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Empowering Futures: Examining the Relationship Between High School Career and Technical Education and College Enrollment in Bexar County

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Research Brief Summary

This brief investigates the impact of high school Career and Technical Education (CTE) coursetaking on immediate college enrollment for students graduating from public high schools in Bexar County in the 2019 and 2021 school years. The findings indicate that, in both cohorts, higher levels of CTE participation, such as CTE-Concentrators and CTE-Explorers, showed a higher likelihood of enrolling in two- and four-year colleges than students who did not take any CTE courses. However, the 2019 cohort revealed more elasticity in the predicted probability across CTE participation levels than 2021 cohort, highlighting the likely influence of dynamic labor market conditions on student college enrollment decisions.

More specifically, the 2019 cohort faced a challenging labor market due to COVID-19, while the 2021 cohort experienced a more favorable environment, contributing to decreased unemployment rates. When unemployment rates were elevated, students likely perceived finding jobs as difficult, potentially motivating them to pursue postsecondary education until the labor market improved. Conversely, in times of a thriving local economy, graduating students may have been more inclined to take up employment opportunities, thereby facilitating a smoother transition into the workforce rather than opting for further education. These results elucidate the relative effects of CTE on postsecondary education, particularly in four-year college enrollment, showing a more pronounced role when economic conditions are favorable than during economic downturns.

Shifting Paradigms: Vocational Education in the Changing Landscape of the Past

Career and Technical Education (CTE) has evolved over time, previously known by various names such as industrial education, career education, and vocational education (Gordon, 2014). Initially designed for unmotivated or at-risk high school students, early vocational education programs focused on providing career-oriented experiences and skills for workforce readiness (Ainsworth & Roscigno, 2005; Dougherty & Lombardi, 2016). However, the shift in the U.S. industrial structure during the 1970s and 1980s created more opportunities in knowledge-intensive and service-oriented sectors, leading to a decline in jobs requiring physical or manual skills that vocational graduates traditionally pursued (Castellano et al., 2003; Plunkert, 1990).

This change resulted in a significant decrease in vocational education enrollment (Levesque et al., 2000). Studies suggested that the decline was due to schools not meeting the contemporary labor market's needs, such as providing higher-order thinking skills and technology training for current and emerging careers (Castellano et al., 2003). Gordon (2014) argued that vocational education had overly emphasized a practical aspect of education for the workforce, and this led to the separation of vocational education from all other academic curricula that would

forgo vocational students' opportunity to develop proper academic skills demanded during the period of rapid economic growth.

National efforts to reform vocational education intensified after the passage of the Carl D. Perkins Vocational and Applied Technology Education Act in 1990 (Perkins II) (Bozick & Dalton, 2013). This legislation marked a pivotal moment by integrating vocational education into the academic curriculum, providing technical skills for the workforce, and incorporating academic rigor to prepare students for higher education (Castellano et al., 2003). The Perkins II was reauthorized in the School-to-Work Opportunities Act in 1994 and Perkins III in 1998 to continue the 1990 Act's focus on curriculum integration and secondary-postsecondary linkages. It then was renamed as Carl D. Perkins Career and Technical Education Improvement Act in 2006 (Perkins IV) as the term "vocational education" was retired (Bozick & Dalton, 2013; Dougherty & Lombardi, 2016). The most recent legislation, the Strengthening Career and Technical Education for the 21st Century Act (Perkins V), signed into law in 2018, retains the main structure of Perkins IV while allowing greater flexibility for states and local education agencies in administering CTE programs.

Trends in High School CTE Programs in Texas

In Texas, the number of Career and Technical Education (CTE) participants witnessed a significant 84.1% increase, growing from 973,787 students in 2007/08 to 1,792,279 students in 2021/22 (Perkins Collaborative Resource Network [PCRN], n.d.). Over the past decade, there has been a consistent rise in the proportion of economically disadvantaged students among CTE participants. In 2021/22, more than half of CTE participants (57.1%) fell into this category, compared to one-third in 2007/08. In the most recent academic year (2021/22), approximately 51.9% of CTE participants were male. Regarding race and ethnicity, the top four groups among secondary CTE participants in 2021/22 were Hispanic/Latino (52.86%), White (26.95%), Black or African American (12.62%), and Asian (4.63%).

Focusing specifically on CTE concentrators in the same academic year, the top four race/ethnicity groups were similar, with Hispanic/Latino comprising 51.50%, White at 29.34%, Black or African American at 11.18%, and Asian at 5.26%.[1] Additionally, among secondary CTE concentrators, the predominant special population groups included individuals from economically disadvantaged families (53.18%), individuals preparing for non-traditional fields (19.43%), English learners (11.36%), and individuals with disabilities (ESEA/IDEA) (8.73%).

CTE programs offer 16 career clusters, and the high school is required to offer at least three career clusters. These 16 career clusters include (a) health science; (b) business, management, and administration; (c) marketing, sales, and service; (d) finance; (e) information technology; (f) science, technology, engineering, and mathematics (STEM); (g) manufacturing; (h) transportation, distribution, and logistics; (i) hospitality and tourism; (j) government and public administration; (k) law, public safety, and security; (l) agriculture, food, and natural resources; (m) human services; (n) architecture and construction; (o) education and training; (p) arts, audio-visual technology and communication. Health science emerged as the most favored career cluster statewide, with 22.9% of students concentrating in this field. It was closely followed by STEM (17.1%), agriculture, food, and natural resources (16.4%), and finance (14.2%) (PCRN, n.d.).

[1] CTE concentrators represent students who complete at least two course credits in a single career cluster.

Review of Evidence in Existing Literature

To date, most of the research on Career and Technical Education (CTE) has focused on its economic advantages. Numerous studies have demonstrated that students engaged in CTE programs generally entered the workforce and earned higher wages post-high school compared to their non-participating counterparts (e.g., Bishop & Mane, 2004; Kemple & Willner, 2008; Neumark & Rothstein, 2006; Page, 2012). While most studies emphasize the economic impact, only a limited number have explored the influence of CTE courses on students' transition from high school to college, yielding inconclusive findings.

