



Do Credit Momentum Policies Through the *15 to Finish* Improve Academic Progression and Completion of Low-Income, First-Generation Students? Evidence from a College Promise Program

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Abstract

Credit momentum policies, or performance-based financial aid policies, have become increasingly popular among policymakers seeking to improve degree completion rates. This paper examines Indiana’s 30-credit-hour completion policy on first-time, full-time students who receive the Twenty-First Century Scholars (TFCS) Promise Program. Using administrative data from the Indiana University’s University Institutional Research and Reporting, representing 7842 low-income students who enrolled shortly before the policy was implemented, I use a difference-in-differences framework to explore the heterogeneous treatment effects of a credit (academic) momentum policy that was supported by the Complete College America *15 to Finish* initiative on the academic progression and completion of promise scholarship recipients at Indiana University Bloomington and Indiana University-Purdue University, Indianapolis, compared to non-TFCS Pell recipients from the Fall 2011 cohorts through the Fall 2014 cohorts. I find some evidence to suggest that credit momentum policies are associated with small increases in cumulative credits and grades but had no effect on degree completion status (Year 4 Graduation Status, Year 6 Graduation Status). I also find evidence that TFCS female and first-generation recipients responded positively to the policy change but find no evidence that the policy affects promise recipients differently by race/ethnicity. While consistent with prior work on credit momentum, these findings are among the first to explore the academic performance of college promise recipients. Together, these findings indicate that credit momentum policies may improve academic progression and completion for low-income, first-generation students who receive a promise scholarship. Implications for policy and research are discussed.

Keywords Higher education policy · Academic progression · College completion · Financial aid · College promise program · Quasi-experimental design

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Extended author information available on the last page of the article

Introduction

Over the last decade—and especially in recent years—college promise programs and debt-free college proposals have been proliferating at both the local and state levels (Ash et al., 2021; Bell & Gándara, 2021; College Promise, 2021a; Kunkle, 2022; Lee et al., 2022; Leigh & González Canché, 2021; Odle et al., 2021). Today, approximately twenty-one statewide college promise programs are in operation (Callahan et al., 2019). These initiatives are aimed to lower or eliminate the cost of college attendance and to reduce the number of credit hours they are paying for through state appropriations, and in doing so improve timely graduation among underrepresented groups: predominantly low-income, first-generation, students of color (Erwin & Binder, 2020; Gándara & Li, 2020; Nguyen, 2020; Page et al., 2019). While several states and cities have announced or launched promise scholarships designed to improve college enrollment and completion, higher education scholars and practitioners know relatively little about the implications of these initiatives, and whether certain policies or approaches such as performance-based financial aid are best suited to specific contexts (Perna & Smith, 2020).

In general, college promise programs or tuition-free grant programs have been advanced at the local, regional, and state levels to promote equity in higher education opportunity and outcomes (Jones et al., 2020; Miller-Adams, 2021; Odle et al., 2021). These programs provide either partial or full scholarships for students to obtain a postsecondary degree in the United States (Perna & Leigh, 2018). The Indiana Twenty-First Century Scholars (TFCS) Promise Program is one such program first created and approved in 1990. Introduced by Evan Bayh, the 46th Governor of Indiana, the Indiana TFCS was designed by Stan Jones, the former commissioner of the Indiana Commission for Higher Education (ICHE) who subsequently founded and served as CEO of Complete College America (CCA).

Today, the Indiana TFCS has been described by some as a national model for student success worthy of emulation when designing promise programs (Kelchen, 2017; ICHE, 2021; St. John et al., 2008). Eligible students must sign a Scholar pledge in middle school, complete the Indiana Scholars Success Program during high school, and graduate with a Core 40 diploma to receive the need-based, first-dollar financial aid award in college. As of 2022, approximately 20,000 students use the scholarship each year, and more than 175,000 Indiana students had received the TFCS since the program's inception in 1990. The program has had a huge impact on the state of Indiana, with over \$173 million dollars disbursed to TFCS recipients in Fiscal Year 2019 to cover full tuition and fees (ICHE, 2020). Despite the growth of the Indiana TFCS, with much written about the success of the program related to college enrollment and persistence (Davis et al., 2018; Jarquin et al., 2019; Toutkoushian et al., 2015), higher education scholars and practitioners know very little about the completion and graduation rates of promise recipients. Furthermore, little research has examined the impact of new policies or campaigns that have been adopted by the state to improve TFCS degree completion rates. As Kelchen (2017) noted in his literature review, “No recent research has examined whether the Indiana Twenty-First Century Scholars Program affected persistence or completion rates” (p. 3).

Consequently, this study investigates one statewide policy—30-credit hour annual completion policy—adopted and approved by the Indiana General Assembly in 2013 to improve the academic progression of underrepresented college students in Indiana. Specifically, this research examines the effect of a credit momentum policy on student progress and completion at two 4-year public research universities who are enrolled in the Indiana TFCS program. The goal of this study is to provide teacher-scholars, policymakers,

and practitioners with empirical evidence surrounding the effectiveness of a statewide performance-based financial aid policy on low-income, first-generation groups in higher education.

Background: Policy Issue

In May 2013, then-Indiana Governor and now former Vice President of the United States Mike Pence signed into law House Enrolled Act 1348, which entailed changes to sections of Indiana Code Title 21 (most notably IC 21-12-6-7) that required all students receiving the need-based Indiana TFCS administered by ICHE to successfully complete a minimum of 30 credit hours every academic year to retain and renew the early commitment promise scholarship (ICHE, 2015). According to this legislation authored by Representative Tom Dermody:

Subject to IC 21-12-13-2, a scholarship awarded under section 6 of this chapter or this section may be renewed. To qualify for a scholarship renewal, a scholarship recipient must complete at least (30) credit hours or the equivalent during the last academic year in which the student received state financial aid. A recipient who fails to meet the credit hour requirement for a particular academic year becomes ineligible for an award during the next academic year. (House Enrolled Act 1348)

This new policy emerged from a similar initiative adopted by the University of Hawaii in 2012 as part of the Hawaii Graduation Initiative now known as the *15 to Finish* campaign. The policy, which has been emulated in many states, aims to encourage students to take 15 credits per semester (or 30 credits per year) and thereby remain on course to complete a bachelor's degree in 4 years. While the new legislation adopted in Indiana is an attempt by the ICHE to improve college completion and on-time graduation of Hoosiers, scholars of education policy and practitioners know relatively little about the effectiveness of such policies. Furthermore, very few scholars have provided evidence that attempting to complete 30 credits per academic year significantly improves academic performance and subsequently, degree completion rates of underrepresented students (Attewell & Monaghan, 2016). Former and retired ICHE Commissioner Teresa S. Lubbers (2009–2022) admitted that “A lot is at stake for our 21st Century Scholars—if they don’t complete the credit hours, they lose the scholarship and they would fall into another financial aid pool” (Smith, 2017, p. 19).

Prior to the 30-credit hour annual completion policy in 2013, a series of empirical studies revealed significant benefits and disparities in college retention and completion for TFCS recipients across all Indiana public and private universities (Ashcraft et al., 2017; St. John et al., 2008). As an illustration, the longitudinal study by Toutkoushian et al. (2015) found that TFCS recipients were 2.4% more likely to enroll in postsecondary education than non-recipients. However, the authors cautioned that “many students who signed up for the TFCS program do not complete it” (p. 63) and that the positive effects of the TFCS on college completion were relatively small. The scholars suggest that financial constraints, including potential loan debt, prevents TFCS recipients from continuing in college. In a similar study, St. John et al. (2008) provided evidence that the Indiana TFCS Program has a small, positive, and indirect impact on academic performance and college completion. The study indicated that recipients of the need-based financial aid program did not significantly differ from other low-income students who had enrolled in college without the scholarship.

A follow up study by Machovina et al. (2021) concluded that the lack of student support services and sense of belonging for TFCS recipients has contributed to the low completion and degree attainment rates across Indiana colleges and universities.

Statewide, approximately 39.7% of low-income students who receive the need-based Indiana TFCS completed their baccalaureate degree on-time (within 4 years) at all public institutions in 2021, which is far below the U.S. national average on-time completion rate of 50% (ICHE, 2021). More specifically, when considering the type of institutions in their analysis, the staff of ICHE (2021) found that 4-year, predominantly or entirely commuter campuses had a 37.1% on-time completion rate for Indiana TFCS recipients in 2020, compared to 4-year residential main campuses with a 46.6% on-time completion rate of Indiana TFCS recipients. Still, more than half of Indiana TFCS recipients at residential main campuses and two third at predominantly commuter campuses did not complete their college degree on-time. The report concluded that minorities (including most Black/African American students) who received the Indiana TFCS were less likely to persist into the fall of their second year, compared to White students. The study cited low levels of sense of belonging and limited college knowledge (i.e., intellectual and academic capital) as two primary factors that affect TFCS completion rate, which is consistent to past study (Machovina et al., 2021). While ICHE (2021) claims that the proportion of TFCS recipients completing 15 credits per semester has slightly improved since the adoption of the new policy in Fall 2013, the ICHE report did not provide empirical evidence that on-time or delayed graduation rates have improved for TFCS scholars as a result of the policy.

