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Variation in Post-Pandemic Postsecondary Transitions across Academic Subgroups

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Abstract

We examine how trends in postsecondary readiness and enrollment from pre- to post-pandemic differ across student subgroups defined by pre-pandemic (8th grade) achievement levels. Using individual-level data from North Carolina and interrupted time series approaches, we find that students with high baseline achievement became less likely to apply to and enroll in a four-year college following the pandemic's onset, whereas enrollment rates of students with low baseline achievement increased. Likewise, post-pandemic changes to key college readiness indicators, including high school college-level course-taking, GPAs, and ACT scores, were either similar or less negative for students with low baseline achievement relative to higher-achieving peers. These results may reflect multiple factors including pandemic-era changes to educational policy, declines in college interest, and floor effects on the ACT exam. Findings contextualize literature documenting post-pandemic declines in college enrollment and success and encourage further research on post-pandemic college persistence, completion, and workforce transition rates.

Keywords: High schools; postsecondary education; postsecondary readiness; educational policy; COVID-19 pandemic

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I. Introduction

College enrollment, particularly at the four-year level, depends on the outcomes of a long sequence of college-preparatory activities (Klasik, 2012). But the educational, social, and economic turbulence associated with the COVID-19 pandemic may have disrupted activities on this pathway with consequences for students' postsecondary enrollments. Indeed, following the pandemic's onset, K-12 academic achievement declined (Dewey et al., 2025; Goldhaber et al., 2023; Peters et al., 2025), absenteeism spiked (Dee, 2024; Swiderski et al., 2026), and youth mental health challenges increased (Bommersbach et al., 2025; Gaylor et al., 2023). Moreover, these harms tended to compound existing disadvantages, affecting students in poverty, Black and Hispanic students, and students with low achievement more than their peers.

However, not all K-12 outcomes changed as dramatically as these outcomes. For example, student GPAs did not decline by nearly as much as test scores, or even continued to rise (Goldhaber & Young, 2024; Sanchez & Moore, 2022; Swiderski & Fuller, 2023); evidence as to whether math course-taking patterns changed is mixed (Kuhfeld et al., 2025; Denice & Dangur-Levy, 2026); and high school graduation rates continued to climb, albeit potentially at a slower rate than pre-pandemic (Harris et al., 2024). These mixed changes in K-12 outcomes portend potential challenges in assessing students' academic readiness for postsecondary. Namely, though there is strong evidence that students' academic and socioemotional readiness decreased, key signals of students' readiness—such as their GPAs and course-taking—may not depict these declines. Further, many colleges instituted test-optional policies during the pandemic that limited their ability to assess preparation with standardized test scores (Lovell & Mallinson, 2022). Indeed, there is evidence that post-pandemic college students are experiencing lower persistence and course success rates (Denice & Andersen, 2025; Gicheva et al., 2026; Howell et al., 2022),

and some institutions have considered reinstating testing requirements based on growing needs for remediation (McLean, 2024; University of California San Diego [UCSD] Senate, 2025). We posit that these trends in experiences at the postsecondary level may be due to (at least) two distinct mechanisms: (a) direct effects of the pandemic on students' academic and social readiness for college, and (b) shifts in the composition of college entrants towards students who may have had lower levels of readiness even if the pandemic had not occurred.

There is currently limited evidence on how changes in college enrollment rates over the pandemic varied by student academic preparation. In general, studies show that enrollments declined in Fall 2020, especially in the two-year sector and among students of traditionally underrepresented backgrounds, with some rebound occurring thereafter (Bulman & Fairlie, 2022; Carrell et al., 2025; Denice & Andersen, 2025; Harris et al., 2024; Howell et al., 2022). In terms of differences by achievement, using a national sample of PSAT takers, Howell et al. (2021, 2022) estimated that four-year enrollment rates of students with GPAs below a B *increased* between 2019 and 2021, whereas rates for students with higher GPAs declined in 2020 before bouncing back (at least partially) in 2021. By contrast, Carrell et al. (2025) found that drops in four-year college enrollment in California's class of 2020 were largest among students who were not proficient on California's 11th grade exam, though this includes about 70% of students in this setting. Thus, evidence as to how post-pandemic enrollment patterns may have varied across achievement-based subgroups is mixed, but the positive results in Howell et al. (2021, 2022) suggest the possibility that there may have been a shift in the composition of four-year enrollees toward students with lower achievement levels.

In this study, we use individual-level data on all public school students in the graduating classes of 2016 through 2022 in North Carolina to examine trends in postsecondary transitions

from pre- to post-pandemic, with a focus on comparing trends for students with higher versus lower baseline (8th grade, pre-pandemic) achievement. Via descriptive and interrupted time series methods, we find that students with lower baseline achievement in the classes of 2021 and 2022 experienced an increase in four-year college enrollments, whereas higher-achieving students experienced decreases, both in absolute magnitude relative to pre-pandemic and relative to expectations based on pre-pandemic trends. For high-achieving students, decreases in four-year enrollments are mirrored by decreases in application rates to in-state public four-year institutions, suggesting that these results may in part be due to shifts in high-achieving students' interest in attending a four-year college. We further find that rates of enrollment conditional on having submitted an application have changed in ways that favor students of lower baseline achievement, suggesting that there have also been differential changes across applicants in admissions and/or yield rates. With respect to overall college enrollment, we find mixed evidence for all subgroups where, across post-pandemic years, changes in four-year enrollments are sometimes offset by opposite changes in two-year enrollments but sometimes are not.

To further contextualize these results, we also examine trends in indicators of students' college readiness, including 12th grade college-level course-taking, high school GPAs, and ACT scores. We find that each of these measures also changed across the pandemic in ways that were either similar across the baseline achievement distribution or less negative for students of lower baseline achievement. These changes could have contributed to, or been a result of, changes in student interest in college, and contributed to changes in applicants' admissions competitiveness. However, these results do not necessarily suggest that gaps in low- and high-achieving students' *true* levels of college readiness narrowed. While this could be the case, it may also be that these indicators became weaker signals of readiness due to other contextual factors. Literature on post-

pandemic grading leniency raises questions about the validity of GPAs and course placements as measures of readiness (Goldhaber & Young, 2024; Sanchez & Moore, 2022; Swiderski & Fuller, 2023; UCSD Senate, 2025), while, with respect to the ACT, we identify some evidence that floor effects could have constrained the potential drop in scores at the bottom of the distribution.

In total, these results lend additional support to the findings in Howell et al. (2021, 2022) in showing that four-year enrollment patterns of students with high and low baseline achievement levels differed across the pandemic in ways that favored lower-achieving students. Further, we show that these results were accompanied by similar trends in application rates, a key signal of college interest, as well as indicators of college readiness, though the extent to which these indicators remain equally valid measures of academic readiness post-pandemic may be questionable. These findings add context helpful for understanding factors behind post-pandemic enrollment and persistence declines and highlight a need for more research on post-pandemic college students' readiness, performance, attainment, and workforce transitions.

II. Data

We begin with student-level data from the North Carolina Department of Public Instruction (NCDPI), which includes student demographics, program classifications (e.g., English Learner status), attendance records, state test scores, course enrollments, grades, and school characteristics. Our sample includes students who entered 9th grade for the first time between 2012-13 and 2018-19 (expected to graduate between 2015-16 and 2021-22). We link NCDPI data to postsecondary enrollment records from the National Student Clearinghouse (NSC) from 2016-17 through 2022-23 as well as postsecondary application and enrollment records from the University of North Carolina (UNC) System from 2015-16 through 2022-23.

Our key postsecondary outcomes include an indicator of whether a student enrolled in a four-year college in the first academic year after their expected high school graduation year (i.e., their fifth year after high school entry); and an indicator of whether a student submitted an application to any UNC System institution (i.e., an in-state public four-year; excluding UNC School of the Arts) for the fall enrollment term following their expected high school graduation year. Although some students may submit applications only to non-UNC institutions, in practice the vast majority of students who enroll in a four-year submit at least one UNC System application, suggesting that this is a reasonable proxy of application rates.[1] We also examine three high school outcomes that provide insight into students' college readiness. These are scores on the ACT, which is taken by all students in our setting in 11th grade (with some exceptions, described more below); final weighted high school GPAs; and an indicator of whether a student took any Advanced Placement (AP) or dual enrollment (DE) courses in 12th grade.

Our main sample is restricted to on-time high school graduates from the classes of 2015-16 through 2021-22. This restriction ensures that all outcomes are defined and measured at the same point in time within each cohort.[2] Our primary moderator variable is defined by a student's 8th grade state end-of-grade reading test score. We placed students into quartiles of this variable based on their within-year standardized score. In our primary analyses, we group students in the bottom two quartiles together because college enrollment rates of students in the bottom quartile

[1] 86% of all four-year enrollees applied to a UNC System institution. The rate varies little over time, ranging from a low of 85% to a high of 87% across cohorts. Rates for pre-pandemic (2016-2019) and post-pandemic (2020-2022) cohorts are each 86%.

[2] In Appendix B, we discuss the sensitivity of our results to the inclusion of all 9th grade entrants, including those who did not graduate. In brief, estimates in 2021 and 2022 under these specifications are directionally more negative for *all* subgroups, but patterns of differences across groups remain the same as the main models.

are low. We use students' 8th grade reading test score because this variable is captured pre-pandemic for all cohorts and measured in the same grade level for all students.[3]

Our preferred analytic strategy makes use of extensive covariates. All covariates refer either to stable student characteristics (e.g., race/ethnicity) or to variables that are measured in 9th grade, a time point that is after our moderator is defined (in 8th grade) but still prior to the pandemic for all cohorts (which began during 10th grade for our youngest cohort). Covariates include student race/ethnicity, sex, quarter of birth,[4] economic disadvantage (ED) status, English Learner status, disability status, gifted status, indicators of their math course enrollment in 9th grade, an indicator of whether they failed any course in 9th grade, indicators of whether they took any AP or any DE course in 9th grade, an indicator of having been on-time promoted to 10th grade, and indicators of their 9th grade school's urbanicity and type (traditional, charter, Early College). Because our key moderator is defined by 8th grade achievement, we necessarily exclude any student who is missing this variable, which omits about 7% of high school graduates. We then exclude students who were otherwise missing any covariate or outcome (except ACT scores, as discussed below), which drops about 3% of the remaining sample.

