Post-COVID Labor Market Shortages and College Enrollment*

Celeste K. Carruthers
University of Tennessee and NBER

January 2026

There were 1.1 million fewer students enrolled in U.S. higher education in Fall 2022 than Fall 2019. During the same period of time, the labor market grew increasingly favorable to young workers without college. I examine the relationship between these patterns using state administrative data connecting K-12, higher education, and workforce outcomes for Tennessee 12th grade classes of 2009 - 2022. I construct labor market indicators that would have been salient to 12th grade students and representative of their local employment opportunities: Job mobility for the most recent cohort from the same school, and in some models, from the same career and technical education focal area. I find that labor tightness may have explained 28% of the fall in college going between 2019-20 and 2021-22 and 18% of the fall in 2-year college going. Estimated effects are concentrated among students with low or missing ACT scores.

Keywords: College enrollment, labor tightness, career and technical education
JEL Codes: I23, J82, J24

*Carruthers: carruthers@utk.edu. I am grateful for feedback and suggestions from the UTK Economics Applied Micro Group, Matt Giani, Matt Harris, and conference attendees at meetings of the Association for Public Policy Analysis and Management and Association for Education Finance and Policy. De-identified administrative data used in this study was provided by the Tennessee Department of Education, Tennessee Higher Education Commission, Tennessee Independent Colleges and Universities Association, and Tennessee Department of Labor and Workforce Development and compiled by TN DATA, Tennessee Data Analytics for Transparency and Accountability, Tennessee's longitudinal integrated data system. Notwithstanding any Tennessee Department of Education (TDOE) data or involvement in the creation of this research product, the TDOE does not guarantee the accuracy of this work or endorse the findings. Any errors are the sole responsibility of the author(s). UTK IRB-24-07957-XM, Tennessee P-20 2023006, TDOE 2023_12.

1 Introduction

There were 500,000 fewer students enrolled in college in Fall 2020 than in Fall 2019 (National Student Clearinghouse, 2022). Much of the fall was concentrated in community colleges, where hands-on coursework may have been constrained by the movement to online learning, social distancing, and other steps that colleges took to mitigate the risks of spreading the virus (Schanzenbach and Turner, 2022). Students more generally expressed a strong preference against online classes, and colleges that maintained in-person instruction sustained larger enrollments through 2020-2021 (Harris et al., 2024). In addition, the onset of COVID-19 in spring 2020 led to a short but deep recession with historically high 14.8% unemployment as well as food, housing, and general economic insecurity that may have ruled out first-time or returning enrollment (Rodriguez-Planas, 2022).

This pattern of declining post-secondary enrollment during the 2020 recession was at odds with prior downturns, when more students chose college over an unfavorable labor market (Barr and Turner, 2013; Dellas and Sakellaris, 2003; Hillman and Orians, 2013; Long, 2014; Sievertsen, 2016). Post-secondary enrollment continued to drop after Fall 2020, however, for both first-time and returning students (Bulman and Fairlie, 2022; Dagorn and Moulin, 2023). The gap from pre-COVID enrollment widened to 1.1 million by Fall 2022 (National Student Clearinghouse, 2022). This is more consistent with counter-cyclical student demand for college because the steep recession in spring 2020 was followed by a rapid return to more than full employment by mid-2021 (Bureau of Labor Statistics, 2024). The labor force participation rate remained below pre-COVID levels, and throughout 2022 there were nearly two job openings per unemployed job seeker (Federal Reserve Bank of St. Louis, 2024). Combined with inflationary pressures, this pushed earnings up as employers competed for a limited pool of available workers.

Autor et al. (2023) document aspects of post-COVID labor market tightness that would have been relevant for college going decisions. First, the post-COVID economy exhibited wage compression: High-earning, older, college-educated workers experienced wage gains that tended to fall short of inflation, whereas pay for younger workers without college exceeded high rates of inflation. Second, young non-college workers were more mobile between jobs in the immediate post-COVID years, tending to move into higher paying work. These patterns are in agreement with an imperfectly competitive, monopsonistic labor market and reduced job stickiness post-COVID. For a 12th grade student considering their next steps, the on-the-ground reality of that model would have been more job openings with higher pay and without the requirement to have a college education.

In the wake of COVID-19, did more high school graduates go to work instead of college? I investigate this question using linked K-12, higher education, and workforce data describing Tennessee 12th grade students from the classes of 2009 - 2022. These data allow me to personalize the labor market conditions that may have informed a student's decision about going to college versus going to work. Specifically, I complement county unemployment rates with measures of short-term job mobility experienced by recent graduates from the same school as each 12th grader, and in some specifications, from same-school prior cohorts who took a similar sequence of career and technical education (CTE) courses.

Stronger economic conditions raise at least the short-term opportunity cost of college, which could lead to counter-cyclical college enrollment. Prior research on post-COVID college enrollment, however, found no significant effect of county unemployment (Schanzenbach and Turner, 2022) or labor force participation (Harris et al., 2024). In other settings, effects of labor market conditions on post-secondary enrollment tend to be more apparent from larger shocks such as the 2000s housing boom (Charles et al., 2018), or with measures of youth unemployment (Clark, 2011; Betts and McFarland, 1995) rather than measures describing an area's entire labor force (Card and Lemieux, 2001). Same-school, prior-cohort measures of labor tightness may be more salient to 12th graders than unemployment among the broad labor force, and they may be better proxies of local labor demand for young workers without a college education.

Tennessee is an important setting for this study. After the introduction of tuition-free community college through Tennessee Promise, college enrollment increased from 59% to 64% among high school graduates, and the college-going gap closed between CTE and non-CTE students (Carruthers and Attridge, 2019). But for the class of 2021, Tennessee's college-going rate was just 53% and has yet to fully recover to pre-COVID levels (THEC, 2024). Complementing a tight labor market, Tennessee's K-12, labor, and higher education agencies have recently accelerated efforts around nontraditional postsecondary pathways including dual enrollment, industry certifications, and apprenticeship training (THEC, 2024; Veach, 2024; Tennessee Board of Regents, 2024).

Results indicate that labor market tightness reduced college going in Tennessee, both before and after COVID. Estimates indicate that labor market developments over 2019 - 2022 (i.e., lower unemployment along with higher job mobility among recent graduates) could have accounted for 28% of the drop in Tennessee college going over that same time frame, and up to 18% of declines in 2-year college going. This leaves a lot of room for reverberating effects of supply constraints, distaste for online learning, higher cost of living, and economic insecurity to explain enrollment declines in the post-COVID period, although enrollment did not fully rebound even as some of those factors resolved or returned to pre-COVID levels. Other factors that are more difficult to quantify include eroding sentiments about the value of college (Fry et al., 2024).

I estimate more potent effects of labor market tightness on 2-year college enrollment than 4-year college enrollment, as well as larger effects on college going for students with low or missing ACT scores. Estimated effects by students' CTE fields are noisier, but two clusters–Hospitality and Tourism Management and Advanced Manufacturing–are notable for having low overall college going rates and larger declines in college going following an increase in labor market tightness.

