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Essays on Higher Education Finance and Performance

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Citation	Gadi, Kyela. Essays on Higher Education Finance and Performance. 16 Dec. 2024, Georgia State University. https://doi.org/10.57709/38001588 .
DOI	https://doi.org/10.57709/38001588
Download date	2026-06-09 17:52:27
Link to Item	https://hdl.handle.net/20.500.14694/1775

ABSTRACT

ESSAYS ON HIGHER EDUCATION FINANCE AND PERFORMANCE

BY

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JANUARY 2025

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Amid rapidly changing U.S. demographics, enhancing equitable educational opportunities through state finance policies for higher education is critical for the nation's economic and workforce development. However, implementing state finance policies as "one size fits all" approaches in a stratified higher education context without considering differences across student groups, and institution types may create disparate impacts that impede educational opportunities. This three-essay dissertation conducts an early finance equity audit that examines the heterogenous effects of three contemporary state finance policies on three critical educational inputs – student enrollment, institutional spending, and instructional faculty composition – that matter to student success in public higher education institutions in the two-year and four-year sectors. Using quasi-experimental methods, the study evaluates the differential and dynamic effects of universal free college programs, performance-based funding, and tuition freezes on educational inputs in public institutions, with a focus on institutions serving disproportionate populations of minoritized student groups. Collectively, the study generates and contributes robust evidence that may help states in employing equity-enhancing finance strategies to boost educational opportunities more effectively and equitably.

ESSAYS ON HIGHER EDUCATION FINANCE AND PERFORMANCE

BY

KYELA H. GADI

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree
of
Doctor of Philosophy
in the
Andrew Young School of Policy Studies
of
Georgia State University

GEORGIA STATE UNIVERSITY

2025

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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Public Policy in the Andrew Young School of Policy Studies of Georgia State University.

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DEDICATION

I dedicate this work to my parents, Joshua Gadi (deceased) and Mary Gadi whose exemplary lives of public service modeled a solid foundation for me. You made this possible.

I also dedicate this to my husband, Timothy Gana. You are my rock.

And the Lord did it – Philippians 1:6.

ACKNOWLEDGEMENTS

Navigating this challenging yet rewarding PhD journey of a thousand miles took a village. Many people supported me along the way. And I am here to express my deepest gratitude.

I am immensely grateful to each member of my dissertation committee for invaluable guidance, and mentorship – helping me become a better independent scholar. Thank you, Dr. Capers, for your unwavering support and encouragement for my research on higher education from my very first day in the program. Thank you, Dr. Jimenez, for helping me become a more critical researcher and for deepening my understanding of performance management. Thank you, Dr. Ribar, for consistently providing clear and timely feedback to my numerous ideas and for the applied evaluation research experience. Thank you, Dr. Thomas, for stimulating my interest in evaluation research early in the program.

I must also thank Dr. Andrew Heiss for introducing me to quasi-experimental research designs in R and for being a helpful resource. I am also thankful to the Dan E. Sweat Dissertation Fellowship for the generous support for this dissertation.

Importantly, I am extremely fortunate to have my family and friends as a firm support system throughout this PhD journey. I am profoundly thankful to my husband, mother, sisters, in-laws, nephews, and friends whose unconditional love, prayers, patience, and encouragement kept me grounded.

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Chapter I. Introduction

1.1. Introduction

A sea wave of state finance policies is restructuring the funding and educational opportunities in U.S. public higher education. Structural shifts in state higher education finance policies are increasingly prioritizing investments that help students earn college credentials and secure jobs for economic growth (Harnisch et al., 2024). Accordingly, states employ a broad mix of finance and policy interventions, including free college programs for students, performance-based funding for public institutions, and tuition price controls for public institutions, to boost educational opportunities, often implementing these state interventions as “one size fits all” structural changes. However, “our higher education system, like the larger society, is growing more and more unequal” (Century Foundation, 2013, p.12). The policy problem with implementing state finance policies as “one size fits all” approaches in an already stratified higher education context signals the likelihood of driving disparate impacts that exacerbate entrenched disparities in educational opportunities.

Disparities in college financing across student groups and unequal funding across higher education institutions persist. Many economically and racially minoritized students attend the poorest colleges (Hillman, 2020; Kelchen et al., 2023; Cheslock & Shamekhi, 2020). The poorest colleges spend the least on educational and related expenses critical for student success (Hillman, 2020; Cheslock & Shamekhi, 2020). Many students attend college and accrue debts but without earning a credential (Harnisch et al., 2024). A growing concern is that structural shifts in state finance policies that do not account for the heterogeneous nature of financial needs of students by class and race and ethnicity as well as the unequal institutional resources across institution types may alter educational inputs in higher education in ways that exacerbate inequities for the

public, given that who attends college and which college they attend matter to educational attainment and economic growth (Hillman, 2020; Kelchen et al., 2023; Cheslock & Shamekhi, 2020). Consequently, “one size fits all” structural changes in state finance policies could create disparate impacts on critical educational inputs, such as student enrollment, institutional spending, and instructional faculty composition, in important ways that matter to advancing educational opportunities more equitably.

The purpose of this dissertation is to understand whether and how the implementation of contemporary state finance policies in a stratified higher education context drives heterogeneous changes in educational inputs across public higher education institutions. Specifically, the study evaluates the 1) enrollment effects of a universal free college program for traditional and minoritized student groups in community colleges, 2) dynamic changes in educational and related spending in public four-year institutions subject to performance-based funding (PBF), and 3) dynamic changes in the composition of instructional faculty in public four-year institutions subject to tuition freezes. The dissertation places particular focus on underrepresented students from low-income backgrounds and students of color, and institutions serving minoritized student populations. Structural changes in state finance policies could distribute resources to students in ways that do not equitably help students with the most financial needs to attend and complete college. Additionally, shifts in state finance policies may restructure educational resources in public institutions in ways that widen persistent disparities in educational inputs critical for improving student success. Unequal educational inputs may be particularly concerning for historically underfunded institutions serving disproportionate shares of minoritized students and for closing gaps in educational attainment for economic prosperity.

Employing an equity lens, I argue that inequities in educational inputs in higher education persist when state finance policies are designed and implemented broadly without accounting for or addressing differences in the needs of diverse student groups, and the capacities of diverse institution types more adequately (Flores, 2022; Hillman et al., 2024). Because financial resources for college varies across student groups (Perna, 2006), state finance policies that do not consider differences in college financing capabilities between students from less and more privileged backgrounds may not improve educational opportunities equitably (Nguyen, 2020; House & Dell, 2020). Likewise, disparities in institutional resources exist across public colleges and universities (Hillman, 2020; Kelchen et al., 2023; Cheslock & Shamekhi, 2020). Minority-serving institutions (MSIs) typically receive less state financial support than their non-MSI counterparts (Kelchen et al., 2023; Ortagus et al., 2022). Similarly, non-doctoral institutions (comprehensive universities) providing college and career pathways for many underserved student groups remain underfunded compared to well-resourced doctoral research institutions (Hillman, 2020). Without accounting for and mitigating entrenched funding and resource gaps across institution types, state finance policies may do little to help institutions improve educational attainment. Instead of the “one size fits all” funding approaches, states may employ equity-enhancing finance strategies that account for heterogeneity in higher education to more equitably improve educational opportunities for economic growth (Flores, 2022; Hillman et al., 2024), especially given the rapidly changing U.S. demographics and the need to educate the expanding minority population for a secured workforce for the nation (Frey, 2018; Boland et al., 2021).

As an initial step in advancing equity-enhancing strategies in higher education finance, many scholars propose conducting funding equity audits (Hillman, 2020; Cummings et al., 2021;

Laderman, 2022). Finance equity audits could help states evaluate how state finance policies affect the distribution of educational inputs in a stratified and unequal higher education context. Finance equity audits entail generating evidence to help states understand the patterns of disparities in higher education. Finance equity audits may involve examining how enrollment patterns vary across student groups and institution types, how financial resources vary across institution types, how spending patterns varies across institution types, and how much institutions spend per student (Hillman, 2020). Understanding these patterns of inequities in a diverse and stratified higher education context may help policymakers inform policy solutions that center equity to address structural and funding gaps that impede educational opportunities for many Americans.

1.2. Main Findings and Structure of Study

This three-essay dissertation responds to the need for evidence to advance equity-enhancing strategies in higher education finance by conducting an early finance equity audit. The study employs quasi-experimental designs to evaluate the differential and dynamic impacts of three contemporary state finance policies on three critical educational inputs – student enrollment, institutional spending, and instructional faculty – in public institutions as illustrated in Figure 1.1. The first essay in Chapter 2 examines the enrollment effects of implementing universal free tuition scholarships to students in community colleges in Tennessee. The growing popularity of free college programs promises increased access to college yet poses the question, “access for whom?” Using difference-in-differences methods, institution-level data from the Integrated Postsecondary Education Data System, and comprehensive state-level data on PBF, the essay examines whether Tennessee’s free tuition scholarships improve enrollment for traditional students (full-time students and White students), and minority students (low-income

students, Black students and Hispanic students). I address this question through the college choice model (Perna, 2006), which describes how the broader policy context influences enrollment processes and outcomes. I find suggestive evidence that offering universal free tuition scholarships to students in the context of PBF may be complementary and boost college enrollment for traditional students, and less complementary and limit minority enrollment. The study provides a more nuanced understanding of the relationship between free college programs and disparities in enrollment effects for traditional and minority students.

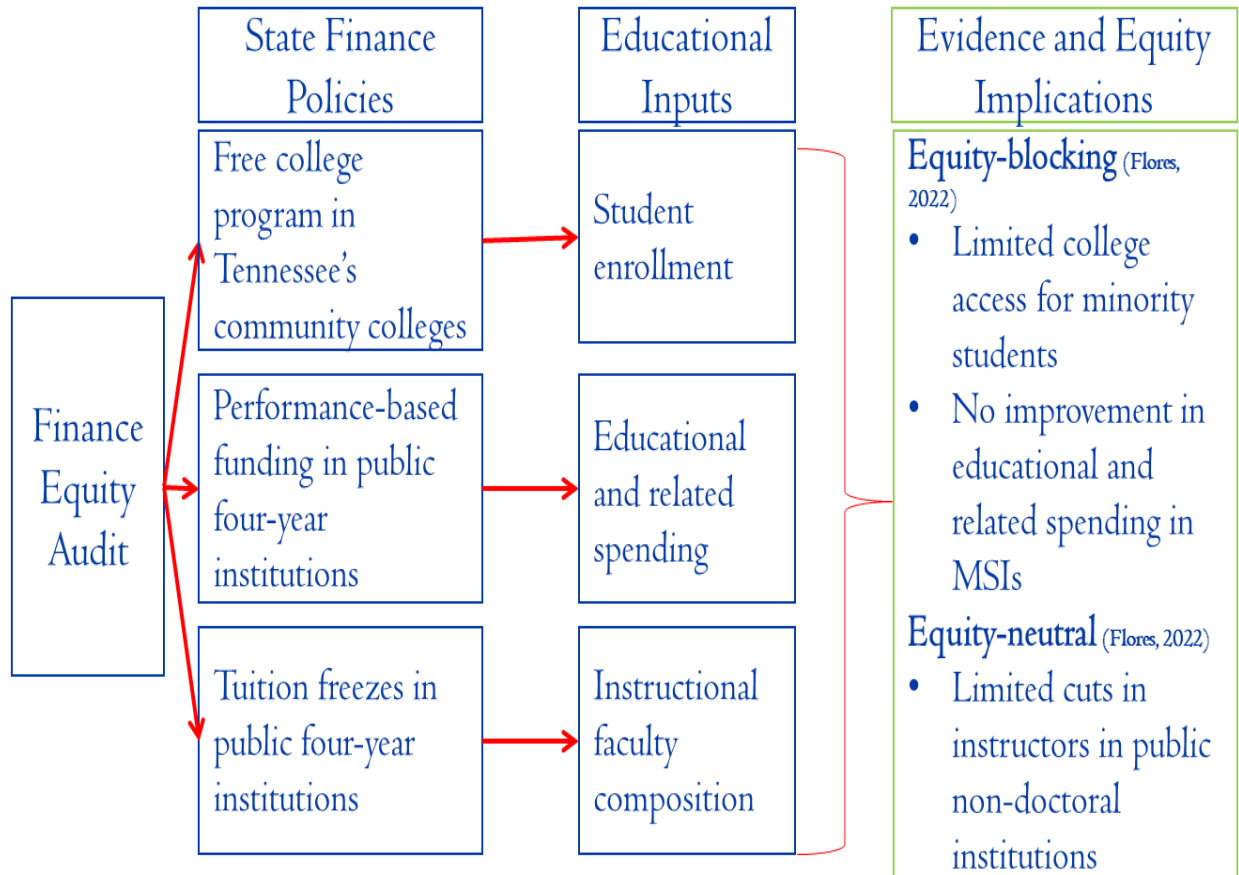


Figure 1.1. Study Framework: Finance Equity Audit of State Higher Education Finance Policies

Next, because states are increasingly funding public higher education institutions based on their performance in recent decades, the second essay in Chapter 3 examines the dynamic shifts in educational and related spending in public four-year institutions funded based on PBF formulas, and by MSI status of institutions. The essay employs event study difference-in-differences methods and uses institution-level data from IPEDS and a comprehensive state-level PBF dataset. Leveraging insights from the principal-agent model (Jensen & Meckling, 1976), this second essay finds suggestive evidence of dynamic increases in spending on instruction over five years after public four-year institutions are funded based on PBF. However, PBF funding did not appear to improve instructional spending in MSIs and non-MSIs over time. Instead, public four-year institutions and non-MSIs experienced delayed increases in administrative spending that is less relevant for improving student success. The study concludes that the differential and dynamic changes in educational and related spending in public institutions provide critical insights as to why PBF policies continue to drive marginal improvements in student outcomes, particularly among underfunded MSIs and their underserved students (Ortagus et al., 2020; Li, 2022).

Lastly, the restrictive tuition control policies that states implement to make college affordable could threaten critical institutional revenues for public colleges and universities. In response to financial uncertainty, public institutions may employ austerity measures, such as consuming lower levels of instructional resources for cost-saving purposes to balance their budgets. Such managerial responses may ultimately impact student outcomes, especially at less-resourced, non-doctoral institutions whose primary mission involves providing undergraduate instruction. In the third and final essay in Chapter 4, I examine the dynamic changes in the composition of instructional faculty in public doctoral research institutions, and public non-

doctoral institutions subject to tuition freezes. This third essay employs event study difference-in-differences methods and uses institution level data from IPEDS and a comprehensive state level tuition and fee control dataset. Leveraging Levine's cutback management theory (1978; 1979), the study finds suggestive evidence of short-term cuts in tenure-track instructors, and delayed cuts in part-time instructors in public doctoral research institutions following exposure to tuition freezes. Dynamic shifts in the composition of instructional faculty in public non-doctoral institutions were rather limited. The findings suggest that the dynamic changes in the composition of instructional faculty in public four-year institutions matter to the success of the students that these institutions serve.

1.3. Contributions of the Study

Collectively, this three-essay dissertation employs quasi-experimental methods to provide robust evidence and causal explanation of the heterogeneous effects of state finance policies on educational inputs in public institutions in the two-year and four-year sectors. By examining disparate impacts of state finance policies on minoritized student groups and institutions serving disproportionate shares of minoritized student groups, the evidence may contribute information relevant for the proposed funding equity audits in higher education and help states articulate and advance equity-enhancing strategies to reduce equity gaps in educational attainment. The empirical evidence also contributes to the literature on higher education finance and performance.

Second, the essays draw on theoretical insights from public management and higher education to explain how several mechanisms at the individual and institution levels drive differential and dynamic effects of state finance policies on educational inputs. Guided by the college choice model in the first essay, I demonstrate how providing financial subsidies

universally to all students without accounting for differences in financial needs may not improve enrollment outcomes for minoritized students in community colleges, especially when conditions for accessing the subsidies by students involve navigating several administrative hurdles such as completing the FAFSA and completing specified hours of community service. Next, building on insights from the principal-agent model in essay two and the cutback management theory in essay three, I describe how public institutions experiencing structural changes in state finance policies alter their educational inputs, noting that the limited responses to state financial policies by under-resourced public institutions serving economically and racially minoritized students may be due to their constrained and limited institutional (and financial) capacities, which have implications for improving student outcomes.

Third, this study's evidence from the higher education context provides theoretical contribution to the principal-agent model, suggesting that when states (as principals) tie incentives to outcomes rather than institutional practices, it may lead to gaming behavior on the part of the institutions (the agents) that are not really about the outcomes but more to gain the rewards. The evidence also contributes theoretically to cutback management, noting that in times of financial uncertainty, institutions may not make strategic decisions on what cuts to make to alter the composition of instructional faculty but rather focus on easy cuts that may involve hiring freezes and cutting contingent faculty.

Fourth, the dissertation encompasses state-specific and national analyses of state finance policy effects. By combining within and between state analyses of contemporary policies, this dissertation accounts for the diverse and stratified nature of U.S. public higher education in providing a wide range of evidence of the heterogeneous effects of state finance policies for different student populations, and public institution types. I conclude the dissertation in Chapter

5 by providing recommendations for policy and research about how to address the disparate impacts of state finance policies on educational inputs in higher education by prioritizing equity-enhancing strategies in higher education finance policies.

Chapter II. Free to Attend Plus Extra Revenue to Earn? College Enrollment at the Nexus of Multiple Incentives in Tennessee’s Community Colleges

2.1. Introduction

Closing postsecondary attainment gaps remains a central theme in debates at the local, state, and federal levels as more than a third of high school graduates delay enrolling in college (NCES, 2023a). Between 2010 and 2018, the overall college enrollment rate fell from 41% to 38% (NCES, 2023b). Declining college enrollment patterns and the shifting costs of college to students and their families motivate the emergence of free college programs also known as “promise programs.” Free college programs offer financial awards to students residing in specific cities, counties, school districts, or states, to subsidize the costs of attending college (Perna & Smith, 2020a; Millet et al., 2020). Promise programs may be state-sponsored, or non-state-sponsored by communities and other private donors (Perna & Leigh, 2018).

Several studies find promising evidence that state-sponsored free college programs improve enrollment (Gurantz, 2020; Nguyen, 2020; House & Dell, 2020; Bell, 2021), and reduce student loans (Odle et al., 2021) in community colleges. Others find that these programs spur unintended tuition hikes (Bell, 2021; Odle et al., 2021), and influence students to substitute enrolling in four-year institutions for tuition-free community colleges (Gurantz, 2020; Bell, 2021), thereby distributing state resources to students who may otherwise not need financial assistance to go to college. This prior evidence provides important insights on desirable and less desirable impacts of state-sponsored free college programs. However, although promise programs often constitute components of broader statewide systemic policy initiatives in higher education, the emerging evidence mainly focuses on isolating effects of non-systemic implementation of promise programs. As such, understanding how implementing promise

programs as part of systemic policy approaches alongside other statewide policy interventions impact access to college, especially for underserved student groups, remains limited (Perna et al., 2021; Perna & Smith, 2020a).

This study contributes to the promise program literature by examining the enrollment effects of implementing the Tennessee Promise program within a statewide systemic approach – “Drive to 55” – to improve postsecondary attainment (Tennessee Higher Education Commission [THEC], n.d.; Meehan & Kent, 2020). Tennessee’s ambitious “Drive to 55” is a state policy initiative to ensure that 55% of Tennesseans obtain a college degree or certificate by 2025. As part of the “Drive to 55,” Tennessee Promise offers universal tuition-free scholarships to students attending in-state community colleges while the state’s outcome-based funding model – the Complete College Tennessee Act 2010 (CCTA) – structures direct appropriations from the state to Tennessee’s public colleges and universities based on institutional performance and student outcomes. CCTA also provides equity bonuses to public institutions for serving underserved student groups.

The broader statewide policy context influences whether and where students enroll in college (Perna, 2006; Cummings et al., 2021; Perna & Titus, 2004). However, implementing multiple policy incentives for students and institutions concurrently may be complementary and boost college access or be counterproductive and limit access (Stone, 2012; Moynihan, 2009), especially for underserved student groups. The research in this chapter asks:

- To what extent does implementing Tennessee’s statewide tuition-free incentives to students impact enrollment outcomes in community colleges receiving performance and equity incentives?

- Do enrollment effects of Tennessee’s statewide tuition-free incentives to students in community colleges receiving performance and equity incentives vary by student groups?

2.2. Overview of State-Sponsored Free College Programs

Providing tuition assistance to students is a common feature of promise programs that are state-sponsored and non-state-sponsored. However, variations exist in the type of content, nature of coverage, and context of implementation of promise programs (Perna et al., 2021; Perna & Leigh, 2018). This overview focuses on discussing state-sponsored promise programs. First, students who benefit from state-sponsored promise programs typically graduate from in-state high schools or meet other residency requirements. Students may be eligible for free tuition scholarships based on financial need as in New York Excelsior Scholarship, and academic merit as in Oregon Promise. Eligibility for other state-sponsored promise programs like Tennessee Promise may be universal, excluding any need-based or merit-based requirements to access free tuition scholarships. Scholars contend that universal promise programs may subsidize college for students from middle-income families who may be ineligible for other forms of financial aid while diverting funds away from students with more financial need (Nguyen, 2020; Gurantz, 2020; Bell, 2021).

Second, free college scholarships may be structured as first-dollar awards, last-dollar awards, or a mix of both. First-dollar awards, as in the California College Promise Grant, provide tuition assistance regardless of other financial aid that students receive from Federal Pell Grants, State Grant Aid, or other sources. In contrast, last-dollar awards, like the Arizona Promise Program, provide tuition assistance to any remaining tuition balance after all other financial aid receipts have been applied. Meanwhile, Oregon Promise employs a mix of last-dollar and first-dollar awards. While last-dollar awards are more cost effective for state-sponsored programs,

scholars argue that last-dollar awards channel less dollars to low-income students in community colleges as the average Pell grant for two-year institutions tends to fully cover tuition costs at such institutions (Nguyen, 2020). Whether structured as first-dollar, or last-dollar scholarships, the impacts of promise programs on enrollment in community colleges do not differ by how funds are distributed (Li & Gandara, 2020). In addition to offering tuition assistance, state-sponsored promise programs may provide non-tuition subsidies and other wraparound activities. For instance, Massachusetts' Washington Center Program Tuition Waiver adds scholarships for accommodation and internship placements on top of its last-dollar awards (College Promise Campaign, n.d.).

Third, the set of in-state institutions where students may use their free tuition scholarships may be expansive or restrictive. Expansive programs typically include a broad range of public institutions, private institutions, four-year universities, and community colleges or restrictive. For instance, recipients of Future Ready Iowa may enroll in public and private colleges. Meanwhile, the Maryland Community College Promise Scholarship is restricted to students enrolling in community colleges, and the Arizona Promise Program limits enrollment to public universities. Restricted use may influence students to substitute attending eligible community colleges for free in place of paying to enroll in ineligible four-year institutions that may lead to better student success and labor market outcomes (Gurantz, 2020; House & Dell, 2020).

As introduced earlier, state-sponsored promise programs may be designed as specific programs to boost access and affordability, or as programs within broader state policy efforts to drive systemic changes in higher education. Often, evaluative studies tend to examine and explain effects of promise programs in isolation from broader systemic approaches, even when state-sponsored promise programs are components of broader policy efforts as in Tennessee

Promise in Tennessee’s “Drive to 55.” Examining how state-sponsored free college programs function within broader policy contexts may expand understanding of mechanisms that influence college enrollment processes and outcomes and may also provide information to guide in improving equity in state higher education funding.

2.3. Impacts of State-Sponsored Promise Programs in Community Colleges

Concerns about financial barriers that exacerbate gaps in postsecondary access and attainment and the future of work are spurring and shaping statewide financial investments in higher education to make college more affordable. Recognizing that the rising costs of postsecondary education pose financial barriers to college (Iriti, Page & Bickel, 2018; Perna, 2006), states implement multiple funding policy innovations concurrently to promote college access and student success, especially targeting underserved student groups. Despite efforts by states to boost college access and outcomes through multiple incentives and programming, previous research on policy effects of state-sponsored, statewide promise programs often does so in isolation, finding mixed effects.

Evaluative evidence on impact of Tennessee Promise, New York Excelsior Scholarship, and Oregon Promise finds positive, null, spillover, and substitution effects. Full-time and in-state students’ enrollment in community colleges improved (House & Dell, 2020; Nguyen, 2019, 2020; Bell, 2021; Gurantz, 2020). Impact on enrollment of Black and Hispanic students in community colleges was mixed, sometimes positive and other times null (House & Dell, 2020; Nguyen, 2019; Bell, 2021). Others find association between Tennessee Promise and decreased borrowing of student loans (Odle et al., 2021), although Black students appeared to slightly increase borrowing while Hispanic students decreased borrowing less consistently. Evidence also shows less desirable evidence of state-sponsored, statewide promise programs relating to

increased tuition prices in community colleges (Bell, 2021), and decreased enrollment in four-year public institutions (Bell, 2021; Gurantz, 2020). While these studies show promising and not-so-promising effects of state-sponsored promise programs, these programs are often implemented alongside other higher education funding policies, but we understand little about how other broader state policies matter to the impacts of free college programs (Perna et al., 2021; Perna & Smith, 2020a).

The broader policy context may also influence enrollment outcomes through direct appropriations (Perna & Titus, 2004; Cummings et al., 2021). PBF policies with equity premiums that reward colleges for student success and for serving underserved student groups may serve as additional mechanisms influencing college enrollment outcomes. Direct appropriations from state funding provide critical institutional resources for community colleges. In 2018, nearly 38% of revenue for public community colleges accrued from state funding, declining from about 45% state support in 2001 (Rosinger et al., 2022a). Given the significance of state funding to institutional resources of colleges, community colleges will respond to financial incentives embedded in PBF models in instrumental and strategic ways to maximize state funding, with implications for enrollment outcomes. For instance, scholars find that states that offer equity premiums in funding public colleges and universities based on PBF marginally improved minority enrollment in public four-year colleges (Kelchen, 2019), boost enrollment of low-income students and yield no enrollment gains for Black and Hispanic students (Li & Ortagus, 2020). Exploring the implications of implementing free college programs in conjunction with state funding policies to colleges may provide nuanced understanding to enhance higher education funding and performance.

2.4. Policy Context: Complete College Tennessee Act of 2010 and Tennessee Promise

Although Tennessee has been funding its public colleges based on performance since 1979, the state revised its outcome-based funding model, commonly known as performance-based funding (PBF), in 2011 as enacted by the Complete College Tennessee Act 2010 (CCTA) (Li & Ortagus, 2019; Meehan & Kent, 2020). Tennessee’s PBF for higher education ties 85% of base funding from state appropriations to institutional performance, directing state funding to public colleges and universities based on outcomes rather than enrollment as done historically. To maximize state funding under CCTA, public colleges and universities in Tennessee must improve outcomes associated with persistence and completion that include measures of students earning 12 credit hours in year one, 24 in year two, and 36 in year three in community colleges (THEC, 2020).

Funding public institutions based on performance has been criticized for creating perverse incentives for institutions to prioritize students who are likely to succeed in college at the detriment of underserved student groups, sometimes called “creaming.” When present in performance management systems, perverse incentives can influence strategic behaviors in agents such as creaming that leads colleges to prioritize outreach and recruitment efforts targeting students that allow colleges maximize revenues from tuition and state appropriations. In doing so, the policy context influences enrollment outcomes, and such strategic behaviors can undermine intended program goals (Moynihan, 2009; Courty et al., 2011).

To motivate colleges to recruit and serve underserved students, many states offer equity premiums in their PBF models (Snyder, Boelscher & Zaragoza, 2020; Li, 2018). Within Tennessee’s PBF formula, public institutions receive equity premiums for completion gains by adult, low-income, and academically underprepared students (THEC, n.d.). Community colleges

earn 80% equity premiums for students belonging to one of the target groups, 100% for students belonging to two of the groups, and 120% for students belonging to all three groups. Previously, Tennessee's equity premium was set at 40% for PELL-eligible and adult students (Ness et al., 2015). These equity-oriented premiums are also offered to incentivize public colleges and universities to support underserved students persist and succeed in college. However, scholars point out that enrollment gains of equity bonuses vary among underserved student groups (Kelchen, 2019; Li & Ortagus, 2019). Moreover, these equity bonuses do not directly target students of color that face significant financial barriers to college and who remain underrepresented in college, despite the nation's growing minority population (Boland et al., 2021).

Additionally, Tennessee is targeting and offering free-tuition incentives to students to boost enrollment outcomes, launched as Tennessee Promise in 2015. Tennessee Promise seeks to contribute to the state's "Drive to 55" – an ambitious state goal of ensuring 55% of its residents obtain a college degree or certificate by 2025 (Meehan & Kent, 2020). Legislated as the Tennessee Promise Scholarship Act of 2014, Tennessee Promise is the nation's first statewide and universal free tuition program for community colleges (Meehan & Kent, 2020). The program provides a last-dollar scholarship that covers the cost of tuition and fees for recent high school graduates and GED holders (prior to their 19th birthday) transitioning to the state's public community colleges. Scholarship recipients must attend college full-time immediately after high school completion. As a last-dollar scholarship, funds from the Tennessee Promise are applied to a scholarship recipient's remaining balance of tuition and fees after other financial aid awards received by the student have been applied, such as the Pell grant. However, students attending

community colleges may have other family and employment obligations that limit their full-time enrollment (McKinney et al., 2022), which might impact scholarship uptake by students.

Unlike other promise programs, Tennessee Promise is neither need-based nor merit-based, but universal to recent high school graduates. To receive the scholarship, students must apply for a scholarship, complete the FAFSA, attend a mandatory meeting with an assigned mentor, apply to an eligible institution, and complete eight hours of community service. Nearly all high school graduates in Tennessee apply for the Tennessee Promise scholarships. For instance, in 2017 – 2018, 61,881 students graduated from public high schools in Tennessee (Tennessee Department of Education [TDOE], 2018) and 62,401 students applied for the 2018 – 2019 Tennessee Promise scholarships (THEC, 2023). However, less than a third of the initial applicants to the Tennessee Promise program tend to enroll in community colleges as Tennessee Promise recipients. For example, of the total 62,401 Tennessee Promise applicants in 2018 - 2019, 55,071 completed the FAFSA, 27,596 completed the required community service, 18,284 became eligible for the scholarships, and 16,734 were recipients of the Tennessee Promise scholarships who enrolled in community colleges (THEC, 2023).

Of the enrolled Tennessee Promise recipients between 2015 and 2019, more than three-quarters were White students, with about 14% and 5% Black and Hispanic students respectively (THEC, 2023), mirroring the racial composition of students in Tennessee’s community colleges prior to the promise program. For instance, between 2012 to 2014, 75% of community college students were White students, 17% were Black students, and 4% were Hispanic students (House & Dell, 2020). The disparities in FAFSA completion might limit uptake of Tennessee Promise by marginally motivated students. Underrepresented students are less likely to complete FAFSA due to their limited understanding of the financial aid process (Bahr et al., 2018; Kantrowitz,

2015). Black and Hispanic students also tend to be late completers of FAFSA and may miss out on financial aid (Castleman & Page, 2015). Further, it appears concerning that about half of the Tennessee Promise applicants who actually file the FAFSA do not fulfill the community service requirement and the available observable data do not immediately explain the reason for this trend. While targeting financial incentives to students and colleges hold implications for Tennessee's ambitious "Drive to 55", the effects of these incentives might vary across student groups.

2.5. Conceptualizing Statewide Financial Incentives and College Enrollment

This study draws conceptual perspectives from Perna's (2006) model on college choice to discuss college enrollment effects of implementing a state-sponsored promise program in the context of performance-based funding for community colleges in Tennessee. Perna's framework integrates economic and sociological factors that influence college choice, noting that college-going decisions and outcomes are multi-layered. At the innermost layer, the background characteristics of students shape how students weigh the costs and benefits of enrolling in college in deciding whether to enroll in college. Moving outward, the second layer recognizes the role of resources available to high schools and communities to support students prepare for college, including providing information on financial aid. The third layer of the college choice model characterizes how higher education institutions impact college enrollment processes and outcomes through their recruitment strategies, mission, location, and competition for students and resources. The fourth and outermost layer of the college choice model is the broader policy context that influences decisions and responses at the student level, high school and community context, and higher education context to shape college enrollment processes and outcomes.

This study leverages the broader policy context in Tennessee as entry point for understanding the enrollment effects of offering universal Tennessee Promise to students in community colleges receiving performance and equity incentives from the state for different student populations. Several studies demonstrate that state policies on higher education that channel financial aid directly to students and provide financial support to colleges and universities through direct appropriations influence whether and where students go to college (Cummings et al., 2021; Perna & Titus, 2004).

For many students, college-going decisions are contingent on the costs of attendance. Unlike in the 1980s, the costs of college have shifted significantly to students and their families (Rosinger et al., 2022b; State Higher Education Executive Officers Association, 2021), leaving many students to borrow and incur student loan debts to obtain college education. However, how students borrow money to attend college differs by student groups. First, while low-income students and Black students top the chart of borrowers, surprisingly, Hispanic students borrow less than White students for college (Hillman, 2015). Second, more Blacks and Hispanic students reported zero expected family contribution toward their college education than Whites (United States Department of Education, 2016). The perceived financial burden associated with postsecondary education and the weight of student loan debts may discourage college enrollment decisions, especially for underserved student groups with limited access to non-debt financial resources for college (Hillman, 2015), although the relationship between student loan debts and college choice is inconclusive.

