
How to Make Technical Education Pay

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Summary

- Evidence is expanding that CTE in high school can smooth the transition to college & the workforce, particularly the latter; possibly more for males
 - As policy emphasis on updating and spending on CTE has increased, figuring out what to offer, where, and to whom, & under what conditions is a necessary focus
 - In this talk:
 - Reconcile growing evidence, with the reality of constraints on state funding, teacher supply, and workforce demands
 - Presenting elements of ongoing research on each of these topics:
 - Impacts,
 - Teacher supply, &
 - Cost/ innovations in CTE funding
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What is high school CTE look like & where does it happen?

	Whole School Model	Regional Centers	Comprehensive HS
Curricular Alignment	X		
Equipment Centralization	X	X	
Cost Smoothing	X	X	
Shared Teaching Staff	X	X	
Work-based learning	X	X	X
Employer Partnerships	X	X	X
College Partners	X	X	X
Universal Access			X
Market Share (NCES)	3-5%	~60%	~35%

Innovations in CTE & Education Policy

- Every Student Succeeds Act (2015) pivoted
 - College-for-all => College and Career Readiness (CCR)
 - Acknowledges multiple postsecondary pathways
 - Allows CCR accountability metric
 - Perkins (V) reauthorization (2018)
 - Lowers threshold for concentrator status (boosts federal funding)
 - Emphasizes local offerings to be aligned w/ “in demand” & high wage jobs (e.g. applied STEM, health care, advanced manufacturing)
 - Workforce Innovation and Investment Act (2014)
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CTE Works, high school edition

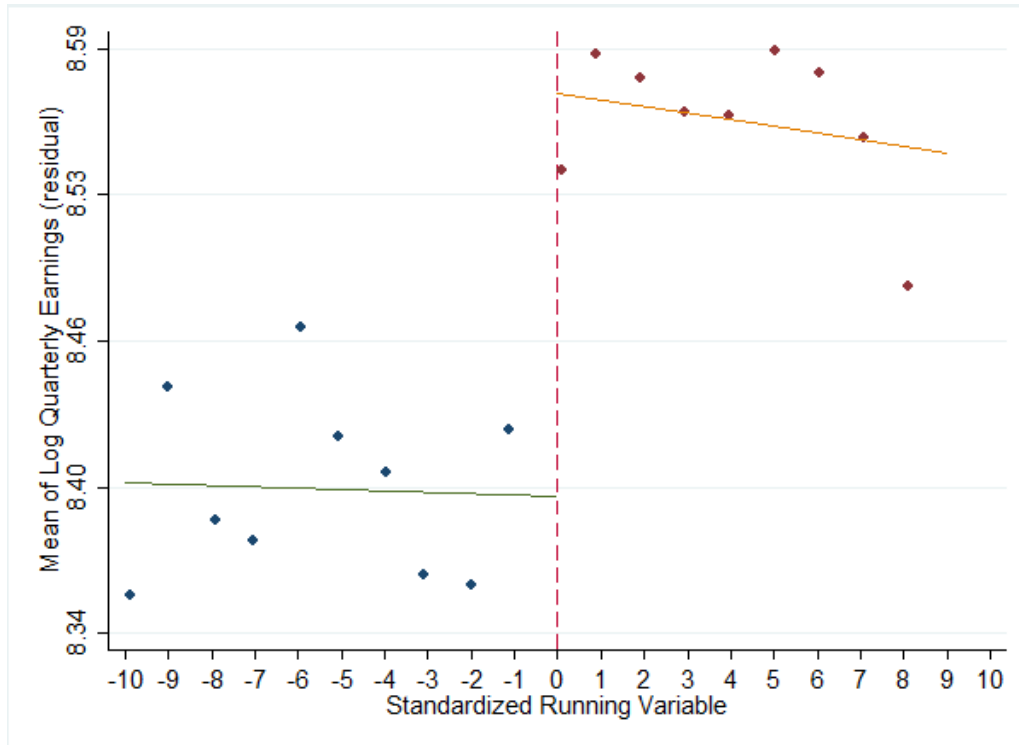
- Better graduation outcomes
 - Bonilla, 2020; Brunner et al., 2021; Dougherty, 2018; Hemelt et al., 2019 *Kemple et al. (2023) shows equivalent outcomes in NYC; Gottfried & Plasman (2018)
 - Improved or equivalent learning outcomes
 - Brunner et al., 2021; Dougherty, 2018; Hemelt et al., 2019
 - Higher attendance levels, especially in pivotal grade 9
 - Brunner et al., 2021; Dougherty, 2018
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CTE & workforce outcomes