Table 1 displays descriptive data on all covariates and outcomes, by graduation cohort (descriptives of outcomes disaggregated by baseline achievement subgroup are shown in Appendix Table A1). We note five descriptive trends of relevance within our covariates. First, over the full period of study, the sample of high school graduates has grown steadily more Hispanic and less White. Second, a growing, though small, percentage of students were enrolled

[3] Students do not all take the same math exam in 8th grade—since 2017-18, students who were enrolled in Math 1 in 8th grade have taken the Math 1 end-of-course exam rather than the grade 8 math end-of-grade exam. There is likewise no exam that is necessarily taken by all 9th graders.

[4] The class of 2022 is smaller than others due to a change in the Kindergarten entry age made 13 years prior that took effect with this cohort. This change made it such that students were only included in this cohort if they were born during an 11-month window. Though effects are likely minor, we include a quarter of birth indicator to account for potential effects of the change in the average age of students in this cohort at graduation.

in AP and DE courses in 9th grade. Third, a small but growing percentage of students were enrolled in charter schools. Fourth, between the 2016 and 2019 cohorts, we observe decreases in the percentage of students who had taken advanced math in 9th grade (i.e., beyond Math 1) and decreases in the percentage of students who had failed a course in 9th grade, but these trends plateaued thereafter. Likewise, there is a slight jump in the percentage of students with disabilities beginning in the 2019 cohort. This appears to be tied to decreased missingness of 8th grade reading test scores for students with disabilities beginning with this cohort (decreasing from rates of about 35-40% missing in early cohorts to 10-15% missing in more recent cohorts).

In addition, we note two important trends in our outcomes. First, we observe sharp decreases in 12th grade AP/DE course-taking rates, GPAs, UNC application submissions, and four-year enrollments starting with the class of 2019, the last cohort to graduate high school fully pre-COVID. We identified that these drops are most likely due to a statewide policy change that took effect with this class that reduced the GPA bonus awarded for taking an AP or DE course from two points to one. This change applied to all courses taken by students in this and all later graduation *cohorts*, regardless of when the course was taken. As such, in our main time series models described below, we include an indicator for whether a student was in a graduation class affected by this policy change.[5]

Second, ACT scores are typically missing for about 4-6% of graduates, likely due to opt-outs, students who follow a non-standard grade level progression (e.g., retained in 10th grade, but then advance to 12th), or errors in the administrative dataset.[6] The missing rate is 100% for the class of 2021 as all state testing was canceled in Spring 2020, when this class would have taken

[5] Thus, this study also provides some descriptive evidence that could be used to infer potential effects of this policy change on student outcomes, but we do not consider this analysis to be a formal test of this policy.
[6] We also omit the scores of a small number of students (<1%) who have an ACT score from a year other than their expected 11th grade year to ensure consistency in exam timing within cohorts.

this exam. The missing rate is also far higher than usual in the class of 2022, reaching a rate of 12%. Appendix Table A1 further shows that the missing rate increased for students of all achievement subgroups but is highest for the low-achieving subgroup (which reached a rate of 19% in 2022, compared to a rate of 6% for the high-achieving subgroup). We consider the potential influence of this increase in missing ACT scores in the results section below.

III. Methods

We examine post-pandemic deviations from trends in each outcome using an interrupted time series (ITS) approach. We model a linear trend based on the evolution of each outcome in pre-pandemic cohorts, adjusted for covariates, to generate predictions for how each outcome may have continued to evolve in post-pandemic years had the pandemic not occurred. Specifically, we estimate:

$$(1)\ Y_{ist} = \beta_0 + \beta_1 Grad2020_t + \beta_2 Grad2021_t + \beta_3 Grad2022_t + \beta_x X_{ist} + \beta_4 Time_t + \beta_5 Pre2019_t + \epsilon_{ist}.$$

In equation (1), X_{ist} is a vector of covariates for student *i* in school *s* and graduation cohort *t*; $Time_t$ is a linear time trend; $Grad2020_t$, $Grad2021_t$, and $Grad2022_t$ are indicators equal to 1 if the student's graduation year is 2020, 2021, or 2022, respectively; $Pre2019_t$ is an indicator equal to 1 if the student graduated prior to 2019, i.e., prior to the institution of the revised GPA weighting policy; and ϵ_{ist} is an error term. $\beta_1$through β_3 are the key coefficients that indicate the extent to which outcomes for students in the 2020, 2021, and 2022 cohorts deviated from expectations based on observed covariates and pre-pandemic time trends. The inclusion of the $Pre2019_t$ indicator means that time trends are estimated based on trends from 2016 through 2018 only; that is, the assumption of this model is that the GPA weighting change caused a one-time level-shift to outcomes, but that trends would have resumed from this new

level thereafter had the pandemic not occurred.[7] In cases where it is not evident that there are strong pre-trends, we also estimate models restricted to students from the class of 2019 through 2022 only, which allows us to drop $Pre19_t$ and $Time_t$ from our specification.

Our results depend on the assumption that each outcome would have continued to change at a linear rate (adjusted for covariates and any level-shift in 2019) had the pandemic not occurred. This assumption is most plausible in immediate post-pandemic years but grows more uncertain as more time passes. Caution is thus warranted as even minor misestimation of trends can compound into meaningful differences in long-run predictions. We enhance the plausibility of this assumption by including an extensive set of covariates measured in 9th grade, prior to the pandemic's onset, that capture early trends in students' high school performance across cohorts. Nevertheless, we have the highest confidence in results that are not dependent on assumptions about time trends, i.e., those where time trends are null. As described below, this is largely the case for postsecondary outcomes, whereas indicators of college readiness in high school more consistently show evidence of pre-pandemic trends that must be incorporated.

IV. Findings

a) Four-year enrollment and UNC System application rates

Table 2 shows results, disaggregated by achievement-based subgroup, for four-year enrollment and UNC System application rates. For each set of results, we show three models: (1) an unadjusted model that includes only students from the classes of 2019 through 2022; (2) a

[7] We observe evidence in support of this assumption in outcomes where the 2019-20 school year can reasonably be considered to still be "pre-pandemic." For example, students' course enrollments in the 2019-20 school year would have been finalized prior to the onset of school closures in the middle of the spring semester of that year; and, as can be seen in Table 1, within this cohort, 12th grade AP/DE course-taking rates trended upward between the class of 2019 and 2020 at a rate that was similar to the upward trend from 2016 to 2018, but from a level that was shifted down due to the one-time shock potentially associated with this policy change in 2019.

covariate-adjusted model that includes only students from the classes of 2019 through 2022; and (3) the ITS model as described in equation 1. Appendix Figure A1 also depicts the ITS results.

Beginning with estimates of four-year enrollment for students with low baseline achievement, we observe that, relative to an enrollment rate of 18.9% in the class of 2019, students with low baseline achievement in the class of 2020 enrolled at approximately the same rate, but students with low baseline achievement in the classes of 2021 and 2022 enrolled at rates that were significantly higher by 2.1 percentage points (11%) and 1.6 points (8%), respectively. The addition of covariates in Model 2 and time trends in Model 3 does not affect these conclusions. Model 3 produces estimates that are slightly larger in magnitude (growing to 2.5 percentage point changes by 2022) on the assumption of a very slight negative time trend that is not statistically significant.

We compare these results to outcomes for students with high baseline achievement, which are consistently estimated to be negative across all pandemic-affected years and specifications. Unadjusted results show that, relative to a four-year enrollment rate of 71.3% in the class of 2019, students with high baseline achievement enrolled at rates that were significantly lower in the classes of 2020, 2021, and 2022, by 2.9 percentage points (4%), 5.9 points (8%), and 3.4 points (5%), respectively. Once again, estimates do not change meaningfully in magnitude, direction, or significance when adding covariates or time trends.

Results for students from the third quartile are between those of lower- and higher-achieving students—results are consistently negative in direction, and strongest in magnitude for the class of 2021. However, these results are only significant in 2021 and 2022 under some specifications and are not significant under any specification in 2020.

In general, patterns of results for UNC applications are similar to those for enrollments, but there are some differences. First, in the class of 2020, we find no significant results for any subgroup across any model. This is consistent with the fact that applications to four-year institutions would typically be submitted during the fall or winter of a student's senior year, which would have occurred prior to school shutdowns in the spring; thus, this outcome likely should not have been affected for this cohort. This result suggests that the decrease in enrollments observed among students with high baseline achievement in the class of 2020 may have been driven by decisions by these students to forego college despite applying; likewise, it suggests that this did *not* occur for lower-achieving applicants, as application *and* enrollment rates held steady between 2019 and 2020 among students with low baseline achievement.

Beyond this, descriptively, we do not find that application rates of students with low baseline achievement increased, but their application rates are estimated to be significantly higher in 2021 and 2022 under the ITS model, which estimates a (negative and significant) time trend. For students with high baseline achievement, we find significant decreases in application rates under all specifications in the classes of 2021 and 2022. These results follow the same pattern as enrollments (i.e., more negative in 2021 than 2022), though the magnitudes of coefficients for applications are generally a bit smaller than the coefficients for enrollments.

