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WHO RIDES OUT THE STORM? THE IMMEDIATE POST-COLLEGE TRANSITION AND ITS ROLE IN SOCIOECONOMIC EARNINGS GAPS

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ABSTRACT

Despite a large earnings premium for bachelor's degree completion in general, graduates from low-income families earn substantially less than graduates from high-income families. While prior research has documented the role of college quality and major choice in explaining these gaps, we examine undermatching on a different margin: the first (post-college) job transition. The transition from college to the labor market can be challenging to navigate, and students with financial, informational, or other disadvantages during the job search may be more likely to "undermatch" to their first job. Using administrative data from a large, urban, public college system, we document large gaps in earnings five years after graduation by SES (proxied by financial aid receipt) that remain unexplained even after controlling for GPA, college, field of study, and other pre-graduation characteristics. We then examine how features of the initial job transition relate to longer-term earnings, and to what extent differences in the first job transition can explain later SES earnings gaps. Our results show that first job transitions are rocky for many graduates, strongly predict earnings at Year 5, and are a substantial mediator of socioeconomic gaps in earnings five years after college graduation—reducing the unexplained gap by almost two-thirds.

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Who Rides Out the Storm?

The Immediate Post-College Transition and its Role in Socioeconomic Earnings Gaps

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Abstract: Despite a large earnings premium for bachelor's degree completion in general, graduates from low-income families earn substantially less than graduates from high-income families. While prior research has documented the role of college quality and major choice in explaining these gaps, we examine undermatching on a different margin: the first (post-college) job transition. The transition from college to the labor market can be a sensitive one, as graduates balance short term constraints against longer term payoffs to finding a good first job. Students with financial, informational, or other disadvantages during the job search may be more likely to "undermatch" in their early career jobs. Using administrative data from a large, urban, public college system, this study documents large gaps in earnings five years after graduation by SES (as proxied by financial aid receipt) that remain unexplained even after controlling for GPA, college, field of study, and other pre-graduation characteristics. We then examine how features of the initial job transition relate to longer-term earnings. Finally, we examine whether differences in the first job transition can explain the SES earnings gaps that exist five years after college. Our results show that first job transitions are rocky for many graduates, strongly predict earnings at Year 5, and are a substantial mediator of socioeconomic gaps in earnings five years after college graduation—reducing the unexplained gap by almost two-thirds.

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I. Introduction

A college education yields substantial advantages in the labor market (Lovenheim and Smith, 2023). The 75% earnings premium in 2021 for a bachelor's degree relative to a high school diploma remains only a few percentage points below its all-time high (Bengali et al., 2023). Yet post-college earnings gaps by socioeconomic status remain large and persistent (Goldin et al. 2017; Bayer & Charles 2018; Chetty et al. 2020; Crawford et al., 2016). Understanding the drivers of variability in earnings outcomes is particularly important in the U.S. context, given that two-thirds of graduates leave school with student debt.[2] The market for young college graduates in particular appears to have softened in recent years, raising the stakes further.[3]

Prior work has established the important role of institutions of higher education in intergenerational mobility. Chetty et al. (2020), for example, report that in the U.S. overall, college enrollees from the highest-income families end up 29 percentiles higher in the earnings distribution (at age 32-34) than those from the lowest-income families on average, but that the gap falls to 11 percentiles after controlling for the specific college attended. Similarly, Campbell et al. (2022) find in the context of the U.K. that students from lower socioeconomic-status (SES) families systematically match to universities and degree fields with lower average earnings than their academic qualifications would predict. Policy efforts to improve socioeconomic mobility have thus often focused on equitable access to high-return institutions and fields (see Lovenheim & Smith, 2023, for a review of the evidence on returns to college quality and major choice). Still, even after accounting for college, major, and prior achievement, substantial gaps remain in post-college earning by SES (Macmillan, Murphy, & Wyness, 2024; Witteveen and Attewell, 2017).

We thus examine undermatching along another potentially critical margin: the initial (post-college) job transition. Labor economists have long recognized that the initial labor market transition involves a high degree of functional churn, reflecting the time needed for a good job prospect to materialize, as well as productive job switching as employees and employers learn

[2] In this paper, we use the term "graduates" to refer specifically to bachelor's degree completers, unless otherwise noted. Statistics on debt among graduates comes from the Baccalaureate and Beyond 2016/2020 survey, via NCES PowerStats (table retrieval code: ctjtel).

[3] Federal statistics indicate that while the unemployment rate has risen by 11% overall since 2022 (from 3.6 to 4.0%), it has increased by nearly 50% among young college graduates (from 3.9 to 5.8%). See: https://www.newyorkfed.org/research/college-labor-market#--:explore:unemployment.

more about each other and workers acquire new skills (Jovanovic, 1979; Topel & Ward, 1992; Klerman & Karoly, 1994; Jovanovic & Nyarko, 1997; Gardecki & Neumark, 1998; Alon & Tienda, 2005; Yankow, 2022; Rubinstein & Weiss, 2006). Labor economic work on this topic was influential in shaping early policy conversations around churn in the 1990s, which had initially viewed this "milling about" period as indicative as a sort of "failure-to-thrive."

Just because this churn is functional, however, does not imply it is benign in its implications for inequality. Evidence from the transition into and through college shows that financial, informational, and behavioral barriers can affect whether and where students apply to college, whether they apply for financial aid, and whether they actually matriculate and complete (for reviews of this literature, see Dynarski, Page, & Scott-Clayton, 2023 and Dynarski, et al., 2023). Similar issues may arise during the transition *out* of college. For example, financial constraints may lead low-income students to cut off their job search earlier than wealthier students, or to prioritize current salary over future growth. Information networks may give some students an advantage in identifying high-quality job opportunities. Procedural and logistical barriers may cause otherwise prepared students to miss important deadlines for job applications. Implicit or explicit biases on the part of employers and/or faculty references (or internalized bias on the part of students) may lead to unequal outcomes even when students exit college equally prepared on paper.

Recent descriptive evidence suggests SES differences in initial job transitions. In the UK, lower-SES graduates apply to jobs later than their higher-SES peers, explaining about 11% of the difference in job offer rates (Dilnot, Macmillan, & Tyler, 2025). Sociological research suggests cultural factors at hiring firms as well as differences in parental support as possible explanations (Rivera, 2012; Witteveen and Attewell, 2017). Causal evidence also finds that higher student debt leads graduates to prioritize salary over non-salary job amenities in their early job choices (Rothstein & Rouse, 2011), with unclear implications for longer-term earnings.

Empirical research on the effects of graduating into a recession provide some of the most rigorous causal evidence regarding the importance of the initial job transition. This evidence consistently indicates that graduating into a recession can depress employment and earnings for up to a decade (Oreopoulos et al., 2012; Kahn, 2010; Liu et al., 2016; van den Berge, 2018; Fernandez-Kranz and Rodriguez-Planas, 2018). Recent work finds that characteristics of the first

job—specifically, industry-major match and firm size—may be important mechanisms underlying these scarring effects (Liu, Salvanes, and Sorenson, 2016; Arrelano-Bover, 2022). Firm size may matter, in turn, because larger firms provide more opportunities for ongoing human capital acquisition (Arrelano-Bover, 2024), which has long-term effects on productivity (Bleakley & Lin, 2012). The recession literature also provides evidence that less economically-advantaged graduates seem to recover more slowly from early negative experiences than their more economically advantaged peers (Oreopoulos et al., 2012). Graduates from less-selective institutions also appear more sensitive to recessions than those from more-selective institutions, in part because of the recruiting strategies of high-wage firms (Weinstein, 2025).

Even when the labor market is strong on average, it may not be so for economically disadvantaged groups: demographic gaps in employment and earnings can be just as large or larger than the differences observed across economic cycles.[4] Financial constraints, informational constraints, or other disadvantages may also influence early career transitions—no matter the business cycle—just as they influence transitions into and through college.

Our analysis takes advantage of administrative data from a large, urban, public college system to describe features of the first job transition and assess its predictive value in explaining longer-term demographic earnings gaps. By covering a wide range of graduates and examining transitions at a more granular level than prior work has done (quarterly relative to degree conferral), our findings yield new insight into graduates' early experiences and provide a valuable complement to the available causal evidence.

We first document large gaps in earnings five years after graduation by income (as well as by gender and race for comparison) that persist even after controlling for pre-college measures of academic preparation, college attended, field of study, cumulative grade-point average, and other pre-graduation characteristics. We then describe key features of the early career transition, highlighting the frequency of stressful economic circumstances in the early period, and analyzing how features of the first job transition relate to longer-term earnings. Finally, we examine whether and how first job transitions differ by student background, and to what extent these differences can explain the earnings gaps that exist five years after college. We ultimately find

[4] For example, as noted by one economist, "Black Americans live in a labor market that feels like it is swinging from mild recessions to severe ones and never reaching a truly healthy low rate of unemployment" (Austin 2021).

that features of the initial job transition can explain about one-quarter of the variation in Year 5 earnings overall, and nearly two thirds of the residual SES gap (for observably similar students at graduation), which falls from $4,900 to about $1,700 after controlling for first job transitions.

While more work is needed to understand which specific features of the first job transition are amenable to policy intervention, interpreting the results here alongside prior causal evidence suggests that experimenting with innovations to support early career transitions for low-income graduates may be a fruitful direction for future policy and research.

II. Data. Sample, and Core Variables

A. Data

We use two decades of administrative education data on Bachelor's degree graduates from a large, urban, public college system ("The University System") spanning 11 individual four-year colleges, linked to quarterly earnings and unemployment claims data from the state's Department of Labor. Both data series begin around 2000 and continue through early 2024, though for most of our analyses we focus on a narrower range of graduating cohorts to avoid incomplete records at the beginning and end of the series.

The educational data include demographic information collected at college entry, as well as financial aid receipt beginning in 2006. Transcript-level data provides semester-by-semester information within the college system, including course enrollment and grades, detailed major, and any dates of any degrees conferred. In addition, the data are also linked to a subset of National Student Clearinghouse (NSC) records enabling us to track any enrollment or degrees earned after the students' last contact with the University System.

The quarterly earnings and unemployment claims data come from the state's unemployment insurance (UI) system. As such, these data have the strengths and limitations typical of single-state UI records. They capture individual-by-quarter-by-employer earnings and industry of employment, but only for those working within the state. They do not include self-employment or Federal employment. Employment at state and local public agencies is included, though with virtually no employer detail within that sector. We do not have any measure of occupation, or of hourly wages or hours worked, and the employer identifiers are anonymized and not separated by specific establishments within the firm. In addition to the individual-level

data, which covers only individuals who ever enrolled in the University System, we also received an additional dataset indicating total wages paid and total number of employees within the state, by employer and quarter, to enable us to accurately measure firm size and average quarterly earnings (though these additional measures are only available for private sector employers).