Given the relatively low progression and completion rates of Indiana TFCS recipients, an empirical study that examines the policy effect of the TFCS 30-credit hour completion policy on academic outcomes is needed to understand what influence the policy has on low-income, first-generation students. Very little research, if any, has examined the significant impact of credit momentum policies beyond the first year of initial enrollment and, more specifically, the *15 to Finish* initiative among college promise program recipients (Perna & Smith, 2020). Hence, this article builds upon a subsequent policy investigation by Anderson et al. (2020), Bell (2020, 2021), Collier et al. (2020), Gándara and Li (2020), Gurantz (2020), Long et al. (2021), Swanson and Ritter (2020), Yanagiura (2020), Gershfeld et al. (2019), Gross et al., (2019), Davis et al. (2018), Kelchen (2017), and Yanagiura and Johnson (2017) studies which call upon scholar-practitioners and public policymakers to assess the longer-term effects of credit momentum policies and need-based college promise scholarships on the academic progression and completion of low-income, first-generation students.

Literature Review

Credit Momentum

The literature review on credit momentum through the *15 to Finish* initiative is a highly contested and criticized topic amongst scholars and practitioners in the field of higher education. Credit momentum, or academic momentum, is defined as attempting at least 15 credits in the first term or at least 30 semester credits in the first academic year (Attewell et al., 2012; Belfield et al., 2016). Most studies have shown that credit momentum is positively related to 1st year and 2nd year retention rate and improved on-time graduation and degree attainment (Attewell & Monaghan, 2016; Clovis & Chang, 2021). While several

studies on academic momentum have consistently examined the first semester of initial enrollment at 2-year community colleges (Belfield et al., 2016; Chan & Wang, 2018; Clovis & Chang, 2021; Doyle, 2011; Wang, 2016), and more recently at public high schools (Moreno et al., 2022), very little research has focused on credit momentum at 4-year public universities from first semester to the final semester of study (Anderson et al., 2020; Yanagiura, 2020; Zhang, 2022). Furthermore, no study as of date has examined the effect of credit momentum policies on student outcomes among college promise recipients in the United States (Perna & Smith, 2020).

In general, empirical research on credit momentum has consistently shown that undergraduate students do not take enough credits needed to graduate on time within 4 years. Specifically, most first-time, full-time students need more than four years to complete a traditional 120 credits bachelor's degree program (Attewell & Monaghan, 2016; Attewell et al., 2012). There are several reasons for low-income students to delay graduation, including their desire to change majors, desire to work full or part-time, family duties and responsibilities, and more recently, their inability to access the internet at home to complete online courses due to the worldwide coronavirus (COVID-19) pandemic (Chan et al., 2021; Witteveen & Attewell, 2021). This issue has led many academic advisors and student success coaches to take a longer and more integrated view of the student experience beyond the semester-by-semester building process.

Today, the Complete College America (CCA) (2021) reports that more than 450 higher education institutions across the United States have expanded the credit momentum movement through the *15 to Finish* campaign, with about 21 states having either adopted state-wide initiatives or campus-based initiatives (Callahan et al., 2019) (Appendix 9). The credit momentum movement intends to increase collegiate graduation rates of underrepresented students at both two- and four-year institutions. The CCA claims that first-time, full-time students who enroll in 15 credits per semester and throughout college have higher graduation rates, and that the effect is especially strong for students of color, despite no rigorous scholarship exists to support such argument (CCA, 2018; Goldrick-Rab, 2016). As a result, the increasing number of institutions adopting and implementing the *15 to Finish* initiative has created some buzz from scholars and practitioners to examine the effectiveness of credit momentum policies and whether low-income, first-generation students who complete 30 credits each academic year improved college graduation and time-to-degree rates at 4-year institutions.

15 to Finish Initiative

The college completion agenda has been bolstered by national calls from intermediary organizations and philanthropic foundations alike to raise the overall rate and timeliness of degree attainment (Ness et al., 2021). The *15 to Finish* initiative, initiated by the CCA, a national alliance dedicated to improving college completion rates, encourages students to enroll in 15 credits per semester (or, including summer terms, 30 credits per year) with the long-term goal of keeping at risk students engaged and thereby increase the likelihood of their graduation (CCA, 2021). It seeks to change the fact that the majority of college students do not register for at least 15 credits per semester, the minimum course load that would enable them to earn a baccalaureate degree in 4 years. Yet, there are on-going debates among policymakers and scholars alike on whether college completion agendas and initiatives such as the *15 to Finish* initiative or other similar campaigns such as Temple

University “Fly in 4” campaign can increase graduation rates for low-income, first-generation students (Kelchen & Goldrick-Rab, 2016).

In general, the *15 to Finish* initiative provides a framework for institutions of higher education to graduate a significant proportion of their disadvantaged students on-time (CCA, 2018). While some research has shown that pushing for 15 credits a semester benefits most students, resulting in more completing on time (Belfield et al., 2016; Klempin, 2014; University of Hawaii’s Institutional Research Office, 2013), other studies suggest that students taking 15 credits while working full-time do not graduate at higher rates compared with students taking 12 credits (Monaghan & Attewell, 2015). Specifically, Monaghan and Attewell (2015) claim that students who must work over 30 hours a week or have other major life obligations outside of academics do not benefit from enrolling in 15 credits. Common criticisms may include: the initiative benefits affluent, privileged students who enter higher education with higher levels of capital; very few institutions provide holistic student support services for low-income, first-generation students; state governments do not collect enough information necessary to properly determine if students completed 30-credit hour per academic year; and, in some cases, the implementation of the *15 to Finish* initiatives is too burdensome for practitioners and policymakers in college promise programs (Rosinger et al., 2021).

For example, the University of Hawaii’s Institutional Research Office (2013) found that after just one year of implementation of the *15 to Finish* initiative, the rate of incoming students at the flagship Manoa campus enrolling for 15 credits per semester jumped from 38 to 64%. Similarly, Scott-Clayton’s (2011) study found that students who complete 30 credits per academic year through the West Virginia Promise Program (WVPP) increased their 4-year completion rates between 5.8 and 10 percentage points and decreased time-to-degree. In a related study, Belfield et al. (2016) provided evidence of substantial positive outcomes for community college students who take 15 credits their first semester, including a 6.4 percentage point increase in degree completion. Using student-level data from the Tennessee Board of Regents, the study found significant improvements in credit accumulation and degree completion rates at both 2- and 4-year colleges. The results, after controlling for student input characteristics, suggest there are savings to learners in the form of paying less tuition as well as an increase in institutional revenues through increased student persistence. This study reflects Klempin’s (2014) previous study which examined the academic outcomes from several 15-credit policies at 2-year institutions, finding a positive impact for less academically prepared students in terms of student credit completion, GPA, and progression. However, the report also highlights several key challenges for low-income, first-generation students to maintain this pace including their ability to balance enrollment intensity and academic performance, as well as institutions capacity to provide holistic student support services for these special populations. In the end, Klempin (2014) recommends that community colleges engage in careful planning and consideration before deciding on and adopting a 15-credit momentum approach.

Hence, the results in this literature review suggests a mixed perspective on credit momentum and that new formal and informal research is needed to understand the longer-term effects of the *15 to Finish* initiative. Much research on credit momentum has focused at 2-year community college institutions, with limited evidence at 4-year public research institutions (Clovis & Chang, 2021; Zhang, 2022). The study addresses this knowledge gap by providing evidence-based information on the effectiveness of the *15 to Finish* initiative on academic progression and graduation at two 4-year public research universities. This study also explores whether the results vary by demographic factors and pre-college characteristics. A full assessment of the current course loads and outcomes will help

policyholders and practitioners understand the potential impact and possible benefits of the nationwide *15 to Finish* initiative.

Data Sources

This study explored the policy effect of the 30-credit hour annual completion policy on college progression and completion of TFCS recipients (low-income, first-generation) at Indiana University Bloomington (IUB) and Indiana University–Purdue University, Indianapolis (IUPUI). The study employs administrative data obtained from Indiana University’s University Institutional Research and Reporting (UIRR) to determine whether there were differences between the academic performance of TFCS recipients who enrolled before and after the relevant changes in Indiana Code Title 21 were implemented in 2013. Indiana University’s UIRR, a unit within the Office of the Executive Vice President for University Academic Affairs (OEVPUAA), “completes myriad federal and state compliance reports and produces official university reports on admissions, enrollment, retention, graduation rates, degree completions, and financial aid for Indiana University and all its campuses.” To date, no study has examined the effectiveness of credit momentum policies among college promise program recipients (Perna & Smith, 2020).

