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A Quasi-Experimental Investigation of Tennessee Promise and Career and Technical Education Postsecondary Enrollment Responses

Gresham D. Collom
University of Tennessee, Knoxville, gcollom@utk.edu

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Gresham D. Collom, Ph.D.
Postdoctoral Research Associate
University of Tennessee, Knoxville
Postsecondary Education Research Center
ECMC Foundation CTE Postdoctoral Research Fellow

Abstract

In this study I deployed quasi-experimental methods to explore the effect of the implementation of a statewide free-college program, Tennessee Promise, on enrollment in postsecondary career and technical education programs. State policymakers implemented the Tennessee Promise, a free-college program for recent high school graduates attending public, two-year institutions, in 2015. As postsecondary attainment in the United States falls short of workforce needs, there has been an increased focus on postsecondary career and technical education credentials and degrees linking workforce needs directly with educational programs (Lumina, 2019; Perkins V, 2019). However, it is currently unknown whether access to statewide free-college funding impacts enrollment in postsecondary career and technical education. In this study, I use federal data to estimate the causal effect of Tennessee Promise on postsecondary career and technical education enrollment. Findings from the analysis show a small but non-significant increase in Tennessee after the implementation of the grant when compared to both the national control group and the contiguous control group. I discuss the implications for research and practice, and how promise programs may be leveraged more effectively moving forward to improve outcomes in postsecondary career and technical education.

Keywords: Career and technical education; state policy; promise program; Tennessee Promise; enrollment

A Quasi-Experimental Investigation of the Effect of Tennessee Promise on Postsecondary Career and Technical Education Enrollment Responses

In the United States there is a growing focus on the importance of postsecondary career and technical education. Career and technical education, which is too often disregarded as "taking shop class or home economics in high school" (Hersperger et al., 2013, p.158), is now central to our country's workforce needs and postsecondary credential goals. The Carl D. Perkins Career and Technical Education Act of 2006 was reauthorized in 2019 through the Strengthening Career and Technical Education for the 21st Century Act (Perkins V; H.R. 2353, 2018). Additions included in Perkins V expanded the focus on postsecondary career and technical education programs, broadening the target student populations to include persons who are incarcerated, students from rural localities, homeless persons, and persons impacted by the foster care system (Office of Career, Technical, and Adult Education, 2018).

Perkins V aligns with the widely adopted goal of 60% post-high school educational attainment in the United States by 2027, a goal which was originally promoted by the Lumina Foundation's *A Stronger Nation* (2019). Since 2014, and central to Lumina's most recent update to the original report, the foundation has called for increased participation in programs that emphasize matching postsecondary programs with workforce needs and focusing on often underrepresented groups in recruitment and retention initiatives (Lumina, 2019).

In 2015 Tennessee implemented the Tennessee Promise initiative (TN Promise). The statewide *free-college* program was created to increase college-going behaviors and improve statewide postsecondary credential attainment (Carruthers & Fox, 2016). Designed as a last-dollar scholarship policy, TN Promise covers full tuition and fees for any high school graduate who attends a public two-year college, including the Tennessee College of Applied Technology

(TCAT), community colleges, and select private institutions. A primary goal stated by policymakers who implemented the TN Promise was to increase the amount of Tennessee students pursuing a postsecondary career and technical education credential or degree and to broaden access to postsecondary programs.

The small but growing body of research on TN Promise is revealing, showing that the program may decrease dependence on student loans (Odle et al., 2021), increase postsecondary enrollment among Black and Hispanic students and students who would not have otherwise enrolled in college (Nguyen, 2020), and divert enrollment away from private colleges and to public Promise eligible institutions (Bell, 2021). Yet, little focus has been given to how statewide promise programs, specifically the TN Promise, may impact participation in postsecondary career and technical education programs. As more states adopt their own promise programs, it is essential to understand how broad access to tuition-free, two-year public education may impact participation in career and technical education programs.