The advantages of these data are the granular (semester or calendar quarter level) window into the timing of graduates' transitions, the rich information on students' educational and demographic backgrounds (including proxies for parental income), and a long time series. A key limitation is the lack of earnings data for graduates who migrate out of state, which we will address in more detail below.

B. Sample

Our focus is on approximately 80,000 Bachelor's (BA) degree recipients who entered the University System at age 20 or below, graduated from 2010 through 2017 (inclusive, and covering all conferral dates within each calendar year), and who did not re-enroll in further education (whether inside or outside the University System) within 18 months of graduation. The age-at-entry limitation is to ensure that our sample does not have substantial pre-college labor market experience, and also to ensure that low-income students can be identified based primarily on their parents' income and not on their own current income. Approximately 66 percent of graduates in these cohorts entered at age 20 or below. The justification for the post-college enrollment restriction is to focus on students who were more likely to be truly looking for employment right after graduation, rather than immediately beginning or preparing for graduate school. This post-college enrollment restriction excludes approximately 22 percent of BA graduates overall. We lift this restriction after 18 months because a longer restriction might differentially exclude graduates who fare poorly in the initial labor market transition and pursue a graduate degree as a result.

For many of our analyses, we further restrict our sample to the 80% of graduates who were employed in-state in any quarter of the fifth year after graduation (i.e., they had non-zero earnings in at least one quarter of the fifth year), which is the length of follow up we focus on for our primary analyses. Examining outcomes after five years necessarily limits the cohorts to those who graduated no later than 2017. The requirement of positive earnings in the fifth year is to address the potential confounding issue of out-of-state mobility: out-of-state workers are

indistinguishable in our data from those who remain in-state but are not working. Prior work finds that out-of-state migration tends to bias downward the estimated returns to college degrees as well as the amount of heterogeneity in returns across majors, but that conditioning on positive earnings greatly reduces this bias (Foote & Stange, 2022). We do not require students to have positive earnings throughout the entire five-year period, as our project is particularly interested in understanding students' transitions into and through employment spells, not just their earnings at a point in time. We also examine rates of in-state employment by demographic groups (we do not find any evidence of systematic differences large enough to explain the observed conditional earnings gaps).

Table 1 provides a description of the pre-graduation characteristics and experiences of our primary analysis sample (column 3). Broader samples are shown for comparison and generally indicate minimal change as we restrict to our analysis sample. The table highlights the diversity of this University System, across a range of characteristics. Like bachelor's degree graduates nationally, University System graduates are 60% female. They are much more racially/ethnically diverse than college graduates nationally: nearly 30% self-identify as Hispanic, followed by White non-Hispanic (27%), Asian/Pacific Islander (23%), and Black non-Hispanic (20%). Nearly 30% report speaking a language other than English.[5] Over 70% received a Pell Grant at least once during their undergraduate studies, while 28% took a Federal student loan at some point. Nearly 40% began their undergraduate studies in the University System in an Associate's degree program. The top broad fields of study are Business / Economics (27%), Social Sciences (27%), and Liberal Arts (13%).[6]

The median student accumulated more than two years of work experience (of any intensity) while enrolled, while about 27% accumulated less than one year of work while enrolled. High school GPAs at entry (on a 0-100 scale) are 82 (for the 75% of students for whom HSGPA is available in the data) and SAT scores (for the 66% that have scores) average 956 out

[5] This is a composite of two variables indicating a native language other than English, or a language other than English spoken at home.

[6] Each of these groupings reflects multiple underlying specific degree fields. As these groupings are inherently somewhat arbitrary, we follow the groupings used in Andrews et al. (2024) to enhance comparability. When we control for majors in our regressions, we use more granular 2-digit CIP (Classification of Instructional Programs) codes, as described below.

of 1600. The average cumulative GPA at graduation from college was 3.06 (on a 4-point scale), or just slightly above a "B" average.

The core comparison of interest for much of our analysis is between low-SES graduates, defined as traditionally-aged students who received a Pell Grant (of any size) in 100% of their fall/spring semesters attending the University System, and high-SES graduates, defined as those from the same group who never received a Pell Grant.[7] The motivation for this comparison is that the data on Pell Grant receipt is more consistently available than family income data, and in the years for which we have both, we observe that the consistency of Pell receipt is predictive of family income.[8] Low SES students are approximately 34 percent of graduates, high SES students are about 30 percent, with the remaining 36 percent receiving Pell in some but not all terms.

The characteristics of low and high SES students are shown in the final two columns of Table 1. Of note among these differences is the large gaps in the gender and racial composition across the always and high SES groups, with women making up a 10 percentage point larger share of the low SES group than the high SES group. Similarly, white students are a much larger share of the high SES group than the low SES group, dropping from 50.7% of the population to just 13.3%. Low SES are also much more likely to speak a language other than English natively, have started their time in the university system pursuing an Associate's degree, and much less likely to have transferred into the University system. We will control for all the characteristics displayed in the table in our regressions.

C. Defining key outcome metrics including the "first job"

[7] We do not have official dependency status for all students in our entire sample period and so cannot explicitly subset the sample on that basis, which would be our ideal sample limitation. However, the age restriction to those 20 and younger is a very strong predictor of dependency status, with 95% of students who are 20 or younger and file a FAFSA with the University System being dependent students. Because Pell awards are largely a function of household income as listed on the FAFSA, dependency status determines whether parental income is considered in the eligibility determination. We therefore want to limit to dependent students to ensure that the SES determination is based on parental income, not just the students' own income. Additionally, to make these intensity comparisons as coherent and comparable across students as possible, we consider only fall and spring terms for the percentage calculation, and only for the subset of terms where both Pell receipt is available for all campuses in our sample.

[8] This approach is similar in spirit to Michelmore and Dynarski (2017), who pioneered the use of panel data with annual free- and reduced-price lunch indicators to extract more information about students' income levels than would ordinarily be available from a binary, cross-sectional measure. For the 2017 graduating cohort, always-Pell students had a mean total income of $20,272 (median of $18,041), while those who never received Pell had mean total incomes of $115,224 (median: $97,976). Students with 1-49% semesters had mean incomes of $46,068 and those with 50-99% of semesters had typical total incomes of $25,824.

Year 1, 5, and 10 employment and earnings. To summarize graduates' outcomes over time, we allow for a six-month (two-quarter) transition period after graduation, and then examine employment and earnings in the first, fifth, and tenth subsequent years. For example, for a May 2002 graduate, Year 1 would be 2003Q1 through 2003Q4, Year 5 would be 2007Q1 through 2007Q4, and Year 10 would be 2012Q1 through 2012Q4. All earnings data are inflated to 2023 constant dollars using the CPI-U. For descriptive statistics we focus on median earnings; however, means are more tractable for regression analyses and gap decompositions. To avoid distortions from outliers, we recode annual earnings above $250,000 to $250,000. This represents approximately the 99.5th percentile of Year 5 earnings. These earnings measures are conditioned on employment in the relevant year, unless otherwise noted. For our regression analyses we focus on year 5 earnings.

First Job. Defining the "first job" after graduation is not as simple as it sounds. We want to distinguish substantial employment relationships from short term, temporary work that graduates may do in the months before starting a permanent position, or which may represent the winding down of a job the student held while enrolled. At the same time, we do not want to disregard such employment completely as it may be an important aspect of graduates' initial labor transitions.

We balance these considerations by defining the first job as the first employer at which a graduate has positive earnings for three consecutive post-graduation quarters. This helps ensure that the employment relationship lasted at least 3 months (one quarter plus at least one day on either side). It allows for the first job to be at a pre-graduation employer, as long as the relationship continues for at least three consecutive post-graduation quarters. Our definition is aligned with how prior literature has defined the first job: for example, Arellano-Bover (2024), using Spanish data including days of work, defines the first employer as the first one at which a person works for at least 100 days in a six-month period post-graduation.

First job annualized starting salary. Once we have identified the first job, we use the second quarter of the worker's employment to measure a variety of characteristics about the first job experience. For example, we take the worker's earnings at that employer in their second quarter of attachment, and multiply by four to estimate their annualized starting salary. Using the second quarter ensures that the earnings reflect a full quarter of attachment and are not censored

by the employee starting or leaving the firm mid-quarter. We again top-code annual earnings above $250,000 to $250,000.

Firm size, average quarterly wages, and industry. We also use the second quarter of attachment to measure the first-job-firm's total number of employees and average quarterly wages paid.[9] Average quarterly wages are also inflated to 2023 constant dollars using the CPI-U. The firm's industry is identified using the 6-digit NAICS code, though for some analyses we use the less-granular 2-digit codes to group industries. Small firms are defined as those with up to 25 in-state workers, medium-sized firms as 26-499 in-state employees, and large firms as those with 500 or more workers. These cutoffs are larger than has been used in the prior literature (e.g., Arellano-Bover's 2021 cross-country analysis defines a large firm as 250 or more workers), but better reflect the distribution in our sample where more than half of recent graduates work at employers with more than 500 workers.

Public sector employment. The prior literature on initial job transitions often excludes public sector employment from consideration, in some cases due to data limitations.[10] This state's UI records also include quarterly wages for public sector employees, but employer-level information including size, average wages, and industry is missing for these records. We identify public sector employers from their pseudo-IDs using a separate crosswalk provided by the state. We impute the two-digit industry for these records to 92, the NAICS code for federal, state, and local government employees. For firm size purposes, we classify public sector employers as "large employers."

Industry-major match. To create a flag for whether the first job was in an industry related to the student's major field of study, we compare the firm's industry as measured by the 3-digit NAICS code to the graduate's major field as indicated by the 6-digit CIP (Classification of Instructional Programs) code of their bachelor's degree. Any given industry contains a wide variety of occupations, so defining a major-industry match is not straightforward. We follow the strategy developed by Odle and Russell (2024), who first use a crosswalk developed by BLS/NCES to map majors (CIPs) to occupations (SOC codes), and then use the BLS's 2023

[9] This employer-level information is based on the firm's in-state employment records. It is provided via a separate extract since our individual-level data cover only workers who enrolled in the University System.
[10] For example, Arellano-Bover (2021) and Arellano-Bover (2024) exclude public sector employees. Public sector employers are included in Arellano-Bover & Saltiel (2024).

Industry-Occupation Matrix to identify industries that make up more than 10% of that occupation's employment. Since our data has 2010 CIP codes, we first convert to 2020 codes using a crosswalk provided by NCES. Our proxy thus considers a first-job to be in a matched industry if the industry is one that attracts at least 10% of the occupations linked to the graduate's major.

