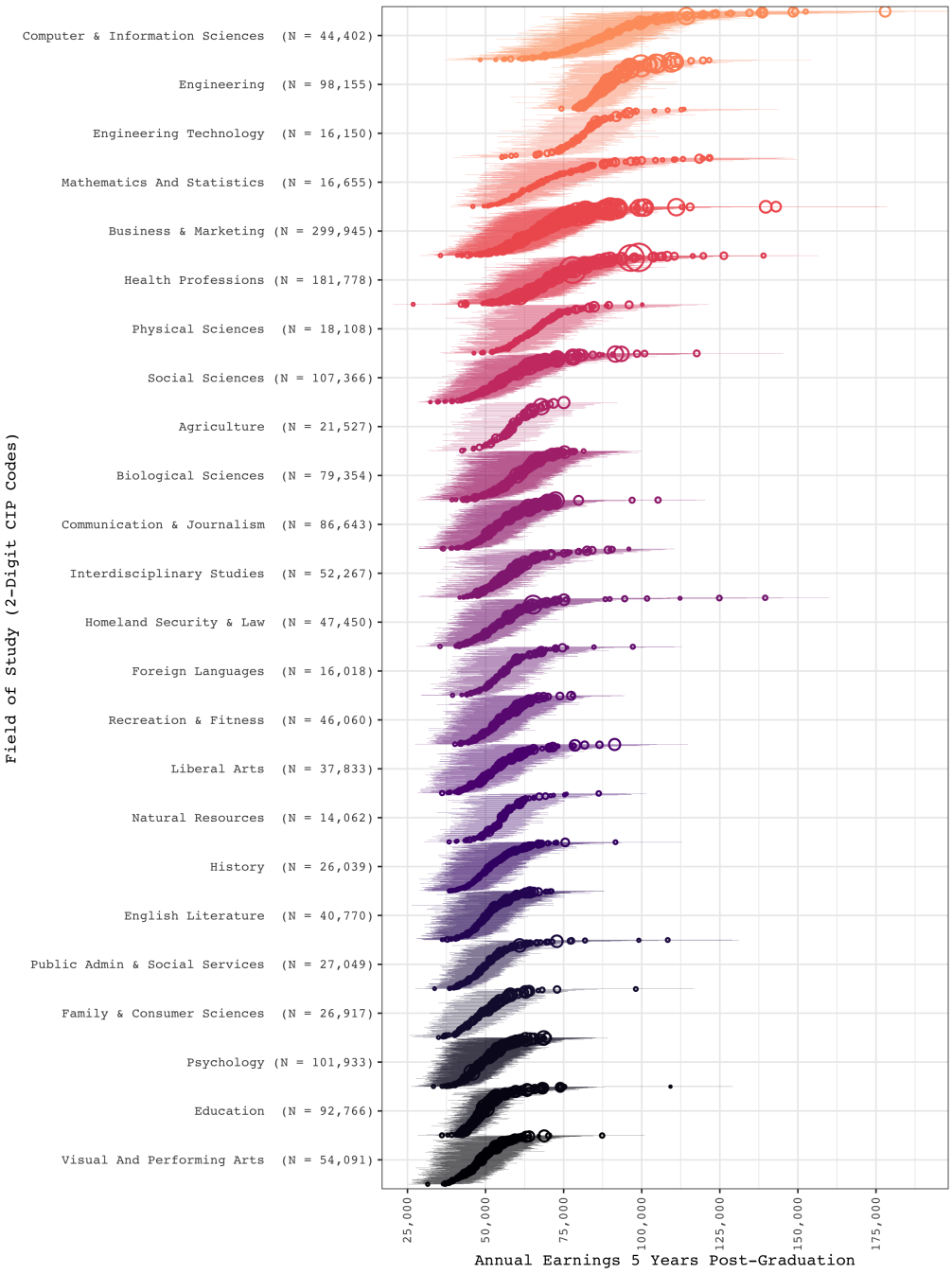

Figure 3: Distributions of Average Annual Earnings, Five Years Post-Graduation, for Specific Credentials (Fields of Study Within Specific Degree-Granting Institutions), By Aggregate Field of Study; Students Graduating 2013–2015

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.