Statewide, universal tuition-free programs can signal that college is within reach to the universe of prospective college students, especially underserved students who may be sensitive to sticker prices (Li & Gandara, 2020). For students concerned about student loan debts, tuition-

free programs may aid in minimizing any extra borrowing for college outside of family contribution. For instance, Tennessee Promise reduced student loans by about 32% for students in community colleges (Ode et al., 2021). The increased access to state-funded financial resources to pay for college and attend college debt-free will lower the costs of college to students. Since the costs of attendance is a key determinant of college choice (Perna, 2006), offering tuition-free scholarships may incentivize favorable college-going decisions among students. These decisions will improve enrollment outcomes in community colleges eligible for the Tennessee Promise scholarships. This leads me to hypothesize that:

H1a: Statewide tuition-free scholarships for students in Tennessee will increase full-time student enrollment in community colleges.

H1b: Statewide tuition-free scholarships for students in Tennessee will increase low-income student enrollment in community colleges.

H1c: Statewide tuition-free scholarships for students in Tennessee will increase Black and Hispanic student enrollment in community colleges.

Offering free tuition scholarships to students and performance incentives to colleges concurrently may also influence institutional behavior of community colleges that impact enrollment. First, for every semester a motivated student enrolls in college full-time, community colleges generate tuition revenue from the free tuition scholarships, and as students persist and complete college, colleges also obtain performance rewards from the state through direct appropriations based on PBF. As such, community colleges may be incentivized to recruit students considered to be motivated and “most financially profitable” such as young, and White students (Li & Ortagus, 2019) to maximize tuition revenue from the scholarships and revenue from state appropriations. Evidence shows that under PBF, community colleges serving fewer

shares of students of color gained more revenue from state appropriations (Ortagus et al., 2022). Second, community colleges may also target underserved student groups in their recruitment efforts to maximize equity incentives the state offers for serving underrepresented groups. When equity bonuses were included in PBF, revenue from state appropriations increased for community colleges serving larger shares of students of color (Ortagus et al., 2022). This leads me to hypothesize that:

H2a: Performance incentives for community colleges in Tennessee will increase full-time student enrollment in community colleges in Tennessee.

H2b: Performance incentives for community colleges in Tennessee will increase enrollment of White students in community colleges in Tennessee.

H2c: Equity bonuses for community colleges in Tennessee will increase enrollment of low-income students in community colleges.

H2d: Equity bonuses for community colleges in Tennessee will increase enrollment of Black and Hispanic students in community colleges.

However, offering free tuition scholarships to students and performance incentives to colleges concurrently may also create perverse incentives for community colleges that may be counterproductive for enrollment outcomes. Emerging evidence finds undesirable tuition hikes in Tennessee's community since the launch of the universal free college scholarship program (Bell, 2021; Odle et al., 2021), and that PBF increased tuition costs in community colleges (Hu & Villareal, 2018). The downside of this unintended institutional behavior from colleges is the potential of creating a negative signal of college being "expensive" to college bound students, which may discourage price sensitive and underserved student groups from enrolling in college. This negative signal may be especially salient for underserved student groups lacking sufficient

information on financial aid and who might be weary of student debt. Furthermore, the negative signal of hiked tuition may also weigh more in whether students at the margins decide to enroll in college than the positive signal of free college due to the human psychological tendency of placing more importance on negative information than positive information of similar magnitude (James et al., 2020; Moynihan, 2021).

2.6. Data and Methods

2.6.1. Analytic Sample

This study leverages data primarily from two sources to examine the enrollment effects of implementing a statewide, universal free tuition program in the context of performance-based funding in Tennessee’s community colleges. First, I obtain information on enrollment outcomes and institutional characteristics from the Integrated Postsecondary Education Data System (IPEDS), which is administered annually by the U.S. Department of Education. I collect enrollment outcomes for five student subgroups, including full-time enrollment (the total number of full-time fall students, logged), low-income students (the number of Pell Grant recipients, logged)¹, Black students (the number of full-time fall Black or African American students, logged), Hispanic students (the number of full-time fall Hispanic or Latino students, logged), and White students (the number of full-time fall White students, logged). Second, I leverage a comprehensive state-level PBF dataset from the Informed States (Ortagus, Rosinger & Kelchen, 2021) to identify whether or not institutions are in states implementing PBF models. I also derive state unemployment rates from the from U.S. Bureau of Labor Statistics, and an index for state higher education policy adoption rates prepared by Tandberg et al. (2022). The constructed data for this study covers the 2009-10 to 2018-19 academic years, a period immediately before and

¹ Using PELL grant recipients as proxy for low-income students may be problematic as a fifth of PELL eligible students do not apply for FAFSA (Kantrowitz, 2015; Kofoed, 2017).

after the implementation of the Tennessee Promise program in 2015. The study period also excludes any confounding impacts of the global COVID-19 pandemic on enrollment outcomes. The final sample includes 127 college-year observations for Tennessee, 3513 for SREB states, and 2167 for contiguous states.

The policy treatment in this study was being subject to Tennessee Promise in the two-year sector. I compared enrollment changes in community colleges in Tennessee to peer colleges in two comparison groups: states without state-sponsored universal tuition-free scholarship programs in the Southern Regional Education Board (SREB), and states without state-sponsored universal tuition-free scholarship programs that are contiguous to Tennessee. Perna (2006) posits that the college choice process may be influenced by unmeasured factors within regions. States in the Southern region typically employ similar funding approaches for higher education by subsidizing college costs through need-based financial aid while keeping tuition low over time (Rosinger et al., 2022b). Perna (2006) posits that the college choice process may be influenced by unmeasured factors within regions. States in the Southern region typically employ similar funding approaches for higher education by subsidizing college costs through need-based financial aid while keeping tuition low over time (Rosinger et al., 2022b). Further, using the two comparison groups accounts for the influence of geography and proximity on where students choose to enroll in college (Hillman, 2016; Li & Gandara, 2020; Furquim et al., 2020). The binary policy treatment variable is coded 1 for Tennessee and 0 otherwise. All states included in this study are listed in Table 2.1.

2.6.2. Covariates

Certain characteristics of colleges and states may influence enrollment patterns. First, the cost of attendance impacts enrollment decisions for students. High tuition and fees are associated

Table 2.1. Summary of States in Treatment and Comparison Groups

Treatment Group	Comparison Group 1 SREB States	Comparison Group 2 Contiguous States
Tennessee	Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Texas, Virginia, and West Virginia	Alabama, Arkansas, Georgia, Kentucky, Mississippi, Missouri, North Carolina, Virginia

with lower enrollment, especially for price sensitive minority students. Cuts in state appropriations induce tuition hikes which in turn lower enrollment; however, some states employ tuition freezes and caps to control how much public institutions charge their students (Kelchen & Pingel, 2023). Alternatively, the availability of state grant aid helps to subsidize attendance costs for students and access to grant aid may motivate students' college enrollment decisions. To account for the cost of attendance, I included tuition and fees for resident students (logged), state appropriation (logged), and state grant aid (logged). All financial variables are Consumer Price Index (CPI) CPI-adjusted to 2020 dollars. Still, student-to-faculty ratio affects college enrollment for students of color (Gandara & Rutherford, 2018) and may moderate the relationship between free tuition incentives and enrollment outcomes.

Student characteristics also moderate enrollment in 2-year colleges. More females tend to enroll in community colleges, especially females of color. In their study, House and Dell (2020) found that minority enrollment was driven by Black females. Additionally, a significant

population of community college students attend part-time. In the models analyzing enrollment effects for full-time students and low-income students, I also included the shares of Black and Hispanic students as additional covariates, to account for racial differences in enrollment.

At the state level, unemployment drives up college enrollment; more people enroll in college when the economy is performing poorly, often in a bid to get credentials to compete in the labor market. Next, the rate of state policy innovations in the higher education landscape may influence both colleges and students in ways that moderate college enrollment; thus, I used Tandberg et al.'s (2022) state higher education policy adoption rate as a covariate to account for the dynamic policy contexts within which colleges operate and students make college choice decisions. Lastly, I control for whether colleges are subject to state tuition price controls using data from Kelchen and Pingel (2023), which may moderate enrollment outcomes.

2.6.3. Empirical Strategy

I employed the generalized difference-in-differences (GDiD) with two-way fixed effects method to estimate college enrollment effects of Tennessee Promise in Tennessee's community colleges. GDiD remains a popular quasi-experimental method in higher education finance and performance literature. GDiD allows for the treatment to take place across states in different years. If statewide financial incentives impacted college enrollment, the average change in college enrollment at community colleges in Tennessee, the treatment, should be different from those of colleges in comparison states after the policy treatment. GDiD estimates the policy treatment effect by calculating the difference in outcomes between the treatment and comparison groups post-policy treatment and then calculating the difference in outcomes between the two groups pre-policy treatment. The general equation for the GDiD regression model is as follows:

$$\diamond y_{ist} = \beta_0 + \beta_1 TN_{ist} + \delta Z_{it} + \gamma_i + \eta_t + \varepsilon_{st}$$

y_{it} is the logged of each outcome measure for college i in state s in year t . β_0 is the college-specific intercept. TN_{ist} is a binary indicator for policy treatment for college i in state s in year t . The coefficient of interest is β_1 . δZ_{it} is a vector that includes institution- and state-level control variables associated with the target outcomes. γ_i captures college fixed effects such as mission and location, and η_t captures year fixed effects. The error term, ε_{st} , captures unobserved differences for each state in each year (Wooldridge, 2021).

GDID assumes that without the Tennessee Promise, the trends in the treatment and comparison groups will be similar. It is therefore necessary to consider if there are differences in enrollment outcomes between Tennessee's community colleges and the comparison colleges before the launch of Tennessee Promise in 2015, in the pre-treatment periods, that may confound the analysis of average treatment effects. Figures 2.1 through 2.5 display pre-treatment and post-treatment enrollment trends for each student group for Tennessee and each of the two comparison groups. The vertical line at year 2015 indicates the first year of implementing the statewide universal free tuition incentives – the Tennessee Promise. Although the average enrollment levels for full-time and low-income students in Tennessee were higher than peers in SREB and contiguous states from 2010 to 2014 (Figures 2.1 and Figure 2.2), enrollment trends for Tennessee, SREB, and contiguous states followed similar paths before 2015. Because of these similar pre-trends, using GDID to estimate average treatment effects of Tennessee Promise on enrollments of full-time and low-income students will eliminate any pre- Tennessee Promise bias. While we observe different enrollment levels for Black and White students in community colleges in Tennessee, SREB and contiguous states prior from 2010 to 2014, the pre-trends were similar at least three years before the implementation of Tennessee Promise in 2015 (Figures 2.3 and 2.5), which is sufficient to minimize any pre-Tennessee Promise bias on average treatment

effects of Tennessee Promise on enrollments of Black and White students (Furquim et al., 2020). In contrast, the enrollment trends for Hispanic students in community colleges in Tennessee, SREB and contiguous states prior from 2010 to 2014 did not follow similar paths at least three years prior to Tennessee Promise in 2015 (Figure 2.4) and may bias the average treatment effects of Tennessee Promise on enrollment of Hispanic students. However, to examine the robustness of my results, I employed event study analysis to further investigate and address violation to GDiD’s parallel trend assumption, which I discuss later in the sensitivity analysis section.

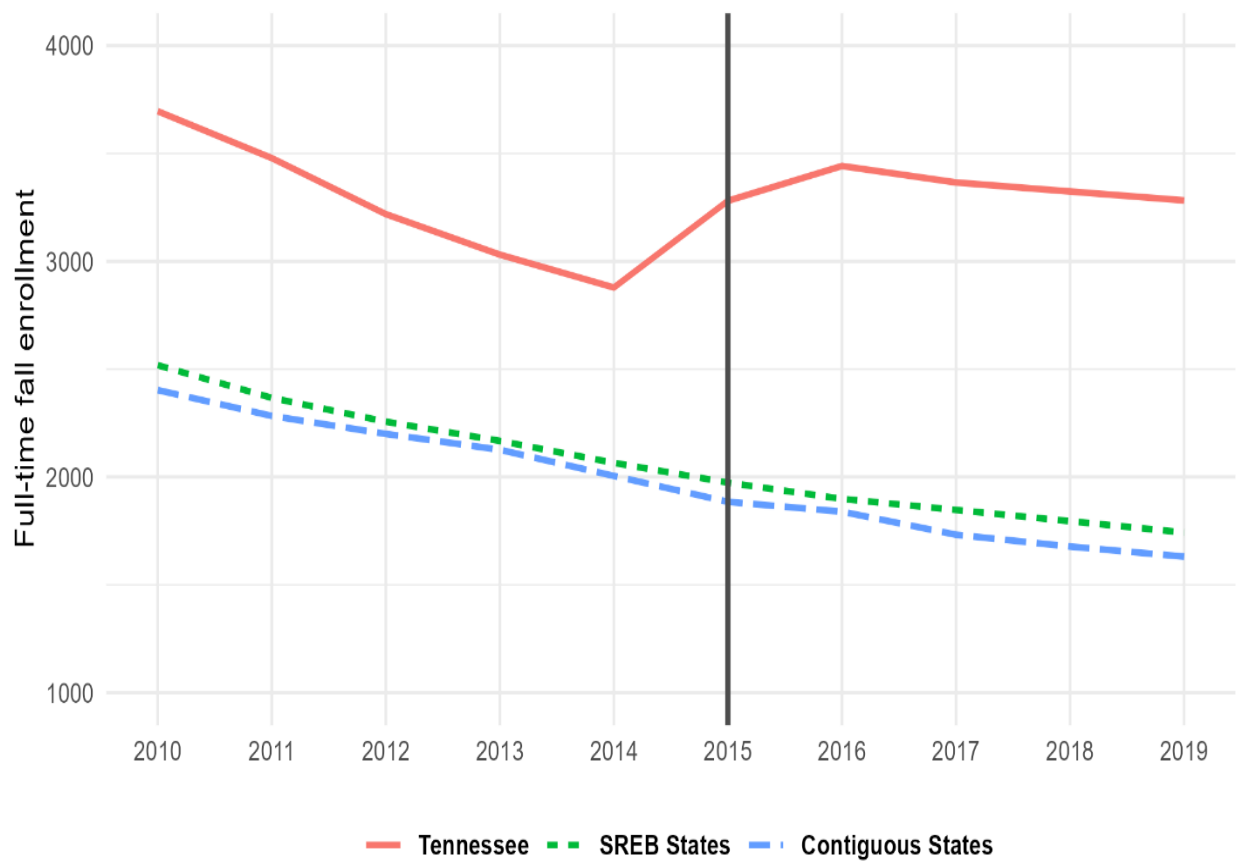


Figure 2.1. Trends in enrollment for Full-time fall students before and after the implementation of Tennessee Promise in 2015 in Tennessee and comparison groups. See Table 2.1 for list of SREB states and contiguous states included.

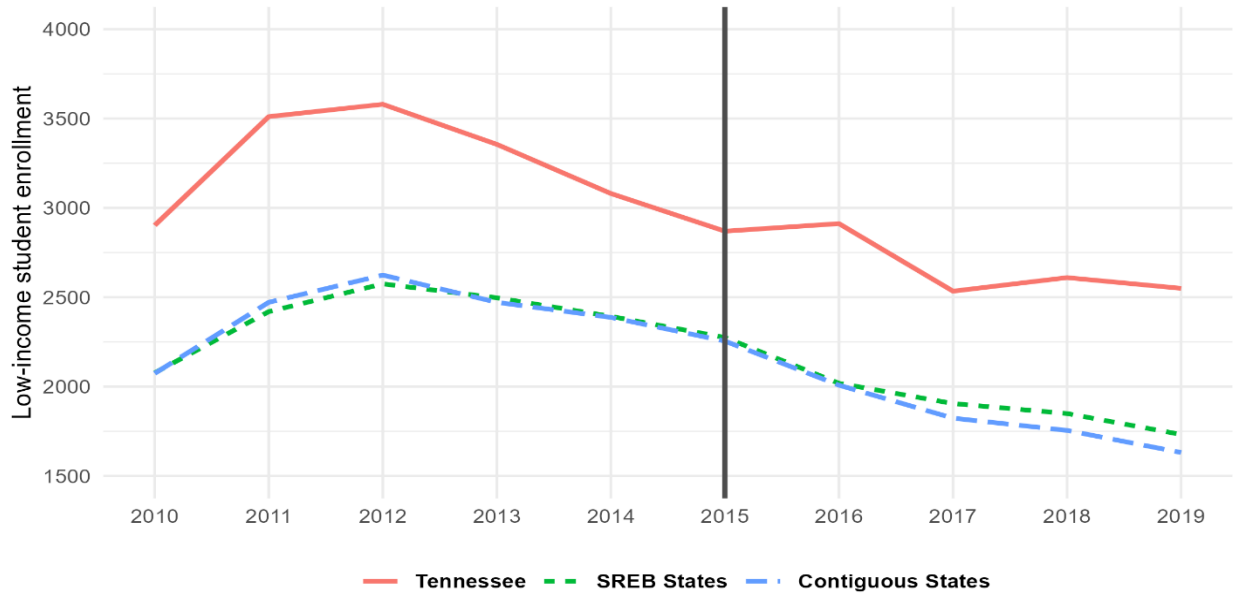


Figure 2.2. Trends in enrollment for Low-income students before and after the implementation of Tennessee Promise in 2015 in Tennessee and comparison groups. See Table 2.1 for list of SREB states and contiguous states included.

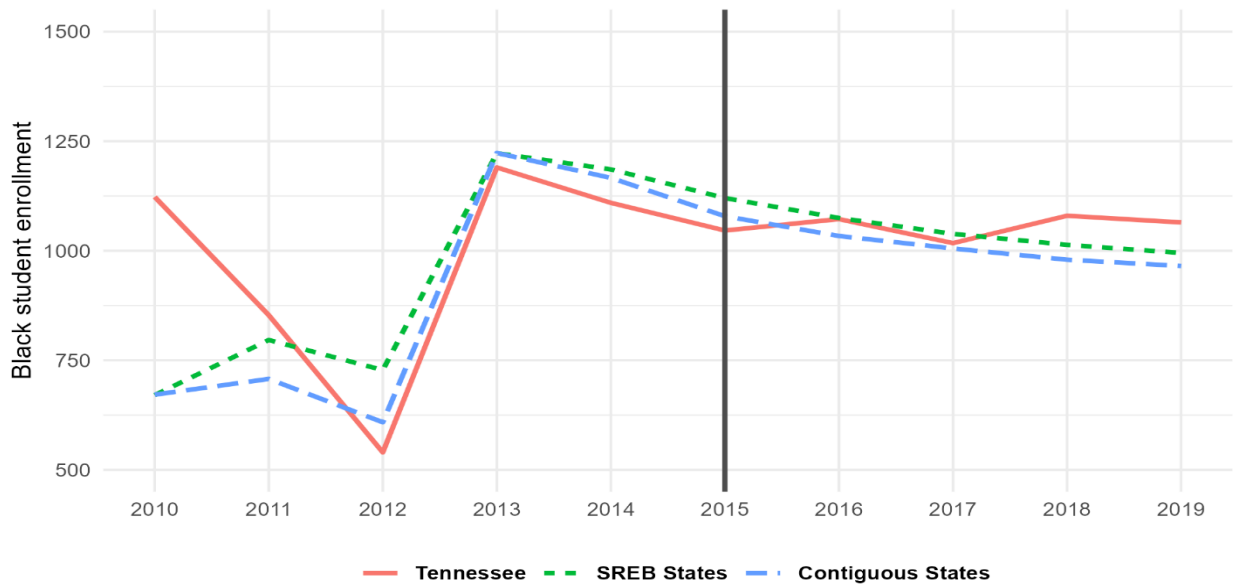


Figure 2.3. Trends in enrollment for Black students before and after the implementation of Tennessee Promise in 2015 in Tennessee and comparison groups. See Table 2.1 for list of SREB states and contiguous states included.

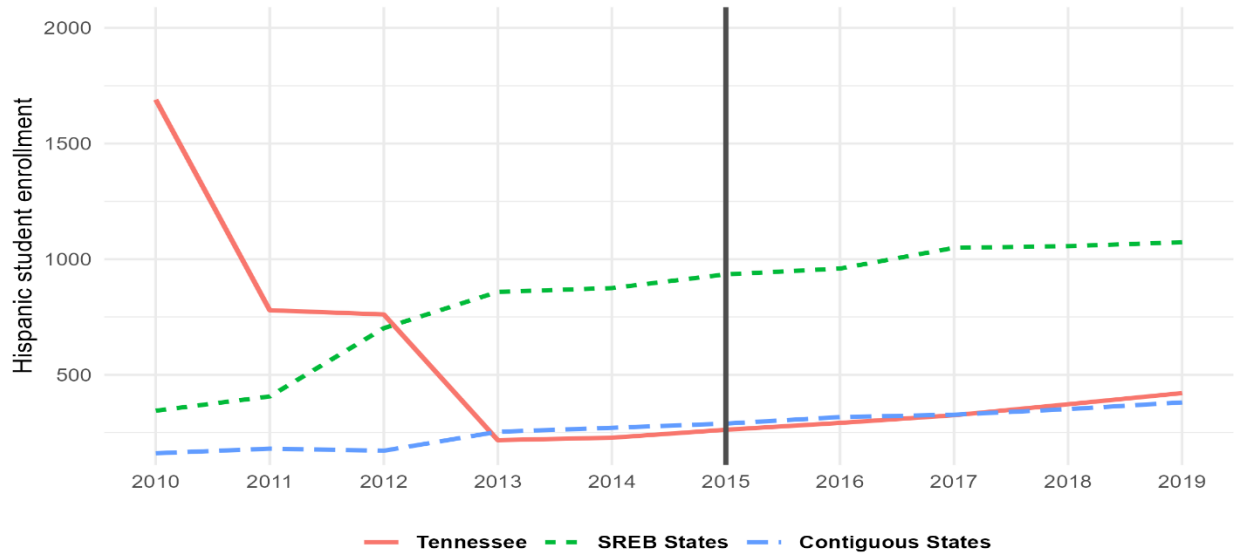


Figure 2.4. Trends in enrollment for Hispanic students before and after the implementation of Tennessee Promise in 2015 in Tennessee and comparison groups. See Table 2.1 for list of SREB states and contiguous states included.

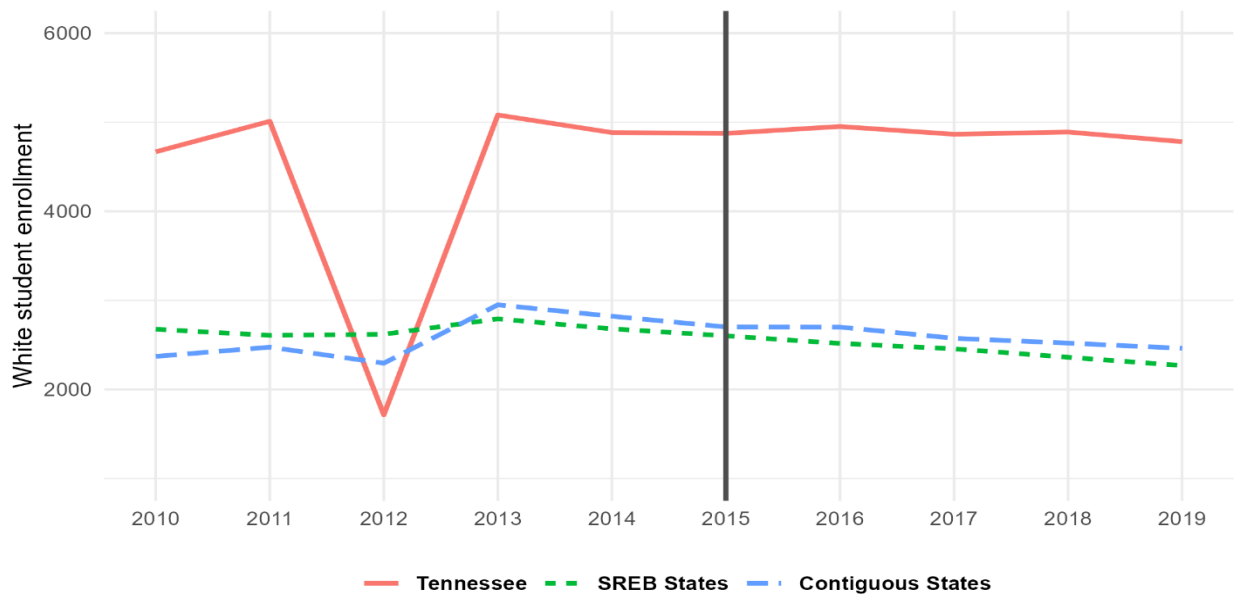


Figure 2.5. Trends in enrollment for White students before and after the implementation of Tennessee Promise in 2015 in Tennessee and comparison groups. See Table 2.1 for list of SREB states and contiguous states included.

2.7. Results

2.7.1. Descriptive Results

Table 2.2 provides descriptive differences in the enrollment outcomes between community colleges in Tennessee (the treatment group) and community colleges in the two comparison groups – SREB, and Tennessee’s contiguous states, before and after 2015. Over the study period, the average full-time enrollment in the fall semester in community colleges in Tennessee grew by 2.25% while full-time enrollment trends fell in comparison colleges, by 18.70% in SREB states, and 20.55% in Tennessee’s contiguous states. However, both colleges in Tennessee and comparison peers experienced declining enrollment rates for low-income students over time, with the rate of decline being slightly faster in Tennessee (18.30%) than in SREB states (18.18%), and slightly slower in Tennessee than in contiguous states (21.34%). In terms of enrollment trends for students of color, community colleges in Tennessee, on average, experienced slower growth rate in Black students (9.58%) than colleges in SREB states (14.09%) and contiguous states (15.65) over time. In contrast to the declining enrollment rate for Hispanic students in Tennessee’s community colleges, Hispanic enrollment grew in colleges in SREB states and contiguous states. Meanwhile, enrollment grew faster for White students in colleges in Tennessee (13.98%) than in comparison states over time. Interestingly, similar to comparison colleges, tuition rates for resident students grew over time within community colleges in Tennessee, in a period where Tennessee was working to make college more affordable for Tennesseans.

2.7.2. Difference-in-Differences Results

This study asks whether Tennessee’s free tuition scholarships impact enrollment outcomes in its community colleges and whether change in enrollment differed across student

Table 2.2. Descriptive Statistics

	Tennessee			SREB states (excluding Tennessee)			Contiguous states (excluding Tennessee)		
	Pre-2015	Post-2015	Change %	Pre-2015	Post-2015	Change %	Pre-2015	Post-2015	Change %
<i>Panel A: Outcome Measures</i>									
Full-Time, Fall Students Enrollment	3260.677 (1240.378)	3334.000 (1152.828)	2.25	2276.578 (2730.184)	1850.893 (2385.781)	-18.70	2203.690 (2195.752)	1750.856 (1859.258)	-20.55
Low-Income (Pell Undergraduate) Students Enrollment	3286.308 (1557.958)	2685.000 (1147.448)	-18.30	2391.077 (2989.122)	1956.277 (2529.085)	-18.18	2405.665 (2181.531)	1892.280 (1819.439)	-21.34
Black Students Enrollment	963.015 (1358.861)	1055.258 (1475.125)	9.58	918.660 (1758.758)	1048.073 (1742.035)	14.09	875.088 (1484.030)	1012.033 (1381.062)	15.65
Hispanic Students Enrollment	734.969 (1466.648)	336.484 (190.075)	-54.22	634.758 (2360.296)	1015.516 (2973.329)	59.98	207.263 (533.475)	333.357 (849.041)	60.84
White Students Enrollment	4271.923 (4559.597)	4869.000 (1818.109)	13.98	2674.444 (4166.235)	2439.727 (2767.565)	-8.78	2582.044 (3311.892)	2588.653 (2386.008)	0.26
<i>Panel B: Institution level covariates</i>									
In-state Tuition and Fees (logged)	8.150 (0.081)	8.351 (0.042)	2.47	7.981 (0.341)	8.229 (0.328)	3.11	7.963 (0.326)	8.185 (0.325)	2.79
State Appropriation (logged)	16.560 (0.407)	16.712 (0.380)	0.92	16.062 (0.905)	16.139 (0.877)	0.48	16.120 (0.661)	16.239 (0.663)	0.74

Table 2.2. Descriptive Statistics (Continued)

State Grant Aid (logged)	14.946 (0.394)	15.660 (0.530)	4.78	13.064 (1.428)	13.067 (1.446)	0.02	13.241 (1.282)	13.345 (1.261)	0.79
Part-Time, Fall Students Enrollment (logged)	8.165 (0.434)	8.062 (0.377)	-1.26	7.371 (1.391)	7.382 (1.353)	0.15	7.451 (1.048)	7.453 (0.982)	0.03
Female Students Enrollment (percent)	58.928 (12.610)	60.290 (4.486)	2.31	61.175 (16.148)	58.198 (9.545)	-4.87	62.145 (14.145)	60.436 (6.776)	-2.75
Student to faculty ratio	20.785 (2.335)	20.484 (2.733)	-1.45	17.920 (5.375)	17.017 (4.804)	-5.04	17.974 (4.959)	16.705 (4.276)	-7.06
			<i>Panel C: State level covariates</i>						
Unemployment	8.160 (1.112)	4.150 (0.897)	-49.14	7.879 (1.728)	4.453 (0.880)	-43.48	8.329 (1.651)	4.465 (0.931)	-46.39
State Higher Education Policy Innovativeness Index	0.035 (0.000)	0.035 (0.000)	0	0.042 (0.012)	0.041 (0.012)	-2.38	0.034 (0.008)	0.034 (0.008)	0
Tuition control	0.000 (0.000)	0.000 (0.000)	0	0.421 (0.494)	0.300 (0.458)	-28.74	0.400 (0.490)	0.293 (0.455)	-26.57
N (College-year)	65	62		1797	1716		1101	1066	
Note. Standard Deviation in parentheses. All financial variables are in 2020 CPI-adjusted dollars.									

groups. I present the main findings in Table 2.3. In Panel A, I find evidence that full-time fall enrollment increased in community colleges in Tennessee. Relative to regional peers in SREB states, full-time fall enrollment in community colleges Tennessee increased by 31.2%, with a large effect size (Cohen's $d = 1.74$). The increase in full-time fall students in Tennessee's community colleges was slightly higher (32.6%) when compared to peers in contiguous states. This growth in full-time fall enrollment in community colleges in Tennessee was substantively large, Cohen's $d = 2.01$.

Conversely, enrollment effects varied considerably across student groups in Panels B through E. Depending on the counterfactual, community colleges in Tennessee experienced null to moderate gains in low-income student enrollment in Panel B. Compared to peers in contiguous states, there was an 11% increase in low-income enrollment in Tennessee's community colleges, with a medium effect size (Cohen's $d = 0.61$) while there was no significant difference in low-income enrollment between community colleges in Tennessee and peer colleges in SREB states, although the direction of the coefficient was positive.

In Panel C, I find null but negative enrollment effects for Black students in community colleges in Tennessee relative to both SREB states and contiguous states. Likewise, I find evidence of significant decrease in Hispanic student enrollment in Panel D, which plummeted by 58.4% in Tennessee's community colleges than in SREB states. However, this decline in Hispanic student enrollment was substantively small, Cohen's $d = -0.484$. Similarly, there was an 58.5% decline in Hispanic students enrolled in Tennessee than in contiguous states, with a medium effect size, Cohen's $d = -0.582$.

In contrast, White student enrollment grew in Tennessee's community colleges in Panel E. Relative to regional peers in SREB states, there was a 30.9% increase in White students

enrolled in community colleges in Tennessee, with a small effect size (Cohen's $d = 0.270$). This increase in White students in Tennessee's community colleges was slightly lower (29.7%), with a small effect size (Cohen's $d = 0.274$), when compared to peers in contiguous states. The summary of results and hypotheses are in Table A.1 in Appendix A.

2.7.3. Sensitivity Analysis

I conducted several robustness checks to assess the sensitivity of my main results, including using multiple comparison groups, and event study analysis (Furquim et al., 2020; Sun & Abraham, 2020). I present these results in Tables A.2 and A.3. First, I examined whether the results differed after one year of implementing the Tennessee Promise scholarships, when information about the free tuition scholarships may have reached more college bound students. I used a one-year lag of each of my two treatment variables. The results in Columns 1 and 2 in Table A.2 were generally consistent with my main findings. The only exception was the statistically significant increase in low-income student enrollment in Tennessee's community colleges relative to peer institutions in SREB states. Meanwhile, the gain in low-income student enrollment in Tennessee's community colleges over contiguous peers persisted one year after Tennessee Promise was launched. Likewise, the growth in full-time fall enrollment and White students persisted while at the same time Hispanic student enrollment declined one year following the policy. Consistent with my main results, there was no significant change in Black students enrolled in Tennessee's community colleges one-year later.