For example, Giani (2019) revealed a positive association between completing a CTE concentration and college attendance, with effects varying by areas of concentration. Conversely, Ainsworth and Roscigno (2005) found that CTE participants exhibited a reduced likelihood of attending a four-year college. Neumark and Rothstein (2006) demonstrated that school enterprise school-to-career (STC) programs increased the likelihood of participants obtaining some college education, whereas Tech-Prep decreased the probability of college attendance. Additionally, Kemple and Willner (2008) argued that participation in Career Academies had positive and sustained impacts on labor market outcomes but did not influence college enrollment and completion. These diverse outcomes are unsurprising given the heterogeneity in program policies, regions, time periods, and the diverse student populations served.

Purpose of the Study

In this research brief, I examine the effect of high school CTE coursetaking on immediate college enrollment for students graduating from public high schools in Bexar County in the 2019 and 2021 school years. The 2019 cohort represents students who faced a challenging labor market marked by increased unemployment rates, while the 2021 cohort represents students who experienced economic growth with a decrease in unemployment rates, accompanied by increased wages.[2]

This study classifies CTE participation into four levels: (a) CTE-Concentrators, who complete at least two course credits in a single career cluster; (b) CTE-Explorers, who complete at least two course credits but not in a single career cluster; (c) CTE-Participants, who complete a CTE course without being a CTE-Concentrator or CTE-Explorer; and (d) Not-CTE, representing students who did not complete any high school CTE course.

Contributions to the Literature

The diversity in Career and Technical Education (CTE) programs across states, time, and students poses challenges to the external validity of findings (Malkus, 2019). Studies indicate that CTE programs with well-defined pathways, aligned academic subjects, and supportive services yield greater benefits, but implementing such high-quality programs in conventional high schools, where most students take CTE classes, is often impractical (Malkus, 2019; Kim et al., 2021). Lastly, most existing studies provided limited evidence of CTE effects by treating CTE as a binary variable–CTE concentrators and non-concentrators–and comparing educational and labor market outcomes between these two groups. Classifying all students into two groups has the advantages of simplifying the statistical analysis and straightforward interpretation of the results. However, such dichotomizing may lead to underestimating the extent of return to CTE course-taking because considerable variability may be subsumed within each group.

[2] To investigate how CTE would affect students' college enrollment based on unique economic patterns in Bexar County, I deliberately selected graduates from the years 2019 and 2021.

McDermott (2011) stated that "external validity results primarily from replication of particular experiments across diverse populations and different settings, using a variety of methods and measures" (p.34). Our research provides further empirical evidence of Career and Technical Education (CTE) for a distinct student population in Bexar County who faced dynamic labor market conditions upon graduating from high school because of the COVID-19 pandemic. Our findings support the need to expand the external validity of existing CTE research in order to better understand its impact on diverse communities.

Data and Method

This brief uses multiple datasets from the State Longitudinal Data System (SLDS), operated by the Texas Education Research Center (ERC) at the University of Texas at Austin. The analysis includes high school graduates from public schools in Bexar County in the school years 2019 and 2021. In addition, as our explanatory variables encompass students' educational progress in high school, I narrow our study population to those who entered public high school in the 9th grade. I analyze a total of 16,617 and 16,333 public high school graduates in the school years 2019 and 2021, respectively.

The dependent variable has three categories: (a) enrolling in a four-year college, (b) enrolling in a two-year college, and (c) not enrolling in a college. Students who enrolled in both two- and four-year colleges are recorded as four-year college enrollment. Key independent variables comprise four levels of CTE participation: (a) CTE-Concentrators, (b) CTE-Explorers, (c) CTE-Participants, and (d) Not-CTE (reference category).

Academic achievement for students is represented by a composite scale derived from the State of Texas Assessments of Academic Readiness (STAAR) performance, encompassing five tests taken during high school. This scale is constructed using standardized test values of Algebra I, Biology, English I and II, and U.S. history. I calculate the mean of these test performance measures to create a composite STAAR achievement variable with strong reliability (with Cronbach's alpha values above 0.91) and subsequently express it in percentile form.

In addition to the variables mentioned above, I include three sets of control variables in our analysis: student characteristics include student age at high school graduation, gender, race and ethnicity, receipt of free- or reduced-price lunch (FRPL) or eligibility for other public assistance, receipt of special education, and participation in gifted and talented programs during high school. I also include high school attendance rates, at-risk of high school dropout designation, and involvement in disciplinary actions, such as expulsion and suspension reports.

Coursework encompasses course credits earned in high school, it includes credits from Advanced Placement (AP) and International Baccalaureate (IB), Dual Credit (DC), Career and Technical Education (CTE), DC-CTE, and advanced courses (as defined by the TEA). Additionally, I consider course credits from English, mathematics, science, social studies, and foreign language courses, excluding the aforementioned categories. Lastly, high school dummy variables are included in our prediction model to account for other high school effects not captured by those high school variables on students' postsecondary education decisions. A detailed description of these variables and their summary statistics are listed in Appendix A.

The multinomial logistic (MNL) model is utilized to predict the likelihood of students' enrollment in four-year college, two-year college, and no college. For identification of the model, one alternative needs to be a reference, "no college" in our study, and its vector of parameters is normalized to zero. Therefore, the MNL model yields a parameter interpreted as the effect of the corresponding variable on the log of the probability of choosing two-year or four-year college relative to the probability of choosing "no college," which is the reference choice.

Results

In the 2019 graduating class, 39.5% were CTE-Concentrators, 29.1% were CTE-Explorers, and 25.3% were CTE-Participants. Only 6.1% of students did not take any CTE courses in high school. The data shows that 60% of high school graduates enrolled in college immediately, with half choosing two-year institutions and the other half selecting four-year ones. The remaining 40% of graduates chose not to pursue postsecondary education. On the other hand, I observe different patterns in the 2021 cohort, where students exhibited higher rates of CTE participation but lower rates of college enrollment compared to the 2019 cohort. Specifically, CTE-Concentrators comprised 42.7%, CTE-Explorers comprised 28.5%, and CTE-Participants comprised 23.2%, while 5.6% of students did not take any CTE courses in high school. Furthermore, over half of the students (57.8%) decided not to pursue postsecondary education upon high school graduation. Among those who did, 20.6% enrolled in two-year colleges and 21.6% enrolled in four-year colleges.

