HARVARD Kennedy School
RAPPAPORT INSTITUTE
for Greater Boston

Policy Brief

February 2025

Policy Recommendations to Meet High Demand for Career and Technical Education in Massachusetts

By Shaun M. Dougherty, Professor of Education & Policy, Boston College

Overview

The current system for students to gain access to high-quality CTE programs in the Commonwealth of Massachusetts would benefit from updates to ensure that it can operate in an efficient and fair manner. This memo defines the problem, highlights current structures that impede efficient allocation of resources, and proposes a series of changes to the current system to help meet expressed demand, while considering the role of costs of expansion of access (Dougherty & Smith 2024).

Background

Massachusetts is home to a longstanding and thriving set of Career and Technical Education (CTE) high school offerings, including almost three dozen regional, statewide, or district-specific "Wall-to-Wall" CTE schools where every student in the school participates in a state-approved CTE program during most of their high school experience. Several of the state's technical high schools have been in existence for over a century and predate even the first Federal investments in secondary technical education. After nearly half a century in operation (more in some cases), a number of regional technical schools that opened between 1962 and 1978 were recently rebuilt, updated, or expanded. For example, Blackstone Valley took on a massive renovation in 2009, Worcester Tech built a new facility in 2006, and Northeast Metro Technical high school will soon open a new facility in 2026. In addition to local and state funding, the federal government provides financial support for the CTE programs through the Carl D. Perkins Act, which was reauthorized in 2018 to emphasize the alignment of CTE programs with high-wage, high-demand fields. The 2018 reauthorization of the Perkins Act

This brief summarizes research by Shaun Dougherty using longitudinal data from Massachusetts to examine trends in enrollment and completion of Career and Technical Education Programs and makes policy recommendations for the Commonwealth. A research paper with detailed analysis is forthcoming.

Shaun Dougherty

Shaun Dougherty (Ed.D., quantitative policy analysis, Harvard University), is a Professor of Education & Policy at Boston College's Lynch School of Education & Human Development. Shaun is an internationally known expert in CTE and is currently on leave to serve as a Senior Advisor at the US Department of Education. He is also a Co-Principal Investigator on the IES-funded CTE Research Network.

Rappaport Institute for Greater Boston
Harvard Kennedy School
79 John F. Kennedy St.
Cambridge, MA 02138
617-495-5091
Visit our website

also mandated a change in terminology with "CTE" replacing "vocational." Massachusetts offers programs in 11 industry clusters (of 16 defined by federal legislation).

Many CTE programs in Massachusetts go beyond Federal Perkins requirements to meet a higher quality standard developed by the state in Chapter 74 of the Massachusetts General Law. Chapter 74 formally defines different elements of CTE programs and lays out the conditions for a program to gain state approval, often called "Chapter 74 approval." While Chapter 74 approval is not required for operation in Massachusetts, Chapter 74 approved programs tend to offer smaller classes, stricter teacher preparation, and formalized relationships with employers, colleges, and organized labor. In Wall-to-Wall CTE schools nearly all CTE programs are Chapter 74 approved, whereas in "comprehensive" high schools, programs differ in whether they meet Chapter 74 requirements. Meeting Chapter 74 approval requirements provides additional state funding to schools and programs which, in conjunction with these higher standards of operation, are designed to improve student training and transition to adulthood and careers.

For at least the last two decades, about 20% of MA high school students have graduated as CTE concentrators each year, meaning that they completed at least two courses (and in many cases 3 or more) in an aligned program of study (i.e. CTE content area).

- In "Wall-to-Wall" CTE schools nearly all (more than 95%) of students were CTE concentrators whereas in comprehensive high schools approximately 11% have been CTE concentrators.
- Almost all CTE concentrators in Wall-to-Wall CTE schools participated in Chapter 74 approved programs whereas only 40% of CTE concentrators in comprehensive high schools participated in Chapter 74 approved programs.

Past research from a variety of states (including Massachusetts, see Dougherty 2018) has consistently found that CTE participation promotes on-time high school graduation, especially at schools that are oversubscribed and that offer a particular emphasis on CTE programs, with largest effects observed for male and low-income students (see, for example, Brunner et al. 2023). In addition, CTE concentrators have also been found to experience significant earnings gains (relative to otherwise similar non-concentrators). These earnings gains are typically found to be higher for male than female students, some of which is explained at least partially by differences in the gender composition of occupations connected to CTE programs (Brunner et al. 2022). There is ongoing academic study and debate on whether CTE participation promotes college enrollment (Ecton & Dougherty 2023; Kemple et al. 2023).

Findings in the Current Study

The figures included in this memo (see pages 8 – 18) use state administrative data to describe the role of CTE programs in Massachusetts public high schools and how that role has changed over a recent twelveyear period. This data includes 450 unique high schools, with 354 to 392 distinct schools represented in each school year. Some key findings are as follows:

1. The share of students completing CTE concentrations has remained steady over time, though there has been a slow shift of concentration to Chapter 74 approved programs (Figure 1). Some new Chapter 74 approved programs have been added while other programs have closed. At the same time, some previously Perkins-only programs have made changes to meet requirements for Chapter 74 approval.
2. There has been a slight increase in both the number and share of schools offering Chapter 74 approved programs from 24 to 27 percent (Figure 2). Much of the growth has come in industry clusters that match industries of growth in the state, such as IT, health, education, and engineering (Figure 3).
3. The average scores of CTE concentrators on middle and high school assessments in ELA and math have increased over time (Figure 4). Much of this change is due to the growing popularity of Chapter 74 approved programs. In 2020, the average high school ELA and Math scores for CTE concentrators were each above the state average for all students for the first time.
4. CTE concentrators are more likely to graduate from high school, enroll in and complete a 2-year college, and earn higher income immediately after high school graduation than students who ever participated in CTE but did not complete a concentration. These effects have been steady over time (Figures 5 and 6).
    - Among CTE concentrators in comprehensive high schools, those students in Chapter 74 programs have higher initial earnings and, also graduate from high school and enroll in and complete two-year degrees at higher rates, than those who enroll in non-Chapter 74 approved programs, but are less likely to enroll in and complete a 4-year college (Table 1).
    - CTE concentrators see higher high school graduation and 2-year college enrollment in both Wall-to-Wall CTE high schools and comprehensive high schools. However, higher rates of 2-year college completion and earning are larger for students in Wall-to-Wall schools than for Chapter 74 approved programs in comprehensive high schools.
5. Students who attend oversubscribed technical high schools have better outcomes – learning, completion, and workforce, than those who apply and are not admitted (Dougherty 2018). Impacts are especially large for males who, all else equal, tend to fare poorly after high school if they do not attend college (Ecton & Dougherty 2023).
6. Participation in CTE differs by demographic subgroup and patterns of participation have changed over time (Figure 7). White students represent a declining share of high school students overall during the last 15 years but a growing share of participants in Chapter 74 programs. Black/African American students have also increased participation in Chapter 74 programs even as the share

in the overall population has been steady. By contrast, Latino and Hispanic as well as Asian students have grown in proportion of the school-aged population but have not grown as a share of CTE participants, indicating declines in participation rates for students in these subgroups.