Second, I conducted event study analysis using Sun and Abraham (2020) to visually inspect treatment effects over time, to assess the pre-treatment trends to identify and address any threats to validity. Any significant differences in enrollment trends between community colleges in Tennessee and colleges in comparison groups before Tennessee Promise was launched in 2015

Table 2.3. Difference-in-Differences: Enrollment Effects of Tennessee Promise in the Context of Performance-Based Funding

	SREB states (excluding Tennessee)	Contiguous states (excluding Tennessee)
	(1)	(2)
<i>Panel A: Full-Time, Fall Students Enrollment (logged)</i>	0.312***	0.326***
	(0.033)	(0.043)
N (College-Year)	2823	1915
R2 Adj.	0.957	0.963
Cohen's d	1.74 (large)	2.01 (large)
<i>Panel B: Low-income (Pell Undergraduate) Students Enrollment (logged)</i>	0.067	0.110*
	(0.041)	(0.044)
N (College-Year)	2823	1915
R2 Adj.	0.942	0.951
Cohen's d	0.320 (small)	0.608 (medium)
<i>Panel C: Black Students Enrollment (logged)</i>	-0.079	-0.236
	(0.22)	(0.260)
N (College-Year)	2791	1898
R2 Adj.	0.412	0.406
Cohen's d	-0.058 (very small)	-0.176 (very small)
<i>Panel D: Hispanic Students Enrollment (logged)</i>	-0.584***	-0.585***
	(0.139)	(0.116)
N (College-Year)	2749	1866
R2 Adj.	0.604	0.497
Cohen's d	-0.484 (small)	-0.524 (medium)
<i>Panel E: White Students Enrollment (logged)</i>	0.309**	0.297**
	(0.089)	(0.083)
N (College-Year)	2813	1912
R2 Adj.	0.377	0.398
Cohen's d	0.270 (small)	0.274 (small)
Covariates	Yes	Yes
FE: opeid	X	X
FE: year	X	X
Note. Standard errors clustered by state are in parentheses.		
*** p<0.001 ** p<0.01 *p<0.05		

may violate DID's parallel trends assumption. In Figure A.1 in Appendix A, I find no significant difference in full-time fall enrollment between colleges in Tennessee and regional peers in SREB and contiguous states before the launch of Tennessee Promise. Similarly, the pre-trends indicate that low-income students in Tennessee's community colleges were enrolled at similar rates as those in SREB and contiguous states in Figure A.2.

Conversely, pre-trends for racial and ethnic groups were mixed. While there was no significant difference in Black student enrollment between Tennessee and peers in contiguous states before Tennessee Promise in 2015, four to five years before the policy in Figure A.3, Black students enrolled in Tennessee's community colleges at a slightly different rate than those in colleges in SREB states. Meanwhile, three to five years before the policy, the enrollment of Hispanic students in community colleges in Tennessee differed slightly from those in SREB and contiguous states in Figure A.4. The pre-trends also show that community college enrollment for White students only differed slightly between Tennessee and SREB and contiguous states three years before Tennessee Promise in Figure A.5. Despite the mixed pre-trends, the near-zero differences in enrollment in the pretreatment for each racial and ethnic group indicate that enrollment outcomes in community colleges in Tennessee were not significantly different from those in the comparison groups and satisfies the parallel trends assumption for difference-in-differences (Furquim et al., 2020).

Given the findings from the event study analyses, I created a subsample for 2012 to 2019, to minimize pre-treatment periods that threaten validity of my main findings. Using the 2012 to 2019 subsample, I estimated the enrollment effects of Tennessee Promise. Analyzing this restricted subsample also accounts for any confounding impact of Knox Achieves, a local free college program in Knox County, implemented between 2009 to 2011 (Carruthers & Fox, 2016).

I compared the coefficients of this restricted subsample results with my main results. The results for the restricted subsample in Columns 3 and 4 in Table A.2 were generally consistent with the main findings in terms of direction and size of the coefficients. However, there are two exceptions. First, while the coefficients for Black student enrollment in the full sample and main results are null and negative for the two comparison groups, in the restricted subsample, the coefficient is null and positive for the SREB states comparison group. Second, the coefficient for Hispanic student enrollment in the restricted subsample is null and positive for the contiguous states comparison group as opposed to significant and negative in the main results. Readers should take caution when interpreting results for Black and Hispanic students.

In the third robustness checks, I compared community colleges in Tennessee with peer colleges in SREB and contiguous states without performance-based funding, to assess whether providing universal financial incentives to students and performance incentives to the colleges simultaneously impacts enrollment outcomes in Tennessee over peers not exposed to such dual incentives. In Column 5 in Table A.2, the estimates for all significant effects mirrored the direction of coefficients in the main findings. These effects persisted one year after Tennessee Promise in Column 6 in Table A.2. This supports the conclusion that providing dual incentives (free tuition in the context of PBF) yields varying enrollment effects across student groups in community colleges.

Further, in Table A.3, I examined how sensitive my main results are to the racial and ethnic composition of students enrolled in Tennessee's community colleges by operationalizing the three race/ethnicity enrollment outcomes as percentages; the percent of Black students (the number of African American students as a percentage of total enrollment), the percent of Hispanic students (the number of Hispanic or Latino students as a percentage of total

enrollment), and the percent of White students (the number of White students as a percentage of total enrollment). Mirroring the main results, the share of Black students did not change in Panel A. In Panel B, the share of Hispanic students declined while the percent of White students increased as presented in Panel C.

Additionally, I estimated the effect sizes of my models to provide the practical significance of my findings, presented as Cohen's d estimates in Tables 2.3, and Tables A.2 and A.3. The effect sizes indicate how substantial the effects of Tennessee Promise are on enrollment outcomes, which complement the statistical significance of the effects, to extend the conversation beyond whether a relationship between the policy and the outcomes exist to how much the impact of the policy effects matter to college access, especially for underserved student groups.

2.8. Discussion

Although states have been offering free tuition scholarships to students for decades, Tennessee is the first to offer state-sponsored universal tuition-free scholarships to students through its Tennessee Promise program. Tennessee Promise is unique in at least two ways. First, it provides tuition-free scholarships that are neither merit- nor need-based to recent high school graduates to enroll full-time in its community colleges. Second, the program is part of Tennessee's "Drive to 55" initiative wherein the state provides performance and equity-oriented incentives to its public colleges and universities to boost student success and better serve underserved student groups through its outcome-based funding formula, commonly known as performance-based funding in the higher education finance literature. However, implementing multiple incentives targeting students and institutions may improve or impede intended policy outcomes (Tandberg et al. 2022; Stone, 2012), especially enrollment outcomes for

underrepresented student groups in historically under-resourced colleges. While acknowledging that the impact of free college programs may be influenced by other state policies, emerging evidence on enrollment effects of Tennessee Promise provide little explanation as to how tuition-free incentives may be interacting with other statewide initiatives targeted at community colleges to influence enrollment outcomes for diverse student groups (Bell, 2021; Nguyen, 2020; House & Dell, 2020). This study contributes to research exploring the effects of free college programs by examining the enrollment effects of implementing universal free tuition scholarships to students in the context of performance-based funding for public colleges in Tennessee, to provide a more nuanced understanding of the relationship between tuition-free college and enrollment outcomes.

The study finds suggestive evidence that offering tuition-free incentives to students and performance and equity incentives to colleges may be complementary and boost enrollment outcomes for full-time and White students, often considered the “most financially profitable students” to colleges (Li & Ortagus, 2019). This positive impact is consistent with previous studies that found growth in full-time and White student enrollment in Tennessee’s colleges after the first two cohorts of program (see Bell, 2021; Nguyen, 2020; House & Dell, 2020). The finding also aligns with expectations from the college choice model. The promise of attending college debt-free minimizes the financial barriers that hinder many students from enrolling in college and may be motivating college-going decisions among eligible Tennesseans. Alongside, community colleges may be prioritizing recruitment efforts to attract full-time and White students who are likely to complete college to secure performance incentives and maximize revenue from state appropriation. However, there are concerns that universal tuition-free incentives may likely distribute subsidies to financially capable students who may be ineligible

for other merit-based and need-based financial aid awards instead of channeling state tax dollars to financially needy students with limited access to non-debt financial resources for colleges (Nguyen, 2020; House & Dell, 2020). This raises the question of whether universal free tuition incentives ensure equitable distribution of financial aid resources across student groups.

The study also finds that implementing tuition-free incentives may be less complementary with limited gains in minority enrollment. Consistent with my theoretical expectations, I also observe some positive effects of universal financial incentives for low-income student enrollment in Tennessee's community colleges, although findings were less consistent across comparison states. One explanation is that low-income students may be responding to the free tuition incentives to defray tuition costs. Another explanation for this result is that colleges may be responding to equity-oriented premiums of PBF to maximize state funding for enrolling low-income students. This is consistent with Gandara and Rutherford (2018) and Li and Ortagus (2019) who found that incorporating equity-oriented premiums in performance-based funding models marginally improves minority enrollment in public institutions. As such, offering free tuition incentives to students and equity-oriented premiums to public institutions simultaneously may help address some access barriers for financially needy students.

However, the results show no improvement in the enrollment of students of color as enrollment effects were null for Black students and negative for Hispanic students. The enrollment effect for Black students aligns with Bell (2021) who found that Tennessee Promise did not increase enrollment for Black students, but contrasts with others that found only marginal increases in Black enrollment (House & Dell, 2020; Nguyen, 2020). The rising tuition costs in Tennessee's community colleges to maximize tuition revenue from the free tuition scholarships

may be creating negative signals that discourage students of color from taking advantage of the free tuition scholarships to enroll in college (Bell, 2021; Odle et al., 2021), especially given that underserved student groups lack adequate information on financial aid.

Further, specific design elements of Tennessee Promise may also provide additional explanation for the lack of growth in Black and Hispanic enrollment in a free college era. Given that Tennessee requires students to complete FAFSA to receive the universal free tuition scholarships, and underrepresented students complete FAFSA at lower rates (Bahr et al., 2018; Kantrowitz, 2015; Kofoed, 2017; Castleman & Page, 2015), it is likely that the eligible underrepresented students may be disincentivized from applying for the tuition-free scholarships and enrolling in college, especially considering the administrative burden of completing FAFSA (Everett et al., 2023). For instance, between 2015 and 2019, more than two-thirds of the students who initially applied for Tennessee Promise did not complete the required processes, did not become recipients of the tuition-free scholarships, and did not enroll in college (THEC, 2023). Of the enrolled Tennessee Promise recipients in the same period, more than three-quarters were White students, with about 14% and 5% Black and Hispanic students, respectively. Informational and compliance costs associated with accessing tuition-free incentives may also limit growth in minority enrollment. In contrast, White students who have a better understanding of the financial aid system may be maximizing the free tuition incentives, resulting in the positive impact on White student enrollment. Still, scholars argue that financially capable students may be substituting enrolling free in community colleges for paying out of pocket to enroll in four-year universities to maximize financial incentives, noting that without the incentives they might have still enrolled in four-year universities (Nguyen, 2020; House & Dell, 2020; Perna et al., 2021).

Another explanation for no improvement in the enrollment of Black and Hispanic students in Tennessee's community colleges might be related to the design of the equity-oriented bonuses in the state's performance-based funding model which does not directly target racial and ethnic minorities. Since changes in the enrollment of students of color would likely yield no equity-oriented rewards or extra revenue for colleges, Tennessee's community colleges may have limited motivation to prioritize recruitment efforts to boost the racial diversity of their student bodies. This situation may even worsen given the recent court ruling on Affirmative Action that prohibits race-conscious college admissions; thus, alternatives for minimizing college participation barriers for students of color in an era of free college and performance-based funding require further exploration.

2.9. Limitations and Future Research

Despite employing several strategies to minimize limitations in this study, four limitations and areas for future research are worth mentioning. The first is the parent-child reporting issue in IPEDS finance data where the finance data for some colleges (child) are reported at the system/institution (parent) level (Jaquette & Parra, 2016). I followed Kelchen's (2019b) recommendation and disaggregated colleges based on their Office of Postsecondary Education ID (OPEID). I excluded less than 1% of the observations affected by the parent-child reporting issue. I analyzed alternative model specifications that included the observations, and the results were consistent with the main findings in models with the excluded observations, implying no significant impact of the parent-child reporting issue in this study's findings. In addition, the data for three community colleges in Tennessee in 2016 were not reported in IPEDS. This is consistent with Bell's (2021) study that found that three community colleges were not eligible for Tennessee Promise in 2016. Future studies may explore why the colleges

were ineligible in 2016 and what implications this had to students' access to the scholarships in that year.

Second, using institution level data may not account for unobserved factors that influence individual students' decision to enroll in college. For instance, family and job obligations may impact college-going decisions (McKinney et al., 2022), especially for financially needy students who must consider the opportunity cost of foregoing income for college. Further, providing tuition assistance only does not defray non-tuition-related expenses such as books, transportation, accommodation that students must cover while in college. Future studies may consider whether state-sponsored free college programs that subsidize both tuition and non-tuition-related costs better serve financially needy students.

Third, changes in enrollment of students of color may differ by gender. For instance, while House and Dell (2020) found growth in Black enrollment in Tennessee's community colleges, the authors acknowledged that accounting for female enrollment eliminates the positive enrollment effect for Black males because females drive Black enrollment in Tennessee's community colleges. Adjusting for the percent of female students in this essay may have moderated the estimated impact of free college for Black enrollment. Future studies may examine whether financial incentives to boost college access yield different outcomes based on gender.

Fourth, this study focuses on policy effects of state-sponsored universal free-tuition scholarships in the state of Tennessee. Given variation in state policy contexts, the effects of similar free college initiatives in other states might be different. As such, this limits the generalizability of this study's findings to community colleges in Tennessee.

2.10. Conclusion

The growing popularity of free college promises increased access to college but poses the important question, “access for whom?” Based on evidence from this essay, I argue that universal free college programs promise more access for some students but not for all students. Echoing other studies, this essay finds that Tennessee’s universal tuition-free incentives consistently improved enrollment for full-time and White students and less consistently for low-income students. In addition, the essay finds that such positive enrollment outcomes were not realized for students of color. It is important to empirically investigate whether there are procedural barriers that impede the take-up of universal free tuition incentives by underserved students, especially students of color. Qualitative interviews with Tennessee Promise applicants and awardees may provide helpful insights. Likewise, college completion is also desirable in the free college era. It is imperative to evaluate the extent to which free college programs improve student retention and credential awards in public colleges. The evidence may help policymakers make funding decisions to equitably distribute state resources to boost college participation for diverse student groups (House & Dell, 2020; Perna, 2006; Ortagus et al., 2020).

Chapter 3. Money Matters: Does Performance-Based Funding Motivate Dynamic Changes in Institutional Spending in Public Four-Year Institutions?

3.1. Introduction

Improving college completion outcomes is a central agenda for many states. States are increasingly modeling funding to public higher education institutions based on institutional performance known as performance-based funding (PBF). The rationale for PBF assumes that tying state funding to performance outcomes would incentivize public higher education institutions to prioritize strategies to boost student success outcomes, such as student retention and graduation rates. Institutional spending remains a critical institutional mechanism for improving student outcomes (Deming & Walters, 2018; Rabovsky, 2012), and how higher education institutions alter their spending priorities may be critical for state completion agendas. Given the importance of educational and related (E & R) spending on instruction, academic support, student services, and institutional support in boosting student success (Hillman, 2020; Cheslock, 2019), public institutions subject to PBF would be expected to prioritize E & R spending to enhance student outcomes to secure state tax dollars.

However, instead of incentivizing improvements in E & R spending, inequities in how states distribute resources to public institutions under PBF may motivate disparate spending behaviors across institutions (Ortagus et al., 2022; Hagood, 2019; Hillman & Corral, 2017; Jones et al., 2017). Under PBF, less-resourced minority-serving institutions (MSIs) serving disproportionate shares of underrepresented student groups tend to receive less state tax dollars than do their more-resourced, non-MSI counterparts (Ortagus et al., 2022; Hillman & Corral, 2017; Jones et al., 2017). Entrenched disparities in financial resources across public institutions may constrain the capacity of underfunded institutions such as MSIs to alter their E & R

spending to boost student outcomes over time (Hillman et al., 2024; Hillman, 2020; Cheslock, 2019; Cheslock & Shamekhi, 2020).

Although a few studies show only marginal changes in E & R spending in public four-year institutions subject to PBF (Rabovsky, 2012; Kelchen & Stedrak, 2016), understanding how institutions alter their E & R spending by MSI status remains to be explored. PBF may motivate heterogeneous changes in spending behavior between MSIs and non-MSIs, especially as MSIs remain underfunded under PBF that could limit MSIs' capacities to alter their spending in ways that improve student outcomes (Hillman et al., 2024; Ortagus et al., 2022; Hillman & Corral, 2017; Jones et al., 2017). Further, given that institutional changes often take time, shifts in spending priorities of incentivized institutions may evolve over time as institutions learn and adapt to their changing state funding environments (Heinrich & Marschke, 2010; Mizrahi, 2020; Dee & Leišytė, 2016). Understanding the dynamic changes in E & R spending over multiple periods may provide information as to why PBF policies continue to drive limited gains in college completion outcomes (Li, 2021; Ortagus et al., 2020; Shin et al., 2023). Evidence on the dynamic shifts in institutional spending by MSI status may also help states to better design and implement performance incentives that induce desirable institutional responses and improve student outcomes more equitably.

This study examines how public four-year institutions alter their E & R spending in response to the dynamic implementation of PBF across states throughout the 2010s (Rosinger et al., 2022b). I expect that public institutions will prioritize spending on instruction, academic support, and student services, which are more closely related to student retention and graduation rates (Gansemer-Topf et al., 2018; Ryan, 2005; Gansemer-Topf and Schuh, 2006; Pike & Robbins,

2019) over institutional support (administrative) spending with limited impact on these outcomes (Abouzeida, 2014; Titus, 2006; Webber & Ehrenberg, 2010). The study asks:

- Research Question 1: To what extent do public four-year institutions subject to PBF policies alter their educational and related spending on instruction, academic support, student services, and institutional support over time?
- Research Question 2: Do the effects of PBF policies on educational and related spending vary by MSI status?

3.2. Dynamic Implementation of Performance-Based Funding

Beginning with Tennessee in 1979, states in the U.S. are increasingly employing PBF policies to hold public colleges and universities more accountable for institutional performance and student outcomes, such as graduation rates, retention rates, and degree/certificate awards. States typically design PBF policies as incentive systems that allow public institutions to receive state funding for improved institutional performance based on some set formulas. However, the adoption and implementation of PBF policies follow dynamic patterns, occurring in several waves, and encompassing similar yet varied design elements across states (Rosinger et al., 2022; Li, 2021). The first wave of PBF policies, which occurred between 1979 and 2000, saw a few states provide bonuses to public institutions for improved performance that supplemented baseline funding. However, the onset of the recession in the early 2000s led to the discontinuation of PBF policies in some states (Dougherty et al., 2014).

In the mid-2000s, the second wave of PBF policies commenced. Instead of providing bonuses, states increased the stakes of the performance incentives by tying a proportion of baseline funding to public institutions to student outcomes. In contrast to earning bonuses from states in the first wave, in the second wave, institutions may lose shares of their baseline funding

for not meeting performance targets. The literature on behavioral public performance posits that negative framing of performance-oriented practices may be more salient in nudging people to behave in ways that ultimately influence performance outcomes (Moynihan, 2022; James et al., 2020). In line with behavioral insights, one would expect high-stakes PBF incentive systems to influence more desirable institutional responses with improved student outcomes. However, empirical research finds mixed effects of PBF regardless of policy wave (see the review articles by Ortagus et al., 2020, and Shin et al., 2023).

The 2010s saw dramatic diffusion of PBF policies, growing from ten states in 2010 to 25 states in 2015 (Rosinger et al., 2022). Despite the popularity of PBF policies, implementation of PBF varies within and between states in terms of sector funded, when PBF is funded, and the level of baseline funding tied to performance (also known as PBF dosage). For instance, while states like Nevada and Montana funded PBF in the two-year and four-year sectors in 2020, Washington and California only had a funded PBF in the two-year sector, and Oregon and Utah only funded PBF in the four-year sector (Rosinger et al., 2022). Besides, some states do not consistently fund PBF after adoption (Snyder, Boelscher & Zaragoza, 2020; Li, 2021), which may impact how institutions respond to performance incentives. Figure 3.1 shows how states implemented PBF in the four-year sector in 2019, highlighting differences in the funding of PBF policies after adoption within one sector across states.

Another element of variation in PBF policies is the proportion of state funding tied to performance. According to Rosinger and colleagues (2022), the median percent of PBF funding in the four-year sector increased from 1.7% of baseline funding in 1997 to 6.6% in 2020. However, some states do budget substantial funds in the four-year sector based on performance, as in 70% of baseline funding in Kentucky, and 80% in Tennessee in 2020. To protect

institutions based on enrollment. The rationale of funding for performance is that performance incentives will spur favorable institutional responses from public colleges and universities since these institutions not only rely on state support but also seek to maximize institutional revenue coming from state tax dollars.

However, PBF policies have yet to deliver on expected improvements in student outcomes, especially in less selective institutions serving many underrepresented students (Li, 2021; Ortagus et al., 2020; Shin et al., 2023; Favero & Rutherford, 2019; Boland, 2020; Hillman et al., 2018; Ward & Ost, 2021). For instance, Boland (2020) found no improvements in bachelor's degree awards in Historically Black Colleges and Universities, which are a type of MSI. Other evidence shows that PBF motivates less desirable institutional responses, including increasing institutional selectivity and restricted access, thereby limiting access for underrepresented students (Ra et al., 2023; Birdsall, 2018; Hillman, 2016; Dougherty et al., 2016). A few others show that institutions alter their spending. Rabovsky (2012) estimated that public research universities in PBF states increased instructional spending by 1.34%. In contrast, Kelchen and Stedrak (2016) did not find any statistically significant changes in expenditures for instruction, student services, and institutional support in public four-year institutions, although the authors found some positive shifts in spending on instruction, student services after two years. More recently, Hu et al. (2022) reported that PBF with research incentives for public 4-year institutions yielded no significant effect on research expenditures even when considering institutions MSI status. However, in PBF states that allowed public four-year institutions to choose to include research incentives in their performance contracts, PBF research incentives increased research spending. The increase in research spending was experienced by non-minority-serving institutions, serving a smaller share of underserved students.

Besides, interviews with university administrators subject to PBF suggest that the financial disadvantages experienced by institutions serving disproportionate shares of underserved students tend to limit the capacity of such institutions in employing strategies that boost student outcomes (Dougherty et al., 2016). According to a university administrator in Dougherty et al.'s qualitative study (2016, p. 158):

We have a heavy teaching load, a heavy advising load, a heavy service load... I think in terms of the implementation [of PBF], our resource reality is a fundamental challenge in terms of doing some of the things [such as in increasing our spending priorities] that would help us to do even better under the performance funding formula. Again, I'll go back to the reality that when you have 30% of your population that is first-generation, one in four students is 25 years or older, you need certain special services. That takes money.

Undoubtedly, institutions need money to better serve their students. The prior studies suggest that disparities in financial resources by institution type may incentive varying spending responses to PBF, that PBF may incentivize small changes in institutional spending, that changes in financial priorities may evolve over time, and that institutions' participation in the design of performance contracts may matter to institutional responses to PBF. However, the quantitative evidence from these studies covers the early 2000s to the early 2010s, prior to the significant diffusion of PBF throughout the 2010s, while the qualitative evidence was primarily collected in 2012. By examining the dynamic changes in educational and related spending in public four-year institutions throughout the 2010s and by MSI status, this current study extends our understanding of institutional responses to PBF in the latter part of the second wave, especially as institutional

responses are critical mechanisms moderating the causal link between PBF and student outcomes (Rabovsky, 2012).

3.4. Institutional Spending and Student Outcomes

Where and how public institutions expend institutional resources to improve student success is a salient policy question especially given the rising costs of college with less impressive completion rates in recent decades (Ode et al., 2021; American Council of Trustees and Alumni [ACTA], 2021). Many studies are exploring the financial priorities of institutions to understand the relationship between E & R spending (on instruction, academic support, student services, and institutional support) and student outcomes.² However, the impact of E & R spending on student success varies by expenditure type. According to ACTA (2021), public four-year institutions channeled less institutional resources toward instructional spending (16%) that more closely impacts student success than to non-instructional spending (19% on administration and 25% on student services) between 2010 and 2018.

Numerous studies conclude that spending on instruction boosts student success. For instance, instructional spending improved 4- and 6-year graduation rates (Pike & Robbins, 2019), improved student retention in public institutions (Gansemmer-Topf et al., 2018), and marginally increased graduation rates in public four-year institutions (ACTA, 2021). However, annual changes in instructional spending in public four-year institutions are mostly incremental, ranging between a decrease of 2.7% to an increase of 5.4% (Ecton & Dziensinski, 2022).

² The E & R spending categories that have gained much attention include instruction, academic support, student services, and institutional support. Expenses for providing instruction for academic and non-credit courses such as salaries for instructional faculty constitute instructional spending. Services that support in advancing institutions' missions of teaching, research, and public service such as library and research services, and course and curriculum development encompass academic support spending. Student services consist of activities and services that contribute to the well-being and social development of students such as counseling, and student records. Administrative expenses for the day-to-day operations of institutions, including executive direction and planning, and legal and fiscal operations are classified as institutional support spending (IPEDS finance survey, n.d).

Meanwhile, evidence on the effects of spending on academic support is mixed. While Pike and Robbins (2019) found that spending on academic support improved 4-year graduation rates, academic support expenditure impacted student retention negatively (Gansemer-Topf et al., 2018). Further, Abouzeida (2014) and Gansemer-Topf and Schuh (2006) observed that spending channeled toward academic support positively impacts student retention.

Further, evidence on the effects of spending on student services, and administrative expenses is mixed. For instance, while Webber and Ehrenberg (2010) found that spending on student services improved graduation rates, Pike and Robbins (2019) found negative impact of student services expenditures on graduation rates. Prior studies also found that administrative expenses do not improve student outcomes. For instance, administrative expenses negatively impact student success (Abouzeida, 2014), graduation rates (Gansmer-Topf & Schuh, 2006), and student engagements (Ryan, 2005). Moreover, in their studies, Webber & Ehrenberg (2010), and Ryan (2004) found that administrative expenses do not improve graduation rates. The disparate effects of institutional expenditures imply that improving student success outcomes depends on where and how public institutions prioritize their institutional spending.

3.5. Conceptual Framework

This study employs the traditional principal-agent model and empirical evidence to conceptualize how public four-year institutions may alter their E & R spending in the context of PBF (Jensen & Meckling, 1976). The first feature of this model is that state policymakers (the principal) are interested in enhancing college completion outcomes to enhance state economic prosperity. To achieve this goal, state policymakers contract public higher education institutions (the agent) to provide undergraduate education for their constituents. Given that public higher education institutions often have multiple priorities such as rankings and prestige (Kim, 2018),

these institutions may prioritize other institutional goals over the principal's preference. Further, the institutions (agents) may know more about their internal workings and how to achieve their institutional goals than do their principals (state policymakers). As such, goal conflict and information asymmetry present two inherent challenges in the traditional principal-agent relationship. However, the intensity of these challenges in the public sector may be lessened as principals and agents often pursue similar interests for public good (Waterman & Meier, 1998).

Still, to induce public higher education institutions to prioritize college completion agenda of the state, state policymakers employ performance incentives as PBF policies that tie state funding to the performance outcomes of public institutions. Simply put, institutions earn as they perform in ways that advance state completion agenda. State funding is a critical resource for public institutions as nearly 30% of institutional revenue in the four-year sector comes from state appropriations (Rosinger et al., 2022b), although state funding may vary depending on states' generosity to higher education.

Because public higher education institutions are reliant on state financial support, PBF incentives may be instrumental in altering financial priorities of public institutions. The financial incentives embedded in PBF may incentivize public institutions in channeling institutional resources to areas that may boost student success outcomes, including E & R spending on instruction, academic support, and student services. Boosting student outcomes may secure performance dollars for performing institutions and advance state college completion agenda. Because administrative expenses do not necessarily improve student outcomes, PBF may not motivate public institutions to increase administrative spending. This leads me to hypothesize that:

H1a: Public four-year institutions subject to PBF funding will increase spending on instruction, academic support, and student service to improve student outcomes to secure state financial support.

H1b: Public four-year institutions subject to PBF funding will not increase spending on administrative expenses given that administrative expenses are not positively associated with student outcomes.

However, changes in spending behaviors of public institutions may vary based on institutional capacity and financial resources. PBF exacerbates financial inequities between MSIs and non-MSIs as states continue to provide less financial support to MSIs that are funded based on their performance (Hillman & Corral, 2017; Ortagus et al., 2022). Funding public institutions without accounting for the differences in financial resources across institution types may create a cycle of disadvantage for MSIs and their underserved students (Hillman & Corral, 2017), where MSIs lose state funding for underperformance and declining state funding limit the capacity of MSIs to improve their E & R spending to improve performance. Likewise, a large qualitative study on PBF implementation that involved interviews with institutional leaders in Indiana, Ohio, and Tennessee found that low-capacity institutions with disproportionate shares of underrepresented students experienced financial challenges, limiting their capacity to respond to PBF (Dougherty et al., 2016). Financial inequities across public institutions may limit shifts in spending for MSIs while enhancing spending for non-MSIs. This leads me to hypothesize that:

H2a: MSIs subject to PBF funding will not increase spending on instruction, academic support, student service, and administrative expenses.

H3a: Non-MSIs subject to PBF funding will increase spending on instruction, academic support, and student service to improve student outcomes to secure state financial support.

H3b: Non-MSIs subject to PBF funding will not increase spending on administrative expenses given that administrative expenses are not positively associated with student outcomes.

Further, the performance management literature notes that agents subject to performance incentives may alter their behavior over time as they learn and adapt to institutionalized performance management systems (Heinrich & Marschke, 2010; Moynihan, 2009; Tandberg & Hillman, 2014; Dee & Leišytė, 2016). As such, agents' response to performance incentives may become dynamic. This may be especially true when the agent is an institution as in public institutions in the PBF context. Institutional changes often take time to manifest. Moreover, given the dynamic implementation of PBF within and between states (Rosinger et al., 2022b), we would expect that institutions responding to PBF incentivizes will shift their E & R spending priorities over time.

3.6. Data and Methods

3.6.1. Analytic Sample

I constructed a longitudinal dataset from multiple sources to analyze the effects of funded PBF formulas on institutional expenditures in public four-year institutions. The study period begins in 2009-10 when PBF diffused greatly across states (Rosinger et al., 2022a) and ends in 2018-19, to eliminate any confounding impact of the COVID-19 pandemic on financial priorities and institutional behavior of public institutions. I obtained data on institutional characteristics, institutional expenditures, institutional revenues, full-time enrollments, graduation rates,

percentage of student applicants admitted for public four-year universities from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS).

To examine PBF policies, I leveraged a comprehensive state-level dataset from the Informed States (Ortagus, Rosinger & Kelchen, 2021) and identified states with funded PBF formulas in the four-year sector and states with no PBF formulas. The PBF dataset also provided information on state general fund budgets for the four-year sector, and the percentage of state baseline funding tied to performance for the four-year sector. In addition, I identified states with tuition control policies from Kelchen and Pingel (2023) and obtained state higher education policy adoption rates as an index for state higher education policy innovativeness from Tandberg et al. (2022). Further, I leveraged the MSI eligibility data from the U.S. Department of Education's Office of Postsecondary Education and created an MSI indicator to analyze PBF effects for the MSI and non-MSI subsamples. The full-sample comprised of 4,727 university-year observations while the MSI and non-MSI subsamples include 1,452 and 3,275 institution-year observations, respectively.

The policy treatment in this study is the funding of public institutions based on PBF formulas in the four-year sector. For the full sample and each subsample (MSI and non-MSI), I first compared public four-year institutions in states that funded institutions based on PBF formulas in the four-year sector coded as 1 with peer institutions in states with no PBF coded as 0.

3.6.2. Outcomes Measures and Covariates

I analyzed changes in institutional expenditures using annual measures for four expenditure categories. Three of the measures, including instructional expenditure per full-time equivalent (FTE) student, academic support expenditure per FTE student, and student services

expenditure per FTE student, are related to the core expenditure categories for higher education institutions (Deming & Walters, 2018; Cheslock et al., 2016). The fourth measure: institutional support expenditure per FTE student serves as proxy for administrative expenses.

I included institution- and state-level control variables associated with institutional expenditures in colleges and universities. First, how much institutions spend depends on the revenues available. I therefore control for tuition and fee revenue per FTE student, state appropriation per FTE student, federal appropriation per FTE student, local appropriation per FTE student, state grant aid per FTE. Second, institutional size may moderate expense and I included full-time fall enrollment (logged) as a covariate. Third, institutional selectivity is associated with higher institutional expenses, and I control for the percentage of applicants admitted as proxy for institutional selectivity.³ Since PBF tends to financially reward non-MSIs more than MSIs and may moderate institutional spending, I included MSI status as an institution-level covariate in the full sample only.