These patterns were not wholly unique to the post-COVID period, although results suggest that overall college going was significantly more responsive to the labor market after COVID than before. Likewise, Autor et al. (2023) find steeper quit elasticities for young, non-college workers post-COVID than pre-COVID, and to a lesser extent during other expansions going back to the early 1980s. The implication is that the appeal of one's current job, or current plans for enrolling in a 2-year college, may weaken during strong economies to a greater degree than they strengthen during weak economies.

I contribute primarily to three threads of research. First, I add to work by Harris et al. (2024) and Schanzenbach and Turner (2022) on enrollment trends in the first year of the pandemic. I extend the timeline through 2022-23 enrollment decisions, when college going remained below pre-COVID levels despite improved conditions on campuses. My findings attribute a large part of the sustained post-COVID drop in enrollment to labor market conditions for young adults. Second, and not limited to the COVID era, I document some of the individual decisions that contribute to counter-cyclical enrollment patterns that related work has shown in the aggregate, particularly for two-year schools (Goodman and Winkelmann, 2025). Specifically, Findings highlight the importance of individualized labor market measures in identifying effects of labor markets on enrollment. Finally, I add to related research on young workers and workers without a college education. Longitudinal, student-level data allow me to directly test the educational implications of Autor et al.'s (2023) model of job ladders, as well as Mohnen's (2025) analysis of youth employment, earnings, and mobility in light of slowing pre-pandemic retirements. Results show that post-pandemic gains at the bottom of the job ladder, which were in part fueled by excess retirements (Montes et al., 2022), led more students to opt out of college pathways after high school.

2 Methods and Data

2.1 Methods

My focal question is whether the labor market affects college enrollment, and in particular, whether the labor market can explain some portion of the drop in college going shortly after the onset of the COVID-19 pandemic. A related, secondary question is whether CTE plays a role in how students navigate the labor market after high school.

My baseline regression model is specified as follows:

$$Y_{isct} = LM_{isct}\delta_1 + X_{it}\gamma + [\theta_s + \theta_t] + [\theta_{st}] + \varepsilon_{isct}, \tag{1}$$

where Y_{ist} is one of three college enrollment outcomes for student i attending 12th grade in school s, county c, year t: Any enrollment in college in year $t+1$, enrollment in a 2-year community or technical college, or enrollment in a 4-year college or university.

Equation 2 examines whether college going decisions were more or less sensitive to the labor market after COVID-19:

$$Y_{isct} = LM_{isct}\delta_1 + LM_{isct} * PostCOVID_t\delta_2 + X_i\gamma + [\theta_s + \theta_t] + [\theta_{st}] + \varepsilon_{isct}, \tag{2}$$

where $PostCOVID_t$ is a binary variable equal to one for the classes of 2020 and later. In both specifications, the variable of interest is LM_{isct}, which represents labor market conditions relevant to student i, school s, and time t. In main results to follow, LM_{isct} is the average of two normalized labor market indicators:

- -1 $\times$ average monthly county c unemployment during student i's 12th grade year.
- School s, cohort $t-1$'s employment-to-employment (EE) separation rate during i's 12th grade year (t). A job separation is defined as the end of a matched employer-employee spell. An EE separation is a separation where the employee works for another employer with no interruption. The EE separation rate is the percent of total jobs in a quarter (i.e., employer-employee matches) that are comprised of EE separated workers. This construction is similar to BLS and Census definitions for EE separations (Hyatt et al., 2014) and is featured by Autor et al. (2023) as a procyclical

measure of labor tightness. In this context, the population of workers is limited to individuals in the year after high school.

I summarize EE indicators for each school, cohort, and quarter over the four quarters following the traditional spring season for high school graduation, i.e., quarters 3-4 and then quarters 1-2 of the following year. As an example, consider a hypothetical cohort of 12th graders from Central High School, class of 2019 - 2020. I link each student in the Central High 2020 cohort to their in-state, UI covered employment and earnings in the year after high school, between July 2020 and June 2021. I compute the cohort's EE rate each quarter of 2020 - 2021 as the number of EE separated workers in the cohort divided by total cohort employment in that quarter. Cohort-by-quarter EE are then assigned to the Central High School 12th grade class of 2020 - 2021 as one part of their LM_{isct}. The other part of LM_{isct} for the Central High class of 2021 is the average monthly unemployment rate in their county over July - June of their 12th grade year, July 2020 - June 2021 (year t).

I normalize each of the two indicators–EE and local unemployment–to have mean zero and standard deviation equal to one samplewide, multiply the unemployment rate by -1, and define LM_{isct} as the average of the two normalized measures. A tighter labor market corresponds with lower unemployment, higher EE as a portion of total employment, and thus higher values of LM_{isct}.

The two-part construction of LM_{isct} offers two advantages over a summary measure of the labor market such as the unemployment or labor force participation rate. First, LM_{isct} indicators are derived from the work mobility experienced by slightly older peers. The t cohort is likely to know students in the $t-1$ cohort from their school, and likely to know how they are faring in college and work. This information may be more influential to their views on college and work than broad labor market measures that describe all workers of all ages.

Second, and related, LM_{isct} indicators at the school-by-cohort level may be better representations of labor opportunities available to young people in the vicinity of school s. In the years before COVID-19, and even more so in the years during and after, wage compression and job ladders differentially benefited young workers without a college education. If students are responsive to the labor market when determining their post-secondary work and schooling, we may be more apt to observe responses to measures that describe youth employment.

In some specifications of Equation 1, I further atomize EE measures to the school-cohort-cluster level. That is, I compute EE for students from school s and cohort $t-1$, and who additionally had the same CTE profile k as student i. A third advantage from this more personalized LM_{iksct} is that it represents labor market opportunities for someone with student i's skill profile. Section 3 reviews results from several alternate constructions of LM_{isct}, including one that incorporates a measure of the $t-1$ cohort's earnings in year t.

Control variables in X_{it} include student i's gender, race, Hispanic ethnicity, ACT score, an indicator for missing ACT, and 16 indicators for potential CTE concentration in one of the career clusters in the national CTE framework.[1]

Time-varying controls in X_{it} include a standardized measure of COVID severity in i's county during academic year t, which played a role in college enrollment nationwide (Harris et al., 2024). Specifically, I normalize cumulative COVID deaths and hospitalizations across Tennessee counties for each cohort, and control for the average of the two normalized indices. Controls in X_{it} also include inflation-adjusted property tax revenue per capita in each county and year. School and cohort fixed effects are represented by θ_s and θ_t, which I substitute for school-by-cohort fixed effects θ_{st} in specifications where LM_{iksct} is tailored to CTE clusters within schools. Standard errors in Equations 1 - 2 allow for clustering within schools for LM_{isct} specifications of labor tightness, and within school-cohorts for LM_{iksct}.

Equations 1 - 2 identify the relationship between labor tightness and college enrollment choices from fluctuations in unemployment and job mobility across cohorts attending the same school. We can interpret these relationships as the causal effect of labor tightness on college enrollment if unobserved components of the error (ε_{isct}) are not related to both LM_{isct} and college enrollment outcomes.

