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Crossing the Finish Line but Losing the Race? Socioeconomic Inequalities in the Labor Market Trajectories of Community College Graduates

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Crossing the Finish Line but Losing the Race?
Socioeconomic Inequalities in the Labor Market Trajectories of Community College Graduates

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Abstract

Despite decades and hundreds of billions of dollars of federal and state investment in policies to promote postsecondary educational attainment as a key lever for increasing the economic mobility of lower-income populations, research continues to show large and meaningful differences in the mid-career earnings of students from families in the bottom and top income quintiles. Prior research has not disentangled whether these disparities are due to differential sorting into colleges and majors, or due to barriers lower-socioeconomic status (SES) graduates encounter during the college-to-career transition. Using linked individual-level higher education and Unemployment Insurance (UI) records for nearly a decade of students from the Virginia Community College System (VCCS), we compare the labor market outcomes of higher- and lower-SES community college graduates within the same college, program, and academic performance level. Our analyses show that, conditional on employment, lower-SES graduates earn nearly $500/quarter less than their higher-SES peers one year after graduation, relative to higher-SES graduate average of $10,846/quarter. The magnitude of this disparity persists through at least three years after graduation. Disparities are concentrated among non-Nursing programs, in which gaps persist seven years from graduation. Our results highlight the importance of greater focus on the college-to-career transition.

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I. Introduction

Decades of federal and state policy have focused on expanding college access and success as key levers for increasing economic mobility among lower-socioeconomic status ("SES") populations. These efforts have included investments in federal and state need-based financial assistance to improve college affordability and intensive college advising programs to help students navigate complex college and financial aid application processes, among other initiatives. A substantial body of rigorous research demonstrates that these programs and policies can lead to meaningful increases in college participation and completion among lower-SES students (Barr & Castleman, 2021; Bettinger et al., 2012; Carrell & Sacerdote, 2017; Castleman & Long, 2016; Denning, Marx, & Turner, 2019; Scrivener & Weiss, 2014). Prior evidence also shows positive overall labor market returns to postsecondary credentials (e.g., quarterly earnings per Jaggars and Xu, 2016) and substantial improvements in labor market outcomes for low-income students who gain access to four-year colleges and universities (e.g., household income per Smith et al., 2020; or earnings per Zimmerman, 2014).

Despite this positive evidence, descriptive research on the intergenerational mobility of students attending college continues to show large and meaningful differences in the mid-career earnings of students from families in the bottom and top income quintiles (Chetty et al., 2017). Students with lower-income parents ("lower-income") are also observed receiving a substantially smaller earnings premium for higher education than peers with higher-income parents ("higher-income"), even conditional on earning a degree: Higher-income students with a college degree experience a 136% lifetime earnings premium compared to higher-income students with

only high school diploma, whereas lower-income college graduates experience a lifetime earnings premium of only 71% (Bartik & Hershbein, 2016).[2]

These longer-term earnings disparities among students attending and even completing college raise fundamental questions: Are investments to increase college completion among lower-income students sufficient to narrow longer-run economic inequality, or do ongoing barriers that graduates encounter *after* earning their degree continue to impede greater mobility? And how much of the descriptive socioeconomic differences in employment and earnings that Chetty et al. (2017) and Bartik and Hershbein (2016) observe are due to choices students make prior to graduation -- e.g. what college to attend, what major to pursue -- versus choices they make at the margin of labor market entry?

The former margin has received substantial attention among researchers over the last several years, with numerous studies demonstrating that the choice of institution and major can have sizeable effects both on whether students complete college and on their labor market performance (Belfield & Bailey, 2017; Black & Smith, 2006; Goodman, Hurwitz, & Smith, 2015; Zimmerman, 2014). Yet we know of no research to date investigating whether labor market inequalities persist between lower- and higher-SES students, holding constant institutional and major choice and performance in their program (e.g. cumulative GPA).

In the present study, using linked individual-level higher education and Unemployment Insurance (UI) records for nearly a decade of students from the Virginia Community College System (VCCS), we compare the labor market outcomes of lower- and higher-SES students within the same college, program, graduation cohort, and academic performance quintile (within

[2] Note that neither Chetty et al. (2017) nor Bartik & Hershbein (2016) attempt to make causal claims about the returns to higher education, in contrast to a larger body of literature on the subject (e.g., Xu & Trimble, 2016).

program), while controlling for a robust set of additional covariates such as prior work experience and length of time enrolled.[3] Our analyses show that, conditional on employment, lower-SES graduates earn nearly $500/quarter less than their higher-SES peers one year after graduation, relative to higher-SES graduate mean earnings of $10,846/quarter. The magnitude of this disparity persists through at least three years after graduation, though results at five and seven years after graduation are too imprecise to draw conclusions about the persistence of disparities into the longer-term. Prior estimates place the return to a community college degree in the Virginia context at $773/quarter across programs (Xu & Trimble, 2016); the disparity in earnings we find between lower- and higher-SES graduates is thus over half the size of this estimated return to an associate's degree, suggesting that the labor market benefits of these degrees are not experienced evenly among all graduates. To further illustrate the magnitude of SES disparities, we estimate that lower-SES graduates in the 4th GPA quintile earn about the same as higher-SES graduates in the *bottom* GPA quintile three years after graduation. We find that these results are robust to a variety of specifications and modeling approaches.

Given the popularity of Nursing programs at community colleges, the structured career pipelines between Nursing programs and employers that exist at many community colleges, and the consistently high returns to Nursing programs across community college contexts (Belfield & Bailey, 2017; Grosz, 2020), we also investigate whether socioeconomic inequalities in labor market outcomes among community college graduates vary between Nursing and non-Nursing programs. We find that employment and earnings disparities are nearly non-existent among

[3] We focus our main analysis on students who submitted the Free Application for Federal Student Aid (FAFSA) and proxy for SES based on Pell Grant receipt, though we also show our results are robust to imputing Pell eligibility among the full sample (i.e. including non-FAFSA filers). Indeed, we find that the socioeconomic disparities in labor market outcomes we observe in our main results nearly double in magnitude once non-filers are incorporated (see Appendix VIIa).

graduates of Nursing and are correspondingly larger among graduates of non-Nursing programs. In non-Nursing programs, lower-SES graduates earn $626/quarter less than their higher-SES peers, relative to a higher-SES graduate average of $9,023/quarter. This socioeconomic disparity in earnings among non-Nursing graduates shows no sign of closing as far as seven years after graduation.

Our research contributes to existing work highlighting socioeconomic inequalities in the college-to-career transition. We demonstrate that even among graduates from the same institution, with the same major and degree, and with the same relative academic performance within their program of study, low-income students fare worse in the labor market than their more affluent peers. While we attempt to examine several potential mechanisms that may explain these differences, our results are largely inconclusive and thus cannot directly address *why* these socioeconomic disparities in labor market performance arise among students with the same credentials and performance. We discuss several additional hypotheses in the discussion section of our paper, opening several paths for future inquiry into this subject.

The remainder of the paper is organized as follows: Section II describes our study context, data, and sample; Section III reviews the construction of our employment metrics, regression frameworks, subsample analyses, and mechanism analyses; Section IV explores the results of our analyses; and Section V concludes.

II. Data and Sample

IIa. Virginia Context

VCCS is comprised of 23 independently-run community colleges distributed across the Commonwealth; with the expansion of satellite campuses in the network, any individual living in Virginia also lives within 30 miles of a VCCS campus. Through its member institutions, VCCS enrolls about 100,000 full-time students annually, and an additional 140,000 part-time students take at least one credit in a given year (excluding dual-enrollment students). While we focus our study on the Virginia context, VCCS is broadly similar to community college contexts across the country: 33% of current VCCS students are underrepresented racial/ethnic minorities compared with 37% of community college students nationally; 29% of VCCS students receive Federal Pell Grants compared with 33% nationally; 42% of VCCS students are 24 or older compared with 49% nationally; and 32% of VCCS students complete their program within 150% of expected time compared with 29% nationally. As such, we expect the findings of our study to be relevant for many state community college systems.

IIb. Academic Data

Our individual-level data from VCCS captures the full universe of students who have ever enrolled at a VCCS institution between 2000 and 2020, whether for a single class or for a completed program of study. From these data, we are able to observe detailed administrative information about each student. In the enrollment data, we observe course-taking behavior at the term-level (courses taken, course grades, term GPA, enrollment intensity, etc.) and intended credential (program of study and degree level). In the financial aid data, we observe term-level

receipt and dollar amounts of any state and federal aid (Pell Grants, Stafford loans, etc.), alongside details on the costs of their tuition (in-state status and other fee waivers) and receipt of additional institutional grant awards.[4] Our graduation data allow us to observe term of graduation, degree received (level, college, and program), and cumulative academic information upon completion (GPA, credit hours earned, credit hours attempted, etc.). Lastly, our demographic data include racial and ethnic identity, gender identity, parental education levels, high school information (school attended, graduation year, etc.), military status, citizenship status, birth date, and Virginia residency status.

We also have access to term-level enrollment records and credential-level graduation records of all students in our sample through the National Student Clearinghouse (NSC). This allows us to observe their enrollment status and degree receipt at any other institution of higher education in the United States, both before and after they enrolled at VCCS.

IIc. Employment Data

Our employment data come from Virginia's UI records; every employer required to pay UI taxes in the state of Virginia must submit quarterly wage information for each individual they employ.[5] We do not observe employment or wages from the following categories of employers: (1) the self-employed, (2) employers solely utilizing independent contractors (e.g. many "gig-economy" companies), (3) federal employers, (4) informal sector employers (i.e. "under the

[4] Our financial aid files begin tracking students in AY 2007-2008; as a result, we observe only incomplete Pell receipt records for the graduation cohort of AY 2007-2008.

[5] In Virginia, general employers are liable for UI taxation if either of the following are true: (a) They had a total gross payroll of $1,500 or more in any quarter of the calendar year, or (b) They employed one or more employees for any portion of a day in 20 different weeks (not necessarily consecutively) of a calendar year. There are slightly different rules for agricultural and non-profit employers, but these low eligibility thresholds capture a large majority of employers in the state of Virginia.

table" payment agreements), or (5) employers outside the state of Virginia. Because of these limitations, an individual with no recorded earnings in a given quarter may be unemployed or they may be working for employers we do not observe. We discuss how we manage this limitation and its implications for our analysis in the discussion of our sample (section IIe below).

For every individual in our sample, we observe each UI-paying employer they worked for in a given quarter, as well as their total earnings from each of those employers. This window of observation begins five years before an individual's first enrollment at any VCCS institution (though our earliest data are from 2005Q1) and continue indefinitely afterwards. Our most recent data are from 2019Q4; as such we cannot, with the present data, investigate how the COVID-19 pandemic may have affected labor market outcomes for lower- vs. higher-SES VCCS graduates. To ensure comparability across years of employment data, we adjust all earnings into inflation-adjusted 2019Q4 dollars.

We observe a variety of employer-level characteristics in these data. For example, we observe an employer's industry classification as categorized by their North American Industry Classification System (NAICS) code. We do not, however, observe an individual employee's occupation or job title. Similarly, we observe the address of an employer's headquarters, whether in the state of Virginia or outside of it, but we cannot observe the precise location of an individual's workplace if distinct from the employer's headquarters (thus precluding any examination of geographic mobility as part of our analysis). Lastly, we see the total quarterly wages an employer pays to a given employee, but not the individual's hourly wage/salary or hours worked.

IId. Defining Socioeconomic Status

Given our data context, we operationalize our measure of low socioeconomic status as Federal Pell Grant receipt in either of the two years prior to a student's graduation. Pell Grant receipt remains a widely-used proxy for student socioeconomic status given the program's focus on identifying and supporting low-income students with need-based grants. Pell eligibility is determined through a combination of a student's family income and assets, dependency status, calculated cost of attendance, and planned enrollment intensity (e.g. full-time or part-time). For reference, the average family income of all Pell-eligible students is about $47,000 annually, versus $110,000 for Pell-ineligible students (Kofoed, 2017).

We focus on Pell receipt in the last two years of student's enrollment for two key reasons. First, we are interested in students' socioeconomic circumstances as they relate to the margin of graduation and labor market entry. Measuring graduates' socioeconomic statuses just before this juncture then gives us the most contemporaneous view of their circumstances. Second, because our financial aid data start in AY 2007-2008 and many of our students take longer than two years of enrollment to complete a community college degree, we lack the full timeline of financial aid data for the 72% of students in our sample (defined in more detail in the next section) who first enrolled prior to AY 2007-2008. That said, Pell receipt seems to be generally stable within students over time in our sample: among students for whom we observe financial aid data in their first enrolled semester, 86% of them maintain the same Pell receipt status by their final two years of enrollment.[6]

[6] Only 4% of these students received a Pell at entry and did not also receive a Pell in their last two years; conversely, 10% did not receive a Pell at entry but did receive one in their last two years.