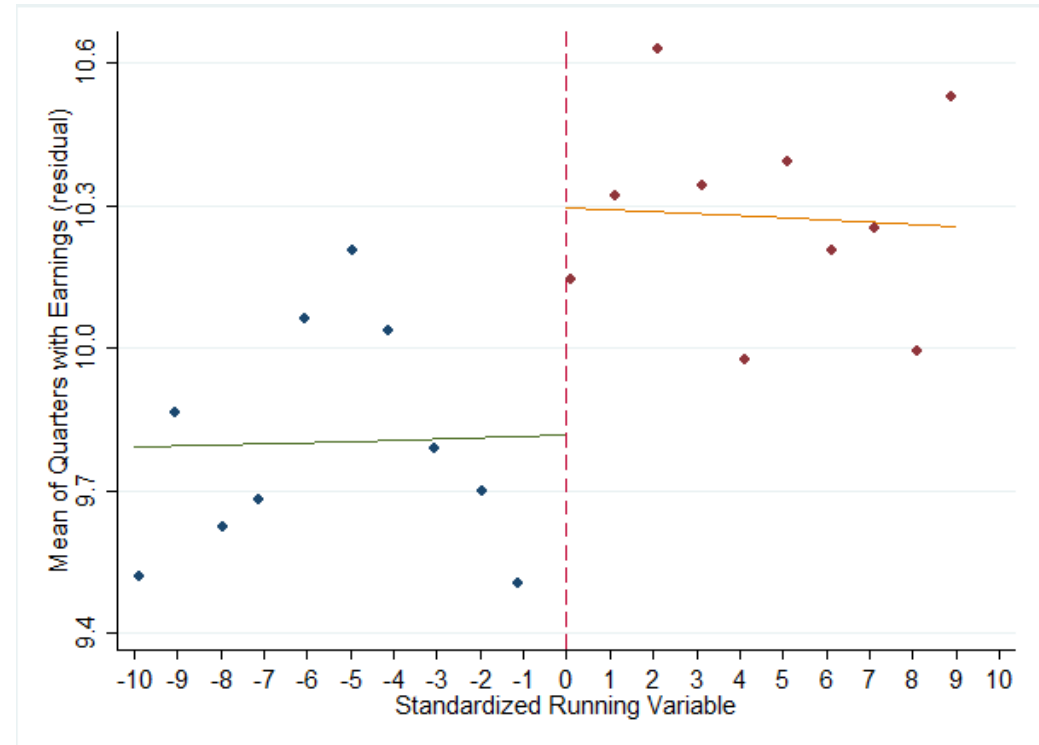
- Clear theory of change to support workforce outcomes. Evidence has long aligned w/ theory
 - Bishop & Mane, 2004; Kemple & Willner, 2008; Kreisman & Stange, 2020; Page, 2012
 - Recent evidence that supports causal interpretation reinforces these conclusions & adds nuance
 - Brunner et al. (2021) find very large impact (30% increase in earnings by age 23), but only for boys
 - Brunner et al. (2022) highlights that much of the gendered differences in impact are explained by industry sorting
 - Within-industry returns are comparable across genders
 - Most of the average difference in earnings by gender is explained by gender patterns in enrollment
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Male Workforce outcomes: Conn. Technical High Schools

Ln(Quart. Earn.)