III. Decomposing earnings gaps

The overall goal of our analyses is to understand how transitions in the labor market relate to medium term job outcomes and how those transitions differ across groups. Our approach is similar in concept to a Oaxaca-Blinder decomposition (as first presented in Oaxaca [1973] and Blinder [1973]). The basic method seeks to decompose observed, group-level gaps in outcomes into a portion that can be explained by differences in other observable characteristics, and an unexplained portion. While many early applications of the Oaxaca-Blinder decomposition sought to explore the scope for labor market discrimination, the method has also been used more generally as a way of exploring potential mechanisms underlying any group-level differences. While it does not test a causal hypothesis, it can help place prior causal estimates in context and inform the development of future hypotheses for causal evaluation. The usefulness of the method depends on the availability and quality of relevant observable characteristics.

Numerous alternatives and improvements to the basic decomposition method have been suggested over time. We follow Elder, Godeeris, and Haider (2010) who consider a variety of approaches and conclude that a simple, pooled OLS regression with a group-level indicator variable is an effective approach and less subject to bias that can overstate the role of observable characteristics in other approaches. We first estimate the observed (raw) gaps in group-level outcomes by running a pooled regression with only the group-level indicator(s), and then add groups of potential explanatory variables sequentially, with characteristics of the first job transition coming last. We are interested both to understand how much of the college-experience-adjusted earnings gaps can be explained by the first job transition, as well as how much of the gap remains unexplained thereafter. Specifically, we estimate versions of the following equation:

(1) $$Y5Earnings_i = \alpha_0 + \beta_1(Pell\ Group_i) + \beta_2(Female_i) + \beta_3 RaceEth_i + \delta PreCollegeChars_i + \gamma CollegeExperiences_i + \theta FirstJobTransition_i + \varepsilon_i$$

Y5Earnings are total earnings in Year 5 (as described above), conditional on positive in-state earnings that year; *Pell Group* is the set of indicators underpinning our key definition of high and low SES but also includes the middle SES groups by indicating the fraction of semesters a student received a Pell Grant, with students falling into 0% of semesters Pell (our high SES group), 1-49% of semesters, 50-99% of semesters, or 100% of semesters (our low SES group); *Female* and *RaceEth* are indicator variable for the student's recorded gender and racial/ethnic identity as recorded in administrative records;[11] *PreCollegeChars* is a vector of other fixed pre-college characteristics at the start of college, including: fixed effects for age at entry (under 18, 18, 19, 20, or missing); an indicator for whether a student natively spoke a language other than English; and a set of controls to characterize pre-college academic preparation, including high school GPA and SAT scores, or indicators for those measures being unavailable. *CollegeExperiences* is a vector of characteristics measured at the time of degree completion, including: college fixed effects, cohort fixed effects, 2-digit CIP code fixed effects, an indicator for whether the student first entered the university system in an Associate's or Bachelor's degree program (with Certificate entrants the omitted category), an indicator for whether the student has an AA degree from the college system, an indicator for whether the student first entered the university system as a transfer from outside the system, time-to-degree (measured in days from university system entry), cumulative grade point average (GPA), and fixed effects for quarters employed during college (0, 1-4, 5-8, or 9+).[12]

Finally, *FirstJobTransitions* is a vector including: fixed effects for the quarters between graduation and the first job start (with immediate employment at a pre-graduation employer serving as the omitted category), an indicator for whether the first job was held for at least two years, an interaction between (started within 2 years) and (held for at least 2 years), total number of unique employers in first four years, first job industry (3-digit NAICS codes; approximately 90 categories), first job was in the public sector, first job was in a major-matched industry, first job size (1-25, 26-499, 500+), first job average firm wage, first job annualized salary, first job wage relative to firm average.

[11] Race/ethnicity is recorded in five categories: Asian/Pacific Islander, Non-Hispanic Black, Hispanic, Non-Hispanic White, and all other.

[12] We group quarters of in-school employment into categories to avoid confounding this variable with time-to-degree.

Figure 1 below provides a conceptual framework—mapping college experiences, to early career transitions, to Year 5 earnings—in order to aid interpretation of the regression results. As indicated, student background characteristics such as SES, gender, or race/ethnicity are factors which could exert influence at any or every stage. College experiences could affect early career transitions, but they can also influence Year 5 earnings directly. Within the set of early career transition metrics, the first job salary has a special position because it may be itself partly determined by other features of the early career transition, such as how long graduates take to find a job, the firm's size, average wage, industry, or industry-major match. This will make it conceptually difficult to fully separate any predictive power of the first job salary from these associated early career transition metrics. We will return to this complexity when discussing the regression results.

IV. Results

A. Raw and demographically-adjusted earnings gaps

To set the overall context, Figure 2 shows overall earnings gaps earnings (conditional on employment) for our full sample in Years 1, 5, and 10 post-graduation, for high and low SES students. Panel A shows that, conditional on positive earnings in the relevant year, low SES graduates earn about 12% ($8,800) less on average than non-recipients in Year 5, with the gap growing larger over time but bouncing around a bit in percentage terms, from 16% ($6,200) at year 1 to 15% ($14,500) at year 10. This magnitude is consistent with the SES gaps documented in previous studies, such as Witteveen and Attewell (2017) who use data from the Baccalaureate and Beyond 1993-2003 study.[13] Mean earnings align best with the measures we will use later for our regression decompositions, but median earnings (Panel B) tell a similar story, lowering the levels, but resulting in similar percentage gaps. Panel C shows little difference in employment rates across the two groups, with low SES students 1-2 percentage points more likely to appear in the earnings data in each year than their high SES peers. This limits the scope for the large earnings gaps to be explained by differences in out-of-state migration.

[13] The statistics are not directly comparable, but Witteveen and Attewell (2017) examine income gaps 10 years after graduation by parental income quintile, finding baseline gaps of 18-20% for the bottom two quintiles versus the top quintile, and 10-11% for the 3rd and 4th quintiles versus the top quintile.

The median earnings for low SES recipients five years after graduation, $58,800, is approximately the 41st percentile of the high SES earnings distribution (a 9 percentile gap). Ten years after graduation, median earnings for low SES recipients ($76,535) is approximately the 39th percentile of the high SES distribution. This matches the 11-percentile gap in earnings by family income that Chetty et al. (2020) find in national data (considering income for 32- to 34-year-old college enrollees with college fixed effects). Given that Chetty et al. (2020) examine gaps between the highest and lowest income quintiles in their data (while in our sample, low SES recipients are 34% of the sample and high SES students are 29%), and they cannot observe graduation rates or the timing of graduation—both of which differ by family income—it is notable that our estimated gaps are not dramatically smaller than theirs.

Of course, low SES recipients are different from non-recipients along a number of dimensions even before starting their current degree program (see Table 1). Figure 3 thus shows the raw and adjusted SES gaps in Year 5 earnings that remain after controlling for all differences that are fixed at the time of college graduation, as illustrated in Equation 1 above. For comparison, the raw and adjusted gaps by gender and race/ethnicity are also shown. The college- and demographically-adjusted SES gap that remains is still large: about $4,900, or about 8% of mean Year 5 earnings for low SES recipients. This is a bit larger than the adjusted Black-White earnings gap and over half the magnitude of the adjusted gender gap at Year 5.

B. Initial transitions post-graduation

We now turn to describing features of the early labor market transition. Figure 4 illustrates how long it takes for graduates to begin their first job after graduation, limiting the sample to those with any employment in Year 5.[14] Quarter 0 in this context indicates that a graduate started their first post-graduation job within three months of graduation at an employer they worked for *prior* to graduation, while quarter 1 means the graduate started their first job within three months of graduation at a new employer. Overall, the patterns for low SES recipient and non-recipient grads are very similar: while the vast majority have started their first job within four years (16 quarters) of graduation, about 22% of graduates had not started their first

[14] This helps ensure that the graduates who remain unlinked to a first job are not just those that left the state; without this restriction the first job attachment rates are about 4-5 percentage points lower after 9 months but the overall pattern is very similar.

job within a year of graduation. One notable difference is that low SES recipients start out somewhat less likely to already have their first job lined up prior to graduation (33% vs. 39%). They then catch up to non-recipients over the first year and are slightly more likely to have started their job within two years of graduation (93% vs. 92%).

Just because a graduate has not yet started their first significant employment, does not necessarily imply that they are not working at all (indeed, 70% have some earnings in their graduation quarter, with slightly higher rates among Pell recipients); conversely, just because a graduate has started their first job does not mean they are economically secure. Figure 5 thus examines three measures of early labor market stress, by SES and graduation cohort. The first two measures focus on Year 1 (beginning *after* a six-month "grace period" after graduation) and examine whether a graduate experienced any zero-earnings quarter in that year, or whether their annual earnings in that year fell below the poverty line (for a single individual). The figure shows that for the 2010 cohort that graduated during the Great Recession, more than one in three graduates experienced at least one quarter of zero earnings during Year 1, while about a quarter had earnings below the poverty line in that year. These figures had fallen to 27% and 15% respectively for the 2017 graduation cohort. While the rates for low-SES graduates are above those for high-SES graduates over most of the period examined, there is little notable difference between low and high SES graduates on these metrics at the end of the series.

The third metric in Figure 5 considers whether graduates ever filed an Unemployment Insurance (UI) claim in the 24 months after graduation. Notably, the two-year UI claim rates are much lower (about 9% on average) than the proportion experiencing at least 3 months without earnings in Year 1 (about 29% on average). The relatively low claiming rates may either reflect true ineligibility for UI (which requires a minimum level of labor market attachment and a qualifying reason for job separation) or lack of take-up among eligible unemployed workers.[15] Whatever the reason, low SES recipient graduates are consistently more likely to claim UI within two years of graduation, even for the more recent cohorts who are no more likely to be out of

[15] Low take-up of UI among the unemployed is a well-documented issue: a 2023 BLS analysis finds that only about one-quarter of unemployed individuals (who had worked in the past 12 months) applied for UI benefits: https://www.bls.gov/news.release/uisup.nr0.htm.

work. The difference is largest for the 2010 cohort (16% vs. 10%) but remains large in 2017 (6% vs 3%).

C. Characteristics of the first job

Table 2 describes average characteristics of the first job, overall and by SES. In order to assess the relationship between these measures and earnings at Year 5, we limit the sample here to the 62,998 that had attached to their first significant job within four years of graduation. As a result, the timing of first job start for this sample is earlier than shown for our broader sample of graduates in Figure 4. Among those who obtained their first job within four years, over a third (39%) had linked up with that employer prior to graduation, with lower proportions for low SES versus high SES graduates (34% vs. 40%).