Table 1 presents legitimate coefficients, robust standard errors clustered at the high school level, and odds ratios (OR) derived from multinomial logistic regression analyses predicting the probability of enrolling in various types of postsecondary education upon high school graduation. For the 2019 cohort, the findings indicate that CTE-Explorers and CTE-Concentrators had 29.3% and 50.8% higher relative probabilities, respectively, of enrolling in two-year colleges over not enrolling in college compared to the reference group, Not-CTE students. Also, notable differences in the relative probabilities of choosing a four-year college over no college emerged across different levels of CTE participation, particularly with CTE-Concentrators and CTE-Explorers indicating 86.8% and 45.4% increased relative probabilities compared to Not-CTE students.

Table 1. Multinomial logistic regression results of students' college enrollment upon high school graduation

	2019 Cohort		2021 Cohort	
	Enrolling in a Two-Year College	Enrolling in a Four-Year College	Enrolling in a Two-Year College	Enrolling in a Four-Year College
CTE Participants	0.124	0.254**	0.314***	0.214*
	(0.102)	(0.121)	(0.111)	(0.113)
	[1.131]	[1.289]	[1.369]	[1.238]
CTE Explorers	0.257**	0.375**	0.524***	0.325***
	(0.112)	(0.163)	(0.086)	(0.126)
	[1.293]	[1.454]	[1.688]	[1.384]
CTE Concentrators	0.411***	0.625***	0.634***	0.430**
	(0.118)	(0.199)	(0.095)	(0.175)
	[1.508]	[1.868]	[1.885]	[1.537]
Loglikelihood	-14403.299		-13593.264	
Pseudo R^2	0.196		0.151	
Observations	16,435		16,333	

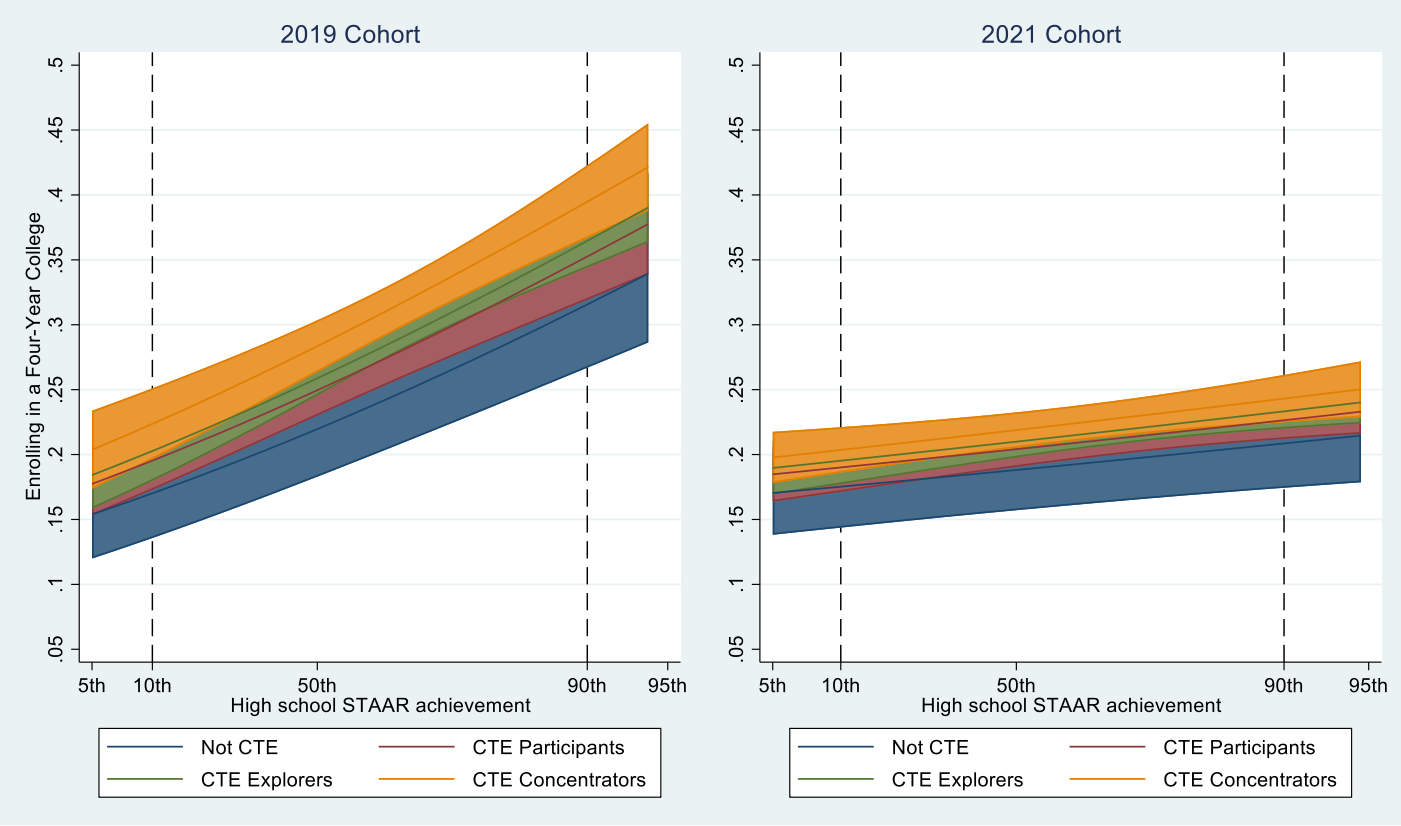
Notes. The table reports legitimate coefficients, robust standard errors clustered at the high school level in parentheses, and odds ratios in brackets. A multinomial logistic model is used to predict students' college enrollment immediately after high school graduation as a function of different levels of CTE participation, STAAR achievement, student characteristics, coursework, and high school dummies. See Appendix B for the full regression outputs.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Conversely, for the 2021 cohort, CTE effects were more pronounced on two-year college enrollment than on four-year college enrollment. Notably, CTE-Concentrators and CTE-Explorers exhibited higher relative probabilities of enrolling in two-year colleges over no college, compared to Not-CTE students, and the magnitudes of these ratios were greater than those found in the 2019 cohort. In addition, unlike the analysis results from the 2019 cohort, the coefficient for CTE-Participants for the 2021 cohort is significant, indicating a 36.9% higher relative probability of enrolling in two-year colleges over no college than the reference group students who did not take any CTE courses. Moreover, CTE-Concentrators and CTE-Explorers exhibited 5.7% and 38.4% higher relative probabilities, respectively, of enrolling in four-year colleges over no college in comparison to the one of Not-CTE students, however these effect sizes, OR, were substantially lower than those observed in the 2019 cohort.