Study Participants

This study uses students as the unit of analysis and conducts separate analyses of students for two institutions: Indiana University Bloomington (IUB) and Indiana University–Purdue University, Indianapolis (IUPUI). The primary rationale for selecting IUB and IUPUI for this study was to compare findings between a “primary residential/very high research activity” campus and a “primary nonresidential/high research activity” campus, as they both serve different types of students in the state of Indiana [Indiana University Center for Postsecondary Research (n.d.)]. In addition, the two institutions are categorized by ICHE (2021) as two distinctive institutions, with IUB classified “main campus” while IUPUI as “non-main campus” (p. 7). The two groups of students in this study are Indiana Twenty-First Century Scholarship (TFCS) recipients and non-TFCS Pell recipients (i.e., Indiana residents who received Federal Pell Grants but did not receive the TFCS).

The non-TFCS Pell recipients include students who were unable to maintain Indiana TFCS eligibility because they did not complete the required steps in high school (i.e., Indiana Scholar Success Program), or perhaps they simply chose not to due to several internal and external factors [e.g., missed June 30th deadline before the end of 8th grade; complexity of filing the FAFSA application; inability to provide proof of residency status in the state of Indiana; DACA status; unaware of the Indiana TFCS Program due to a lack of awareness by high school counselors (mostly in rural towns)]. The non-TFCS Pell recipient group might also include students who did not meet the Indiana TFCS eligibility income requirements when in high school, but whose families have since, and maybe only temporarily, have lower income to qualify for the Federal Pell Grant.

Variables of Interest

Table 1 provides a detailed list of the variables or areas of measurements used in this study along with description and labels. The variables of interest used in this study included

Table 1 Overview of grouping variables, continuous variables, dichotomous variables, and independent variables

Variable	Description
<i>Grouping variables</i>	
POST-POLICY (i.e., pre/post policy implementation)	Whether the student entered before (Fall 2011 or 2012) or after (Fall 2013 or 2014) the policy went into effect (0 = <i>pre policy</i> , 2011–2012, 1 = <i>post policy</i> , 2013–2014)
TFCS RECIPIENT STATUS	Student was reported to receive the TFCS recipient (0 = <i>non-TFCS Pell recipient</i> , 1 = <i>TFCS recipient</i>)
<i>Continuous outcomes</i>	
Year 1 cumulative credits completed	Annual cumulative credits successfully completed in first year by the student
Year 2 cumulative credits completed	Annual cumulative credits successfully completed in second year by the student
Year 1 cumulative GPA	Annual cumulative grade point average (GPA) of all courses completed in first year by the student
<i>Dichotomous outcomes</i>	
Year 4 graduation status	Binary indicator of whether the student was awarded a baccalaureate degree after Year 4 (0 = <i>no</i> , 1 = <i>yes</i>)
Year 6 graduation status	Binary indicator of whether the student was awarded a baccalaureate degree by Year 6 (0 = <i>no</i> , 1 = <i>yes</i>)
<i>Pre-college characteristics</i>	
High School GPA	Average high school cumulative GPA converted to 4.00 scale
SAT Score	Average SAT score (or converted ACT to SAT score)
<i>Demographic factors</i>	
Race	Race or ethnic group as reported by the institution (1 = <i>Caucasian/White</i> , 2 = <i>African American/Black</i> , 3 = <i>Hispanic/Latino</i> , 4 = <i>Asian American and Pacific Islander</i> , 5 = <i>Multiracial American</i> , 6 = <i>American Indian</i> , 7 = <i>Other/Unknown</i>)
Gender	Gender (1 = <i>male</i> , 2 = <i>female</i>)
Generation status	Whether neither parent/guardian has a bachelor's degree of higher (0 = <i>continuing-generation</i> , 1 = <i>first-generation</i>)

Source: Indiana University's University Institutional Research and Reporting (UIRR) (2022)

cumulative academic progression variables (e.g., Year 1 Cumulative GPA, Year 1 Cumulative Credits Completed, Year 2 Cumulative Credits Completed), pre-college characteristics (e.g., high school GPA, SAT score), demographic factors (e.g., race, gender, generation status), and college completion status (e.g., Year 4 Graduation Status, Year 6 Graduation Status).

Analytic Approach

This observational study employs a quasi-experimental, DiD framework to identify the grades, progression, and graduation status of low-income, first-generation college students at IUB and IUPUI. Specifically, this study compares Indiana TFCS recipients and non-TFCS Pell recipients to determine whether the credit momentum policy affected the academic performance of students in these groups regarding accumulated credit hours, cumulative GPA, and graduation. The study combined students who entered the two years prior

to 2013 and those who entered the two years post policy as two separate samples. Specifically, this study combined data from Fall 2011 and Fall 2012 into a pre-policy cohort. For the Fall 2011 group, year 1 refers to academic year 2011–2012 and year 2 refers to academic year 2012–2013. For the Fall 2012 cohort, year 1 pertains to academic year 2012–2013 and year 2 to academic year 2013–2014. The Fall 2013 and Fall 2014 cohorts were combined into a post-policy cohort, with the years tracked analogously to those of the earlier cohorts (e.g., Year 1 for the Fall 2013 being 2013–2014).

Difference-in-Differences Technique: Rationale

The primary rationale for selecting the DiD testing is to create control and experimental groups to assess a change or implementation of a policy in the Indiana TFCS Program. Specifically, the DiD design allows the researcher to determine a policy effect that occurs at a specific point in time, as long as other aspects of the context do not change (Kelchen et al., 2019). For example, DiD estimation can compare the difference in academic outcomes (e.g., Year 1 Credit Hours Completed, Year 2 Credit Hours Completed, Year 1 Cumulative GPA) before and after the credit momentum policy took effect in Fall 2013 (treatment group) to the difference in academic outcomes for those that did not receive the policy (control group) (Anderson et al., 2020).

In general, the DiD method uses comparison groups to estimate treatment effects. Specifically, the model estimates the differences between two groups before and after a “treatment” (policy implementation) to which only one of the groups has been exposed, in this case the 30-credit hour annual completion policy. The DiD testing is considered a natural experiment that accounts for selection effects from the non-random assignment (Goodman-Bacon, 2021). The model can also accommodate covariates (e.g., student demographics and academic background) related to student outcomes. Any difference in the outcome variable in terms of credit hour accumulation or cumulative GPA is either a result of the policy adoption or other unmeasured external factors affecting the target group but not the control group (Kelchen et al., 2019).

Regression Specifications of Difference-in-Differences (DiD) Method

Ordinary least squares (OLS) estimations were applied to the three dependent variables (i.e., Year 1 Cumulative Credits Completed, Year 2 Cumulative Credits Completed, Year 1 Cumulative GPA) which were used to evaluate and assess the academic progression and completion of TFCS recipients. Ordinary least squares estimation has been used in higher education research to approximate how a series of independent variables are associated with the outcome variable (Delaney & Hemenway, 2020). Three sets of OLS regression models were used in this study: (a) an initial pre-post comparison (i.e., a first difference) with only the treated group, (b) group differences of the treated and control groups (TFCS recipients relative to non-TFCS Pell recipients), and (c) group differences of the treated and control groups with covariates.

The OLS estimation is defined in the following equation:

$$Y_i = \alpha + \beta_d(\text{DEMOGRAPHICS}) + \beta_a(\text{ACADEMIC_BACKGROUND}) + \beta_{\text{int}}(\text{GROUP}_i \times \text{POST - POLICY}_i) + \delta \text{GROUP} + \theta \text{POST - POLICY}_i + v_i \quad (1)$$

where y (e.g., Year 1 Cumulative Credits, Year 1 Cumulative GPA) denotes the academic outcome variables for a given student (i). Academic outcomes are defined as the credit hours completed in Year 1, the cumulative GPA in Year 1, the students' graduation status in Year 4, and the graduation status in Year 6. The α is the intercept, θ is the parameter that estimates the policy effect before taking into account the group differences, the POST-POLICY is a dichotomous variable indicating the pre- (0) and post (1) policy observations, and ν is the residual term. For all models, standard errors are clustered to adjust for serial correlation and heteroskedasticity in DiD estimates for a large sample size.