Results discussed below are from specifications that exclude measures of instructional modality of colleges and universities near student i's school, the local cost of goods and housing, and less observable student sentiments about the value of higher education that might co-move with local labor markets. Each of these are in ε_{isct} and plausibly correlate with labor market tightness as well as student demand for college. As shown below, inferences are robust to several modifications of the baseline model, including specifications that control for school-cohort fixed effects along with the school-cohort-cluster specification of

[1]For the cohorts under study, the 16 career clusters in the national framework were as follows: Agriculture, Food, & Natural Resources; Architecture & Construction; Arts, A/V Technology, & Communications; Business Management & Administration; Education & Training; Finance; Government & Public Administration; Health Science; Hospitality & Tourism; Human Services; Information Technology; Law, Public Safety, Corrections, & Security; Manufacturing; Marketing; Science, Technology, Engineering, & Mathematics (STEM); and Transportation, Distribution, & Logistics. These 16 clusters were re-grouped into 14 clusters in 2024. Descriptions and additional details are at https://careertech.org/what-we-do/career-clusters/

LM_{iksct}. This richer specification controls for unobserved health, instruction, inflation, and sentiment factors that are shared among members of a cohort within a school, and identification is driven from within-school, within-cohort variation in labor indicators across career clusters, conditional on cluster fixed effects.

2.2 Data

I estimate Equations 1 and 2 using linked administrative data from Tennessee's Department of Education (TDOE), Higher Education Commission (THEC), Independent Colleges and Universities Association (TICUA), and Department of Labor and Workforce Development (TDLWD).

The sample starts with all 12th graders enrolled in the state's public schools, from school years 2007-08 through 2021-22. TDOE records on these students include course-taking, school, gender, race, Hispanic ethnicity, and ACT composite and subject tests.

I use course-taking records to identify the CTE cluster or clusters where a student took three or more courses, and where they may have been designated as a concentrator. Tennessee followed the 16-cluster national framework over this time period, which includes focal areas spanning nearly every occupation and industry in the economy. Students usually attain concentrator status if they take three courses in a program within a cluster. I do not observe CTE programs, however, which varied from one cohort to another and consolidated over this timeframe, and I also do not observe students' formal concentrator status. So, these three-course indicators are best thought of as potential concentrations that are consistent across cohorts and schools.

I use THEC data to identify college enrollment after high school in any institution that reports to the National Student Clearinghouse. This includes the vast majority in in-state, out-of-state, public, and private institutions in the United States. THEC enrollment data additionally describe students in Tennessee Colleges of Applied Technology, which are not included in National Student Clearinghouse records. My estimates of cohort college-going shares are within 3.0 percentage points of corresponding figures in state reports (THEC, 2024). I define high school cohorts somewhat more broadly than THEC, covering all enrolled 12th graders regardless of graduation outcomes, whereas THEC limits their college-going analysis to graduates with regular diplomas. Graduation rates are very high for students who reach 12th grade (94% in these data), so my cohort groups are likely very similar to THEC's.

TDLWD data allow me to link each 12th grade student to quarterly measures of in-state earnings, de-identified employer identifiers, and employer industry through the second quarter of 2023. These linkages permit EE construction for the $t-1$ classes of 2008 through 2021, which I combine with county unemployment rates from the BLS LAUS. I estimate Equations 1 and 2 for the classes of 2009 through 2022. All earnings measures are converted to 2023 dollars using the Consumer Price Index.

3 Results

3.1 College going and youth labor markets: Trends from 2009 - 2022

Figure 1 plots trends in the percent of 12th grade cohorts observed in a college or university in the next year (solid line) along with the percent who have any UI-covered Tennessee earnings in the next year.

Rates of enrollment in observed institutions increased from 57.4 to 61.9% between the 12th grade classes of 2014 and 2015, the same year that Tennessee Promise made tuition-free community college available to all high school graduates. This 4.5-point increase is somewhat smaller than official state reports of 5.8 percentage point gains in college enrollment (THEC, 2024), which differ from my estimates by limiting the set of 12th graders to those who graduated with a regular diploma. In the research data, college enrollment declined from the class of 2015 peak to 58.8% for the class of 2019, before dropping to the lowest level on record for the class of 2021 (52.8%). The class of 2022 was somewhat more likely to enroll in college, at 53.4%, which was still below pre-COVID and pre-Promise rates.

Similar to the rest of the U.S., enrollment declines were driven by fewer students attending 2-year schools. The 5.4-point fall in observed enrollment between the classes of 2019 and 2022 came from a 4.4-point drop in 2-year enrollment and a 1.1-point reduction in 4-year enrollment (from 28.0 and 33.2%, respectively, to 23.6 and 32.1%).

Rates of employment in UI-covered work increased from 64% for the class of 2009 to 74% for the class of 2015, and fluctuated within 3 percentage points from 2015 - 2022. Not shown in Figure 1, I find that while 12th graders were not substantially more likely to work during the labor shortages that followed COVID, they were less likely to work and attend college at the same time (44.4% for the class of 2019 falling to 40.8% for the class of 2022, the lowest level since 2013), and less likely to only attend college (14.4% for the class of 2019 falling to to 12.6% for the class of 2022).

Figure 2 plots the two components of the labor market index: county unemployment in panel A and the average employment-to-employment separation rate in panel B. Figure 3 plots the LM_{isct} index itself that combines these two measures. All three measures roughly track the broader economy: improving during the 2010s expansion, worsening around 2020, and then bouncing back post-COVID.

The most remarkable insight from Figure 2, though, is the enormous amount of mobility that students exhibit in the year after high school. For comparison, Autor et al. (2023) document EE separation rates of 3-5% for the broad workforce in recent years, versus 26 - 33% in Figure 2 for Tennessee students who have just left high school. That is, as many as 1 in 3 of the jobs for this young population are held by workers who have just left another employer. This is in agreement with a large number of separations relative to total employment for teenagers[2] and a high likelihood of holding more than one job at a time.[3] Job spells in this population last 4 quarters at the uncensored median during the three years following high school. Some specifications to follow substitute overall EE separations with EE separations to higher-paying employment. This more upwardly mobile measure of job changes follows a similar trend as the overall EE separation rate and likewise accounts for a high rate of total employment among workers who have just finished high school. Upward EE separation rates measured 8 - 18% prior to COVID and 16 - 18% over 2020-2022.

In addition to tracking the overall economy, labor market index components shown in Figures 2 - 3 also follow trends in in-state earnings for new high school graduates. Figure 4 illustrates prior-cohort median earnings, by graduating class (panel A) and the equivalent number of full-time jobs at minimum wage (panel B). Both series shift sharply upward starting with the class of 2020. The first COVID cohort earned $12,034 over the four quarters starting in summer 2020 (in real 2023 dollars), up 15% from $10,477 for the class of 2019. This corresponded with about 0.91 full-time equivalent jobs, a 16% increase over 0.77 for the prior class.[4] The labor market started to cool after 2022, and that class's own earnings and full-time equivalent jobs dropped below the levels shown in Figure 4, from $15,285 to $14,890 for first-year earnings, and from 0.98 to 0.95 full-time equivalent jobs.

[2] Among 14-21 year-old Tennesseans, the ratio of total separations to employment is about 49%, versus 14 - 18% for 35 - 54 year-olds (author's calculations using the Census QWI).