At the state level, I included state general fund budgets for the four-year sector, and the percentage of state baseline funding tied to performance for the four-year sector, and state tuition control policies as covariates, which can impact the revenues that institutions receive from their state governments and from students and may moderate the spending behavior of public institutions. Lastly, the rate of state policy innovations in the higher education landscape may also influence strategic institutional responses; thus, I used state higher education policy adoption rates as index for state higher education policy innovativeness from Tandberg et al. (2022). While this index attempts to account for several state higher education policies, it is only

³ I use the percentage of applicants admitted as proxy for institutional selectivity as commonly used in the PBF and literature on higher education finance (e.g. Hu et al. 2022; Gandara & Rutherford, 2018; Birdsall, 2018).

a proxy and may only account for some policy changes, not all. All financial variables are Consumer Price Index (CPI) CPI-adjusted to 2020 dollars.

3.6.3. Empirical Strategy

This essay examines how institutional expenditures in public four-year institutions subject to PBF change over time. For the event study analysis, I followed Sun and Abraham's (2021) approach in conducting dynamic difference-in-differences to account for heterogenous treatment effects across multiple time periods and multiple groups. I specify the model as follows:

$$\diamond \text{ Spending}_{ist} = \alpha + \sum_{k=-5}^{+5} \beta_k \text{PBF}_{ist+k} + \delta Z_{it} + \gamma_i + \eta_t + \varepsilon_{st}$$

Spending_{ist} represents each outcome measure (instructional expenditure per FTE student, academic support expenditure per FTE student, student services expenditure per FTE student, and institutional support expenditure per FTE student) for institution i in state s in year t . PBF_{ist} is a binary indicator for policy treatment for institution i in state s in year t . The policy treatment is the funding of public institutions by states based on PBF formulas in the four-year sector, with the binary indicator coded as 1 for PBF-funded institutions and 0 for comparison institutions in states with no PBF. β_k is the coefficient of interest, which indicates the differences in institutional spending between PBF and non-PBF institutions in each year before and after states funded public institutions based on PBF. I am interested in the post-treatment and lagged effects of PBF funding for each spending category for up to 5 years. The pre-treatment and lead effects for 5 years before PBF funding provide a falsification test of whether PBF-funded and non-PBF institutions followed similar pre-trends in institutional spending for each spending category. Near-zero and insignificant point estimates of pre-implementation differences in spending outcomes provide support for the parallel trends assumption, implying that in the absence of PBF funding, the average change in institutional spending for PBF-funded institutions

would have been same as the average change in institutional spending for non-PBF institutions. All estimates are relative to the year $(t - 1)$ before institutions were funded based on PBF. δ_{zit} is a vector that includes institution- and state-level control variables associated with the target outcomes described above. γ_i captures college fixed effects such as mission and location, and η_t captures year fixed effects. The error term, ε_{st} , captures unobserved differences for each state in each year (Wooldridge, 2021).

3.7. Results

3.7.1. Descriptive Statistics

Table 3.1 presents the descriptive differences in institutional expenditures for public institutions in the treatment group in states with funded PBF formulas for the four-year sector (in Columns 1 for the full sample, 2 for MSIs, and 3 for non-MSIs) and comparison peer institutions in states with no PBF formulas (in Columns 4 for the full sample, 5 for MSIs, and 6 for non-MSIs). Overall, institutional expenditures vary between and within institution types. On average, spending on instruction per FTE was lower for PBF-funded institutions in the full sample (\$11728) than their non-PBF peers (\$11902). Similarly, MSIs and non-MSIs funded based on PBF spent less on instruction than comparable peers in non-PBF states. Spending on academic support per FTE was on average slightly higher for PBF-funded institutions in the full sample (\$3218) than their non-PBF peers (\$3204). In contrast, MSIs funded based on PBF spent slightly less (\$2722) on academic support than comparable MSIs in non-PBF states (\$2749) while non-MSIs funded based on PBF spent slightly more (\$3432) on academic support than comparable non-MSIs in non-PBF states (\$3408). On average, spending on student services per FTE was lower for PBF-funded institutions in the full sample (\$2473) than their non-PBF peers (\$2594). In contrast, MSIs funded based on PBF spent slightly more (\$2673) on student services than

comparable MSIs in non-PBF states (\$2578) while non-MSIs funded based on PBF spent less (\$2387) on student services than comparable non-MSIs in non-PBF states (\$2601). Spending on institutional support per FTE was on average lower for PBF-funded institutions in the full sample (\$3329) than their non-PBF peers (\$3732). Similarly, MSIs funded based on PBF spent less (\$3126) on institutional support than comparable MSIs in non-PBF states (\$3432), and non-MSIs funded based on PBF spent less (\$3416) on institutional support than comparable non-MSIs in non-PBF states (\$3866). Interestingly, institutions funded based on PBF in the full sample, the MSI and non-MSI subsamples each received the lower average revenues from state appropriation per FTE, and state grant aid per FTE than their comparable non-PBF institutions. Further, the percentage of PBF funding tied to performance in the four-year sector was lowest among PBF-funded institutions in the non-MSI subsample (19%), 20% in the full sample, and highest in the MSI category (22%). The level of funding at stake under PBF policies may moderate spending behavior between and within categories of public institutions.

3.7.2. Event Study Results

This study examines whether funding public four-year institutions based on performance alters educational and related spending patterns of PBF-funded institutions over time relative to peer institutions that were not funded based on performance. Tables 3.2, 3.3, 3.4, and 3.5 present the lagged treatment effects of funded PBF on institutional spending on instruction, academic support, student services, and institutional support, respectively, based on Sun and Abraham's (2021) event study approach. Panels A, B, C in each table provide lagged treatment effects across all treated public four-year institutions in the full sample, within treated MSIs, and for treated non-MSIs, respectively. The results show variation of lagged effects of PBF funding on institutional expenditures between and within types of treated institutions.

Table 3.1. Descriptive Statistics

	PBF-funded			NonPBF		
	Full Sample (1)	MSI (2)	Non-MSI (3)	Full Sample (4)	MSI (5)	Non-MSI (6)
Instructional Expenditure per FTE	11728.4 (5543.659)	10794.65 (3437.541)	12129.46 (6192.172)	11902.48 (6415.545)	10883.04 (4202.034)	12359.81 (7144.14)
Academic Support Expenditure per FTE	3218.371 (2593.431)	2721.675 (1380.901)	3431.714 (2940.837)	3203.818 (2520.458)	2748.987 (1541.818)	3407.859 (2829.032)
Student Services Expenditure per FTE	2473.345 (1234.62)	2673.495 (1341.149)	2387.377 (1176.295)	2593.659 (2134.119)	2578.05 (1191.43)	2600.662 (2441.693)
Institutional Support Expenditure per FTE	3328.707 (2438.805)	3125.673 (1794.219)	3415.914 (2664.448)	3731.793 (2725.273)	3432.258 (1839.96)	3866.167 (3030.529)
Tuition and Fee Revenue per FTE	9867.05 (4177.909)	8756.333 (2890.288)	10344.13 (4540.854)	8745.127 (4251.382)	7944.457 (3233.803)	9104.316 (4591.326)
State Appropriation per FTE	7545.736 (4425.08)	7799.434 (4413.326)	7436.767 (4428.102)	8591.92 (5777.723)	8424.513 (4164.325)	8667.02 (6369.468)
Federal Appropriation per FTE	718.8207 (8887.022)	178.8263 (2440.65)	950.7605 (10497.91)	950.0666 (9465.754)	101.2532 (1371.027)	1330.853 (11335.87)
Local Appropriation per FTE	33.72787 (353.461)	57.96318 (568.495)	23.31825 (199.208)	47.62806 (583.205)	18.16495 (109.087)	60.84551 (939.614)
State Grant per FTE	794.7081 (889.269)	923.2475 (958.547)	739.4974 (852.418)	992.1721 (1018.568)	1109.33 (971.353)	939.6139 (1034.95)

Table 3.1. Descriptive Statistics (Continued)

Full-Time Fall Enrollment (logged)	8.846107 (1.405)	8.806857 (1.14)	8.862966 (1.505)	8.514901 (1.588)	8.752381 (1.291)	8.408365 (1.694)
Percentage of Applicants Admitted	73.01786 (15.977)	74.24289 (17.81)	72.49168 (15.102)	65.83425 (18.503)	67.62911 (17.723)	65.02906 (18.78)
Minority-Serving Institution Status	0.3004658 (0.459)	1 0	0 0	0.309683 (0.31)	1 0	0 0
State Appropriation to the 4-Year Sector (logged)	20.36459 (0.665)	20.2625 (0.695)	20.40844 (0.647)	20.67903 (1.162)	20.84778 (1.151)	20.60333 (1.159)
Percentage of Performance-Based Funding for the 4-Year Sector	20.19791 (29.931)	22.00618 (29.59173)	19.42122 (30.05776)	0 0	0 0	0 0
Tuition Control	0.4192547 (0.494)	0.4392765 (0.497)	0.4106548 (0.492)	0.4100029 (0.492)	0.3446009 (0.475)	0.4393429 (0.496)
State Higher Education Policy Innovativeness	0.0393442 (0.011)	0.0395797 (0.011)	0.039243 (0.011)	0.036372 (0.011)	0.0369688 (0.011)	0.0361043 (0.011)
N = College - Year	1288	387	901	3439	1065	2374
<p>Note. PBF = Performance-Based Funding Standard Deviation in parentheses All financial variables are in 2020 CPI-adjusted dollars</p>						

Panel A in Table 3.2 reveals a consistent increase in spending on instruction in the first five years after funding public institutions based on performance. Instructional spending per FTE grew from \$428 after one year of funding based on PBF to \$1,180 five years later. In Panel B, PBF funding yields no significant lagged effect on instructional spending among PBF-funded MSIs, although effects follow similar directions as seen among all treated public institutions in Panel A. Likewise, implementing PBF did not significantly alter spending on instruction in PBF-funded non-MSIs in the first five years in Panel C.

The results in Panel A in Table 3.3 show no significant shifts in spending on academic support spending per FTE student across all PBF-funded public institutions. Similarly, MSIs funded based on performance in Panel B and non-MSI subject to PBF in Panel C did not improve financial investments in academic support in the first five years.

Panel A in Table 3.4 indicates that funding public institutions based on performance increased student services expenditure per FTE student by \$411 across all treated public institutions after five years. In Panel B, PBF funding yielded no lagged effect on student services expenditure per FTE student among PBF-funded MSIs. Likewise, Panel C reveals no shifts in spending on student services expenditure per FTE student among PBF-funded non-MSIs in the first five years.

There are significant lagged effects on institutional support expenditure per FTE student in Table 3.5. In Panel A, the increase in institutional support expenditure per FTE among PBF-funded institutions was between \$664 to \$1,153 three to five years later. Institutional support spending appears to also increase over time in MSI-treated institutions in Panel B although changes in spending were not significant. Meanwhile, in Panel C, non-MSI subject to PBF experienced a delayed increase in spending on institutional support. PBF funding yielded a \$780

Table 3.2. Event Study of PBF Effects on Instructional Expenditure

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: All Four-Year Institutions</i>					
Instructional Expenditure per FTE	428.073+	520.883+	754.298*	1089.35+	1180.385+
	(242.988)	(278.111)	(354.152)	(639.149)	(659.635)
N (College-Year)	4726	4726	4726	4726	4726
<i>Panel B: Minority-Serving Institutions</i>					
Instructional Expenditure per FTE	497.571	656.505	938.413	1380.520	1303.265
	(361.440)	(440.318)	(861.095)	(1538.314)	(1521.412)
N (College-Year)	1450	1450	1450	1450	1450
<i>Panel C: Non-Minority-Serving Institutions</i>					
Instructional Expenditure per FTE	430.884	485.432	549.019	675.724	811.641
	(272.416)	(331.151)	(368.118)	(565.198)	(514.603)
N (College-Year)	3274	3274	3274	3274	3274

Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X

Note. PBF = Performance-Based Funding

Standard errors clustered by state are in parentheses

+ p<0.1 *p<0.05 ** p<0.01 *** p<0.001

increase institutional support expenditure per FTE in non-MSI-treated institutions after five years.

The event study results show that, over time, funding public institutions based on PBF is associated with dynamic changes in institutional spending. However, delayed shifts in spending appear to be more persistent in instructional spending across all institutions subject to PBF but less so for other spending categories. Further, MSIs do not appear to alter spending patterns in response to PBF. Meanwhile, non-MSIs appear to respond to PBF policies by delaying the increase in spending on institutional support, a spending behavior also observed across all

Table 3.3. Event Study of PBF Effects on Academic Support

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: All Four-Year Institutions</i>					
Academic Support Expenditure per FTE	71.929	67.977	279.885	223.329	296.134
	(95.524)	(130.146)	(194.147)	(259.294)	(206.286)
N (College-Year)	4726	4726	4726	4726	4726
<i>Panel B: Minority-Serving Institutions</i>					
Academic Support Expenditure per FTE	11.346	-14.021	-3.269	-159.486	-57.191
	(102.510)	(107.417)	(211.549)	(285.108)	(246.367)
N (College-Year)	1450	1450	1450	1450	1450
<i>Panel C: Non-Minority-Serving Institutions</i>					
Academic Support Expenditure per FTE	100.513	100.513	369.885	235.747	147.645
	(112.667)	(112.667)	(245.585)	(320.879)	(299.375)
N (College-Year)	3274	3274	3274	3274	3274

Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X

Note. PBF = Performance-Based Funding

Standard errors clustered by state are in parentheses

+ p<0.1 *p<0.05 ** p<0.01 *** p<0.001

institutions subject to PBF. The summary of results and hypotheses are in Table B.1 in Appendix B.

3.7.3. Sensitivity Analysis

I conducted several robustness checks to assess the sensitivity of my main results. I used event study analysis to examine the pre-treatment effects of PBF on institutional expenditure to assess whether public institutions in the treatment and comparison groups were similar before exposure to PBF policies (Furquim et al., 2020; Sun & Abraham, 2021). The event study plots in Figures 3.2, 3.3, and 3.4 largely show near-zero differences in institutional expenditures in the

Table 3.4. Event Study of PBF Effects on Student Services

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: All Four-Year Institutions</i>					
Student Services Expenditure per FTE	117.129	161.930	165.180	158.343	410.925*
	(98.210)	(124.454)	(147.964)	(182.574)	(197.234)
N (College-Year)	4726	4726	4726	4726	4726
<i>Panel B: Minority-Serving Institutions</i>					
Student Services Expenditure per FTE	43.913	171.816	-151.486	-173.005	251.866
	(180.421)	(157.431)	(267.744)	(368.897)	(322.808)
N (College-Year)	1450	1450	1450	1450	1450
<i>Panel C: Non-Minority-Serving Institutions</i>					
Student Services Expenditure per FTE	124.440	186.637	195.087	149.977	233.599
	(101.637)	(156.428)	(125.398)	(168.082)	(151.630)
N (College-Year)	3274	3274	3274	3274	3274

Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X

Note. PBF = Performance-Based Funding
Standard errors clustered by state are in parentheses
+ p<0.1 *p<0.05 ** p<0.01 *** p<0.001

pre-treatment periods between PBF-funded institutions and non-PBF institutions, and by MSI status. The near-zero differences in institutional expenditures in the pre-treatment serve as a falsification test, indicating that spending patterns were not significantly different between treated and untreated institutions prior to PBF funding and satisfies the parallel trends assumption for estimation with difference-in-differences regressions (Furquim et al., 2020). Few exceptions are observed in the plots for institutional support expenditure per FTE with non-zero differences four to five years before PBF. Readers should take caution when interpreting lagged effects for spending on institutional support.

Table 3.5. Event Study of PBF Effects on Institutional Support

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: All Four-Year Institutions</i>					
Institutional Support Expenditure per FTE	252.675	279.870	663.502*	823.725**	1152.700**
	(286.716)	(278.353)	(284.871)	(305.815)	(336.646)
N (College-Year)	4726	4726	4726	4726	4726
<i>Panel B: Minority-Serving Institutions</i>					
Institutional Support Expenditure per FTE	-168.729	101.253	751.637	624.362	755.106
	(209.341)	(228.860)	(460.651)	(600.559)	(646.502)
N (College-Year)	1450	1450	1450	1450	1450
<i>Panel C: Non-Minority-Serving Institutions</i>					
Institutional Support Expenditure per FTE	361.382	285.974	285.870	285.870	779.592*
	(295.084)	(307.438)	(257.241)	(257.241)	(297.953)
N (College-Year)	3274	3274	3274	3274	3274
Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
Note. PBF = Performance-Based Funding Standard errors clustered by state are in parentheses + p<0.1 *p<0.05 ** p<0.01 *** p<0.001					

The study accounted for heterogeneous treatment effects of PBF funding by examining spending behavior by type of institutions for all public four-year institutions, MSIs, and non-MSIs. Heterogeneous treatment effects of PBF funding were also disaggregated by expenditure type. Because the level of state funding tied to performance varies between states, I attempted to account for any confounding effects of PBF dosage on the main results by estimating the impact of implementing PBF above the median dosage of 5.45% versus no PBF, and below the median dosage versus no PBF. Table B.2 and Figure B.1 in the appendix show that tying more than 5.45% of baseline funding to performance appears to support increased spending on instruction per FTE student two to five years after, delayed increases in spending on student services, and institutional support. Similarly, allocating less than 5.45% of baseline funding based on PBF incentivized some lagged increases in spending on instruction, student services, and institutional support spending per FTE student in Table B.3 and Figure B.2. The sporadic shifts in institutional spending per FTE appear to be driven by both below and above median PBF dosage. Another issue I addressed is the confounding effects of early adopters and implementers of PBF policies in my analytic sample as effects of performance management tend to become more evident over time (Gerrish, 2016). To check for any confounding effects of early adopters and implementers of PBF policies, I created a restricted sample of only public universities in states that adopted PBF between 2010 – 2019, leading me to exclude public universities in the states of Arkansas, Colorado, Florida, Illinois, Indiana, Kentucky, Minnesota, Missouri, New Jersey, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, and Washington that had adopted PBF policies before 2010 (Rosinger et al., 2022a).

Dougherty and Reddy (2013) reported that some college and university administrators in

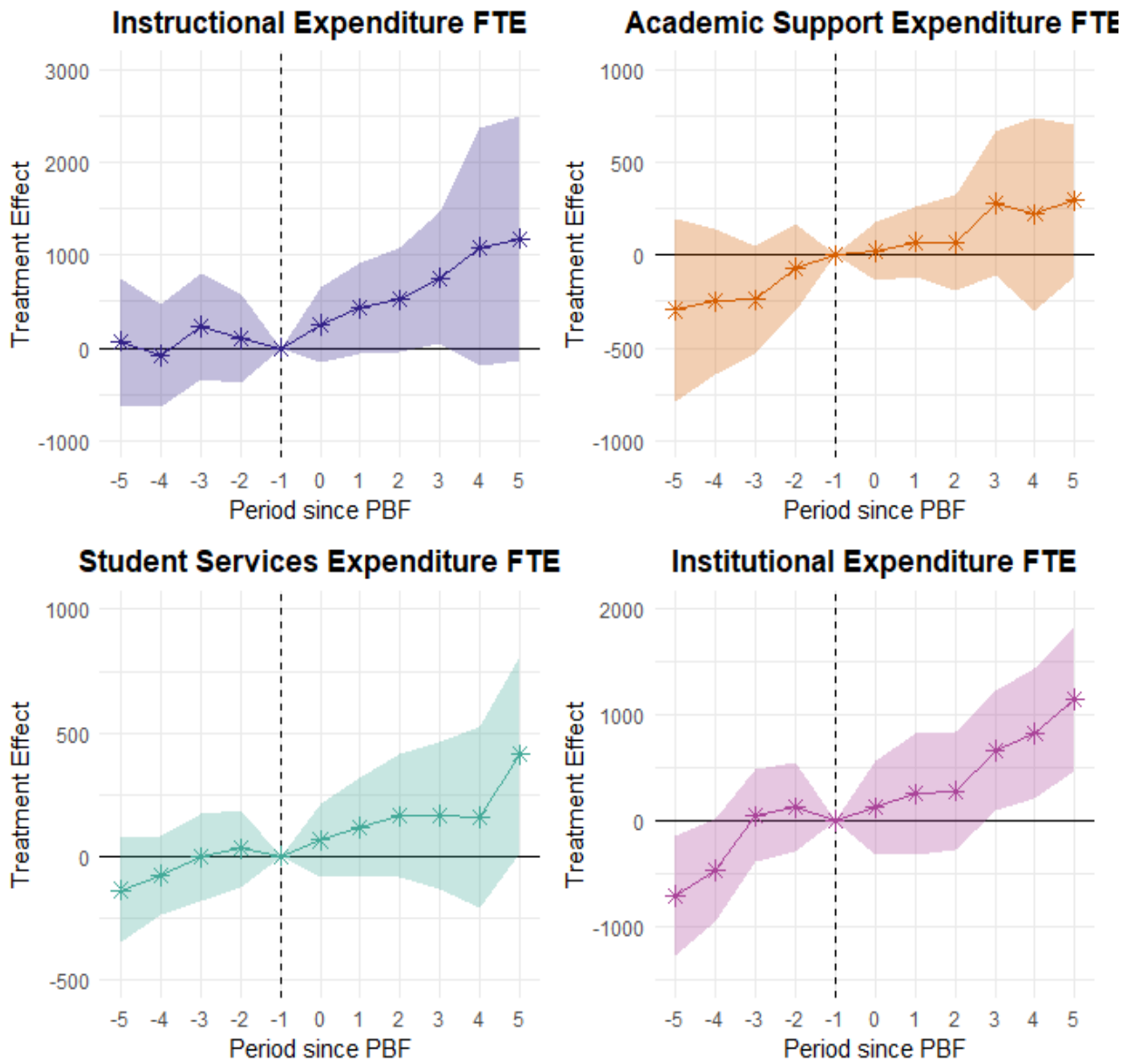


Figure 3.2. Event Study of Funded PBF for the Full Sample

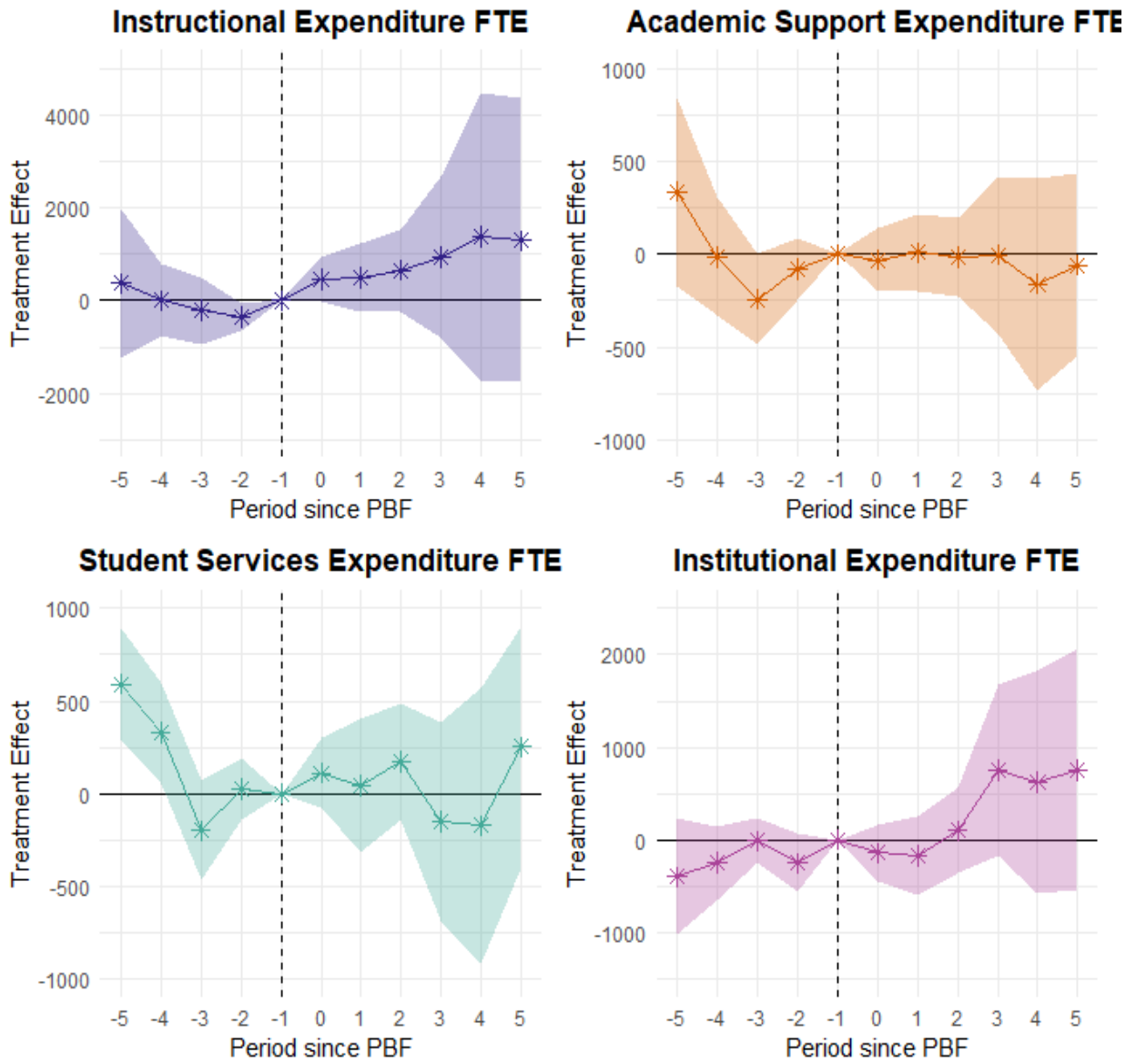


Figure 3.3. Event Study of Funded PBF for the MSI Subsample

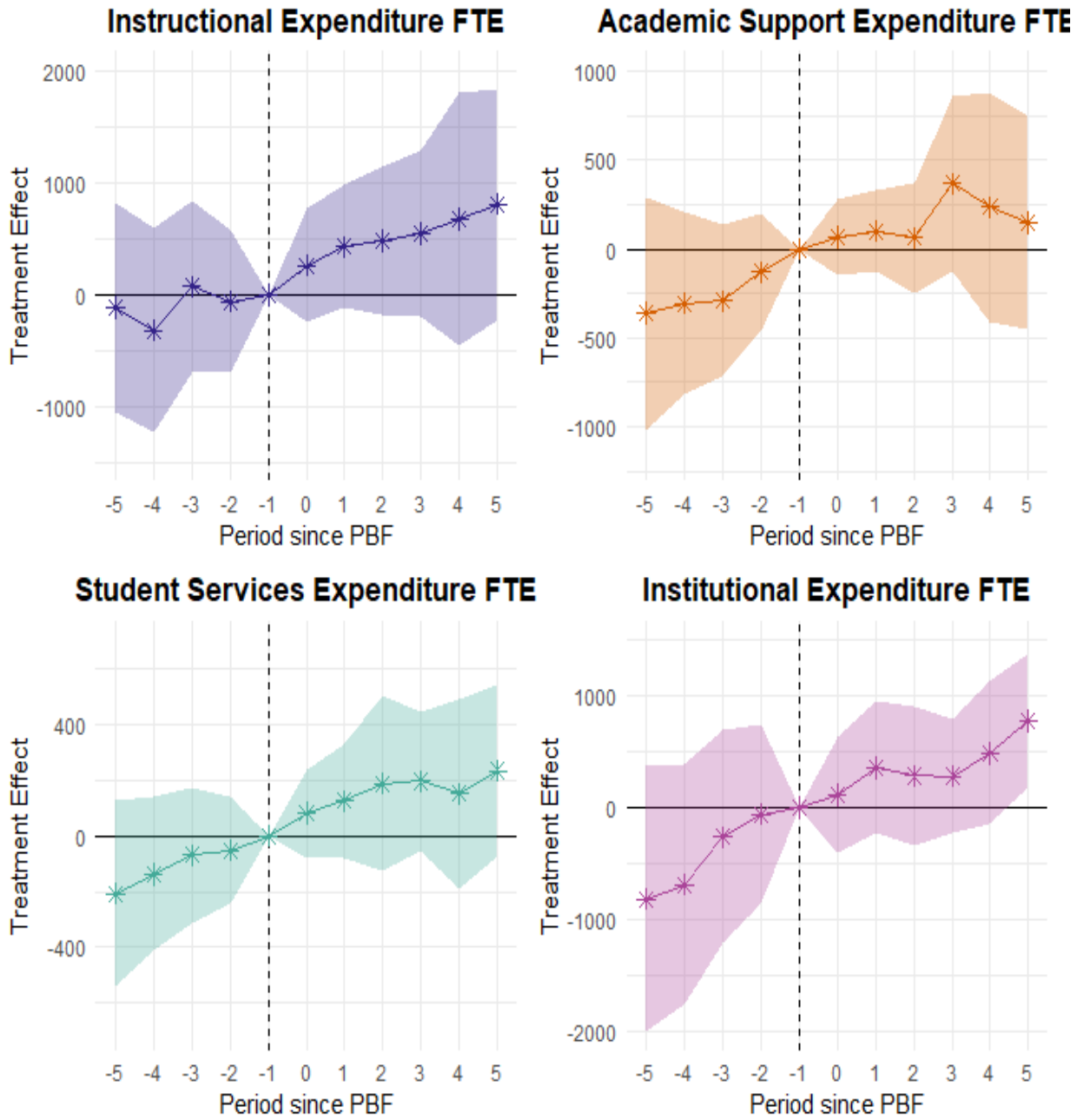


Figure 3.4. Event Study of Funded PBF for the Non-MSI Subsample

states that had adopted PBF between 1990 and 2013 regarded PBF policies as symbolic policies. The performance management literature tells us that performance regimes that serve symbolic purposes do not necessarily improve organizational effectiveness as those that serve for purposeful uses (Moynihan, 2008). The results for the restricted sample of recent adopters of PBF are largely consistent with the main results (Table B.4 and Figure B.3).

Given that institutions might be altering spending to improve completion outcomes that states implementing PBF care about, I explored the impact of PBF on graduation rates in public four-year institutions, a common measure of student success, as an exploratory examination of whether dynamic changes in institution expenditures in institutions subject to PBF improves graduation rates. The results in Table B.5 and Figure B.4 do not show any significant improvement in graduation rates across all treated public institutions, and by MSI status. However, changes in institutional spending might be associated with other measures of student outcomes not explored in this study. Furthermore, I conducted the Chow test to show that disaggregating the analyses of PBF effects on institutional spending provides improvement in model fit and is suitable for this study (Table B.6).

3.8. Discussion

Changes in the financial priorities of public colleges and universities serve as crucial institutional mechanisms for translating PBF policies to improved student outcomes. Although the extensive literature on the impact of PBF policies reveals limited improvement in student outcomes in public institutions, understanding how PBF policies influence changes in institutional behavior, which moderate student success and institutional performance, remains limited. In response, this study examines how funding public institutions based on performance alters institutional spending patterns of public universities in the four-year sector over time.

According to the principal-agent theory, we would expect public institutions receiving state funding based on their performance to channel institutional resources toward educational and related spending areas that are more likely to improve college completion outcomes to secure state tax dollars. I find suggestive evidence of dynamic and differential effects of PBF on spending patterns in public four-year institutions, which vary by expenditure category and MSI status of institutions.

Over time, public four-year institutions increase their spending on instruction after receiving state funding based on their performance, which is consistent with my theoretical expectations. This finding also aligns with Kelchen and Stedrak's (2016) study that found a positive lagged effect of PBF on instruction in the second year of the policy. Given that extant evidence suggests that investing in instruction improves student outcomes (Pike & Robbins, 2019; Gansemer-Topf et al., 2018; ACTA, 2021), when states fund public institutions based on student success, the institutions may be motivated to channel more resources toward instruction. However, while channeling more resources to instruction is desirable, it is not exactly clear as to whether institutions have sufficient information on what level of changes in spending per FTE student on instruction will be adequate to improve student outcomes. The question of how much spending is adequate to improve student success remains, especially as the supplemental analysis in this study finds no improvement in graduation rates in public four-year institutions subject to PBF.

Similarly, this study also finds evidence that public four-year institutions experience some delayed increase in student services. Prior qualitative study by Dougherty and Reddy (2013) found that public colleges and universities made several changes to student services in response to PBF, including improvements in student advising and counseling, course registration

procedures, financial aid procedures, and job placement services. Again, whether and how changes on student services spending boost student outcomes for institutions funded based on performance is an avenue for future research. Information on how much spending will improve student outcomes may help institutional leaders in making financial decisions that enhance student outcomes more effectively and equitably.

Consistent with theoretical expectations, MSIs funded based on their performances do not appear to significantly alter their spending on instruction, student services, and academic support, which may be explained by several reasons. First, limited financial resources in MSIs may constrain improvements in instructional spending (Hillman, 2020; Cheslock, 2019). PBF incentives do not offer much financial advantages to MSIs (Hillman & Corral, 2017; Ortagus et al., 2022) and may disincentivize these institutions from shifting their financial priorities in response to PBF policies. Limited opportunities to maximize revenue from state funding may also impede changes in institutional budgets. The null response of MSIs in investing more institutional resources in instruction is concerning and may imply less improved student outcomes for many underserved students who attend MSIs as pathways for economic mobility (Espinosa et al., 2019; Boland et al., 2019). Second,

constrains in other areas of institutional capacity may limit MSIs responses to PBF funding (Dougherty et al., 2016; Hillman et al., 2024). For instance, instituting performance-oriented practices in colleges and universities requires both the data management infrastructure and institutional research staff and these resources may be limited in historically underfunded MSIs. Thus, limiting the capacity of MSIs to make institutional changes in response to PBF policies.