The study uses dichotomous or binary variables (e.g., TFCS status, policy period) to assess whether the policy effected the TFCS recipient group and not the control group, without considering the student level covariates. The effect of most interest is β_{int} , which determines if the policy has a differential effect on the groups (i.e., TFCS recipients vs. non-TFCS Pell recipients). If the TFCS group is "1" and non-TFCS Pell is "0," and if the POST-POLICY is "0 = year(s) before," and "1 = year(s) after policy," then the coefficient of interest, β_{int} , is the critical parameter. In other words, the " $GROUP_i \times POST-POLICY_i$ " is an interaction, reflecting how the academic outcome variables changes in the TFCS recipient group relative to a non-TFCS Pell recipient group. The β_{int} represents the parameter of interest showing the differential estimate of the effects of the credit momentum policy by indicating if and how TFCS recipients respond to the policy after its implementation in Fall 2013. This estimator represents an intent-to-treat effect.

While this study can estimate the impact for treatment on the treated as well as intent-treat effects, it is not possible because the DiD estimation cannot observe which TFCS or non-TFCS Pell recipients would have completed 30 credit hours per academic year in the pre-policy period. However, this study expects the estimates of intent-to-treat effects and treatment-on-the-treated effects to be close. The δ parameter represents the group different effect, if any. The model can account for specific non-TFCS Pell pre-policy cohorts in the θ parameter that are distinct to the TFCS pre-policy cohorts (α). Because this study is testing time difference and time change from before to after the policy went into effect in which treatment begins, the " $GROUP_i \times POST-POLICY_i$ " interaction is set to equal one in the years during and following the adoption of the credit momentum policy.

For this study, covariates in the model included generation status, gender, race, high school GPA, and SAT score. These control variables are included to increase the precision of the estimates reported. The student level covariates help with precision of the DiD estimation and control for any differences in characteristics in the cohorts over time and/or between the treatment and comparison groups. The β_{int} is estimated for each of the three continuous outcomes: Year 1 Cumulative Credit Completed, Year 2 Cumulative Credits Completed, Year 1 Cumulative GPA. Binary logistic regression is applied for the two dichotomous variables: Year 4 Graduation Status, Year 6 Graduation Status.

Identification Assumption

A key assumption of a difference-in-differences (DiD) analysis is that in the absence of the 30-credit hour completion policy, the outcomes of interest would have continued the trajectory observed in the pre-treatment years (i.e., parallel trends assumption). To verify that observed changes are due to Indiana's credit momentum policy and not pre-existing trends in outcome measures, I plot the trajectory of the two credit hours accumulation (Year 1 Cumulative Credits Completed, Year 2 Cumulative Credits Completed) for TFCS recipients and non-TFCS Pell recipients at IUB (Fig. 1), and IUPUI (Fig. 2). Both figures provide

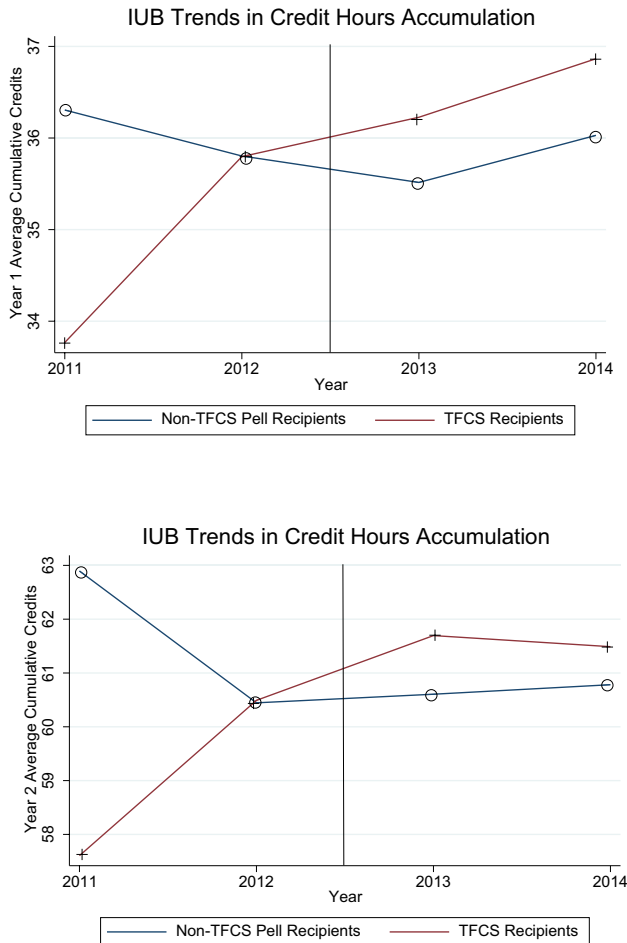


Fig. 1 IUB trends in credit hours accumulation

some evidence in support of parallel trends assumption, where neither treatment groups exhibit dramatically different pre-treatment trends in credit hours accumulation compared to the comparison group. In other words, in the absence of Indiana's credit momentum policy, it is possible to suggest that the treatment and control groups would have continued along the same trajectory, and that any difference in outcomes after 2012–2013 is due to the implementation of the 30-credit hour completion policy.

This study also conducted a standardized DiD check using descriptive statistics for both demographic factors and pre-college characteristics over time for the treatment and comparison groups. Specifically, Tables 2 and 3 provides the descriptive statistics of TFCS recipients and non-TFCS Pell recipients to show that the two groups are socio-demographically similar pre-2013 and post-2013. This is the most straightforward approach in DiD design since the treatment and control groups are easily identified and there are few concerns about contamination in the control group. The tables also give evidence that the additivity assumption of DiD holds for this analysis. Notably, the two tables descriptively show that the Indiana TFCS program may

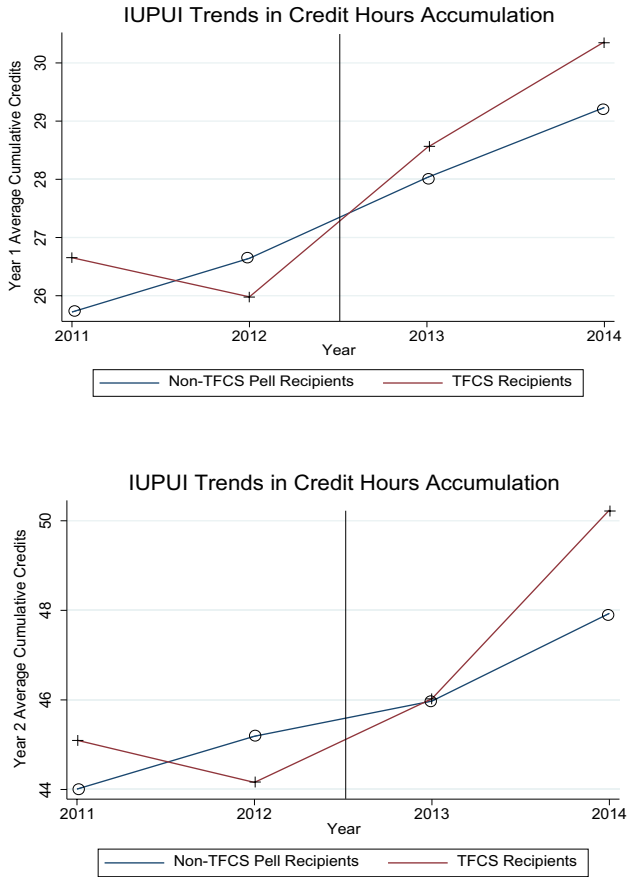


Fig. 2 IUPUI trends in credit hours accumulation

be associated with improved academic performance at IUB. However, parallel trends appear most concerning at IUPUI in the percentage of college completion status where clear pre-post trends are difficult to define. While readers should interpret the results with caution, the primary findings largely remain intact of which gives me some confidence that the DiD estimates provide the true impact of Indiana’s credit momentum policy and are not biased by changes in the promise program.

Appendix 1 provide the descriptive statistics of the demographic factors and pre-college characteristics by award status group at IUB and IUPUI. Appendix 2 outline the descriptive statistics of the college completion status variables by award status group at IUB and IUPUI. The notable differences across these variables support the design choice to examine the impact of the policy separately for IUB and IUPUI: the two campuses clearly serve different types of students, even when considering those who qualify for the TFCS. Non-TFCS Pell recipients at IUB achieved slightly higher cumulative year-to-year credits compared to TFCS recipients. On the other hand, TFCS recipients performed slightly better than non-TFCS Pell recipients at IUPUI in terms of credits and GPA.