Importantly, students must file the FAFSA to actually receive a Pell Grant, and a meaningful share of Pell-eligible students do not receive a Pell Grant only because they do not file a FAFSA (Kofoed, 2017). Approximately 39% of students in our sample did not file a FAFSA at all in their final two years of enrollment (shown in Table 1), and thus we are not able to observe Pell eligibility among non-filers in our sample. In other words, a high-income student who did not file the FAFSA is indistinguishable from a low-income student who did not file the FAFSA. Our main estimates therefore focus specifically on differences among the set of FAFSA-filing students.[7] We argue this decision likely results in an underestimation of the true magnitude of socioeconomic inequalities in labor market outcomes, as FAFSA completion has a strong, negative correlation with income.[8] We conduct supplementary analyses in which we impute Pell receipt among our non-filers using multiple imputation (MI) and assess how our results change when they are re-incorporated into the analytic sample; we describe our MI approach and results in more detail in Appendix VIIa. Broadly speaking, we find that the socioeconomic disparities in labor market outcomes we observe in our main results nearly *double* in magnitude once non-filers (and their imputed Pell status) are incorporated.

[7] As we describe in more detail when reviewing our regression approach, these non-filers remain in the analytic sample to contribute to our estimates of other coefficients (e.g., race/ethnicity, in-state status, etc.); we exclude them from estimation of Pell recipient and non-recipient differences by creating a separate indicator for these non-filers. When interacting GPA quintile and Pell receipt in Equation 2, we also create a separate set of quintile indicators specifically for non-filers. As such, these students remain in the analytic sample without contributing to our coefficients of interest.

[8] Per Kofoed, 2017, only 14% of independent students earning $140,000 or more annually file a FAFSA, whereas approximately 75% of those earning $20,000 or less do. The distribution of post-graduate earnings among filers and non-filers reveals a similar pattern (Appendix Figure A7).

IIe. Sample

Though our data spans the universe of VCCS students over the past two decades, we restrict our sample along a number of dimensions. We first restrict our sample to individuals who successfully graduated from a VCCS program of study. While non-completers are a substantively important population, we focus here on completers to explore the specific margin of labor market entry among graduates.[9] For the same reason, we further focus on graduates who earned an AAS degree in particular - terminal degrees designed to prepare students directly for workforce entry upon completion.[10] Students in other associate's degree programs generally intend to transfer to four-year institutions after completing their program of study, so we would not expect to observe full-time employment for several years. We then restrict our analysis to students who graduated in AY 2007-2008 through AY 2015-2016. We begin with 2007 as the earliest graduation cohort for which we have at least one year of financial aid data and for which we can construct Pell Grant receipt status for each student. To maximize the number of cohorts we can include in our analysis, we restrict our primary labor market measures to the period three years after an individual's graduation, and examine any longer-term employment outcomes (e.g. wage at five years after graduation) only as supplemental analyses. The 2015-2016 cohort is thus the last cohort to have a complete three years of employment data for our analysis, as our employment data are complete and undisrupted by the COVID-19 pandemic through 2019.

[9] In related work, we directly compare the labor market trajectories of graduates and non-graduates in the VCCS context (Bird et al., 2022)

[10] If a student graduated from multiple AAS programs in our study timeframe, their employment data will be included in the sample for each program as a separate observation, centered on each respective graduation year. Note that we also include indicators for prior degrees as controls.

We then selected the top 20 AAS programs in terms of total graduates across VCCS over the sample timeframe. The primary reason for this is to focus on those programs most likely to be offered in other state community college contexts and thus to improve our external validity. Based on programs' Classification of Instructional Program (CIP) codes, these 20 programs group into four broader categories: Nursing; Health, Non-Nursing; Technology and Information Technology; and Broad Human Services.[11] Our sample then includes 81% of all graduates who received an AAS from VCCS in our sample timeframe.[12]

Lastly, we exclude individuals for whom we do not observe any employment data in their three year post-graduation window; this affects 14% of graduates who meet all aforementioned criteria. If an individual has no employment information for a given quarter in our UI data, we cannot distinguish whether they are actually unemployed or instead working for an employer that simply does not file Virginia UI taxes. Following Minaya & Scott-Clayton (2018) and Scott-Clayton & Wen (2018), we opt to exclude students who do not appear at all in the three-year window after graduation. One clear concern associated with not observing employment and earnings for this portion of the sample is that this missingness may biases our estimates of socioeconomic inequalities in labor market outcomes between community college graduates, especially since, as we show in Appendix Table A1, several of the characteristics

[11] We keep Nursing separate from other programs as it is the only individual program at VCCS with sufficient sample size for its own estimates, alongside other reasons we articulate in section IIIc. The other individual programs, and their broader program groupings, are as follows:
Health (Excluding Nursing): Radiography, Emergency Medical Services, Respiratory Therapy, Veterinary Technology, Dental Hygiene, Physical Therapist Assistant, and Medical Laboratory Technology
Technology and Information Technology: Automotive Technology, Electronics Technology, Information Systems Technology, Administrative Support Technology, and Technical Studies
Broad Human Services: Early Childhood Education, Paralegal Studies, Police Science, Accounting, Administration of Justice, Management, and Human Services

[12] We also exclude any college-by-program cells with fewer than 20 graduates across all cohorts from our analysis. This last step affects only 15 of the 223 college-by-program combinations that would otherwise be included in our sample, or 119 out of 40,890 students.

associated with missingness in the UI data (e.g. Pell receipt) may also be correlated with graduates' labor market outcomes. That being said, based on prior related research we do not believe this missingness should substantially bias our estimates. Ost, Pan, & Webber (2018) estimate that, among students who do not appear in Ohio UI data after college, nearly a third (32%) is due to individuals actually having no employment or income, and more than half of the missingness (56%) is due to individuals having have left the state. Scott-Clayton & Wen (2018) moreover find no relationship in earnings between associate's degree holders who stay in-state or move out-of-state, which suggests that the socioeconomic labor market earnings disparities we observe for graduates who appear in the UI data may also hold for graduates who move out of state. Finally, Foote & Stange (2019) explore the repercussions of state-level UI data limitations versus more complete employment data sources and find that this style of restriction substantially reduces the bias of earnings estimates derived from UI data.

Table 1 provides descriptive statistics for our sample. We present comparisons between Pell non-recipients (column 1), and Pell recipients (column 2). We also test for differences between the Pell recipients and non-recipients (columns 3 and 4) given our substantive interest in labor market inequalities between these two groups in particular. Finally, we also include statistics for FAFSA non-filers for reference (column 5).

Among FAFSA filers, the sample is majority female for Pell recipients and non-recipients at about 78%. Approximately one-third of the sample are students of color and over one half are first generation college students, with higher shares of students of color (35% vs. 25% for non-recipients) and first-generation students (65% vs. 51%) among Pell recipients. Across both Pell recipients and non-recipients, the average age at the time of entry to the VCCS was

approximately 25 years. The substantial majority of both groups had employment experience prior to enrollment: 76% of Pell non-recipients were employed for at least one quarter in the year prior to enrollment, compared to 70% of Pell recipients. Pell non-recipient mean quarterly wages were also higher in the year prior to enrollment (approximately $5,500 vs. $4,300).[13]

As we show in column 3, many of these differences are substantively and statistically significant; as we later remark, this motivates our decision to include these variables as controls in our regression analyses. Column 4 also shows the differences between groups after accounting for students' college-by-program combination and GPA quintile; we see that several of the most salient differences (e.g., first-generation status, employment in the year prior to enrollment, mean quarterly wage in the year prior to enrollment) are attenuated but not completely removed, further motivating the inclusion of these demographic and pre-enrollment employment controls in our models even once college-by-program fixed effects and GPA are included.

III. Methods and Empirical Strategy

IIIa. Construction of Labor Market Outcome Metrics

We construct an array of labor market metrics to characterize community college graduate employment and earnings outcomes. We first examine earnings and employment stability outcomes in isolation of one another, and then construct a composite measure that examines both dynamics together (share of quarters earning a living wage after graduation). Across measures, we define an employed quarter as any quarter where a graduate had non-zero earnings, to align with the definition used by the Bureau of Labor Statistics. We also look

[13] Due to the open enrollment nature of community colleges, we do not have meaningful coverage on baseline academic measures, e.g. high school GPA or college entrance exam scores, to report descriptive statistics on academic performance prior to college enrollment.

specifically at the three years after an individual's graduation in calculating these metrics, for a total of 12 quarters of employment data per graduate. For those cohorts with a longer post-graduation time horizon, we run supplementary analyses of their earnings at five and seven years from graduation; these are the only outcomes that span beyond this standardized 12 quarter window.

Briefly, we define each measure as follows: For earnings 1, 2, and 3 years after graduation, we take the quarterly earnings of a graduate averaged over the four quarters leading up to and including each stated time point, conditional on employment (e.g. averaged over quarters 1, 2, 3, and 4 after graduation for measuring earnings one year after graduation).[14] We condition on employment to better distinguish disparities in graduates' earnings from their employability (which we measure separately).[15] We construct earnings at 5 and 7 years after graduation in the same manner for those cohorts with the data available.

For employment measures, we measure "employment stability" as a binary indicator for whether the student experienced eight consecutive quarters of employment (i.e. any earnings) at any point in the 12 quarters after graduation. Note that this mirrors the typical expectation of two years of consecutive employment history to be considered for mortgage loans. We also create a stricter measure of "employer stability" using a binary indicator for whether the student experienced eight consecutive quarters of employment with *the same employer* at any point in the 12 quarters after graduation.

[14] Note that our findings remain broadly identical in significance and substance when using log earnings instead. Results of this analysis are available upon request.

[15] Because we are measuring earnings conditional on employment, any quarters in which a graduate is observed as unemployed for a given earnings window are excluded from the four-quarter average. If a graduate is unemployed for all four quarters of a given window, they are treated as missing and thus excluded from that specific regression.

Lastly, our composite measure is the share of quarters a graduate earns a living wage after graduation: similar to the specification used by Minaya & Scott-Clayton (2018), we calculate what share of the 12 quarters after graduation a student was earning a living wage, unconditional on employment. This can alternately be interpreted as the average probability that a graduate is earning a living wage in any given post-graduate quarter. We use the benchmark values for a living wage used in analyses by the State Council of Higher Education for Virginia at $6,825/quarter ($15/hour at 35 hours/week and 13 weeks/quarter, in inflation-adjusted 2019Q4 dollars).

IIIb. Regression Analyses

We begin our analysis by including each of these outcomes in a linear regression[16] on Pell Grant receipt, a vector of student-level controls, and a vector of college-by-program-by-cohort fixed effect indicators. This fixed effect specification effectively compares the outcomes of lower- and higher-SES students within the same college (which also proxies for geographic labor market in this context), studying the same program, and graduating at the same time (proxying for time-varying labor market conditions), after accounting for a variety of individual-level demographic and background characteristics. These individual-level controls include basic demographic characteristics such as age at college entry, gender, in-state status, military status, and visa-holding status. We also control for pre-enrollment employment behavior; specifically, we include an indicator for employment at any point in the year prior to first enrollment, as well

[16] For our two binary outcomes, employment stability and employer stability, we opt to use a linear probability model to facilitate consistent interpretation in coefficients across outcomes. We observe no noticeable differences in these outcomes' results when instead using a logit regression.

as average quarterly earnings, conditional on employment, in the year prior to enrollment.[17] We opt for this simplified, but parsimonious, approach to reduce data availability issues – attempting to model a longer time horizon prior to enrollment risks introducing a "moving window" effect, whereby later cohorts necessarily have far more data than earlier cohorts (as our UI employment data begin in 2005) and no longer represent a stable construct to measure.

In addition we control for during-enrollment behavior (GPA quintile,[18] indicators for remedial coursetaking, indicators for each level of prior degree attainment, an indicator for being employed at any point while enrolled, length of time enrolled standardized against other students in their same college-by-program combination, and number of excess credits accumulated), and additional SES covariates (indicators for first-generation status and racial/ethnic minority status). Across all models, we cluster standard errors at the college-by-program-by-cohort level.