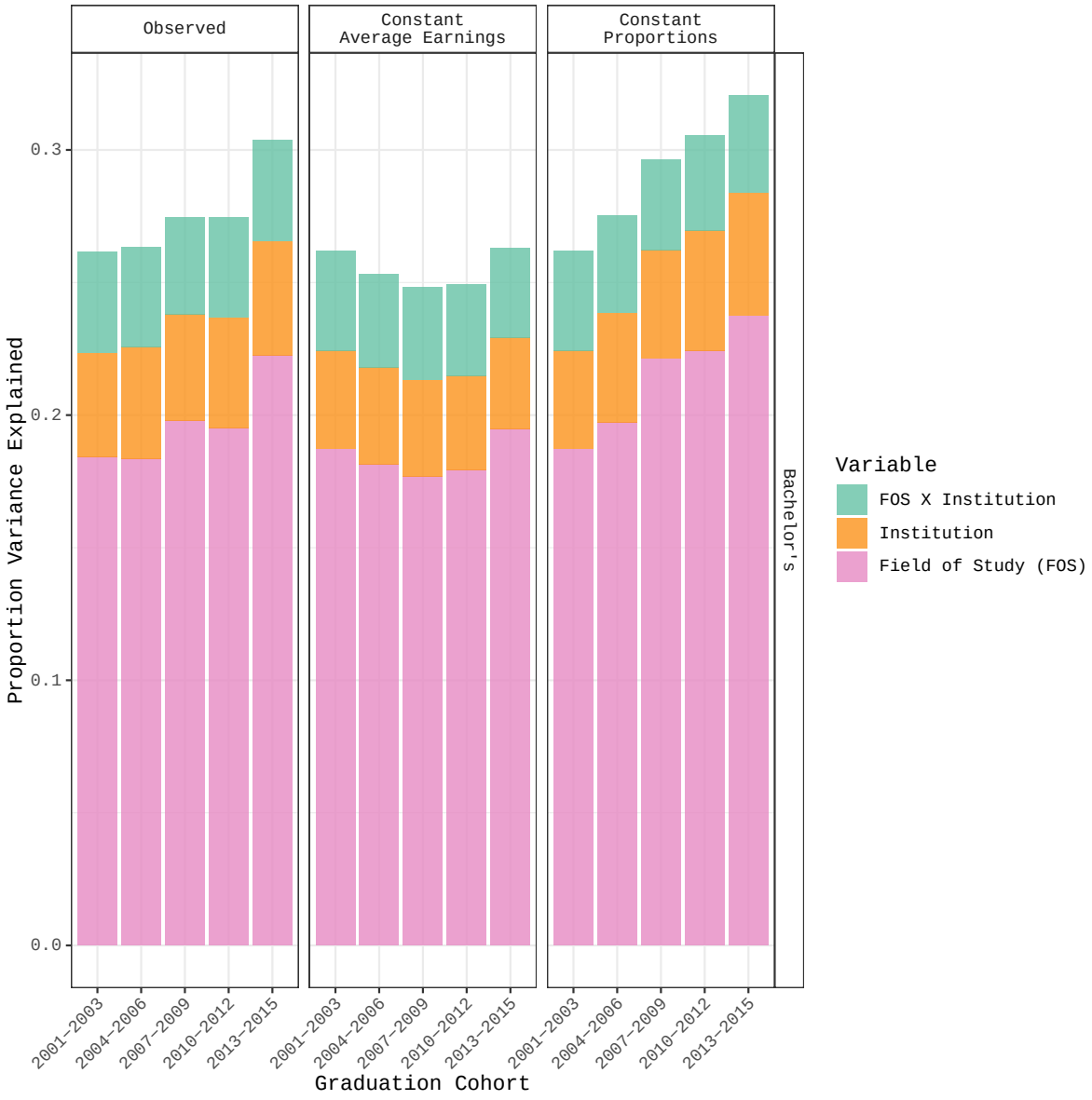

Figure 4: Variance Decomposition of annual earnings Five Years Post-Graduation by Field of Study (Major), Educational Institution, and Their Intersection Alongside Scenarios Assuming Constant Allocations Across Fields and Universities or Constant Average Annual Earnings Across Fields and Universities

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.