Table 2 Indiana University Bloomington (IUB) summary of statistics: means of TFCS recipients and non-TFCS Pell recipients before and after policy implementation

	Pre-policy (2011, 2012)		Post-policy (2013, 2014)		Difference-in-differences
	TFCS Recipients	Non-TFCS Pell Recipients	TFCS Recipients	Non-TFCS Pell Recipients	
Year 1 cumulative credits completed	34.820 (0.329)	36.064 (0.330)	36.558 (0.306)	35.754 (0.312)	2.407 (0.649)
Year 2 cumulative credits completed	59.101 (0.612)	61.715 (0.614)	61.588 (0.570)	60.686 (0.579)	3.516 (1.188)
Year 1 cumulative GPA	2.708 (0.024)	2.910 (0.024)	2.773 (0.022)	2.868 (0.023)	0.106 (0.024)
% Year 4 graduation	48.80 (0.016)	51.80 (0.016)	52.60 (0.015)	53.00 (0.015)	2.60 (0.002)
% Year 6 graduation	67.10 (0.015)	72.50 (0.015)	69.00 (0.014)	69.00 (0.014)	5.40 (0.002)
% First-generation students	49.30 (0.016)	40.10 (0.016)	49.10 (0.015)	37.40 (0.015)	2.50 (0.002)
% Female	59.80 (0.016)	55.00 (0.016)	58.20 (0.015)	56.00 (0.015)	-2.60 (0.003)
% Black students	30.81 (0.023)	14.41 (0.022)	31.00 (0.022)	12.99 (0.021)	1.61 (0.002)
% Hispanic students	11.10 (0.019)	7.71 (0.017)	14.33 (0.018)	6.14 (0.019)	4.80 (0.002)
% Asian students	5.94 (0.009)	6.16 (0.010)	5.58 (0.009)	6.14 (0.0010)	-0.16 (0.001)
% Race unknown	0.01 (0.001)	0.09 (0.001)	1.52 (0.002)	1.39 (0.002)	0.21 (0.001)
High school GPA	3.516 (0.012)	3.554 (0.012)	3.576 (0.011)	3.591 (0.011)	0.023 (0.002)
SAT score	1156.80 (4.102)	1194.45 (4.123)	1168.53 (3.892)	1209.34 (3.892)	-2.82 (0.441)
Number of observations	892	1103	984	1286	275

Results

Table 4 provides the DiD estimates when accounting for specific group (TFCS recipients, non-TFCS Pell Recipients) and treatment (Pre-Policy, Post-Policy) differences. Specifically, a by-hand calculation of the DiD interaction effect ($POST-POLICY \times GROUP$) between the treatment status and time period, shown in Tables 2 and 3, indicated that the implementation of the credit momentum policy through the *15 to Finish* initiative improved IUB students' academic outcomes in terms of cumulative credit hours accumulation, and, to a slightly weaker extent for cumulative GPA. This calculation matches the 2.407 estimate in the regression model (Model 1) in Table 4, which is significant at the $p < 0.001$ level for Year 1 Cumulative Credits Completed and significant at the $p < 0.01$ for Year 2 Cumulative Credits Completed.

$$(36.558 - 34.820) - (35.754 - 36.064) = 2.407 \quad (2)$$

Table 3 Indiana University–Purdue University, Indianapolis (IUPUI) summary of statistics: means of TFCS recipients and non-TFCS Pell recipients before and after policy implementation

	Pre-policy (2011, 2012)		Post-policy (2013, 2014)		Difference-in-differences
	TFCS recipients	Non-TFCS pell recipients	TFCS recipients	Non-TFCS pell recipients	
Year 1 cumulative credits completed	26.291 (0.449)	26.194 (0.450)	29.558 (0.344)	28.595 (0.344)	0.8651 (0.800)
Year 2 cumulative credits completed	44.593 (0.888)	44.615 (0.890)	48.375 (0.680)	46.895 (0.681)	1.503 (1.583)
Year 1 cumulative GPA	2.468 (0.038)	2.572 (0.039)	2.503 (0.029)	2.603 (0.030)	0.004 (0.069)
% Year 4 graduation	19.00 (0.016)	19.10 (0.017)	29.00 (0.013)	24.50 (0.013)	4.60 (0.002)
% Year 6 graduation	49.00 (0.019)	52.40 (0.019)	44.20 (0.015)	47.00 (0.015)	0.60 (0.008)
% First-generation students	60.20 (0.019)	57.10 (0.019)	51.80 (0.015)	46.70 (0.015)	2.00 (0.008)
% Female	65.60 (0.019)	60.80 (0.019)	67.60 (0.014)	62.40 (0.014)	0.04 (0.010)
% Black students	28.35 (0.022)	19.39 (0.018)	23.93 (0.021)	16.25 (0.017)	-1.28 (0.002)
% Hispanic students	11.10 (0.014)	9.46 (0.013)	10.99 (0.013)	8.08 (0.011)	1.27 (0.001)
% Asian students	3.01 (0.008)	7.72 (0.010)	5.93 (0.008)	7.37 (0.010)	3.27 (0.001)
% Race unknown	1.05 (0.001)	1.06 (0.001)	1.42 (0.001)	1.59 (0.001)	-0.16 (0.001)
High school GPA	3.251 (0.015)	3.268 (0.015)	3.332 (0.011)	3.323 (0.012)	0.026 (0.007)

Table 3 (continued)

	Pre-policy (2011, 2012)		Post-policy (2013, 2014)		Difference-in-differences
	TFCS recipients	Non-TFCS pell recipients	TFCS recipients	Non-TFCS pell recipients	
SAT score	1034.59 (5.242)	1068.83 (5.340)	1045.79 (4.022)	1075.94 (4.115)	4.09 (2.445)
Number of observations	663	660	1128	1126	931

Table 4 Difference-in-differences (DiD) analyses for treatment and control effects across policy groups at Indiana University Bloomington (IUB) and Indiana University-Purdue University, Indianapolis (IUPUI)

	(1)		(2)		(3)	
	Year 1 credits cumulative completed		Year 2 credits cumulative completed		Year 1 cumulative GPA	
	IUB	IUPUI	IUB	IUPUI	IUB	IUPUI
POST-POLICY	-0.31 (0.454)	2.4*** (0.566)	-1.03 (0.844)	2.28* (1.12)	-0.2*** (0.341)	0.03 (0.485)
Group	-1.24** (0.466)	0.09 (0.635)	-2.61** (0.866)	-0.02 (1.256)	-0.04 (0.332)	-0.103 (0.054)
POST-POLICY × Group	2.407*** (0.649)	0.865 (0.80)	3.516** (1.188)	1.503 (1.583)	0.106* (0.024)	0.004 (0.069)
Covariates	1.959*** (0.597)	0.723 (0.71)	3.212** (1.095)	1.276 (1.213)	0.085* (0.039)	0.002 (0.001)
Observations	4265	3577	4265	3577	4265	3,577
R ²	0.003	0.015	0.003	0.005	0.010	0.003
Intercept	36.06	26.19	61.72	44.62	2.91	2.57
SE	0.33	0.45	0.614	0.89	0.02	0.04

POST-POLICY variable indicates the pre- and post-policy implementation; the coefficient of interest is on POST-POLICY × GROUP. * $p < .05$, ** $p < .01$, *** $p < .001$. All data are from 2011 to 2014. SE = standard error. Each coefficient is the result of a separate regression. Covariates include demographic factors and pre-college characteristics

The Year 1 Cumulative GPA at IUB is also significant at the $p < 0.05$. However, the interaction effects were non-significant for the IUPUI academic progression variables, suggesting that the credit momentum policy did not achieve its intended effects: increasing credit accumulation and improving student grades.

In relation to whether the POST-POLICY (time) itself impacted the TFCS students, the DiD results showed positive significant time differences at IUPUI for the Year 1 Cumulative Credits ($p < 0.01$) and Year 2 Cumulative Credits ($p < 0.05$), suggesting that changes were happening at IUPUI that effects both TFCS recipient and non-TFCS Pell recipient similarly. On the other hand, although IUB TFCS recipients averaged 1.24 lower Year 1 Cumulative Credits and 2.61 lower Year 2 Cumulative Credits compared to the non-TFCS IUB sample, the time difference appears to have more than made up for these differences, resulting in 2.41 credit hour completion increase for year 1, and a 3.51 credit hour completion increase for year 2 credits for students at IUB. There was also a 0.11 Year 1 Cumulative GPA boost attributable to the POST-POLICY change. Appendix 8 provides the first difference for treatment effects across pre- and post-policy cohorts at IUB and IUPUI (reference only).

When accounting for the covariates in the DiD model (Gender, Race, Generation Status, SAT Scores, High School GPA), the estimated effect of the credit momentum policy slightly changes at IUB. Specifically, at IUB, the significant interaction effects slightly decreased to 1.959 for Year 1 Cumulative Credits, 3.212 for Year 2 Cumulative Credits, and 0.085 for Year 1 Cumulative GPA, respectively. The non-significant interaction effects IUPUI also decreased with the addition of the covariates. The DiD with the covariates model captures the key determinants of students' academic progression for the identifying assumptions of this study. In other words, the DiD analysis with

the covariates provided preliminary evidence that the credit momentum policy through the *15 to Finish* initiative are somewhat associated with greater improvements for low-income students at IUB in terms of accumulated credit hours and GPA.