In this study I estimate the causal effects on postsecondary career and technical education enrollment in Tennessee following the adoption of TN Promise. A differences-in-differences estimation was used to observe the enrollment responses following the implementation of TN Promise in 2015 and to further analyze the natural experiment in Tennessee. Data were gathered from the Consolidated Annual Report (CAR) from the U.S. Department of Education/Office of Career, Technical, and Adult Education (2020), which generates state reported data required by the Perkins V Act. Findings from this study contribute to the growing body of promise literature and are the first to link postsecondary career and technical education participation with the adoption of a statewide promise program through quasi-experimental methods. I conclude by discussing the implications for policy, practice, and research.

Literature Review

While improving postsecondary CTE is a focus of Perkins V and nationally, there is minimal research on the topic. Further, there is currently no research exploring how TN Promise or other statewide promise programs align with federal education policies such as Perkins V. The following section provides a brief review of current research on postsecondary CTE and a brief review of research on TN Promise.

Current Research on Postsecondary Career and Technical Education

Postsecondary career and technical education (CTE) was largely an afterthought during the dawn of American higher education. Despite the stated goal of increasing vocational education, the Morrill Acts of 1862 and 1890 resulted in colleges "focused on the general education curriculum with little to no attention to vocational education" (Hersperger et al., 2013, p. 161). It was not until the Smith-Hughes Act of 1917 that secondary CTE was specifically funded by the federal government; postsecondary CTE was largely absent from any federal legislation until the Perkins II Act was adopted in 1990[1].

The focus on postsecondary CTE increased substantially in the last 10 years. Following an unprecedented economic recession in 2008, newly elected President Barack Obama delivered a speech to congress in which he stated:

> I ask every American to commit to at least one year or more of higher education or career training. This can be community college or a four-year school, vocational training, or an apprenticeship. But whatever the training may be, every American will need to get more

[1] see Hersperger et al., 2013 for a more robust review of CTE history.

> than a high school diploma…by 2020, American will once again have the highest proportion of college graduates in the world.

National foundations and state leaders echoed Obama's call for a more educated American population. The Lumina Foundation has tracked educational attainment in the US since 2008 for their *A Stronger Nation* initiative. The foundation articulated a goal to increase nationwide postsecondary attainment to 60% by 2025 (Lumina Foundation, 2019). The Lumina Foundation has partnered with numerous states to develop plans and policies to increase statewide postsecondary educational attainment. Recently, the organization has increased their emphasis on CTE. Since 2014, the Lumina Foundation has included workforce relevant certificates when tracking postsecondary attainment, and it began tracking certifications in 2018. The foundation's current state policy agenda specifically called for innovation within higher education and for state policymakers to think beyond traditional academic programs and focus more on postsecondary CTE.

Today, postsecondary CTE is an often-discussed topic among state and federal policymakers. The Carl D. Perkins Career and Technical Education Act of 2006 was reauthorized in 2019 through the Strengthening Career and Technical Education for the 21st Century Act (Perkins V Act, 2019). Amendments to the 2006 Act in Perkins V expanded funding for increased rigorous research focused on postsecondary CTE and called for increased student diversity with an emphasis on equity in secondary and postsecondary CTE programs.

Despite the increased focus on postsecondary CTE, there is limited recent research focused on the topic in the United States or how postsecondary CTE interacts with existing policies. Much of the research regarding postsecondary CTE centers on how secondary CTE participation impacts educational pathways. For example, Cowan et al. (2020) studied how

participation in secondary CTE impacted postsecondary transitions. The researchers found students who participated in secondary CTE were less likely to pursue postsecondary education overall, more likely to enroll in further vocational training following high school graduation, and more likely to work full-time in the three years following high school (Cowan et al., 2020). Similarly, Dougherty and Lombardi (2016) found that the existing body of research on postsecondary CTE is growing and that "it is an opportune time to study how policy and program shifts in these areas affect student experiences and outcomes" (p. 349). The authors emphasized that future research should focus on equity and access to high quality postsecondary CTE programs for historically marginalized groups.