[3] Tennessee students have 1.2 employers per quarter in the year after high school, on average.

[4] For each worker and each quarter, I compute full-time equivalent jobs from earnings divided by the product of the federal minimum wage ($7.25 throughout almost all of this time period) and 500 hours, and then divided by the worker's number of employers.

3.2 Estimated effects of labor market tightness on college going

Table 1 regression results indicate that greater post-COVID employment, job mobility, and earnings shown in Figures 2 - 4 can explain some degree of college enrollment patterns seen in Figure 1. Each standard deviation increase in the two-part indicator of labor tightness during a student's 12th grade year corresponds with a 3.6 percentage point decline in the likelihood of enrolling in college (column 1). This is driven by a 2.1-point lower likelihood of enrolling in a 2-year school (column 3), alongside a smaller and less precisely estimated 1.4-point decline in 4-year enrollment (column 5).

The story is more potent for post-COVID cohorts. Student decisions about enrolling in college were significantly more sensitive to the labor market after COVID compared with before (column 2 compared with 1). Between the classes of 2020 and 2022, the labor market index increased by 19.4% of a standard deviation. Based on column 1 estimates, we would expect this to lead lower rates of college going by about 0.7 percentage points, explaining 28% of the actual 2.4-point decline. But the combination of point estimates in column 2 (δ_1 and δ_2 in Equation 2) suggests that for the three post-COVID cohorts, a one standard-deviation increase in labor market tightness would decrease overall college going by 6.5 percentage points, which could explain 52% of the actual decline for those cohorts.

Post-COVID sensitivity to the labor market appears to have been driven by fewer students enrolling in 2-year schools. Columns 3 - 4 of Table 1 indicate a 1-standard deviation increase in labor tightness would have decreased 2-year college going by 2.1 percentage points typically, but up to 5.3 percentage points in the post-COVID cohorts. This degree of responsiveness to the labor market could could account for 18 - 45% of the 2.3-point decline in 2-year college going between the class of 2020 and class of 2022. Nevertheless, this leaves a lot to be explained by other post-COVID factors not represented in X_{it}, including heterogeneous responses to COVID risks and mitigators, economic insecurity, higher cost of living, and worsening qualitative views toward higher education.

Enrollment into 4-year colleges and universities changed very little after COVID and actually increased between the classes of 2021 and 2022. Since the labor market index remained elevated at this time, column 6 estimates indicate that an increase in labor tightness is associated with a conditionally higher but statistically insignificant change in the post-COVID likelihood of enrollment into 4-year colleges and universities.

3.3 Heterogeneous effects by student subgroup and CTE cluster

Figure 5 plots δ_1 coefficient estimates from Equation 1 for the full sample as well as several subgroups. Estimated declines in college going for a given improvement in the youth labor market are of a similar magnitude for men, women, and both CTE and non-CTE students, although confidence intervals include zero for Black and CTE students. Estimates of δ_1 are highly imprecise for Hispanic students, who represent just 7% of a typical 12th grade cohort.

Point estimates are most negative for those with low/missing ACT scores, and least negative for White students and students with higher ACT scores. High-ACT students enroll in college at much greater rates than others (85.1% versus 43.0%, respectively, for the class of 2019), and it is intuitive that they would be further from the college/work margin than students with lower or missing ACT scores. Nonetheless, high-ACT students are not *un*-responsive to tighter youth labor markets. The point estimate illustrated in Figure 5 suggests that high-ACT students are 1.8 percentage points less likely to enroll in college given a 1-standard deviation improvement in the labor market. A 19.4% shock, like the one seen between the classes of 2020 and 2022, might be expected to decrease college going by 0.4 percentage points for this population, compared with 1.0 percentage point for low/missing-ACT students.

Figure 6 illustrates δ_1 coefficient estimates by CTE cluster (vertical axis), where each cluster's point estimate and confidence interval is plotted against overall college enrollment rates among potential concentrators (horizontal axis). There is not a clear pattern between estimated effects by cluster and expected college going, i.e., it is not the case that clusters with less college going tend to be more sensitive to labor market fluctuations. The only two clusters fitting that pattern might be Hospitality & Tourism Management and Advanced Manufacturing, both of which have college going under 50% and large, statistically imprecise enrollment responses to labor tightness. Both fields may have been particularly sensitive to growing employment opportunities in the post-COVID economy, e.g., in production of supply-limited goods or in low-wage service industries where labor shortages were particularly acute (Dvorkin and Bharadwaj, 2022; U.S. Chamber of Commerce, 2023). But in general, cluster-specific estimates in Figure 6 are too imprecise to draw strong conclusions about the relative contribution of different CTE fields to the overall fall in college enrollment.

Next, Figure 7 plots estimates of $\delta_1 + \delta_2$ from Equation 2, which represents the effect of post-COVID labor tightness on college going. Standard errors and confidence intervals of this coefficient combination are derived by the delta method. The same subgroups exhibiting more overall sensitivity to labor tightness–all but Hispanic, White, and high-ACT students–were also significantly more sensitive to unemployment rates and prior cohort job mobility and earnings after COVID.

3.4 Estimated effects of cluster-level labor tightness on college going

Table 2 reports results from a modification of Equation 1 and 2, where LM_{iksct} is computed at the cohort t, school s, and CTE cluster k level. In these specifications, the EE indicators in LM_{iksct} represent job mobility experienced by the prior $t-1$ cohort from student i's school s, and with the same CTE concentration profile k as student i. Students with no potential CTE concentrations are matched with indicators from prior-cohort, same-school, non-CTE students, and students with multiple potential CTE concentrations are matched with average labor market indicators across their fields.

Identification in this model comes from differences in near-peer labor tightness across CTE concentrations in the same school and cohort, conditional on cluster fixed effects that are included in all results. If the labor market shifted over time in such a way that, for example, a school's Hospitality alumni improved relative to Marketing alumni, we might expect college going to fall more for current Hospitality concentrators than for current Marketing concentrators. This more granular measure of labor market opportunities may have been even more salient to 12th graders, since they may have shared more classes with prior-cohort students in their CTE cluster. More generally, LM_{iksct} at the school-cohort-cluster level may better represent labor demand for i's skillset and their career preparation through CTE. A final advantage of this specification, with school-cohort-cluster labor market indicators and school-cohort fixed effects, is that it allows me to addresses potential omitted variables that affect students attending 12th grade in the same place and time, such as local COVID health risks and the instructional modality of nearby schools. School-by-cohort fixed effects also stand in for variables that might measure local sentiments toward higher education at a point in time, such as political preferences (Fry et al., 2024).

Perhaps because of θ_{st} controls, Table 2 coefficient estimates indicate that students are somewhat less responsive to variation in labor market conditions across clusters in their school and cohort, compared with variation across cohorts from their school. A 1-standard-deviation increase in LM_{iksct} is expected to reduce college going by 2.0 - 2.2 percentage points (columns 1 - 2), versus 3.0 - 3.6 percentage points from an equivalent increase in labor tightness at the broader schoolwide level (columns 1 - 2, Table 1). Also different from Table 1 results, students are about as responsive to personalized labor market indicators on the 4-year college enrollment margin than on the 2-year college enrollment margin (columns 3 - 6). One interpretation is that college or career decisions may be more dependent on the economic outlook across sectors for aspiring 2-year college students, whose transitions between high school and higher education tend to be more counter-cyclical than transitions into 4-year college (National Center for Education Statistics, 2024; Goodman and Winkelmann, 2025).