Quarters w/ Earn.

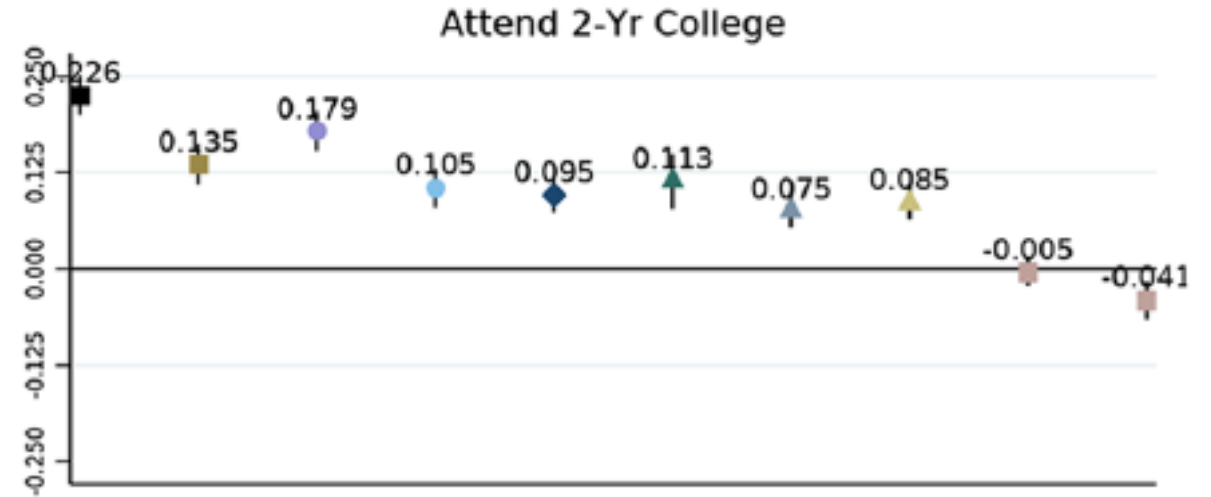
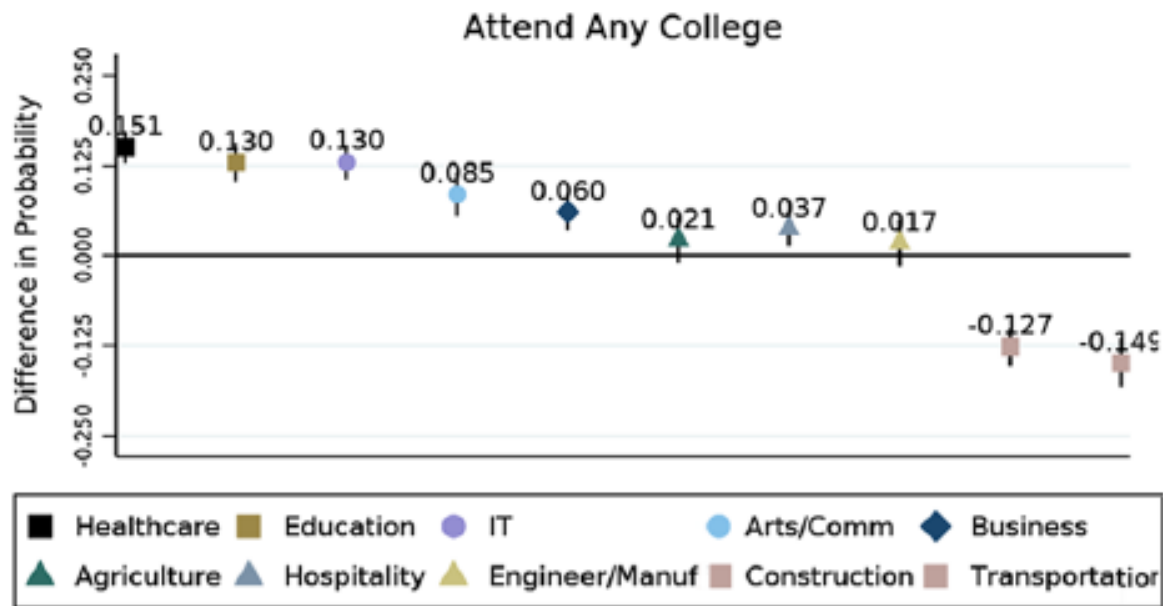