7. Geography plays an observable role in participation for some subgroups. Female students and English Learners are likely to complete a concentration in any school setting. Asian, Black, and Hispanic students complete CTE concentrations at predicted rates at comprehensive high schools but at lower than predicted rates at Wall-to-Wall schools, especially when those schools are known to be oversubscribed (Figure 8).

Policy Issues

Despite the success of its existing CTE programs, there remain a number of fundamental challenges for the state to address.

<u>Oversubscription</u>

Nearly all Wall-to-Wall CTE schools are now oversubscribed.

This includes regional, municipal schools, as well as county- or state-wide agricultural schools. A previous study found that Wall-to-Wall programs were 30 to 50% oversubscribed, with applications growing every year, but the number of spots in those programs remains fairly constant (Dougherty & Macdonald 2019).

In an ideal circumstance, all students who wanted access to high-quality technical education, and who met reasonable participation requirements, would be able to gain access. However, resource limitations in the near term, and anticipated continued long-term decline in the school-age population in the state, make it impracticable to expand access quickly or completely. Surveys of school administrators suggested that building costs are the primary limiting factor restricting the ability of Wall-to-Wall programs to serve interested students, though staffing challenges are also a key factor for some schools.

The state has innovated in their development and addition of Innovation Career Pathways that organize coursework related to preparation for high-demand occupations in growing sectors such as information technology, engineering, healthcare, life sciences, and advanced manufacturing. These Pathways are offered in comprehensive high schools and offer sector-specific options that complement other technical education programs. An important aspect of Innovation Pathways is that they incorporate business partnerships in ways that mirror those in Chapter 74 approved programs. Despite the addition of these Pathways, there is clear evidence of overall excess demand, as well as important considerations regarding workforce needs in a range of occupations beyond those supported by the addition of Innovation Pathways.

Inequities in Access

In communities with especially high demand, many applicants to schools or programs stand little chance of being admitted despite meeting the requirements for eligibility, though they would be much more likely to be admitted if they lived in a different community (Ansel et al. 2023). As has been seen in test-based admissions in exam schools, such circumstances can have a chilling effect on applications, thus suppressing expressions of actual demand and creating additional inefficiency to the system.

In Wall-to-Wall CTE schools with the greatest degree of oversubscription, the student population looks least similar to the student population in the surrounding communities.

Even when students can get access to Exploratory Programs for Chapter 74, the process by which students are subsequently assigned to specific programs for their remaining years in high school may also inefficiently allocate spaces. This could contribute to student disengagement.

In the extreme, both program access and matching problems articulated here could lead to a mismatch between labor market needs in specific occupations and the supply of appropriately trained labor.

General Recommendations

1. Expand Supply

The state should encourage construction of an additional school(s) in places where there is enough regional excess demand to support an additional building (e.g., waitlists are large enough in the region to fill a second incoming class). Funding models for any new school should be structured such that admission is open across towns. This will ensure broad access and be positioned to adapt to long-term changes in local population and program demand (i.e. not tied to static regional agreements about seat allocation). The state should also continue to support the addition of Chapter 74 programs in comprehensive high schools and to evaluate the longer-term impacts of Innovation Pathways.

More specifically, the state should consider:

A) Continuing to expand Chapter 74 programs, ensuring that as many comprehensive schools as possible have a range of options so that Exploratory Programs can help students make better informed choices. Ideally this would include a range of options, such as:

  i. Existing schools with programs add more seats, sections, or programs with state support for recruitment and hiring (potentially on flexible contracts) for teachers in areas that align with high need (Chen et al. 2023; Kistler et al. 2024).
  ii. Sharing of program offerings or resources across clusters of comprehensive high schools that are in relatively close proximity to reduce redundancy and navigate the potential for short-term fluctuations in demand (e.g. local interdistrict choice driven by Chapter 74 program participation).

B) Awarding and expanding the use of Innovation Pathways & add Dual Enrollment programs connected to

Chapter 74 programs, that lower costs by leveraging existing resources in higher education and that may be more scalable in comprehensive school settings.

C) New construction to add capacity is most defensible in places where there is such excess demand that marginal increases in programs or seats cannot meaningfully reduce excess demand. Meeting current demand must be balances against the likely long-term contraction in school-aged youth. Newly constructed schools should consider differences in funding structure, and statewide access to prevent inefficiencies and inequality that may arise from imbalances between local supply and demand.

   Constructing new buildings is expensive. In areas of especially high demand (e.g. New Bedford) brownfield development, in conjunction with input from regional boards, might offer access to financing that could defray costs and lead to local development.

2. Use Conditional Lotteries for Allocating Seats to Oversubscribed Programs

To ensure equitable access within communities, we recommend the adoption of conditional lotteries with minimal conditions for eligibility. The goal of this approach is to ensure that eligible applicants have equal chances of earning a seat, reduce concerns that application criteria are biased, and reduce any incentive for sending schools to use technical education as an outlet for students who have struggled in other settings.

Conditional lotteries should admit students in proportion to the seats their town has funded based on the regional agreement. Regional agreements should be reassessed periodically (e.g. every 5 years) to rebalance allocations in response to potentially shifting demand and population. Ideally the standards for exclusion from a conditional lottery should be restricted to three criteria:

- Unexcused Absences: Students with an unusually large number of unexcused absence (e.g. greater than 10% of school days) can be excluded from the conditional lottery;
- Disciplinary Issues: Students who missed more than 10 days of school due to suspension that was not a manifestation of a disability or who were expelled can be excluded from the conditional lottery;
- Failing Grades: Students who did not pass both of their required ELA and math courses in 8^{th} grade can be excluded from the conditional lottery.

Applicants should be allowed to provide documentation for any extenuating circumstances if they would otherwise be excluded from the lottery based only on the attendance criteria.