3.5 Alternate specifications

Table 3 reports results from several modifications of LM_{isct} in Equations 1 and 2. All specifications of LM_{isct} are measured at the school and cohort level.

First, I find that overall college going and 2-year college going is significantly responsive to LM_{isct} derived from EE as experienced by the $t-1$ and $t-2$ cohorts together, even more so than from the $t-1$ cohort alone. A 1-standard-deviation increase in labor market tightness among the prior two cohorts decreases overall college enrollment by 4.4 percentage points, compared with 3.6 percentage points in Table 1. This runs counter to the idea that salience is the primary mechanism explaining my main findings. A student in cohort t is less likely to know students from $t-2$, and less likely to have shared a class with them. But the $t-2$ cohort is still very close in age, experience, and education to cohort t students, and the two-cohort index may smooth out year-to-year noise in job mobility.

In the second set of results in Table 3, I return to the $t-1$ cohort measure of LM_{isct} but remove the Class of 2020 from the analysis. The primary concern with inferring causal effects from δ_1 estimates is that unobserved aspects may have co-moved with student demand for college as well as the labor market. Many such aspects might relate to the early phase of the pandemic, when the job market was improving but health risks and adaptations to the college experience may have kept students away. Although X_{it} controls for local COVID deaths and hospitalizations, it is possible that this fails to capture all shocks from that period. I show in Table 3 that removing the 2019-20 cohort does not change takeaways from Equations 1 - 2. I estimate nearly equivalent effects of labor market dynamics on college going, although coefficients for baseline, pre-COVID LM_{isct} are less precise for 2-year enrollment in this specification.

Main results are derived from labor market indicators that are averaged over four quarters starting just after the traditional high school graduation season and concluding one year later. The depth of the short, mid-year 2020 recession pulled academic-year indicators down to an extent that understated labor market tightness in the fourth and first quarters of the 2020-21 cohort's 12th grade year, when they would have been taking important steps toward enrolling in college. In addition, the April - August period is an especially volatile one for recent high school graduates, in terms of their job mobility and earnings growth. With this in mind, the third alternate specification in Table 3 reports estimated effects of LM_{isct} from prior-cohort, same-school EE measured over September - March of each student's 12th grade year. Enrollment responses are somewhat more sensitive to this measure (particularly regarding two-year college going), but conclusions are not qualitatively different from those reported in Table 1.

Fourth, I estimate responsiveness to LM_{isct} that includes upwardly mobile EE separation rates rather than overall EE. This is in recognition of a high degree of job mobility among recent high school graduates that is not necessarily into higher paying work. The upward EE separation rate in a given quarter is equal to the percent of prior-cohort jobs held by workers who ended an employment spell in the prior quarter and had greater total earnings in the current quarter. Roughly 1-2 out of every 3 EE separations in these data are upward EE separations. I prefer the full EE indicator since the year immediately following high school is a short window to observe movements up the job ladder. Nonetheless, this adapted LM_{isct} results in very similar changes in overall, two-year, and four-year college going, when compared with main results in Table 1.

The fifth set of results in Table 3 rely on a three-part construction of LM_{isct}: county unemployment, prior-cohort EE job mobility, and a measure of the prior cohort's earnings in year t. Higher earnings go hand-in-hand with higher job mobility and including them both may overstate particularly weak or strong job markets. But it is reasonable to think that students react to prior cohorts' job mobility and pay growth. I compute school s, cohort $t-1$'s average number of full-time-equivalent jobs during i's 12th grade year (t). For each worker and each quarter, this indicator is equal to earnings divided by the product of the federal minimum wage ($7.25 throughout almost all of this time period) and 500 hours, and then divided by the worker's number of employers. An individual's number of full-time equivalent jobs rises with earnings, and for a given level of earnings, the measure is smaller for workers with multiple jobs. The multi-job penalty is meant to account for non-wage benefits such as health insurance coverage, retirement, sick leave, and public service loan forgiveness that are conditioned on full-time work. In the aggregate, full-time-equivalent jobs rose sharply after COVID, as shown in Figure 4.

Results in Table 3 indicate that employment and earnings mobility factor into college enrollment decisions, especially for four-year college enrollment. A 1-standard-deviation improvement in the three-part LM_{isct} is expected to decrease four-year enrollment by 2.5 percentage points, versus an imprecise 1.4 percentage points without considering what prior cohorts are earning in the labor market (Table 1 column 5).

The sixth and seventh iterations of Equations 1 - 2 shown in Table 3 offer an interesting contrast to results from the three-part construction of LM_{isct}. There, I show results when LM_{isct} is represented only by county unemployment rates averaged over year t, or only by cohort $t-1$'s EE mobility in year t. College going decisions are largely unresponsive to county unemployment, perhaps because the available data on county unemployment covers workers of all ages rather than entry-level teenagers at the bottom of the job ladder. Employment mobility among near-peers, however, is strongly associated with lower college enrollment, particularly at the two-year college margin.

Looking across results with three-part and one-part constructions of LM_{isc}, and bearing in mind the caveat that a three-part LM_{isct} overstates labor market extremes, it is possible that 12th graders are more attentive to potential earnings when considering four-year college enrollment, and more attentive to employment opportunities when considering two-year college enrollment. Since employment *per se* represents an earnings floor, this would be consistent with the idea that a technical education track through a community college is a safer path to short-term employment, albeit one with lower earnings growth over a career (Hanushek et al., 2017).

4 Discussion

Findings suggest that better workforce opportunities for young workers without college can affect college enrollment, and that the decision to enroll in a 2-year college is particularly sensitive to the labor market. This was the case for Tennessee 12th graders during an extraordinarily tight post-COVID labor market, and also for several cohorts who graduated prior to COVID. The estimated college/work tradeoff can explain 28% of the drop in seamless transitions from 12th grade to college between 2019 and 2022, and perhaps 18% of the drop in 2-year college going. Estimated effects are more potent for groups of Tennessee students with lower baseline levels of college enrollment: Students with low or missing ACT scores, and CTE students in Advanced Manufacturing and Hospitality.

These findings are derived from measures of job mobility that are specific to each student's cohort, school, and in some specifications, their CTE cluster. Same-school, prior-cohort labor market indicators describe job mobility for near-peers and thus may be particularly influential on student decisions and serve as better proxies of labor demand for young workers without college in an area.

Results are conditional on local COVID deaths and hospitalizations, but these are coarse proxies for the health, safety, and institutional factors that Schanzenbach and Turner (2022) and Harris et al. (2024) have shown to be important in college enrollment patterns after COVID, as well as rising cost of living and declining sentiments toward college that may have both co-moved with near-peer labor supply. Post-secondary institutional responses to economic conditions are likewise omitted, and it is possible that college going decisions were influenced by schools' ability to absorb stimulus funds (Dinerstein et al., 2014), cut or recruit faculty (Turner, 2014), or alter ACT/SAT requirements for admission applications. Specifications with school-by-cohort fixed effects help to control for the portion of those factors that are unique to a particular time and place. Labor market responsiveness attenuates somewhat in those models, but nonetheless, results indicate that students are much less likely to enroll in college when the have better employment prospects.