- More quarters worked, total and average quarterly earnings about 30% higher (Brunner et al. 2021)

College going impacts are ambiguous, perhaps predictably

- Aggregate evidence is equivocal
 - Often, on average, no difference or negative impact for high school CTE participants
 - Most postsecondary CTE research is set in Comm. Colleges and doesn't observe transition
 - Expanding evidence that likelihood of college enrollment is connected to program of study in high school
 - Hemelt et al. (2019) IT-focused academy in high-performing setting
 - Ecton & Dougherty (2023) – statewide averages in Massachusetts
 - Edmunds et al. (2022) – North Carolina dual enrollment
 - Kemple et al. (2023) – NYC CTE dedicated schools
 - All builds on work from Cellini (2006) on tech prep
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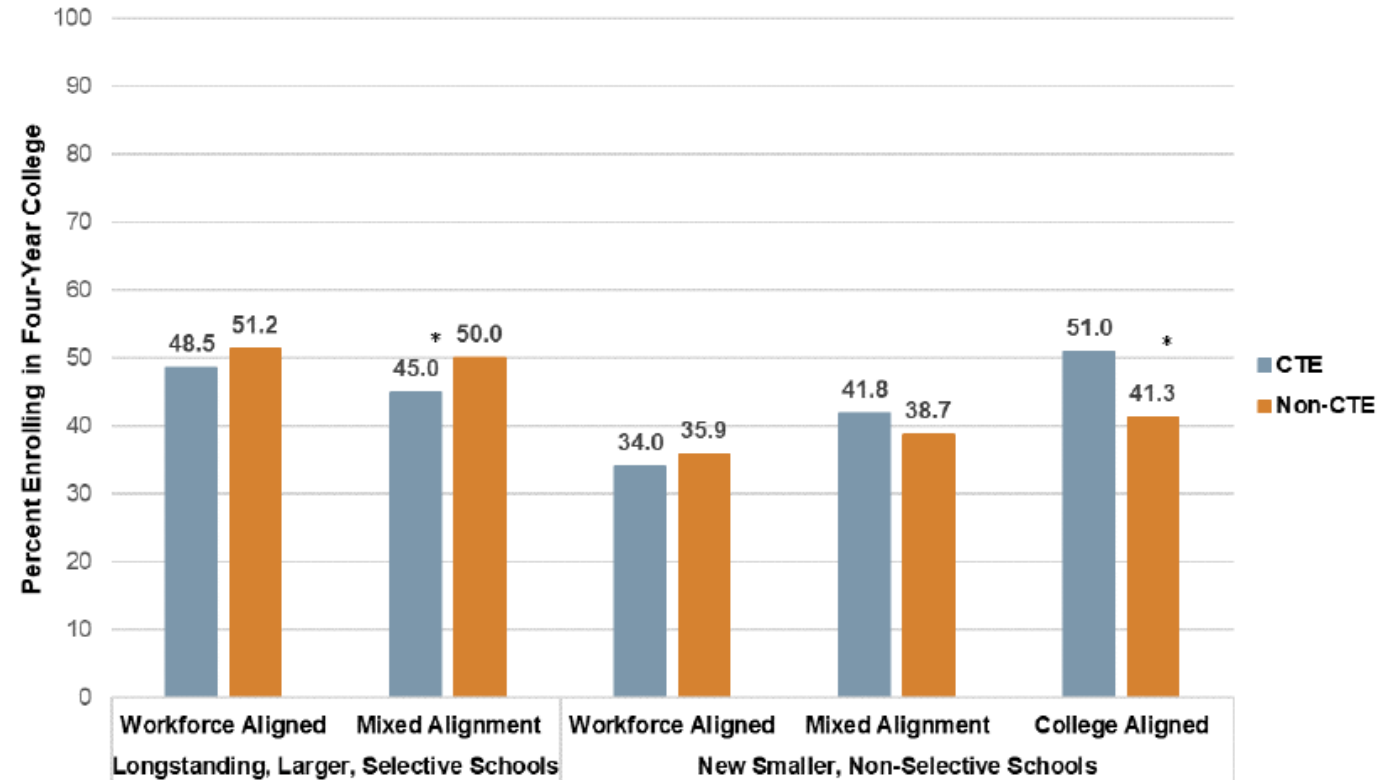
College going differs by CTE cluster in Massachusetts