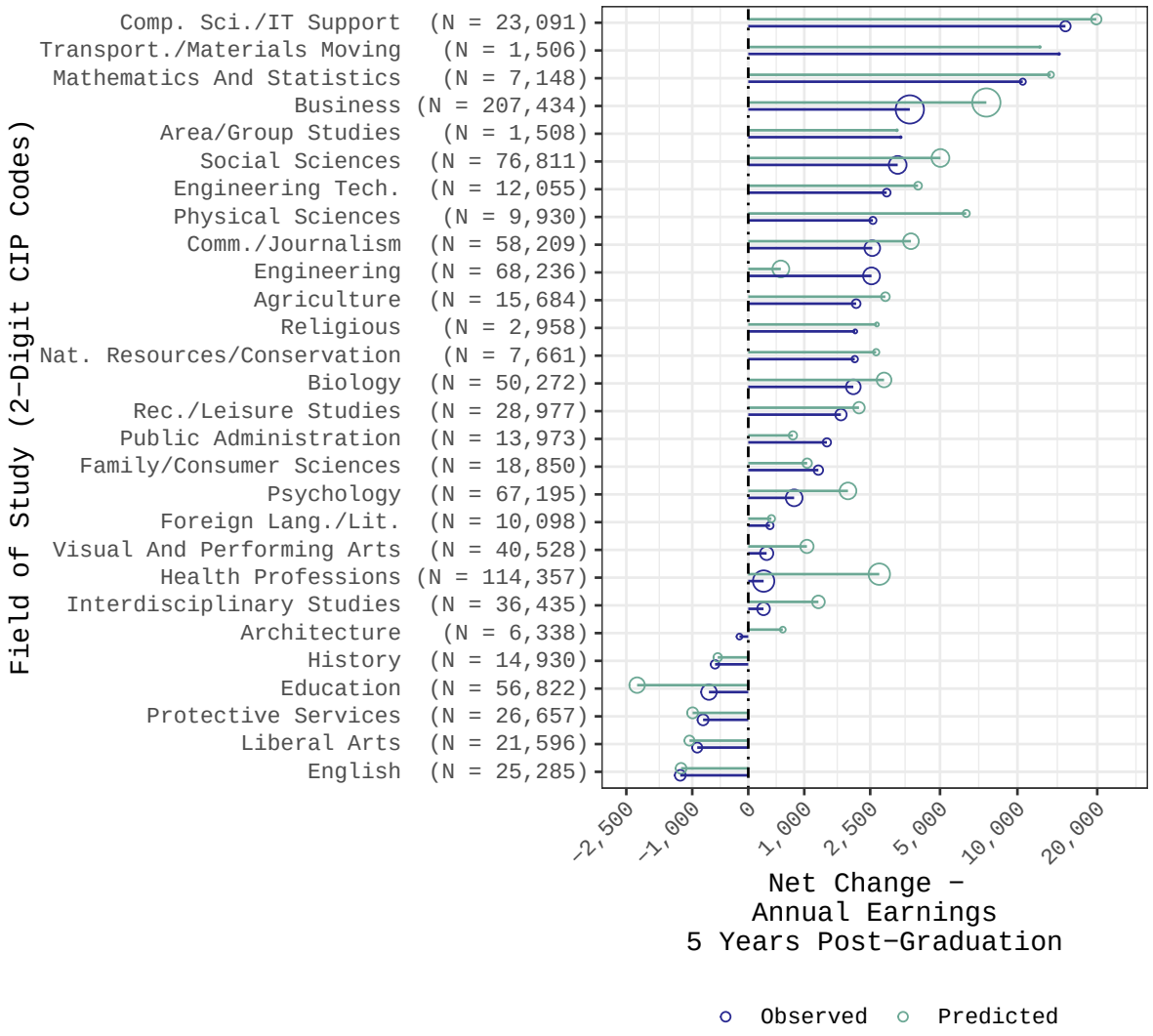

Figure 5: Change In Observed Average Field of Study (Two-Digit CIP Codes) Annual Earnings Five Years Post Graduation, Comparing Cohorts 2013–2015 to Cohorts 2001–2003

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.