Binary logistic regression was also performed to examine the impact of the credit momentum policy on timely graduation and delayed graduation rate at IUB and IUPUI (Table 5). Specifically, the interaction effect in the binary logistic regression model shows no policy effect for both the Year 4 Graduation Status and Year 6 Graduation Status dichotomous variables at IUB and IUPUI, suggesting that credit momentum policy through the *15 to Finish* initiative did not improve on-time or delayed graduation rates. However, the regression analysis also showed a negative significant Group effect at IUB for Year 6 Graduation Status ($p < 0.05$), suggesting that changes were happening that effects both Indiana TFCS recipients and non-TFCS Pell recipients who delayed graduation. Specifically, the likelihood of delayed graduation decreased by a factor of 0.77 ($\text{Exp}(B)$) (i.e., indicates the change in odds of graduating), suggesting that some TFCS recipients may have been negatively affected by the policy implementation (i.e., time-related effects). The corresponding effect of POST-POLICY on the Year 4 Graduation Status was in the same direction (negative) but not statistically significant.

On the other hand, the POST-POLICY effects at IUPUI—positive for the Year 4 Graduation Status ($p < 0.001$) and negative for Year 6 Graduation Status ($p < 0.01$)—indicate that there was a time-related effect that apply to both TFCS and non-TFCS recipients at IUPUI. Specifically, the likelihood of on-time graduation rate increased by a factor of 1.38 ($\text{Exp}(B)$) but the chances of delayed graduation decreased by a factor of 0.80 ($\text{Exp}(B)$), suggesting that the time of the policy implementation may have had a negative impact for low-income students at IUPUI. Although there were no interaction effects at both IUB and IUPUI, Table 5 does provide some evidence that broader moves to improve on-time graduation rates through the *15 to Finish* initiative appear to have had a positive impact on timely graduation but may also have had a negative impact

Table 5 Logistic regression of binary variables on college completion status at IUB and IUPUI

	IUB ($N=4265$)			IUPUI ($N=3577$)		
	POST-POLICY	Group	POST-POLICY \times group	POST-POLICY	Group	POST-POLICY \times group
Year 4 graduation status						
<i>B</i>	0.04	-0.12	0.11	0.32	-0.01	0.24
<i>SE</i>	0.09	0.09	0.12	0.12	0.14	0.17
Wald	0.28	1.87	0.77	6.98	1.53	1.92
<i>p</i>	ns	ns	ns	***	ns	ns
Odds ratio	1.05	0.89	1.11	1.38	0.99	1.26
Year 6 graduation status						
<i>B</i>	-0.17	-0.26	0.12	-0.22	-0.14	0.03
<i>SE</i>	0.10	0.10	0.13	0.10	0.11	0.14
Wald	3.17	6.89	0.84	4.93	1.53	0.03
<i>p</i>	ns	***	ns	**	ns	ns
Odds ratio	0.84	0.77	1.13	0.80	0.87	1.03

* $p < .05$, ** $p < .01$, *** $p < .001$

for those students who are not able to keep that pace and decreased the overall 6-year graduation rate among low-income students at IUPUI.

Discussion

The result of this study suggests that Indiana's credit momentum policy through the *15 to Finish* initiative have produced a modest, positive effect on credit hour accumulations and first-year cumulative GPA for IUB TFCS recipients but did not for IUPUI TFCS recipients. Specifically, the analyses pool four academic years from the TFCS program and found that IUB TFCS recipients who were subject to the policy were more likely to complete a higher number of college credits (about 2–3 credit hour benefit) compared to IUB TFCS recipients who entered before the policy went into effect. IUB TFCS recipients who entered in Fall 2013 and Fall 2014 were accumulating credit hours in slightly greater number than their counterparts who entered Fall 2011 and Fall 2012. In addition, IUB TFCS recipients who entered in the Fall 2013 and Fall 2014 were performing slightly better in terms of first-year academic GPA than their peers who entered Fall 2011 and Fall 2012.

On the other hand, although there was no significant interaction effect for TFCS recipients at IUPUI, changes were happening that affected their year-to-year credit hour accumulation over time (time difference), suggesting a time-related effect existed during the post-policy period. The lack of a significant interaction effect, or policy effect, may be due to the broader efforts to decrease time to graduation (as discussed earlier in the literature). With this broader effort, the DiD results at IUPUI may suggest that the credit momentum policy through the *15 to Finish* initiative could improve the rate of 4-year degree completion but at the expense of longer-term completion. That is, cumulatively, more students graduate by year 4 but fewer, overall, by year 6.

The results of the binary logistic regression analysis also showed that the policy did not affect the graduation outcomes for TFCS recipients at either campus, indicating that the *15 to Finish* initiative neither improved timely graduation nor delayed graduation. There are many potential reasons for the non-significant policy effect in the logistic regression analysis, including the lack of scholarship funds available for low-income, first-generation students after their 4th year, in which the Indiana TFCS runs out. Furthermore, TFCS recipients who decide to delay graduation are often left out from the targeted communication and/or student support services programming provided by the Indiana University (IU) twenty-first Century Scholars Program. To overcome such challenge, the IU Office of Scholarships may need to provide unrestricted emergency funds for delayed TFCS recipients who want to obtain their degrees and stay enrolled at either IUB or IUPUI. An example worth emulating is the Georgia State University's (GSU) Panther Retention Grant Program of which provides micro grants to students each semester to help cover modest financial shortfalls affecting students' ability to pay tuition and fees. As a result of such program, sixty-one percent of seniors graduated within two semesters, and 82% were either still enrolled after 1 year or graduated (Higher Learning Advocates, 2019). Given the success of the initiative, campus leaders may want to emulate such completion grant at IUB or IUPUI to improve college completion and time to degree rates for low-income, first-generation students. Policymakers and practitioners could look to existing programs such as Title III, Part A, or the Supplemental Educational Opportunity Grant (SEOG) program for existing resources that may be allocated toward micro-grants (Goldrick-Rab et al., 2021).

The study used ANOVA to test for interaction effects of the covariates (gender, race/ethnicity, generation status, high school GPA, SAT/ACT score) on the academic progression

outcomes. The ANOVA models showed a significant interaction effect for Gender and Generation Status when accounting for POST-POLICY groups (Appendices 3 and 4). Specifically, the Gender effect suggest that TFCS female recipients responded positively to the policy change for all three outcome variables, whereas males did not. A relatively weak significant interaction effect was found for Generation Status on Year 1 Cumulative GPA, suggesting IUB TFCS first-generation recipients responded positively on these outcomes to the policy implementation, whereas their continuing-generation TFCS peers responded negatively. This finding mirrors similar study by EAB (2017), which found that students who take 15 credits per semester have higher GPA than those who take 12 credits. In other words, the credit momentum policy through the *15 to Finish* initiative may have helped a variety of low-income students, including first-generation students that traditionally perform poorly.

The Race variable for which there were no significant interaction effects for the three academic progression variables indicates that the credit momentum policy did not affect students differently by race/ethnicity at IUB (i.e., the effects were similar across racial groups) (Appendix 5). This finding is not all surprising given the fact that the number of students of color attending public institution continues to rise nationwide from about 30 percent to approximately 45% (Espinosa et al., 2019). Specifically, the total completion rate who started at a public 4-year college in fall 2011 was at an all-time high for the majority of Hispanic (81.9%) and Black (72.5%) students who completed within six years (Espinosa et al., 2019). As more students of color continue to enroll and graduate in higher education, IUB and IUPUI has developed several new initiatives and programs to build a culturally engaging campus environment for all students of which may explain the non-significant interaction effects for the Race/Ethnicity variable.

The ANOVA test also revealed that one of the two pre-college characteristics, high school GPA, moderated the effects of the policy, but the other, average college entry exam score (SAT or ACT) did not (Appendices 6 and 7). Specifically, the policy appears to have had a larger effect for students with higher GPAs, given the positive coefficient. The credit momentum policy did not have a differential effect by college entry exam score. This finding is not all surprising given the fact that past studies have consistently shown that high school GPAs are stronger predictors than test scores of college outcomes (Bowen et al., 2009). Notably, Bowen et al. (2009) found the relationship of SAT scores with college outcomes was small and sometimes not significant (depending on institution type) after controlling for high school GPAs. In contrast, high school GPAs had a strong relationship with college outcomes controlling for students' test scores. Hence, the interaction effects for high school GPA and not for SAT score is consistent with past research that claim that high school GPA is a better predictor of college graduation rates than SAT/ACT score (Bowen et al., 2009).