3. Make Maximal Use of Existing Supply

When towns do not use all of their allocated seats in a particular school, students from other towns in the regional agreement (followed by students in town outside the agreement if openings remain) should have the first option to be admitted via a second-round lottery and money should follow the student if they are admitted, as is the case with current charter school policy. Schools and communities should consider whether a flexible pool of funds should be made available to partially reimburse towns in years they do not use all of their seats.

In instances where seats become available in Chapter 74 programs and if they are not filled by students from a waitlist from communities in the regional agreement, the state should consider augmenting existing systems of inter-district choice to fill these seats with students from nearby communities who can provide their own transportation. This would follow the model of intra-district choice already available for general education, but would be a new application of it in high school Chapter 74 CTE programs.

- A tweak on this option could include "sharing" of spaces in existing programs across district lines to balance supply and demand. Sending districts should not be allowed to restrict such movement if students seek it and access is available. A de facto version of this exists for interdistrict choice, which is not specific to Chapter 74.
- In comprehensive schools, this could require coordination and scheduling such that students move among buildings.

***Policy Alternatives*:**

There are two alternative policies to consider:

1) Unconditional lotteries for admissions, proportional by regional agreement. This is less complex to administer, but increases the risk that bad actors could direct students who may not be interested in technical education, but who schools would prefer to offload.
2) Restructuring of regional agreements and school funding structures at regional schools to expand access across more communities. In areas where there is extremely high demand this is less likely to meaningfully change access issues, but may help in parts of metro Boston where there are schools nearby to one another geographically, but where there are substantial differences in demand.

Conclusion:

High-quality CTE programs in Massachusetts are in high demand, and rightfully so. Outcomes for students in these programs are strong and program characteristics likely promote these favorable outcomes. To meet high demand, the system needs updates to operate efficiently and fairly. Expanding the supply of CTE programs, thinking innovatively about how to handle oversubscription to certain programs, and making maximal use of existing supply are three policy areas in which Massachusetts has an opportunity to act. Doing so would benefit both students and the Commonwealth by increasing the number of graduates prepared to enter the workforce.

References

1. Ansel, D., Dougherty, S.M., Ecton, W., Holden, K., & Theobald, R. (2023) Understanding Student Interest and Equitable Access to Specialized High School Technical Education, Journal of School Choice, 16(4), 58-622.

2. Brunner, E., Dougherty, S.M., & Ross, S., Industry Choice and within Industry Earnings Effects, Human Capital and Economic Opportunity Global Working Group, WP 2022-025 http://humcap.uchicago.edu/RePEc/hka/wpaper/Brunner_Dougherty_Ross_2022_industry-choice-within-industry-earning.pdf

3. Brunner, E., Dougherty, S.M., & Ross, S., The effects of career and technical education: Evidence from the Connecticut Technical High School System, Review of Economics and Statistics 105, 867-882 (2023).

4. Chen, B., Dougherty, S.M., Goldhaber, D. Holden, K., Theobald, R. (2023), CTE Teacher Licensure and Long-Term Student Outcomes, *Education Finance & Policy, 18*(2), 253-276.

5. Dougherty, S.M., Macdonald, I. (2019). Understanding Excess Demand for High-quality Career and Technical Education in Massachusetts. A Report Prepared for the Massachusetts Department of Elementary & Secondary Education.

6. Dougherty, S.M., Smith, M.M., At What Cost? Is Technical Education Worth the Investment? Education Finance and Policy (2024).

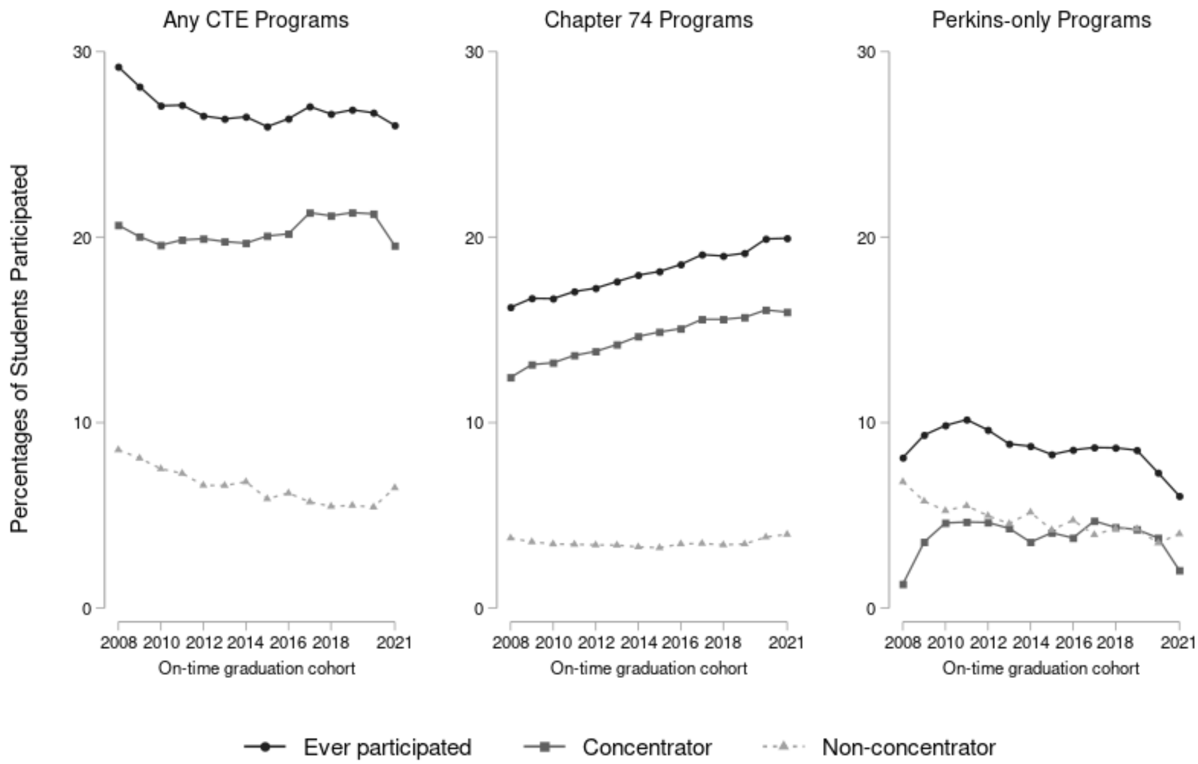
7. Ecton, W.G., & Dougherty, S.M., (2023). Heterogeneity in High School Career & Technical Education Outcomes, Educational Evaluation & Policy Analysis, 45(1), 151-181.