In combination, these results suggest that, post-pandemic, a substantial portion of the decline in the enrollment rates of students with high baseline achievement might be explained by associated decreases in their application rates, but that there may have also been decreases in rates of successful conversion from application to enrollment. As a test of this hypothesis, Table 3 shows results of models of four-year enrollment that are restricted to UNC System applicants. Results of these models consistently suggest that the four-year enrollment rate of applicants with

high baseline achievement had declined by about 1-2 percentage points (or 1-2%), while the four-year enrollment rate of applicants with low baseline achievement in the classes of 2021 and 2022 had increased by 5-8 percentage points (8-13%). As we cannot observe admissions decisions in this study, these results could be due to (a) relative changes in admission rates in favor of applicants with lower baseline achievement; (b) greater declines in yield among higher-achieving admits as compared to lower-achieving admits post-pandemic; or (c) a mix of both channels.

b) Two-year and overall college enrollment

In Appendix Table A2 and Figure A2 we show results of ITS models for two-year and any (two- or four-year) enrollment, which provide context as to whether changes in four-year enrollment rates were offset by, compounded by, or unrelated to changes in college enrollment generally (note that estimates of "any enrollment" may not equal the sum of estimates for two- and four-year enrollments both because of differences in estimation across models and because some students enroll in both a two- and a four-year in the same year). Patterns of estimates on these outcomes vary by year and may be dependent on time trends. However, we observe some broad patterns. First, all subgroups experienced a decrease in overall enrollments in 2020. Second, for students of low baseline achievement, increases in four-year enrollment were offset by decreases in two-year enrollment in 2021, but not 2022. By contrast, for students of high baseline achievement, decreases in four-year enrollment were offset by increases in two-year enrollment in 2022, but not 2021. Finally, students from quartile 3 appear to have consistently experienced declines in both two- and four-year enrollment, though estimates are not always significant.

c) Indicators of college readiness

We next examine trends in indicators of students' college readiness across the pandemic, including their participation in college-level courses in 12th grade, high school GPAs, and ACT scores. As with applications, for students in the class of 2020, these outcomes would have been at most only partially affected, if not entirely unaffected, by the pandemic. Further, our results above indicate that college application rates were unaffected in this cohort, such that any enrollment changes within this cohort are most likely attributable to student reactions to the pandemic environment. Thus, for analysis of high school outcomes, we include the class of 2020 as a pre-pandemic cohort (i.e., we remove the $Grad2020_t$ indicator from equation 1), which helps to improve estimation of changes in later cohorts by (a) requiring less extrapolation and (b) improving the estimation of pre-pandemic time trends by incorporating an additional pre-COVID cohort that graduated after the change to the GPA weighting system.

Table 4 presents the results (see also Appendix Figure A3). Because of evidence of time trends in these outcomes, for simplicity, we only show results for our ITS model specifications, noting that more caution may be warranted in interpreting these results given their dependence on time trends. With this in mind, we estimate that changes in all outcomes were consistently more negative in magnitude among students with high baseline achievement as compared to those with low baseline achievement, with differences between subgroups sometimes null but sometimes significant. For example, focusing on the class of 2022 and noting that patterns are similar for the class of 2021, we estimate that the percentage of low-achieving students in the class of 2022 who took an AP/DE course in 12th grade was 5.4 percentage points lower than expected, while the rate among high-achieving students was 5.7 points lower than expected, a difference that was not significant (though, the AP/DE course-taking rate of low-achieving

students was more than 50 points lower than that of high-achieving students in 2020, so the relative change is more severe). We estimate that the high school GPAs of low-achieving students in the class of 2022 were not significantly different from expectation, while the GPAs of high-achieving students were nearly 0.09 points lower than expected.[8] Finally, we estimate that the ACT scores of low-achieving students in the class of 2022 (among those with a score) were 0.33 points lower than expected, but the ACT scores of high-achieving students in this class were 0.82 points lower than expected.[9]

Results on ACT scores may appear to conflict with other evidence that finds test score declines were greatest at the bottom of the distribution (e.g., Mahnken, 2022), so we examine this result more closely. First, we note that this narrative may better fit the test scores of students in lower grade levels, and moreover may be based more on descriptive changes rather than deviations from trends (Hanushek, 2026). For example, 12th grade NAEP Reading scores (National Center for Education Statistics, 2025) declined by a slightly greater amount from pre- to post-pandemic at the 10th percentile (4 points) than at the 90th (3 points), but the decline at the 10th percentile was consistent with a prior trend, whereas the change at the 90th percentile was a deviation from prior trends. A similar pattern appears within our results on ACT scores, in which we see that the ACT scores of low-achieving students were already slightly declining pre-pandemic, whereas the ACT scores of higher-achieving peers were not.

Second, as noted above, we observed a large increase in the percentage of students who were missing an ACT score in the class of 2022. Further, not only was the missing rate higher

[8] While in some settings students appear to have generally received the same or better grades during the pandemic as pre-pandemic (e.g., Goldhaber & Young, 2024), in North Carolina there is evidence that students' grades decreased during the 2020-21 school year, but rebounded by 2021-22 (Fuller et al., 2024). The modest drop in overall GPAs that we observe here is thus most likely attributable to decreases from the 2020-21 year.

[9] Although 95% confidence intervals overlap, in this case a post-hoc F-test shows that the difference between low- and high-achieving subgroups on this outcome is significant at $p = 0.002$.

among students of low baseline achievement, but, among students with low baseline achievement, those who were missing an ACT score in 2022 had even relatively lower 8th grade reading scores than peers from the same achievement subgroup who had an ACT score.[10] These missing data rates are important in that they raise questions about the validity of *observed* ACT scores as a measure of population- or subgroup-level academic readiness in this year. As a simple test of the effect of missingness on our results, we generated a single imputation of students' ACT scores by regressing ACT scores on all student-level covariates, students' 8th grade reading standardized score, and graduation year, using a truncated regression that bounded imputed scores to be between 1 and 36. A limitation of this approach is that it assumes that students' ACT scores can be predicted based on observables; if students opt out based on hidden information, such as an expectation that they will not do well on the exam, this procedure will be biased. Given this caveat, ultimately, results based on the imputed score are very similar to our main estimates and continue to indicate that students from the highest baseline quartile experienced larger average decreases than students from the lowest baseline half by about 0.5 points (see Appendix Table A3). Thus, the increased rate of missing ACT scores in the class of 2022 seems unlikely to explain the difference in trends observed across subgroups.

As an alternative possible explanation, we examined the distribution of ACT scores by subgroup. We identified evidence of bunching in the ACT scores of students with low baseline achievement, which suggests that floor effects on this exam might constrain observable drops at the bottom of the distribution. As shown in Figure 1, about 50% of low-achieving students in the class of 2022 earned one of just three ACT scores—a 12, 13, or 14. By contrast, the distribution of scores for high achievers is far more diverse. Thus, although the ACT may allow for a low bar,

[10] The average standardized 8th grade reading score of students in quartile 1-2 in the class of 2022 who were missing an ACT score was -1.0, whereas the average score of students in quartile 1-2 who had an ACT score was -0.7.

in practice students who are able to graduate from high school will typically have accumulated the skills and knowledge necessary to achieve scores of about 11-12. Even though the pandemic resulted in substantial disruptions to students' educational opportunities, it did not push many students below this floor. This thus does not confirm that students with low baseline achievement were less negatively affected in terms of achievement than their higher-achieving peers; instead, it may be that scores on the ACT do not characterize the full extent of the decline in skills at the bottom of the distribution.

V. Discussion

This study provides new evidence on how trends in college transitions by students of different baseline achievement levels diverged across the pandemic in ways that favored students with lower baseline achievement. Students with high 8th grade achievement experienced decreases in four-year college enrollment rates, whereas students with low 8th grade achievement experienced increases, in 2021 and 2022 as compared to pre-pandemic. We find that these trends mirror similar patterns in application rates, especially for high-achieving students. Likewise, changes in many indicators of college readiness, including college-level course-taking in 12th grade, high school GPAs, and ACT scores, all changed across the pandemic in ways that were either no different or less negative in magnitude for students with low baseline achievement as compared to their higher-achieving peers.

These results have several possible explanations. For one, some reports suggest that interest in college has declined since the start of the pandemic (e.g., Gallup, 2024). As we find that the application rate of low-achieving students did *not* decline during the pandemic, our results provide some evidence to suggest that any decline in interest may *not* have occurred among the relatively modest percentage of low-achieving students who pursue four-year college

entry, who might have particularly high levels of motivation, college interest, or family support. Differences in the composition of the applicant pool may be a key cause of the related shifts in enrollment rates that we observe.

However, this may not be the only cause. One important consideration is whether students who we define as "low-achieving"—based on their 8th grade test performance—might have narrowed gaps in their end-of-high-school college readiness with (initially) higher-achieving peers across the pandemic. Our results show that several key indicators of college readiness may have been less negatively affected, or at least no more affected, for low-achieving students as compared to higher-achieving students across the pandemic. However, while this could represent a narrowing of readiness gaps, other explanations are possible. Several studies document increased grading leniency in the aftermath of the pandemic, raising questions about whether GPAs and associated course placements serve as signals of college readiness in the same way as pre-pandemic (Goldhaber & Young, 2024; Sanchez & Moore, 2022; Swiderski & Fuller, 2023; UCSD Senate, 2025). Indeed, this possibility is evident when simply comparing the characteristics of four-year entrants in the class of 2022 to entrants from the class of 2019—although the ACT scores of students in the class of 2022 were 0.6 points lower (21.3 vs 21.9), their weighted GPAs were higher (3.88 vs. 3.80) and an equal percentage had taken an AP or DE course in 12th grade (72%). Moreover, it is unclear if ACT scores capture the full extent of lower-achieving students' pandemic-era learning losses, as we find appreciable bunching in the ACT scores of low-achieving students that suggests that floor effects might constrain the extent to which these scores could drop.