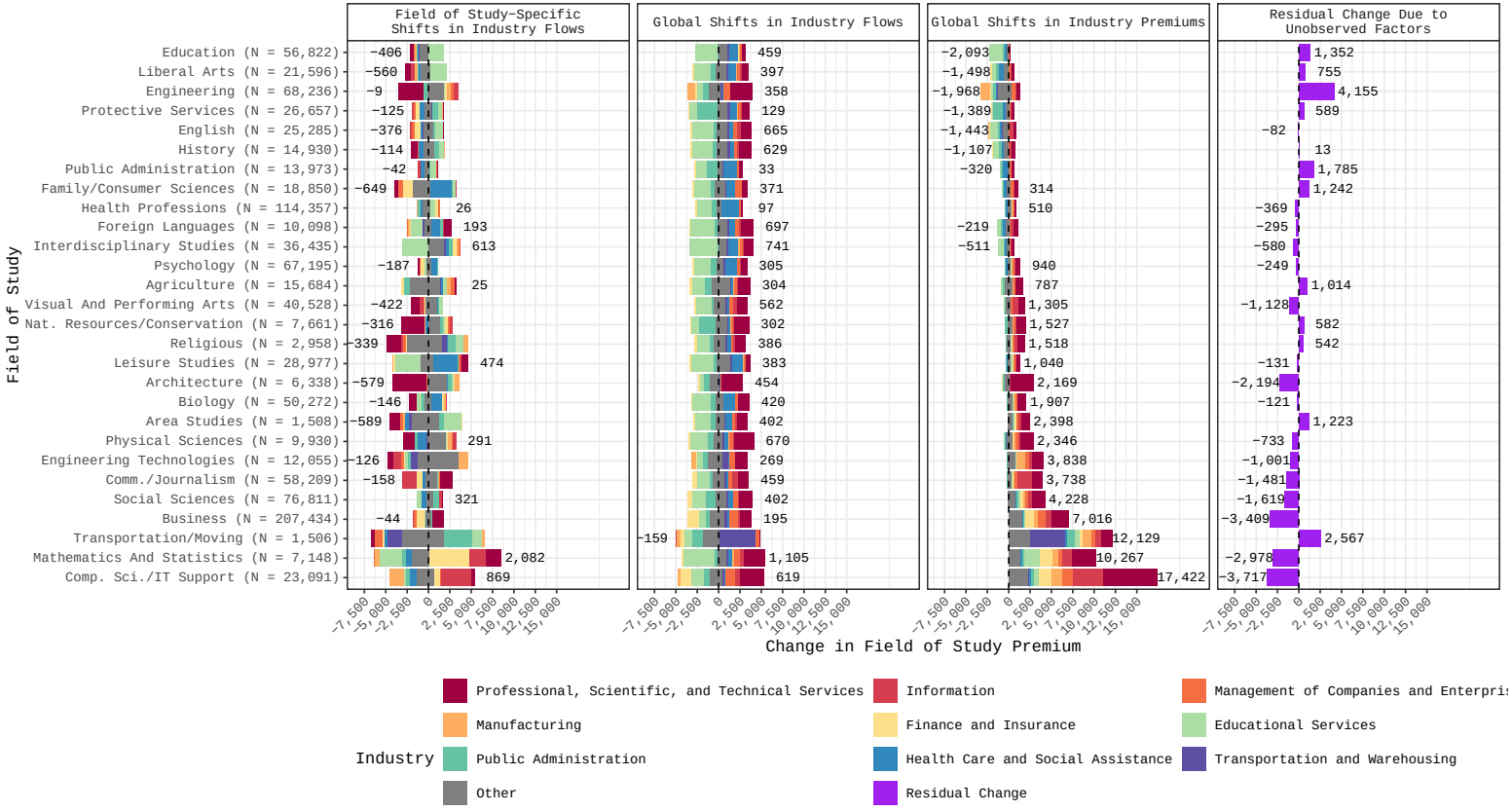

Figure 6: Kitagawa-Oaxaca-Blinder Decomposition of Observed Changes Between 2001–2003 and 2011–2013 Graduates in Field of Study average annual earnings at the Bachelor's Level, Using Observed Changes in FOS-Industry Flows Changes in Calculated Industry-Level Average Annual Earnings

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."

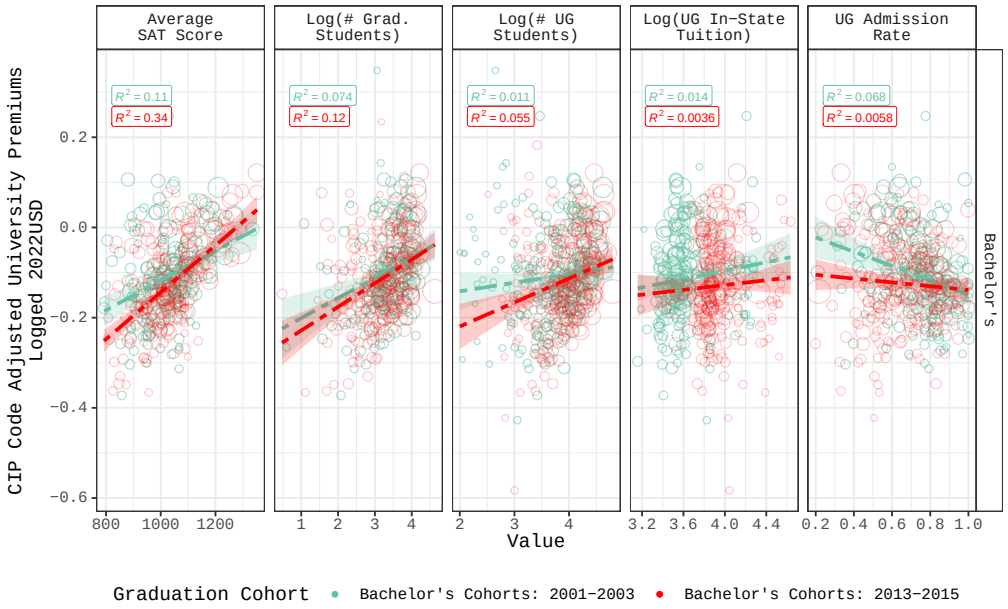

Figure 7: Degree-Granting Institution Average Premiums, After Adjusting for Distribution of Fields of Studies, Regressed on Institutional Characteristics for Two Cohorts

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

Table 1: 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 2: 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 3: Fields of Study (2-Digit CIP Codes) Predicted Earnings Increases From Industry Recomposition Alongside Observed Earnings Increases