8. Kemple, J., Unterman, R., & Dougherty, S.M. (2023). New York City as a Laboratory for Learning about Career and Technical Education: Lessons from CTE Dedicated High Schools. Research Alliance for New York City Schools. With John Sludden & Samuel Kamin. https://steinhardt.nyu.edu/research-alliance/research/nyc-laboratory-learning-about-career-and-technical-education

9. Kistler, H., Dougherty, SM., Woods, S.C, (2024) Teacher Exit and Educational Opportunity: Lessons from Career & Technical Education, *Educational Researcher*, *53*(3), 156-166. https://doi.org/10.3102/0013189X231223132

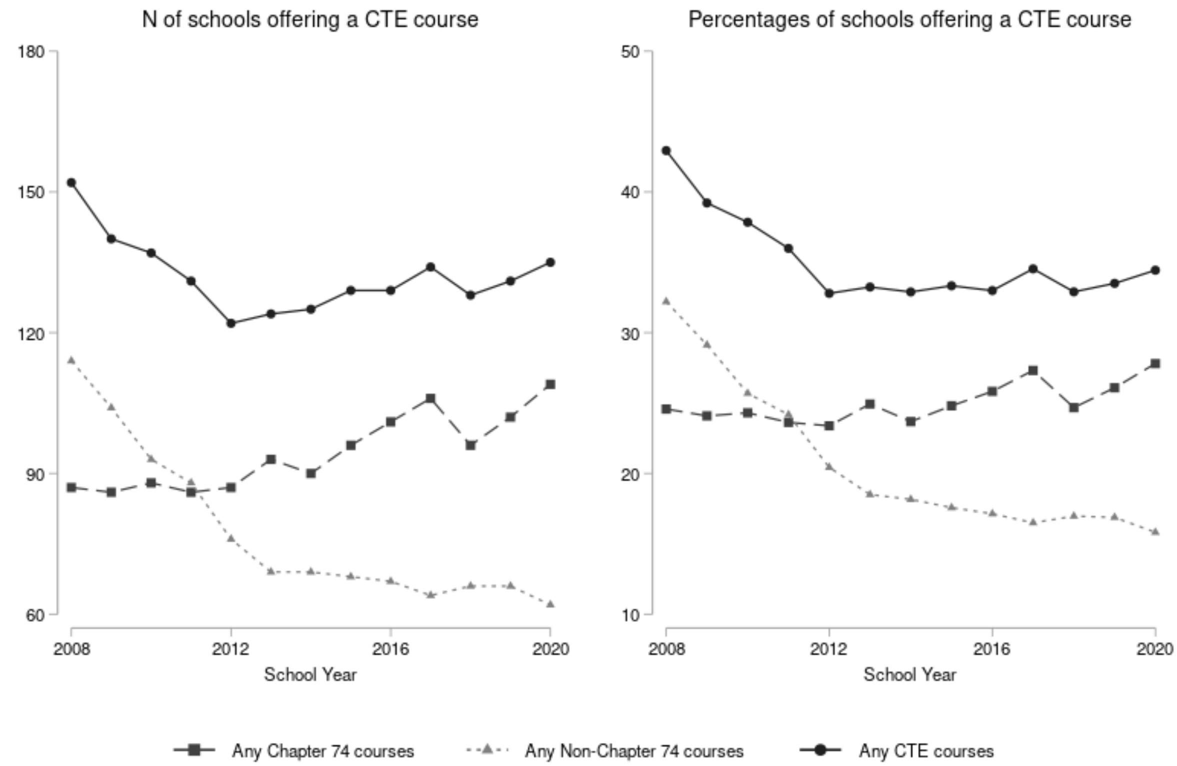
Figures & Tables

Figure 1. CTE Participation in Massachusetts



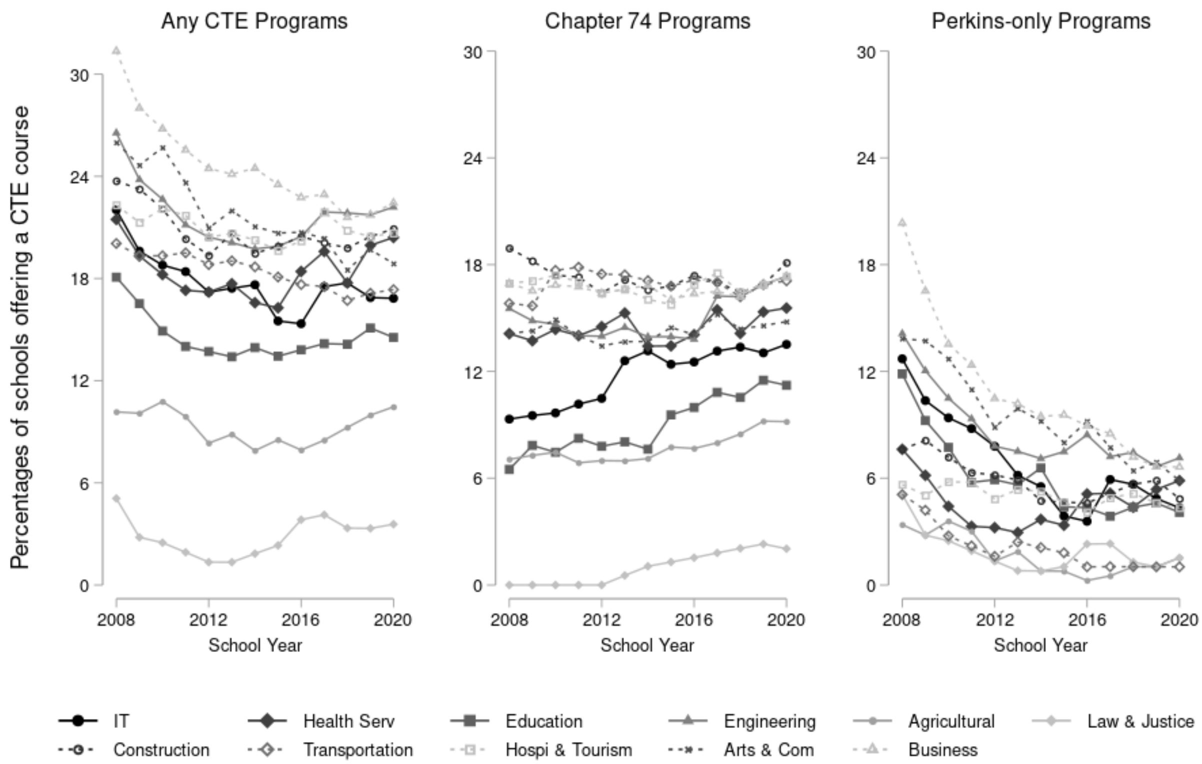
Notes: This figure presents trends in the share of students who have ever participated in, concentrated in, or non-concentrated in CTE programs, disaggregated by program type. The left panel represents any CTE programs, the middle panel represents Chapter 74 programs, and the right panel represents Perkins-only programs.