Regarding existing postsecondary CTE programs, there are indicators that the increased focus and access to non-degree credentials may yield positive outcomes for students. In their 2016 paper, Xu and Trimble analyzed the impact of certificates offered at community colleges. Contrary to previous research on community college certificates, which often focuses on changes in income, their analysis revealed that individuals who received a certificate were more likely to be employed and may use their credential to switch industries (Xu & Trimble, 2016). Similarly, in their 2019 paper Stevens et al. explored the estimated labor market returns of a postsecondary CTE credential in California. Their analysis revealed a 14% to 45% return compared to the cost of a postsecondary CTE degree or certificate, which is comparable to or exceeds most four-year degree ROI estimates (Stevens et al., 2019).

While the analyses highlighted above focused on transitions to postsecondary CTE and employment outcomes, little is known about how existing policies created to broadly increase access to postsecondary education (i.e. TN Promise) impact participation in postsecondary CTE. As the importance of high quality postsecondary CTE continues to grow, it is imperative that

researchers also explore “the mechanisms by which students have come to access them” (Dougherty & Lombardi, 2016, p. 348).

Research on Tennessee Promise

In 2015, Tennessee implemented the Tennessee Promise Initiative to increase college-going behaviors and improve statewide postsecondary credential attainment (Tennessee Promise, n.d.). Designed as a last-dollar scholarship policy, TN Promise covers full tuition and fees for any high school graduate who attends a public two-year college, including the Tennessee College of Applied Technology (TCAT) and community colleges (Tennessee Promise, n.d.). Thus far the body of research on Tennessee Promise is small but promising. In their analysis of Knox Achieves, the precursor pilot program to the TN Promise, Carruthers and Fox (2016) found that participating in the program was strongly associated with a 25 to 30% increase in college enrollment. The success of the Knox Achieves promise program resulted in a statewide expansion of the Tennessee Promise in 2015.

Nguyen’s (2020) analysis found similar results in the statewide program. He deployed a differences-in-differences estimation to analyze the Tennessee Promise and its impact on enrollment in the state. His study found that while implementation of the Tennessee Promise was associated with a 2% enrollment decrease in the state’s public four-year institutions, there was an enrollment increase of 40% of full-time first-time undergraduates at the state’s community colleges. Nguyen’s (2020) analysis did not delaminate by degree programs and focused on enrollment by sector and race.

Bell (2021) explored the spillover effects of TN Promise through quasi-experimental methods. She found TN Promise resulted in significant changes to enrollment across various

sectors in the state. Her study's findings - similarly to Nguyen's (2020) and Carruthers and Fox's (2016) - showed a sharp increase in overall enrollment at public community colleges and technical colleges. However, Bell's (2021) findings also revealed an increase of out-of-state students at public four-year colleges who were ineligible to receive promise funding, a decrease in Black students at private colleges ineligible for promise funding, and an increase in tuition at public institutions eligible for promise funding.

Carruthers and Welch (2020) explored how the TN Promise impacted enrollment at Tennessee Colleges of Applied Technology (TCAT). Their analysis dived further than previous studies by exploring individual level financial aid data for students attending TCATs. The researchers found that while many TCAT students were eligible for state or federal aid that would have covered tuition expenses, such as TN Promise/Reconnect, HOPE Scholarship, Pell Grant, 64% of TCAT students did not apply for financial aid through the Free Application for Federal Student Aid (FAFSA; Carruthers & Welch, 2020). Findings from their analysis pointed to the potential for students pursuing a postsecondary CTE credential to benefit from the existing free-college policies in the state.

Statewide promise programs like TN Promise are becoming more common in the United States. While existing literature on the program is promising, more analyses are warranted. Further, researchers must determine how statewide promise programs align with federal policy focuses, such as Perkins V, and with the national emphasis on improving access and participation in postsecondary CTE programs. Thus, this study expands on existing postsecondary CTE and TN Promise research by leveraging data available through the Perkins data portal to explore the causal effect of TN Promise specifically on postsecondary CTE program enrollment.