Equation 1 is our initial model as described above. y_{ipct} represents any one of our labor market outcomes for an individual *i,* in program *p,* at college *c,* in cohort *t*. X_i is the vector of

[17] Common practice in the returns to education literature is to include a longer panel of pre-enrollment employment controls to account for potential "Ashenfelter's Dips", where individuals experience a reduction in employment or earnings which is positively associated with their decision to pursue postsecondary enrollment. In our context, an Ashenfelter's Dip could potentially lead us to over- or underestimate socioeconomic disparities in labor market outcomes among college graduates if there was evidence of *differential* pre-enrollment employment or earnings dips between Pell recipients and Pell non-recipients. As we show in Appendix Figures A1 and A2, however, Pell recipients and non-recipients appear to have very similar pre-enrollment employment and conditional quarterly earnings trends. It is the case that Pell recipients' employment rates diverge slightly in the last quarter just prior to enrollment, but at a level unlikely to explain our main estimates given that we average over several quarters and we observe more of a flattening-out relative to non-recipients than a dip per se.

[18] We utilize GPA quintile indicators rather than a linear specification due to likely nonlinearities in the relationship between GPA and employment outcomes. We calculate GPA quintiles relative to other students in their same college-by-program combination, across years, to account for potential differences in grading practices. For example, the GPA of a Nursing graduate from Tidewater is ranked against the GPAs of all other Nursing graduates in our sample from Tidewater. We find that standardizing GPA performance within college-by-program-by-cohort combinations produces substantially noisier and less stable quintile assignments. While we might be concerned about grade inflation over time, we find a negligible relationship between grades and time within our sample after including college-by-program fixed effects: 0.008 grade points of inflation per academic year, or a difference of about 0.06 GPA from the first cohort in our sample to the last. Our results are robust to the use of other quantile schemes, including terciles and quartiles.

student-level covariates, and $GPAQuintile_{ipc}$ is a vector of indicators for each GPA quintile (with the bottom quintile as the omitted category). $Pell_i$ is our indicator for Pell Grant receipt prior to graduation, and π is our coefficient of interest - the difference in outcome y_{ipct} for Pell recipients versus non-recipients. Note that we include FAFSA non-filers in this approach to improve the precision of our covariate coefficients, but keep them separate from the estimation of π by including a separate indicator for FAFSA filing status. ω_{pct} is a vector of college-by-program-by-cohort fixed effects. Finally, ε_{ipct} is our idiosyncratic error term.

$$\textbf{(1)} \quad y_{ipct} = \delta X_i + \varphi GPAQuintile_{ipc} + \pi Pell_i + \omega_{pct} + \varepsilon_{ipct}$$

Equation 1 produces an average difference between Pell recipients and non-recipients across all GPA quintiles. We also interact GPA quintile and Pell receipt in Equation 2 below to better capture the extent of earnings differences between lower- and higher-SES students *within* each GPA quintile.[19] For example, it could be the case that socioeconomic disparities are actually largest among the set of high-performing students because all lower-performing students receive uniformly low earnings regardless of Pell receipt, but Equation 1 would not reveal this meaningful variation. Equation 2 is identical to Equation 1 in nearly all respects, except with the interaction between $GPAQuintile_{ipc}$ and $Pell_i$ included (again with the bottom GPA quintile as the omitted group) and $Pell_i$ alone excluded (subsumed by the interaction term). Note also that FAFSA-filers remain in this sample as per Equation 1, but we now create another set of

[19] It could be the case that Pell recipients and non-recipients have substantially different performance *within* quintiles, e.g. that Pell recipients in the top quintile are just barely over the GPA threshold to be part of the top quintile, while non-recipients are all receiving 4.0's. We find that the distribution of academic performance within quintiles is strikingly similar between recipients and non-recipients, with only minor differences in the top GPA quintile: non-recipients are only slightly more likely to have a perfect 4.0 than recipients also in the top GPA quintile.

interaction terms between FAFSA non-filing status and GPA quintile to remove them from our estimation of our coefficients of interest, φ and λ.

$$\textbf{(2)} \quad y_{ipct} = \delta X_i + \varphi GPAQuintile_{ipc} + \lambda(GPAQuintile_{ipc} * Pell_i) + \omega_{pct} + \varepsilon_{ipct}$$

IIIc. Nursing and Non-Nursing Subsample Analysis

A large body of evidence shows that Nursing programs tend to produce strong earnings returns and employment outcomes relative to other programs in the community college space (Belfield & Bailey, 2017; Grosz, 2020). Nursing is also the most popular program at VCCS; is one of the only programs in our sample with competitive admissions; and comprises a third of our overall sample of graduates. Given these factors and to better identify disparities across programs, we re-run our main specifications separately for the subsamples of Nursing and non-Nursing programs, across each of our main outcome variables.[20]

IIId. Exploring Mechanisms and Additional Heterogeneity

We construct several additional measures, as our data allow, that describe students' labor market experiences and set them as the outcomes of our regression specifications to investigate potential mechanisms that could explain the overall labor market disparities we observe between lower- and higher-SES graduates.

[20] While we would ideally estimate disparities across all programs separately, the smaller cell sizes of remaining programs result in estimates that are too imprecise to be informative. As we discuss further in section IVb, we do present results on socioeconomic disparities in labor market outcomes between broader groups of programs: Health, non-nursing; Technology and Information Technology; and Human Services. Even at the aggregated level of these program groups, however, we have limited precision and do not find significant differences between program groups (see Appendix Figures A3 and A4).

Disparities we observe in our main analyses could be driven by differences in students' ability to find employment immediately after graduation, which then go on to influence the rest of their post-graduation experiences. We first count the number of quarters between graduation and a student's first employment after graduation to examine the time it takes for students to find paying work; immediate employment or continuous employment through graduation are coded as zeroes.[21] As a metric of the quality of a student's first employment, we also examine the earnings of their first employed quarter, the size of their first employer (in total employee count), and the length of a student's first employer spell: the number of consecutive quarters a student was employed by their first employer after graduation.[22]

We moreover examine whether there are other qualitative differences in students' post-graduation trajectories. To examine whether students experience different earnings trajectories over time, we calculate the simple average of their quarter-over-quarter growth in employed quarter earnings over the 12 quarter window. This allows us to identify whether students experienced differential earnings growth over time, and offer additional evidence as to whether observed earnings disparities in our main analysis are on track to close over time. We also measure the share of the 12 postgraduate quarters each student is employed, rather than looking at two-year spells as per our main specification. To examine the prevalence of students working multiple concurrent jobs, we also calculate the share of the 12 postgraduate quarters a student reports earnings from multiple employers.[23] Lastly, to explore whether students may have

[21] Note that the maximum value is 12 (student's first employment is at the very end of the employment window we observe), as students who were not observed as employed within 12 quarters were removed from the sample (per sample restrictions described in section IIe above); this may result in a "ceiling" effect.
[22] The maximum value for this measure is 12 because our window spans only 12 quarters after graduation; this may also present a "ceiling" effect.
[23] As earnings are reported only quarterly, it could be the case that a student reports multiple employers in one quarter if they stopped working for one employer and began working for another in the same quarter, rather than

experienced different labor market outcomes as a result of differential re-enrollment in higher education *after* receiving their AAS degree of interest, we leverage NSC enrollment data to generate a binary indicator for whether a graduate enrolled in any institution in the 12 quarter window after their AAS graduation, for any duration of time.

Two salient dynamics we are not able to measure using our data are the geographic mobility of students and the proportion of students entering into jobs related to their degrees (i.e., "in-field" employment). In both cases, we are limited by the employer-centric, rather than job-centric, nature of our UI data. That is, we cannot observe the movement of graduates to specific job locations across the state because the addresses we observe in the data correspond with the employer's headquarters, rather than a specific workplace. We also cannot observe the extent to which students are working in-field because the UI data only provide information about an employer's sector (via NAICS codes), rather than the specific job's occupational codes (e.g., SOC codes).[24]

IV. Results

IVa. Full Sample Results

Table 2 displays the results of Equation 1 for our full sample of students with at least one quarter of employment in the three years after graduation, across all outcomes. Beginning with

working multiple concurrent jobs. We thus only count multiple employers when they do not represent the start or end of an employer spell to address this concern.

[24] We attempted to use UI data on the employment sector in which graduates were employed to investigate whether graduates were working in their field of study. However, we found we could not satisfactorily measure whether certain students were working in-field or not using just the employer's sector in our preliminary analyses. For example, an Accounting graduate we observe working for a large coffee shop corporation could be working as a barista, but they could also be working in their accounting department. Similarly, a Nursing graduate working for a major hospital could be working as a nurse, or they could also be working as an administrative assistant. As we cannot meaningfully distinguish these cases from one another without making strong, untestable assumptions, we opted not to proceed with this analysis.

our earnings outcomes, Pell recipients earn on average $479/quarter less than non-recipients, with a non-recipient average of $10,846/quarter one year after graduation (thus, a -4.4% difference in relative terms). This disparity decreases over time both in absolute magnitude, down to $368/quarter and $204/quarter by three and seven years from graduation, and relative magnitude, as non-recipient earnings steadily increase to $12,111/quarter by three years from graduation (thus, a -3% difference) and $13,762/quarter by seven years (thus, a -1.5% difference). Note, however, that our sample size and precision also decrease across these time points (both because we condition on employment, and because fewer cohorts have had five or seven years since graduation in our data), making it difficult to interpret these results as conclusive evidence of disparities closing over time.[25]

For employment outcomes, we find that Pell recipients are 1.5 percentage points less likely to experience employment stability, compared with a Pell non-recipient mean of 80%. Pell recipients are also 2.5 percentage points less likely to experience employer stability at the same employer, given a Pell non-recipient mean of 63%. Lastly, we find that Pell recipients are 4.3 percentage points less likely to earn a living wage each quarter than non-recipients, a 7% decrease relative to a Pell non-recipient average of 65%.

We explore how these disparities vary within GPA quintiles in Table 3. We do not observe statistically significant disparities in earnings or employment outcomes between Pell recipients and non-recipients in the top GPA quintile, though as we describe in the next section, disparities in this top GPA quintile are significant in the non-Nursing subsample. By contrast, we observe meaningful and significant differences between Pell recipients and non-recipients

[25] When we assess whether the disparity at one year since graduation is significantly different from the disparities at each further time point, we see that it is significantly different only between the first and fifth years since graduation, and marginally significant between the first and seventh years since graduation.

throughout the rest of the academic distribution. For instance, at one year out, Pell recipients in the bottom GPA quintile earn $787/quarter less than Pell non-recipients also in the bottom GPA quintile, while Pell recipients in the fourth GPA quintile earn $564/quarter less than their Pell non-recipient peers. We lack sufficient precision to measure whether disparities within each GPA quintile change over time.

IVb. Nursing and Non-Nursing Subsample Results

Table 4 displays the results of our Nursing and non-Nursing subsample analyses for each earnings outcome; each column represents the results of a regression using Equation 1 for the outcome and subsample indicated, and we further include a test for significant differences in the point estimates of the outcomes between each subsample. The disparities in earnings across time points for non-Nursing programs (which comprise approximately two-thirds of the main sample) are larger when compared against estimates for the full sample, while the disparity in earnings for Nursing programs trends closer towards zero.[26] For example, Pell recipients in non-Nursing programs earn $626 less than their Pell non-recipient peers one year after graduation, while Pell recipients in Nursing programs earn only $193 less than their Pell non-recipient peers (compared with $479 for the full sample). Moreover, we see that the earnings disparity among non-Nursing programs seem to remain fairly consistent over time, remaining large and statistically significant at $584/quarter even seven years after graduation (compared with $204 for the full sample). These disparities are also larger in relative magnitude as well, as the average earnings for Pell non-recipients in non-Nursing programs is smaller than our full sample at $9023/quarter one year

[26] Interestingly, we see the coefficient on Pell among Nursing students actually becomes positive by three years out, and is statistically significant at five years out. Table 5 shows that this trend seems to be driven by the bottom and top quintiles at these time points, but it is unclear what would explain this dynamic.

after graduation and $11,999/quarter seven years after graduation. The difference in point estimates between the Nursing and non-Nursing groups are highly significant at every time point we measure.

When we examine within-quintile disparities for these earnings outcomes in Table 5, we see that the disparity among non-Nursing graduates is generally smallest in the top GPA quintile. This is similar to our within-quintile results for the full sample - but in contrast to the full sample results, we still observe statistically significant disparities for the top GPA quintile at multiple time points. Moreover, students in the lower GPA quintiles experience disparities as large as $1089/quarter in the case of earnings one year after graduation for bottom quintile Pell recipients. The disparities we observed in the full sample are thus primarily driven by non-Nursing programs.