Figure 2. CTE Program Offerings in Massachusetts



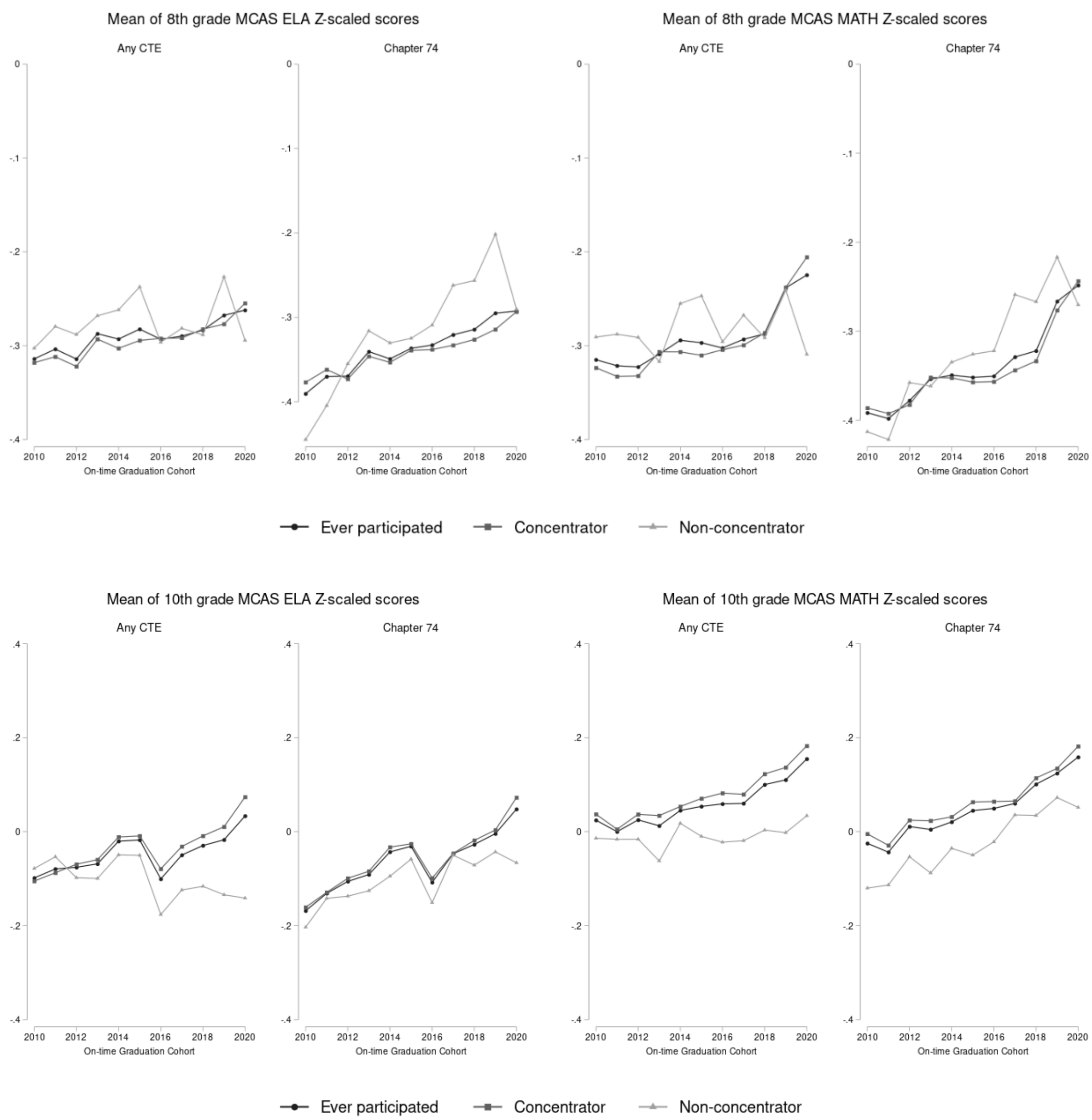
Notes: This figure presents trends over school years in the number of schools (left panel) and the proportion of schools (right panel) offering CTE programs, disaggregated by program type.