Even if these results do not reflect true changes in students' college readiness, they may still have influenced student application and college admissions decisions. For example, as high-

achieving students experienced larger drops in their ACT scores, high-achieving students in pandemic-affected cohorts may have been more likely to be discouraged from pursuing college by the receipt of a low ACT score and may have presented as less competitive applicants when they applied.[11] At the same time, we cannot rule out that trends in readiness outcomes might instead be reflections of related changes in students' college interest, and thus their associated effort on assessments like the ACT or interest in college-level course-taking.

Regardless of the underlying mechanisms, our results demonstrate that four-year enrollment rates of students with low baseline achievement increased across the pandemic, whereas rates for students with high baseline achievement declined, consistent with Howell et al. (2021, 2022). These findings add to our understanding of post-pandemic trends in college enrollment, persistence, and completion outcomes. In particular, these findings raise the possibility that declines in college student success rates post-pandemic (e.g., Gicheva et al., 2026) may be due not only to direct effects of the pandemic on students' educational opportunities and human capital acquisition, but also to related shifts in the baseline composition of enrollees. These results highlight a strong need for more research on post-pandemic college students' outcomes, encourage the expansion of interventions or policy changes to address the academic needs of current college students, and raise important questions for research and policy as to the meaning of traditional indicators of college readiness in the post-pandemic era.

VI. References

Bommersbach, T. J., Olfson, M., & Rhee, T. G. (2025). Trends in depressive symptoms among high school students with and without health-risk behaviors in the United States: A

[11] Test cancelations in the 2019-20 school year may have also played a role. Prior research shows that statewide ACT and SAT testing can increase college enrollments (Goodman, 2016; Hurwitz et al., 2015; Hyman, 2017; Klasik, 2013; Swiderski, 2025). In our setting, the ACT is mandatory for all 11th graders, but the administration was canceled in 2019-20 (i.e., the class of 2021), as were all other state-mandated tests, due to COVID.

population-based study. *The Lancet Regional Health – Americas, 42*. https://doi.org/10.1016/j.lana.2025.101000

Bulman, G., & Fairlie, R. (2022). The impact of COVID-19 on community college enrollment and student success: Evidence from California administrative data. *Education Finance & Policy, 17*(4), 745-764. https://doi.org/10.1162/edfp_a_00384

Carrell, S., Dykeman, K., Kurlaender, M., & Martorell, P. (2025). College canceled: What happened to California's high school graduating class of 2020? *Educational Researcher* [advance online publication]. https://doi.org/10.3102/0013189X251357674

Dee, T. S. (2024). Higher chronic absenteeism threatens academic recovery from the COVID-19 pandemic. *Proceedings of the National Academy of Sciences, 121*(3), e2312249121. https://doi.org/10.1073/pnas.2312249121

Denice, P., & Anderson, K. (2025). Trends in postsecondary enrollment during the COVID-19 pandemic: A research note. *Demography, 62*(5), 1441-1456. https://doi.org/10.1215/00703370-12246521

Denice, P., & Dangur-Levy, S. (2026). *Math coursetaking trajectories in high school during the COVID-19 disruptions to schooling* (EdWorkingPapers No. 26-1422). https://doi.org/10.26300/AHY7-RW84

Dewey, D. C., Fahle, E., Kane, T. J., Reardon, S. F., & Staiger, D. O. (2025). *Pivoting from pandemic recovery to long-term reform: A district-level analysis.* Education Recovery Scorecard. https://cepr.harvard.edu/resource/pivoting-pandemic-recovery-long-term-reform

Fuller, S. C., Swiderski, T., Mikkelsen, C., & Bastian, K. C. (2025). In school, engaged, on track? The effect of the pandemic on student attendance, course grades, and grade

retention in North Carolina. *Educational Researcher, 54*(2), 78-90. https://doi.org/10.3102/0013189X241299397

Gallup. (2024). *Walton Family Foundation – Gallup voices of Gen Z study: Year 2 annual survey report.* https://www.gallup.com/analytics/648638/gallup-walton-family-foundation-2024-voices-gen-report.aspx

Gaylor, E. M., Krause, K. H., Welder, L. E., Cooper, A. C., Ashley, C., Mack, K. A., Crosby, A. E., Trinh, E., Ivey-Stephenson, A. Z., & Whittle, L. (2023). Suicidal thoughts and behaviors among high school students — Youth Risk Behavior Survey, United States, 2021. *MMWR Supplements, 72*, 45-54. https://doi.org/10.15585/mmwr.su7201a6

Gicheva, D., Edmunds, J. A., Hutchins, B. C., Eilam, N., & Arshavsky, N. (2026). Postsecondary gaps in recovery from the COVID-19 pandemic: Evidence From public colleges and universities. *Educational Researcher* [advance online article]. https://doi.org/10.3102/0013189X261462499

Goldhaber, D., Kane, T. J., McEachin, A., Morton, E., Patterson, T., & Staiger, D. O. (2023). The educational consequences of remote and hybrid instruction during the pandemic. *American Economic Review: Insights, 5*(3), 377-392. https://doi.org/10.1257/aeri.20220180

Goldhaber, D., & Young, M. G. (2024). Course grades as a signal of student achievement: Evidence of grade inflation before and after COVID-19. *Journal of Policy Analysis & Management, 43*(4), 1270-1282. https://doi.org/10.1002/pam.22618

Goodman, S. (2016). Learning from the test: Raising selective college enrollment by providing information. *Review of Economics and Statistics, 98*(4), 671-684. https://doi.org/10.1162/REST_a_00600

Hanushek, E. A. (2026). Putting pandemic learning loss in perspective. *Education Next, 26*(2). https://www.educationnext.org/putting-pandemic-learning-loss-in-perspective-achievement-declines-21st-century-america-naep/

Harris, D. N., Chen, F., Martin, R. C., Bernhardt, A. F., Marsicano, C. R., & Hippel, P. T. von. (2024). The effects of the COVID-19 pandemic on educational attainment. *RSF: The Russell Sage Foundation Journal of the Social Sciences*, *10*(1), 152–180. https://doi.org/10.7758/RSF.2024.10.1.07

Howell, J., Hurwitz, M., Ma, J., Pender, M., Perfetto, G., & Wyatt, J. (2022). *College enrollment and retention in the era of Covid: Fall 2021 update on continued pandemic impacts*. College Board. https://research.collegeboard.org/media/pdf/enrollment_retention_covid2021_post.pdf

Howell, J., Hurwitz, M., Ma, J., Pender, M., Perfetto, G., Wyatt, J., & Young, L. (2021). *College enrollment and retention in the era of Covid.* College Board. https://research.collegeboard.org/media/pdf/enrollment-retention-covid2020.pdf

Hurwitz, M., Smith, J., Niu, S., & Howell, J. (2015). The Maine question: How is 4-year college enrollment affected by mandatory college entrance exams? *Educational Evaluation and Policy Analysis, 37*(1), 138-159. https://doi.org/10.3102/0162373714521866

Hyman, J. (2017). ACT for all: The effect of mandatory college entrance exams on postsecondary attainment and choice. *Education Finance & Policy, 12*(3), 281-311. https://doi.org/10.1162/EDFP_a_00206

Klasik, D. (2013). The ACT of enrollment: The college enrollment effects of state-required college entrance exam testing. *Educational Researcher, 42*(3), 151-160. https://doi.org/10.3102/0013189X12474065

Klasik, D. (2012). The college application gauntlet: A systematic analysis of the steps to four-year college enrollment. *Research in Higher Education, 53*(5), 506-549. https://doi.org/10.1007/s11162-011-9242-3

Kuhfeld, M., Robinson, G., Isaacs, J., Postell, S., Lee, J.-E., & Ottmar, E. (2025). High school math course-taking: Shifts in access and achievement post-COVID-19. *AERA Open, 11*. https://doi.org/10.1177/23328584251353514

Lovell, D., & Mallinson, D. (2022). *How test-optional college admissions expanded during the COVID-19 pandemic*. Urban Institute. https://www.urban.org/research/publication/how-test-optional-college-admissions-expanded-during-covid-19-pandemic

Mahnken, K. (Sep. 1, 2022). *'Nation's Report Card': Two decades of growth wiped out by two years of pandemic.* The 74. https://www.the74million.org/article/nations-report-card-two-decades-of-growth-wiped-out-by-two-years-of-pandemic/

McLean, D. (May 20, 2024). *What's next for the test-optional movement.* HigherEdDive. https://www.highereddive.com/news/test-optional-movement-harvard-yale-brown/716466/

National Center for Education Statistics. (2025). *2024 NAEP Reading Assessment: Grade 12 Results for the Nation* (NCES 2024223). https://ies.ed.gov/use-work/resource-library/report/data-release-report/2024-naep-reading-assessment-grade-12-results-nation

Peters, S. J., Langi, M., Kuhfeld, M., & Lewis, K. (2025). Unequal learning loss: How the COVID-19 pandemic influenced the academic growth of learners at the tails of the achievement distribution. *Journal for the Education of the Gifted*, *48*(1), 25–47. https://doi.org/10.1177/01623532241301079

Sanchez, E. I., & Moore, R. (2022). *Grade inflation continues to grow in the past decade.* ACT Research. https://www.act.org/content/dam/act/unsecured/documents/2022/R2134-Grade-Inflation-Continues-to-Grow-in-the-Past-Decade-Final-Accessible.pdf

Swiderski, T. (2025). Testing the way forward: The impact of statewide ACT or SAT testing on postsecondary outcomes. *Educational Evaluation and Policy Analysis, 47*(3), 730-750. https://doi.org/10.3102/01623737241241260