Turning our focus to the employment outcomes in Table 6, disparities in employment stability are roughly the same as in the full sample (1.5 percentage points) at 1.3 and 1.6 percentage points for non-Nursing and Nursing, respectively, though neither of these results are significant. The results for employer stability also mirror our findings from the full sample (2.5 percentage points) at 2.8 and 2.1 percentage points. However, the disparity between Pell recipients and non-recipients in the share of quarters earning a living wage is larger among non-Nursing programs at 6.2 percentage points and smaller among Nursing programs at 1.1 percentage points (compared with 4.3 percentage points in the full sample). Examining within-quintile disparities for these outcomes in Table 7 (Equation 2) reveals generally consistent disparities by quintile.[27]

[27] There are two exceptions to this general trend. First, we observe a disparity across all outcomes for Nursing students in the third GPA quintile, though it is unclear why these estimates are so markedly different from Nursing

The fact that disparities are larger among lower-performing, lower-SES students in non-Nursing programs in general[28] could also be consistent with the hypothesis that differences in labor market outcomes are perhaps attributable to students' awareness and pursuit of well-matched opportunities, since students from these backgrounds may have more limited access to professional networks, career advising, and other sources of support with the job search process.

IVc. Exploring Mechanisms and Additional Heterogeneity

Finally, we turn to examine socioeconomic disparities along a variety of descriptive measures to explore whether we can discern any potential mechanisms for the employment and earnings disparities we observe. Table 8 displays the results of each potential mechanism across the full sample.

We see that the disparity in the number of quarters to first employment is statistically significant but substantively small at 0.093 quarters. One-tenth of a quarter is about nine days, meaning that it is unlikely the case that Pell recipients are earning less because they have more difficulty arriving at their first job than non-recipients. That said, it does seem to be the case that the first employer spell of Pell recipients is shorter than their non-recipient peers by 0.208 quarters, or about 18 days. We also find that Pell recipients experience an earnings disparity of

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students in the other GPA quintiles. Second, the disparity in the share of quarters earning a living wage among non-Nursing programs is largest for Pell recipients in the bottom quintile and fairly even across the other quintiles.

[28] We have limited precision to detect whether the earnings disparities we observe among non-Nursing programs are driven by specific programs or groups of programs (i.e., grouped into non-Nursing Health, Technology and Information Technology, and Broad Human Services). We show a subset of these analyses in Appendix Figures A3 and A4 for illustration purposes, but the overall trends are the same across all outcomes: we detect no significant differences in the magnitude of earnings disparities across non-Nursing program groups, largely due to wide confidence intervals.

$604 at their first employed quarter. As we show in column 4 of Table 8, we do not find evidence that Pell recipients work at significantly smaller or larger firms than Pell non-recipients.[29]

Interpreting these results together, perhaps Pell recipients are finding work about as quickly as non-recipients and work at firms of similar size, but Pell recipients might face more financial pressure to accept less stable, less desirable, or lesser paying positions for the sake of employment. The result for quarterly earnings growth indicates no apparent relationship with Pell receipt and is precisely estimated at 0.002% earnings growth per quarter, so it doesn't seem to be the case that Pell recipients are experiencing wage stagnation at a higher rate than non-recipients. Pell recipients are employed for a slightly smaller share of quarters post-graduation, but the difference relative to the share of employed quarters for Pell non-recipients is trivial (85% vs. 85.9%). We do not observe any difference in the share of quarters in which Pell recipients or non-recipients hold multiple jobs, which could be associated with lower longer-term employment stability and/or wage growth. These results further suggest that the earnings disparities we observe in our main analyses are likely to be stable over time.

We do observe a marginally significant increase in the probability that Pell recipients re-enroll in higher education after their AAS graduation at 1.3 percentage points, but we are currently unable to distinguish whether Pell recipients are more likely to enroll because they experience worse labor market outcomes, or they experience worse labor market outcomes because they re-enroll (though our indicator for re-enrollment in our main regression specification should capture at least some of the latter). In either case, the magnitude is small

[29] Note that the surprisingly large non-recipient mean of 6,651 is driven by a handful of very common, very large employers in the dataset. For example, the Commonwealth of Virginia employs many VCCS graduates, and is recorded as having roughly 95,000 employees depending on the exact quarter. Large city governments like Richmond, and large corporations like Wal-Mart, Target, and so on, also contribute to this skew.

enough that re-enrollment alone likely could not explain the full disparity among recipients and non-recipients even if the causality were certain to flow in that direction.

We proceed to examine these same mechanism measures by Nursing and non-Nursing subsamples in Tables 9 and 10; because we observe larger earnings disparities for non-Nursing programs, any potential mechanisms would likely be more prevalent among those non-Nursing programs as well. We see that the only significant differences across groups are in the outcomes of earnings at the first employed quarter, re-enrollment after graduation, and the share of postgraduate quarters working multiple jobs. We see here that Pell recipients of Nursing programs experience an earnings disparity of $339 at the first quarter, though it is significantly larger for non-Nursing graduates at $738. Non-Nursing Pell recipients are substantially more likely to re-enroll in higher education than their Pell non-recipient peers at a rate of 0.026, but this magnitude again seems insufficient to explain the entirety of the earnings disparities we observe. Finally, Pell recipients of non-Nursing programs are 1 percentage point more likely to work multiple jobs in a given quarter than their non-recipient peers, whereas this difference is -0.8 percentage points for Nursing programs.

It is possible that the socioeconomic differences we observe in labor market outcomes are further heterogeneous along additional student characteristics. Related research demonstrates, for instance, that returns to postsecondary education are much larger for female students than male students (for a helpful review of this evidence, see Belfield & Bailey, 2011): it may then be the case that the employment and earnings differences we detect between Pell recipients and non-recipients could be more pronounced for males or females. In Appendix Figures A5 and A6 we explore socioeconomic differences in earnings one and three years after graduation, by

gender and by whether students are from an underrepresented minoritized group (URM). We do not observe significant between-group differences for Pell recipients vs. non-recipients for either gender (whether excluding Nursing or not) or race/ethnicity, though this largely reflects the limited precision we have to conduct additional subgroup analyses.

The null or small values across most of these measures then leaves it largely open as to why the labor market disparities in our main analyses exist, though we are limited by our data in terms of what mechanisms we can explore. Our data do not allow us to observe differences in within-employer dynamics (e.g. positions held) and within-quarter employment intensity (e.g. hours worked), nor differences in the application behavior of students (e.g. number of applications completed and positions applied for). This latter limitation is especially salient given our hypothesis that these observed disparities are the result of differential frictions that low-SES students experience in the job application process - perhaps better measured using linked application or career advising data in future work.

V. Discussion

Our findings suggest that socioeconomic disparities in earnings outcomes exist even among students we would expect to be observably similar on nearly all measures relevant to employers, especially among students in non-Nursing programs, and moreover that these disparities persist for at least seven years following graduation among students in non-Nursing programs. For reference, estimates of the returns to an Associate's degree in the Virginia community college context are $773/quarter across programs (Xu & Trimble, 2016), making the

socioeconomic disparities we observe among graduates large relative to the average return to an associate's degree.

Our main results may moreover be *underestimates* of the true disparity due to our focus on FAFSA filers (see Appendix VIIa) and our exclusion of students who move out-of-state. To expound on the latter: prior research shows that students coming from higher-income family backgrounds earn substantially more than their lower-income peers (Bartik & Hershbein, 2016; Chetty et al., 2017), and that higher *earnings* students are more likely to leave state UI data due to out-of-state mobility (Foote & Stange, 2019). While these mobility relationships are attenuated for associate's degree holders (Scott-Clayton & Wen, 2018), we might still expect a greater proportion of our graduates missing all post-graduation employment data are higher-earnings, higher-SES students rather than higher-earnings, lower-SES students. Since we are directly comparing lower-SES student earnings to higher-SES student earnings, this deflation at the top-end of the higher-SES earnings distribution would then cause us to underestimate the true disparity between these two groups.

Our findings motivate several related strands of inquiry. First, it remains an open question as to exactly why lower-SES students experience worse outcomes in our results; for example, it may be the case that the post-graduation job search serves as yet another critical juncture like the postsecondary application process, in which lower-SES students lack the resources, support, or knowledge to choose optimally from many complex options in a competitive environment with higher-SES peers (Bettinger et al., 2012; Castleman & Page, 2015; Dynarski & Scott-Clayton, 2006; Hoxby & Avery, 2013; ideas42, 2016). Likewise, it could also be the case that lower-SES students form preferences over available jobs using different criteria than their higher-SES peers

(e.g., if they value geographic proximity to earnings, as we are unable to examine geographic characteristics of jobs in the present analysis), leading to systematic sorting away from higher-earnings positions. There may also be differences in preparation prior to students' college experiences (e.g., in their high school experiences) that we cannot adequately account for using college performance proxies like GPA. We believe further inquiry into the mechanisms underlying the socioeconomic inequalities we describe here is essential to inform potential strategies and policies to reduce these labor market disparities.

Our results also motivate critical consideration of the potential efficacy of using college access and success policies to promote socioeconomic mobility among low-SES students. Literature on the earnings returns to postsecondary degrees generally assume that such returns are consistent across the socioeconomic distribution; our work shows that this assumption may not be tenable, at least among community college graduates. If it is the case that the earnings returns to a college degree are indeed smaller for lower-SES graduates, simply increasing college attendance and graduation may not necessarily be sufficient to guarantee upward socioeconomic mobility among these students.

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Main Tables and Figures

Table 1. Descriptive Statistics for Sample Graduates by FAFSA Filing and Pell Receipt

Variable	Pell Non-Recipients	Pell Recipients	Raw Difference	Controlled Difference	FAFSA Non-Filers^
N	6193	15118			13680
% of Total	0.18	0.43			0.39
% Female	0.77	0.78	0.017 **	0.033 **	0.65
			(0.006)	(0.007)	
% Racial/Ethnic Minority	0.25	0.35	0.102 **	0.078 **	0.23
			(0.007)	(0.01)	
% Missing Race	0.01	0.01	-0.004 *	0.000	0.02
			(0.002)	(0.002)	
% In-state	0.98	0.98	-0.001	-0.003 +	0.97
			(0.002)	(0.002)	
% Missing In-state	0.00	0.00	0.000	0.000	0.00
			(0)	(0)	
% on Visa	0.04	0.04	0.000	0.023 **	0.03
			(0.003)	(0.007)	
% Ever in Military	0.06	0.09	0.029 **	0.026 **	0.12
			(0.005)	(0.005)	
% Missing Military Status	0.23	0.24	0.009	-0.008	0.35
			(0.006)	(0.008)	
% First-Generation	0.51	0.65	0.140 **	0.086 **	0.46
			(0.01)	(0.011)	
% Missing First-Generation Status	0.46	0.48	0.026 **	0.007	0.59
			(0.008)	(0.008)	
Average Age at Entry	25.42	25.64	0.219	0.314 +	25.42
			(0.136)	(0.174)	
% Missing Full Financial Aid History	0.63	0.56	-0.073 **	-0.092 **	0.94
			(0.007)	(0.01)	
% Without Any FAFSA Data in Final Two Years of Enrollment	0.00	0.00	0.000	0.000	1.00
			(0)	(0)	
% Employed in Any Quarter of the Year Prior to Enrollment	0.76	0.70	-0.058 **	-0.037 **	0.72
			(0.008)	(0.008)	
Mean Quarterly Wage in the Year Prior to Enrollment (Unconditional)	5482.44	4268.38	-1214.067 **	-823.529 **	5543.02
			(89.281)	(117.58)	

Notes: This table compares the descriptive statistics of sample graduates. The "Raw Difference" column calculates the difference in simple means between Pell Recipients and Pell Non-Recipients. The "Controlled Difference" column reports this same difference after controlling for College-by-Program-by-Cohort groups, as well as relative GPA quintiles.

^ As we explain in the sample section, FAFSA filers are only included in the estimation sample for covariates; they do not contribute to the estimation of the Pell recipient and non-recipient differences of interest to our study.