Source: Ecton, W. G., & Dougherty, S. M. (2023). Heterogeneity in high school career and technical education outcomes. *Educational Evaluation and Policy Analysis*, 45(1), 157-181.

Impacts on college depend on aligned occupational needs

Figure 6: CTE Impacts on Enrollment in Four-Year Colleges, by High School Subgroup



Source: <https://steinhardt.nyu.edu/research-alliance/research/nyc-laboratory-learning-about-career-and-technical-education>

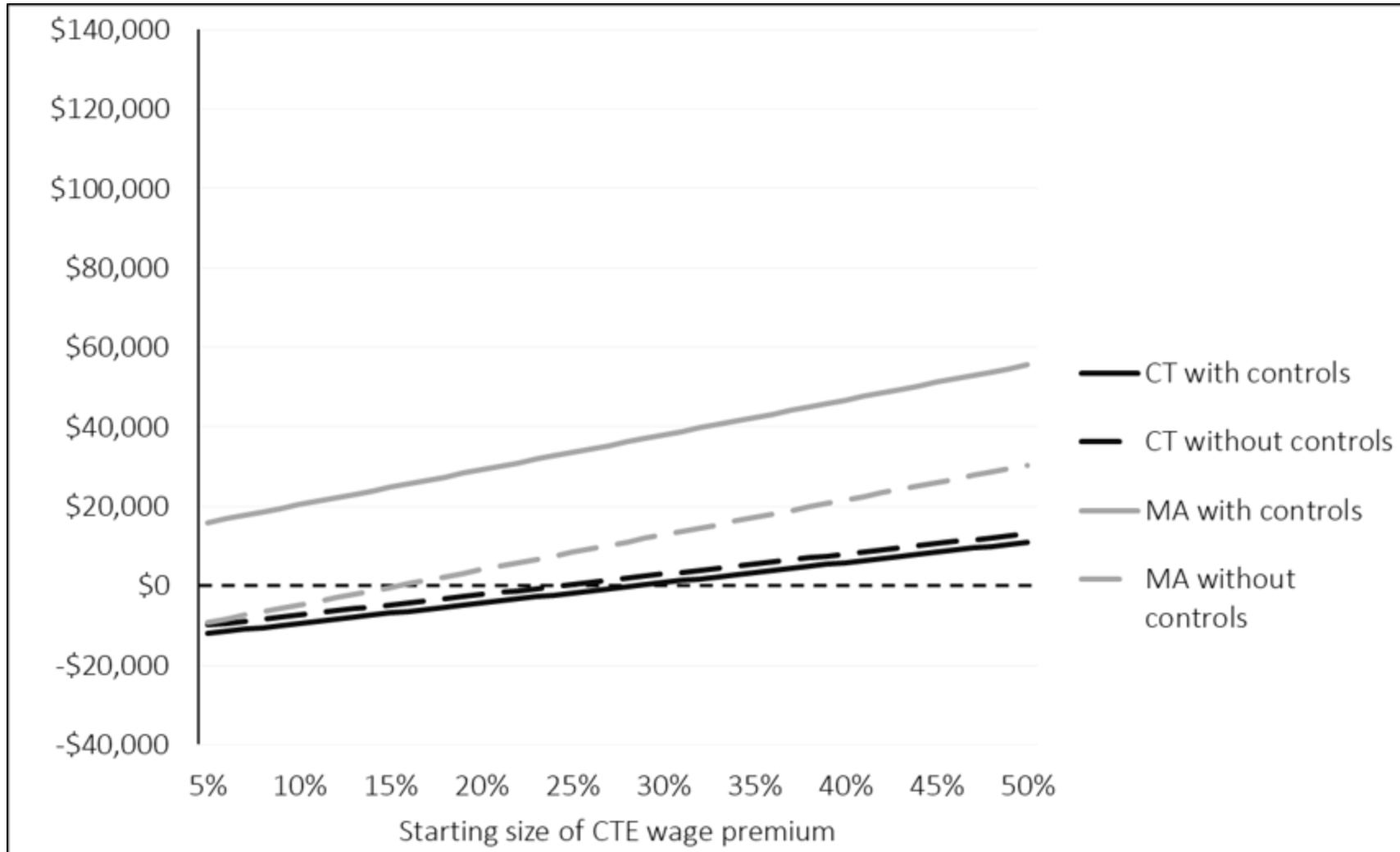
CTE is also more expensive, on average

Table A4: Future value of additional per pupil expenditure for CTE

	Interest rate			
	0.02	0.03	0.04	0.05
With controls				
Connecticut	40,185	64,187	102,061	161,565
New Jersey	54,614	87,233	138,705	219,573
Massachusetts	31,130	49,723	79,063	125,158
Pennsylvania	(7,505)	(11,987)	(19,060)	(30,172)
Delaware	77,615	123,973	197,124	312,051
Without controls				
Connecticut	38,062	60,795	96,668	153,028
New Jersey	71,239	113,788	180,930	286,416
Massachusetts	56,302	89,930	142,994	226,362
Pennsylvania	(8,271)	(13,212)	(21,007)	(33,255)
Delaware	53,711	85,791	136,412	215,943

Note: CTE = career and technical education. Future value calculated as the total per student cost of 4 years of obtaining a CTE-specific high school education over student career (ages 20-65). The regression-adjusted estimates of additional per pupil expenditures at CTE schools are \$3,883.30 per year in Connecticut, \$3,008.25 per year in Massachusetts, \$5,277.56 in New Jersey, -\$725.20 in Pennsylvania, and \$7,500.26 in Delaware. The non-adjusted estimates of additional per pupil expenditures at CTE schools are \$3,678.10 per year in Connecticut, \$5,440.73 per year in Massachusetts, \$6,884.15 in New Jersey, -\$799.30 in Pennsylvania, and \$5,190.26 in Delaware. Regression-adjusted estimates come from Column 4 of tables 3 and 4 and appendix tables A5, A6, and A7.

Yet, CTE can pay off even under reasonable assumptions



Note: Figure shows the difference between estimated lifetime future benefits and total estimated costs from models with and without controls when assuming an interest rate of 2%. CTE wage premium is held constant from ages 18-25 and linearly smoothed to zero by age 45.