Beyond this, perhaps the most notable differences in first job characteristics between low SES and high SES graduates relates to their own salary and their firm's average salary: low SES graduates earn about 12% less at their first job than high SES graduates ($37,600 vs. $42,700). However, the firms low-SES graduates work at have even lower average earnings compared to the firms of their high-SES peers (18% lower, $52,600 vs. $64,400). As a result, the median low SES graduate earns a higher proportion of their firm's average wage than the median high SES graduate (65% vs. 62%). While the comparisons in this table should not be overinterpreted (because Pell and non-Pell graduates differ in their other characteristics at graduation), firms at which one's own wage is lower relative to the firm average could potentially correlate with greater opportunities for human capital development and upward advancement. We will explore these relationships directly in our regression analysis.

D. Relationship of the first job to Year 5 earnings

Table 3 presents regression coefficients based on versions of equation (1), which relates average earnings at Year 5 to first job characteristics and other early labor market metrics. All models include demographic, pre-college academic achievement, and college experience controls, which on their own explain about 14% of variation in Year 5 earnings, as measured by the R-squared. Model 1 adds to these baseline predictors the first job characteristics and related early labor market transition variables (timing of job start and total number of employers within first four years) but excludes the first-job salary variable and the salary-relative-to-firm-average

variable. First job industry fixed effects are also included in this model but not reported in the table for brevity. Our complete model in column (2) adds the first job annualized salary, and salary-relative-to-firm average. We initially exclude the first job annualized salary because of the expectation that it is highly correlated with other first job characteristics; it is useful to examine the predictive value of first job characteristics both separately and in addition to the direct salary measure. Finally, Model 3 shows for comparison a model that drops all first job and early labor market transition variables (including industry) *except* for the first job salary.

Several interesting patterns emerge from this table: first, the first job salary is (unsurprisingly) a powerful predictor of earnings at Year 5. Every $1,000 of additional first job salary translates into an extra $700 in earnings at Year 5, whether or not other first job characteristics are included. Added to the baseline model, it can explain an additional 18 percentage points of the variation in Year 5 earnings. Yet other first job and early transition metrics are also powerful predictors beyond our baseline model, explaining an additional 8 percentage points of the variation in Year 5 earnings even before own salary is added. Together, our complete model explains about 35% of variation in Year 5 earnings.

Next, all else equal, those who start a job sooner rather than later is better for earnings at Year 5, though this pattern is less pronounced in column (1) which does not control for first job earnings. This implies there may be some tradeoff between first job salary and start quarter. However, it is important to note that most of the sample finds a job before graduation or shortly thereafter. As Figure 4 shows, over 60% of the sample has found their first job by the second quarter after graduation.

Third, holding the first job for at least two years has a substantial association with Year 5 earnings, with those who stay for at least 8 quarters after graduation earning $10,000 more than their peers who do not, a relationship that shrinks somewhat once we control for first-job salary (to $6,800). In addition, the coefficient on the interaction between this measure of job tenure and an indicator for starting the first job within two years is negative and of equal or larger magnitude. Since most graduates do in fact start their first job within two years, this indicates earnings gains from moving on from the first job for most graduates. Our direct measure of this relationship comes from the coefficient unique number of employer IDs a student has in the UI data within 16 quarters of graduation. This variable indicates each additional employer is

associated with about $634 in additional Year 5 salary (the typical graduate has about 2.5 employers within four years).

Finally, Table 3 suggests that firm size, firm average wages (and own wage relative to firm average), and industry-major match are all positively associated with earnings at Year 5, even after controlling for pre-transition characteristics and all other early transition metrics, including the first job industry and annualized individual salary.

To complement these regression results, Table 4 presents results from a Shapley-Owen decomposition of the R-squared value (following Huettner & Sunder, 2012). This decomposition summarizes the proportion of variation in Year 5 earnings that can be explained by different groups of predictors, regardless of what order they are added to the regression.[16] To form logical groupings, we have organized the table in accordance with the conceptual model in Figure 1, to separately understand the explanatory power of pre-college characteristics, in-college experience measures, and first-job characteristics, with enough granularity within each of these broad categories to balance computational burden and a more precise understanding of the most powerful subcomponents of each grouping.

This table confirms the central importance of annualized starting earnings at the first job for explaining variation in Year 5 earnings: it accounts for just under half of the total R-squared, or 17% of variation overall. Industry fixed effects explain an additional 11% of the total R-squared, or 4% overall. Together, firm average earnings and own earnings relative to firm average are about as powerful as major field (each explaining about 3% of variation). Together, even the first job characteristics without initial wage have nearly twice the explanatory power for Year 5 wages (about 29% of R^2 comes from them) than do college characteristics and

[16] A common way to describe the contribution to the explanatory power of a model of a given regressor or set of regressors is to see how much the R2 increases when that measure is included after all other components of the model. However, in the (very common) case where the measure of interest is correlated with other elements of the model, the marginal R2 will not reflect the full contribution of that measure to explaining the variation of the outcomes because its correlates will already have captured some of its own explanatory power. The Shapley-Owen approach attempts to more accurately represent the marginal contribution of regressors by expanding the approach of measuring the difference in R2 between models with and without the variable of interest to include all the permutations of models possible with the set of regressors in the fully specified model. The Shapley value is then calculated as the average marginal R2 across all these model permutations. Because the number of permutations for large models is often computationally infeasible to calculate, the Owen approach allows us to group sets of predictors together and calculate their combined marginal contribution to the explanatory power of the model.

experiences (which include college and major fixed effects and cumulative GPA and account for 16.5% of R^2).

D. The role of the first job transition in Year 5 earnings gaps

Having documented the large socioeconomic gaps in Year 5 earnings and the relationship of the first job transition to Year 5 earnings, we now put the two together. Figure 6 presents the adjusted gaps previously shown in Figure 3 (after adjusting for other demographic, pre-college academic preparation, and end-of-college measures, including major and GPA), and compares them to the gaps after controlling for first job transition metrics. All in, differences in the first job transition can explain about two-thirds of Year 5 earnings gaps between higher- and lower-SES students (as proxied by Pell status) with similar observable characteristics at graduation. The first job salary on its own can explain nearly 54% of the residual gap.

Low SES recipients are disproportionately women and students of color (see Table 1). Though our regressions compare low SES and high SES graduates who are otherwise observably similar, one may still wonder to what extent the role of the first job transition is specifically important for SES gaps, or whether it can similarly explain the large racial/ethnic and gender gaps. We do find that first job transition can also explain substantial portions of racial/ethnic and gender gaps in Year 5 earnings. The proportions explained, however, are much smaller—ranging from about 14% to 30%, depending on the group.

V. Discussion

Prior research demonstrates the causal impact of early labor market transitions on subsequent earnings. The causal literature is largely based on arguably exogenous variation in these transitions due to differential exposure to recessions across graduating cohorts. Yet, some graduates may be disadvantaged in this transition, regardless of the broader economic context.

We focus in particular on the extent to which differences in the first job transition may explain large gaps in Year 5 earnings for graduates from lower- versus higher-income families, as measured by whether or not they always or never received Pell while enrolled. We document a large, 12% gap in earnings at Year 5 by SES, which remains large and highly statistically significant even after controlling for a rich set of demographic and end-of-college predictors. The

adjusted gap of $4,900 is larger than the adjusted Black-White gap at Year 5, and more than half the size of the adjusted gender gap.

Descriptive statistics on the first job transition highlight the substantial exposure to economic stress that graduates face in their first two years in the labor market, even in favorable economic conditions and despite strong earnings on average. Among the 2017 graduating cohort, for example, nearly one in four graduates had earnings below the poverty line in Year 1, and a little more than one in four experienced at least three months in Year 1 with no earnings (both figures set aside the first 6 months when many graduates have not yet started a job). About 9% applied for unemployment benefits within two years of graduation. If higher- and lower-SES students have differential resources (family wealth, information, and/or networks) with which to navigate this economically stressful transition, it may lead to differences in first-job outcomes that have persistent effects on earnings.

Our initial examination of the role of first job characteristics in explaining Year 5 earnings are largely consistent with prior economic theory and evidence: characteristics of the first job transition, including firm size, industry-employer match, and measures of job mobility are strong predictors of Year 5 earnings. We also find a significant role for the first firm's average salary and own salary relative to the firm average, even after controlling for own salary. These measures may identify firms with more potential for human capital development and upward advancement. Overall, characteristics of the first job transition including first job salary can explain 27% of the variation in Year 5 earnings, well beyond the 2% explained by pre-college background characteristics and or 6% for end-of-college predictors (Table 4). First job transitions also explain nearly two-thirds of the SES gap in Year 5 earnings, reducing the adjusted gap from about $4,900 to under $1,700 (Figure 6).

Some puzzles and open questions remain, however. If lower SES graduates are matching to lower-paying firms and earning lower wages than their college, major, GPA, and other pre-graduation characteristics would predict, what is driving these differences? Future research is needed to explore the role of pre-graduation work experiences, and job-seeking behavior by SES before and after graduation. Additionally, more work is needed to understand which specific features of the first job transition are amenable to policy intervention, and whether such interventions would causally impact future earnings in the ways these descriptive patterns

suggest. Finally, an important caveat is that our descriptive analysis is limited to university graduates from a single system (representing multiple campuses) in a limited geographic area, and the relationships that we document are predictive but not necessarily causal. Nonetheless, interpreting the results here alongside prior causal evidence suggests that experimenting with innovations to support early career transitions for low-income graduates may be a fruitful direction for future policy and research.

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Figure 1. Conceptual framework.