** p<0.01, * p<0.05, + p<0.1

Table 2. Socioeconomic Disparities in Labor Market Outcomes, Full Sample

Covariate	Quarterly Earnings One Year Out	Quarterly Earnings Two Years Out	Quarterly Earnings Three Years Out	Quarterly Earnings Five Years Out	Quarterly Earnings Seven Years Out	Employment Stability	Employer Stability	Share of Quarters Earning Living Wage
GPA Quintile 2	82	75	244*	328**	317+	-0.005	0.011	0.010
	(78)	(89)	(98)	(119)	(163)	(0.007)	(0.008)	(0.006)
GPA Quintile 3	337**	354**	528**	522**	464**	0.005	0.016+	0.024**
	(91)	(99)	(103)	(132)	(178)	(0.008)	(0.009)	(0.006)
GPA Quintile 4	478**	416**	606**	893**	564**	0.012	0.037**	0.034**
	(90)	(98)	(103)	(136)	(183)	(0.008)	(0.009)	(0.006)
GPA Quintile 5	796**	765**	973**	1,195**	1,292**	0.019*	0.055**	0.056**
	(99)	(115)	(118)	(158)	(209)	(0.008)	(0.010)	(0.007)
Pell Receipt Prior to Graduation	-479**	-408**	-368**	**-263***	-204	-0.015*	-0.025**	-0.043**
	(74)	(83)	(86)	(108)	(163)	(0.007)	(0.008)	(0.005)
Non-Recipient Mean	10,846.47	11,468.20	12,111.46	12,860.72	13,762.91	0.80	0.63	0.65
Observations	32,334	31,442	30,071	22,233	14,900	34,991	34,991	34,991
R-Squared	0.421	0.392	0.386	0.358	0.346	0.127	0.119	0.345

Notes: Standard errors in parentheses. Bolded results on earnings outcomes indicate a significant difference ($p<0.05$) from the corresponding estimate at one year out. All standard errors are clustered at the college-by-program-by-cohort level. Covariates include basic demographic covariates, employment prior to enrollment covariates, during-enrollment covariates, and additional SES covariates. GPA Quintiles are relative to other students in the same college-by-program combination, across cohorts. Non-recipient means are uncontrolled and only intended to serve as a point of reference for the stated outcome.

** $p<0.01$, * $p<0.05$, + $p<0.1$

Table 3. Socioeconomic Disparities in Labor Market Outcomes

Within GPA Quintiles, Full Sample

Covariate	Quarterly Earnings One Year Out	Quarterly Earnings Two Years Out	Quarterly Earnings Three Years Out	Quarterly Earnings Five Years Out	Quarterly Earnings Seven Years Out	Employment Stability	Employer Stability	Share of Quarters Earning Living Wage
GPA Quintile 2	-154	-134	183	153	365	-0.012	-0.005	-0.002
	(189)	(206)	(220)	(279)	(371)	(0.016)	(0.020)	(0.014)
GPA Quintile 3	117	161	197	211	285	0.003	0.018	0.010
	(184)	(210)	(234)	(298)	(361)	(0.017)	(0.021)	(0.014)
GPA Quintile 4	51	155	406+	685*	628	0.001	0.025	0.028*
	(198)	(215)	(241)	(296)	(394)	(0.016)	(0.020)	(0.014)
GPA Quintile 5	25	305	370	742*	1,173**	0.026	0.045*	0.041**
	(198)	(215)	(236)	(309)	(396)	(0.017)	(0.020)	(0.013)
GPA Quintile 1 * Pell Prior to Graduation	-787**	-569**	-486**	**-263**	**-77**	-0.015	-0.035+	-0.053**
	(168)	(176)	(187)	(221)	(331)	(0.015)	(0.018)	(0.012)
GPA Quintile 2 * Pell Prior to Graduation	-456**	-290+	-586**	-310	-278	-0.010	-0.014	-0.038**
	(145)	(160)	(169)	(238)	(315)	(0.014)	(0.017)	(0.011)
GPA Quintile 3 * Pell Prior to Graduation	-611**	-464**	-281	-222	-124	-0.029*	-0.051**	-0.041**
	(149)	(178)	(201)	(255)	(329)	(0.014)	(0.017)	(0.011)
GPA Quintile 4 * Pell Prior to Graduation	-564**	-551**	-551**	-474*	-380	0.000	-0.012	-0.052**
	(153)	(174)	(187)	(241)	(389)	(0.014)	(0.016)	(0.011)
GPA Quintile 5 * Pell Prior to Graduation	-99	-253	-19	-132	-207	-0.021	-0.013	-0.032**
	(155)	(171)	(182)	(254)	(362)	(0.015)	(0.016)	(0.011)
Non-Recipient Mean	10,846.47	11,468.20	12,111.46	12,860.72	13,762.91	0.80	0.63	0.65
Observations	32,334	31,442	30,071	22,233	14,900	34,991	34,991	34,991
R-Squared	0.422	0.392	0.386	0.359	0.346	0.127	0.119	0.345

Notes: Standard errors in parentheses. Bolded results on earnings outcomes indicate a significant difference ($p<0.05$) from the corresponding estimate at one year out. All standard errors are clustered at the college-by-program-by-cohort level. Covariates include basic demographic covariates, employment prior to enrollment covariates, during-enrollment covariates, and additional SES covariates. GPA Quintiles are relative to other students in the same college-by-program combination, across cohorts. Non-recipient means are uncontrolled and only intended to serve as a point of reference for the stated outcome.

** $p<0.01$, * $p<0.05$, + $p<0.1$

Table 4. Socioeconomic Disparities in Earnings Outcomes, Nursing and Non-Nursing Comparisons

	Earnings One Year Out		Earnings Two Years Out		Earnings Three Years Out		Earnings Five Years Out		Earnings Seven Years Out	
	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students
GPA Quintile 2	85	131	68	149	284*	227	389**	357+	377+	367
	(95)	(135)	(105)	(154)	(114)	(180)	(144)	(200)	(198)	(281)
GPA Quintile 3	452**	121	462**	179	702**	236	792**	165	780**	71
	(112)	(153)	(120)	(165)	(126)	(174)	(156)	(233)	(212)	(302)
GPA Quintile 4	569**	276+	541**	162	812**	221	1,264**	378+	1,080**	-195
	(114)	(142)	(126)	(150)	(128)	(173)	(164)	(221)	(219)	(294)
GPA Quintile 5	1,065**	255+	1,044**	215	1,296**	363+	1,710**	409+	1,797**	616+
	(125)	(152)	(132)	(202)	(144)	(191)	(197)	(243)	(251)	(354)
Pell Receipt Prior to Graduation	**-626****	**-193+**	**-616****	**-19**	**-668****	**157**	**-729****	**485****	**-584****	**427**
	(98)	(111)	(105)	(133)	(113)	(121)	(136)	(161)	(188)	(276)
Non-Recipient Mean	9,023	13,250	9,723	13,767	10,463	14,259	11,330	14,853	11,999	16,078
Observations	21,812	10,522	21,246	10,196	20,335	9,736	14,919	7,314	9,981	4,919
R-Squared	0.405	0.157	0.389	0.139	0.392	0.132	0.385	0.123	0.375	0.130

Notes: Standard errors in parentheses. Bolded results outcomes indicate a significant difference ($p<0.05$) between nursing and non-nursing estimates. All standard errors are clustered at the college-by-program-by-cohort level. Covariates are all basic demographic covariates, employment prior to enrollment covariates, during-enrollment covariates, and additional SES covariates, from prior models. GPA Quintiles are relative to other students in the same college-by-program combination, across cohorts. Non-recipient means are uncontrolled and only intended to serve as a point of reference for the stated outcome.

** $p<0.01$, * $p<0.05$, + $p<0.1$

Table 5. Socioeconomic Disparities in Earnings Outcomes Within GPA Quintiles, Nursing and Non-Nursing Comparisons

	Earnings One Year Out		Earnings Two Years Out		Earnings Three Years Out		Earnings Five Years Out		Earnings Seven Years Out	
	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students
GPA Quintile 2	-357	97	-188	-47	-6	448	52	314	410	235
	(270)	(262)	(282)	(299)	(290)	(329)	(383)	(407)	(494)	(561)
GPA Quintile 3	80	148	201	150	105	355	194	288	99	461
	(267)	(252)	(288)	(303)	(315)	(345)	(383)	(444)	(484)	(526)
GPA Quintile 4	-95	229	172	146	225	691+	659	826+	540	829
	(300)	(255)	(307)	(303)	(327)	(355)	(403)	(429)	(567)	(536)
GPA Quintile 5	-21	-32	390	137	331	384	953*	542	1,316**	917
	(268)	(292)	(274)	(326)	(303)	(356)	(377)	(483)	(505)	(595)
GPA Quintile 1 * Pell Prior to Graduation	**-1,089****	**-301**	**-850****	**-43**	**-1,072****	**541+**	**-995****	**903****	**-738+**	**724**
	(224)	(263)	(229)	(287)	(242)	(291)	(298)	(312)	(399)	(531)
GPA Quintile 2 * Pell Prior to Graduation	-470*	-336	-423*	25	-783**	-200	**-717***	**432**	**-793***	**635**
	(189)	(231)	(205)	(260)	(222)	(266)	(285)	(403)	(390)	(505)
GPA Quintile 3 * Pell Prior to Graduation	-765**	-379+	-650**	-155	-532*	141	-585+	364	-275	339
	(204)	(225)	(234)	(282)	(255)	(325)	(329)	(398)	(427)	(532)
GPA Quintile 4 * Pell Prior to Graduation	-749**	-213	-782**	-133	-746**	-229	**-852****	**165**	-503	-266
	(221)	(211)	(236)	(254)	(247)	(284)	(323)	(371)	(508)	(642)
GPA Quintile 5 * Pell Prior to Graduation	-282	308	**-533***	**283**	**-373**	**643***	**-656***	**653**	**-701+**	**810**
	(199)	(238)	(216)	(273)	(236)	(275)	(295)	(448)	(393)	(674)
Non-Recipient Mean	9,023	13,250	9,723	13,767	10,463	14,259	11,330	14,853	11,999	16,078
Observations	21,812	10,522	21,246	10,196	20,335	9,736	14,919	7,314	9,981	4,919
R-Squared	0.407	0.158	0.390	0.139	0.393	0.134	0.386	0.124	0.376	0.132

Notes: Standard errors in parentheses. Bolded results outcomes indicate a significant difference ($p<0.05$) between nursing and non-nursing estimates. All standard errors are clustered at the college-by-program-by-cohort level. Covariates are all basic demographic covariates, employment prior to enrollment covariates, during-enrollment covariates, and additional SES covariates, from prior models. GPA Quintiles are relative to other students in the same college-by-program combination, across cohorts. Non-recipient means are uncontrolled and only intended to serve as a point of reference for the stated outcome.

** $p<0.01$, * $p<0.05$, + $p<0.1$

Table 6. Socioeconomic Disparities in Employment Outcomes,

Nursing and Non-Nursing Comparisons

	Employment Stability		Employer Stability		Share of Quarters Earning Living Wage	
	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students
GPA Quintile 2	-0.002	-0.013	0.018+	-0.006	0.015+	-0.001
	(0.009)	(0.011)	(0.010)	(0.015)	(0.008)	(0.009)
GPA Quintile 3	0.005	0.000	0.019+	0.002	0.033**	0.005
	(0.010)	(0.012)	(0.011)	(0.014)	(0.008)	(0.009)
GPA Quintile 4	0.008	0.011	0.039**	0.021	0.034**	0.026**
	(0.010)	(0.013)	(0.012)	(0.015)	(0.008)	(0.009)
GPA Quintile 5	0.014	0.016	0.048**	0.051**	0.060**	0.036**
	(0.011)	(0.013)	(0.013)	(0.015)	(0.009)	(0.009)
Pell Receipt Prior to Graduation	-0.013	-0.016	-0.028**	-0.021+	**-0.062****	**-0.011**
	(0.009)	(0.010)	(0.010)	(0.012)	(0.008)	(0.007)
Non-Recipient Mean	0.77	0.83	0.61	0.66	0.57	0.77
Observations	23,797	11,194	23,797	11,194	23,797	11,194
R-Squared	0.139	0.089	0.140	0.077	0.331	0.122

Notes: Standard errors in parentheses. Bolded results outcomes indicate a significant difference ($p<0.05$) between nursing and non-nursing estimates. All standard errors are clustered at the college-by-program-by-cohort level. Covariates are all basic demographic covariates, employment prior to enrollment covariates, during-enrollment covariates, and additional SES covariates, from prior models. GPA Quintiles are relative to other students in the same college-by-program combination, across cohorts. Non-recipient means are uncontrolled and only intended to serve as a point of reference for the stated outcome.