Figure 3. CTE Program Offerings by Career Clusters in Massachusetts



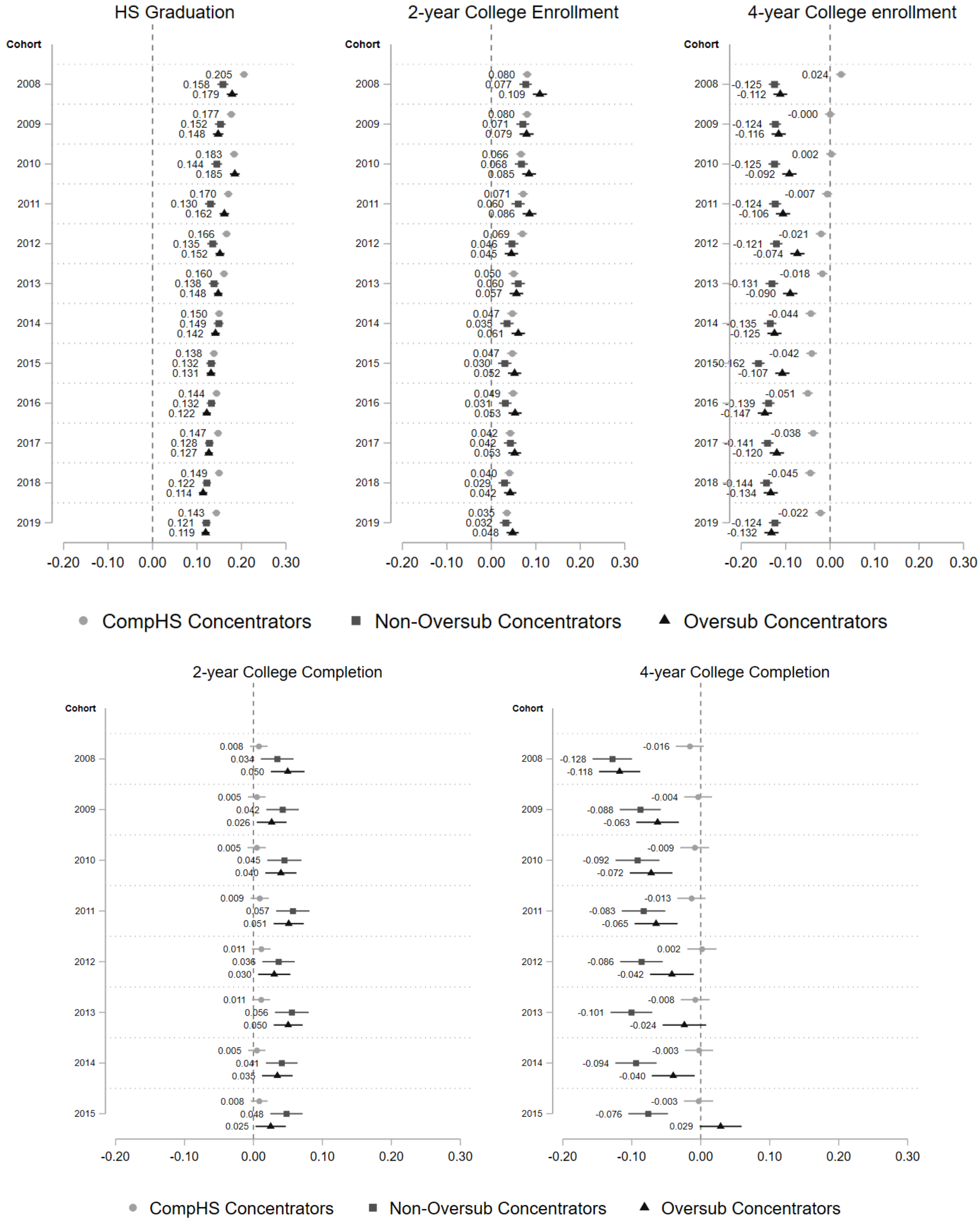
Notes: This figure presents trends over school years in the proportion of schools offering each career cluster CTE programs, disaggregated by program type.

Figure 4. Academic Achievement of CTE Participants in Grades 8 and 10



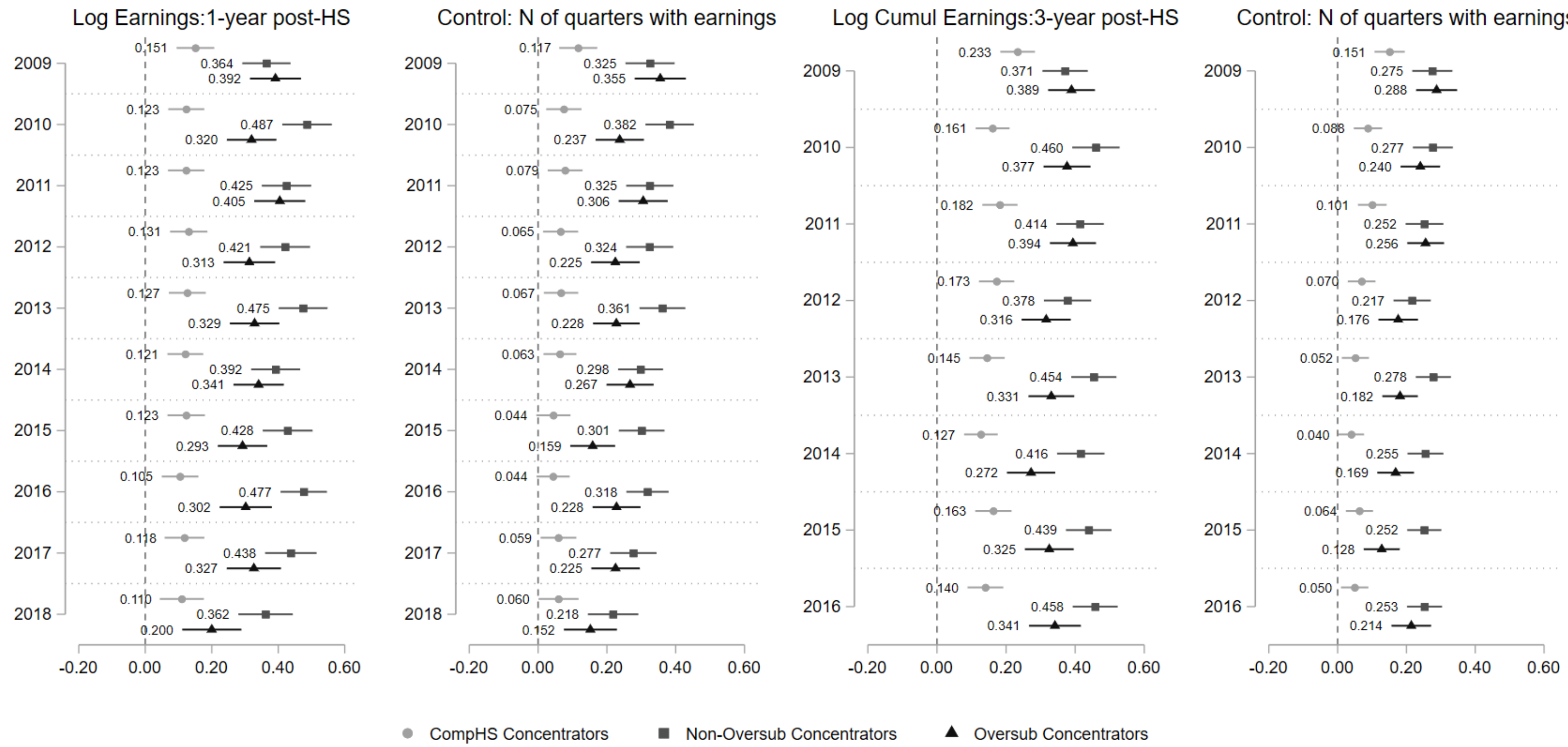
Notes: These figures present trends in the average MCAS z-scores for CTE participants in ELA (left panel) and Math (right panel) at grade 8 (top) and grade 10 (bottom). The first attempt score is used for each outcome.