Contrary to theoretical expectations, non-MSIs do not appear to significantly alter their spending on instruction, student services, and academic support. Instead of increasing their educational and related spending in response to PBF, non-MSIs may exploit other avenues on the revenue side, especially as empirical evidence suggests that non-MSIs are less likely to lose state funding under PBF (Ortagus et al., 2022; Hagood, 2019). For instance, evidence suggests that PBF motivates some public institutions to become more selective (Ra et al., 2023; Birdsall, 2018; Hillman, 2016; Dougherty et al., 2016), enrolling students with higher chances of completing their programs and graduating. Increased institutional selectivity may restrict access for students perceived to be less likely to complete college, in a manner that games the system, to secure state performance dollars. Gaming in performance management contexts makes performance incentives counterproductive (Courty & Marschke, 2004; Heinrich & Marschke, 2010). Such unintended institutional responses may widen existing gaps in educational attainment by class and race and ethnicity (Hillman, 2020).

Contrary to expectations, this study finds that public institutions committed more resources toward administrative expenses three to five years later. Non-MSIs also experienced a delayed increase in outlays for administrative support. Like Kelchen and Stedrak (2016), this study did not find any immediate increase in institutional support spending in the first two years of PBF implementation. The delayed increase in institutional support expenses may be due to the compliance costs associated with collecting, analyzing, and reporting performance data over time (Dougherty & Reddy, 2013). As such, the dynamic increases in institutional support expenses across public four-year institutions may be associated with attempts to enhance institutional capacity to comply with the growing demand to generate and manage performance data to secure performance dollars.

However, compliance costs associated with implementing PBF in some public institutions is perceived to create “administrative nightmare” and implementation barriers (Dougherty & Reddy, 2013). Moreover, extant research does not find a positive relationship between spending on institutional support and student outcomes success (Abouzeida, 2014; Gansmer-Topf and Schuh, 2006; Ryan, 2005; Webber and Ehrenberg, 2010). States policymakers may consider ways to help public institutions keep compliance costs low and invest more in areas with higher likelihood of improving student outcomes, including spending on instruction and academic support.

3.9. Limitations and Future Research

Although this study draws on quasi-experimental methods and is grounded in extant theoretical and empirical insights to provide robust evidence on institutional responses to PBF, some limitations and potential areas of future work should be noted. First, although using per FTE student measures is associated with student outcomes (Deming & Walters, 2018), it is likely that changes in full-time enrollment levels may bias changes in spending patterns, especially in MSIs with high part-time students. Future studies may operationalize institutional spending with alternative measures to estimate PBF effects, such as logged amounts of spending categories, or year-to-year percent change by expenditure type.

While the sensitivity analysis of dosage effects of PBF on spending patterns supports the main findings of this study, PBF dosage was operationalized using binary treatment variables for above and below median dosage. Future studies may examine what level of PBF funding is associated with changes in institutional spending using the continuous variable of PBF funding tied to institutional performance to estimate average causal response for specific spending categories. This understanding may help state policymakers determine the percentage of baseline

funding to tie to institutional performance to incentivize desirable responses from public institutions for improved student outcomes.

Understanding how PBF incentivizes specific expenses within broad spending categories may provide more nuanced insights on institutional responses. For instance, examining how public institutions potentially alter their instructional staff by substituting less expensive adjunct faculty for expensive tenure-stream faculty to contain instructional costs in response to PBF may provide plausible explanation for why funding shifts from input-based to outcome-based funding fails to significantly move the needle on student outcomes (Leslie et al., 2012). This may be particularly salient in MSIs facing funding instability.

The evidence of increased spending on institutional support may indicate that PBF places some administrative burden on institutions, potentially motivating institutions to prioritize resources to meet compliance requirements than to areas with more direct impact on student outcomes. Qualitative studies may help tease out the specific administrative changes institutions make in response to PBF. This understanding may help policymakers design institutional capacity strengthening initiatives for public institutions, to enable colleges and universities to make desirable institutional changes to boost student outcomes.

Lastly, IPEDS finance data has the parent-child reporting issue (Jaquette & Parra, 2016), where some institutions with multi-campus may combine the finance data of their main campus (parent) and branch campuses (child) and report their finance data to IPEDS at the parent level. However, public four-year institutions are less affected by this problem (Kelchen, 2019b). Still, I followed Kelchen's (2019b) recommendation and disaggregated institutions based on their Office of Postsecondary Education ID (OPEID) and excluded less than 1% of the observations affected by the parent-child reporting issue. I analyzed alternative model specifications that

included the observations, and the results were consistent with the main findings. There was no significant impact of the parent-child reporting issue in this study's findings.

3.10. Conclusion

As PBF policies continue to gain traction across states, understanding whether and how structural shifts in state funding to higher education from input-based to outcome-based incentivize responses from public institutions is central to improving student outcomes. This study finds that public universities often prioritize investments in instruction and institutional support over time. While improved instructional spending is desirable, understanding how much should be spent on instruction and other educational and related outlays may help institutions improve student success more equitably (Hillman et al. 2024). It is also important to investigate whether institutions are (re)directing resources toward institutional support because they expect administrative expenses to improve student outcomes, whether it is to meet compliance requirements, or whether to meet competing goals such as institutional prestige associated with high administrative expenses. The evidence may help policymakers make funding decisions to equitably distribute state resources to boost college participation for diverse student groups.

Chapter IV. Financial Pressures and Cutbacks: Do Tuition Freezes Motivate Dynamic Changes in Instructional Faculty Composition in Public Four-Year Institutions?

4.1. Introduction

Making college affordable is a top priority for many states (Harnisch et al., 2024). An increasing number of states are employing tuition price control policies to keep costs of attendance low for resident students in response to concerns about college affordability. Nearly two in three states imposed tuition price controls during the four years between 2017 – 2022 (Colorado et al., 2023). Tuition price controls may be designed as tuition freezes that keep tuition flat from year to year, tuition caps that limit tuition increases, and guaranteed tuition that fix tuition rates for students from enrollment until completion (Colorado et al., 2023; Kelchen & Pingel, 2023; Worsham, 2022; Delaney & Kearney, 2016). However, as tuition price controls have increased in popularity, public higher education institutions experienced a 4.7% decline in average tuition revenue between 2016 – 2021 (Laderman & Kunkle, 2022). Making college affordable for resident students by imposing tuition price restrictions threatens tuition revenue and creates financial uncertainty for higher education institutions, which may impact student success ultimately.

Although studies find that institutions may attempt to alter their enrollment mix to generate revenue from non-resident and graduate students in response to tuition price controls (Miller & Park, 2022; Kelchen & Pingel, 2023; Kim & Ko, 2015; Worsham, 2023), tuition price controls limit institutions' capacity to offset fluctuating state appropriations with declining tuition revenue (Deming & Walters, 2017; Colorado et al., 2023). With limited room to diversify revenue, financial uncertainty creates budget imbalances. Financial uncertainty may motivate organizations to employ austerity measures that involve consuming fewer institutional resources

to contain institutional costs (Levine, 1979; Leslie et al., 2012; Brinkman & Morgan, 1995).

Thus, public institutions operating in state policy contexts with tuition price controls face dire financial pressures and may look inward to contain costs.

Recent empirical evidence reveals that tuition controls motivated decreases in per-student instructional expenditure and benefits for instructional staff in public universities (Miller & Park, 2022). Other evidence shows that public institutions experiencing financial shocks cut back on full-time instructional faculty (Rutherford & van der Voet, 2019), and substitute less expensive contingent faculty for more expensive for tenure-stream faculty (Frye, 2015; Goodman & Volz, 2020). It is likely that public institutions may cut back on instructional costs, a major expenditure category, by altering their instructional faculty composition to manage budget imbalances in the short-term when exposed to tuition price controls.

This study examines whether and how exposure to tuition freezes motivates changes in the composition of instructional faculty in public four-year institutions – changes that may lower instructional costs but potentially impact students outcomes in the long run. Because there may be trade-offs associated with addressing budget imbalances in the short-term and achieving organizational goals (Rutherford & Van Der Voet, 2019; Cameron & Smart, 1998), public institutions subject to tuition restrictions may do nothing or delay changes to instructional faculty composition. The study asks:

- Research Question 1: To what extent do public four-year institutions operating in states with tuition freezes alter their instructional faculty composition over time?
- Research Question 2: Do the effects of tuition freezes on instructional faculty composition vary for doctoral research institutions and non-doctoral institutions?

The study contributes to the literature on tuition price controls by examining institutional responses on the expenditure side to complement studies exploring institutional responses to tuition price controls on the revenue side (Miller & Park, 2022; Kelchen & Pingel, 2023; Kim & Ko, 2015; Worsham, 2023). Evidence on institutional changes on the expenditure side may help states to better understand how institutions alter their budgets when subject to tuition price controls in ways that put college affordability initiatives at odds with the quality of higher education and student success, especially for less-resourced non-doctoral institutions with fewer financial resources than doctoral research institutions (Hillman, 2020; Cheslock & Shamekhi, 2020). The study examines how tuition freezes are associated with shifts in full-time tenured, full-time tenure-track, full-time non-tenure-track, and part-time instructional faculty in doctoral research institutions and non-doctoral institutions.

4.2. Tuition Price Control Policies and Institutional Responses

A central feature of tuition price control policies involves limiting year-to-year changes in tuition rates to boost college affordability. However, the three broad categories of tuition price control policies vary in key design elements and state contexts. For instance, states appear to favor keeping tuition flat for set periods with tuition freezes. Between 2017 – 2022, one in three states implemented a tuition freeze in the four-year sector while one in ten states employed a tuition cap (Colorado et al., 2022). States often cap tuition increases at, above, or below the Consumer Price Index (CPI) (Kelchen & Pingel, 2023). Further, the states of Illinois, Oklahoma, Texas, and North Carolina have provided fixed tuition rates for resident students from the time of enrollment to time of completion via guaranteed tuition programs (Delaney & Kearney, 2016; Worsham, 2023). Policies restricting tuition prices may be set via state legislation as was set by

13 states in 2020 (Pingel & Broom, 2020), or by state higher education governing boards (Kim & Ko, 2015; Colorado et al., 2023).

There are indications that tuition regulations spur strategic behaviors in institutions. Kim and Ko (2015) found that instead of controlling growth in tuition, the introduction of caps increased tuition by 12% in public colleges and universities. The authors contend that tuition controls may trigger moral hazards wherein institutions increase their tuition prices in anticipation of tuition cap announcements. When this happens, the authors argue that tuition caps become counterproductive to the intended purpose of making college affordable to students. Interestingly, the implementation of tuition caps in recent years is becoming much lower than in the early 2000s, indicating that states may have recognized the tendency of this perverse behavior occurring in public institutions. Instead, an increasing number of states now opt for tuition freezes rather than caps in controlling tuition prices (Colorado et al., 2022).

In contrast to Kim and Ko (2015), Miller and Park (2022) reported that tuition freezes and caps caused tuition prices to fall by 6.3 percentage points at four-year institutions, and 9.3 percentage points at two-year institutions. Since tuition controls restrict price increases for in-state students, public institutions may respond strategically by changing the enrollment mix to attract more financially attractive students such as full-pay students from out of state and international students who pay much more than in-state students to boost tuition revenue (Ehrenberg, 2020), potentially restricting access for in-state students. In their analyses of changes in enrollment outcomes in public universities subject to tuition freezes, Kelchen and Pingel (2023) only found modest enrollment gains for underserved, Hispanic students in less selective public universities. While these empirical studies reveal diverse effects of tuition price controls, these studies often cited that the level of dependence on tuition revenue may moderate

institutional responses to tuition price controls. Less selective and non-research institutions that are more reliant on tuition revenue are likely to be more responsive to tuition price controls.

Additionally, Miller and Park (2022) reported that tuition freezes motivated a 3.3 percentage point decrease in instructional spending per-student in four-year institutions, with a 4.5 percentage point reduction in benefits for instructional staff, although the study did not disaggregate effects between public and private four-year institutions. Miller and Park's findings align with evidence from Rutherford and van der Voet (2019) that show that public universities experiencing financial shocks decreased their full-time instructional faculty. However, it is not immediately clear as to whether and how changes in instructional faculty in institutions experiencing financial instability differ for doctoral research institutions and non-doctoral four-year institutions that tend to vary in their faculty composition (American Association of University Professors [AAUP], 2020).

Between 2009 and 2019, nearly half of the faculty in doctoral institutions were tenure-stream, while only around a third of the faculty in master's and bachelor's institutions were tenure-stream (AAUP, 2020). In the same period, about a third of the faculty in doctoral institutions were part-time while more than half of faculty in master's institutions and nearly half of faculty in bachelor's institutions were part-time. Additionally, non-tenure-track faculty was the smallest instructional faculty category across institution types in the four-year sector between 2009 to 2019. This variation in faculty composition across institution types may serve as an indication of differences in institutional capacity between doctoral institutions and non-doctoral institutions. Higher education institutions with different capacities may respond differently to state policy changes (Hillman et al., 2024).

The current study examines changes in full-time and part-time instructional faculty in public doctoral research institutions and non-doctoral four-year institutions when tuition is frozen to contribute evidence on the cost behavior of varying institutions during financial stress. Full-time instructional faculty may be tenured, tenure-track, or non-tenure-track. Unlike other full-time instructors, non-tenure-track instructors and part-time instructors do not enjoy tenure protections and may be susceptible to being cut. The conditions of faculty employment may also constrain who and how university administrators cut back on instructional faculty when responding to financial uncertainty. Following the existing convention (see Woessmann & Bettinger, 2020), tenured faculty and tenure-track faculty are referred to as tenure-stream faculty while non-tenure-track faculty and part-time faculty are described as contingent faculty throughout this chapter.

4.3. Institutional Resources and Instructional Faculty Composition

Amid dwindling state appropriations, public colleges and universities increasingly rely on tuition revenue. Following the Great Recession, tuition revenue comprised about 48% of revenue for public higher education institutions in 2013 (Laderman & Kunkle, 2021). However, tuition regulations are increasingly making tuition revenue unstable in recent times, potentially incentivizing strategic spending cuts to contain costs, even as evidence reveals trends of cutbacks on instructional spending in public higher education institutions in recent decades (Ecton & Dziensinski, 2022).

Spending on instruction, including faculty compensation, constitutes the largest expenditure category in public higher education and is reliant on tuition revenue (Leslie et al., 2012). More than a third of all spending in public colleges and nearly 40% in public universities in the 2021-22 academic year went to instructional expenditure (National Center for Education

Statistics [NCES], 2022). However, instructional spending has been growing at a slower pace than other non-instructional categories since the Great Recession (American Council of Trustees and Alumni [ACTA], 2021), suggesting cost containment on instructional outlays. Since teaching excellence encompasses a primary function of many public institutions, college administrators may employ cutback tactics that allow for continued teaching of students at reduced costs in times of financial uncertainty. However, doing so may impact the quality of teaching that students receive.

Even when course instructions are offered continuously during financial instability, who does the teaching may matter to student outcomes. Based the analyses of productivity in doctoral and masters institutions, Sav (2019) found that tenured faculty were associated with improved graduation rates in doctoral and masters institutions while tenure-track faculty were negatively associated with graduation rates in doctoral institutions and neither improved nor decreased graduation rates in masters institutions. Like tenured faculty, non-tenure-track faculty were positively associated with graduation rates in doctoral institution but were associated with null effects on graduation in masters institutions. One may argue based on this evidence that students would more likely succeed when taught by tenured, and non-tenure-track faculty in doctoral institutions, and by tenured faculty in non-doctoral institutions.

However, because tenured and tenure-track faculty are significantly more expensive than contingent faculty, university administrators responding to unstable revenue might look into substituting the latter for the former to contain instructional costs. According to Monk (2007), contingent faculty cost about 64% less than tenured and tenure-track faculty. Cheslock et al. (2016) add that this pay gap may be even wider if benefits are considered given that contingent faculty typically do not receive the benefits that tenure-stream faculty receive. The potential cost

savings on instructional expenditure associated with hiring contingent faculty may motivate college and university administrators to alter their instructional faculty composition in favor of contingent appointments, especially when contending with financial shocks and operating in state policy contexts with restrictive tuition policies.

Additionally, contingent faculty typically take up most of the teaching workload (Xu & Solanki, 2020) and may provide more flexibility for tenure-stream faculty to focus on other research endeavors that contribute to institutional prestige. In 2018-19, nearly 55% of faculty in master's universities were part-time and 16% were non-tenure-track, while tenured faculty in doctoral research institutions fell from 51% in 2009 to 45% in 2019 (AAUP, 2020). Given that the proportion of contingent faculty is increasingly outpacing tenure-stream faculty, projections are that by 2040 only one in ten faculty in higher education institutions will be tenure-stream (Morson & Schapiro, 2015). From the managerial standpoint, the benefits of substituting contingent faculty for tenure-stream faculty are cost-savings and flexibility, but the burden of learning may shift to students in the long-run. For instance, using contingent faculty to teach complex graduate classes may be challenging, and thesis and dissertation mentoring for graduate students may also suffer when contingent faculty substitute tenure-stream faculty.

While there is a growing concern regarding the impact of contingent faculty on student success, empirical evidence reveals mixed effects. For instance, scholars found that the use of contingent faculty at four-year institutions negatively impacts graduation rates (Ehrenberg & Zhang, 2005; Sav, 2019) and persistence (Bettinger & Long, 2010). Interestingly, Bettinger and Long (2010) reported that contingent faculty positively impacts students' choice of majors. Likewise, Figlio et al. (2015) found that contingent faculty with long-term relationships with Northwestern University tend to be better instructors than comparable tenure-stream faculty.

Given this mixed evidence on the relationship between instructional faculty and student success, exploring how interventions to make college affordable for resident students that limit tuition revenue alter instructional faculty composition in public institutions becomes salient.

4.4. Conceptualizing Cutbacks on Instructional Faculty Composition

In 1995, Brinkman and Morgan predicted a shift in the financial future of higher education institutions away from increasing revenue to controlling expenditure. The authors cautioned that revenue restrictions from government and students would create disruptions in the finances of higher education institutions. Volatile revenue will motivate institutional leaders to employ austerity measures in balancing budget shocks. With the increasing burden of tuition price controls and dwindling state funding in recent times, it appears that public higher education institutions now operate within the precarious financial future that Brinkman and Morgan envisioned, spurring strategic institutional responses and cutbacks (Colorado et al., 2023).

This study draws on conceptual perspectives from Levine's (1978; 1979) organization theory on cutback management to systematically assess whether financial uncertainty associated with tuition freezes induce cutbacks in higher education institutions. As Levine puts it, cutback management involves "managing organizational change toward lower levels of resource consumption and organizational activity" in times of financial stress (1979, p180). The theory posits that organizations facing financial shocks will employ strategic choices to manage budget imbalances. However, managing short-term budget imbalances while managing organizational effectiveness may be challenging for many organizations. For many higher education institutions, instructional faculty responsible for teaching, research, and service constitute vital institutional resources (Cheslock et al., 2016), and instructional spending is a major cost category for colleges and universities (Rutherford & van der Voet, 2019; Demining & Walters, 2017).

Times of financial uncertainty may put instructional spending at risk of cuts for cost-saving. Given that instructional spending is largely reliant on tuition revenue (Cheslock et al., 2016), unstable tuition revenue due to frozen tuition that keep tuition flat may lead higher education institutions to alter instructional faculty composition to contain instructional costs.

According to cutback management theory, organizations facing financial pressures may choose to implement any one or a mix of these broad cutback approaches; 1) across-the-board cuts, 2) targeted cuts, and 3) efficiency-oriented cuts. Across-the-board cuts involve cutting all organizational units, services, and programs equally (Pollitt, 2010). For instance, management can ask all organizational entities to reduce their budgets by a set percentage, with everyone experiencing “equal misery” (Hood & Wright, 1981). Employing across-the-board cuts reduces management discretion and is typically faster to implement but may create disparate effects on services and programs. In contrast, targeted cuts are more discretionary, involving strategic prioritization (Pollitt, 2010; Jimenez, 2014). With targeted cuts, managers prioritize which organizational entities would be cut and may apply cuts to selected entities based on different percentages. Implementing targeted cuts is more involved as managers may have to analyze performance data and link cutback decisions to their organizations’ strategic plans, in what Jimenez (2014) describes as “smart cuts.” Targeted cuts are a more rational approach to cutbacks that leverage performance-oriented practices in responding to budget shocks (Raudla et al., 2017; Jimenez, 2014). However, unstable financial circumstances may leave organizations with incomplete or outdated information to inform rational cuts (Rutherford & Van Der Voet, 2019), in which case organizations may do nothing and wait out the fiscal stress while anticipating a return to fiscal normalcy.

The third approach to cutbacks involves efficiency-oriented cuts, a kind of “doing more with less” organizational response to financial instability (Pollitt, 2010). Efficiency-oriented cuts “would be made in a manner that maintains (or even improves) the quality of services while saving money” (Raudla et al., 2017, p378). Cutback tactics for the purposes of productivity and efficiency often involve personnel changes (Raudla et al., 2017). In practice, organizations may cut back personnel costs to balance their budgets in the short-term using specific cutback instruments such as salary and/or benefit cuts, layoffs, hiring freezes, and substituting less expensive staff for expensive staff. In addition to personnel changes, institutions may also explore cutting supplies and other non-essential resources to contain costs (Levine, 1978; 1979; Raudla et al., 2017). Prior research suggests that higher education institutions may target changes in faculty composition in times of financial uncertainty (Rutherford & van der Voet, 2019); Miller & Park, 2022). However, there is need for more evidence to enhance understanding on whether and how different institution types make changes to their faculty composition when exposed to tuition price controls.

Recent evidence shows that exposure to tuition freezes decreased spending on instruction in four-year colleges and universities, with cuts in instructional spending driven by cuts in fringe benefits for instructional faculty (Miller and Park, 2022). Declining fringe benefits may be indicative of shifts in tenure-stream faculty who tend to receive more benefits than their contingent faculty peers. Likewise, Rutherford and van der Voet (2019) found that four-year colleges and universities operating in turbulent fiscal environments decreased their full-time instructional faculty, but the decline did not appear to persist over time. However, because doctoral research institutions require tenure-stream faculty for other research endeavors, we would expect limited cuts of tenure-stream faculty in public doctoral research institutions than in

non-doctoral institutions with primary mission of providing undergraduate instructions. This leads me to hypothesize that:

H1a: Tenured and tenure-track instructional faculty in public doctoral research institutions and public non-doctoral institutions will decrease following exposure to tuition freezes.

H1b: Public doctoral institutions will be less likely to make expensive cuts of tenured and tenure-track instructional faculty than public non-doctoral institutions in the short-term as public doctoral institutions require tenure-stream faculty for other research purposes.

Further, contingent faculty with no tenure protections may also be at risk of easy cuts when tuition revenue is threatened. Institutions may cut contingent faculty for cost-saving purposes or to rebuild tenure lines in the short-term. Making easy cuts of contingent faculty to rebuild any lost tenure lines for the purposes of improving research productivity may be particularly appealing to doctoral research institutions. However, non-doctoral institutions make short-term cuts of contingent faculty to balance their budgets in times of financial uncertainty.

This leads me to hypothesize that:

H2a: Contingent non-tenure-track and part-time instructional faculty in public doctoral research institutions and public non-doctoral institutions will decrease following exposure to tuition freezes.

H2b: Public doctoral institutions will be more likely to make easy cuts of contingent non-tenure-track and part-time instructional faculty to rebuild tenure lines than public non-doctoral institutions in the short-term.

However, the joint production characteristic of higher education where faculty are typically engaged in teaching, research, and service – endeavors that drive organizational goals

and performance of colleges and universities – may complicate the outright cuts of instructional faculty even in times of financial uncertainty (Cheslock et al., 2016). Instead of outright cuts, financial uncertainty may motivate public institutions to substitute less expensive contingent faculty for more expensive tenure-stream faculty for cost-saving purposes in the long-term (Frye, 2015; Hurlburt & McGarrah, 2016a; AAUP, 2022). Such substitution may allow institutions to shift more teaching load to contingent faculty, to provide flexibility for tenure-stream faculty to focus on their research productivity that may help generate research grants for institutions, especially for doctoral research institutions.

Additionally, while higher education is labor-intensive, advancements in instructional technologies do not provide sufficient substitutes for labor-expensive instructional faculty (Cheslock et al., 2016). Instead, instructional technologies are reliant on inputs from and usage by instructional faculty to serve instructional purposes. For instance, the use of virtual reality (VR) technology for teaching students in a manufacturing course only becomes effective when an instructor customizes content for the VR and then uses the customized VR for teaching, all of which require investment of time and effort by an instructor. Without sufficient technological substitutes for labor-expensive instructional faculty, higher education institutions suffer what scholars term the “cost disease” (Archibald & Feldman, 2011; Bowen, 2013; Cheslock et al., 2016). Thus, colleges and universities subject to tuition freezes may be constrained in altering instructional faculty and may maintain the status quo.

4.5. Data and Methods

4.5.1. Analytic Sample

I constructed a longitudinal dataset comprising institution- and state-level data from multiple sources to examine dynamic shifts in instructional faculty composition in public four-

year institutions subject to tuition freezes. I merged institutional data of public colleges and universities from the Integrated Postsecondary Education Data System (IPEDS) with a dataset on tuition control policies prepared by Kelchen and Pingel (2023) for the period from 2012-13 (when the earliest complete data on instructional staff became available) to 2018-19 (to exclude the confounding effects of COVID-19 on institutional behavior). The study period also aligns with the period when tuition price controls began to peak across states. Using Carnegie Classification, the sample includes 1215 public doctoral research institutions, and 1900 public non-doctoral institutions consisting of masters- and bachelors- granting institutions.

The policy treatment in this study is the implementation of tuition freezes by states in the four-year sector. For each type of public four-year institutions (public doctoral research institutions, and public non-doctoral institutions), I compared treated institutions in states with tuition freezes coded as 1 and peer institutions in states with no tuition freezes coded as 0. Figure 4.1 shows how states implemented tuition freezes in the four-year sector between 2013 – 2019.

4.5.2. Outcome Measures, and Covariates

I analyzed changes in instructional faculty using four annual measures for instructional staff from IPEDS. The measures include counts of full-time tenured instructors (logged), full-time tenure-track instructors (logged), full-time non-tenure-track instructors, and part-time instructors.

I included institution- and state-level control variables associated with faculty employment (Miller & Park, 2022; Frye, 2015). First, institutional revenues are associated with cost behavior in higher education institutions (Cheslock et al., 2016), so I control for tuition and fee revenue per FTE student, state appropriation per FTE student, and federal appropriation per FTE. Second, I control for institutional size using full-time fall enrollment (logged). Third, more

selective institutions may be less motivated to cut back on more expensive instructional faculty than their less selective peers to maintain institutional prestige (Ehrenberg, 2020), and I control for percent of students admitted as proxy for institutional selectivity.⁴ Fourth, to account for gender differences in faculty composition and pay, I control for full-time female instructors, and average weighted monthly salary for full-time female instructors (Choi, 2023; Perna et al., 2000; Perna, 2001).

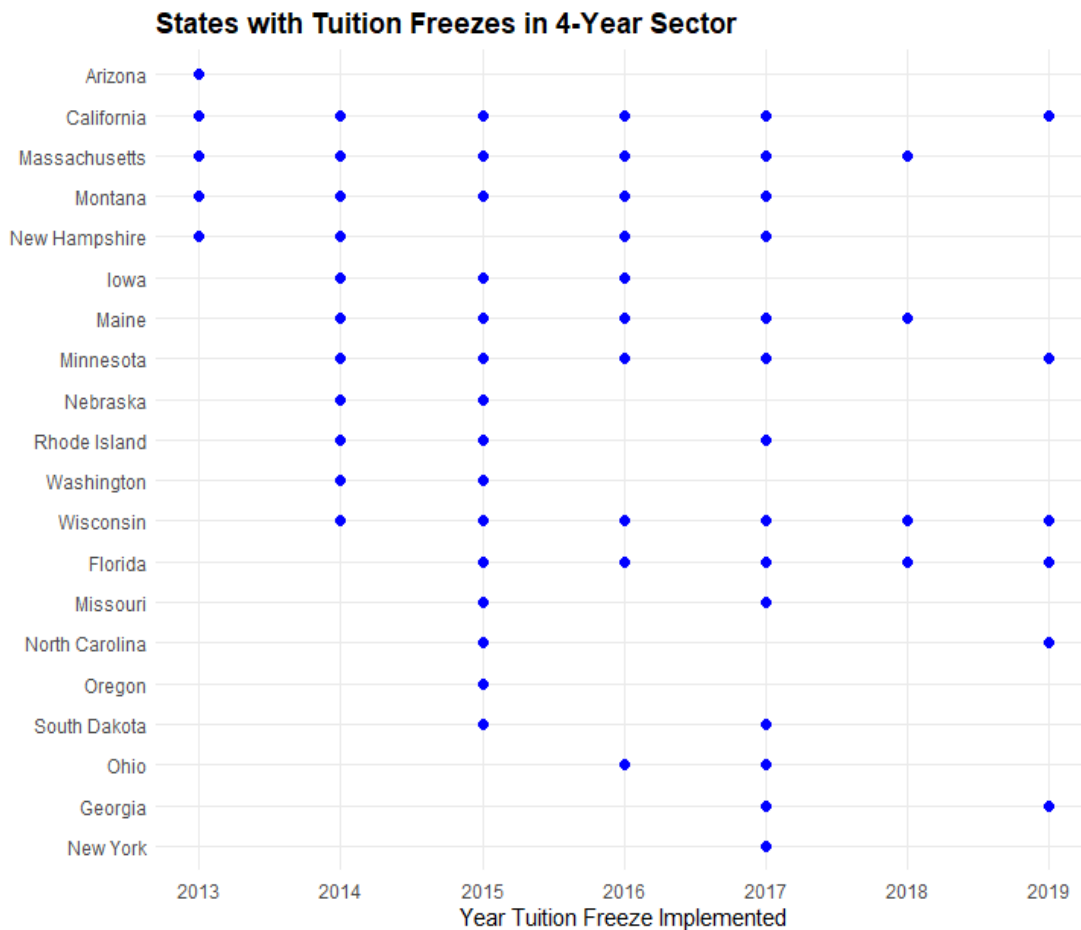


Figure 4.1. Implementation of Tuition Freezes in the Four-Year Sector: 2013 – 2019

⁴ I use the percentage of applicants admitted as proxy for institutional selectivity as commonly used in the higher education finance literature (e.g. Hu et al. 2022; Gandara & Rutherford, 2018; Birdsall, 2018).

At the state level, I control for whether tuition policies are set via state legislation or otherwise using a dataset prepared by Pingel and Broom (2020). I also included state general fund budgets for the four-year sector, and the percentage of state funding budgets tied to performance for the four-year sector as covariates, which may impact the revenues that institutions receive from their state governments and from student and may moderate cutback behaviors in public institutions. Lastly, the rate of state policy innovations in the higher education landscape may also influence strategic institutional responses; thus, I used state higher education policy adoption rates as index for state higher education policy innovativeness from Tandberg et al. (2022). While this index attempts to account for several state higher education policies, it is only a proxy and may only account for some policy changes, not all. All financial variables are Consumer Price Index (CPI) CPI-adjusted to 2020 dollars.

4.5.3 Empirical Strategy

I employed event study analysis to examine the dynamic changes in instructional faculty in public doctoral research institutions and non-doctoral institutions. For the event study analysis, I followed Sun and Abraham's (2021) approach in conducting dynamic difference-in-differences to account for heterogenous treatment effects across multiple time periods and multiple groups. I specify the model as follows:

$$\diamond y_{ist} = \alpha + \sum_{k=-4}^{k=+5} \beta_k TF_{ist+k} + \delta Z_{it} + \gamma_i + \eta_t + \varepsilon_{st}$$

y_{ist} is the logged of each outcome measure (full-time tenured faculty (logged), full-time tenure-track faculty (logged), full-time non-tenure-track faculty (logged), and part-time faculty (logged) for institution i in state s in year t . TF_{ist} is a binary indicator for policy treatment for institution i in state s in year t . The policy treatment in this study is the implementation of tuition freezes by states in the four-year sector, with the binary indicator coded 1 for institutions in states

with tuition freezes and 0 for comparison institutions in states with no tuition freezes. β_k is the coefficient of interest, which indicates the difference in instructional faculty composition between TF and non-TF institutions in each year before and after states subjected public institutions to tuition freezes. I am interested in the post-implementation and lagged effects of TF for each instructional faculty category for up to 5 years. The pre-implementation and leads effects for 4 years before public institutions were subjected to TF provide a falsification test of whether the composition of each category of instructional faculty for TF and non-TF institutions followed similar pre-trends. Near-zero and insignificant point estimates of pre-implementation differences in spending outcomes provide support for the parallel trends assumption, implying that in the absence of TF, the average change in instructional faculty for TF-treated institutions would have been same as the average change in instructional faculty for non-TF institutions. All estimates are relative to the year $(t - 1)$ before institutions were funded based on TF. δz_{it} is a vector that includes institution- and state-level control variables associated with the target outcomes based on prior studies (Frye, 2015; Miller & Park, 2022). γ_i captures institution fixed effects such as mission and location, and η_t captures year fixed effects. The error term, ε_{st} , captures unobserved differences for each state in each year (Wooldridge, 2021).