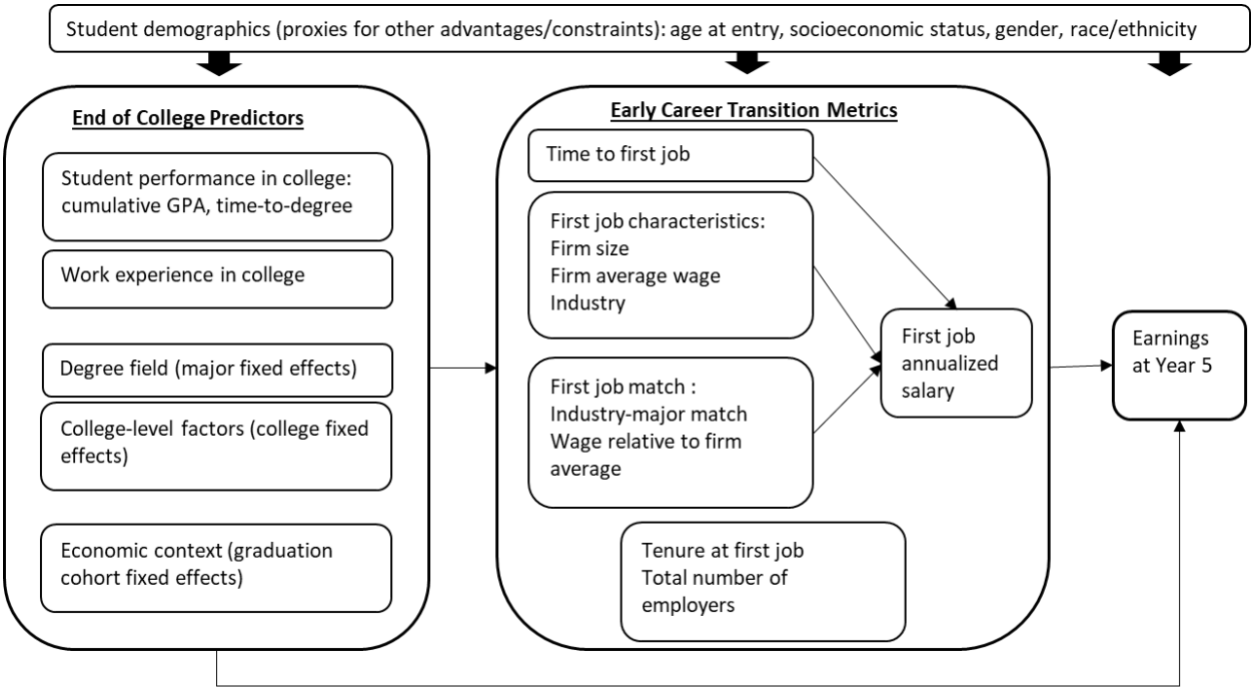
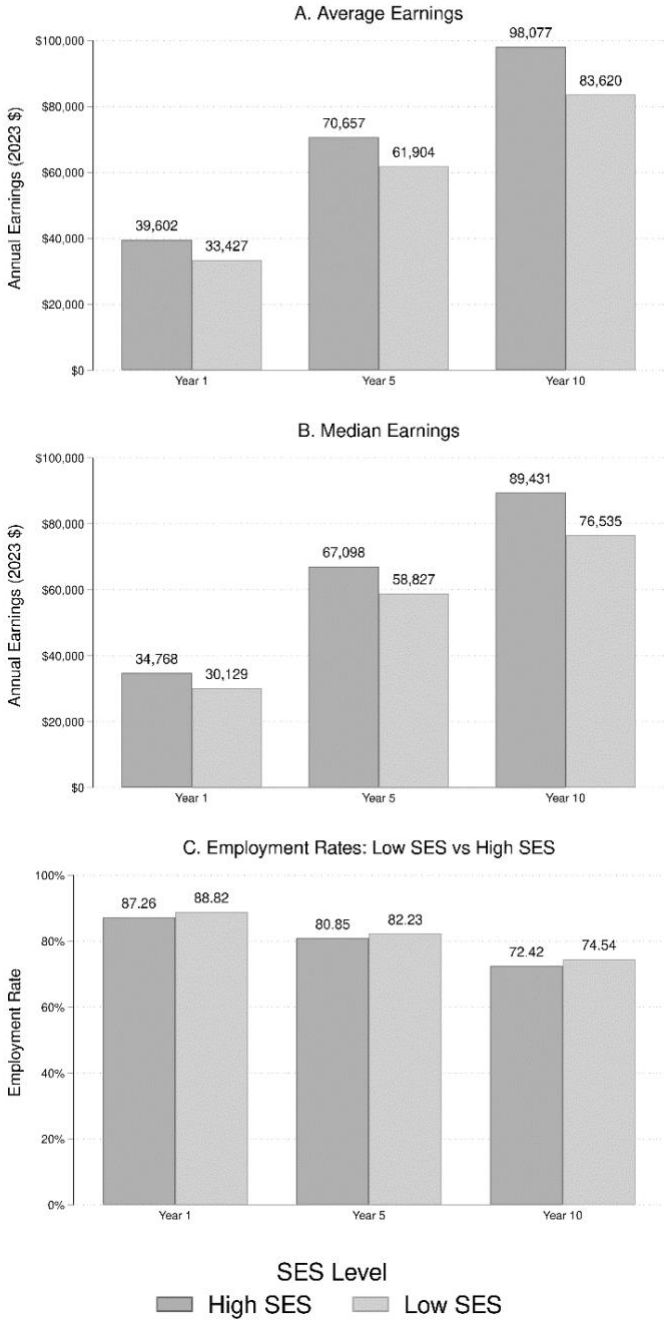


Figure 2: Low SES vs High SES Comparison

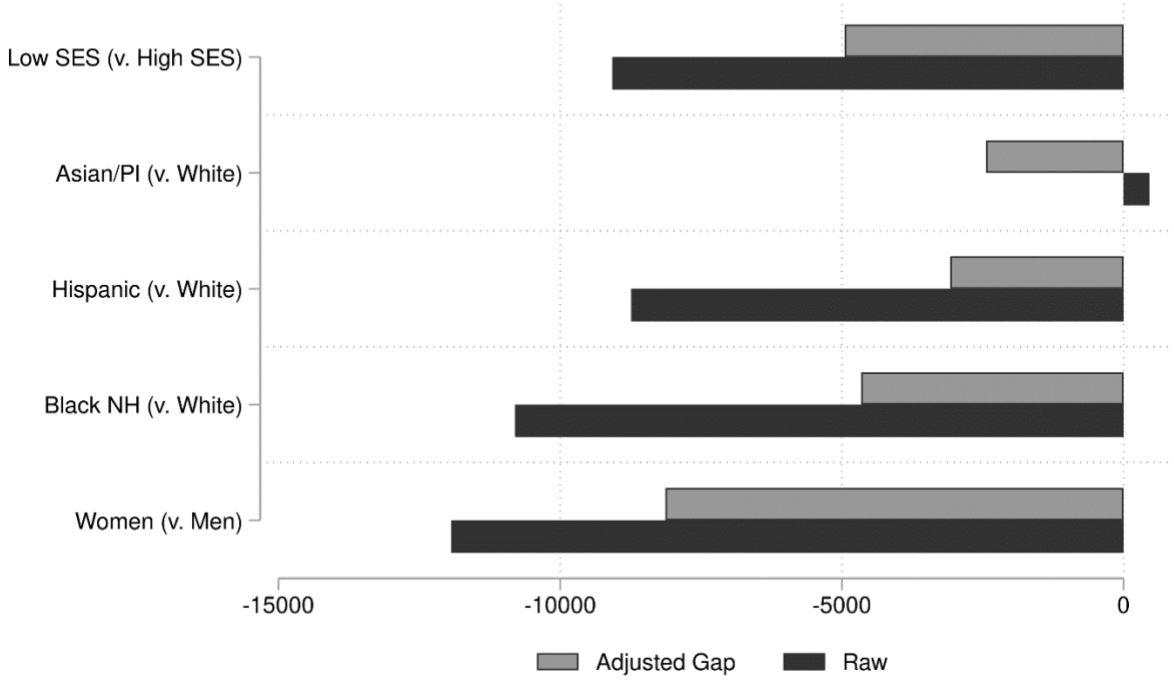
College System BA Graduates 2010-2017, Age at Entry ≤20



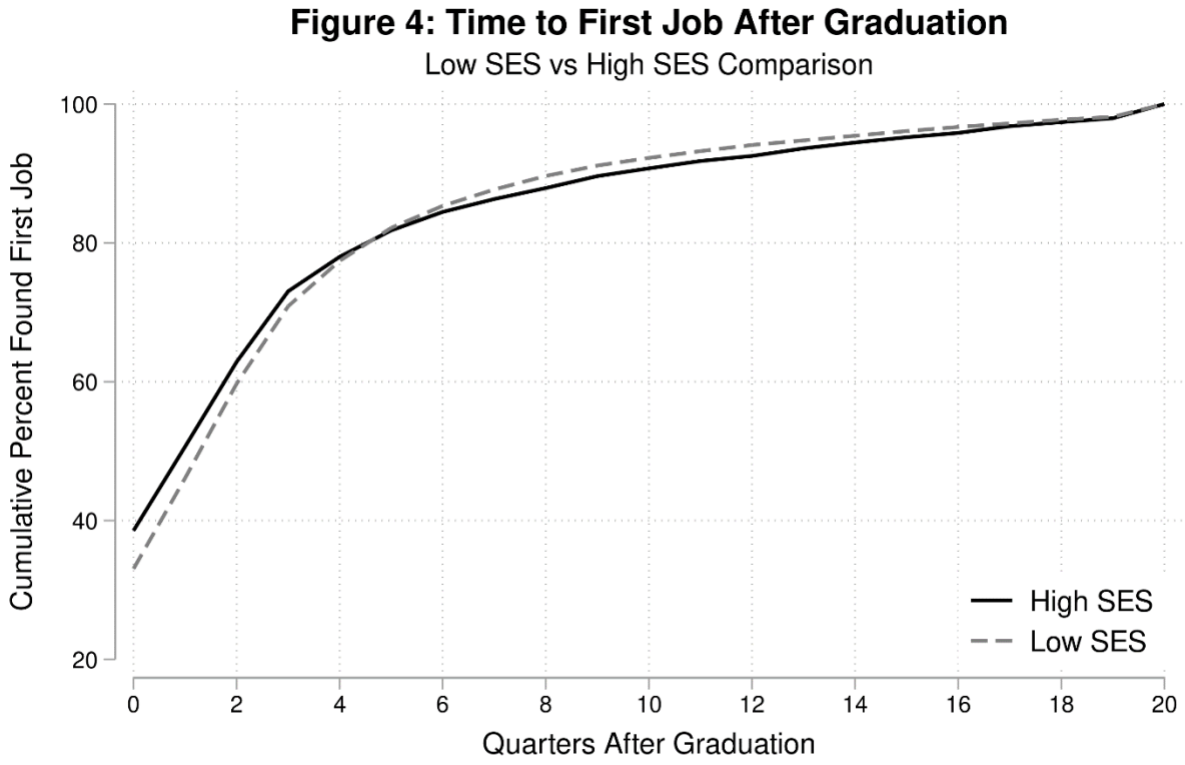
Source: Administrative enrollment and financial aid data from the College System and administrative earnings records for the Unemployment Insurance (UI) system from the state Department of Labor.
Note: Sample includes college system BA graduates 2010-2017, age at entry ≤20, who did not re-enroll anywhere within 18 months of graduation and had at least one quarter of post-graduation employment in state. High and low SES is defined by the extremes of our Pell intensity groupings, based on share of fall/spring semesters with Pell grants: High SES = Never Pell (0%) and Low SES = Always (100%). Earnings adjusted to 2023 dollars using CPI-U. Note that 10-year earnings are undefined for graduation cohorts 2014-17 and therefore not included in the means for that year only. For a balanced panel version of this plot, see Appendix Figure 1. Employment is defined as any UI-covered wages in calendar year.