In summary, this study provides evidence that TFCS recipient appears to have somewhat benefited from the *15 to Finish* initiative at IUB but not at IUPUI. Specifically, this quasi-experimental research provides evidence that the Indiana Code 21-12-6-7 has a differential policy effect for certain student groups and for certain types of institution within an early commitment, need-based, first-dollar college promise program. However, the non-significant interaction effect at IUPUI may be viewed as compensatory guided by the assumption that the *15 to Finish* policy initiative may shape academic progress and graduation status along different dimensions in different ways. For example, the credit momentum policy might indeed encourage some IUPUI TFCS recipients to study longer hours or to participate in group tutoring and thus improve on-time degree completion, but they also might compensate for others—increasing delayed graduation rate because of higher

levels of financial stress to fulfill scholarship renewal requirements. That is, holistically, the credit momentum policy may have been effective at IUPUI that is far beyond the scope of this study impacting both TFCS recipients and non-TFCS Pell recipients. Ultimately, the question is not whether it is possible the credit momentum policy can improve college graduation rates of low-income, first-generation students; the question is whether the credit momentum policy through the *15 to Finish* initiative is the best strategy for reducing them.

Limitations

There are several limitations regarding the overall research design of this study. Specifically, this research did not take into consideration the potential effect of recent banded tuition implemented at IUB and IUPUI, which started in Fall 2016. Notably, some TFCS recipients and non-TFCS Pell recipients may have accumulated additional credit hours simply by taking advantage of the “flat-rate” tuition rate across the Indiana University system and thus, the tuition policy (and not the credit momentum policy) may have improved the academic progression of low-income, first-generation students at IUB and IUPUI. In addition, this study did not analyze the effect of the credit momentum policy on TFCS persistence and retention rates between year 1 and year 6. Instead, this study solely focused on the academic progression (credits, GPA) of TFCS recipients and non-TFCS Pell recipients at IUB and IUPUI, along with on-time and delayed graduation status. Future studies should examine college promise program recipients each academic years to understand the persistence and retention rates before and after the policy implementation.

This study is also limited to only 1–2 academic years pre- and post-policy implementation in 2012 and thus, the internal validity of this study may be invalid as the performance-based financial aid policy could have decreased credit hours accumulation in both Year 1 and Year 2. A follow up study should consider additional years before and after the policy implementation in 2012–2013 (e.g., 3–4 years prior to policy implementation), along with the overall selection (i.e., students who have better academic performance might be more likely to participate in the TFCS program after the policy change) and cumulative credits attempted (i.e., students who have completed a class but earned an “F” or “W”) of TFCS recipients.

In addition to those limitations, this research did not take into consideration the advances of DiD regarding how the models could assume a linear interaction effect that may change at a constant rate with the moderator (Hainmueller et al., 2019). Specifically, this study did not consider the conditional effects of the independent variable at all values of which requires sufficient common support (Hainmueller et al., 2019). Furthermore, this research did not perform a doubly robust estimator for the average treatment effect on the treated (Sant’Anna & Zhao, 2020). As the methodological understanding of DiD framework continues to change (as scholars find additional spaces for bias to be introduced or remain in the estimates), higher education scholars may want to replicate this study in the future by using a combination of both DiD and other quantitative techniques such as, regression discontinuity design (RDD), propensity score matching (PSM), event history analysis, latent class analysis (LCA), or machine learning (ML) techniques to ensure that the interaction effects are at best highly model dependent (Furquim et al., 2020). By doing so, higher education scholars and policymakers can better assess the validity of these assumptions and offer flexible estimation strategies that allow for nonlinear interaction effects against excessive extrapolation.

Future Research

Rising tuition costs and decreasing state appropriations will continue to impact the future of college promise programs (and debt free college proposals) across the United States (College Leigh & González Canché, 2021; Odle et al., 2021; Promise, 2021b). Given that the concept of the *15 to Finish* initiative is new phenomenon, future research should be conducted to examine how policymakers can design credit momentum policies that advances equity, as well as provide greater transparency to students and families about the changes to performance-based financial aid programs (Perna et al., 2021). One area of need for future research is to extend this type of study, examining the impact of credit momentum policies on promise program participants at different types of institutions (e.g., doctoral institutions vs. community college institutions; minority-serving institution vs. predominately White institution; for-profit vs. non-profit; public vs. private; distance education vs. in-person). In addition, future research should explore how and why credit momentum practices are changing, and how performance-based funding (PBF) policies may be connected to the desire for performance-based financial aid in higher education (Ortagus et al., 2021). Moreover, new studies should examine the impact of performance-based financial aid on other types of students (e.g., adult students, military and public safety-affiliated students, rural students, single parent students, career and technical education students), and other institutional factors (e.g., intensity of employment, percentage of Pell recipients) that may affect the academic progression and graduation of low-income students (Custer & Akaeze, 2021; Leigh & González Canché, 2021).

Conclusion

This research took the first step in the field of higher education to empirically investigate the relationship between credit momentum policies and student outcomes and demonstrated the modest positive effects of the policy for some in-process measures (credits, GPA) among some types of students (women, first-generation) at IUB and, to a lesser extent, at IUPUI. Specifically, this study found that the credit momentum policy through the *15 to Finish* initiative are moderately predictive of academic outcomes at Indiana's need-based, first dollar, TFCS program. This result is promising in the context of existing research on financial aid and free college tuition, which generally finds small positive impacts for enrollment or persistence with limited evidence on outcomes (Anderson et al., 2020; Bell, 2021; Bell & Gándara, 2021; Collier et al., 2020; Custer & Akaeze, 2021; Erwin & Binder, 2020; Gándara & Li, 2020; Gurantz, 2020; Kramer et al., 2018; Nguyen, 2019, 2020; Page et al., 2019; Swanson & Ritter, 2020). However, the study and its limitations raised some important questions for additional research. Specifically, the effect of the credit momentum policy on other types of institution (community college, for-profit college) is still unknown, given that the *15 to Finish* initiative was launched in Fall 2013. In addition, the effect of the policy is somewhat unclear for all types of students, as the study did not provide evidence as to why the initiative had no effect for TFCS males. Moreover, the study did not account for those who transferred to IUB or IUPUI during the spring semester, which may have some effect on credit accumulation (Doyle, 2011; Worsham et al., 2021). However, the study assumes that the effect is low given the fact that most TFCS recipients typically enroll immediately in the fall semester after high school.

Second, this study did not examine non-traditional students (adult learners), given the recent rise of college promise programs designed for these populations (Bell, 2019; Collom, 2022). There are ten states that have either created or piloted adult college promise programs: Arizona, Indiana, Maine, Minnesota, Oklahoma, Rhode Island, Tennessee, Texas, Washington, and Wyoming (Carlson & Laderman, 2018). Adult students are becoming more diverse in backgrounds than traditional students. They are older, more likely to be enrolled part-time, and more likely a member of a racial minority group. Many are employed full-time and have family responsibilities outside of higher education that prevents them from graduating when compared to traditional students. To make matters worse, adult students also are more likely to delay graduation and take additional credits that do not lead to a degree or credential. For these reasons, future research is necessary to examine how credit momentum policy for adult students would impact their academic progression and graduation rates. A follow up study should explore whether such academic performance metrics for adult students who receives a promise scholarship will have increased graduation and time-to-degree rate.

The Indiana legislature implemented the 30-credit hour annual completion policy to improve the efficiency of degree production of low-income students. Although nine academic years have passed since the introduction in Fall 2013, the effectiveness of the policy is still in its infancy. It was the author's concern that the credit momentum policy through the *15 to Finish* initiative either increases the academic pressure and on-time completion for low-income, first-generation students or merely decreases timely graduation rates. This study served as a much-needed policy evaluation and found that the credit momentum policy showed modest positive effects on early academic progress (credits and GPA) for some types of students at IUB but, most importantly, that the policy did not improve on-time or delayed graduation status at either IUB or IUPUI.

The results from this study contribute to filling the gap in the higher education policy literature and provide future research to advance the understanding of academic momentum in postsecondary education. It is not an easy task to set credit hour completion requirements in college promise programs that is equitable for all types of students, especially during the COVID-19 pandemic (and endemic) (College Promise, 2021b). In addition, the increased diversity in student population across the United States makes the *15 to Finish* initiative more challenging, as there is no one size fit all solution. To ensure that students attain their degrees, policymakers and teacher-scholars must make student success the number one goal in college promise programs. They must advocate for culturally responsive, equity-minded policies and practices impacting low-income students in higher education. The success of policy implementation and innovativeness is highly dependent upon the intersection of policies, people, and places (Tandberg et al., 2022). New regulations, statutes, and innovations being created at the federal and state levels must be designed to help all students, regardless of their background (gender, age, race, generation, religion, disability, socioeconomic status).