Theoretical Framework

Perna's (2006) conceptual model for college choice served as the guiding theory for this study. She proposed that college choices are shaped by four layers. Layer one represents habitus, or the belief in what one can achieve based on their socioeconomic and demographic characteristics, as well as other factors such as institutionalized racism and oppression (Bourdieu, 1984; Luedke et al., 2019). Layer two is the school and community context. This layer reflects "the ways in which social structures and resources facilitate or impede college choice" (Perna, 2006, p.177). Layer three is the higher education context and reflects the role postsecondary education institutions have in college choice through marketing and admission practices. Lastly, layer four reflects the macro-level effects on college choice due to social forces, economic conditions, and public policies.

Due to currently available data, the analysis in this study centered on the effect of a public policy (TN Promise) on enrollment in postsecondary CTE programs. However, Perna's (2006) theory informed the discussion section of this manuscript. Particularly, her theory informed the discussion around why TN Promise may increase enrollment for certain groups of students, programs, or institutions, and have little to no effect elsewhere.

Methods

In this study I leveraged a natural policy experiment to explore the causal effect of TN Promise on CTE program enrollment. In the following section, I explain the methods for this study, including the study data, analytic framework, limitations, and results. The guiding research question for this study was: *What effect did the implementation of Tennessee Promise have on postsecondary CTE program enrollment in Tennessee?*

Data

State level panel data were gathered from the Consolidated Annual Report (CAR) from the U.S. Department of Education/Office of Career, Technical, and Adult Education (2020), which compiles state reported data required by the Perkins Act on CTE enrollment and performance and is available through the Perkins data web portal[2]. Data on postsecondary CTE enrollment in the United States between 2011 to 2018 were analyzed in this study. State median income data for the same timeframe were also gathered from the United States Census Bureau. Cases prior to 2011 and data from non-state territories were deleted due to high levels of missing data.

Two control samples were used in this study. For the national control sample, I excluded four states which enacted some variant of a large-scale college promise program in the timeframe of this study: Oregon, Minnesota, Kentucky, and Rhode Island (Nguyen, 2020). The final national sample included 46 states over an eight-year period, for a total of 368 cases (state-year). For the contiguous state sample, I included Alabama, Georgia, Missouri, Mississippi, North Carolina, and Virginia. I excluded the one contiguous state with a large-scale promise program, Kentucky. Summary statistics are provided in tables 1, 2 and 3.

[2] https://perkins.ed.gov/pims/dataExplorer

Table 1: Summary Statistics Non-Tennessee CTE Enrollment

Year	Mean	SD	Min	Max
2011	43400.851	52778.832	2088	243186
2012	42809.128	53831.36	1990	247827
2013	39768.851	49760.189	1833	243999
2014	39897.234	49423.645	1876	240458
2015	38167.915	48530.739	1602	240451
2016	38380.298	47528.455	1370	241481
2017	37011.830	46740.346	1642	241211
2018	35817.596	45875.553	849	243476

Table 2: Summary Statistics Contiguous States CTE Enrollment

Year	Mean	SD	Min	Max
2011	66626.167	42941.126	9703	119927
2012	58278.333	32570.566	9121	90388
2013	59133.5	30418.404	23346	104596
2014	56562.5	28707.536	24281	98574
2015	53145.333	27146.351	25338	91056
2016	53504.833	23741.897	23634	88495
2017	51538.167	22508.793	23027	85634
2018	46604.833	22779.392	23035	82855

Table 3: Summary Statistics Tennessee CTE Enrollment

Year	Total Enrolled
2011	15185
2012	15636
2013	16483
2014	16112
2015	14410
2016	14444
2017	13387
2018	12828

Analytic Framework

To estimate the causal impact of Tennessee Promise on postsecondary career and technical education enrollment I used a standard fixed-effects differences-in-differences (DiD) framework (Nguyen, 2020). Differences-in-differences is a widely used method in social science research to measure the causal effect of a policy or other treatment in non-experimental settings (Cunningham, 2021). The method is often used in policy analyses such as this study which rely on panel data (Donald & Lang, 2007). Recently, the method has been used to explore higher education policies such as performance-based funding (Hillman et al., 2015) and promise programs (Bell, 2021; Nguyen, 2019; Nguyen, 2020).