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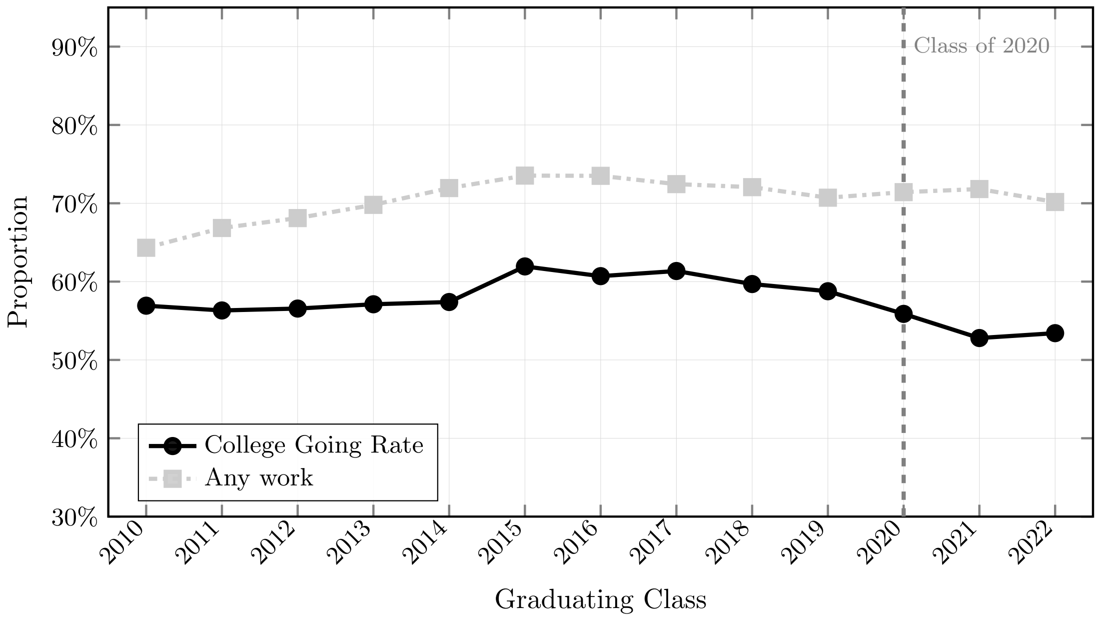
Figures and Tables

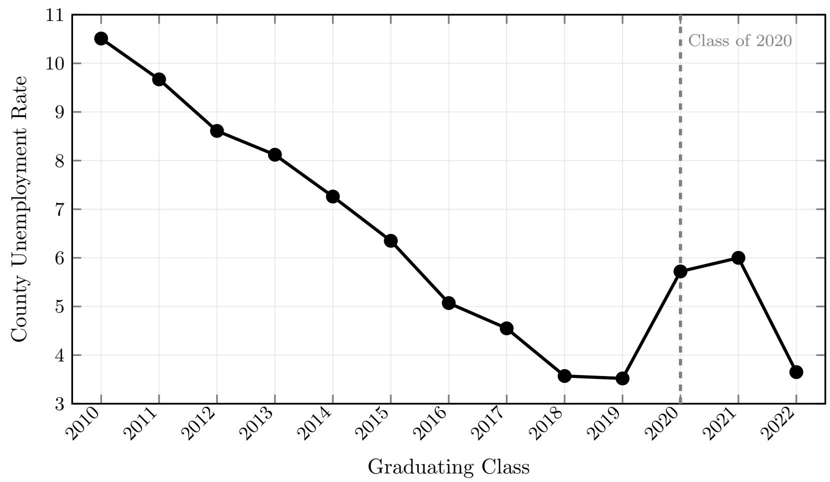
Figure 1. College and work outcomes after high school, by cohort



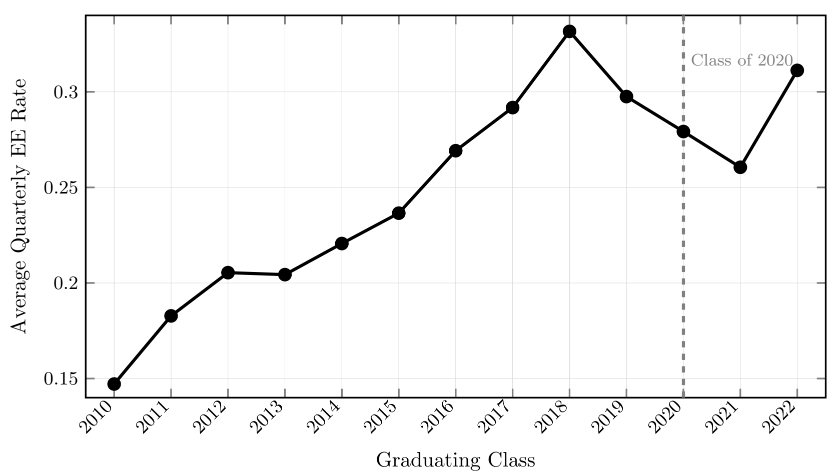
Notes: Author's calculations in TN DATA. The figure plots the percent of each graduating high school class who enrolled in college the year after high school (circles) along with the percent who had any in-state, UI-covered earnings the year after high school (squares).

Figure 2. Employment Indicators, by Cohort

A. County unemployment, year t

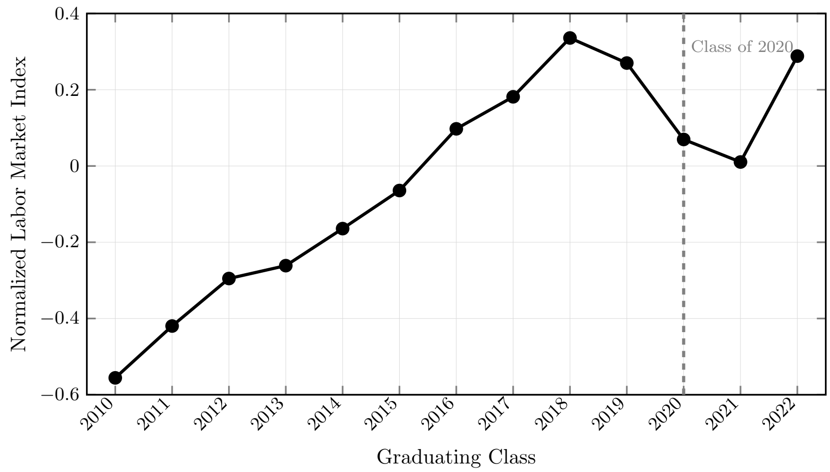


B. Cohort $t-1$ job mobility, year t



Notes: Author's calculations in TN DATA. Panel A plots the unemployment rate in the county where each student attends high school, averaged over their 12th grade academic year t (July through June of the following year). Panel B plots the quarterly EE job mobility rate of the $t-1$ cohort, averaged over July through June of year t.