4.6. Results

4.6.1. Descriptive Statistics

Table 4.1 presents the descriptive differences in full-time and part-time instructional faculty composition in public four-year institutions in states with tuition freezes in the four-year sector and comparison peer institutions in states with no tuition freezes. Average estimates are provided for doctoral research institutions in Columns 1 and 2, and for non-doctoral institutions in Columns 3 and 4. The composition of full-time and part-time instructional faculty vary

between and within institution types. Among doctoral research institutions, institutions subject to tuition freezes had more full-time instructors that were tenured (646.57) and non-tenure-track (393.76) and fewer tenure-track instructors (202.21) than their peers in states without tuition freezes with 571.64 tenured, 374.19 non-tenure-track, and 221.79 tenure-track instructors. Doctoral research institutions experiencing tuition freezes had more part-time instructors (451.48) than peers not subject to tuition freezes (385.53). Full-time and part-time instructional faculty composition among non-doctoral institutions generally followed similar patterns as observed among doctoral research institutions with one exception. Unlike doctoral research institutions, non-doctoral institutions subject to tuition freezes had slightly more tenure-track instructors (76.05) than comparison peers (69.76).

4.6.2. Event Study Results

This study examines whether exposure to tuition freezes changes instructional faculty composition in public four-year institutions and whether changes differ for doctoral research institutions and non-doctoral institutions. Tables 4.2, 4.3, 4.4, and 4.5 present the lagged treatment effects of tuition freezes on full-time tenured, full-time tenure-track, full-time non-tenure-track, and part-time instructional faculty, respectively. Panels A and B in each table provide lagged treatment effects for doctoral research institutions and non-doctoral institutions, respectively. The results show variation of lagged effects of tuition freezes on instructional faculty between and within doctoral research institutions and non-doctoral institutions.

Panels A and B in Table 4.2 show that exposure to tuition freezes did not significantly change the numbers of instructional faculty that were tenured in doctoral research institutions and non-doctoral institutions in the first five years. Expensive tenured instructors were less at risk of cutbacks. In Panel A in Table 4.3, doctoral research institutions subject to tuition freezes

Table 4.1. Descriptive Statistics

	Doctoral Research Institutions		Non-Doctoral Institutions	
	Tuition Freeze	No Tuition Freeze	Tuition Freeze	No Tuition Freeze
	(1)	(2)	(3)	(4)
Tenured Instructors	645.564 (410.011)	571.639 (374.637)	184.925 (128.971)	151.776 (107.503)
Tenure-Track Instructors	202.209 (109.046)	221.787 (169.093)	76.046 (49.611)	69.761 (44.911)
Non-Tenure-Track Instructors	393.761 (394.72)	374.190 (410.927)	62.782 (52.367)	61.751 (53.553)
Part-Time Instructors	451.479 (263.206)	385.534 (293.471)	267.688 (262.922)	209.754 (213.706)
Instructional Expenditure per FTE	14770.36 (7803.876)	14380.5 (6003.961)	9873.196 (3036.351)	11067.2 (4476.698)
Research Expenditure per FTE	8258.074 (8346.269)	6984.16 (6659.828)	821.2531 (6331.631)	1056.337 (6681.002)
Tuition and Fee Revenue per FTE	12193.58 (4412.963)	12431.36 (4608.592)	7059.392 (2252.418)	8191.836 (3159.552)
State Appropriation per FTE	10200.06 (4360.668)	9138.569 (5592.207)	8306.154 (5211.501)	8130.451 (5831.343)
Federal Appropriation per FTE	44.6097 (144.017)	66.551 (215.224)	191.333 (3729.316)	481.959 (6593.245)
Full-Time Fall Enrollment (logged)	10.112 (0.555)	9.9577 (0.564)	8.932 (0.846)	8.701 (0.695)
Percentage of Applicants Admitted	59.494 (19.47)	69.136 (16.153)	70.012 (15.725)	69.229 (18.191)
Full-Time Female Instructors	429.869 (206.733)	412.621 (219.983)	154.257 (102.035)	136.26 (90.91)
Average Weighted Monthly Salary – Full-Time Female Instructors (\$)	9695.766 (1966.55)	8601.948 (1368.557)	7927.538 (1224.023)	7378.326 (1367.061)

Table 4.1. Descriptive Statistics (Continued)

Tuition-Setting Authority Policy	2.139 (0.594)	2.138 (0.539)	2.189 (0.633)	2.217 (0.639)
State Appropriation to the 4-Year Sector (logged)	21.165 (1.316)	20.565 (0.851)	20.995 (1.313)	20.528 (0.970)
Percentage of Performance-Based Funding for the 4-Year Sector	9.307 (21.142)	10.516 (25.496)	2.706 (8.977)	5.744 (18.119)
Unemployment Rate	4.973 (1.454)	4.947 (1.465)	4.736 (1.439)	4.992 (1.461)
State Higher Education Policy Innovativeness	0.041 (0.013)	0.038 (0.011)	0.037 (0.01)	0.0362 (0.011)
N = College – Year	259	956	413	1487
Note. Standard Deviation in parentheses All financial variables are in 2020 CPI-adjusted dollars				

reduced tenure-track instructors by 6.3% ($p < 0.05$) after one year although this shift in tenure-track instructors was not sustained beyond the first year, with indications of institutions attempting to rebuild tenure-track lines three to five years later. In contrast, this study finds no evidence of changes in tenure-track instructors in non-doctoral institutions exposed to tuition freezes in Panel B in Table 4.3, with institutions appearing to maintain status quo.

The results in Table 4.4 show that while exposure to tuition freezes did not significantly change the composition of non-tenure-track instructors in doctoral research institutions in Panel A, there was some delayed decline in non-tenure-track instructors in non-doctoral institutions in Panel B. Non-doctoral institutions reduced non-tenure-track instructors by 15.7% ($p < 0.1$) after four years of exposure to tuition freezes. In contrast, Table 4.5 shows that while doctoral research institutions subject to tuition freezes experienced delayed decline in part-time instructors in Panel

A, non-doctoral institutions did not alter part-time instructors in Panel B. Part-time instructors declined between 12.8% ($p < 0.1$) to 17.7% ($p < 0.05$) in doctoral research institutions four to five years after exposure to tuition freezes, suggesting institutions made some easy cuts around the time of rebuilding initially lost tenure-track lines.

The event study results show that, over time, tuition freezes are associated with slightly more instances of dynamic changes in instructional faculty in doctoral research institutions than in non-doctoral institutions. However, apart from easy cuts in part-time instructors in doctoral research institutions, cuts tend to be short-lived. In addition, tenured instructors appear to be the least at risk of cutbacks in public four-year institutions subject to tuition freezes. The summary of results and hypotheses are in Table C.1 in Appendix C.

4.6.3 Sensitivity Analysis

I conducted several robustness checks to assess the sensitivity of my main results. First, using the event study results, I examined the pre-treatment effects of tuition freezes on instructional faculty to assess whether public institutions in the treatment and comparison groups were similar before exposure to tuition freezes (Furquim et al., 2020; Sun & Abraham, 2021). The event study plots in Figures 4.2, and 4.3 largely show near-zero differences in instructional faculty composition in the pretreatment periods for doctoral research institutions (Figure 4.2), and non-doctoral institutions (Figure 4.3). The near-zero differences in instructional faculty composition in the pretreatment serve as a falsification test, indicating that full-time and part-time faculty instructors were not significantly different between treated and comparison institutions prior to exposure to tuition freezes, satisfying the parallel trends assumption (Furquim et al., 2020). Second, the study explored the heterogeneity in the effects of tuition freezes on instructional faculty composition in public four-year institutions by disaggregating the

Table 4.2. Event Study of Tuition Freezes Effects on Full-time Tenured Instructional Faculty

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: Doctoral Research Institutions</i>					
Tenured Instructional Faculty (logged)	-0.008	0.011	-0.004	-0.015	-0.024
	(0.015)	(0.016)	(0.021)	(0.029)	(0.046)
N (College-Year)	1214	1214	1214	1214	1214
<i>Panel B: Non-Doctoral Institutions</i>					
Tenured Instructional Faculty (logged)	0.004	0.003	0.011	0.002	0.005
	(0.019)	(0.03)	(0.041)	(0.042)	(0.071)
N (College-Year)	1899	1899	1899	1899	1899
Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
Note. Standard errors clustered by state are in parentheses + p<0.1 *p<0.05 ** p<0.01 *** p<0.001					

Table 4.3. Event Study of Tuition Freezes Effects on Full-Time Tenure-Track Instructional Faculty

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: Doctoral Research Institutions</i>					
Tenure-Track Instructional Faculty (logged)	-0.063*	-0.036	0.012	0.010	0.075
	(0.03)	(0.041)	(0.04)	(0.063)	(0.13)
N (College-Year)	1214	1214	1214	1214	1214
<i>Panel B: Non-Doctoral Research Institutions</i>					
Tenure-Track Instructional Faculty (logged)	0.033	0.034	0.012	0.088	0.057
	(0.038)	(0.048)	(0.085)	(0.095)	(0.12)
N (College-Year)	1899	1899	1899	1899	1899
Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
Note. Standard errors clustered by state are in parentheses + p<0.1 *p<0.05 ** p<0.01 *** p<0.001					

Table 4.4. Event Study of Tuition Freezes Effects on Full-Time Non-Tenure-Track Instructional Faculty

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: Doctoral Research Institutions</i>					
Non-Tenure-Track Instructional Faculty (logged)	0.086	0.083	0.120	0.157	0.385
	(0.059)	(0.062)	(0.081)	(0.121)	(0.281)
N (College-Year)	1214	1214	1214	1214	1214
<i>Panel B: Non-Doctoral Research Institutions</i>					
Non-Tenure-Track Instructional Faculty (logged)	-0.051	-0.029	-0.051	-0.157+	-0.171
	(0.045)	(0.035)	(0.066)	(0.081)	(0.107)
N (College-Year)	1899	1899	1899	1899	1899
Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
<p>Note.</p> <p>Standard errors clustered by state are in parentheses</p> <p>+ p<0.1 *p<0.05 ** p<0.01 *** p<0.001</p>					

Table 4.5. Event Study of Tuition Freezes Effects on Part-Time Instructional Faculty

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: Doctoral Research Institutions</i>					
Part-Time Instructional Faculty (logged)	-0.012	-0.037	-0.066	-0.128+	-0.177*
	(0.031)	(0.042)	(0.051)	(0.07)	(0.85)
N (College-Year)	1214	1214	1214	1214	1214
<i>Panel B: Non-Doctoral Research Institutions</i>					
Part-Time Instructional Faculty (logged)	-0.047	0.018	0.095	0.084	0.095
	(0.049)	(0.055)	(0.066)	(0.082)	(0.074)
N (College-Year)	1899	1899	1899	1899	1899
Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
<p>Note.</p> <p>Standard errors clustered by state are in parentheses</p> <p>+ p<0.1 *p<0.05 ** p<0.01 *** p<0.001</p>					

effects for doctoral research institutions and non-doctoral institutions. Further, heterogeneous treatment effects of tuition freezes were estimated by instructional faculty type. The study explored effects for full-time tenured, full-time tenure-track, and full-time non-tenure-track instructors, and part-time instructors.

Third, it is plausible that having more or less tuition revenue might confound how public four-year institutions alter their instructional faculty composition in times of financial uncertainty as cost behavior in higher education is often associated with the revenue that institutions have (Cheslock et al., 2016; Ehrenberg, 2020). To address this potential confounding, this study estimated the effects of tuition freezes on changes in instructional faculty for institutions with above median tuition revenue (Table C.2), and institutions with below median tuition revenue (Table C.3). Panels A, B, C, D present results for doctoral research institutions in Table C.2 and Table C.3 while results for non-doctoral institutions are shown in Panels E, F, G, and H.

The results show that the short-lived decline in tenure-track instructors in doctoral research institutions in the main result is likely driven by cuts in doctoral research institutions earning below \$11,690.45 tuition revenue per FTE student. Meanwhile, the cuts in part-time instructors in doctoral research institutions in the main result is potentially driven by cuts in doctoral research institutions earning above \$11,690.45 tuition revenue per FTE student. However, the short-lived decline in non-tenure-track instructors in non-doctoral institutions in the main result is neither explained by non-doctoral institutions earning above or below the median tuition revenue of \$7541.46 per FTE student. Although the level of tuition revenue available to public institutions might explain dynamic shifts in instructional faculty, readers should take caution when interpreting lagged negative effect of tuition freezes on non-tenure-track instructors in non-doctoral institutions.

Further, while doctoral research institutions with above median tuition revenue per FTE appear to make delayed easy cuts of part-time instructors to build tenure-track lines, doctoral research institutions with below median tuition revenue per FTE do not appear to rebuild initially lost tenure-track lines. In contrast, the results do not suggest differences in shifts in instructional faculty in non-doctoral institutions with above and below median tuition revenue per FTE. Fourth, the instances of exposure to tuition freezes appear to vary by state (as in Figure 4.1). The median length of implementation of tuition freezes within the study period was 2.5 years. As such, I created a restricted sample excluding institutions in states that had implemented tuition freezes for more than 3 years. Using the restricted sample, I examined whether the intensity of exposure to tuition freezes may help to explain dynamic shifts in instructional faculty composition (Table C.4).

The results show that doctoral research institutions subject to tuition freezes for less than three years were likely to experience short-lived cuts in tenure-track instructions (Panel B), and delayed cuts in part-time instructors (Panel D) indicative of easy cuts to rebuild initially lost tenure-track lines. However, non-doctoral institutions subject to tuition freezes appear to have rather mixed cost behavior related to shifts in instructional faculty.

Fifth, given that shifts in instructional faculty might be associated with changes in instructional spending during tuition freezes, I explored the impact of tuition freezes on instructional spending per FTE student in doctoral research and non-doctoral institutions, as a potential mechanism that may explain the dynamic shifts in instructional faculty in public four-year institutions in times of financial uncertainty related to tuition freezes.⁵ While doctoral research institutions cut back on instructional spending two years after experiencing tuition

⁵ Instructional spending includes expenses for providing instruction for academic and non-credit courses such as salaries for instructional faculty.

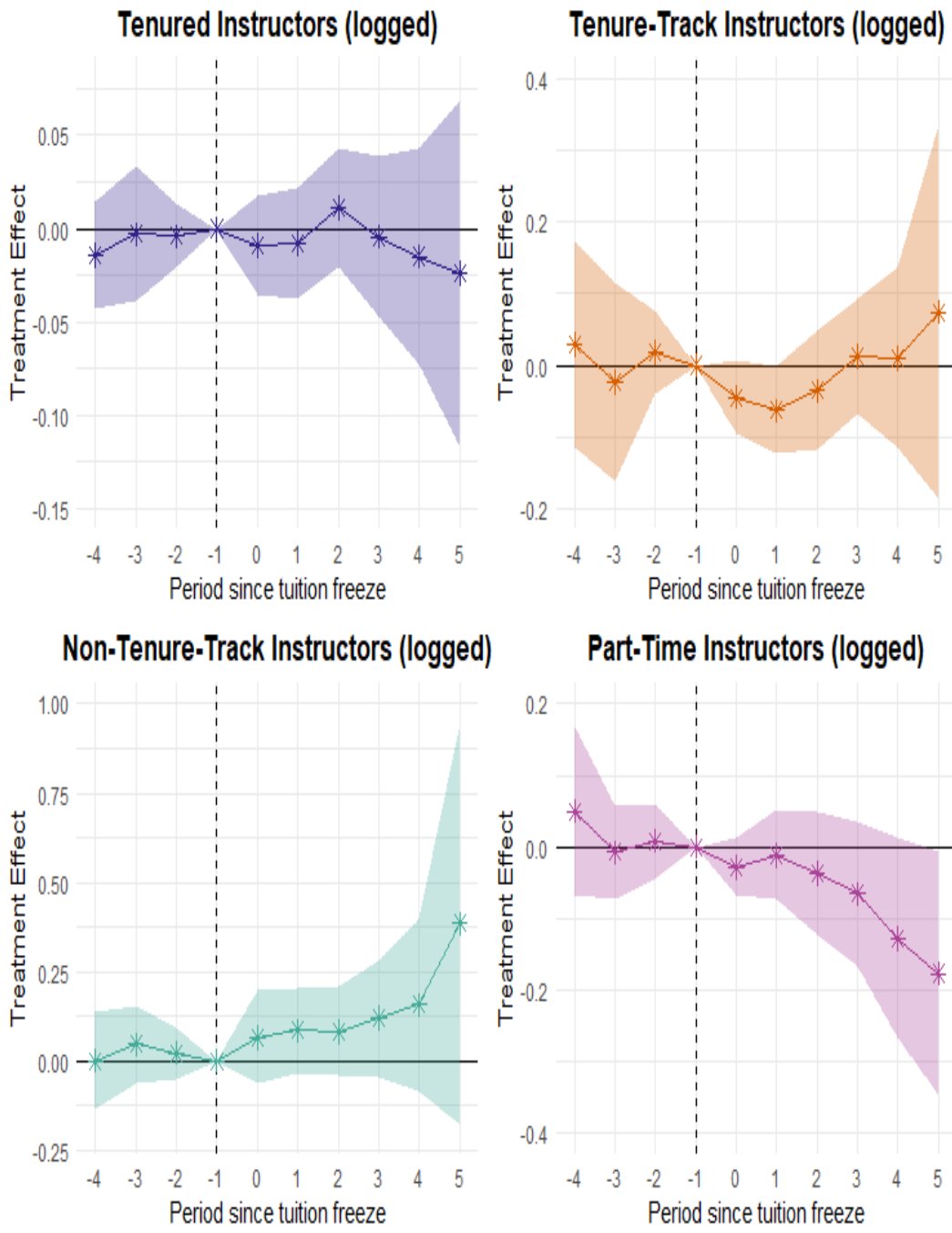


Figure 4.2. Event Study of Tuition Freezes for Doctoral Research Institutions

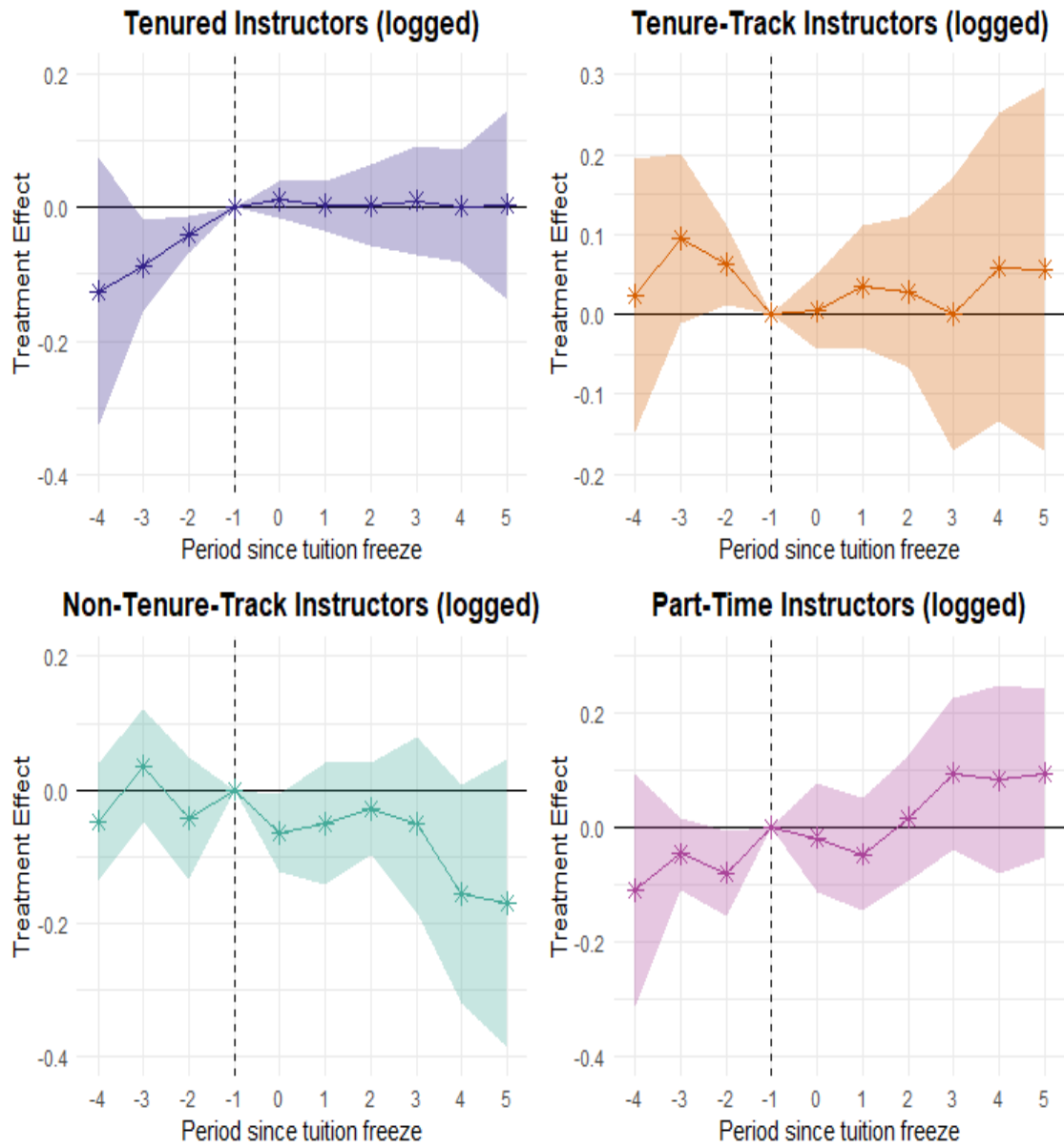


Figure 4.3. Event Study of Tuition Freezes for Non-Doctoral Institutions

freezes (Panel A in Table C.5), non-doctoral institutions did not appear to significantly cut back spending on instruction (Panel B in Table C.5). The initial decline in tenure-track instructors in doctoral research institutions one year following tuition freezes in the main results appear to correspond with the decline in instructional spending in doctoral research institutions two years after subject to tuition freezes (Figure C.1). Furthermore, I conducted the Chow test to show that disaggregating the analyses of the impact of tuition freezes on instructional faculty composition provides improvement in model fit and is suitable for this study (Table C.6).

4.7. Discussion

Restrictive tuition policies that keep tuition flat may be financially beneficial for students but threaten tuition revenue for higher education institutions. When tuition revenue is threatened, institutions may employ austerity measures to contain costs. This study examines how exposure to tuition freezes to make college affordable for students shifts instructional faculty composition in public doctoral research institutions and non-doctoral institutions. According to the cutback management theory, we would expect public institutions experiencing financial uncertainty to employ personnel changes as austerity measures to contain organizational costs. This study finds suggestive evidence of dynamic changes in instructional faculty in public four-year institutions subject to tuition freezes. Effects vary by type of instructional faculty in doctoral research institutions and non-doctoral institutions.

First, public doctoral research institutions and non-doctoral institutions do not appear to significantly cut full-time tenured faculty to manage short-term budget imbalances, which is contrary to my theoretical expectation that financial uncertainty will influence institutions to make expensive cuts. Although tenured faculty tend to be labor-expensive, they are critical inputs for the performance and prestige of higher education institutions, owing to their joint

involvement in teaching, research, and service. Institutional inputs that are essential but expensive may be immune to organizational cuts during financial stress (Rutherford & Van Der Voet, 2019; Levine, 1978), which may explain why we do not see tuition freezes inducing decline in full-time tenured instructors in public four-year institutions. Besides, tenured faculty tend to have tenure protections, putting them less at risk of being subject to budgetary cuts. Tenure protections may limit the ability of higher education administrators to reduce tenured faculty to contain instructional costs in times of financial uncertainty. Administrators considering saving costs on full-time instructors may do nothing to alter already tenured instructors but employ other cutback tactics to alter tenure-track and non-tenure-track instructors.

For instance, this study finds evidence of decline in tenure-track instructors in doctoral research institutions although this decline does not persist beyond one year, with indications of tenure-track line being rebuilt over time, which is consistent with my theoretical expectation on expensive cuts. This finding aligns with Rutherford and Van Der Voet's (2019) study that suggests that four-year institutions make strategic cuts that involve rebuilding initially cut full-time instructors. Additional analysis on instructional spending in doctoral research institutions subject to tuition freezes reveals that the decline in tenure-track instructors corresponds to the period when doctoral research institutions experienced some decline in instructional outlays.

Doctoral research institutions might have implemented short-term hiring freezes to limit the recruitment of new tenure-track faculty to reduce full-time instructor costs, especially as hiring freezes often considered as less controversial cutback tactics than layoffs or salary cuts (Raudla et al., 2017). Short-term hiring freezes for tenure-track faculty may be less likely to impact institutional performance and student outcomes negatively, given that tenure-track faculty do not tend to improve graduation rates in doctoral research institutions (Sav, 2019). Besides,

prior studies in higher education institutions assert that how cutbacks in personnel happen matters more to organizational effectiveness than whether cutbacks in personnel happen (Cameron & Smart, 1998).

Next, this study also finds that non-doctoral institutions' approach to saving costs on full-time instructors appears to target non-tenure-track instructors, which is consistent with my theoretical expectation of easy cuts of contingent faculty. However, the decline in non-tenure-track instructors appears to be delayed. Non-doctoral institutions are reliant on contingent faculty for undergraduate instructions and may limit the extent to which they cut contingent faculty to balance their budgets in times of financial uncertainty. Unlike doctoral research institutions, non-doctoral institutions appear to take more caution in maintaining the status quo and waiting out tuition freezes than in making strategic changes in instructional faculty. Likewise, instructional outlay in non-doctoral institutions appears to remain flat following exposure to tuition freezes (Figure C.1 in Appendix C). It is likely that the non-decision-making in non-doctoral institutions may be related to the challenge of incomplete information that institutions experience during times of financial uncertainty that limit their ability to make institutional changes to cut back on costs (Rutherford & Van Der Voet, 2019).

In addition to cuts on full-time instructors, the study also finds evidence that doctoral research institutions experience some delayed decline in part-time instructors, which is consistent with my theoretical expectation on easy cuts. The decline in part-time instructors may imply that rather than substituting less expensive contingent faculty for more expensive tenure-stream faculty, doctoral research institutions subject to tuition freezes instead opted for easy cuts. The tenuous employment conditions of contingent faculty provide budgetary flexibility for higher education institutions to make easy cuts (Hurlburt & McGarrah, 2016b). The ease of cutting

contingent faculty might explain why this current study consistently finds delayed declines in part-time instructors in doctoral research institutions subject to restrictive tuition price controls. Moreover, the timing of these cuts appears notable. Doctoral research institutions appear to make easy cuts when attempting to rebuild initially lost tenure-track lines. However, less-resourced doctoral research institutions may be constrained in rebuilding declining tenure-track lines.

As public higher education institutions respond to financial uncertainty, dynamic changes in instructional faculty may impact student outcomes. Understanding whether shifts in instructional faculty improve or impede student outcomes in the context of tuition price controls requires further investigation. Likewise, understanding whether maintaining the status quo as observed among non-doctoral institutions better serves their students. Other than making personnel changes in times of financial uncertainty, it is likely that higher education institutions may explore potential cuts in supplies and other non-essential resources to contain costs, which might also limit changes in the composition of instructional faculty.

4.8. Limitations and Future Research

Although this study draws on quasi-experimental methods and is grounded in extant theoretical and empirical insights to provide robust evidence on institutional responses to tuition freezes, some limitations and potential areas of future work should be noted. While the use of logged measures of instructional faculty allows for inferring changes in growth and decline of instructors in public four-year institutions, it is likely that institutions may be altering instructors relative to enrollment size to maintain quality of instruction. Future studies may operationalize instructional faculty with alternative measures such as instructional faculty per FTE student to estimate dynamic changes in institutions subject to tuition freezes.

Tuition freezes are a type of tuition price controls. It is likely that the cutback behavior and shifts in instructional faculty may differ from other tuition price controls like tuition caps given that tuition freezes keep tuition flat while tuition caps allow for limited increase in tuition. Future studies may explore how shifts in instructional faculty in public colleges in response to tuition caps differ from those of tuition freezes. Further, this study focuses on the four-year sector. Given that colleges in the two-year sector provide instruction to a large majority of undergraduate students in America, understanding how two-year colleges alter instructional staff when experiencing tuition price controls would be an important area for future research.

Another limitation is the parent-child reporting issue in IPEDS finance data, where some institutions with multi-campus may combine the finance data of their main campus (parent) and branch campuses (child) and report their finance data to IPEDS at the parent level (Jaquette & Parra, 2016). However, public four-year institutions are less affected by this problem. Still, I followed Kelchen's (2019b) recommendation and disaggregated institutions based on their Office of Postsecondary Education ID (OPEID) and excluded less than 1% of the observations affected by the parent-child reporting issue. I analyzed alternative model specifications that included the observations, and the results were consistent with the main findings in models with the excluded observations. There was no significant impact of the parent-child reporting issue in this study's findings.

4.9. Conclusion

As states continue to employ strategies to make college affordable such as tuition price controls that create financial instability for colleges, understanding whether and how higher education institutions employ austerity measures as well as diversify revenue streams to navigate challenging financial times is central to student success. This study finds that public four-year

institutions make dynamic changes to instructional faculty in manners that may or may not diminish organizational performance and student success. It is important to investigate how the dynamic changes in instructional faculty are associated with student outcomes such as retention rate, time-to-completion, and graduation rates. The evidence may help policymakers decide whether and when to impose tuition price controls to boost college affordability while ensuring student success.

Chapter V. Discussion and Conclusion

The purpose of this dissertation was to examine the heterogeneous effects of state finance policies on critical educational inputs in a diverse and stratified higher education context to contribute evidence on an equity audit in higher education. Specifically, I analyzed the enrollment effects of a universal free college program – Tennessee Promise – for traditional and minority students in Tennessee, the effects of performance-based funding on educational and related spending in minority-serving institutions and non-minority-serving institutions, and the effect of tuition freezes on the composition of instructional faculty in doctoral research institutions and non-doctoral institutions. This three-essay study finds that while state finance policies aim to expand educational opportunities for economic growth, without accounting for and mitigating entrenched disparities in higher education, state finance policies may do little to improve educational attainment more equitably. The study provides robust evidence that may help states in reviewing current finance approaches toward employing equity-enhancing strategies to address disparities and enhance educational opportunities more equitably.

5.1. Study Summary

In my analysis of a statewide universal free college program in Tennessee, I found that free tuition scholarships that do not account for differences in financial needs for traditional college students and economically and racially minoritized students may not advance equitable access to college for all student groups. Universal free college programs may not eliminate access barriers completely for students from non-privileged backgrounds with the most financial needs. Moreover, while minoritized students typically grapple with covering tuition and non-tuition related costs for college (Perna & Smith 2020), financial subsidies for college designed as tuition-only subsidies may be lacking for students from low-income backgrounds and students of

color. Instead, financial subsidies for college that help students to cover the costs of books, accommodation, and transportation may provide more incentives for minoritized students to enroll and succeed in college. I also contend that because access to Tennessee's free tuition scholarships requires completion of FAFSA, the paperwork involved in completing FAFSA may discourage minoritized students from applying for the free tuition scholarships given their lower rates of FAFSA completion (Bahr et al., 2018; Kantrowitz, 2015; Kofoed, 2017; Castleman & Page, 2015). Further, only about a third of the students who overcome the initial application hurdle satisfy other application requirements and eventually receive the Tennessee's free tuition scholarships (THEC, 2023), indicating a low uptake of the universal financial subsidies for college. When states design free college programs but students who need such financial assistance for college are unable to access available public subsidies, it limits the extent to which state finance policies advance equitable access to college.

Next, in my analysis of how performance-based funding incentivizes public four-year institutions to alter their educational and related spending, I found that minority-serving institutions that are funded based on their performance do not improve their spending on instruction, academic support, and student services over time even though spending in these areas are salient to boosting student success (Pike & Robbins, 2019; Gansemer-Topf et al., 2018; Webber & Ehrenberg, 2010). I argue that given that minority-serving institutions are historically underfunded to begin with, these institutions may not have sufficient financial resources to increase their educational and related spending. Limited financial resources may constrain their capacity to respond to performance-based funding in desirable ways. Given that many economically and racially minoritized students attend minority-serving institutions, the lack of improvement in spending on instruction, academic support, and student services may not

improve college completion outcomes for minoritized students. Besides, when minority-serving institutions perform below state expectations, it increases the vulnerability of minority-serving institutions to losing more state funding. Indeed, prior research finds evidence that performance-based funding creates financial disadvantages for minority-serving institutions (Hillman & Corral, 2018; Ortagus et al., 2022). Consequently, when states expect all institutions, including minority-serving institutions, to improve their performance without addressing entrenched disparities in funding and institutional resources, funding based on performance may widen existing inequities in educational attainment.