Quasi-experimental methods can be effective when examining a natural experiment when the data and sample size are appropriate (Kim & Steiner, 2016). For this study, the effect was measured compared to both a national sample (46 non-treatment) and contiguous sample (six non-treatment). Further, it is ideal to include at least three years of pre-treatment data and three years of post-treatment data to establish a causal relationship in studies using DiD (Hu & Hoover, 2018). In this study, data were included from four pre-treatment periods (years) and four post-treatment periods (years).

In this study I sought to measure the effect (δ) of Tennessee Promise on postsecondary career and technical education enrollment (CTEE).

$$E[\delta] = E\left[CTEE^{1} - CTEE^{o}\right]$$

Causal effect cannot be determined by means testing because $CTEE^{1}$ (enrollment when TNP exists) and $CTEE^{o}$ (enrollment when TNP does not exist) do not exist at the same time and are therefore counterfactuals (Cunningham, 2021).

Differences-in-differences provided a more accurate estimate of the effect by comparing the differences in the treated group (Tennessee) with differences in the non-treated groups (non-Tennessee & contiguous states). The representative regression equation for this study was:

$$Y_{st} = Year_t + \gamma TN_s + \lambda \text{TREAT}_t + \delta\,(TN_s * \text{TREAT}_t) + \boldsymbol{x}'_{st}\,\boldsymbol{\beta} + \epsilon_{st}$$

Where Y_{st} is enrollment for state (s) in year (t). TN is the variable dummy coded to 1=TN and non-TN=0. TREAT_t is the dummy variable which marks the start of TN Promise in 2015. $Year_t$ is the year fixed effects. $\boldsymbol{x}'_{st}$ equals the state income control covariate. Lastly, δ is the average enrollment effect of the TN Promise on postsecondary CTE enrollment by state. Following Nguyen's (2020) analytic method, I also conducted the analysis with the natural logarithm of the dependent variable enrollment (Y_{st}); the estimated treatment effect was then calculated as $100*(e^{\delta}– 1)$ or δ*00 percent.

Common Trends

An important and often violated assumption for DiD is the common trends assumption (Cunningham, 2021). The common trends assumption requires that the treated group and non-treated group follow similar trends prior to the treatment (Angrist & Pischke, 2009; Cunningham, 2021). Prior to running the DiD analysis, I visually compared trends of postsecondary CTE student enrollment between 2011 and 2018 (see Figures 6 and 7). To account for the unequal trends in national pre-treatment enrollment, I ran the analysis against two samples (national and contiguous). The contiguous sample followed a similar pre-treatment trend in postsecondary career and technical education enrollment to Tennessee.

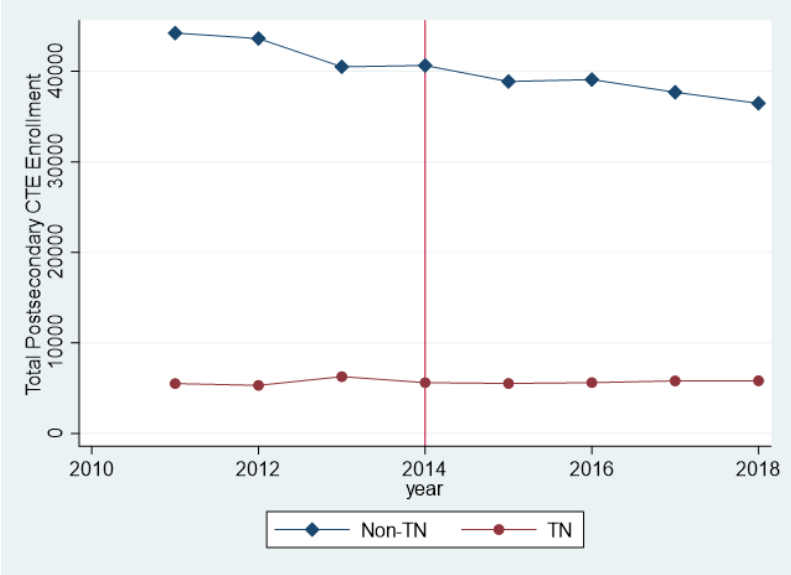

Figure 1: Common Trend Plot Nationwide Sample[3]