Both cohorts displayed an increasing likelihood pattern of enrolling in four-year colleges as their STAAR achievement increased. This indicates that students with higher STAAR achievement were more likely to pursue four-year college degrees. However, the 2019 cohort exhibited more elasticity in the predicted probability of four-year college enrollment across levels of CTE participation compared to the 2021 cohort (Figure 1). Additionally, I observed a decrease in the predicted probability of two-year college enrollment with an increase in STAAR achievement, as shown in Figure 2. This reflects the expectation that students with higher STAAR achievement would be more inclined to opt for four-year colleges over two-year colleges.

Figure 1. Prediction of four-year college enrollment by levels of CTE participation for 2019 and 2021 cohorts



While CTE-Concentrators and CTE-Explorers exhibited higher college enrollment rates compared to Not-CTE students in both cohorts, students who graduated in 2021 appeared to have less responsiveness to changes in academic performance. For instance, when examining students positioned at a lower academic level (such as those at the 5th percentile of the distribution), I observe comparable probabilities of four-year college enrollment, ranging from 15% to 20%, in both cohorts. In contrast, significant differences in the likelihood of two-year college enrollment

are apparent for these students (Figure 2). The 2019 cohort students at the 5th percentile of the distribution had a two-year college enrollment probability that was at least 20 percentage points higher than that of the 2021 cohort. This difference is even more noticeable in Figure 3, which demonstrates a substantially higher likelihood of students not pursuing postsecondary education in 2021.

Figure 2. Prediction of two-year college enrollment by levels of CTE participation for 2019 and 2021 cohorts