The final state finance policy I analyzed was tuition freezes. I found that subjecting non-doctoral institutions to tuition freezes resulted in limited changes in the composition of instructional faculty public four-year institutions. Like minority-serving institutions, non-doctoral institutions serve many disadvantaged student groups as well as face the problem of underfunding (Hillman, 2020). While exposure to tuition freezes did not appear to influence significant changes in the composition of instructional faculty in non-doctoral institutions for cost containment purposes, it is unclear as to whether maintaining the status quo of tenure-stream and contingent faculty during times of financial uncertainty helps non-doctoral institutions to improve student outcomes. Further, the limited response of non-doctoral institutions to tuition freezes may be an indication of constrained institutional capacity. Institutions with limited capacity may not enhance student outcomes adequately and equitably (Hillman, 2024; Flores, 2022).

Collectively, the three essays provide evidence-based implications for equity in higher education. State finance policies that do not necessarily improve college access and success for minority students may be equity-blocking as in the cases of Tennessee Promise Scholarships, and

performance-based funding at MSIs (Flores, 2022). Meanwhile, state finance policies that neither help nor hurt equity in higher education may be equity-neutral as in the case of limited cuts in instructors in public non-doctoral institutions. However, the goal for states seeking to expand educational opportunities is to move beyond equity-neutral finance policies to equity-enhancing policies in higher education to address inequities in educational opportunities for diverse student groups across different higher education institutions.

5.2 Limitations

Although employing quasi-experimental methods in this study provides robust causal evidence, some important limitations are worth noting. First, the generalizability of the findings may be limited. There are significant variations in the design elements of free college scholarships across states. As such, the state-specific analysis of Tennessee's free college scholarships may not be generalizable to all states. For instance, states often have varying eligibility requirements for scholarships, and the types of colleges students must attend to receive the scholarships. Understanding the impact of other universal free college programs in other states may help in synthesizing who benefits from such programs in different state policy contexts. Another concern with generalizability is that analyzing the effects of PBF and tuition freezes on educational resources in public institutions at the national level may be limited in providing state-specific insights. Because of the dynamic implementation of PBF, and tuition freezes within and between states, state-specific analyses would complement findings from this current study to advance understanding on how state finance policies improve or impede educational inputs in public institutions within states.

Second, the study focuses on short-term policy effects, between one to five years following policy treatment, and in the pre-COVID era. It is likely that the implementation of

each of the three state finance policies in this study might lead to other long-term changes in educational inputs beyond the first five years (Furquim et al., 2019), especially in the post-COVID era as higher education institutions received additional funding from states during COVID-19 as part of the federal government's Higher Education Emergency Relief Fund (Kunkle & Laderman, 2023), which might influence changes in educational inputs in higher education institutions. Future research on the long-term policy effects of free college programs, performance-based funding, and tuition freezes on educational inputs in public institutions may complement this study's findings on short-term policy effects to advance our understanding of how sustained structural shifts in state finance policies may help or hinder educational opportunities in public higher education.

Further, relying on quantitative analyses limits in-depth understanding of how students navigate the requirements of free college programs, and how college administrators make decisions regarding institutional spending, and instructional faculty composition. For instance, some institutions manage their finances using Responsibility Centered Management approaches that decentralize spending decisions to institutional units (Cheslock et al., 2016). Institution-specific financial management approaches may be moderating how institutions alter their spending priorities, and educational resources. Conducting qualitative studies to gain insights on how the state finance policies under review in this study influence college choice processes of students and administrative decisions of college administrators and staff may provide additional information to understand the impacts of state finance policies on changes in critical educational inputs – student enrollment, institutional spending, and instructional faculty composition – in public higher education institutions more holistically.

5.3. Implications and Conclusion

The findings of this study have several implications for policy and research. State finance policies have the potential to address inequities in higher education when designed and implemented with equity not just effectiveness in mind. This study concludes by outlining recommendations for policy and research.

- *Account for the differences in need across student groups.* The pool of financial resources available to support students through college varies by class and race and ethnicity. Students from low-income families and students of color have access to fewer financial resources for college than do students from more privileged backgrounds (U.S. Department of Education, 2016; Perna, 2006). The limited financial resources available to students from disadvantaged backgrounds may not be adequate to cover all their tuition-related costs and non-tuition-related costs. States offering free college scholarships may consider ways to expand financial subsidies to cover both tuition-related and non-tuition-related expenses, especially for students from low-income families and students of color. Researchers can also assess how effective providing financial subsidies to tuition and non-tuition -related costs improves college enrollment and completion for low-income students and students of color. Evidence on how such subsidies enhance equitable educational opportunities in higher education may help other states design similar programs.
- *Improve program uptake of free college programs by minimizing administrative burden.* The findings from Tennessee Promise suggest a low uptake of free college scholarships, especially for students who need financial assistance (THEC, 2023). Because the application process for the Tennessee Promise scholarships involves FAFSA completion,

periodic meetings with assigned mentors, and completing specified hours of community service, it is likely that fulfilling these requirements might be burdensome and discouraging for some students. Researchers can conduct interviews with successful and unsuccessful scholarship applicants to identify whether and how applicants experience administrative burdens when applying for free college scholarships. Program designers and policymakers may leverage such evidence to map out strategies to minimize administrative burden for students.

- *Account for unequal financial resources across institution types.* Exposing all types of institutions to “one size fits all” state finance policies without considering the differences in financial resources may limit the potential of under-resourced institutions from making desirable responses to improve student outcomes. To enhance the capacity of under-resourced institutions to implement desirable responses to state finance policies, states may provide capacity grants to under-resourced institutions that educate many students from economically and racially minoritized backgrounds (Hillman et al., 2024). The capacity grants could help equalize educational resources for institutions and mitigate inequities in higher education outcomes. State finance policies may also be designed and implemented in ways that minimize financial uncertainty for institutions. Researchers can evaluate whether capacity grants help under-resourced institutions improve student outcomes.
- *Provide information on how to improve student outcomes instead of only requiring all institutions to improve student outcomes.* In addition to providing capacity grants to institutions, states may collaborate with researchers to generate and communicate evidence-based strategies that may help institutions improve student outcomes. Such

strategies could include institutional spending models that will boost student retention, course completion, and graduation.

Appendices

Appendix A. Chapter II Tables and Figures

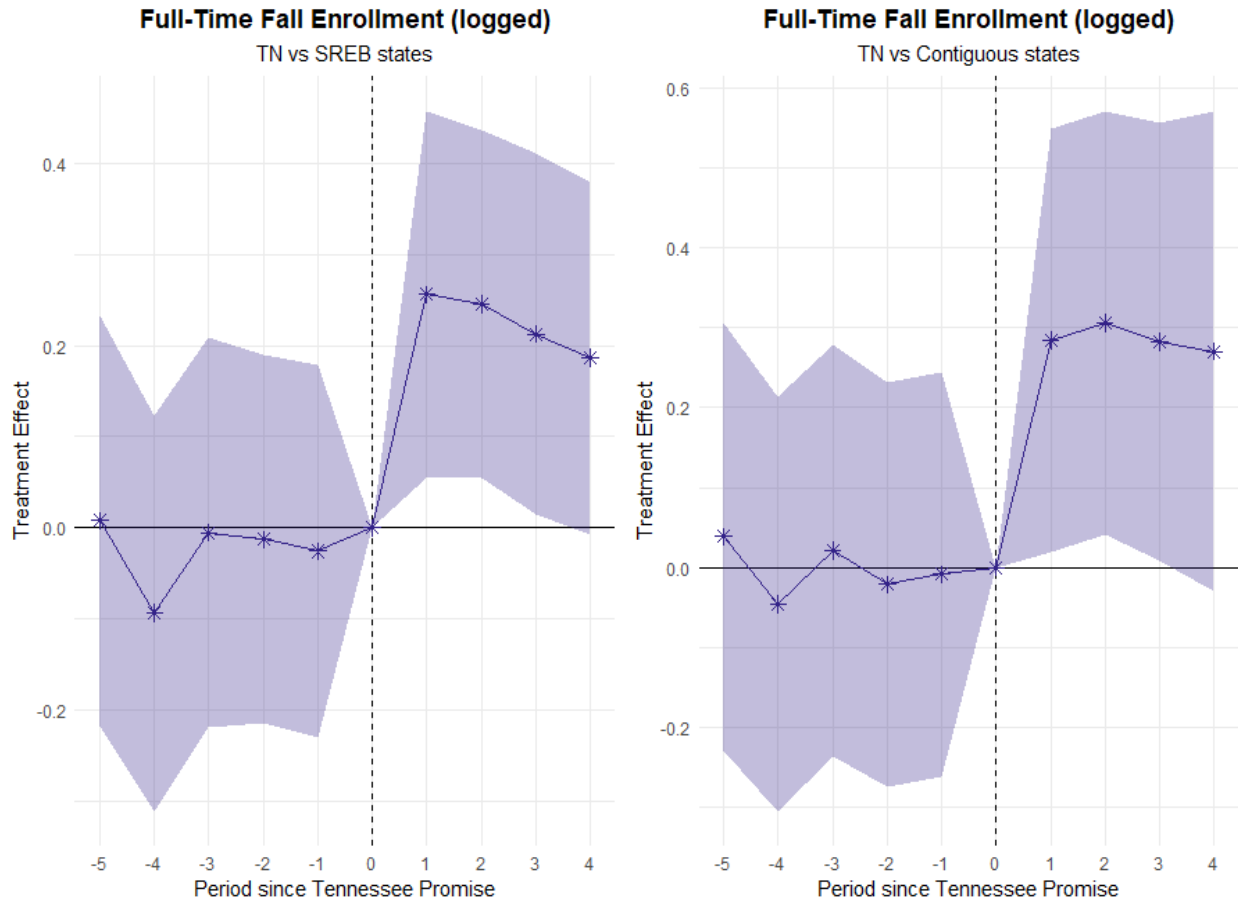


Figure A.1. Event Study Plots for Full-Time Fall Students (log)

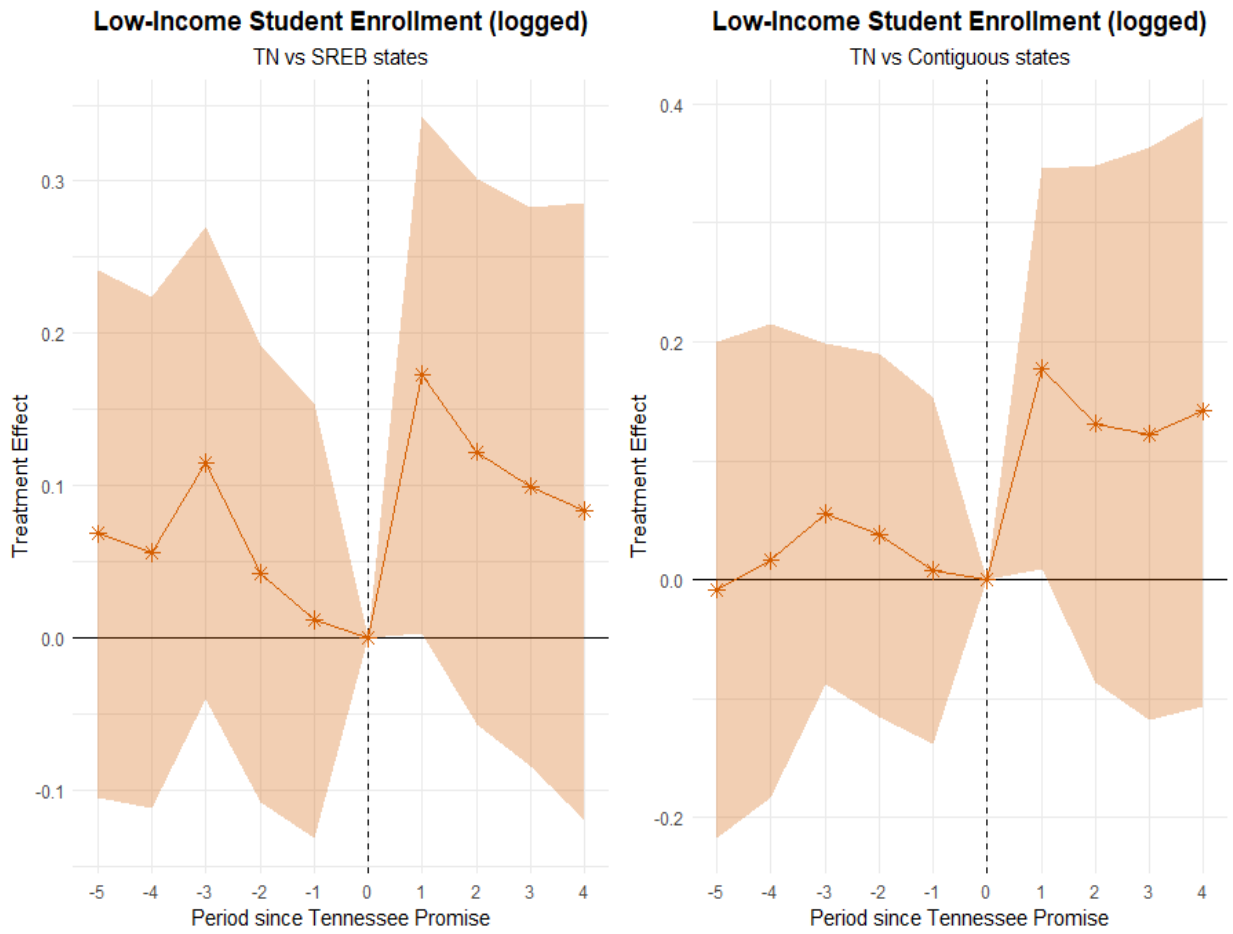


Figure A.2. Event Study Plots for Low-Income Students (log)

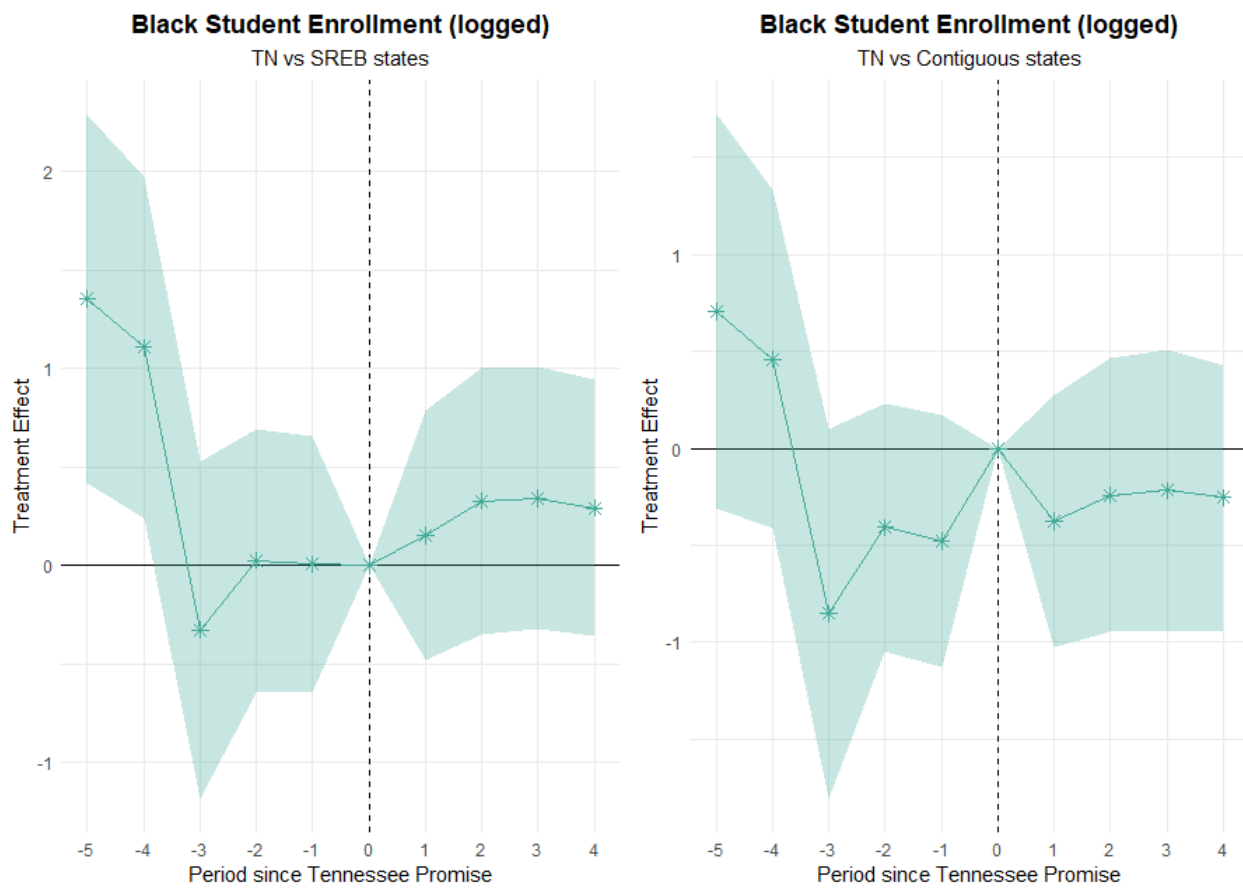


Figure A.3. Event Study Plots for Black Students (log)

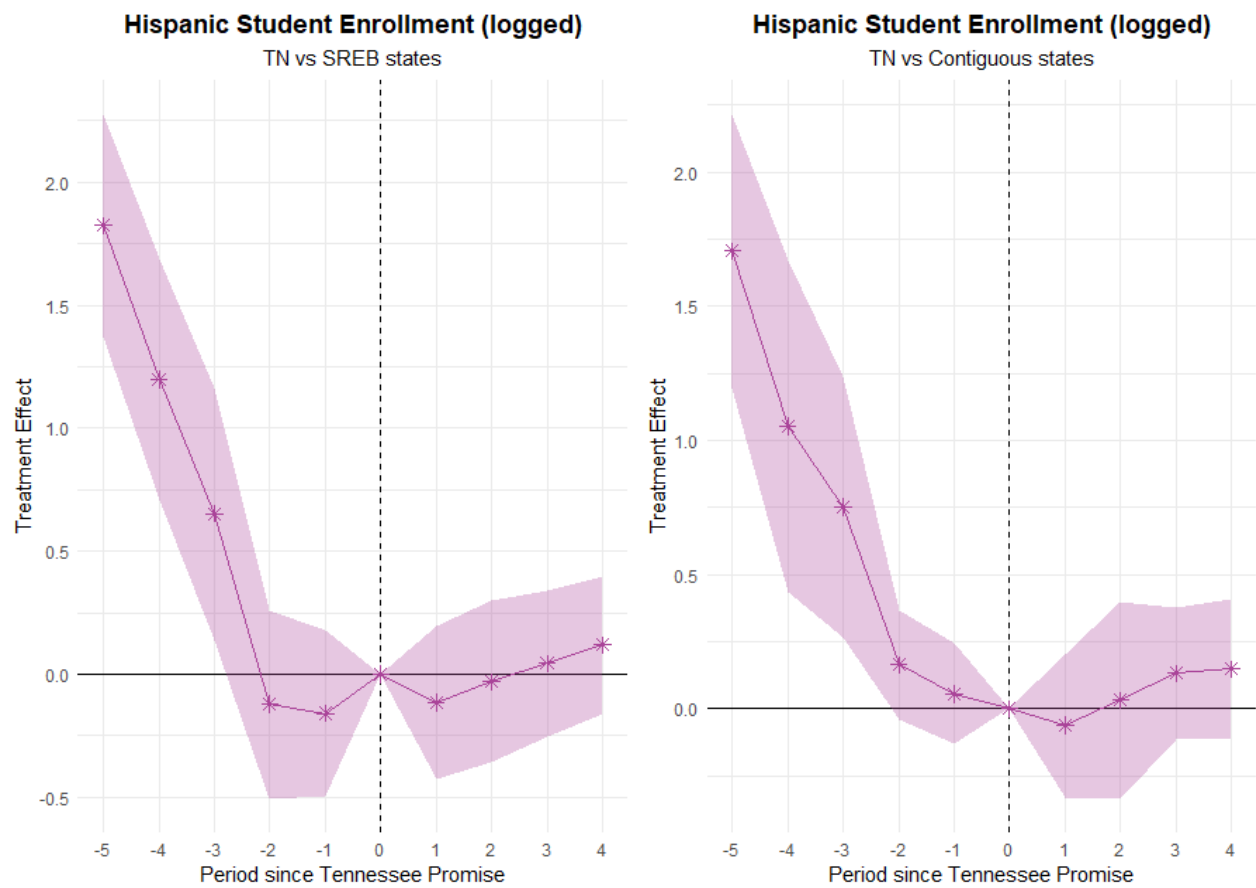


Figure A.4. Event Study Plots for Hispanic Students (log)

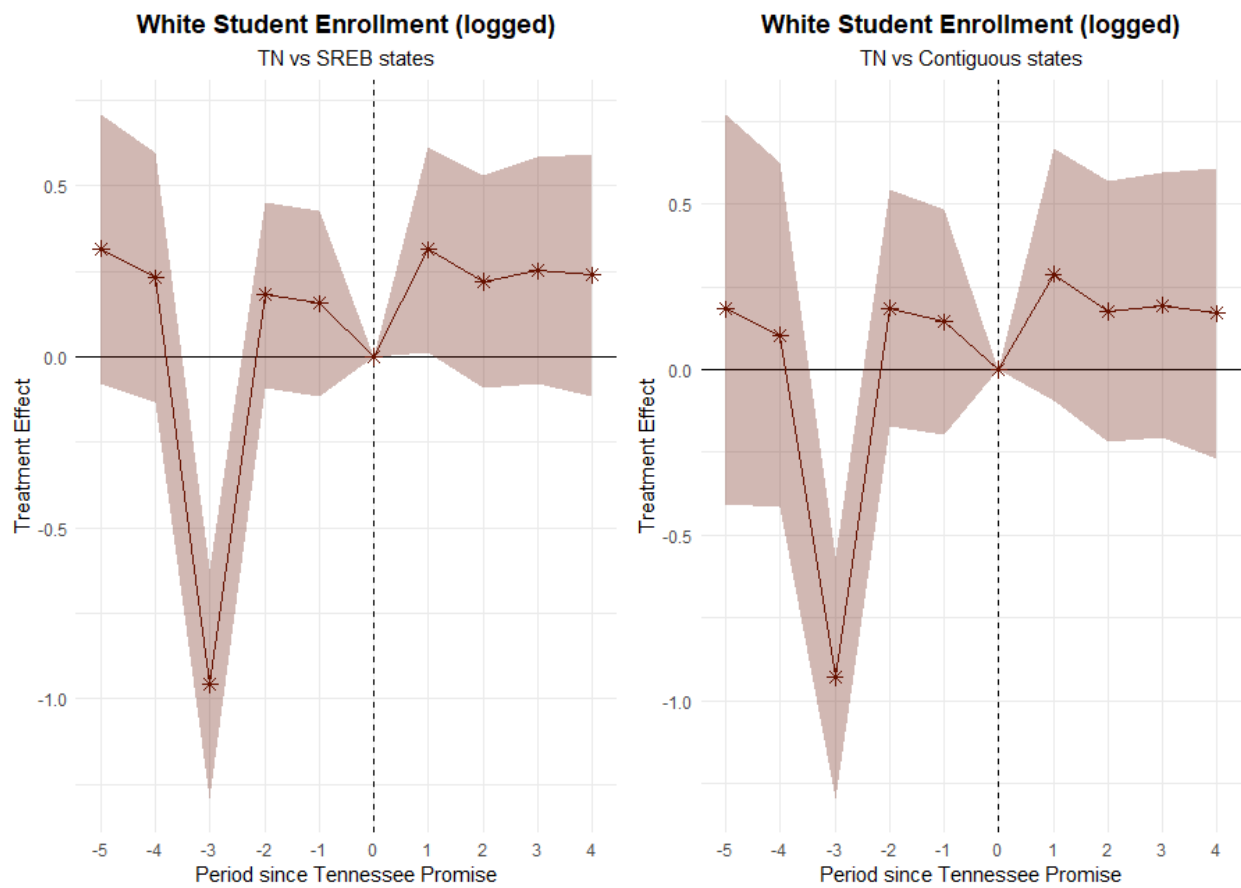


Figure A.5. Event Study for White Students (log)

Table A.1. Summary of Hypotheses and Results

Hypothesis	Outcome of Interest	Hypothesized relationship between state finance policy and outcome of interest	Results	Table # (Panel #)
<i>H1a: Statewide tuition-free scholarships for students in Tennessee will increase full-time student enrollment in community colleges.</i>	Full-time fall enrollment (logged)	Positive	Supported	2.3 (A)
<i>H1b: Statewide tuition-free scholarships for students in Tennessee will increase low-income student enrollment in community colleges.</i>	Low-income students (logged)	Positive	Partially supported	2.3 (B)
<i>H1c: Statewide tuition-free scholarships for students in Tennessee will increase Black and Hispanic student enrollment in community colleges.</i>	Black students (logged)	Positive	Not supported	2.3 (C)
	Hispanic students (logged)	Positive	Not supported	2.3 (D)
<i>H2a: Performance incentives for community colleges in Tennessee will increase full-time student enrollment in community colleges in Tennessee.</i>	Full-time fall enrollment (logged)	Positive	Supported	2.3 (A)
<i>H2b: Performance incentives for community colleges in Tennessee will increase enrollment of White students in community colleges in Tennessee.</i>	White students (logged)	Positive	Supported	2.3 (E)
<i>H2c: Equity bonuses for community colleges in Tennessee will increase enrollment of low-income students in community colleges.</i>	Low-income students (logged)	Positive	Partially supported	2.3 (B)
<i>H2d: Equity bonuses for community colleges in Tennessee will increase enrollment of Black and Hispanic students in community colleges.</i>	Black students (logged)	Positive	Not supported	2.3 (C)
	Hispanic students (logged)	Positive	Not supported	2.3 (D)

Table A.2. Difference-in-Differences: 1-Year Lag Enrollment Effects of Tennessee Promise in the Context of Performance-Based Funding

	1-Year Lag SREB States	1-Year Lag Contiguous States	SREB States, 2013 - 2019	Contiguous States, 2013 - 2019	SREB and Contiguous States (No PBF)	1-Year Lag SREB and Contiguous States (No PBF)
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Full-Time, Fall Students Enrollment (logged)						
	0.210***	0.188***			0.252***	0.154***
	(0.036)	(0.039)	0.327***	0.33***	(0.029)	(0.035)
N (College-Year)	2823	1915	1959	1341	1309	1309
R2 Adj.	0.956	0.960	0.963	0.973	0.961	0.959
Cohen's d	1.16 (large)	1.12 (large)	1.95 (large)	2.35 (large)	1.62 (large)	0.967 (large)
Panel B: Low-income (Pell Undergraduate) Students Enrollment (logged)						
	0.114**	0.121***			0.101	0.114**
	(0.028)	(0.021)	0.109*	0.11	(0.050)	(0.033)
N (College-Year)	2823	1915	1959	1341	1309	1309
R2 Adj.	0.942	0.951	0.957	0.964	0.949	0.948
Cohen's d	0.539 (medium)	0.671 (medium)	0.606 (medium)	0.709 (medium)	0.575 (medium)	0.645 (medium)
Panel C: Black Students Enrollment (logged)						
	-0.152	-0.243			-0.206	-0.209
	(0.113)	(0.137)	0.133	-0.089	(0.490)	(0.279)
N (College-Year)	2791	1898	1959	1341	1286	1286
R2 Adj.	0.413	0.405	0.875	0.912	0.379	0.379
Cohen's d	-0.112 (very small)	-0.181 (very small)	0.258 (small)	-0.201 (small)	-0.139 (small)	-0.141 (very small)

Table A.2. Difference-in-Differences: 1-Year Lag Enrollment Effects of Tennessee Promise in the Context of Performance-Based Funding (Continued)

Panel D:						
Hispanic						
Students	-0.448***	-0.460**			-0.449***	-0.381***
Enrollment			-0.116	0.082		
(logged)	(0.096)	(0.099)	(0.126)	(0.039)	(0.124)	(0.080)
N (College-Year)	2749	1866	1950	1339	1252	1252
R2 Adj.	0.604	0.412	0.949	0.942	0.440	0.438
Cohen's d	-0.371	-0.412	-0.292	0.258	-0.343	-0.291
	(small)	(small)	(small)	(small)	(small)	(small)
Panel E: White						
Students						
Enrollment	0.260***	0.258***			0.30*	0.259**
(logged)			0.157	0.134**		
	(0.053)	(0.052)	(0.086)	(0.042)	(0.149)	(0.119)
N (College-Year)	2813	1912	1959	1341	1299	1299
R2 Adj.	0.376	0.398	0.954	0.983	0.364	0.363
Cohen's d	0.228	0.238	0.79	1.11	0.229	0.198
	(small)	(small)	(medium)	(large)	(small)	(small)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X	X
FE: year	X	X	X	X	X	X
Note. PBF = Performance-Based Funding. Standard errors clustered by state are in parentheses. *** p<0.001 ** p<0.01 *p<0.05						

Table A.3. Difference-in-Differences: Enrollment Effects of Tennessee Promise in the Context of Performance-Based Funding on Student Composition by Race/Ethnicity

	SREB States	Contiguous States	1-Year Lag SREB States	1-Year Lag Contiguous States	SREB and Contiguous States (No PBF)	1-Year Lag SREB and Contiguous States (No PBF)
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Black Students Enrollment (percent)	-0.284	-2.74	-1.02	-2.74	-3.73	-2.31
	(2.43)	(2.54)	(1.42)	(1.57)	(6.05)	(3.11)
N (College-Year)	2823	1915	2823	1915	1309	1309
R2 Adj.	0.398	0.384	0.398	0.383	0.392	0.392
Cohen's d	-0.019 (very small)	-0.174 (very small)	-0.068 (very small)	-0.174 (very small)	-0.217 (small)	-0.134 (very small)
Panel B: Hispanic Students Enrollment (percent)	-9.69***	-8.29***	-6.81***	-6.39***	-9.20***	-6.81***
	(2.02)	(0.882)	(1.24)	(0.725)	(0.896)	(0.911)
N (College-Year)	2823	1915	2823	1915	1309	1309
R2 Adj.	0.558	0.393	0.554	0.364	0.430	0.416
Cohen's d	-0.946 (large)	-1.85 (large)	-0.661 (medium)	-1.39 (large)	-1.17 (large)	-0.852 (large)
Panel C: White Students Enrollment (percent)	10.9***	11.6***	8.53***	9.32***	13.1*	9.79**
	(2.29)	(2.39)	(0.969)	(1.31)	(5.40)	(2.79)
N (College-Year)	2823	1915	2823	1915	1309	1309

Table A.3. Difference-in-Differences: Enrollment Effects of Tennessee Promise in the Context of Performance-Based Funding on Student Composition by Race/Ethnicity (Continued)

R2 Adj.	0.398	0.374	0.396	0.369	0.379	0.373
Cohen's d	0.632 (medium)	0.702 (medium)	0.495 (small)	0.564 (medium)	0.714 (medium)	0.529 (medium)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X	X
FE: year	X	X	X	X	X	X
<p>Note. PBF = Performance-Based Funding. Standard errors clustered by state are in parentheses. *** p<0.001 ** p<0.01 *p<0.05</p>						