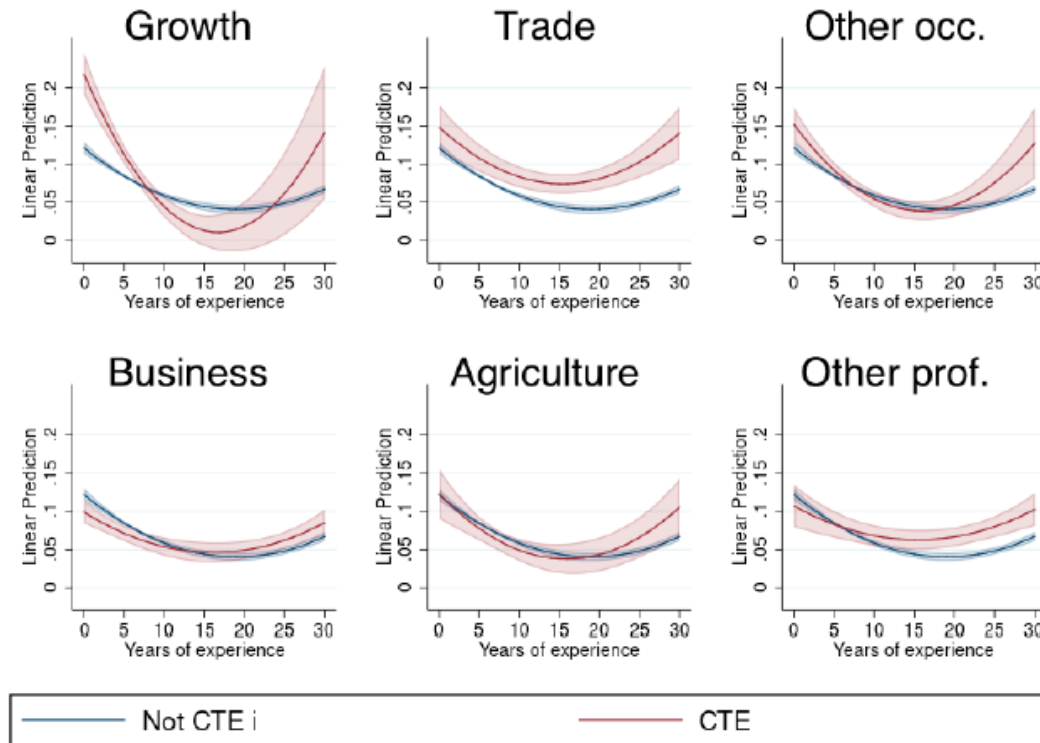
Staffing: CTE content knowledge appears critical

- Chen et al. (2022) find that students having a CTE teacher who scored higher on their subject-specific certification exam had higher earnings, though this did not hold for teacher certification exams in writing
 - Theobald et al. (2023) showed better non-test outcomes for students with disabilities who had teachers with more industry experience
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CTE can be hard to staff

- Districts report teacher shortages in high-demand, high-wage Career and Technical Education (CTE) subjects such as manufacturing (81%), IT (73%), health sciences (71%), and STEM (Student Research Foundation, 2019).

Figure 2: Predicted probability of turnover, by cluster



Note: Estimated probabilities of turnover include 95% confidence intervals.

Innovation quickly outstripping evidence: Funding

- Smith & Dougherty (2023) are documenting and studying changes in CTE funding
 - Florida, Georgia, Kansas all have increased state funding weights for CTE participants or credential earners
 - Indiana, Oregon, Ohio, all providing funding incentives for participation in high-demand areas
 - Colorado, Kansas, Florida, North Carolina, and Washington all have enacted incentive programs for industry credential attainment
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Policy challenge

- Scale effective offerings while managing costs, access, & personnel
 - Understand content and industry knowledge are important, while acknowledging that private sector wages make CTE teachers especially hard to attract and retain
 - Expanding high-demand, high-wage CTE programs requires efficient use of scarce teaching resources & allocation of space, equipment, & access
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Potential policy solutions

- Ensure funding innovations address demonstrated needs & likelihood for impact
 - Encourage secondary-postsecondary collaboration to share teaching resources and distribute equipment costs,
 - Especially in high demand or equipment intensive programs.
 - May be especially important in rural communities or cities with concentrated demand (e.g. healthcare)
 - Improve access by scaling low-cost programs in comprehensive high schools
 - Bundle high- and low-cost programs in regional centers or specialized schools to smooth cost differential
 - Innovate staffing models to allow part-time & flexible compensation
 - Additional tax breaks for employers that donate equipment and/or employ program graduates upon completion
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Conclusion

- Expansion of focus on multiple pathways to adulthood should be a net positive for education & workforce policy
- Ensuring success will mean attention & coordination of elements known to positively contribute to skill development
- Thank you

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