Figure 3: Year-5 Earnings Gaps, Raw and Adjusted

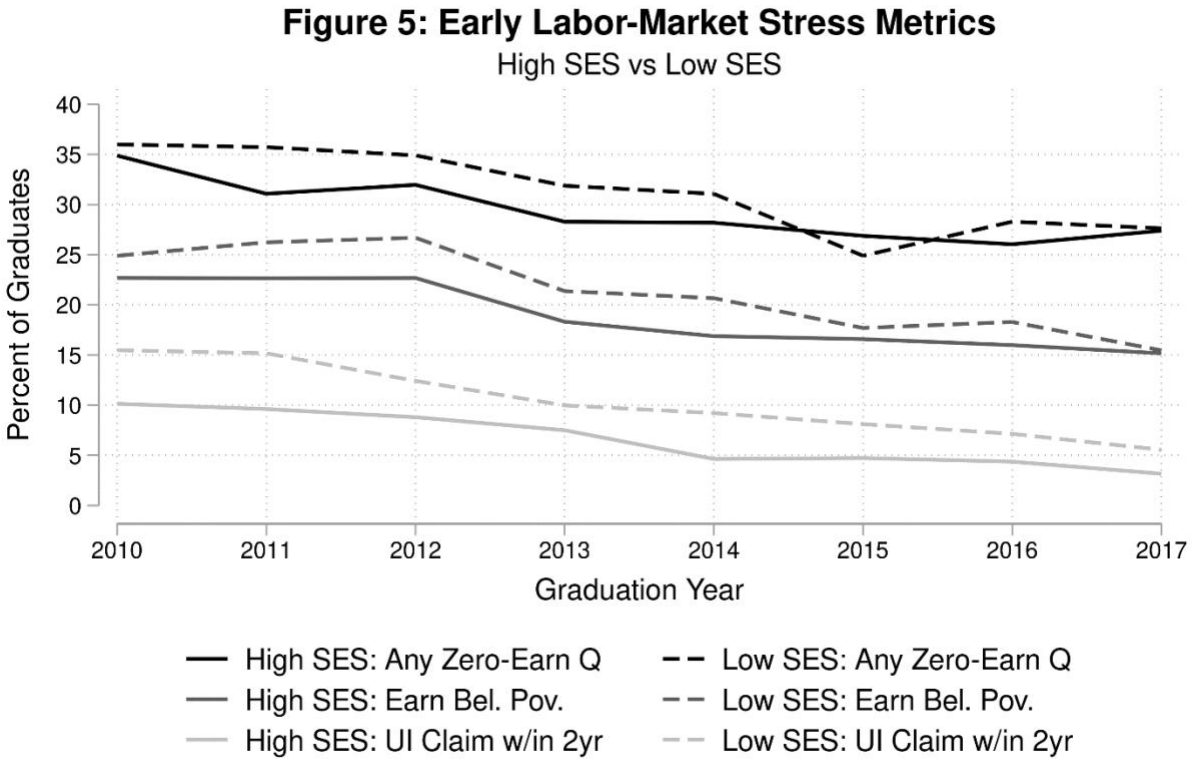
Unadjusted vs. Adjusted for Pre-College Characteristics & College Experience



Source: Administrative enrollment and financial aid data from the College System and administrative earnings records for the Unemployment Insurance (UI) system from the state Department of Labor.
Notes: Sample includes college System BA graduates from 2010-2017 whose age at entry was 20 or younger, who did not re-enroll anywhere within 18 months of graduation, had a first job within 16 quarters, and are employed at 5 years after completing their degree. "Raw" gaps show coefficients from bivariate regressions (e.g. earnings on SES indicators only). "Adjusted gaps" control for pre-college characteristics and college experiences but not first-job characteristics. See Figure 6 for gaps after controlling for first job measures. Low SES means 100% of fall and spring semesters receiving Pell; high SES means 0% of fall/spring semesters receiving Pell. For all variables but the outcome, missing values replaced with zero and missing indicators included for all continuous regressors. Categorical variables have an added missing group. All earnings expressed in 2023 dollars using the CPI-U.



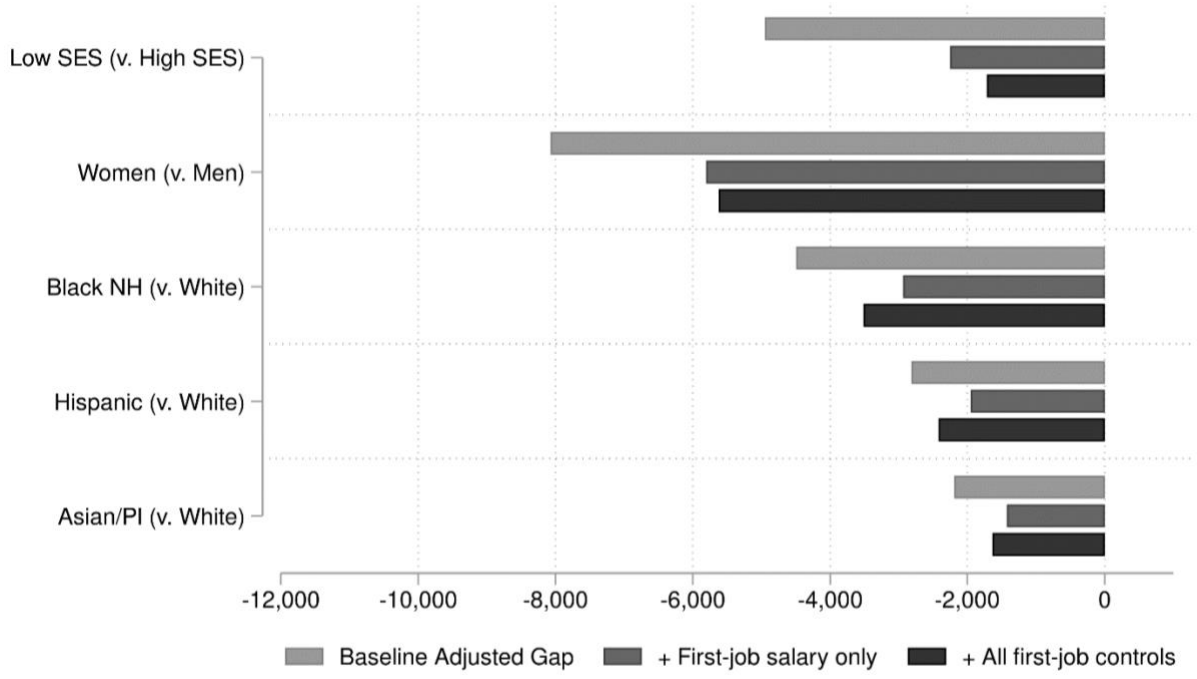
Source: Administrative enrollment and financial aid data from the College System and administrative earnings records for the Unemployment Insurance (UI) system from the state Department of Labor.
Notes: Sample includes College System BA graduates 2010-2017, age at entry ≤20, who did not re-enroll anywhere within 18 months of graduation and had at least one quarter of post-graduation employment in state. First job defined as 3 consecutive post-graduation quarters of employment with same employer. High SES = Never Pell (0% of fall/spring semesters); Low SES = Always Pell (100% of semesters). Timing measured in quarters from graduation to start of first stable employment relationship. Quarter 0 means that a student continued working at an employer for at least 3 quarters post-graduation (the minimum to qualify as a first job) who they had worked for prior to graduation.



Source: Administrative enrollment and financial aid data from the College System and administrative earnings records for the Unemployment Insurance (UI) system from the state Department of Labor.
Note: Sample includes College System BA graduates 2010-2017, age at entry ≤20, who did not re-enroll within 18 months of graduation and had at least one quarter of post-graduation employment in state. "Any Zero-Earnings Quarter in Year 1" means student had at least one quarter with no reported earnings in their first year after graduation. "Earnings Below Poverty Line in Year 1" means student's total earnings in their first year were below the federal poverty threshold. "UI Claim within 2 years" means student filed an unemployment insurance claim within 2 years of graduation. High SES means 0% of fall/spring semesters receiving Pell; low SES means 100% of fall/spring semesters receiving Pell.

Figure 6: Additional Impact of First-Job Controls on Earnings Gaps

Relative to Adjusted Base SES Gap, for Traditionally Aged BA Graduates, 2010-17



Source: Administrative enrollment and financial aid data from the College System and administrative earnings records for the Unemployment Insurance (UI) system from the state Department of Labor.
Notes: Sample includes college System BA graduates from 2010-2017 whose age at entry was 20 or younger, who did not re-enroll anywhere within 18 months of graduation, had a first job within 16 quarters, and are employed at 5 years after completing their degree. All models control for demographics and college experience. "Baseline adjusted gap" matches Figure 3 adjusted gaps. "Baseline adjustments + First Job Salary" adds first-job earnings only. "All first-job controls" adds earnings plus all other first job measures described in Section III of the paper and shown in full in Appendix Table 1. Low SES means 100% of fall and spring semesters receiving Pell; high SES means 0% of fall/spring semesters receiving Pell. For all variables but the outcome, missing values replaced with zero and missing indicators included for all continuous regressors. Categorical variables have an added missing group. All earnings expressed in 2023 dollars using the CPI-U.