Appendix B. Chapter III Tables and Figures

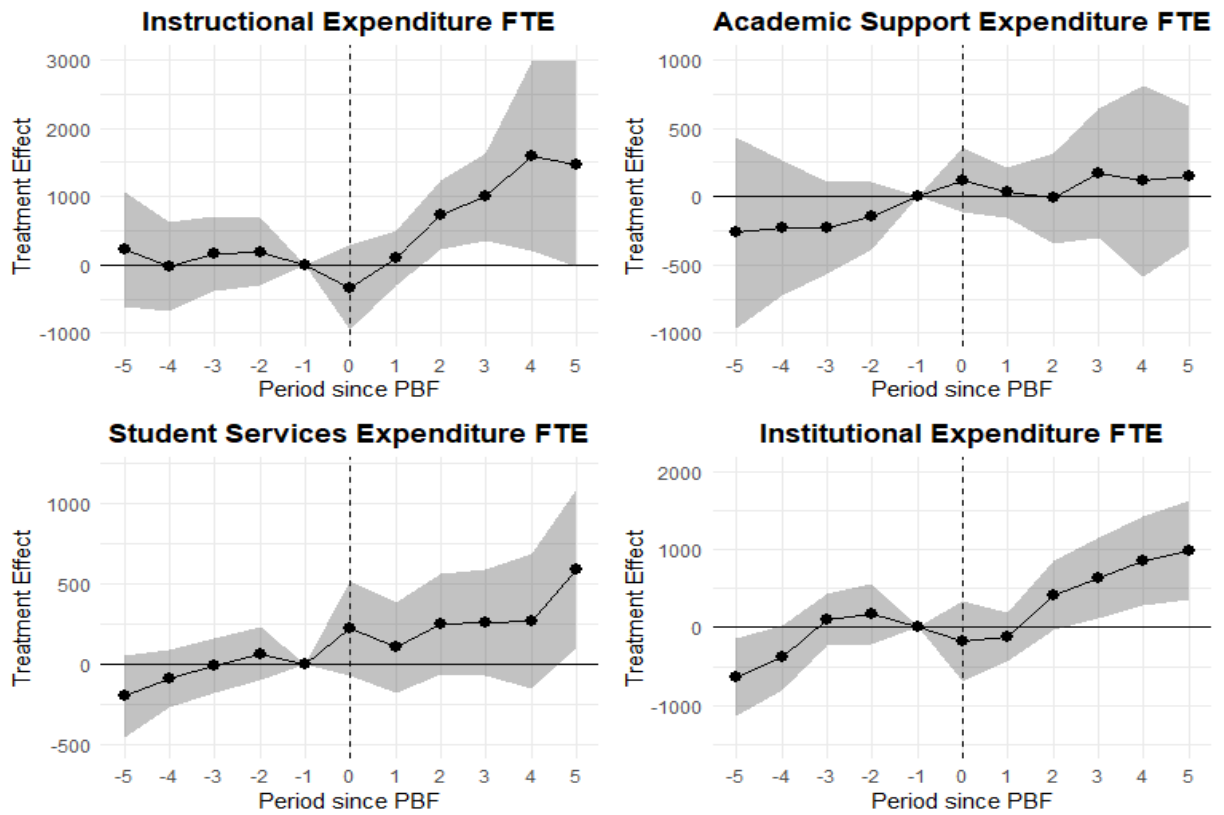


Figure B.1. Event Study: Above Median PBF Dosage for the Full Sample

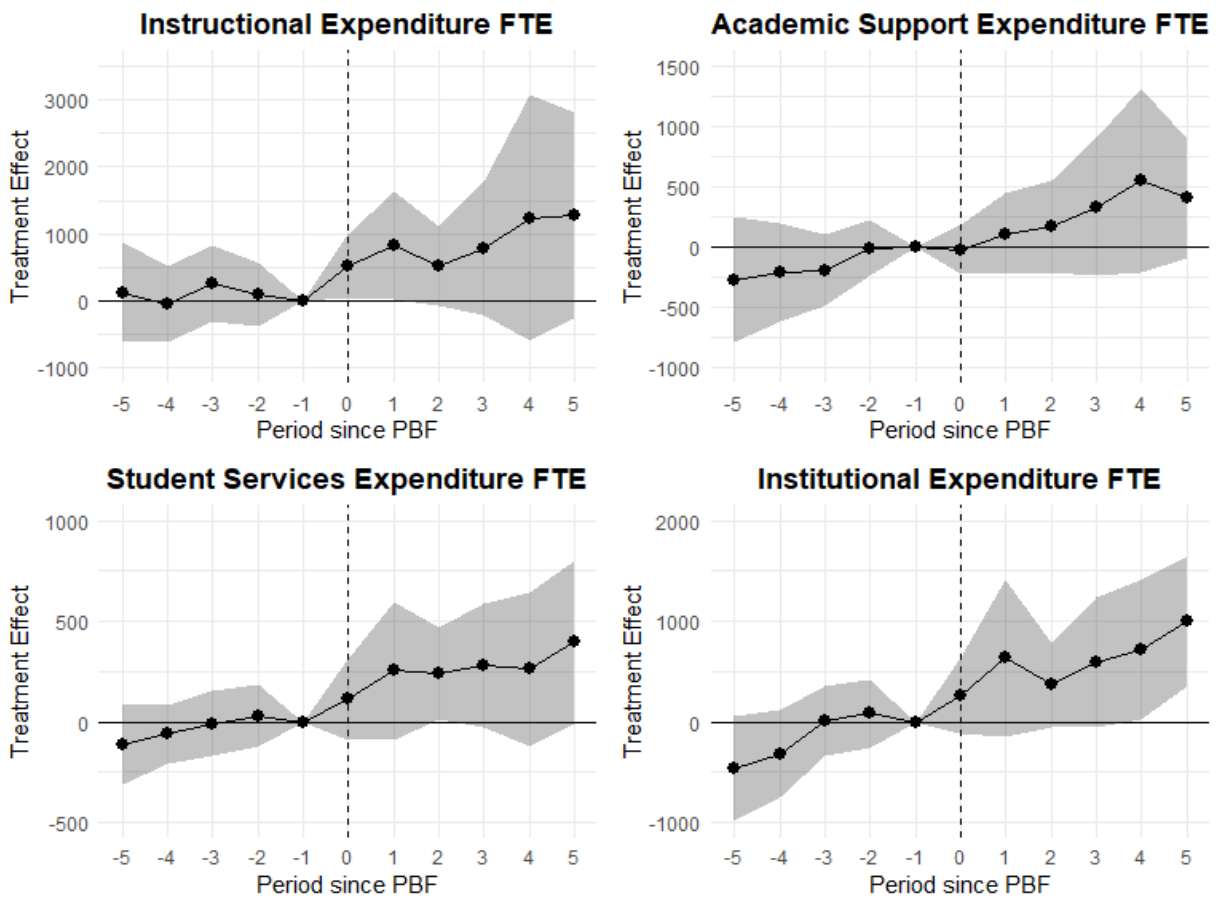


Figure B.2. Event Study: Below Median PBF Dosage for the Full Sample

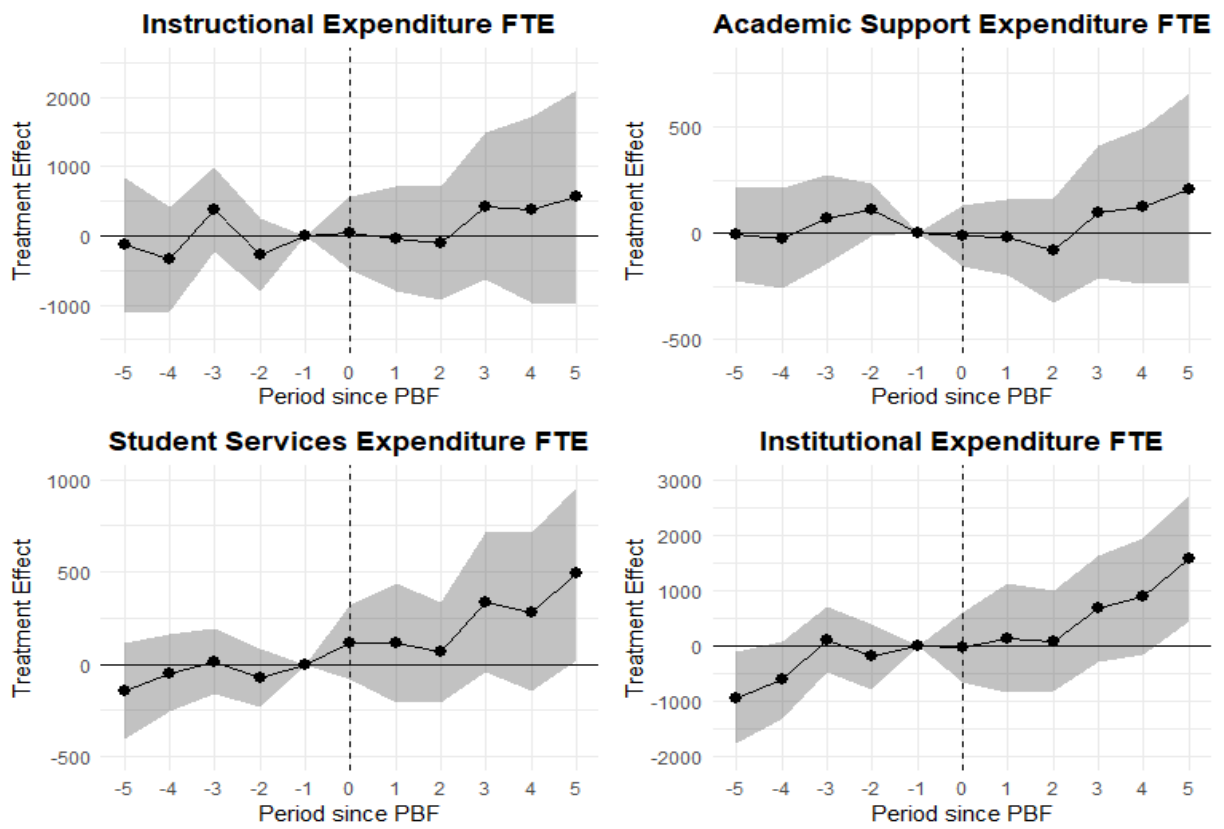


Figure B.3. Event Study: Recent Adopters of PBF

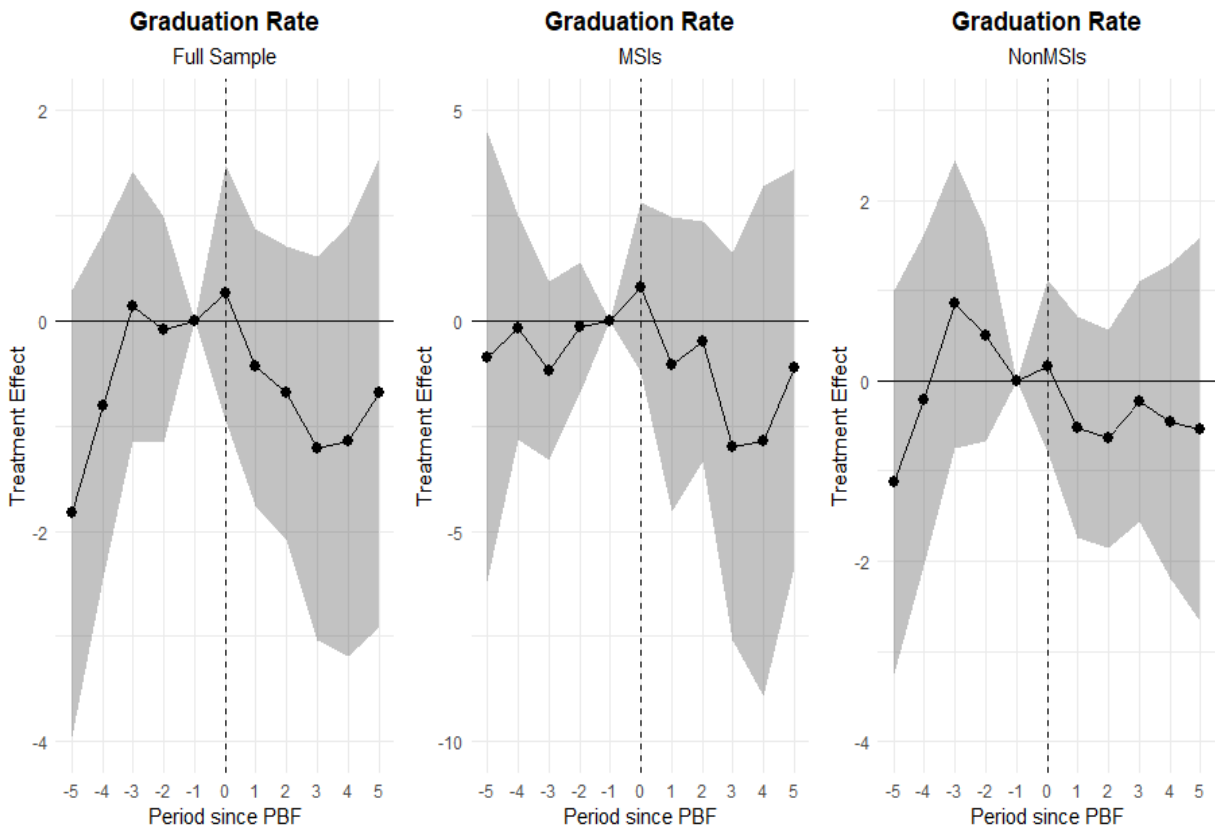


Figure B.4. Event Study: Funded PBF and Graduation Rates

Table B.1. Summary of Hypotheses and Results

Hypothesis	Outcome of Interest	Hypothesized relationship between state finance policy and outcome of interest	Results	Table # (Panel #)
<i>H1a: Public four-year institutions subject to PBF funding will increase spending on instruction, academic support, and student service to improve student outcomes to secure state financial support.</i>	Instructional spending per FTE	Positive	Supported	3.2 (A)
	Academic support spending per FTE	Positive	Not supported	3.3 (A)
	Student services spending per FTE	Positive	Supported	3.4 (A)
<i>H1b: Public four-year institutions subject to PBF funding will not increase spending on administrative expenses given that administrative expenses are not positively associated with student outcomes.</i>	Institutional support spending per FTE	Null	Not supported	3.5 (A)
<i>H2a: MSIs subject to PBF funding will not increase spending on instruction, academic support, student service, and administrative expenses.</i>	Instructional spending per FTE	Null	Supported	3.2 (B)
	Academic support spending per FTE	Null	Supported	3.3 (B)
	Student services spending per FTE	Null	Supported	3.4 (B)
	Institutional support spending per FTE	Null	Supported	3.5 (B)

Table B.1. Summary of Hypotheses and Results (Continued)

<i>H3a: Non-MSIs subject to PBF funding will increase spending on instruction, academic support, and student service to improve student outcomes to secure state financial support.</i>	Instructional spending per FTE	Positive	Not supported	3.2 (C)
	Academic support spending per FTE	Positive	Not supported	3.3 (C)
	Student services spending per FTE	Positive	Not supported	3.4 (C)
<i>H3b: Non-MSIs subject to PBF funding will not increase spending on administrative expenses given that administrative expenses are not positively associated with student outcomes.</i>	Institutional support spending per FTE	Null	Not supported	3.5 (A)

Table B.2. Event Study of Above Median Dosage Effects of PBF on Institutional Expenditures by Expenditure Type

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
Panel A: Instructional Expenditure per FTE	105.179 (196.400)	730.507** (249.977)	997.901** (320.843)	1587.705* (687.611)	1475.756+ (747.278)
Panel B: Academic Support Expenditure per FTE	29.175 (90.418)	-13.657 (162.063)	171.123 (233.921)	113.086 (347.289)	148.725 (253.823)
Panel C: Student Services Expenditure per FTE	105.287 (140.864)	251.229 (155.413)	259.478 (163.321)	268.378 (207.712)	594.121* (245.591)
Panel D: Institutional Support Expenditure per FTE	-118.791 (153.618)	415.640+ (222.310)	634.136* (259.031)	849.204** (284.432)	988.161** (316.524)
N (College-Year)	4074	4074	4074	4074	4074
Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
<p>Note. PBF = Performance-Based Funding</p> <p>Standard errors clustered by state are in parentheses</p> <p>+ p<0.1 *p<0.05 ** p<0.01 *** p<0.001</p>					

Table B.3. Event Study of Below Median Dosage Effects of PBF on Institutional Expenditures by Expenditure Type

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
Panel A: Instructional Expenditure per FTE	830.852* (397.329)	523.429+ (297.308)	777.647 (489.900)	1233.068 (909.568)	1276.737 (767.619)
Panel B: Academic Support Expenditure per FTE	112.519 (165.787)	174.377 (188.413)	335.609 (281.862)	556.875 (380.117)	406.424 (245.029)
Panel C: Student Services Expenditure per FTE	254.026 (170.939)	238.920* (112.707)	278.163+ (152.115)	262.227 (191.094)	395.572+ (202.914)
Panel D: Institutional Support Expenditure per FTE	636.814 (389.029)	365.538+ (204.460)	589.674+ (323.041)	722.718* (344.026)	919.352* (419.109)
N (College-Year)	4089	4089	4089	4089	4089
Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
<p>Note. PBF = Performance-Based Funding</p> <p>Standard errors clustered by state are in parentheses</p> <p>+ p<0.1 *p<0.05 ** p<0.01 *** p<0.001</p>					

Table B.4. Event Study of Recent Adopters of PBF Effects on Institutional Expenditures by Expenditure Type

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
Panel A: Instructional Expenditure per FTE	-41.625 (369.438)	-97.607 (401.281)	425.031 (516.256)	378.297 (656.941)	559.666 (753.399)
Panel B: Academic Support Expenditure per FTE	-20.183 (87.621)	-80.829 (120.304)	98.389 (151.314)	126.342 (178.879)	206.237 (218.467)
Panel C: Student Services Expenditure per FTE	113.811 (158.097)	64.799 (133.566)	336.769+ (183.856)	283.144 (208.702)	489.782* (229.078)
Panel D: Institutional Support Expenditure per FTE	138.906 (477.818)	88.467 (440.619)	672.547 (469.317)	887.858+ (513.023)	1568.507** (550.593)
N (College-Year)	2545	2545	2545	2545	2545

Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
<p>Note. PBF = Performance-Based Funding</p> <p>Standard errors clustered by state are in parentheses</p> <p>+ p<0.1 *p<0.05 ** p<0.01 *** p<0.001</p>					

Table B.5. Event Study of PBF Effects on Graduation Rate

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: All Four-Year Institutions</i>					
Graduation Rate	-0.435 (0.655)	-0.683 (0.692)	-1.209 (0.907)	-1.144 (1.021)	-0.683 (1.107)
N (College-Year)	4690	4690	4690	4690	4690
<i>Panel B: Minority-Serving Institutions</i>					
Graduation Rate	-1.047 (1.739)	-0.495 (1.422)	-2.990 (2.296)	-2.870 (3.013)	-1.116 (2.349)
N (College-Year)	1450	1450	1450	1450	1450
<i>Panel C: Non-Minority-Serving Institutions</i>					
Graduation Rate	-0.520 (0.611)	-0.640 (0.602)	-0.233 (0.662)	-0.452 (0.871)	-0.538 (1.057)
N (College-Year)	3274	3274	3274	3274	3274
Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
<p>Note. PBF = Performance-Based Funding</p> <p>Standard errors clustered by state are in parentheses</p> <p>+ p<0.1 *p<0.05 ** p<0.01 *** p<0.001</p>					

Table B.6. Chow Test for Institutional Spending

	Instructional Spending per FTE Student	Academic Support Spending per FTE Student	Student Services Spending per FTE Student	Institutional Support Spending per FTE Student
F statistic	34.944	19.365	30.55	71.838
P value	<0.001	<0.001	<0.001	<0.001
<p>Note.</p> <p>H0: There is no significant improvement in fit from running separate regressions. The F statistic from the chow test shows that there is some improvement in fit when I disaggregate the analyses for MSI and non-MSI subsamples and run separate regressions.</p>				

Appendix C. Chapter IV Tables and Figures

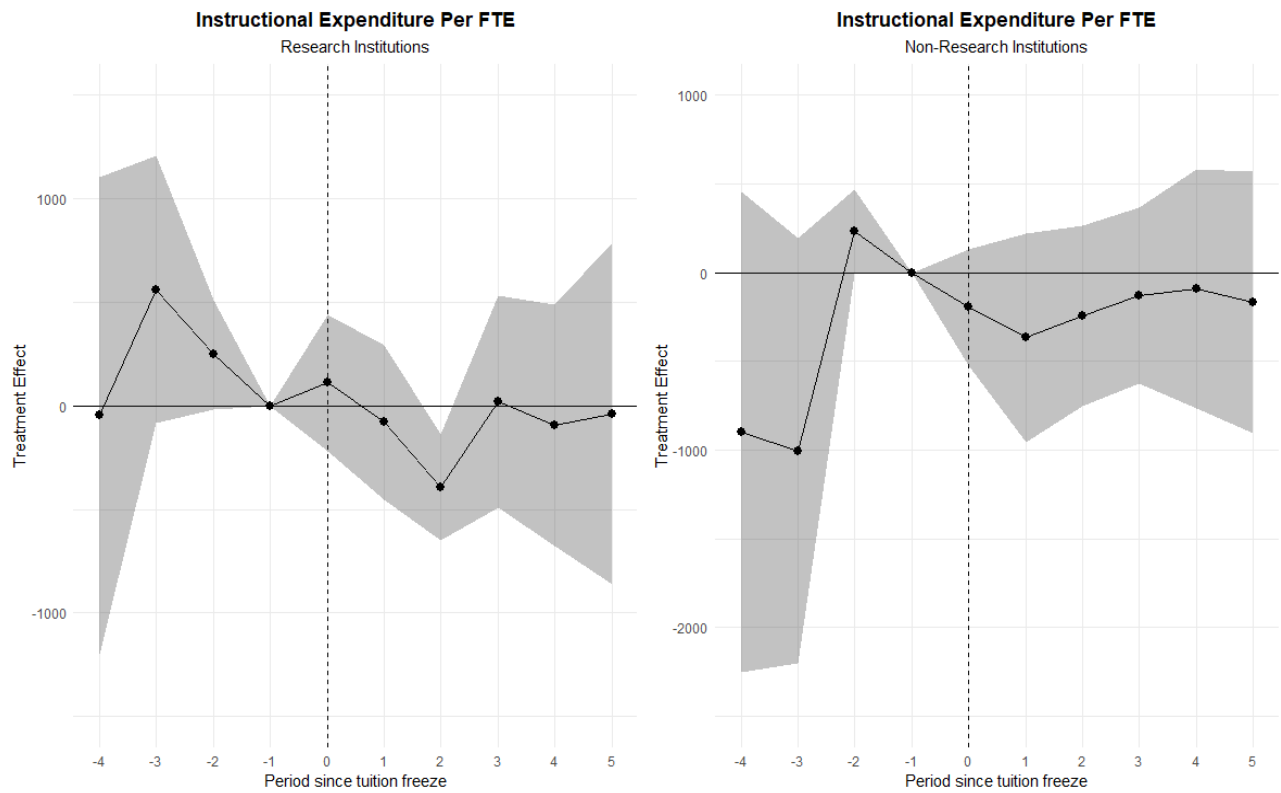


Figure C.1. Event Study of Tuition Freezes for Instructional Spending for Doctoral Research Institutions and Non-Doctoral Institutions

Table C.1. Summary of Hypotheses and Results

Hypothesis	Outcome of Interest	Hypothesized relationship between state finance policy and outcome of interest	Results	Table # (Panel #)
<i>H1a: Tenured and tenure-track instructional faculty in public doctoral research institutions and public non-doctoral institutions will decrease following exposure to tuition freezes.</i>	Tenured instructional faculty (logged)	Negative	Not supported	4.2 (A), 4.2 (B)
	Tenure track instructional faculty (logged)	Negative	Partially support	4.3 (A)
<i>H1b: Public doctoral institutions will be less likely to make expensive cuts of tenured and tenure-track instructional faculty than public non-doctoral institutions in the short-term as public doctoral institutions require tenure-stream faculty for other research purposes.</i>	Tenured instructional faculty (logged)	Negative	Not supported	4.2 (A), 4.2 (B)
	Tenure track instructional faculty (logged)	Negative	Not supported	4.3 (A), 4.3 (B)
<i>H2a: Contingent non-tenure-track and part-time instructional faculty in public doctoral research institutions and public non-doctoral institutions will decrease following exposure to tuition freezes.</i>	Non-tenure-track instructional faculty	Negative	Partially supported	4.4 (B)
	Part-time instructional faculty	Negative	Partially support	4.5 (A)
<i>H2b: Public doctoral institutions will be more likely to make easy cuts of contingent non-tenure-track and part-time instructional faculty to rebuild tenure lines than public non-doctoral institutions in the short-term.</i>	Non-tenure-track instructional faculty	Negative	Not supported	4.4 (A), 4.4 (B)
	Part-time instructional faculty	Negative	Supported	4.5 (A)

Table C.2. Event Study of Above Median Tuition Revenue Per FTE Student on Instructional Faculty Composition

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: Doctoral Research Institutions</i>					
Tenured Instructional Faculty (logged)	-0.023	0.009	0.015	-0.015	-0.031
	(0.025)	(0.026)	(0.033)	(0.055)	(0.059)
N (College-Year)	606	606	606	606	606
<i>Panel B: Doctoral Research Institutions</i>					
Tenure-Track Instructional Faculty (logged)	-0.026	0.023	0.060	0.070	0.281**
	(0.031)	(0.045)	(0.057)	(0.051)	(0.087)
N (College-Year)	606	606	606	606	606
<i>Panel C: Doctoral Research Institutions</i>					
Non-Tenure-Track Instructional Faculty (logged)	0.077*	0.044	0.065	0.085	0.053
	(0.029)	(0.032)	(0.055)	(0.075)	(0.160)
N (College-Year)	606	606	606	606	606
<i>Panel D: Doctoral Research Institutions</i>					
Part-Time Instructional Faculty (logged)	0.030	-0.034	-0.055	-0.200**	-0.191*
	(0.043)	(0.053)	(0.073)	(0.066)	(0.08)
N (College-Year)	606	606	606	606	606
<i>Panel E: Non-Doctoral Research Institutions</i>					
Tenured Instructional Faculty (logged)	0.033	0.008	0.008	0.006	-0.004
	(0.019)	(0.023)	(0.028)	(0.031)	(0.041)
N (College-Year)	949	949	949	949	949
<i>Panel F: Non-Doctoral Research Institutions</i>					
Tenure-Track Instructional Faculty (logged)	-0.003	0.013	-0.033	0.010	0.099*
	(0.038)	(0.034)	(0.053)	(0.062)	(0.048)

**Table C.2. Event Study of Above Median Tuition Revenue Per FTE Student on Instructional Faculty Composition
(Continued)**

N (College-Year)	949	949	949	949	949
<i>Panel G: Non-Doctoral Research Institutions</i>					
Non-Tenure-Track Instructional Faculty (logged)	-0.014 (0.071)	-0.027 (0.059)	0.014 (0.072)	-0.073 (0.119)	-0.034 (0.165)
N (College-Year)	949	949	949	949	949
<i>Panel H: Non-Doctoral Research Institutions</i>					
Part-Time Instructional Faculty (logged)	-0.038 (0.131)	0.123 (0.098)	0.162 (0.106)	0.099 (0.138)	0.054 (0.149)
N (College-Year)	949	949	949	949	949

Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X

Note.

Standard errors clustered by state are in parentheses

+ p<0.1 *p<0.05 ** p<0.01 *** p<0.001

Table C.3. Event Study of Below Median Tuition Revenue Per FTE Student on Instructional Faculty Composition

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: Doctoral Research Institutions</i>					
Tenured Instructional Faculty (logged)	-0.004	0.002	-0.042+	-0.039	-0.013
	(0.01)	(0.019)	(0.023)	(0.029)	(0.054)
N (College-Year)	607	607	607	607	607
<i>Panel B: Doctoral Research Institutions</i>					
Tenure-Track Instructional Faculty (logged)	-0.072*	-0.074	-0.029	-0.025	-0.135
	(0.033)	(0.051)	(0.055)	(0.084)	(0.022)
N (College-Year)	607	607	607	607	607
<i>Panel C: Doctoral Research Institutions</i>					
Non-Tenure-Track Instructional Faculty (logged)	0.079	0.078	0.077	0.101	0.535
	(0.088)	(0.079)	(0.11)	(0.159)	(0.42)
N (College-Year)	607	607	607	607	607
<i>Panel D: Doctoral Research Institutions</i>					
Part-Time Instructional Faculty (logged)	-0.060	-0.043	-0.109	-0.105	-0.047
	(0.042)	(0.051)	(0.078)	(0.11)	(0.187)
N (College-Year)	607	607	607	607	607
<i>Panel E: Non-Doctoral Research Institutions</i>					
Tenured Instructional Faculty (logged)	-0.001	0.038	0.043	0.020	0.104
	(0.024)	(0.023)	(0.038)	(0.049)	(0.072)
N (College-Year)	949	949	949	949	949
<i>Panel F: Non-Doctoral Research Institutions</i>					
Tenure-Track Instructional Faculty (logged)	0.061	-0.006	0.044	0.139	0.024
	(0.049)	(0.069)	(0.129)	(0.161)	(0.129)

**Table C.3. Event Study of Below Median Tuition Revenue Per FTE Student on Instructional Faculty Composition
(Continued)**

N (College-Year)	949	949	949	949	949
<i>Panel G: Non-Doctoral Research Institutions</i>					
Non-Tenure-Track Instructional Faculty (logged)	0.015 (0.040)	0.109** (0.037)	0.050 (0.072)	-0.039 (0.067)	-0.154 (0.096)
N (College-Year)	949	949	949	949	949
<i>Panel H: Non-Doctoral Research Institutions</i>					
Part-Time Instructional Faculty (logged)	-0.063 (0.039)	-0.029 (0.052)	-0.017 (0.053)	0.045 (0.068)	0.165* (0.080)
N (College-Year)	949	949	949	949	949
Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
<p>Note. Standard errors clustered by state are in parentheses + p<0.1 *p<0.05 ** p<0.01 *** p<0.001</p>					

Table C.4. Event Study for Median Intensity of Tuition Freezes on Instructional Faculty Composition

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: Doctoral Research Institutions</i>					
Tenured Instructional Faculty (logged)	-0.013	0.012	-0.004	-0.025	-0.027
	(0.017)	(0.018)	(0.024)	(0.042)	(0.06)
N (College-Year)	996	996	996	996	996
<i>Panel B: Doctoral Research Institutions</i>					
Tenure-Track Instructional Faculty (logged)	-0.050+	-0.007	0.062+	0.075+	0.327***
	(0.028)	(0.042)	(0.033)	(0.044)	(0.034)
N (College-Year)	996	996	996	996	996
<i>Panel C: Doctoral Research Institutions</i>					
Non-Tenure-Track Instructional Faculty (logged)	0.043*	0.033	0.057	0.047	0.000
	(0.017)	(0.02)	(0.034)	(0.053)	(0.064)
N (College-Year)	996	996	996	996	996
<i>Panel D: Doctoral Research Institutions</i>					
Part-Time Instructional Faculty (logged)	-0.016	-0.027	-0.056	-0.187+	-0.257**
	(0.033)	(0.047)	(0.054)	(0.098)	(0.08)
N (College-Year)	996	996	996	996	996
<i>Panel E: Non-Doctoral Research Institutions</i>					
Tenured Instructional Faculty (logged)	-0.026	-0.032	-0.034	-0.049	-0.066+
	(0.019)	(0.024)	(0.041)	(0.057)	(0.035)
N (College-Year)	1520	1520	1520	1520	1520

Table C.4. Event Study for Median Intensity of Tuition Freezes on Instructional Faculty Composition (Continued)

Panel F: Non-Doctoral Research Institutions

Tenure-Track Instructional Faculty (logged)	0.038 (0.044)	0.054 (0.051)	0.043 (0.125)	0.264 (0.175)	0.229** (0.077)
N (College-Year)	1520	1520	1520	1520	1520

Panel G: Non-Doctoral Research Institutions

Non-Tenure-Track Instructional Faculty (logged)	-0.021 (0.056)	0.022 (0.039)	0.028 (0.080)	-0.034 (0.066)	0.025 (0.073)
N (College-Year)	1520	1520	1520	1520	1520

Panel H: Non-Doctoral Research Institutions

Part-Time Instructional Faculty (logged)	-0.045 (0.062)	0.041 (0.056)	0.177* (0.084)	0.162 (0.154)	-0.050 (0.104)
N (College-Year)	1520	1520	1520	1520	1520

Covariates	Yes	Yes	Yes	Yes	Yes
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
<p>Note.</p> <p>Standard errors clustered by state are in parentheses</p> <p>+ p<0.1 *p<0.05 ** p<0.01 *** p<0.001</p>					

Table C.5. Event Study of Tuition Freezes Effects on Instructional Spending per FTE Student

	1-Year Lag	2-Year Lag	3-Year Lag	4-Year Lag	5-Year Lag
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: Doctoral Research Institutions</i>					
Instructional Spending per FTE Student	-80.186	-393.829**	19.867	-93.749	-37.974
	(185.876)	(127.606)	253.676)	(289.167)	(409.757)
N (College-Year)	1214	1214	1214	1214	1214
<i>Panel B: Non-Doctoral Research Institutions</i>					
Instructional Spending per FTE Student	-366.855	-244.158	-128.970	-91.106	-168.346
	(291.107)	(252.652)	(246.208)	(334.546)	(365.728)
N (College-Year)	1899	1899	1899	1899	1899
Covariates	X	X	X	X	X
FE: opeid	X	X	X	X	X
FE: year	X	X	X	X	X
Note. Standard errors clustered by state are in parentheses + p<0.1 *p<0.05 ** p<0.01 *** p<0.001					

Table C.6. Chow Test for Instructional Faculty Composition

	Tenured (logged)	Tenure-track (logged)	Non-tenure-track (logged)	Part-time (logged)
F statistic	10.427	7.55	19.91	13.726
P value	<0.001	<0.001	<0.001	<0.001

Note.
H0: There is no significant improvement in fit from running separate regressions.
The F statistic from the chow test shows that there is some improvement in fit when I disaggregate the analyses for doctoral research institutions and non-doctoral institutions subsamples and run separate regressions.

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Vita

Kyela Gadi's research focuses on public management with specific interest in higher education finance and performance. Kyela examines how and why contemporary finance and policy innovations in the higher education landscape help or hinder the delivery of desirable and equitable outcomes. Her research, teaching, and service reflect her commitment and conscious efforts to support structures and programs that provide pathways for all students to thrive in college, careers and beyond. Kyela holds a Master of Science in Environment and Sustainable Development degree from University College London, United Kingdom, and a Bachelor of Science in Biology from Ahmadu Bello University, Zaria, Nigeria.

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