Field of Study	Observed Salary 2001-2003	Observed Salary 2013-2015	Observed Difference	Predicted Difference	FOS Share 2001-2003	FOS Share 2013-2015
Agriculture	53,838	55,969	2,131	2,940	0.02	0.02
Nat. Resources/Conservation	48,371	50,467	2,096	2,667	0.01	0.01
Architecture	60,209	60,057	-151	602	0.01	0.01
Area/Group Studies	47,116	50,551	3,435	3,308	0	0
Comm./Journalism	51,675	54,232	2,557	3,799	0.06	0.06
Comp. Sci./IT Support	75,862	91,057	15,194	19,837	0.03	0.02
Education	49,644	48,956	-688	-2,214	0.08	0.06
Engineering	86,025	88,562	2,536	567	0.06	0.07
Engineering Tech.	75,682	78,663	2,980	4,068	0.02	0.01
Foreign Lang./Lit.	51,556	51,931	375	401	0.01	0.01
Family/Consumer Sciences	48,319	49,597	1,279	1,056	0.02	0.02
English	49,196	47,960	-1,236	-1,220	0.04	0.02
Liberal Arts	49,867	48,961	-905	-1,054	0.02	0.02
Biology	52,411	54,471	2,060	2,900	0.04	0.05
Mathematics And Statistics	63,098	73,575	10,477	13,386	0.01	0.01
Interdisciplinary Studies	54,444	54,707	263	1,280	0.03	0.04
Rec./Leisure Studies	51,092	52,858	1,766	2,203	0.02	0.03
Religious	47,118	49,226	2,107	2,688	0	0
Physical Sciences	58,546	61,121	2,575	6,352	0.01	0.01
Psychology	47,008	47,817	809	1,931	0.06	0.07
Protective Services	53,650	52,855	-796	-993	0.02	0.03
Public Administration	47,756	49,212	1,456	786	0.01	0.01
Social Sciences	52,432	55,765	3,333	5,021	0.08	0.07
Transport./Materials Moving	59,720	74,095	14,375	12,167	0	0
Visual And Performing Arts	44,813	45,130	317	1,051	0.04	0.04
Health Professions	67,950	68,216	265	2,758	0.06	0.11
Business	64,321	68,078	3,757	7,604	0.23	0.2
History	50,404	49,825	-579	-531	0.02	0.01

Data source: Longitudinal Employer-Household Dynamics Post-Secondary Education Outcomes.
Notes: Shares for the three smallest fields of study are below 0.5%.

Table 4: 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

Degrees of Inequality:

Horizontal Stratification in Earnings by Educational Institutions and Fields of Study in the 21st Century

Contents

Supplementary Methods

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 1 and 2):

$$\omega_{f,y} = \alpha_{f,y} + \sum_{ind} S_{f,ind,y} \cdot \beta_{ind,y} \tag{1}$$

$$\omega_{ind,y} = \beta_{ind,y} + \sum_{f} S_{f,ind,y} \cdot \alpha_{f,y} \tag{2}$$

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:

$$\sum_{ind,y} \beta_{ind,y} = 0 \tag{3}$$

This system of three equations (equations 1-3) 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.