Table 1: Student Demographic and College Background - 0% vs 100% Pell Categories Analysis

	2010-2017 Grad Cohorts, Ever Match to UI Data	2010-2017 Grad Cohorts, Employed at Any Point in Year 5	2010-2017 Grad Cohorts, Employed at Any Point in Year 5 & First Job w/in 4 years	Socioeconomic Status Group	
				High	Low
Gender					
Female	59.8	60.0	60.3	54.3	64.7
Race/Ethnicity					
White, Non-Hispanic	28.3	27.5	27.2	50.7	13.3
Black, Non-Hispanic	19.8	20.0	20.1	14.7	19.6
Hispanic	28.6	29.4	29.7	17.3	37.6
Asian/Pacific Islander	23.0	22.8	22.7	17.1	29.3
Language					
Language other than English	29.9	29.6	29.5	17.2	38.2
HS GPA at Entry (0-100)	81.6	81.6	81.5	83.4	81.6
Percent Missing HS GPA	25.8	25.1	25.0	30.2	21.2
SAT Score at Entry (400-1600)	962.0	958.6	956.4	1033.5	921.0
Percent Missing SAT	34.0	33.1	33.1	34.3	29.8
Pell Grant Status					
Pell Grant Status: Ever Pell	70.4	70.7	70.9		
Loan Status					
Loan Status: Ever Borrowed	27.9	28.0	28.1	21.4	22.4
Credential Level					
Certificate	0.2	0.2	0.2	0.2	0.2
Associate's	37.7	37.9	38.1	25.6	39.1
Bachelor's	62.1	61.9	61.7	74.3	60.7
Cumulative GPA at Graduation	3.1	3.1	3.1	3.1	3.1
Field of Study					
Business + Economics	27.2	27.4	27.6	28.4	28.2
Social Sciences	26.6	26.6	26.6	24.3	27.4
Liberal Arts	13.5	13.3	13.2	15.1	11.7
Biology + Health	8.1	8.1	8.1	7.7	7.2
Communications + IT	8.1	8.1	8.1	9.6	7.4
Security/Protective & Other Applied Svcs	8.5	8.6	8.6	7.6	10.2
Education	2.7	2.9	3.0	2.8	2.9
Engineering + Architecture	2.0	1.9	1.9	1.7	2.0
Physical Sciences + Math	1.8	1.6	1.5	1.6	1.4
Undeclared	1.3	1.3	1.3	1.0	1.5
Agriculture + Natural Resources	0.2	0.2	0.2	0.2	0.1
Employment during Enrollment					
No Employment	7.9	7.4	7.1	7.1	7.7
1-4 Quarters	21.3	20.5	20.0	20.9	23.0
5-8 Quarters	25.0	25.0	25.1	24.4	28.5
9+ Quarters	45.8	47.1	47.8	47.7	40.9
Time to Degree from First UG Enrollment	5.6	5.6	5.6	5.0	5.0
Flag for Transfer into First UG Enrollment (%)	15.6	15.0	15.0	22.9	10.9
Missing Transfer Flag Info (%)	1.0	1.0	1.0	1.2	0.6
Number of Observations	80,018	65,300	62,998	18,426	21,493

Source: Administrative enrollment and financial aid data from the College System and administrative earnings records for the Unemployment Insurance (UI) system from the state Department of Labor.

Note: All columns restricted to College System BA completers who enter college before age 20 and did not re-enroll anywhere within 18 months of graduation. Other sample restrictions listed in column headers. High SES column shows students who never received a Pell grant; Low SES shows students who received Pell in all fall and spring semesters. High and low SES columns use the same sample restrictions as column 3, but with the additional SES restriction. All dollar amounts are in 2023 dollars, adjusted using the CPI-U.

Table 2. First Job Characteristics – By Income Group

	Overall	Socioeconomic Status Group	
		High	Low
Timing of Starting First Job			
Continued Pre-Graduation Job	38.8	40.2	34.2
New Job in Graduation Quarter	12.5	12.6	13.5
2nd Quarter After Graduation	13.2	12.7	14.1
3rd Quarter After Graduation	10.8	10.6	11.5
4th Quarter After Graduation	5.9	5.2	6.8
2nd Year After Graduation (Q5-8)	11.3	10.3	12.6
3rd Year After Graduation (Q9-12)	4.6	4.8	4.6
4th Year After Graduation (Q13-16)	2.9	3.5	2.7
Employer Size			
1-25	15.4	17.0	15.0
26-500	31.3	32.4	31.2
500+	53.3	50.6	53.8
Industry			
Government Entity	13.1	12.8	12.7
Retail Trade	12.1	11.6	12.6
Finance and Insurance	7.7	7.6	8.0
Professional, Scientific, and Technical Services	10.7	12.1	10.9
Admin and Support and Waste Mgmt & Remed Services	9.3	9.3	9.5
Educational Services	3.7	3.8	3.8
Health Care and Social Assistance	19.8	16.1	21.5
Accommodation and Food Services	5.7	6.2	5.1
Held Job for 2+ Years	57.7	58.0	56.1
Full time employment proxy (based on min wage)	66.8	68.2	63.3
Major-Industry Match (10% cutoff)	34.5	35.1	35.3
Average Number of Employers in 4 years	2.5	2.4	2.5
Annualized earnings (med)	40,526	42,716	37,584
Median Firm Average Wage for First Job Employer	57,510	64,445	52,571
Median Earnings as % of firm average	64.7	61.9	64.5
N	62,998	18,426	21,493

Source: Administrative enrollment and financial aid data from the College System and administrative earnings records for the Unemployment Insurance (UI) system from the state Department of Labor.

Note: This table contains data on students who completed their first BA degree between 2010 and 2017, entered college before or at age 20, did not re-enroll within 18 months after graduation, are employed at 5-years after graduation, and found their first job (defined as the first job where they had three quarters of consecutive employment) within 4 years (16 quarters) of completing their degree. High SES column shows students who never received a Pell grant; Low SES shows students who received Pell in all fall and spring semesters. All dollar amounts are in 2023 dollars, adjusted using the CPI-U.

Table 3. Regression Analysis of Year 5 Earnings

	(1)	(2)	(3)
	Base + First Job Predictors, Except Salary	**M1 + First Job Salary**	**Base + First Job Salary Only**
First Job Earnings in Q2 of Emp, Annualized (2023 $)		0.7***	0.7***
		(0.0)	(0.0)
Timing of Starting First Job			
New Job in Graduation Quarter	-370.2	-1846.5***	
	(481.5)	(450.0)	
2nd Quarter After Graduation	-3498.8***	-3378.4***	
	(459.3)	(426.1)	
3rd Quarter After Graduation	-3919.2***	-5971.0***	
	(496.4)	(460.7)	
4th Quarter After Graduation	-7246.7***	-7395.8***	
	(610.1)	(560.4)	
2nd Year After Graduation (Q5-8)	-9430.8***	-10698.8***	
	(494.1)	(458.7)	
3rd Year After Graduation (Q9-12)	-16501.3***	-20841.1***	
	(988.2)	(879.4)	
4th Year After Graduation (Q13-16)	-18037.6***	-25198.7***	
	(1110.7)	(964.3)	
At least 8 quarters of post-grad tenure	10071.8***	6764.3***	
	(1086.0)	(932.6)	
Started w/in 2 years & maintained 8+ quarters tenure	-9431.8***	-10403.9***	
	(1119.2)	(963.4)	
Total Firm Wages / Total Employees (Annualized)	0.1***	0.0***	
	(0.0)	(0.0)	
Ratio of worker's salary to firm average (topcode=3)		-1903.7***	
		(317.5)	
First Job in Large Employer	542.7	786.5**	
	(376.2)	(347.5)	
First Job in Small Employer	-5580.8***	-1730.1***	
	(463.0)	(437.4)	
First Job Major Match	5159.5***	2101.5***	
	(424.3)	(384.0)	
Unique # of Employer IDs w/in 16 Qtrs of Graduation	278.6**	634.4***	
	(133.3)	(123.7)	
Indicator for Whether Employer is Government Entity	-20344.7***	-3410.7*	
	(2093.5)	(1879.9)	
Intercept	19030.8***	22417.7***	11786.0***
	(5287.3)	(4780.4)	(4488.7)
N	62,998	62,998	62,998
Adj. R2	0.227	0.352	0.324
2-Digit CIP FEs	Yes	Yes	Yes
College FEs	Yes	Yes	Yes
Graduation Year FEs	Yes	Yes	Yes
First Job 3-Digit NAICS FEs	Yes	Yes	No

*** p<.01, ** p<.05, * p<.1

Source: Administrative enrollment and financial aid data from the College System and administrative earnings records for the Unemployment Insurance (UI) system from the state Department of Labor.

Note: This table contains data on students who entered college at age 20 or younger, completed their first BA degree between 2010 and 2017, had a first job within the first 4 years and are employed within 5 years of completing their degree. All models control for a baseline set of demographics (gender, race/ethnicity, primary language, pre-college academic performance) and college experience variables (entry age, loan status, graduation cohort, major field, college attended, employment while enrolled, transfer status, time to degree, cumulative GPA, and unemployment claim history); this baseline model matches the baseline model reported in Figures 3 and 6 and has an adjusted R-squared of 0.144. Missing values are replaced by an arbitrary value and an indicator for this replacement is included in the regression.

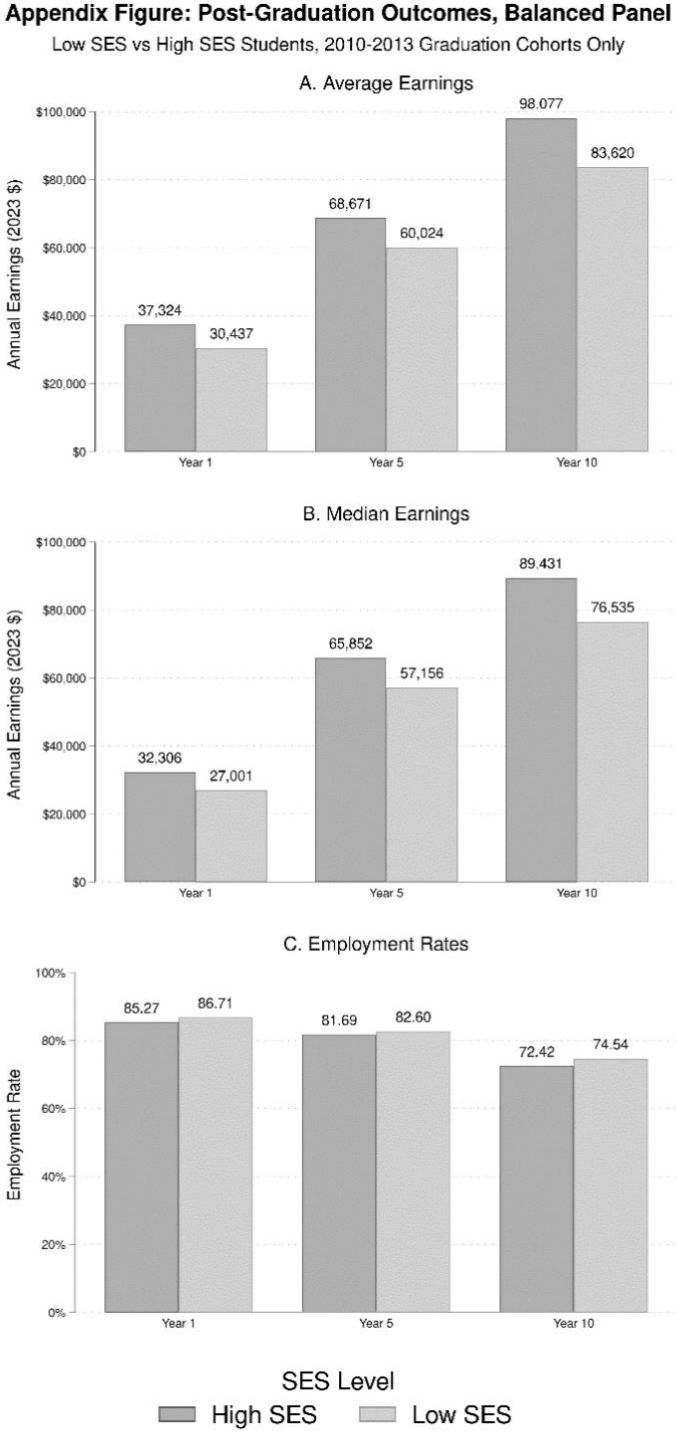
Table 4: Shapley-Owen Decomposition

		Mean Marginal R^2 (Shapley Value)	% of R^2
Socioeconomic Status	Pell Categories	0.0031	0.89%
Other Student Pre-College Characteristics	Gender, Race/Ethnicity, Native Language, AA Receipt	0.0141	3.97%
	High School Academic Achievement	0.0072	2.04%
End of College Predictors	Major (CIP-2 FEs)	0.0341	9.64%
	College FEs	0.0110	3.11%
	College GPA	0.0077	2.18%
	All Other College Experience Measures	0.0057	1.61%
First Job Annualized Salary	First Job Annualized Salary	0.1690	47.74%
Early Career Transition Metrics	Industry FEs (NAICS-3)	0.0398	11.25%
	Firm Average Wage	0.0250	7.05%
	Time to First Job (Quarters)	0.0117	3.32%
	All Other Early-Job Characteristics	0.0104	2.93%
	Relative Wage at Employer	0.0088	2.47%
	Job–Major Match	0.0064	1.81%

Source: Administrative enrollment and financial aid data from the College System and administrative earnings records for the Unemployment Insurance (UI) system from the state Department of Labor.