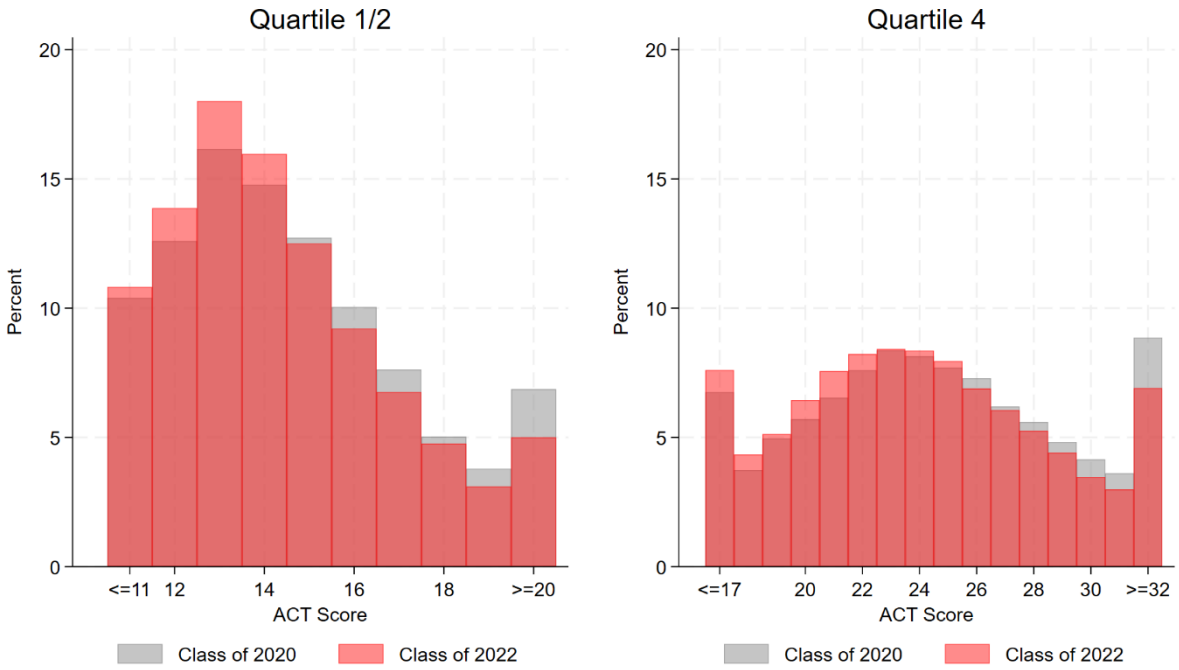
Swiderski, T., & Fuller, S. C. (2023). Student GPA and test score gaps are growing—And could be slowing COVID recovery. *Brookings Brown Center Chalkboard*. https://www.brookings.edu/articles/student-gpa-and-test-score-gaps-are-growing-and-could-be-slowing-pandemic-recovery/

Swiderski, T., Fuller, S. C., & Bastian, K. C. (2026). Student-level attendance patterns across three post-pandemic years. *Educational Evaluation and Policy Analysis, 48*(1), 400-407. https://doi.org/10.3102/01623737251315715

University of California San Diego Senate. (2025). *University of California San Diego Senate-Administration workgroup on admissions: Final report.* https://senate.ucsd.edu/media/740347/sawg-report-on-admissions-review-docs.pdf

VII. Figures

Figure 1. Histogram of ACT scores by baseline achievement subgroup, class of 2020 vs. 2022



Note. Charts show the distribution of ACT scores earned by students in the high school graduation class of 2020 (gray) and 2022 (red), by 8th grade reading test score achievement quartile. To protect confidentiality, within each chart, scores below the 5th percentile or above the 95th percentile of the subgroup's scoring distribution are aggregated together. Sample includes on-time high school graduates in North Carolina from 2015-16 to 2021-22 with complete data.

VIII. Tables

Table 1. Descriptive statistics by cohort

	High school graduation year						
Covariates	2016	2017	2018	2019	2020	2021	2022
American Indian	1.5%	1.4%	1.5%	1.3%	1.2%	1.2%	1.1%
Asian	2.8%	2.8%	2.9%	3.0%	3.2%	3.4%	3.7%
Black	25.5%	25.8%	25.4%	25.2%	24.7%	23.8%	23.4%
Hispanic	10.9%	11.7%	12.7%	13.9%	15.1%	15.3%	16.0%
Multiracial	3.5%	3.3%	3.4%	3.6%	3.8%	4.0%	4.2%
White	55.9%	55.1%	54.2%	52.9%	52.0%	52.0%	51.5%
Female	50.7%	51.1%	50.8%	50.4%	50.1%	50.5%	50.2%
Econ. Dis.	44.5%	45.4%	42.3%	43.2%	43.9%	38.7%	40.1%
English Learner	3.7%	3.6%	3.3%	3.4%	3.6%	3.0%	3.7%
SWD	6.7%	6.4%	7.3%	9.8%	10.1%	9.8%	10.1%
AIG	22.4%	21.8%	21.3%	20.3%	20.0%	20.2%	20.1%
Urban School	45.7%	45.8%	45.9%	46.2%	46.3%	47.1%	47.8%
Early College High School	1.6%	1.6%	1.5%	1.1%	1.6%	1.6%	1.9%
Charter School	2.0%	2.5%	2.7%	3.6%	3.9%	4.2%	4.9%
QOB = Jan-March	24.3%	23.9%	24.6%	24.0%	24.5%	24.1%	25.9%
QOB = Apr-June	24.7%	24.8%	24.5%	24.3%	24.3%	25.1%	26.6%
QOB = July-Sep	26.7%	26.7%	26.5%	26.5%	26.4%	26.4%	23.3%
QOB = Oct-Dec	24.4%	24.6%	24.4%	25.1%	24.8%	24.4%	24.2%
Took Math 3 in 9th	6.7%	5.7%	5.4%	4.7%	4.2%	4.9%	5.6%
Took Math 2 in 9th	37.5%	35.6%	33.2%	30.2%	30.3%	30.9%	31.1%
Took Math 1 in 9th	58.0%	60.3%	61.0%	64.0%	64.4%	63.8%	63.1%
Failed any course in 9th	20.5%	16.8%	16.7%	13.1%	14.2%	13.0%	13.9%
Took any AP in 9th	1.3%	2.0%	2.3%	2.3%	2.7%	3.2%	3.8%
Took any DE in 9th	2.2%	3.0%	2.9%	2.1%	2.8%	2.9%	3.2%
Promoted to gr10 on-time	97.9%	97.6%	97.4%	98.1%	98.1%	98.3%	98.3%
Outcomes							
Took any AP/DE in 12th	43.6%	45.3%	46.4%	44.5%	46.5%	45.2%	44.2%
Weighted GPA	3.26	3.30	3.35	3.17	3.16	3.22	3.22
	(0.97)	(0.98)	(0.99)	(0.86)	(0.89)	(0.89)	(0.91)
ACT score in 11th	18.86	18.86	18.89	18.71	18.48	.	18.40
	(5.09)	(4.98)	(5.16)	(5.16)	(5.46)	(.)	(5.39)
Missing ACT score	4.4%	4.5%	4.1%	5.1%	6.2%	100%	12.2%
Submitted any UNC app	48.3%	48.4%	47.4%	43.8%	42.8%	42.6%	42.7%
Enrolled in any PSE	68.9%	67.8%	67.0%	65.6%	61.9%	62.0%	63.5%
Enrolled in any 2-year	31.8%	31.1%	30.6%	31.1%	28.0%	28.2%	29.4%
Enrolled in any 4-year	42.1%	42.3%	42.4%	39.7%	38.3%	39.3%	39.8%
N	79568	81169	84220	87671	87492	86355	79431

Note. Sample includes on-time high school graduates in North Carolina from 2015-16 to 2021-22 with complete data. "Econ Dis" = Economically disadvantaged. SWD = Student with disability. AIG = academically/intellectually gifted. QOB = Quarter of Birth. AP = Advanced Placement. DE = Dual Enrollment. "PSE" = postsecondary education. "Submitted any UNC app" refers to whether the student submitted an application to any UNC System institution.

Table 2. Pandemic-related changes to four-year college enrollment and UNC System application rates

Panel A:	Q1/2			Q3			Q4		
4-year enrollment	M1	M2	M3	M1	M2	M3	M1	M2	M3
Grad Year = 2020	-0.000	0.004	0.006	-0.009	-0.010	-0.013	-0.029*	-0.027**	-0.026**
	(0.0057)	(0.0043)	(0.0051)	(0.0118)	(0.0082)	(0.0093)	(0.0128)	(0.0085)	(0.0095)
Grad Year = 2021	0.021***	0.016***	0.020**	-0.022	-0.027**	-0.034**	-0.059***	-0.055***	-0.052***
	(0.0061)	(0.0046)	(0.0070)	(0.0118)	(0.0085)	(0.0123)	(0.0130)	(0.0086)	(0.0121)
Grad Year = 2022	0.016*	0.017***	0.025**	-0.007	-0.017*	-0.028	-0.034**	-0.044***	-0.039*
	(0.0061)	(0.0046)	(0.0092)	(0.0118)	(0.0084)	(0.0158)	(0.0131)	(0.0089)	(0.0154)
Time			-0.002			0.004			-0.001
			(0.0026)			(0.0045)			(0.0042)
N	157529	157529	274920	99239	99239	169192	84181	84181	141794
2019 Mean	0.189	0.189	0.189	0.465	0.465	0.465	0.713	0.713	0.713
Covs?	N	Y	Y	N	Y	Y	N	Y	Y
Panel B: Applied	Q1/2			Q3			Q4		
to a UNC institution	M1	M2	M3	M1	M2	M3	M1	M2	M3
Grad Year = 2020	-0.006	-0.002	0.008	-0.002	-0.003	-0.001	-0.009	-0.007	-0.004
	(0.0069)	(0.0052)	(0.0060)	(0.0108)	(0.0075)	(0.0086)	(0.0107)	(0.0071)	(0.0081)
Grad Year = 2021	0.004	-0.002	0.016*	-0.026*	-0.030***	-0.027*	-0.047***	-0.044***	-0.037***
	(0.0073)	(0.0052)	(0.0080)	(0.0110)	(0.0077)	(0.0112)	(0.0112)	(0.0074)	(0.0105)
Grad Year = 2022	-0.004	-0.001	0.027*	-0.017	-0.026***	-0.021	-0.032**	-0.040***	-0.029*
	(0.0071)	(0.0051)	(0.0103)	(0.0111)	(0.0078)	(0.0144)	(0.0114)	(0.0077)	(0.0134)
Time			-0.009**			-0.002			-0.003
			(0.0030)			(0.0040)			(0.0036)
N	157529	157529	274920	99239	99239	169192	84181	84181	141794
2019 Mean	0.247	0.247	0.247	0.510	0.510	0.510	0.713	0.713	0.713
Covs?	N	Y	Y	N	Y	Y	N	Y	Y

Note. Estimates obtained from OLS regression models. The outcome in Panel A is an indicator of whether a student enrolled in a four-year institution in the year following their high school graduation; the outcome in Panel B is an indicator of whether a student applied to any UNC System institution. M1 and M2 are restricted to students in the high school graduation classes of 2019 to 2022; M3 includes students in the high school graduation classes of 2016 to 2022. M1 includes no additional covariates, M2 includes all covariates listed in Table 1, and M3 includes all covariates in Table 1 and a linear time trend. Standard errors, clustered by school-year, appear below coefficients. Q1/2 refers to students in the bottom two quartiles of 8th grade reading achievement; Q3 and Q4 are defined similarly. Sample includes on-time high school graduates in North Carolina.