Supplemental Figures

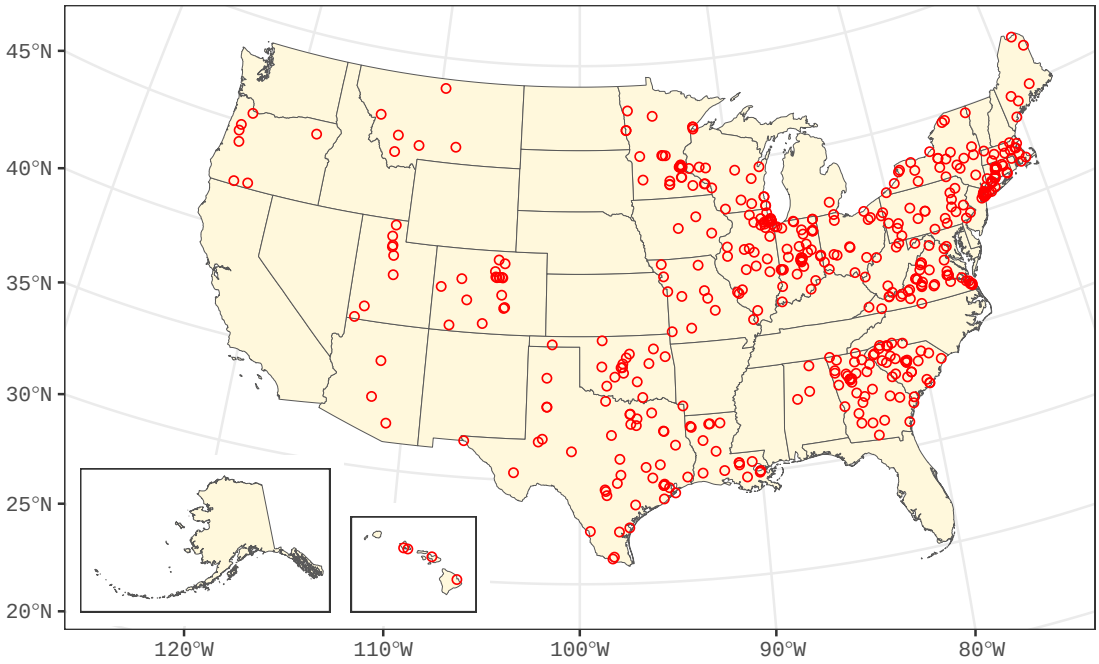

Figure A1. Map of Included Degree-Granting Institutions Showing Unequal Coverage by State

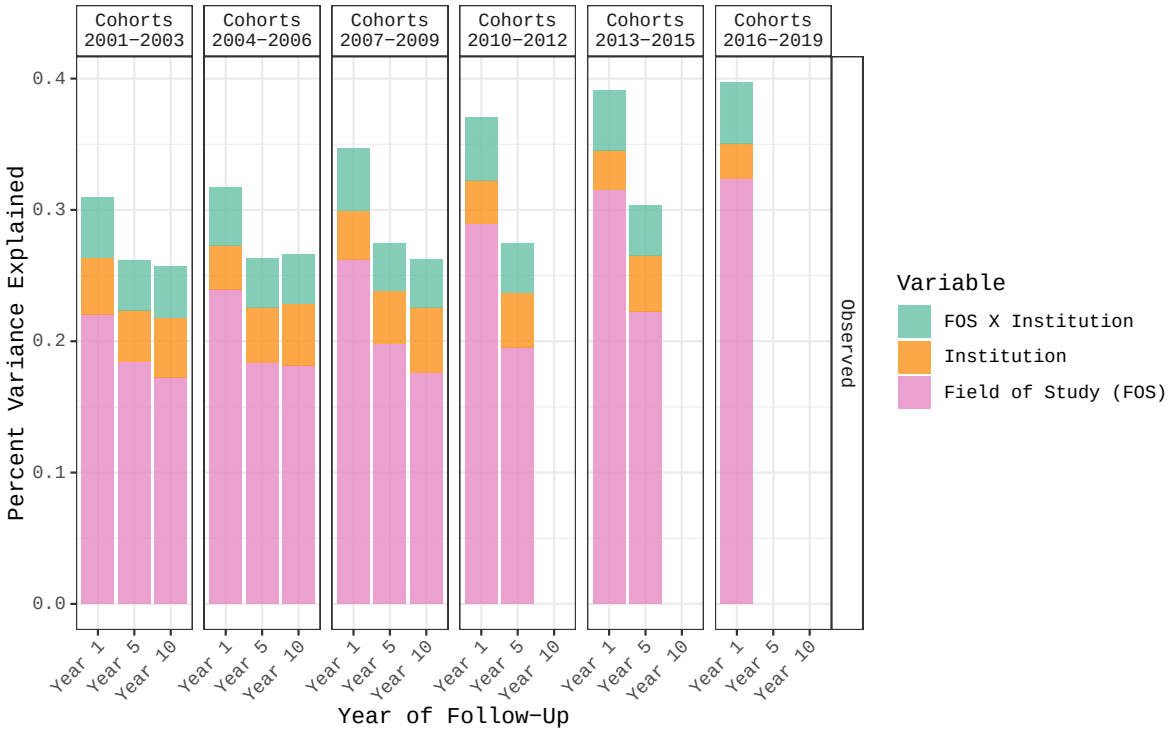

Figure A2. Replication of Primary Analysis, Visualized by Cohort and Year of Follow-Up