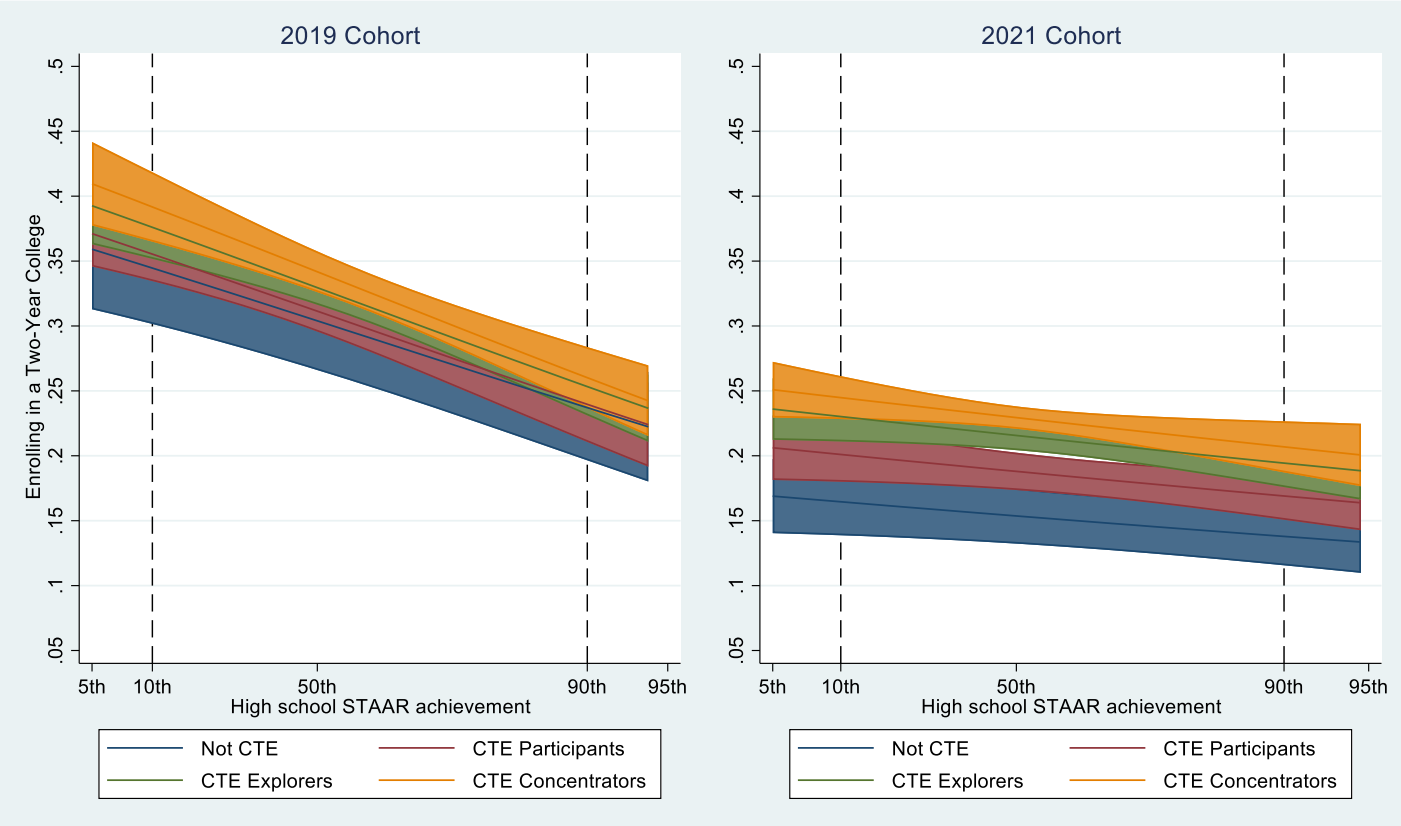
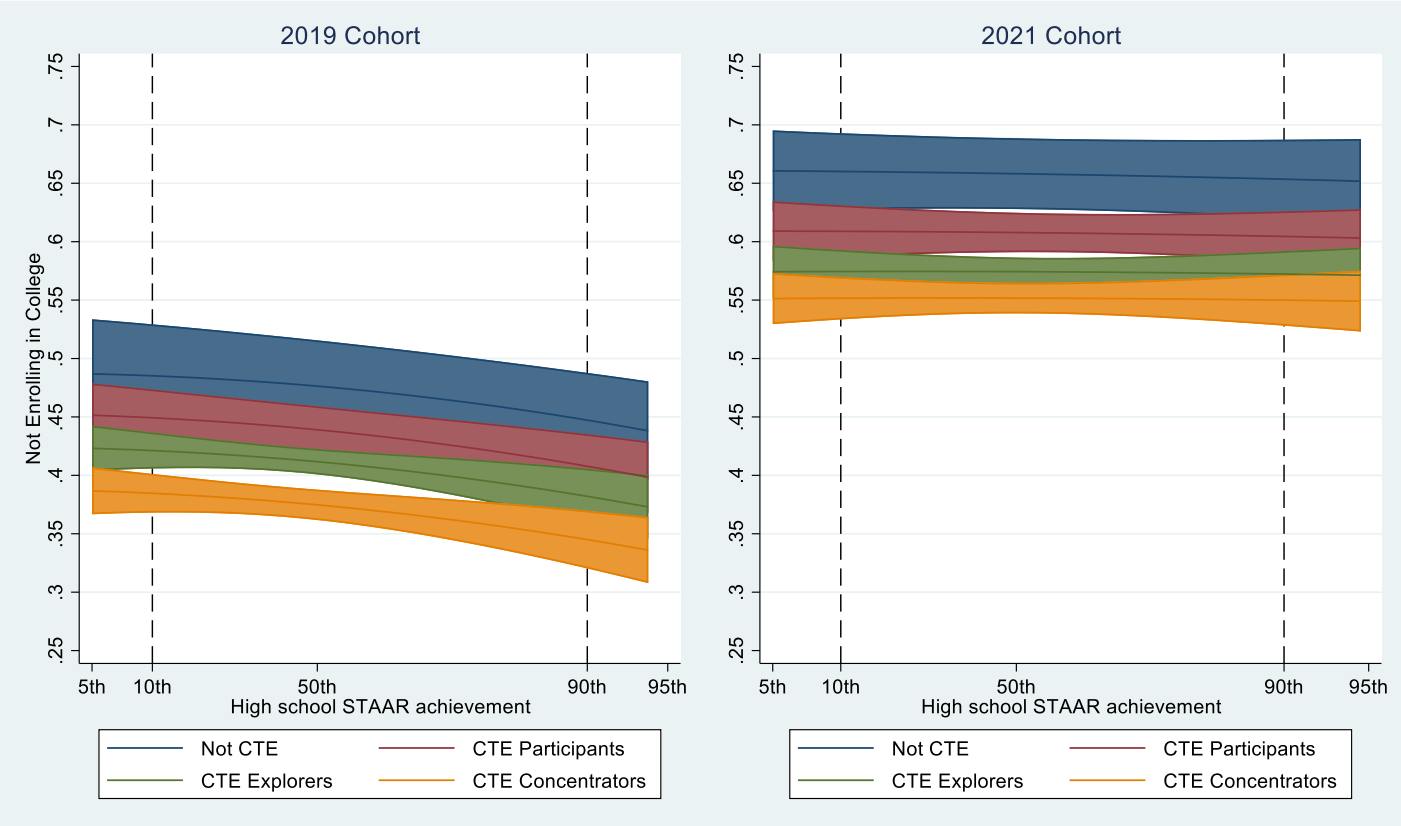


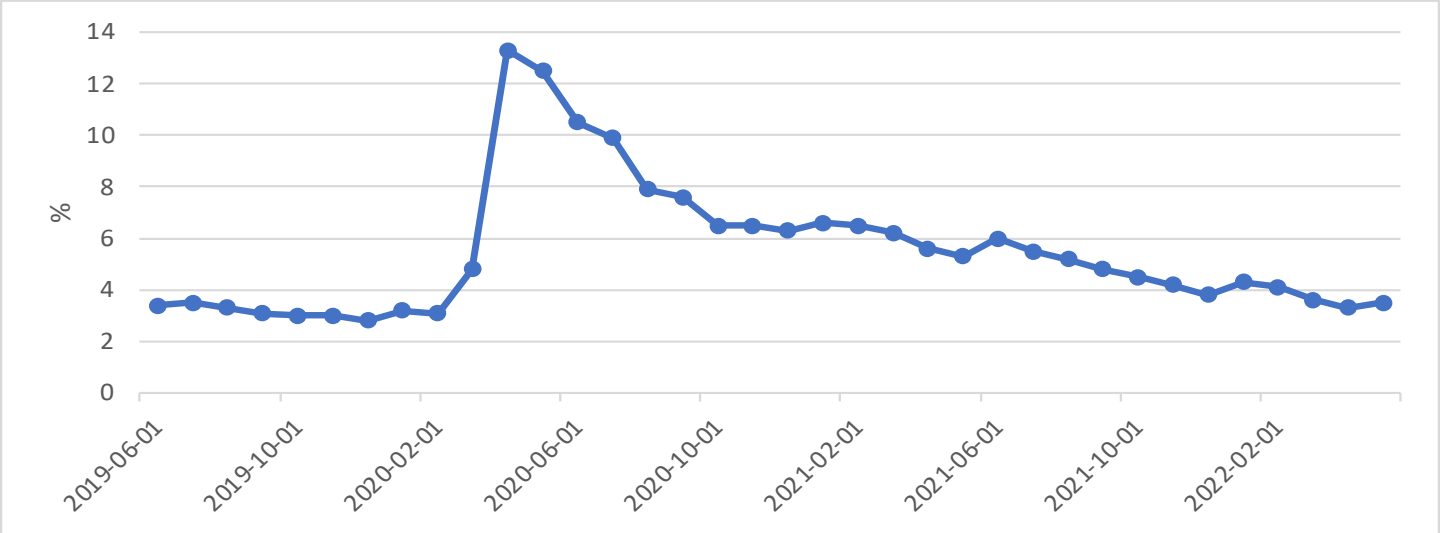
Figure 3. Prediction of no-college enrollment by levels of CTE participation for 2019 and 2021 cohorts