Figure 5. Educational outcomes over cohorts for CTE concentrators



Notes: Each of the three markers represents the average difference in outcomes between CTE concentrators (overall, regardless of Chapter 74 status) and the CTE-ever group (i.e., students who participated in at least one CTE course but did not concentrate in it) in one of three school settings: a comprehensive high school (HS), a non-oversubscribed Wall-to-Wall CTE HS, or an oversubscribed Wall-to-Wall CTE HS. For comprehensive HSs, CTE concentrators are compared with the CTE-ever group within the same school type. In Wall-to-Wall CTE HS models, concentrators are compared with the CTE-ever group both within the Wall-to-Wall CTE HSs and in comprehensive HSs. This approach accounts for the fact that the majority of students (approximately 95–99%) in Wall-to-Wall CTE schools are CTE concentrators. For the college graduation models, we restrict our sample to students who enrolled in any college, accounting for the possibility of transfers between 2-year and 4-year institutions.

Figure 6. Workforce outcomes (Earnings) over cohorts for CTE concentrators



Notes: For each earnings measure, the left panel presents the estimates from the model without the variable for the number of quarters employed, while the right panel includes this control variable. Same as Figure 6, each of the three markers presents the average difference in outcomes between CTE concentrators (overall, regardless of Chapter 74 status) and the CTE ever group (i.e., students who participated in at least one CTE course but did not concentrate in it) in either a comprehensive high school, a non-oversubscribed Wall-to-Wall CTE HS, or an oversubscribed Wall-to-Wall CTE HS.

Table 1. The relationship between CTE participation and post-high school outcomes: among students who ever participated in CTE

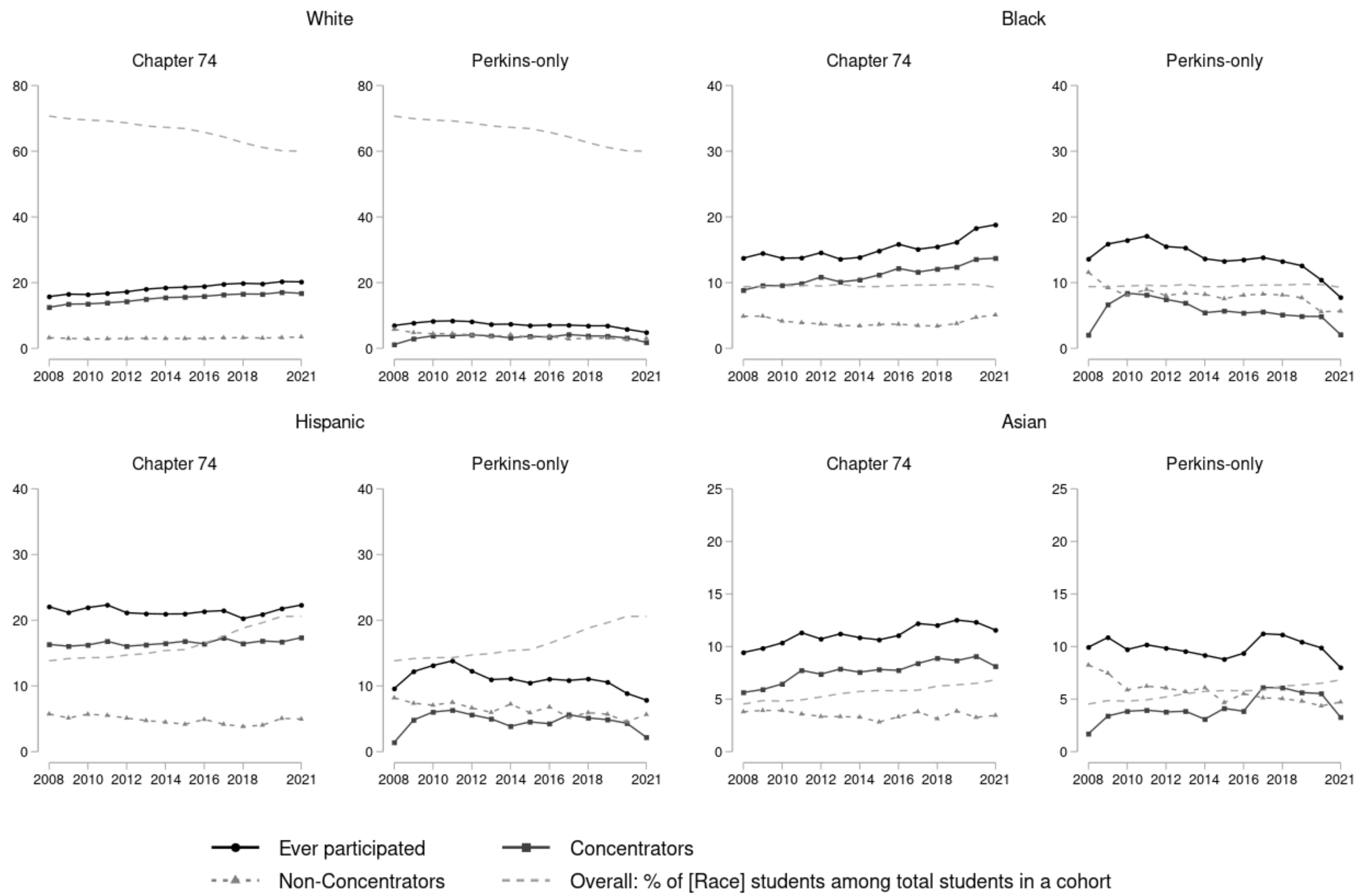
Cohort 2008-2019	**(1) HS Graduation**							
	Comp HS	Comp HS: C74	Non-oversub	Oversub				
CTE Concentrator	0.130***	0.122***	0.118***	0.100***				
	(0.002)	(0.002)	(0.003)	(0.003)				
Chapter 74 Concentrator		0.021***						
		(0.002)						
Adjusted R^2	0.148	0.148	0.133	0.119				
N	159,063	159,063	212,875	203,996				
Cohort 2008-2019	**(2) 2-year College Enrollment**				**(3) 4-year College Enrollment**			
	Comp HS	Comp HS: C74	Non-oversub	Oversub	Comp HS	Comp HS: C74	Non-oversub	Oversub
CTE Concentrator	0.038***	0.036***	0.038***	0.032***	0.017***	0.037***	-0.092***	-0.054***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
Chapter 74 Concentrator		0.006+				-0.053***		
		(0.003)				(0.003)		
Adjusted R^2	0.049	0.049	0.043	0.044	0.281	0.282	0.265	0.254
N	159,063	159,063	212,875	203,996	159,063	159,063	212,875	203,996
Cohort 2008-2015	**(4) 2-year College Graduation (Any College Enrolled)**				**(5) 4-year College Graduation (Any College Enrolled)**			
	Comp HS	Comp HS: C74	Non-oversub	Oversub	Comp HS	Comp HS: C74	Non-oversub	Oversub
CTE Concentrator	0.007**	0.003	0.041***	0.040***	-0.007+	0.005	-0.093***	-0.053***
	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Chapter 74 Concentrator		0.012***				-0.037***		
		(0.003)				(0.005)		
Adjusted R^2	0.025	0.025	0.025	0.023	0.235	0.236	0.230	0.212
N	68,485	68,485	85,903	86,368	68,485	68,485	85,903	86,368
Cohort 2009-2018 (2016)	**(6) log 1-year Initial Earning**				**(7) log 3-year Cumulative Earning**			
	Comp HS	Comp HS: C74	Non-oversub	Oversub	Comp HS	Comp HS: C74	Non-oversub	Oversub
CTE Concentrator	0.066***	0.020*	0.327***	0.252***	0.077***	0.037***	0.265***	0.216***
	(0.008)	(0.009)	(0.011)	(0.011)	(0.007)	(0.008)	(0.010)	(0.010)
		0.118***				0.101***		