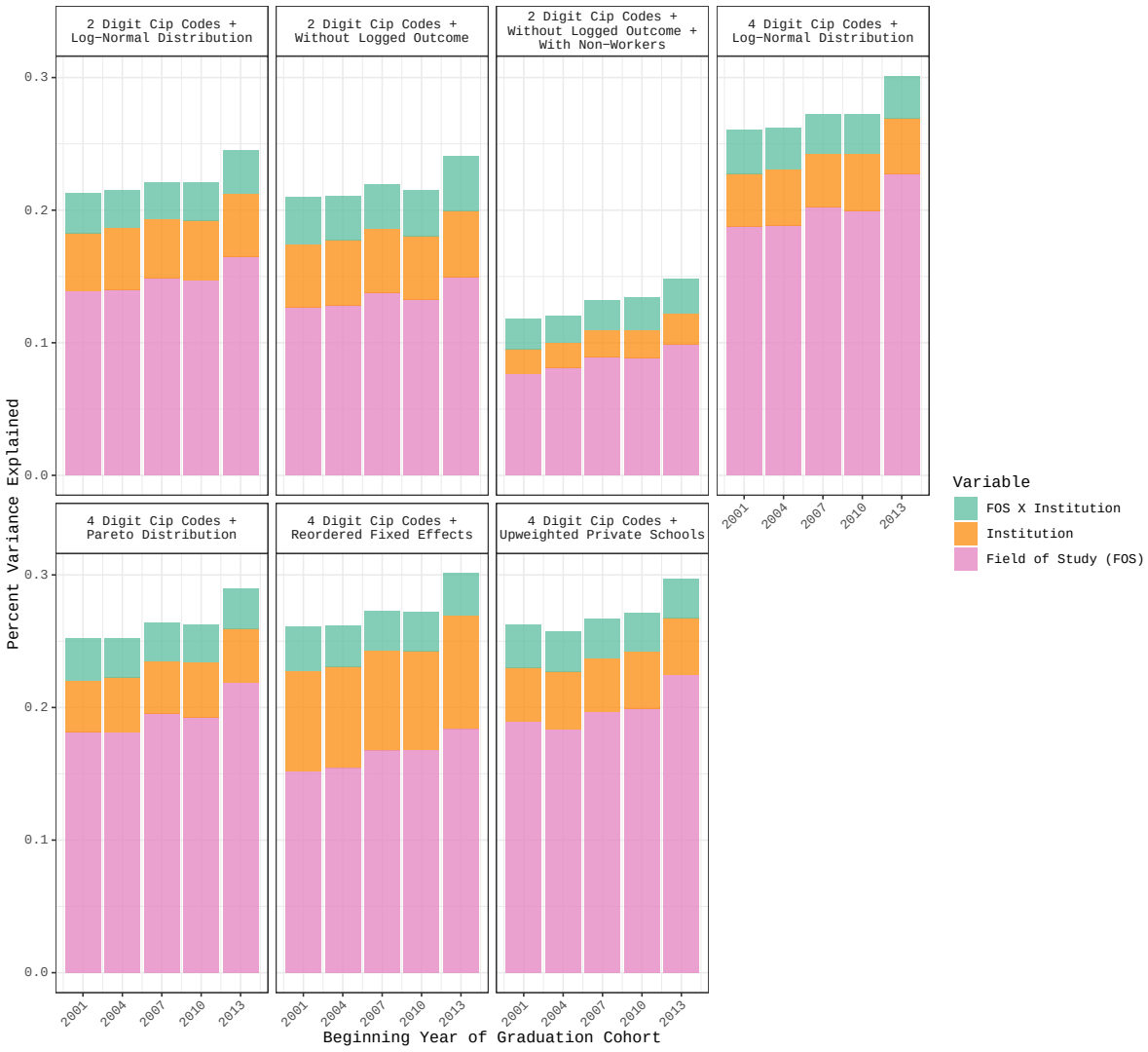

Figure A3. Various Robustness Checks of the Primary Decomposition Analysis, Variably Alternating the Level of CIP Code Aggregation, Logged and Unlogged Outcomes, the Distribution Functional Form, Weights for Missingness, and the Presence of Non-Workers