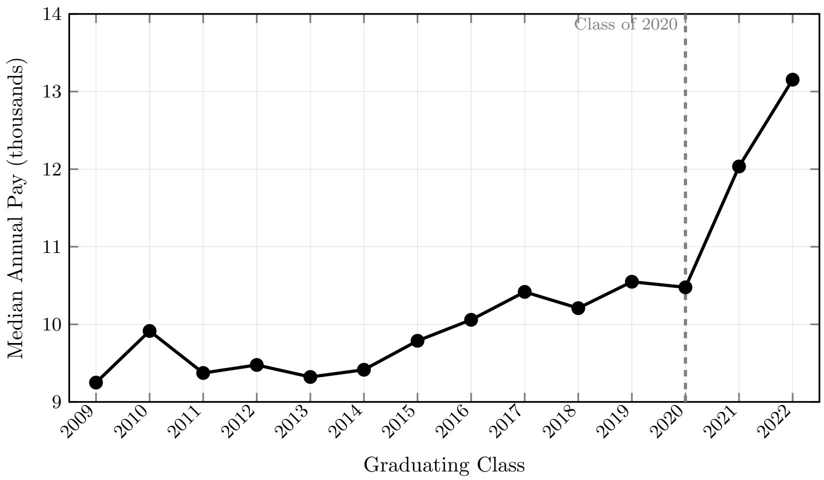
Figure 3. Labor Market Index, by Cohort



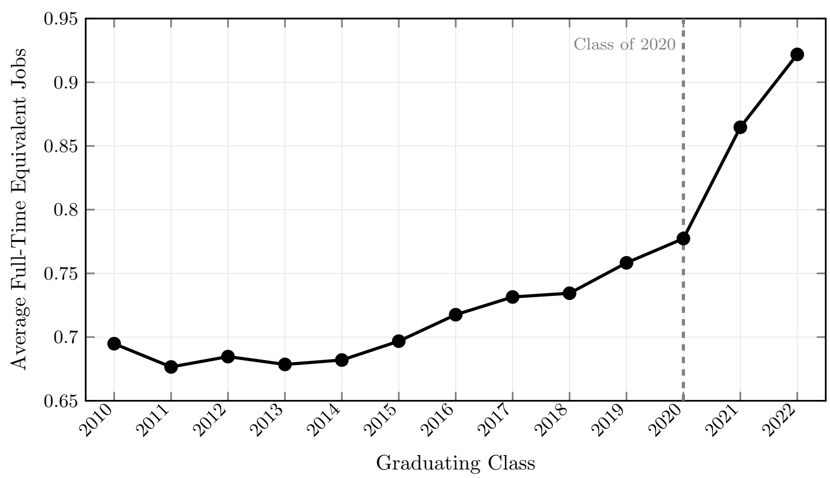
Notes: Author's calculations in TN DATA. The figure plots average LM_{isct} across cohorts. The index is calculated as the average of normalized county unemployment (multiplied by -1) and normalized prior-cohort EE.

Figure 4. Previous Cohort Earnings

A. Cohort $t-1$ median earnings, year t



B. Cohort $t-1$ full-time equivalent jobs, year t



Notes: Author's calculations in TN DATA. The figure plots two measures of prior-cohort student earnings, both measured over the academic year after they were in 12th grade, July through June of the following year. Panel A illustrates median in-state, UI-covered earnings (excluding zeros), and Panel B illustrates full-time equivalent jobs. For each student, the latter is calculated from quarterly earnings divided by the product of minimum wage and 500 hours, and then divided by the number of unique employers.

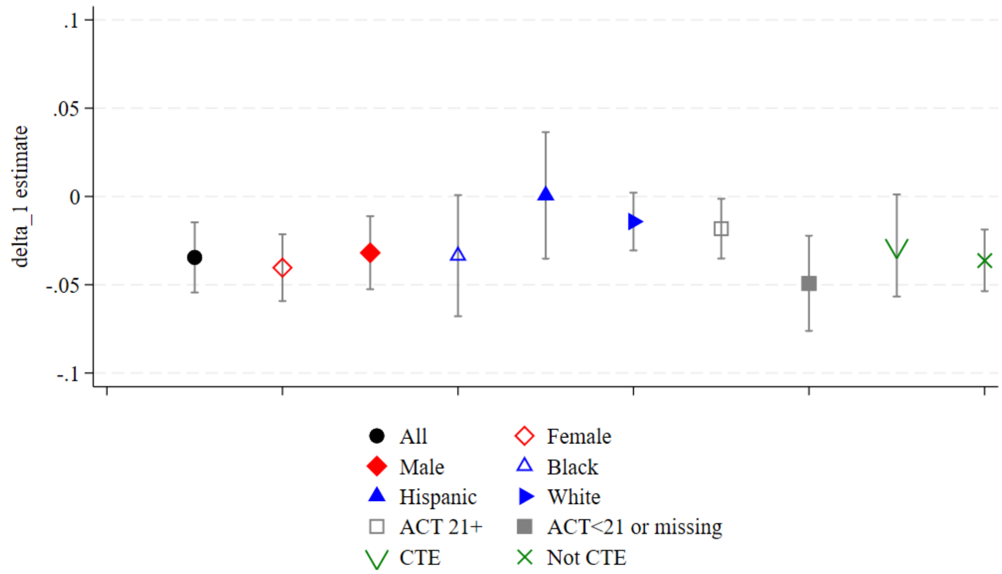
Table 1. Equation 1 and 2 results: Estimated effect of labor tightness on college going

	College enrollment		2-year enrollment		4-year enrollment	
	(1)	(2)	(3)	(4)	(5)	(6)
LM_{isct}	-0.036***	-0.030***	-0.021**	-0.015*	-0.014*	-0.016*
	(0.009)	(0.009)	(0.008)	(0.007)	(0.007)	(0.007)
$LM_{isct} * PostCOVID_t$		-0.035**		-0.038***		0.013
		(0.013)		(0.010)		(0.011)
Students	883,293	883,293	883,293	883,293	883,293	883,293

Notes: Author's calculations in TN DATA. Standard errors in parentheses allow for clustering within schools.