* p < .05, ** p < .01, *** p < .001

Table 3. Pandemic-related changes to four-year college enrollment rates among UNC System applicants

	Q1/2			Q3			Q4		
	M1	M2	M3	M1	M2	M3	M1	M2	M3
Year = 2020	0.016	0.015	0.009	-0.005	-0.007	-0.013	-0.015*	-0.015**	-0.018***
	(0.0099)	(0.0083)	(0.0094)	(0.0078)	(0.0064)	(0.0073)	(0.0060)	(0.0048)	(0.0054)
Year = 2021	0.079***	0.073***	0.061***	0.009	0.005	-0.008	-0.015**	-0.016**	-0.020**
	(0.0092)	(0.0083)	(0.0117)	(0.0074)	(0.0064)	(0.0095)	(0.0058)	(0.0048)	(0.0070)
Year = 2022	0.062***	0.065***	0.048**	0.009	0.004	-0.015	-0.008	-0.011*	-0.018*
	(0.0099)	(0.0085)	(0.0150)	(0.0077)	(0.0064)	(0.0122)	(0.0060)	(0.0051)	(0.0091)
Time			0.006			0.006			0.002
			(0.0041)			(0.0034)			(0.0025)
N	38760	38760	75985	49587	49587	88299	58125	58125	99861
2019 Mean	0.596	0.596	0.596	0.786	0.786	0.786	0.889	0.889	0.889
Covs?	N	Y	Y	N	Y	Y	N	Y	Y

Note. Estimates obtained from OLS regression models. All models are restricted to students who applied to a UNC System institution. M1 and M2 are restricted to students in the high school graduation classes of 2019 to 2022; M3 includes students in the high school graduation classes of 2016 to 2022. M1 includes no additional covariates, M2 includes all covariates listed in Table 1, and M3 includes all covariates in Table 1 and a linear time trend. Standard errors, clustered by school-year, appear below coefficients. Q1/2 refers to students in the bottom two quartiles of 8th grade reading achievement; Q3 and Q4 are defined similarly. Sample includes on-time high school graduates in North Carolina.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4. Pandemic-related changes to college readiness indicators

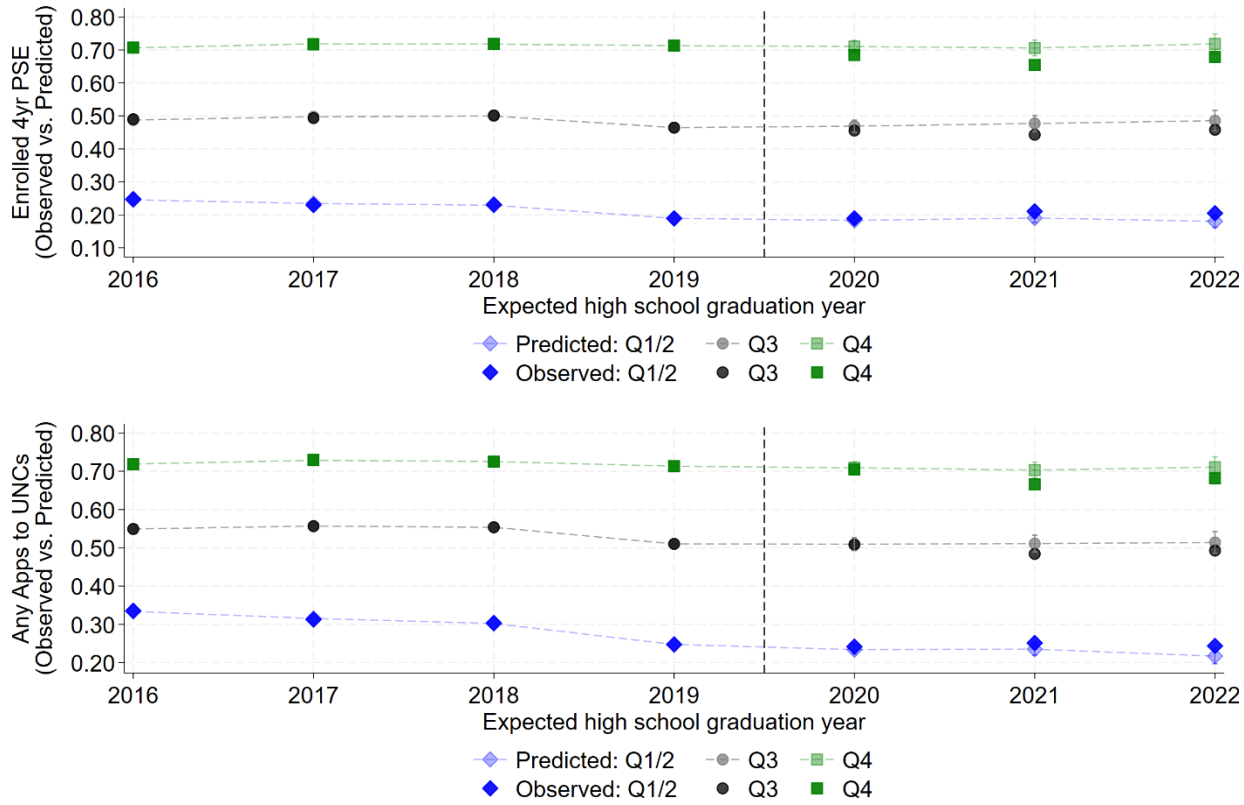
	Any AP/DE in 12th Grade			Final Weighted HSGPA			ACT Score		
	Q1/2	Q3	Q4	Q1/2	Q3	Q4	Q1/2	Q3	Q4
Grad Year = 2021	-0.030***	-0.057***	-0.040***	0.014	-0.036**	-0.056***			
	(0.0077)	(0.0101)	(0.0100)	(0.0119)	(0.0133)	(0.0135)			
Grad Year = 2022	-0.054***	-0.095***	-0.057***	-0.001	-0.080***	-0.085***	-0.330***	-0.584***	-0.818***
	(0.0102)	(0.0131)	(0.0126)	(0.0163)	(0.0186)	(0.0191)	(0.0755)	(0.1171)	(0.1849)
Time	0.014***	0.023***	0.010*	0.016**	0.037***	0.036***	-0.081**	0.003	0.107
	(0.0033)	(0.0041)	(0.0039)	(0.0055)	(0.0062)	(0.0067)	(0.0250)	(0.0354)	(0.0553)
N	274920	169192	141794	274920	169192	141794	212136	141674	115551
2020 Mean	0.249	0.562	0.784	2.622	3.401	3.940	14.720	19.285	24.530
Covs?	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note. Estimates obtained from OLS regression models. Models include all covariates in Table 1 and a linear time trend. Standard errors, clustered by school-year, appear below coefficients. Q1/2 refers to students in the bottom two quartiles of 8th grade reading achievement; Q3 and Q4 are defined similarly. Sample includes on-time high school graduates from the classes of 2016 through 2022 in North Carolina.