Note: Sample is BA graduates who completed their first BA degree from 2010-2017, entered the degree program at age 20 or younger, started their first job within 16 quarters of graduation, and were employed in Year 5. The Shapley-Owen decomposition provides an order-invariant way of representing the marginal contribution to the R^2 of each group of regressors. In this case, it decomposes the R^2 of Model 2 from Table 3, which contains all pre-college, in-college, and first-job independent variables. The mean marginal value comes from averaging the difference between the R^2 of all models in all orderings, with and without the group of regressors of interest.

Appendix Figure: Post-Graduation Outcomes, Balanced Panel



Source: Administrative enrollment and financial aid data from the College System and administrative earnings records for the Unemployment Insurance (UI) system from the state Department of Labor.
Note: Sample includes college system BA graduates 2010-2013, age at entry ≤20, who did not re-enroll anywhere within 18 months of graduation and had at least one quarter of post-graduation employment in state. High and low SES is defined by the extremes of our Pell intensity groupings, based on share of fall/spring semesters with Pell grants: High SES = Never Pell (0%) and Low SES = Always (100%). Earnings adjusted to 2023 dollars using CPI-U. Employment is defined as any UI-covered wages in calendar year. The unbalanced panel figure 2 in the main text uses all 2010-2017 graduation cohorts but implicitly omits from 10-year earnings statistics any students who graduated too recently to have earnings observed. Employment is defined as any UI-covered wages in calendar year.

Appendix Table 1. Full Regression Specifications Across Models, Outcome: Year-5 Earnings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Pell Only	+ Background	+ College FE	+ Other College Chars	+ First-Job Earnings	+ First Job Chars	(4) + Job Chars, No Earn
Pell Group							
1-49%	-3971.0***	-1394.5**	-1429.4**	-2127.6***	-1466.9***	-1137.1**	-1615.8***
	(559.5)	(561.6)	(556.3)	(543.6)	(477.8)	(469.2)	(517.6)
50-99%	-8332.9***	-4663.7***	-4541.8***	-4634.0***	-2424.1***	-1922.7***	-3527.3***
	(442.7)	(465.0)	(462.0)	(450.1)	(394.7)	(387.7)	(428.3)
100%	-9074.3***	-5610.3***	-5628.1***	-4948.4***	-2250.8***	-1716.1***	-3645.7***
	(409.9)	(437.2)	(435.5)	(419.9)	(372.7)	(365.4)	(398.4)
Missing	9792.6	12603.2	14759.1	13387.7	7201.4	4077.9	10232.4
	(15872.2)	(16377.8)	(16635.6)	(15536.9)	(9040.1)	(9356.0)	(15978.4)
Gender							
Women		-10099.5***	-9294.0***	-8071.7***	-5806.9***	-5623.0***	-7313.8***
		(334.9)	(334.5)	(337.4)	(298.7)	(295.7)	(323.5)
Race/Ethnicity							
Black NH		-4618.3***	-4850.6***	-4494.1***	-2935.5***	-3513.0***	-4687.1***
		(482.8)	(509.7)	(496.6)	(443.6)	(438.5)	(478.0)
Hispanic		-3436.0***	-3693.6***	-2814.4***	-1951.2***	-2418.7***	-3249.6***
		(446.8)	(465.7)	(453.6)	(404.9)	(398.8)	(433.2)
Asian/PI		1655.0***	-86.0	-2191.2***	-1424.9***	-1635.9***	-2262.4***
		(516.0)	(525.2)	(509.6)	(450.4)	(442.0)	(484.5)
All other		342.7	-201.8	69.8	-2126.6	-2940.3	-1924.6
		(3116.3)	(3140.6)	(3007.4)	(2479.7)	(2408.2)	(2845.0)
Non-English Native Spkr		3219.6***	2513.6***	1074.3***	626.4**	813.0***	1261.4***
		(373.7)	(372.4)	(361.2)	(319.5)	(313.7)	(344.1)
SAT Score		29.2***	24.9***	17.2***	8.5***	8.1***	13.4***
		(1.4)	(1.4)	(1.4)	(1.3)	(1.2)	(1.3)
SAT Score Missing		27015.0***	22828.7***	15253.0***	7569.2***	7272.9***	11859.0***
		(1252.4)	(1274.6)	(1267.4)	(1131.0)	(1109.9)	(1207.1)
HS GPA at Entry		210.1***	183.0***	-117.0***	-91.0***	-76.5***	-93.9***
		(28.9)	(28.8)	(29.3)	(25.8)	(25.4)	(28.0)
Missing HS GPA		19553.8***	17276.2***	-7629.1***	-6656.3***	-5515.7***	-6113.0***
		(2286.7)	(2285.6)	(2344.0)	(2065.8)	(2030.7)	(2240.4)
Entered w/ AA		2593.8***	2111.1***	-452.6	-225.0	-703.9*	-683.4*
		(367.7)	(369.9)	(422.7)	(370.9)	(363.9)	(402.8)
Student Ever Receives Loan				-256.2	-433.9	-757.0***	-683.5**
				(334.6)	(296.9)	(293.0)	(321.2)
Age of Entry							
18				-257.2	-349.6	-296.0	-217.5
				(359.5)	(321.3)	(314.4)	(341.9)
19				-1489.7***	-1548.9***	-1196.5**	-1036.5**
				(531.3)	(475.5)	(465.3)	(506.4)

20	-2440.9***	-2949.4***	-2447.9***	-1631.0**
	(670.3)	(596.3)	(585.1)	(638.8)
Cumul BA GPA (4pt Scl)	10939.6***	6527.0***	5538.2***	8077.4***
	(396.3)	(352.5)	(346.0)	(376.9)
Missing GPA for First BA	41678.7***	24649.1***	21909.8***	33614.3***
	(6261.6)	(4947.1)	(4910.7)	(6105.5)
Years to complete BA from first enrollment	883.3***	-520.6***	-500.7***	558.7***
	(88.3)	(73.9)	(73.6)	(85.4)
Transfer Student	3348.7***	857.3	514.9	2336.6***
	(729.2)	(645.2)	(632.3)	(694.1)
Transfer Status Missing	4487.2***	1897.7	889.9	2779.7*
	(1674.1)	(1336.9)	(1344.3)	(1650.0)
Quarters Emp. while enrolled				
1-4 quarters	3654.1***	2653.8***	956.2*	2006.2***
	(649.8)	(572.4)	(560.5)	(614.6)
5-8 quarters	7036.1***	4931.2***	1745.2***	4082.7***
	(628.3)	(554.3)	(551.4)	(604.3)
9+ quarters	10003.5***	6890.1***	2966.7***	6449.4***
	(605.8)	(534.5)	(540.0)	(591.2)
First Job Earnings (2023$)		0.7***	0.7***	
		(0.0)	(0.0)	
Time to First Job				
At Grad			-1846.5***	-370.2
			(450.0)	(481.5)
Q2 After Grad			-3378.4***	-3498.8***
			(426.1)	(459.3)
Q3 After Grad			-5971.0***	-3919.2***
			(460.7)	(496.4)
Q4 After Grad			-7395.8***	-7246.7***
			(560.4)	(610.1)
2nd Year After Grad (Q5-8)			-10698.8***	-9430.8***
			(458.7)	(494.1)
3rd Year After Grad (Q9-12)			-20841.1***	-16501.3***
			(879.4)	(988.2)
4th Year After Grad (Q13-16)			-25198.7***	-18037.6***

						(964.3)	(1110.7)
>= 8 quarters of post-grad tenure						6764.3***	10071.8***
						(932.6)	(1086.0)
Started w/in 2 yrs & 8+ quarters tenure						-10403.9***	-9431.8***
						(963.4)	(1119.2)
Total Firm Wages (2023$) / Total Number of Employees (Annualized)						0.0***	0.1***
						(0.0)	(0.0)
Worker's salary as % of firm average (topcode=3)						-1903.7***	
						(317.5)	
Missing Relative Wage Measure						-7070.6***	
						(2370.2)	
Large First Job Employer						786.5**	542.7
						(347.5)	(376.2)
Small First Job Employer						-1730.1***	-5580.8***
						(437.4)	(463.0)
Missing First Job Employer Size Indicator						-7535.4***	-22524.3***
						(2595.7)	(2987.4)
First Job Major Match						2101.5***	5159.5***
						(384.0)	(424.3)
Unique # of Employer IDs w/in 4 yrs of Graduation						634.4***	278.6**
						(123.7)	(133.3)
First Job Employer is Government						-3410.7*	-20344.7***
						(1879.9)	(2093.5)
Intercept	72029.3***	27057.7***	32068.9***	12815.4***	11457.5***	22791.6***	20667.7***
	(322.1)	(2375.8)	(2534.4)	(4473.3)	(3894.0)	(4271.4)	(4670.0)
N	62998	62998	62998	62998	62998	62998	62998
Adj. R^2	0.01	0.05	0.07	0.14	0.32	0.35	0.23
Major FEs	No	No	No	Yes	Yes	Yes	Yes
College FEs	No	No	Yes	Yes	Yes	Yes	Yes
Grad Yr FEs	No	No	No	Yes	Yes	Yes	Yes
Industry FEs	No	No	No	No	No	Yes	Yes

*** p<.01, ** p<.05, * p<.1