** $p<0.01$, * $p<0.05$, + $p<0.1$

Table 7. Socioeconomic Disparities in Employment Outcomes Within GPA Quintiles, Nursing and Non-Nursing Comparisons

	Employment Stability		Employer Stability		Share of Quarters Earning Living Wage	
	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students
GPA Quintile 2	0.002	-0.034	0.023	-0.047	-0.007	-0.003
	(0.023)	(0.023)	(0.028)	(0.029)	(0.021)	(0.015)
GPA Quintile 3	-0.001	0.003	0.019	0.008	-0.002	0.018
	(0.024)	(0.023)	(0.029)	(0.030)	(0.021)	(0.016)
GPA Quintile 4	-0.003	0.002	0.030	0.011	0.011	0.040*
	(0.023)	(0.023)	(0.028)	(0.029)	(0.021)	(0.016)
GPA Quintile 5	0.026	0.015	0.048+	0.027	0.030	0.037*
	(0.023)	(0.025)	(0.027)	(0.031)	(0.020)	(0.017)
GPA Quintile 1 * Pell Prior to Graduation	-0.012	-0.017	-0.031	-0.037	**-0.086****	**-0.006**
	(0.020)	(0.021)	(0.024)	(0.028)	(0.017)	(0.015)
GPA Quintile 2 * Pell Prior to Graduation	-0.017	0.001	-0.032	0.010	**-0.058****	**-0.004**
	(0.019)	(0.020)	(0.022)	(0.025)	(0.016)	(0.015)
GPA Quintile 3 * Pell Prior to Graduation	-0.016	-0.046*	-0.040+	-0.068*	-0.049**	-0.032*
	(0.019)	(0.022)	(0.022)	(0.028)	(0.016)	(0.016)
GPA Quintile 4 * Pell Prior to Graduation	0.006	-0.007	-0.012	-0.013	**-0.068****	**-0.020**
	(0.019)	(0.022)	(0.021)	(0.024)	(0.015)	(0.016)
GPA Quintile 5 * Pell Prior to Graduation	-0.027	-0.005	-0.023	0.011	**-0.052****	**0.010**
	(0.019)	(0.022)	(0.021)	(0.026)	(0.015)	(0.016)
Non-Recipient Mean	0.77	0.83	0.61	0.66	0.57	0.77
Observations	23,797	11,194	23,797	11,194	23,797	11,194
R-Squared	0.139	0.089	0.140	0.078	0.331	0.122

Notes: Standard errors in parentheses. Bolded results outcomes indicate a significant difference ($p<0.05$) between nursing and non-nursing estimates. All standard errors are clustered at the college-by-program-by-cohort level. Covariates are all basic demographic covariates, employment prior to enrollment covariates, during-enrollment covariates, and additional SES covariates, from prior models. GPA Quintiles are relative to other students in the same college-by-program combination, across cohorts. Non-recipient means are uncontrolled and only intended to serve as a point of reference for the stated outcome.

** $p<0.01$, * $p<0.05$, + $p<0.1$

Table 8. Socioeconomic Disparities in Additional Labor Market Patterns, Full Sample

	Quarters to First Employed Quarter	Length of First Employer Spell	Earnings of First Employed Quarter	Size of First Employer	Quarterly Earnings Growth (%)	Share of Postgrad Quarters Employed	Re-Enroll After Grad	Share of Emp Qtrs Holding Multiple Jobs
GPA Quintile 2	0.004	0.218**	95	587.024+	0.000	-0.001	0.006	-0.010**
	(0.029)	(0.075)	(77)	(340.105)	(0.003)	(0.004)	(0.008)	(0.004)
GPA Quintile 3	0.004	0.374**	318**	326.130	0.001	0.001	-0.004	-0.013**
	(0.030)	(0.078)	(93)	(332.205)	(0.003)	(0.005)	(0.009)	(0.004)
GPA Quintile 4	0.025	0.584**	467**	1,057.760*	-0.001	0.007	-0.006	-0.015**
	(0.032)	(0.080)	(92)	(371.721)	(0.003)	(0.005)	(0.009)	(0.004)
GPA Quintile 5	0.001	0.759**	762**	2,162.990*	-0.002	0.006	0.005	-0.018**
	(0.036)	(0.086)	(106)	(428.549)	(0.003)	(0.005)	(0.010)	(0.004)
Pell Receipt Prior to Graduation	0.093**	-0.208**	-604**	202.944	0.002	-0.009*	0.013+	0.002
	(0.026)	(0.071)	(73)	(354.066)	(0.002)	(0.004)	(0.008)	(0.004)
Non-Recipient Mean	0.483	6.583	8,391	6651.805	0.022	0.859	0.283	0.104
Observations	34,991	34,991	34,991	31,947	32,460	34,991	34,991	34,991
R-Squared	0.150	0.138	0.303	0.177	0.091	0.147	0.123	0.155

Notes: Standard errors in parentheses. All standard errors are clustered at the college-by-program-by-cohort level. Covariates are all basic demographic covariates, employment prior to enrollment covariates, during-enrollment covariates, and additional SES covariates, from prior models. GPA Quintiles are relative to other students in the same college-by-program combination, across cohorts.

** p<0.01, * p<0.05, + p<0.1

Table 9. Socioeconomic Disparities in Additional Labor Market Patterns, Nursing and Non-Nursing Comparisons

	Quarters to First Employed Quarter		Length of First Employer Spell		Earnings of First Employed Quarter		Size of First Employer	
	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students
GPA Quintile 2	0.009	0.008	0.216*	0.214+	170+	-2	276.508	1,096.870
	(0.038)	(0.043)	(0.091)	(0.128)	(95)	(134)	(422.561)	(560.213)
GPA Quintile 3	0.005	0.025	0.402**	0.271*	492**	-20	90.770	640.486
	(0.039)	(0.044)	(0.099)	(0.122)	(115)	(154)	(436.600)	(475.904)
GPA Quintile 4	0.065	-0.014	0.598**	0.479**	612**	143	851.195+	1,182.820
	(0.043)	(0.046)	(0.101)	(0.132)	(115)	(150)	(471.532)	(568.496)
GPA Quintile 5	0.062	-0.070	0.782**	0.632**	924**	413*	2,179.935	1,883.742
	(0.047)	(0.053)	(0.112)	(0.132)	(130)	(181)	(544.375)	(653.021)
Pell Receipt Prior to Graduation	0.083*	0.101**	-0.280**	-0.108	**-738****	**-339****	271.141	-121.776
	(0.036)	(0.037)	(0.092)	(0.112)	**(92)**	**(120)**	(447.574)	(566.171)
Non-Recipient Mean	0.517	0.419	6.571	6.606	8,142	8,874	6,237	7,466
Observations	23,797	11,194	23,797	11,194	23,797	11,194	21,794	10,153
R-Squared	0.163	0.119	0.172	0.082	0.354	0.147	0.135	0.291

Notes: Standard errors in parentheses. Bolded results outcomes indicate a significant difference ($p<0.05$) between nursing and non-nursing estimates. All standard errors are clustered at the college-by-program-by-cohort level. Covariates are all basic demographic covariates, employment prior to enrollment covariates, during-enrollment covariates, and additional SES covariates, from prior models. GPA Quintiles are relative to other students in the same college-by-program combination, across cohorts.

** $p<0.01$, * $p<0.05$, + $p<0.1$

Table 10. Socioeconomic Disparities in Additional Labor Market Patterns, Nursing and Non-Nursing Comparisons

	Quarterly Earnings Growth (%)		Share of Postgrad Quarters Employed		Re-Enroll After Grad		Share of Emp Qtrs Holding Multiple Jobs	
	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students
GPA Quintile 2	-0.001	0.002	-0.002	-0.003	0.003	0.012	-0.010+	-0.010+
	(0.004)	(0.004)	(0.006)	(0.006)	(0.010)	(0.014)	(0.005)	(0.005)
GPA Quintile 3	0.001	0.002	-0.003	0.003	-0.017+	0.020	-0.015**	-0.009
	(0.004)	(0.004)	(0.006)	(0.007)	(0.010)	(0.016)	(0.005)	(0.006)
GPA Quintile 4	-0.002	0.002	0.001	0.011	-0.016	0.014	-0.016**	-0.011+
	(0.004)	(0.004)	(0.006)	(0.008)	(0.010)	(0.017)	(0.005)	(0.006)
GPA Quintile 5	0.001	-0.006	-0.003	0.015+	-0.010	0.036+	-0.020**	-0.013*
	(0.004)	(0.005)	(0.007)	(0.008)	(0.011)	(0.019)	(0.006)	(0.006)
Pell Receipt Prior to Graduation	0.003	0.000	-0.006	-0.011+	**0.026****	**-0.007**	**0.010***	**-0.008**
	(0.003)	(0.004)	(0.005)	(0.006)	**(0.009)**	**(0.013)**	**(0.005)**	**(0.006)**
Non-Recipient Mean	0.021	0.025	0.849	0.877	0.242	0.361	0.107	0.098
Observations	21,877	10,583	23,797	11,194	23,797	11,194	23,797	11,194
R-Squared	0.113	0.055	0.158	0.118	0.133	0.081	0.180	0.091

Notes: Standard errors in parentheses. Bolded results outcomes indicate a significant difference ($p<0.05$) between nursing and non-nursing estimates. All standard errors are clustered at the college-by-program-by-cohort level. Covariates are all basic demographic covariates, employment prior to enrollment covariates, during-enrollment covariates, and additional SES covariates, from prior models. GPA Quintiles are relative to other students in the same college-by-program combination, across cohorts.

** $p<0.01$, * $p<0.05$, + $p<0.1$

VII. Appendix

VIIa. Imputation Analysis Methodology and Results

Because such a large share of our sample (39%) did not file the FAFSA in either of their final two years of enrollment, we lose both precision and external validity by focusing solely on socioeconomic disparities among FAFSA-filers in our analyses. As an exploratory exercise, we conduct multiple imputation (MI) to impute Pell receipt among our non-filers given its robustness and well-studied idiosyncrasies in the literature (White et al., 2011).

Per best practices of MI, we deploy an imputation model that is congenial with the substantive model in our main analysis. In other words, we mirror our main regression specification in the imputation model (Buuren, 2018). We run 50 imputation iterations per diagnostic recommendations proposed by White et al. (2011). We find that Pell receipt is missing in a monotone pattern, and we use a logit approach accordingly. That said, we opt not to impute earnings outcomes that are missing as part of the imputation process; though MI is intended to impute missingness across the entire dataset (including outcomes), imputing the missing earnings data is conceptually misguided in this context because the earnings data are missing in this context either due to the graduate being unemployed in those quarters or working for an employer not reporting UI data (as articulated in section IIc). Given that we are specifically interested in the measure of earnings *conditional on observing employment* via the UI data, imputation here would create a measure more related to *expected earnings had we observed the graduate in employment* in a given quarter.

Stemming from that last point, we exclude our longer-term earnings outcomes (5 and 7 years out) from this supplemental analysis due to the high missingness of these values. If we

included them in this analysis, and thus the imputation model, without imputing them (per our decision above), we would lose a substantial proportion of our sample - largely defeating the purpose of the exercise to begin with. For reference, the most missingness we see in our primary earnings outcomes is roughly 15%, but the most missingness we see in our longer-term outcomes is 57%. While we lose the ability to remark on trends in these longer term outcomes in the imputation analysis, it will substantially improve the robustness of results on our primary outcomes of interest.

Lastly, because we use interactions as part of Equation 2 in our main specification, and there exists meaningful concerns about the imputation of interaction terms in the MI literature (von Hippel, 2009), we opt to exclude Equation 2 from this analysis. While we will not be able to remark on within-quintile disparities, we feel the robustness of this analysis is far stronger as a result.

We find that the trends we observe in our main analyses remain true, but are generally substantially larger in magnitude. First, earnings disparities over time in the full sample remain large, reported in Table A2. In fact, Pell recipients in the top GPA quintile would seem to earn about as much as non-recipients in the *bottom* GPA quintile on average given these differences, with nearly identical odds of earning a living wage in a given quarter. When we revisit our Nursing and non-Nursing subsample analyses in Table A3, we see that the earnings disparities are similarly exacerbated here - jumping in magnitude to about $1350/quarter across all time points for non-Nursing graduates.