* p < .05, ** p < .01, *** p < .001

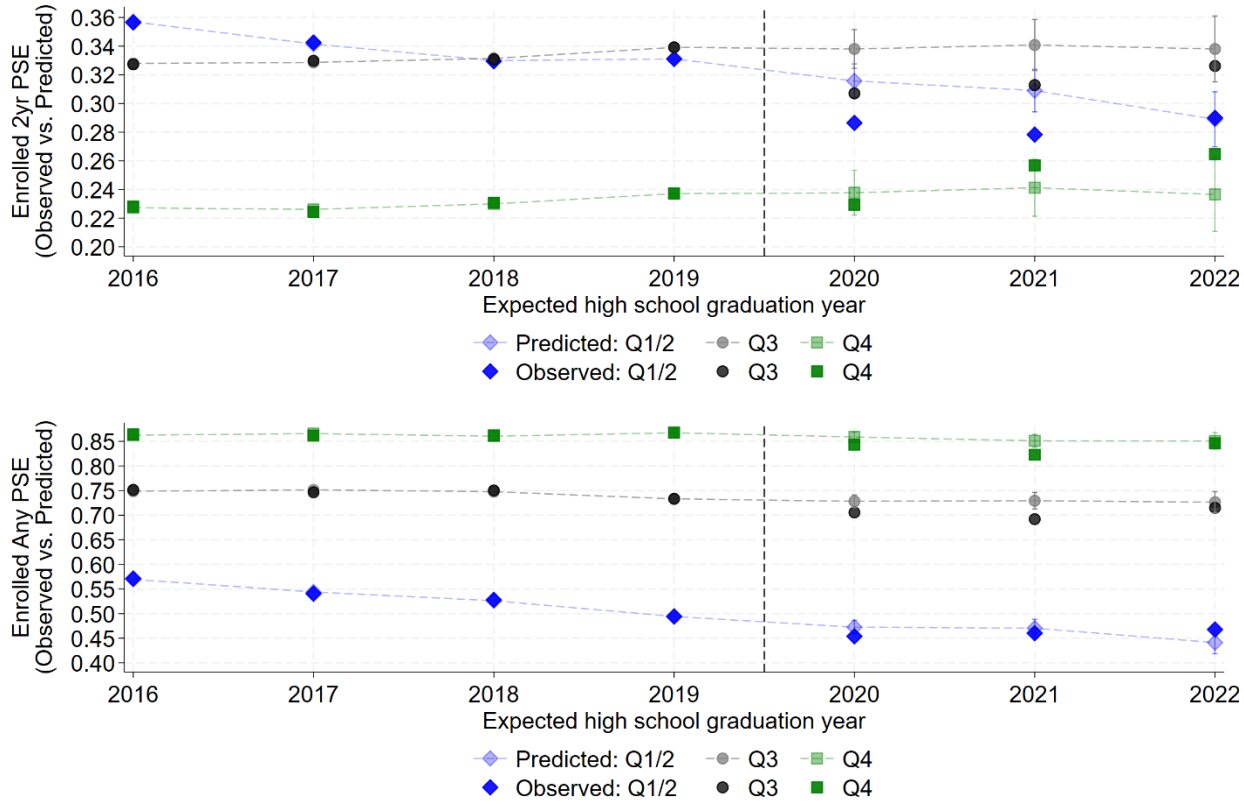
Appendix A. Supplemental Figures & Tables

Appendix Figure A1. Observed and interrupted time series model predicted values of four-year enrollment and UNC system applications, by achievement subgroup



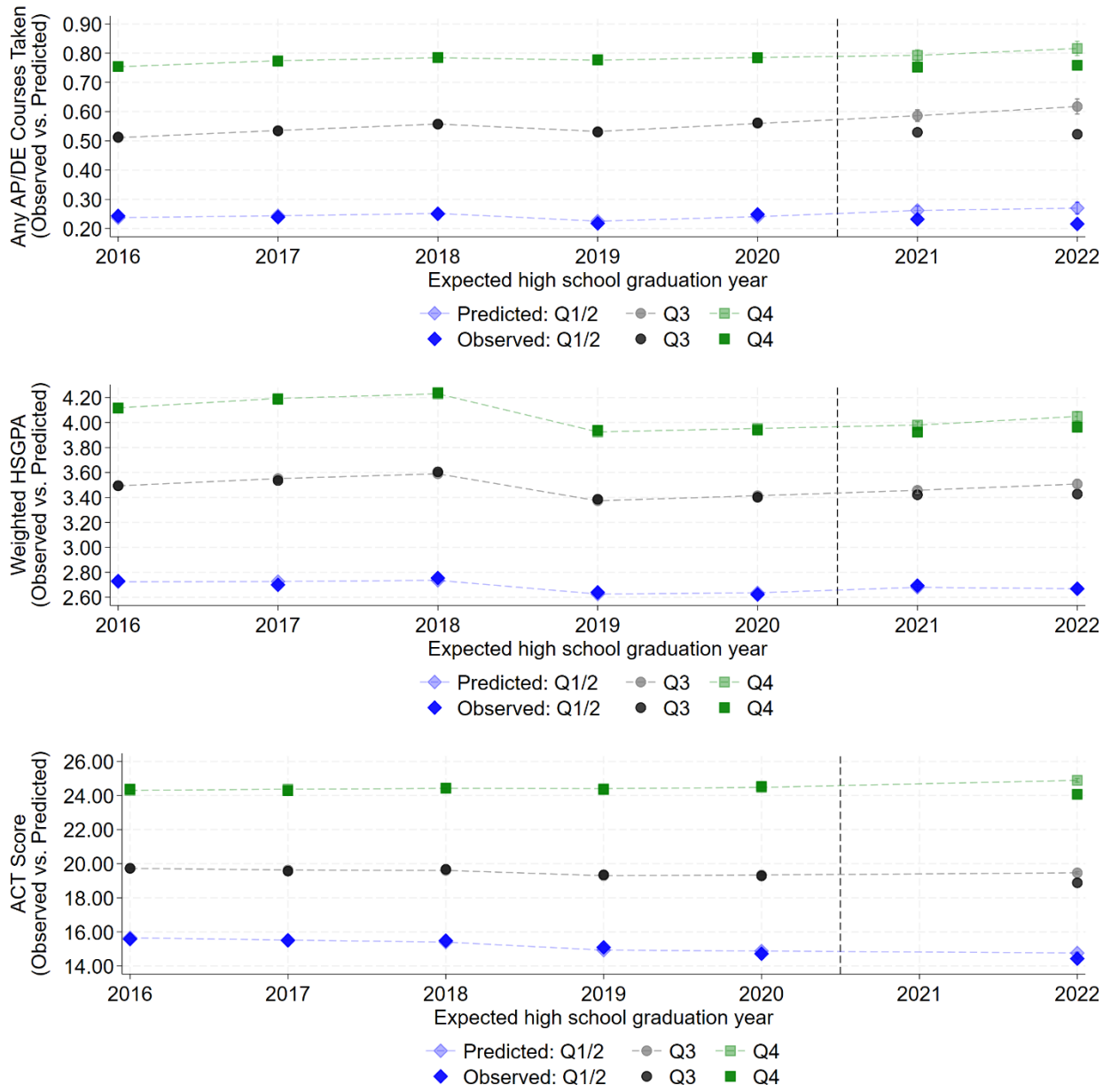
Note. Dashed, connected points show model-predicted outcome values based on a covariate-adjusted linear trend model, while solid points show observed (actual) outcomes. Spikes in post-pandemic years depict 95% confidence intervals (standard errors clustered by school-year). Q1/2 refers to students in the bottom two quartiles of 8th grade reading achievement; Q3 and Q4 are defined similarly. Sample includes on-time high school graduates in North Carolina from 2015-16 to 2021-22.

Appendix Figure A2. Observed and interrupted time series model predicted values of two-year enrollment and any (two- or four-year) enrollment, by achievement subgroup



Note. Dashed, connected points show model-predicted outcome values based on a covariate-adjusted linear trend model, while solid points show observed (actual) outcomes. Spikes in post-pandemic years depict 95% confidence intervals (standard errors clustered by school-year). Q1/2 refers to students in the bottom two quartiles of 8th grade reading achievement; Q3 and Q4 are defined similarly. Sample includes on-time high school graduates in North Carolina from 2015-16 to 2021-22.

Appendix Figure A3. Observed and interrupted time series model predicted values of indicators of academic readiness, by achievement subgroup



Note. Dashed, connected points show model-predicted outcome values based on a covariate-adjusted linear trend model, while solid points show observed (actual) outcomes. Spikes in post-pandemic years depict 95% confidence intervals (standard errors clustered by school-year). Q1/2 refers to students in the bottom two quartiles of 8th grade reading achievement; Q3 and Q4 are defined similarly. Sample includes on-time high school graduates in North Carolina from 2015-16 to 2021-22.

Appendix Table A1. Descriptive statistics of outcomes, by achievement subgroup

	High school graduation year						
	2016	2017	2018	2019	2020	2021	2022
Panel A. Quartile 1 & 2							
Took AP/DE in 12th	24.3%	23.9%	25.0%	21.7%	24.9%	23.2%	21.6%
Weighted GPA	2.73	2.70	2.75	2.64	2.62	2.69	2.67
	(0.79)	(0.78)	(0.79)	(0.72)	(0.75)	(0.75)	(0.78)
ACT score in 11th	15.58	15.50	15.49	15.09	14.72	.	14.43
	(3.13)	(2.93)	(2.99)	(2.82)	(2.98)	(.)	(2.80)
Missing ACT score	6.8%	7.4%	6.6%	8.9%	10.2%	100%	18.8%
Submitted any UNC app	33.5%	31.3%	30.3%	24.7%	24.2%	25.1%	24.4%
Enrolled in any PSE	57.1%	54.1%	52.8%	49.4%	45.4%	46.0%	46.8%
Enrolled in any 2-year	35.7%	34.3%	32.9%	33.1%	28.6%	27.8%	29.0%
Enrolled in any 4-year	24.8%	23.0%	23.1%	18.9%	18.9%	21.1%	20.5%
N	39358	37504	40529	40164	41202	40095	36068
Panel B. Quartile 3							
Took AP/DE in 12th	51.3%	53.4%	55.7%	53.0%	56.2%	52.9%	52.3%
Weighted GPA	3.49	3.54	3.60	3.39	3.40	3.42	3.43
	(0.80)	(0.79)	(0.78)	(0.69)	(0.72)	(0.73)	(0.76)
ACT score in 11th	19.73	19.56	19.67	19.35	19.28	.	18.88
	(3.69)	(3.71)	(3.80)	(3.74)	(3.96)	(.)	(3.85)
Missing ACT score	2.4%	2.4%	2.1%	2.3%	3.0%	100%	7.7%
Submitted any UNC app	54.9%	55.7%	55.4%	51.0%	50.8%	48.4%	49.3%
Enrolled in any PSE	75.2%	74.7%	75.0%	73.3%	70.6%	69.2%	71.5%
Enrolled in any 2-year	32.7%	33.0%	33.1%	33.9%	30.7%	31.3%	32.6%
Enrolled in any 4-year	49.0%	49.3%	50.2%	46.5%	45.6%	44.3%	45.8%
N	21480	25001	23472	26724	26198	22683	23634
Panel C. Quartile 4							
Took AP/DE in 12th	75.4%	77.3%	78.6%	77.7%	78.4%	75.3%	75.9%
Weighted GPA	4.11	4.19	4.24	3.94	3.94	3.92	3.96
	(0.75)	(0.73)	(0.71)	(0.59)	(0.60)	(0.65)	(0.64)
ACT score in 11th	24.37	24.28	24.43	24.35	24.53	.	24.07
	(4.38)	(4.33)	(4.56)	(4.51)	(4.82)	(.)	(4.69)
Missing ACT score	1.5%	1.4%	1.3%	1.5%	2.2%	100%	5.7%
Submitted any UNC app	71.8%	73.0%	72.5%	71.3%	70.5%	66.6%	68.2%
Enrolled in any PSE	86.4%	86.2%	86.2%	86.7%	84.3%	82.3%	84.6%
Enrolled in any 2-year	22.8%	22.4%	23.1%	23.7%	22.9%	25.7%	26.5%
Enrolled in any 4-year	70.7%	71.7%	71.8%	71.3%	68.5%	65.5%	67.9%
N	18730	18664	20219	20783	20092	23577	19729

Note. Sample includes on-time high school graduates in North Carolina from 2015-16 to 2021-22. Quartile 1 & 2 refers to students in the bottom two quartiles of 8th grade reading achievement; Quartile 3 and Quartile 4 are defined similarly.