Discussion

I speculate that the study results appear to be intricately linked to the dynamic economic circumstances that students faced upon graduating from high school. A critical factor influencing their decisions seems to be the prevailing unemployment rates at the time of graduation. When unemployment rates were elevated, students likely perceived finding jobs as difficult, potentially motivating them to pursue postsecondary education until the labor market improved. Conversely, in times of a thriving local economy, graduating students may have been more inclined to take up employment opportunities, thereby facilitating a smoother transition into the workforce rather than opting for further education. The cohort that graduated from high school in 2019 encountered a particularly challenging local labor market, primarily due to the advent of the COVID-19 pandemic. News articles and media reports extensively covered the consequences of lockdowns, quarantines, limited mobility, and restricted gatherings. The challenging circumstances of early 2020 led to a significant rise in unemployment rates, which surged to 13.3%. However, the situation has improved for recent graduates in 2021, as there has been an increase in demand for labor in the County (Figure 4).

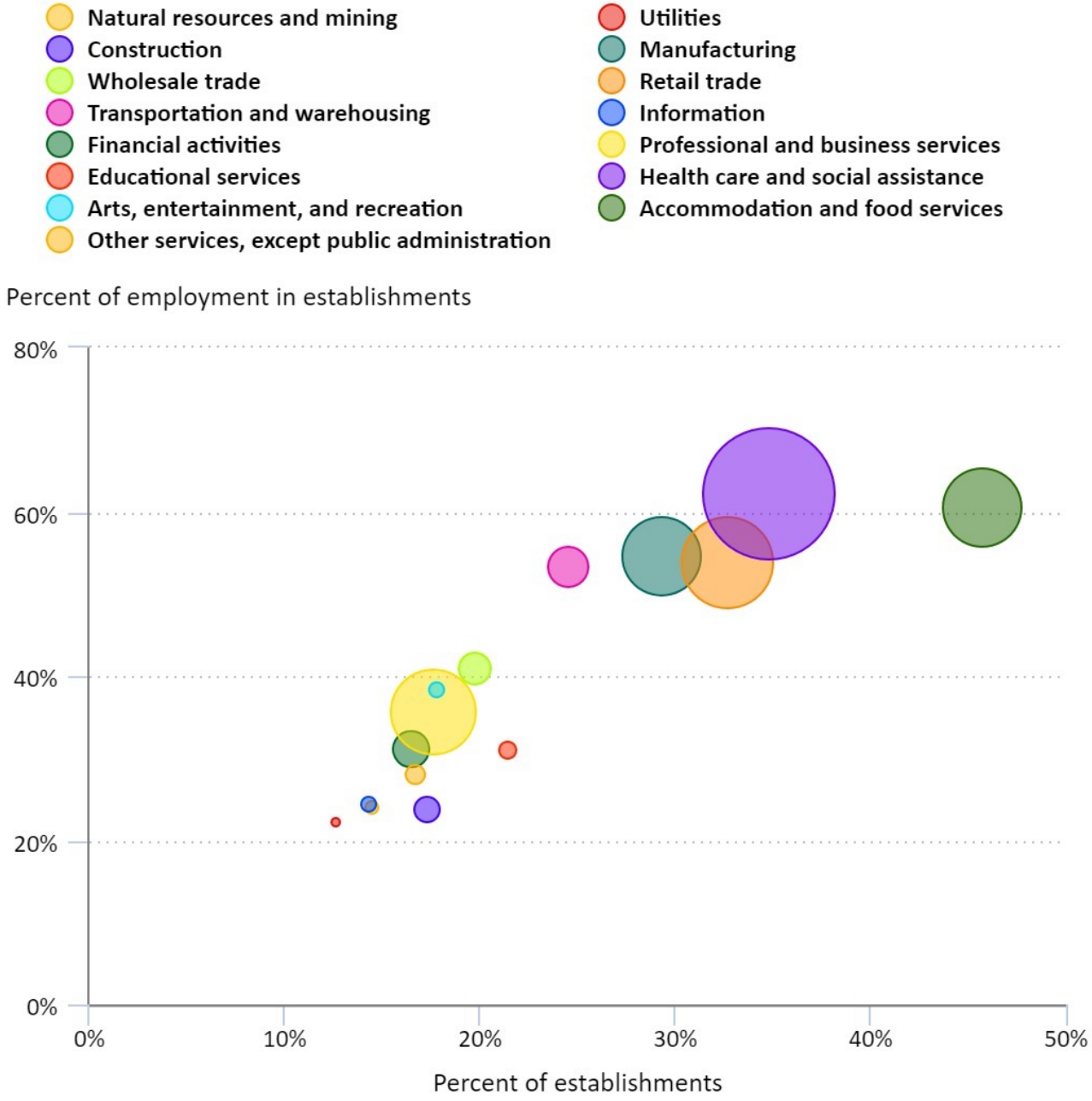
Figure 4. Unemployment rates in Bexar County



Source. U.S. Bureau of Labor Statistics (2023).