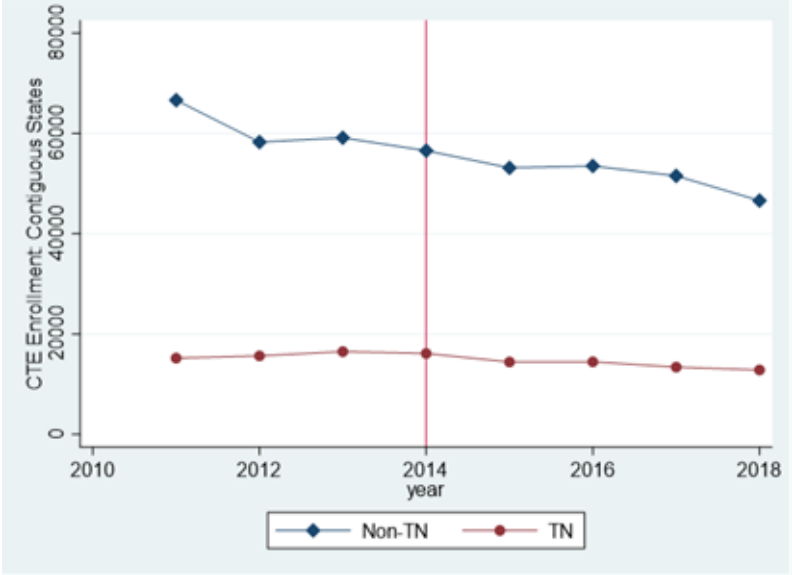

Figure 2: Common Trends Plot Contiguous States[4]

[3] Data source: Consolidated Annual Report (CAR) from the U.S. Department of Education/Office of Career, Technical, and Adult Education (2020). Data from Oregon, Minnesota, Kentucky, and Rhode Island were excluded from the nationwide sample due to implementation of similar statewide promise programs.

[4] Contiguous states included data from Alabama, Georgia, Missouri, Mississippi, North Carolina, and Virginia. Data from Kentucky was excluded due to implementation of a similar statewide promise program.

Limitations

This analysis was limited by the institutional level panel data available through CAR and the United States Census Bureau, and therefore could not account for individual level factors (e.g. socioeconomic background, location, high school factors, GPA) which may have affected student enrollment decisions. Further, this analysis was limited to state-level data and could not measure for institutional-level effects of the policy as Nguyen (2020) and Bell (2021) did in their analyses. Lastly, for this analysis I limited the scope to enrollment and did not explore whether TN Promise impacted other academic outcomes in postsecondary CTE programs such as retention and graduation. Future studies should expand on this analysis to investigate whether TN Promise had a causal relationship with other academic outcomes in postsecondary CTE programs other than enrollment.

Results

Results from the DiD analyses are presented in table 4. Results are displayed for analyses which compared Tennessee to a national (non-promise) control group and a contiguous control group. The interaction effects (TN*TREAT) in table 6 show the TN Promise had a non-statistically significant effect on enrollment in postsecondary CTE programs when compared to both the national control group and contiguous state control group.