Appendix Table A2. Pandemic-related changes to two-year and overall (two- or four-year) college-going rates

	Q1/2			Q3			Q4		
	4-year	2-year	Any PSE	4-year	2-year	Any PSE	4-year	2-year	Any PSE
Grad Year = 2020	0.006	-0.029***	-0.019**	-0.013	-0.031***	-0.023***	-0.026**	-0.008	-0.016**
	(0.0051)	(0.0061)	(0.0071)	(0.0093)	(0.0069)	(0.0065)	(0.0095)	(0.0079)	(0.0051)
Grad Year = 2021	0.020**	-0.031***	-0.010	-0.034**	-0.028**	-0.037***	-0.052***	0.016	-0.029***
	(0.0070)	(0.0076)	(0.0092)	(0.0123)	(0.0091)	(0.0086)	(0.0121)	(0.0101)	(0.0068)
Grad Year = 2022	0.025**	0.001	0.027*	-0.028	-0.012	-0.012	-0.039*	0.028*	-0.005
	(0.0092)	(0.0098)	(0.0117)	(0.0158)	(0.0117)	(0.0108)	(0.0154)	(0.0132)	(0.0085)
Time	-0.002	-0.015***	-0.018***	0.004	-0.000	-0.005	-0.001	0.002	-0.007**
	(0.0026)	(0.0027)	(0.0032)	(0.0045)	(0.0034)	(0.0030)	(0.0042)	(0.0037)	(0.0024)
N	274920	274920	274920	169192	169192	169192	141794	141794	141794
2019 Mean	0.189	0.331	0.494	0.465	0.339	0.733	0.713	0.237	0.867
Covs?	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note. Estimates obtained from OLS regression models. Columns labeled "4-year" refer to whether a student enrolled in any four-year institution in the year following their high school graduation; columns labeled "2-year" refer to whether a student enrolled in any two-year institution in the year following their high school graduation; and columns labeled "Any PSE" refer to whether a student enrolled in any two- or four-year institution in the year following their high school graduation. The results of the "Any PSE" column may not equal the sum of the "4-year" and "2-year" columns both because of differences in estimation across models and because some students enroll in both a two- and a four-year in the same year. All models shown include all covariates in Table 1 and a linear time trend and include students in the expected high school graduation classes of 2016 through 2022 in North Carolina. Standard errors, clustered by school-year, appear below coefficients. Q1/2 refers to students in the bottom two quartiles of 8th grade reading achievement; Q3 and Q4 are defined similarly.
* p < .05, ** p < .01, *** p < .001

Appendix Table A3. Sensitivity check: Observed vs. imputed ACT scores

	Q1/2		Q3		Q4	
	Observed	Imputed	Observed	Imputed	Observed	Imputed
Grad Year = 2022	-0.330***	-0.320***	-0.584***	-0.566***	-0.818***	-0.842***
	(0.0755)	(0.0709)	(0.1171)	(0.1127)	(0.1849)	(0.1792)
Time	-0.081**	-0.079**	0.003	0.005	0.107	0.104
	(0.0250)	(0.0240)	(0.0354)	(0.0346)	(0.0553)	(0.0545)
N	212136	234825	141674	146509	115551	118217
2020 Mean	14.720	14.987	19.285	19.382	24.530	24.313
Covs?	Y	Y	Y	Y	Y	Y

Note. Estimates obtained from OLS regression models. Columns labeled "observed" are restricted to students with non-missing ACT scores; columns labeled "imputed" include students with missing ACT scores whose scores were singly-imputed by regressing ACT scores on all student-level covariates, students' 8th grade reading standardized score, and graduation year, using a truncated regression that bounded imputed scores to be between 1 and 36. All models shown include all covariates in Table 1 and a linear time trend and include students in the expected high school graduation classes of 2016 through 2022 in North Carolina. Standard errors, clustered by school-year, appear below coefficients. Q1/2 refers to students in the bottom two quartiles of 8th grade reading achievement; Q3 and Q4 are defined similarly.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix B: Sensitivity to Inclusion of all 9th Grade Entrants

In this Appendix, we describe results for four-year and overall (two- or four-year) college enrollment that include all 9th grade entrants rather than restricting to high school graduates. Our primary analysis restricts to high school graduates because (a) this permits consistency across outcome measures, as students who exit the public school system will not have valid data for indicators of college readiness; and (b) students who left to a private, out-of-state, or home school may have enrolled in college, but we would not observe this unless this happened at a UNC institution, as the NSC data we receive only includes North Carolina public high school graduates. However, a limitation of this restriction is that pandemic-related forces may have also shaped the composition of high school graduates in ways related to college-going and college choice. Indeed, the overall percentage of students in our sample observed as graduating on time increased from 80% to 83% from 2016 to 2020, but then slightly declined to 82% in 2021 and 81% in 2022, with lower overall rates and steeper post-pandemic declines for students of low baseline achievement. We note that this is *not* the official high school graduation rate—students who are not observed as graduating may have dropped out, but also may have transferred out of the state public system (e.g., to a private, out-of-state, or home school) or delayed their graduation to their fifth year after high school entry.

College enrollment estimates that include all 9th grade entrants, regardless of their high school graduation status, are shown in Appendix Table B1. Estimates in 2021 and 2022 are directionally more negative for *all* subgroups; however, patterns of differences across subgroups remain the same as in the main analysis. Four-year enrollment estimates for students of low baseline achievement remain directionally positive but insignificant, while estimates for students in quartiles 3 and 4 are significant and negative.

Appendix Table B1. Sensitivity to inclusion of all grade 9 entrants on four-year and overall (two- or four-year) enrollment estimates

Panel A:	Q1/2		Q3		Q4	
4-year enrollment	Main	All Gr9	Main	All Gr9	Main	All Gr9
Grad Year = 2020	0.006	0.004	-0.013	-0.013	-0.026**	-0.033***
	(0.0051)	(0.0040)	(0.0093)	(0.0085)	(0.0095)	(0.0095)
Grad Year = 2021	0.020**	0.011	-0.034**	-0.040***	-0.052***	-0.062***
	(0.0070)	(0.0055)	(0.0123)	(0.0110)	(0.0121)	(0.0120)
Grad Year = 2022	0.025**	0.010	-0.028	-0.042**	-0.039*	-0.059***
	(0.0092)	(0.0072)	(0.0158)	(0.0141)	(0.0154)	(0.0154)
Time	-0.002	0.000	0.004	0.008*	-0.001	0.005
	(0.0026)	(0.0021)	(0.0045)	(0.0040)	(0.0042)	(0.0042)
N	274920	381838	169192	202175	141794	163843
2019 Mean	0.189	0.140	0.465	0.402	0.713	0.647
Covs?	Y	Y	Y	Y	Y	Y
Panel B:	Q1/2		Q3		Q4	
Any enrollment	Main	All Gr9	Main	All Gr9	Main	All Gr9
Grad Year = 2020	-0.019**	-0.016*	-0.023***	-0.023***	-0.016**	-0.026***
	(0.0071)	(0.0061)	(0.0065)	(0.0067)	(0.0051)	(0.0068)
Grad Year = 2021	-0.010	-0.021**	-0.037***	-0.051***	-0.029***	-0.045***
	(0.0092)	(0.0079)	(0.0086)	(0.0089)	(0.0068)	(0.0087)
Grad Year = 2022	0.027*	-0.006	-0.012	-0.041***	-0.005	-0.033**
	(0.0117)	(0.0102)	(0.0108)	(0.0114)	(0.0085)	(0.0112)
Time	-0.018***	-0.007*	-0.005	0.003	-0.007**	0.001
	(0.0032)	(0.0028)	(0.0030)	(0.0031)	(0.0024)	(0.0031)
N	274920	381838	169192	202175	141794	163843
2019 Mean	0.494	0.367	0.733	0.636	0.867	0.787
Covs?	Y	Y	Y	Y	Y	Y

Note. Estimates obtained from OLS regression models. The outcome in Panel A is an indicator of whether a student enrolled in a four-year institution in the year following their expected high school graduation; the outcome in Panel B is an indicator of whether a student enrolled in any two- or four-year institution in the year following their expected high school graduation. "Main" shows results from preferred models that are restricted to on-time high school graduates, for reference. "All Gr9" shows results from alternative models that include all 9th grade entrants. All models shown include all covariates in Table 1 and a linear time trend and include students in the expected high school graduation classes of 2016 through 2022 in North Carolina. Standard errors, clustered by school-year, appear below coefficients. Q1/2 refers to students in the bottom two quartiles of 8th grade reading achievement; Q3 and Q4 are defined similarly.

* p < .05, ** p < .01, *** p < .001