Furthermore, Figure 5 illustrates that the industries with the highest percentages of establishments increasing wages and salaries, paying wage premiums, or providing bonuses include accommodation and food services (45.8%), health care and social assistance (34.8%), retail trade (32.7%), manufacturing (29.4%), and transportation and warehousing (24.6%). Notably, these industries represent the types of jobs that high school graduates are more likely to secure after graduation. The notable increase in demand for jobs and wage premium within these sectors may serve as a strong motivator for high school graduates to actively seek employment rather than pursuing postsecondary education. These results elucidate the relative effects of CTE on postsecondary education, particularly in four-year college enrollment, showing a more pronounced role when economic conditions are favorable than during economic downturns.

Figure 5. Establishments that increased pay or paid bonuses due to the COVID-19 pandemic



Source. U.S. Bureau of Labor Statistics (2022).

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Acknowledgments

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UEI Mission

The mission of UEI is to provide equity-focused and impactful research, evaluation, and training in collaboration with community-based research-practice-policy partnerships on issues that inform and influence educational and workforce-related policies, experiences, and outcomes.

Appendix

Appendix A.

A.1. Description of variables

	Description of Variable
Dependent variable	
College enrollment	3 if enrolling in a four-year college; 2 if enrolling in a two-year college; 1 if not enrolling in a college.
Exploratory variable	
CTE participation	
Concentrators	1 if a student completes at least two course credits in a single career cluster; 0 if otherwise
Explorers	1 if a student completes at least two course credits but not in a single career cluster; 0 if otherwise
Participants	1 if a student completes a CTE course without being a CTE-Concentrator or CTE-Explorer; 0 if otherwise
Not-CTE	1 if a student did not take any CTE courses; 0 if otherwise
Student achievement	
STAAR achievement	This is a composite scale variable derived from the State of Texas Assessments of Academic Readiness (STAAR) performance, encompassing five tests taken during high school (Algebra I, Biology, English I and II, and U.S. history).
Student characteristics	
Female	1 if a student is female; 0 if male
African American	1 if a student is African American; 0 if otherwise
Hispanic	1 if a student is Hispanic; 0 if otherwise
Other non-White races	1 if a student has other non-White races; 0 if otherwise
No FRPL	1 if a student neither received a free- or reduced-price lunch nor was eligible for other public assistance in the graduating year; 0 if otherwise
At risk	1 if a student was designed as at risk of dropout in the graduating year; 0 if otherwise
Age	Student age at graduation
Special education	1 if a student received special education in high school; 0 if otherwise
Gifted	1 if a student participated in gifted and talented programs in high school; 0 if otherwise
Attendance rates	Student average attendance rates in high school
Disciplinary action	1 if a student received a disciplinary action report in high school; 0 if otherwise

Coursework	
AP credits earned	The total number of credits earned from Advanced Placement (AP) courses
IB credits earned	The total number of credits earned from International Baccalaureate (IB) courses
DC credits earned	The total number of credits earned from dual credit (DC) courses
Advanced credits earned	The total number of credits earned from advanced courses (defined by Texas Education Agency)
English credits earned	The total number of credits earned from non-AP, non-IB, non-DC, and non-advanced English courses.
Math credits earned	The total number of credits earned from non-AP, non-IB, non-DC, and non-advanced mathematics courses
Science credits earned	The total number of credits earned from non-AP, non-IB, non-DC, and non-advanced science courses
Social studies credits earned	The total number of credits earned from non-AP, non-IB, non-DC, and non-advanced social studies courses
Foreign language credits earned	The total number of credits earned from non-AP, non-IB, non-DC, and non-advanced foreign language courses
Other course credits earned	The total number of credits earned from all other courses

A.2. Descriptive statistics of explanatory variables by the college enrollment status

	2019 Cohort			2021 Cohort		
	No College	Two-Year College	Four-Year College	No College	Two-Year College	Four-Year College
	(1)	(2)	(3)	(4)	(5)	(6)
CTE participation						
Concentrators	0.369	0.439	0.383	0.411	0.481	0.417
	(0.43)	(0.496)	(0.486)	(0.492)	(0.500)	(0.493)
Explorers	0.327	0.292	0.241	0.302	0.285	0.239
	(0.469)	(0.455)	(0.428)	(0.459)	(0.451)	(0.426)
Participants	0.254	0.219	0.289	0.234	0.196	0.261
	(0.435)	(0.413)	(0.453)	(0.424)	(0.397)	(0.439)
Not-CTE	0.050	0.049	0.087	0.053	0.038	0.083
(reference category)	(0.218)	(0.216)	(0.283)	(0.224)	(0.191)	(0.276)
Student achievement						
STAAR achievement	38.875	44.936	72.020	43.131	50.295	69.863
	(27.300)	(24.852)	(22.475)	(28.459)	(25.756)	(23.236)
Student characteristics						
Age	17.270	17.135	17.038	17.194	17.104	17.038
	(0.556)	(0.423)	(0.320)	(0.489)	(0.392)	(0.314)
Female	0.406	0.549	0.562	0.450	0.566	0.599
	(0.491)	(0.498)	(0.496)	(0.498)	(0.496)	(0.490)
African American	0.071	0.061	0.083	0.072	0.058	0.067
	(0.258)	(0.239)	(0.276)	(0.259)	(0.234)	(0.251)
Hispanic	0.755	0.785	0.581	0.734	0.769	0.592
	(0.430)	(0.411)	(0.493)	(0.442)	(0.182)	(0.491)
Other non-White races	0.037	0.033	0.076	0.046	0.034	0.083
	(0.190)	(0.178)	(0.265)	(0.210)	(0.182)	(0.276)
No FRPL	0.398	0.461	0.659	0.451	0.515	0.682
	(0.489)	(0.496)	(0.474)	(0.498)	(0.500)	(0.466)
At risk	0.673	0.536	0.197	0.701	0.584	0.440
	(0.469)	(0.499)	(0.398)	(0.458)	(0.493)	(0.496)