Chapter 74 Concentrator		(0.011)				(0.010)		
Adjusted R^2	0.209	0.210	0.227	0.219	0.367	0.368	0.384	0.378
N	88,405	88,405	119,333	116,812	86,352	86,352	115,712	112,615

+ p<0.10 * p<0.05 ** p<0.01 *** p<0.001 ; Standard errors in parentheses

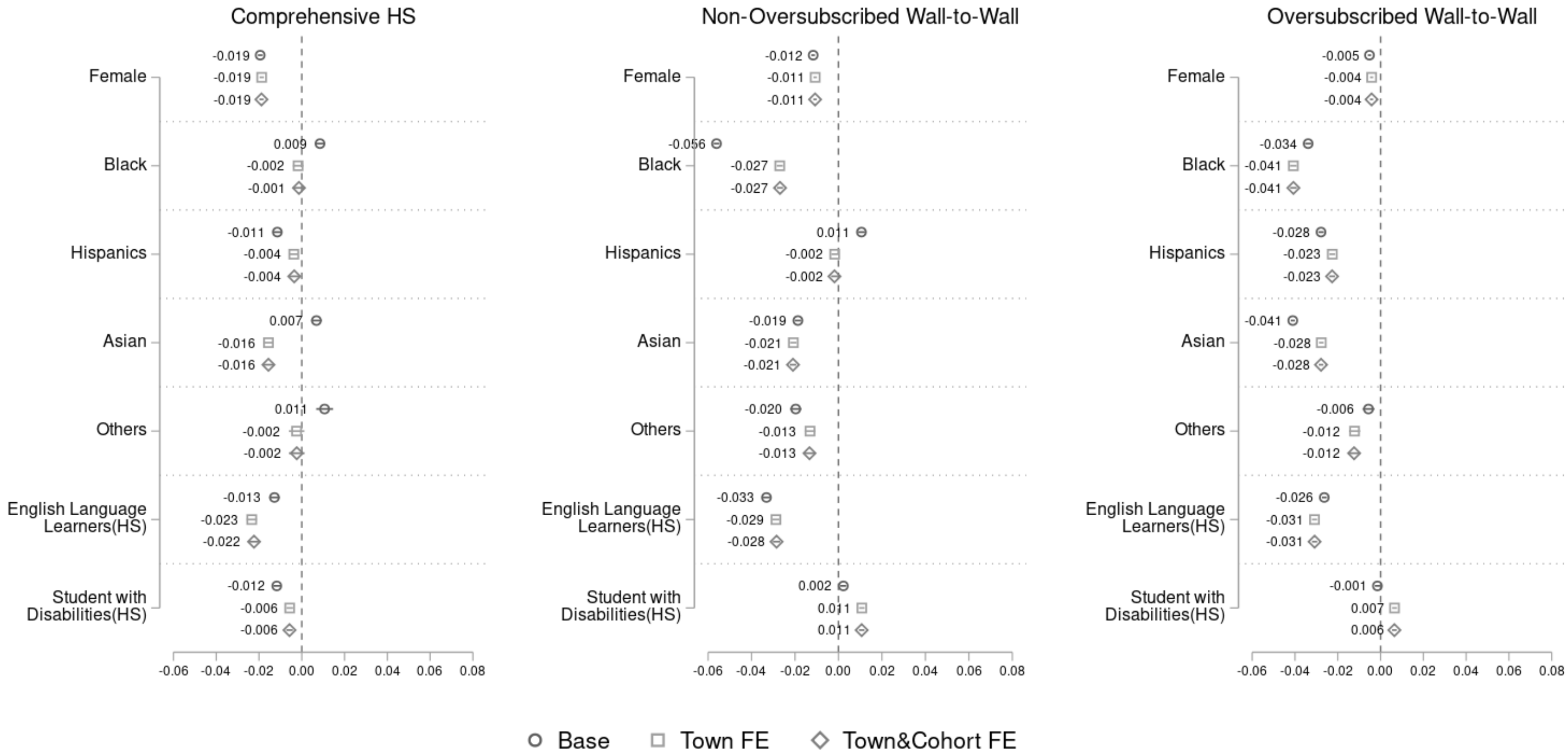
Notes: This table presents linear regression results showing the relationship between students' CTE concentration and postsecondary outcomes. We use the sample of students who participated in at least one CTE program (i.e., CTE ever group). For Comp HS models, CTE concentrators are compared with the CTE ever group within the same school type. For RVTS models, concentrators are compared with the CTE ever group not only in the RVTS but also those in comprehensive HSs. For the college graduation models (4) ~ (5), we restrict our sample to students who enrolled in any college, considering the possibility of students transferring between 2-year and 4-year colleges. Our coefficients of interest are: 1) CTE concentration and 2) Chapter 74 concentration. Chapter 74 concentrators are a subset of CTE concentrators. Interpreting the estimates in the second column (*Comp HS: C74*), the row for CTE concentrators reflects results for non-Chapter 74 (Perkins-only) concentrators.

Figure 7. Share of Students participated in Chapter 74 and Perkins-only Programs by Student's Race/Ethnicity



Notes: This figure presents the percentage of students who participated in in Chapter 74 and Perkins-only CTE programs, disaggregated by students' race or ethnicity.

Figure 8. Differences in CTE participation (being a CTE concentrator) by gender, race/ethnicity, English learner, and disability status



Notes: Each of the three panels presents the average difference in the probability of becoming a CTE concentrator by identifiable student characteristic, holding all others constant. Estimates, by panel, are presented based on what type of high school a student attended.