These results for the share of quarters earning a living wage present an interesting puzzle. The living wage outcome we utilize is partially built off of our earnings measures; why is it that

when we incorporate FAFSA non-filers into our analysis, we see far larger socioeconomic disparities across our earnings measures, but disparities in our living wage measure do not seem to move at all? We argue that this provides us some insight into how FAFSA non-filers are different from our filers. That is, FAFSA non-filers seem to be similar to filers on the *extensive* margin of how often they are employed and with what stability. However, they seem to be on the far higher end of the *intensive* margin of how much they earn while employed - this would explain why our estimates for a graduate's probability of earning a living wage do not change once they are incorporated, but our actual earnings estimates do. Indeed, when we plot the earnings distributions of students at one year out by FAFSA filing status and Pell receipt in Appendix Figure A7, non-filers (in red) are substantially more likely to experience exceptionally high wages of $20,000/quarter and above. This evidence meshes with our earlier speculation that including only FAFSA-filers may reduce the contrast of our sample by excluding those very high income students who choose not to file a FAFSA because they know they are not eligible for financial aid.

Taken together, the results from our imputation analysis offer suggestive evidence that socioeconomic disparities in earnings outcomes among lower- and higher-SES graduates are actually substantially larger than our main estimates would imply.

Appendix Tables and Figures

Table A1. Descriptive Statistics for Graduates With and Without Employment and Earnings UI Data in the Three Years After Graduation: Demographics

Variable	Observed in UI Data Within Three Years of Graduation	Not Observed in UI Data Within Three Years of Graduation	Difference	
N	34991	5780		
% Female	0.73	0.67	-0.060	**
			(0.006)	
% Racial/Ethnic Minority	0.29	0.36	0.071	**
			(0.007)	
% Missing Race	0.01	0.02	0.009	**
			(0.002)	
% In-state	0.98	0.83	-0.142	**
			(0.003)	
% Missing In-state	0.00	0.01	0.012	**
			(0.001)	
% on Visa	0.04	0.07	0.031	**
			(0.003)	
% Ever in Military	0.09	0.20	0.101	**
			(0.005)	
% Missing Military Status	0.28	0.30	0.024	**
			(0.006)	
% First-Generation	0.56	0.54	-0.021	+
			(0.011)	
% Missing First-Generation Status	0.52	0.56	0.044	**
			(0.007)	
Average Age at Entry	25.51	28.41	2.893	**
			(0.134)	
% Missing Full Financial Aid History	0.72	0.73	0.011	+
			(0.006)	
% Without Any FAFSA data in Final Two Years of Enrollment	0.39	0.49	0.096	**
			(0.007)	
% of FAFSA Filers Receiving Pell in Final Two Years of Enrollment	0.71	0.76	0.053	**
			(0.009)	

Notes: This table compares the descriptive statistics of graduates for whom we do and do not observe employment records in the three years after their graduation, conditional on meeting all other sample specifications described.

** p<0.01, * p<0.05, + p<0.1

Table A2. Socioeconomic Disparities in Labor Market Outcomes,

Full Sample Including FAFSA Non-Filers

Covariate	Quarterly Earnings One Year Out	Quarterly Earnings Two Years Out	Quarterly Earnings Three Years Out	Employment Stability	Employer Stability	Share of Quarters Earning Living Wage
GPA Quintile 2	14	34	188+	-0.013+	0.005	0.004
	(78)	(89)	(97)	(0.007)	(0.009)	(0.006)
GPA Quintile 3	292**	306**	468**	-0.004	0.007	0.019**
	(89)	(99)	(102)	(0.007)	(0.009)	(0.006)
GPA Quintile 4	394**	358**	572**	0.006	0.033**	0.030**
	(90)	(99)	(105)	(0.007)	(0.009)	(0.006)
GPA Quintile 5	726**	758**	904**	0.018*	0.055**	0.056**
	(100)	(113)	(119)	(0.008)	(0.010)	(0.007)
Pell Receipt Prior to Graduation	-1,057**	-1,022**	-977**	-0.018**	-0.027**	-0.051**
	(95)	(100)	(103)	(0.006)	(0.007)	(0.005)
Observations	30,891	30,353	29,500	32,589	32,589	32,589

Notes: Standard errors in parentheses. All standard errors are clustered at the college-by-program-by-cohort level regardless of fixed-effect specification. Covariates include basic demographic covariates, employment prior to enrollment covariates, during-enrollment covariates, and additional SES covariates. GPA Quintiles are relative to other students in the same college-by-program combination, across cohorts.

** p<0.01, * p<0.05, + p<0.1

Table A3. Socioeconomic Disparities in Labor Market Outcomes,

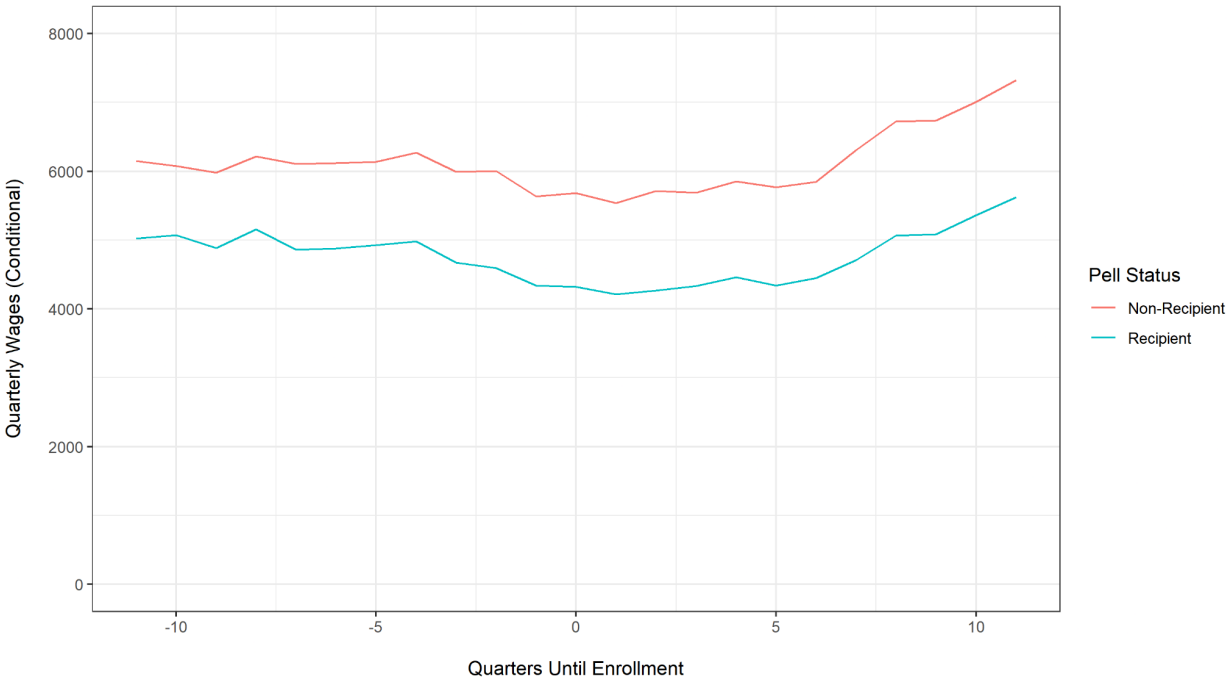
Nursing and Non-Nursing Comparisons Including FAFSA Non-Filers

	Quarterly Earnings One Year Out		Quarterly Earnings Two Years Out		Quarterly Earnings Three Years Out		Employment Stability		Employer Stability		Share of Quarters Earning Living Wage	
	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students	Non-Nursing Students	Nursing Students
GPA Quintile 2	-14	115	13	118	224+	174	-0.011	-0.018+	0.011	-0.008	0.008	-0.003
	(97)	(133)	(106)	(153)	(114)	(172)	(0.009)	(0.010)	(0.011)	(0.015)	(0.008)	(0.008)
GPA Quintile 3	366**	152	397**	160	625**	208	-0.007	-0.004	0.008	-0.002	0.026**	0.003
	(111)	(150)	(120)	(169)	(126)	(172)	(0.010)	(0.011)	(0.012)	(0.015)	(0.008)	(0.008)
GPA Quintile 4	448**	249+	472**	116	753**	233	0.000	0.009	0.032**	0.022	0.028**	0.027**
	(115)	(141)	(127)	(152)	(128)	(177)	(0.010)	(0.011)	(0.012)	(0.014)	(0.009)	(0.008)
GPA Quintile 5	962**	239	1,028**	218	1,219**	309	0.014	0.015	0.050**	0.049**	0.061**	0.037**
	(128)	(153)	(133)	(193)	(145)	(192)	(0.010)	(0.012)	(0.013)	(0.015)	(0.009)	(0.008)
Pell Receipt Prior to Graduation	-1,342**	-555**	-1,359**	-430**	-1,352**	-310*	-0.019*	-0.016+	-0.030**	-0.023*	-0.069**	-0.020**
	(131)	(114)	(134)	(126)	(136)	(132)	(0.008)	(0.009)	(0.010)	(0.011)	(0.007)	(0.006)
Observations	20,768	10,123	20,450	9,903	19,888	9,612	22,027	10,562	22,027	10,562	22,027	10,562

Notes: Standard errors in parentheses. All standard errors are clustered at the college-by-program-by-cohort level. Covariates are all basic demographic covariates, employment prior to enrollment covariates, during-enrollment covariates, and additional SES covariates, from prior models. GPA Quintiles are relative to other students in the same college-by-program combination, across cohorts.

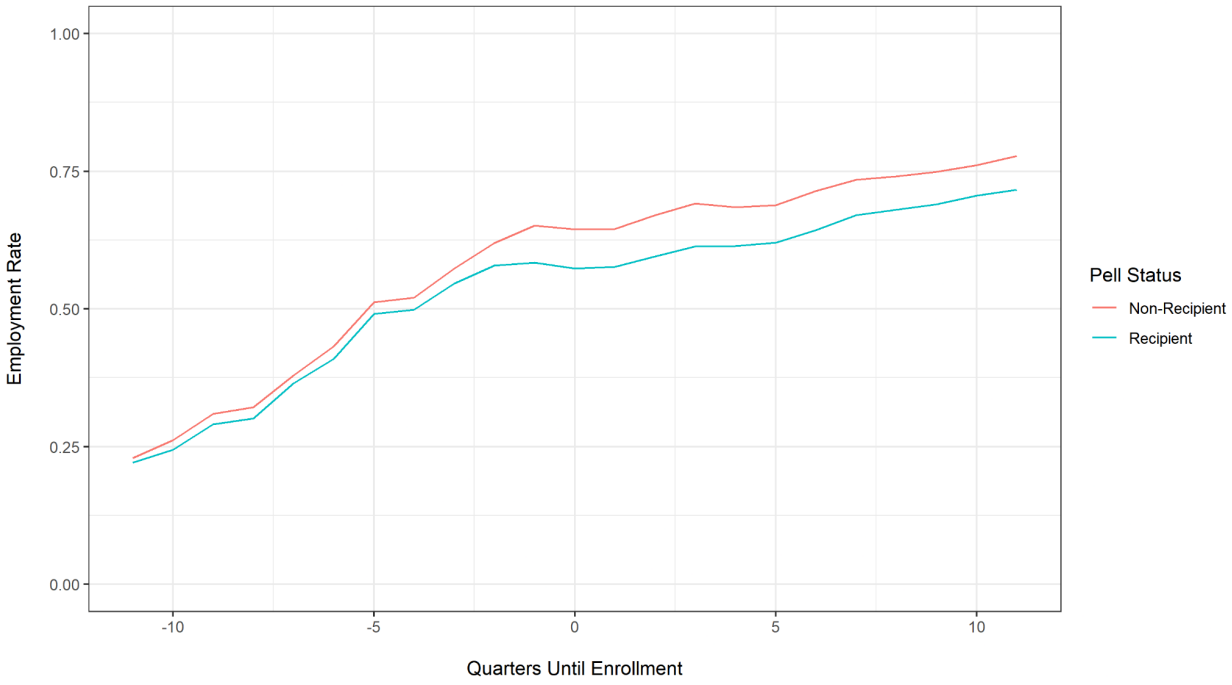
** p<0.01, * p<0.05, + p<0.1

Figure A1. Average Conditional Wages Over Time by Pell Receipt, Centered on Student's Quarter of First Enrollment