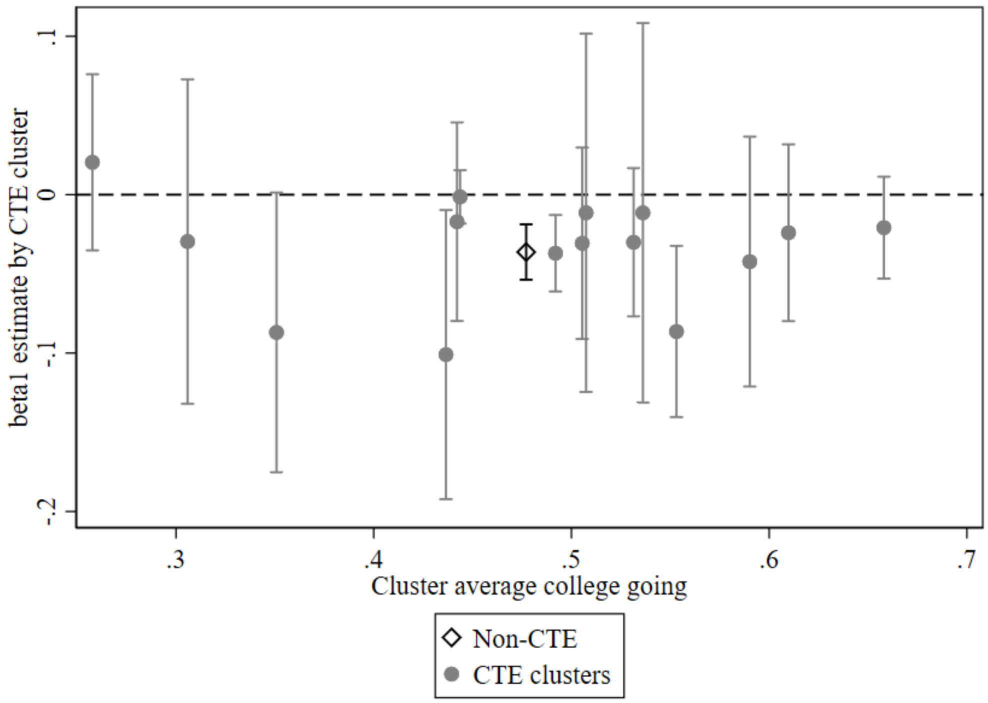
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 5. Estimated effect of labor tightness on college going, by subgroup



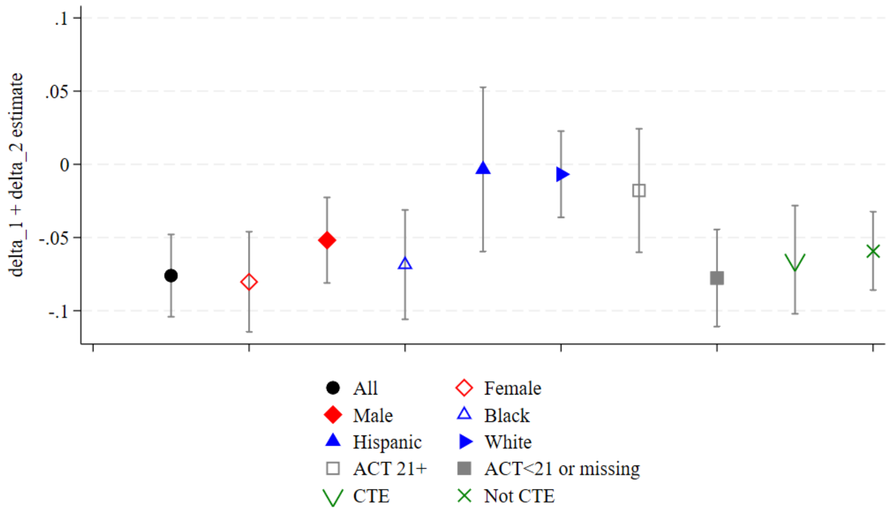
Notes: Author's calculations in TN DATA. The figure plots Equation 1 estimates of δ_1, overall and by subgroup. 95% confidence intervals are derived from standard errors that allow for clustering within schools.

Figure 6. Estimated effect of labor tightness on college going, by CTE cluster



Notes: Author's calculations in TN DATA. The figure plots Equation 1 estimates of δ_1 by CTE cluster and for non-CTE students. 95% confidence intervals are derived from standard errors that allow for clustering within schools.

Figure 7. Estimated effect of post-COVID labor tightness on college going, by subgroup



Notes: Author's calculations in TN DATA. The figure plots Equation 2 estimates of $\delta_1 + \delta_2$, overall and by subgroup. 95% confidence intervals are derived from delta-method standard errors that allow for clustering within schools.

Table 2. Equation 1 and 2 results: Estimated effect of cluster level labor tightness on college going, with school-by-cohort fixed effects

	College enrollment		2-year enrollment		4-year enrollment	
	(1)	(2)	(3)	(4)	(5)	(6)
LM_{iksct}	-0.022***	-0.020***	-0.014***	-0.010*	-0.011***	-0.012***
	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
$LM_{iksct} * PostCOVID_t$		-0.010		-0.012		0.004
		(0.008)		(0.007)		(0.007)
N	878,558	878,558	878,558	878,558	878,558	878,558

Notes: Author's calculations in TN DATA. Standard errors in parentheses allow for clustering within schools. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3. Equation 1 and 2 results: Alternate specifications

	College enrollment		2-year enrollment		4-year enrollment	
	(1)	(2)	(3)	(4)	(5)	(6)
$t-1$ and $t-2$ cohort indicators						
LM_{isct}	-0.044**	-0.036*	-0.034*	-0.026*	-0.012	-0.013
	(0.016)	(0.016)	(0.013)	(0.013)	(0.007)	(0.008)
$LM_{isct} * PostCOVID_t$		-0.042***		-0.040***		0.006
		(0.012)		(0.009)		(0.009)
Without Class of 2020						
LM_{isct}	-0.035***	-0.032***	-0.020*	-0.015	-0.015*	-0.018*
	(0.010)	(0.009)	(0.008)	(0.007)	(0.007)	(0.007)
$LM_{isct} * PostCOVID_t$		-0.029		-0.042***		0.027*
		(0.015)		(0.012)		(0.013)
With only 4th and 1st quarter indicators						
LM_{isct}	-0.026**	-0.023**	-0.011	-0.006	-0.014*	-0.017*
	(0.008)	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)
$LM_{isct} * PostCOVID_t$		-0.025		-0.034**		0.020
		(0.014)		(0.012)		(0.014)
With upwardly mobile EE						
LM_{isct}	-0.035***	-0.029***	-0.024**	-0.017*	-0.011	-0.014*
	(0.008)	(0.008)	(0.008)	(0.008)	(0.006)	(0.007)
$LM_{isct} * PostCOVID_t$		-0.033*		-0.039***		0.016
		(0.014)		(0.011)		(0.012)
With three-part LM_{isct}: unemployment, job mobility, and earnings mobility						
LM_{iksct}	-0.047***	-0.043***	-0.021**	-0.013	-0.025***	-0.033***
	(0.008)	(0.009)	(0.008)	(0.008)	(0.007)	(0.007)
$LM_{iksct} * PostCOVID_t$		-0.011		-0.027**		0.029**
		(0.009)		(0.009)		(0.010)
With one-part LM_{isct}: county unemployment						
$-1*$ County Unemp.	0.015	0.005	0.019*	0.012	-0.005	-0.008
	(0.009)	(0.010)	(0.010)	(0.011)	(0.008)	(0.009)
$-1*$ County Unemp		0.043**		0.032*		0.014
$*PostCOVID_t$		(0.013)		(0.013)		(0.014)
With one-part LM_{isct}: Cohort $t-1$ job mobility						
Cohort $t-1$ EE	-0.024***	-0.019**	-0.016**	-0.011*	-0.008*	-0.009*
	(0.007)	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)
Cohort $t-1$ EE		-0.024***		-0.024***		0.005
$*PostCOVID_t$		(0.006)		(0.005)		(0.005)

Notes: Author's calculations in TN DATA. Standard errors in parentheses allow for clustering within schools.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$