Table 4: Differences-in-Differences Estimation Results for CTE Program Enrollment

	Raw Data		Natural Logarithm	
	(1)	(2)	(3)	(4)
	National	Contiguous	National	Contiguous
TN*TREAT	2,282.680	10,995.083	-0.039	0.046
	(4,861.429)	(7,610.702)	(0.223)	(0.168)
95% CI	-7282.53 - 11847.89	-4386.72 - 26376.89	-.4781 - .4009	-.2943 - .3865
Constant	52,107.079***	318,696.573**	11.614***	17.801***
	(19,961.461)	(124,101.756)	(0.917)	(2.747)
Observations	368	56	368	56
States	46	7	46	7
R-Squared	0.142	0.332	0.057	0.230

Clustered standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

The effect on postsecondary CTE enrollment due to TN Promise was calculated as 100 * (e^{δ}– 1) or δ*100 percent on both the lower and upper 95% confidence interval coefficients (Nguyen, 2020). As expected, due to the observed non-significant effect there was a broad range of estimated enrollment changes attributable to TN Promise; -47% to 40% when compared to the national sample, and -29% to 39% when compared to the contiguous state sample. The results from this study, therefore, do not establish a causal relationship between TN Promise and postsecondary CTE enrollment.

Discussion

In this study I explored the effect of TN Promise on enrollment in postsecondary CTE programs in Tennessee using quasi-experimental methods. While descriptive statistics showed a small increase in postsecondary CTE enrollment in Tennessee when compared to both the national and contiguous samples, the results from the DiD analysis were not statistically significant and revealed no causal link between TN Promise and postsecondary CTE enrollment. The findings from this study supported Carruthers and Welch's (2020) study; while many students who pursue postsecondary CTE programs or enroll in TCATs may be eligible for funding through TN Promise, thus far the policy has had little to no impact on postsecondary CTE enrollment in the state.

Due to the multiple limitations to this analysis, I encourage researchers to replicate and expand upon this study to further investigate whether TN Promise effected enrollment in postsecondary CTE programs. In the following section I offer recommendations for future research, policy, and practice.

Recommendations for Research, Policy, and Practice

As the United States continues to prioritize postsecondary credential and degree attainment, attention must be given to how existing policies can be leveraged to meet stated goals. Future research must be conducted to explore why students who pursue postsecondary CTE do not appear to use existing state funding such as TN Promise (Carruthers & Welch, 2020). Further, researchers should explore existing pathways from secondary to postsecondary CTE programs in the state and determine whether such programs provide the necessary information and incentives for students to make informed choices regarding if and how they can use the FAFSA and federal/state funding to continue their education beyond high school in postsecondary CTE programs (Carruthers & Welch, 2020; Collom et al., forthcoming; Odle et al., 2021). Further research must be conducted to determine if current guided pathways efforts in select community colleges are effective and whether such programs could be expanded statewide to all public community colleges and TCATs to further incentivize students who are pursuing postsecondary CTE to use the TN Promise (Carruthers & Welch, 2020; Klempin & Lahr, 2021). Lastly, future research should explore whether the TN Reconnect (Tennessee's other promise program for adult students 24 and over) had a causal effect on CTE program enrollment.

From a policy perspective, as secondary CTE programs grow in Tennessee, state and local policymakers must ensure that postsecondary CTE is presented as an option to students from marginalized backgrounds and available in parts of the state where vocational education is not traditionally pursued. Furthermore, state policymakers should explore whether the potential expanded funding currently piloted in the state, which covers expenses beyond the tuition covered by existing programs such as books and living expenses, is also an effective way to support low-income individuals who are pursuing postsecondary CTE programs (Bohle, 2021).

From a practical standpoint, the TN Promise presents an opportunity for TCAT institutions and non-degree CTE credential programs in public community colleges to recruit and admit students who may not be interested in enrolling in two-year non-CTE or four-year programs. Admissions representatives and institutional leaders at TCATs and within community college CTE programs can leverage the free-college policies available in Tennessee to expand their student body and increase postsecondary CTE attainment in the state. While TN Promise is widely marketed by community colleges in the state, TCATs and specific CTE non-degree programs within community colleges should use the availability of TN Promise in marketing efforts.

The federal government and select states are beginning to realize the equity implications of increasing postsecondary CTE attainment. Findings from this study indicate there was little effect on postsecondary CTE enrollment in the state following the implementation of TN Promise. However, Tennessee has the opportunity to continue its role as a leader in postsecondary access by leveraging their current policies to expand postsecondary CTE outcomes and expand the number of students who pursue and succeed in postsecondary education.

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