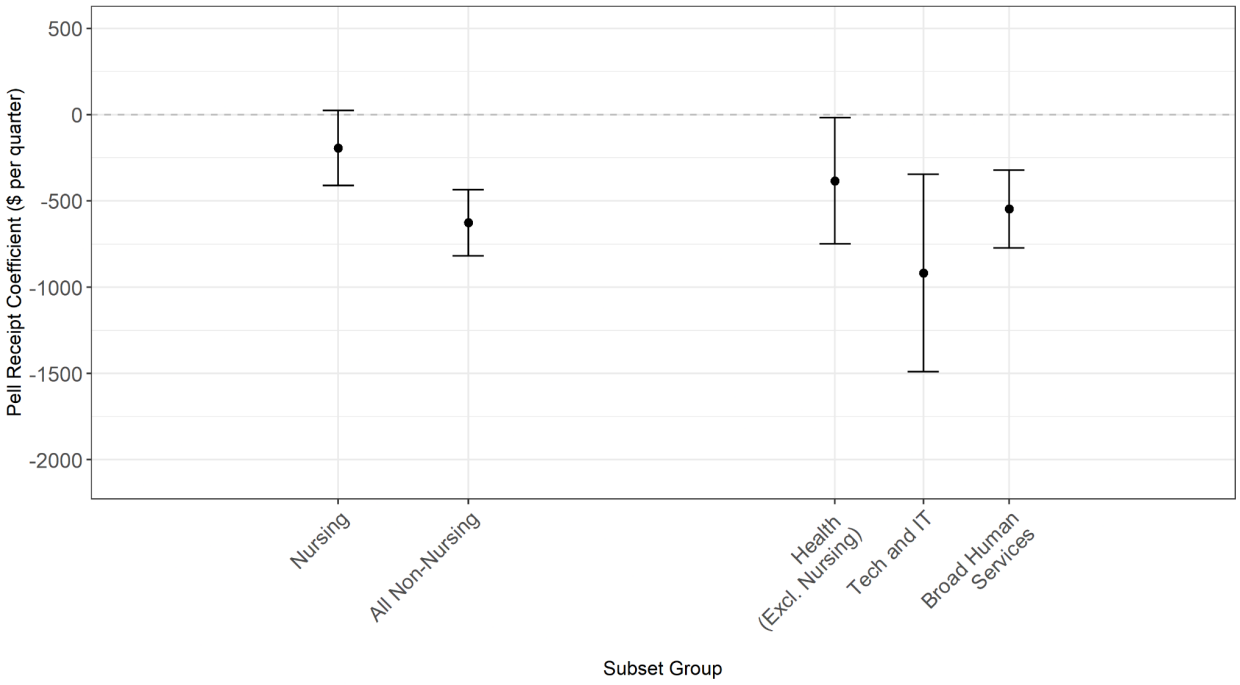
Note: The above plot displays average quarterly earnings (conditional on employment) over time for Pell recipients and non-recipients, excluding FAFSA non-filers, relative to the student's first enrolled quarter.

Figure A2. Average Employment Rate Over Time by Pell Receipt, Centered on Student's Quarter of First Enrollment



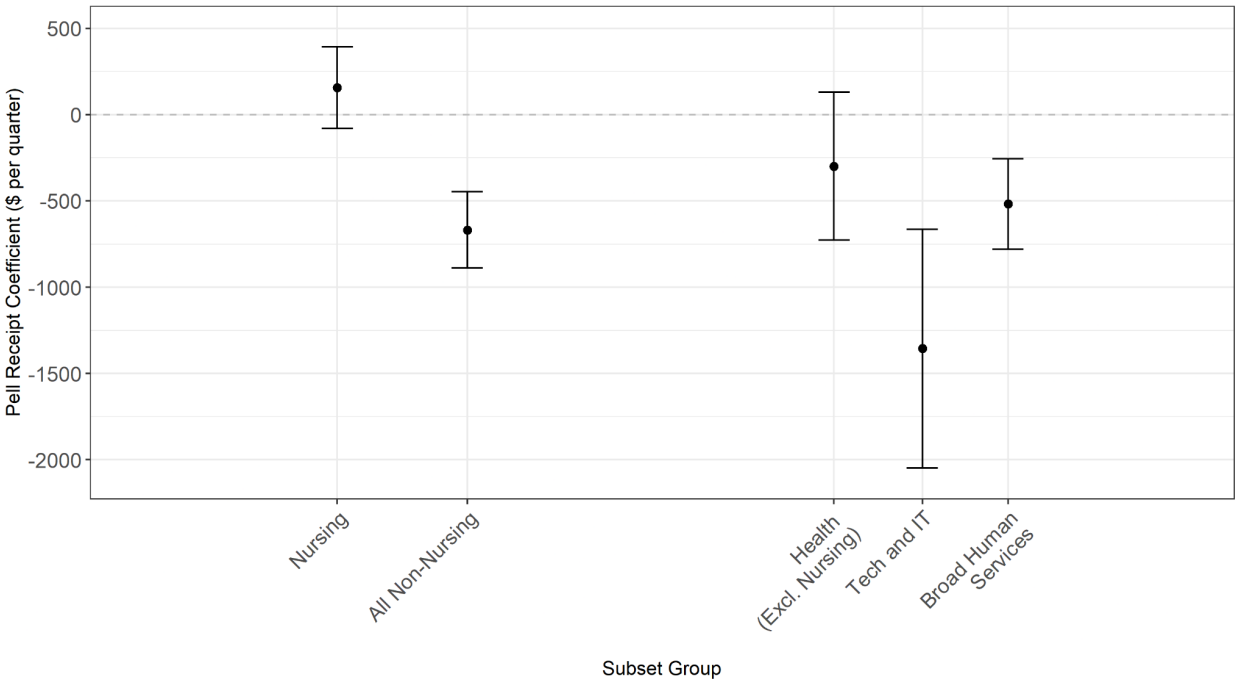
Note: The above plot displays average quarterly employment rates over time for Pell recipients and non-recipients, excluding FAFSA non-filers, relative to the student's first enrolled quarter.

Figure A3. Socioeconomic Disparities in Earnings One Year After Graduation by Program Groupings



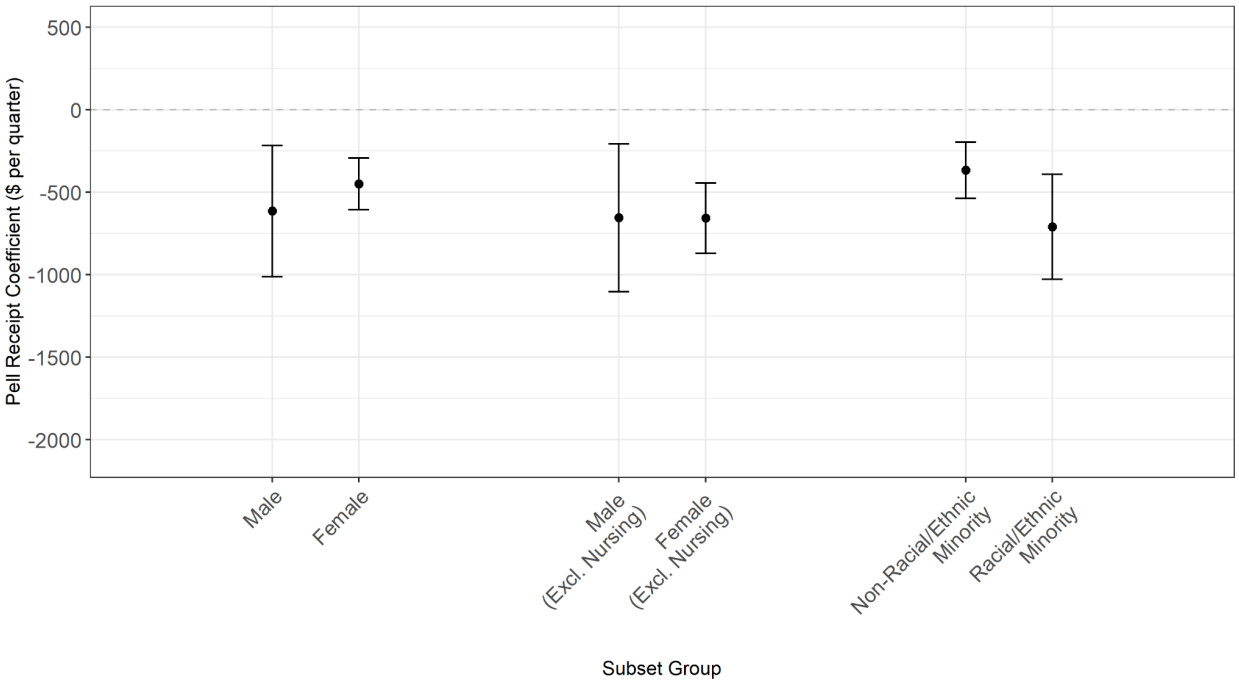
Note: Each point represents the coefficient on Pell receipt, per Equation 1, in a subsample regression including only students in the indicated program grouping. Coefficients are thus relative to Pell non-recipients in the same subsample. On the left, we aggregate all non-Nursing programs together; on the right, we display separated groupings within this set.

Figure A4. Socioeconomic Disparities in Earnings Three Years After Graduation by Program Groupings



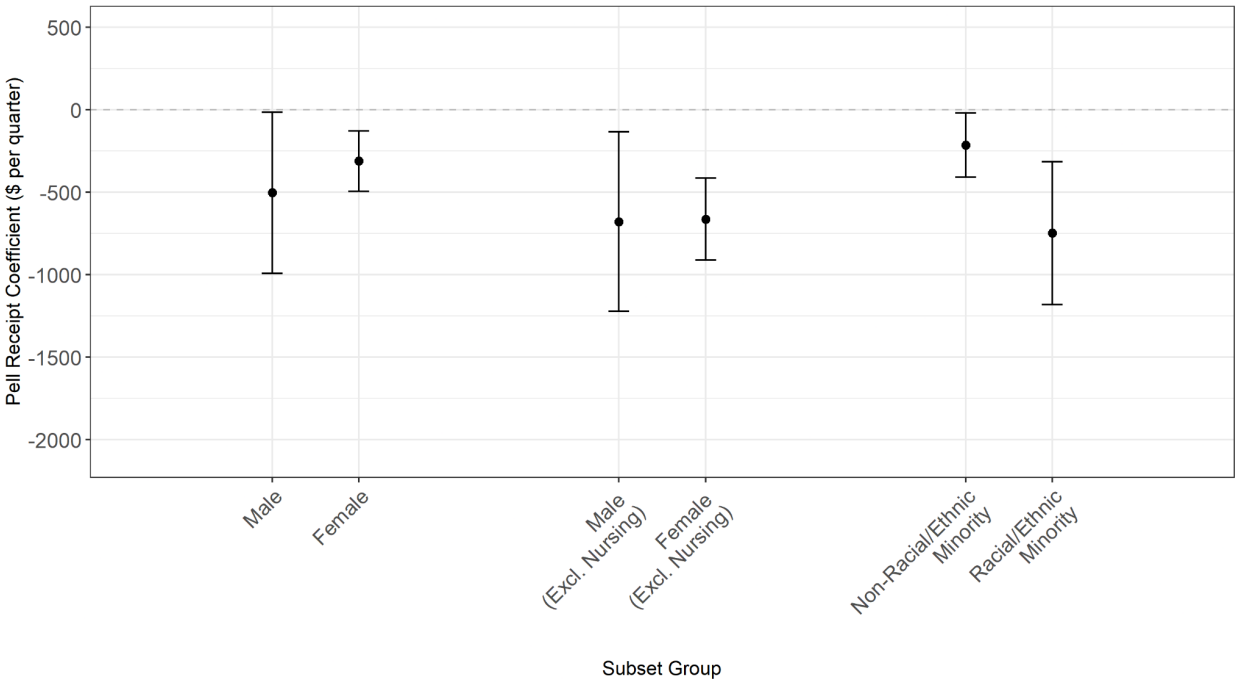
Note: Each point represents the coefficient on Pell receipt, per Equation 1, in a subsample regression including only students in the indicated program grouping. Coefficients are thus relative to Pell non-recipients in the same subsample. On the left, we aggregate all non-Nursing programs together; on the right, we display separated groupings within this set.

Figure A5. Socioeconomic Disparities in Earnings One Year After Graduation by Demographic Groupings



Note: Each point represents the coefficient on Pell receipt, per Equation 1, in a subsample regression including only students in the indicated demographic grouping. Coefficients are thus relative to Pell non-recipients in the same subsample.

Figure A6. Socioeconomic Disparities in Earnings Three Years After Graduation by Demographic Groupings



Note: Each point represents the coefficient on Pell receipt, per Equation 1, in a subsample regression including only students in the indicated demographic grouping. Coefficients are thus relative to Pell non-recipients in the same subsample.

Figure A7. Earnings Distributions of Graduates at One Year After Graduation, by FAFSA Filing Status and Pell Receipt