Special education	0.163	0.071	0.015	0.154	0.066	0.018
	(0.369)	(0.257)	(0.122)	(0.361)	(0.249)	(0.133)
Gifted	0.058	0.061	0.206	0.074	0.091	0.182
	(0.233)	(0.240)	(0.404)	(0.261)	(0.287)	(0.386)
Attendance rates	91.269	93.562	95.999	93.236	95.210	97.200
	(7.859)	(5.933)	(4.044)	(7.132)	(5.147)	(3.059)
Disciplinary action	0.355	0.252	0.121	0.275	0.213	0.101
	(0.479)	(0.434)	(0.327)	(0.446)	(0.410)	(0.496)
Coursework						
AP credits earned	1.128	1.542	4.315	1.525	1.890	4.126
	(2.245)	(2.213)	(3.331)	(2.646)	(2.432)	(3.354)
IB credits earned	0.004	0.010	0.019	0.047	0.063	0.115
	(0.169)	(0.246)	(0.386)	(0.726)	(0.802)	(1.232)
DC credits earned	0.173	0.381	1.147	0.301	0.847	1.454
	(0.778)	(1.145)	(1.926)	(1.130)	(1.845)	(2.278)
Advanced credits earned	0.682	0.886	1.275	0.759	0.920	1.195
	(0.803)	(0.816)	(0.938)	(0.839)	(0.836)	(0.978)
English credits earned	4.238	4.129	3.325	4.086	3.866	3.259
	(1.241)	(1.273)	(1.240)	(1.310)	(1.266)	(1.301)
Math credits earned	3.158	3.194	3.002	3.218	3.254	3.027
	(0.685)	(0.595)	(0.516)	(0.717)	(0.626)	(0.585)
Science credits earned	3.126	3.184	2.819	3.061	3.068	2.788
	(0.790)	(0.741)	(0.749)	(0.795)	(0.752)	(0.783)
Social studies credits earned	4.474	4.435	3.143	4.431	4.194	2.988
	(1.364)	(1.461)	(1.812)	(1.650)	(1.727)	(1.871)
Foreign language credits earned	1.841	1.915	2.043	1.848	1.861	1.930
	(0.733)	(0.669)	(1.812)	(0.744)	(0.695)	(0.740)
Other course credits earned	5.421	5.598	5.903	5.456	5.743	6.013
	(2.032)	(2.077)	(2.207)	(2.028)	(2.052)	(2.236)
Observations	6,455	5,161	4,819	9,332	3,416	3,585

Notes. Means and standard deviations (in parentheses) are reported.

Appendix B. Multinomial logistic regression results of predicting students' college enrollment by levels of CTE participation

	2019 Cohort		2021 Cohort	
	Two-Year College	Four-Year College	Two-Year College	Four-Year College
	(1)	(2)	(3)	(4)
CTE-Concentrators	0.411***	0.625***	0.634***	0.430**
	(0.118)	(0.199)	(0.095)	(0.175)
CTE-Explorers	0.257**	0.374**	0.524***	0.325***
	(0.112)	(0.163)	(0.086)	(0.126)
CTE-Participants	0.124	0.254**	0.314***	0.214*
	(0.102)	(0.121)	(0.111)	(0.113)
STAAR achievement	–0.003**	0.017***	0.001	0.009***
	(0.001)	(0.002)	(0.001)	(0.002)
Age	–0.302***	–0.288***	–0.126**	–0.083
	(0.045)	(0.076)	(0.062)	(0.055)
Female	0.514***	0.462***	0.387***	0.434***
	(0.049)	(0.059)	(0.045)	(0.070)
African American	0.274***	0.865***	0.003	0.321**
	(0.092)	(0.113)	(0.126)	(0.140)
Hispanic	0.321***	–0.004	0.218***	–0.042
	(0.067)	(0.090)	(0.084)	(0.062)
Other non-White races	–0.077	–0.071	-0.280	–0.168
	(0.116)	(0.146)	(0.178)	(0.116)
Special education	–0.430***	–0.508***	–0.410***	–0.739***
	(0.088)	(0.127)	(0.088)	(0.136)
Gifted	–0.381***	–0.349***	–0.229**	–0.307***
	(0.099)	(0.094)	(0.093)	(0.081)
No FRPL	0.007	0.082	0.157***	0.108
	(0.052)	(0.059)	(0.047)	(0.075)
Attendance rates	0.030***	0.055***	0.035***	0.091***
	(0.004)	(0.008)	(0.005)	(0.008)
At risk	–0.158**	–0.510***	–0.185***	–0.486***
	(0.064)	(0.068)	(0.061)	(0.083)
Disciplinary action	–0.177***	–0.161***	0.017	-0.099
	(0.040)	(0.057)	(0.054)	(0.063)
AP credits earned	0.028	0.187***	–0.008	0.086***
	(0.021)	(0.029)	(0.019)	(0.028)
IB credits earned	0.136***	0.131**	0.049***	0.117***
	(0.051)	(0.059)	(0.011)	(0.024)
DC credits earned	0.187***	0.329***	0.240***	0.285***
	(0.033)	(0.054)	(0.031)	(0.042)

Advanced credits earned	0.161***	0.270***	0.171***	0.191***
	(0.033)	(0.042)	(0.041)	(0.046)
English credits earned	-0.035	–0.073***	–0.043	–0.103**
	(0.023)	(0.026)	(0.029)	(0.046)
Math credits earned	0.099**	–0.023	0.178***	0.054
	(0.040)	(0.061)	(0.038)	(0.041)
Science credits earned	0.049	–0.011	0.021	–0.029
	(0.033)	(0.050)	(0.045)	(0.052)
Social studies credits earned	0.027	0.017	0.037	–0.037
	(0.021)	(0.033)	(0.023)	(0.035)
Foreign language credits	–0.052	–0.044	–0.011***	–0.143***
earned	(0.033)	(0.051)	(0.040)	(0.033)
Other course credits earned	0.008	0.076**	0.047***	0.101***
	(0.013)	(0.034)	(0.011)	(0.019)
Log-likelihood	-14403.299		-13593.264	
Pseudo R2	0.196		0.151	
Observations	16,435		16,333	

Notes. High school dummy variables are included in the estimation but omitted due to the space. Robust standard errors are clustered at the high school level.

* p < 0.1; ** p < 0.05; *** p < 0.01.

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