Appendix 1: Descriptive Statistics of Independent Variables and Pre-college Characteristics, by Award Status Group at IUB and IUPUI

Indiana University Bloomington

Independent variables

	TFCS RECIPIENTS		NON-TFCS PELL RECIPIENTS	
	<i>N</i>	%	<i>N</i>	%
Gender				
Female	1271	58.9	1172	55.5
Male	884	41.1	938	44.5
Generation status				
First-generation	1060	49.2	816	38.7
Continuing-generation	1095	50.8	1294	61.3
Race/ethnicity				
Caucasian/white	1186	55.0	1428	67.7
African American/Black	580	26.9	326	15.5
Hispanic/Latinx	240	11.1	157	7.4
Asian American	108	5.0	147	7.0
American Indian	17	0.7	23	1.1
Non-Resident/Alien	1	0.0	1	0.0
Other/unknown	23	1.1	28	1.3

Pre-college characteristics

	TFCS RECIPIENTS		NON-TFCS PELL RECIPIENTS	
	<i>N</i>	Mean	<i>N</i>	Mean
Academic performance group				
High school GPA	2144	3.55	2073	3.57
SAT score	2155	1163	2103	1202

Indiana University-Purdue University, Indianapolis (IUPUI)

Demographic factors

	TFCS RECIPIENTS		NON-TFCS PELL RECIPIENTS	
	<i>N</i>	%	<i>N</i>	%
Gender				
Female	1197	66.8	1104	61.8
Male	594	33.2	682	38.2
Generation status				
First-generation	983	54.8	903	50.5
Continuing-generation	808	45.2	883	49.5
Race/ethnicity				
Caucasian/White	1006	56.2	1146	64.2
African American/Black	458	25.6	311	17.4
Hispanic/Latinx	198	11.1	154	8.6

	TFCS RECIPIENTS		NON-TFCS PELL RECIPIENTS	
	<i>N</i>	%	<i>N</i>	%
Asian American	87	4.9	134	7.5
American Indian	18	1.0	14	0.8
Non-Resident/Alien	1	0.0	2	0.1
Other/unknown	23	1.1	25	1.4

Pre-college characteristics

	TFCS RECIPIENTS		NON-TFCS PELL RECIPIENTS	
	<i>N</i>	Mean	<i>N</i>	Mean
Academic performance group				
High school GPA	1774	3.30	1710	3.30
SAT score	1781	1041	1707	1073

Appendix 2: Descriptive Statistics of Academic Outcomes Variables, by Award Status Group at IUB and IUPUI

Indiana University Bloomington

Academic progress variables

	TFCS RECIPIENTS		NON-TFCS PELL RECIPIENTS	
	Mean	SD	Mean	SD
Year 1 cum. credits completed	35.8	10.83	35.9	10.00
Year 2 cum. credits completed	60.4	20.02	61.2	18.68
Year 1 cumulative GPA	2.74	0.79	2.89	0.73

College completion status variables

	TFCS RECIPIENTS		NON-TFCS PELL RECIPIENTS	
	<i>N</i>	%	<i>N</i>	%
Year 4 graduation status				
Graduated	1095	49.1	1106	52.4
Not graduated	1060	50.8	1004	47.6
Year 6 graduation status				
Graduated	1434	66.5	1491	70.7

	TFCS RECIPIENTS		NON-TFCS PELL RECIPIENTS	
	<i>N</i>	%	<i>N</i>	%
Not graduated	721	33.5	619	29.3

Indiana University-Purdue University, Indianapolis (IUPUI)

Academic progress variables

	TFCS RECIPIENTS		NON-TFCS PELL RECIPIENTS	
	Mean	SD	Mean	SD
Year 1 cum. credits completed	28.3	11.69	27.7	11.57
Year 2 cum. credits completed	47.0	23.21	46.1	22.58
Year 1 cumulative GPA	2.49	0.99	2.59	0.99

College completion status variables

	TFCS RECIPIENTS		NON-TFCS PELL RECIPIENTS	
	<i>N</i>	%	<i>N</i>	%
Year 4 graduation status				
Graduated	453	25.3	402	22.5
Not graduated	1338	74.7	1384	77.5
Year 6 graduation status				
Graduated	824	46.1	875	48.9
Not graduated	967	53.9	911	51.1

Appendix 3: Test of Gender as Moderator of Policy Effect on TFCS Students at Indiana University Bloomington

Source	Sum of squares	df	Mean square	<i>F</i>	<i>p</i>
Year 1 cumulative credits					
POST-POLICY	405.462	1	405.462	3.781	0.055
Gender	5298.724	1	5298.724	49.410	0.001***
POST-POLICY × Gender	541.480	1	541.480	5.049	0.025**
Residual	456,947.735	4261	107.240		
Year 2 cumulative credits					
POST-POLICY	332.599	1	332.599	0.898	0.343
Gender	18,047.265	1	18,047.265	48.712	0.001***

Source	Sum of squares	df	Mean square	<i>F</i>	<i>p</i>
POST-POLICY × Gender	1731.981	1	1731.981	4.675	0.031*
Residual	1.579e+6	4261	370.492		
Year 1 cumulative GPA					
POST-POLICY	0.007	1	0.007	0.013	0.910
Gender	40.298	1	40.298	69.916	0.001***
POST-POLICY × Gender	4.132	1	4.132	7.174	0.007**
Residual	2454.380	4261	0.576		

p* < 0.05, *p* < 0.01, ****p* < 0.001

Appendix 5: Test of Generation Status as Moderator of Policy Effect on TFCS Students at Indiana University Bloomington

Source	Sum of squares	df	Mean square	<i>F</i>	<i>p</i>
Year 1 cumulative credits					
POST-POLICY	633.557	1	633.557	5.840	0.016**
Generation	547.021	1	547.021	5.043	0.025**
POST-POLICY × Generation	309.321	1	309.321	2.851	0.091
Residual	462,226.455	4261	108.478		
Year 2 cumulative credits					
POST-POLICY	741.578	1	741.578	1.982	0.159
Generation	4178.084	1	4178.084	11.168	0.001***
POST-POLICY × Generation	1199.007	1	1199.007	3.205	0.073
Residual	1.594e+6	4261	374.124		
Year 1 cumulative GPA					
POST-POLICY	0.241	1	0.241	0.413	0.521
Generation	14.186	1	14.186	24.326	0.001***
POST-POLICY × Generation	2.230	1	2.230	3.824	0.050*
Residual	2484.909	4261	0.583		

p* < 0.05, *p* < 0.01, ****p* < 0.001

Appendix 5: Test of Race as Moderator of Policy Effect on TFCS Students at Indiana University Bloomington

Source	Sum of squares	df	Mean square	<i>F</i>	<i>p</i>
Year 1 cumulative credits					
POST-POLICY	107.085	1	107.085	1.003	0.317
Race	8189.961	6	1364.994	12.788	0.001***
POST-POLICY × Race	991.193	5	198.239	1.857	0.098

Source	Sum of squares	df	Mean square	<i>F</i>	<i>p</i>
Residual	453,852.705	4252	106.739		
Year 2 cumulative credits					
POST-POLICY	70.235	1	70.235	0.191	0.662
Race	28,848.213	5	5769.643	15.686	0.001***
POST-POLICY × Race	2479.026	4	619.756	1.685	0.151
Residual	1,545,947.294	4203	367.820		
Year 1 cumulative GPA					
POST-POLICY	0.051	1	0.051	0.091	0.763
Race	101.691	5	20.338	36.354	0.001***
POST-POLICY × Race	2.427	4	0.607	1.084	0.362
Residual	2351.376	4203	0.559		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 6: Test of High School GPA as Moderator of Policy Effect on TFCS Students at Indiana University Bloomington

Source	Unstandardized	Standard Error	Standardized	<i>t</i>	<i>p</i>
Year 1 cumulative credits					
POST-POLICY	− 6.345	2.879	− 0.304	− 2.204	0.028*
High School GPA	10.281	0.572	0.362	17.984	0.001***
POST-POLICY × high school GPA	1.834	0.805	0.318	2.279	0.023*
Year 2 cumulative credits					
POST-POLICY	− 5.845	5.364	− 0.151	− 1.090	0.276
High School GPA	19.969	1.065	0.378	18.747	0.001***
POST-POLICY × high school GPA	1.571	1.499	0.147	1.048	0.295
Year 1 cumulative GPA					
POST-POLICY	− 0.593	0.196	− 0.386	− 3.021	0.003**
High School GPA	1.017	0.039	0.488	26.112	0.001***
POST-POLICY × high school GPA	0.155	0.055	0.366	2.824	0.005**

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 7: Test of SAT Score as Moderator of Policy Effect on TFCS Students at Indiana University Bloomington

Source	Unstandardized	Standard Error	Standardized	<i>t</i>	<i>p</i>
Year 1 cumulative credits					
POST-POLICY	2.857	2.827	0.137	1.011	0.312
SAT Score	0.018	0.002	0.229	10.695	0.001***
POST-POLICY × SAT Score	-0.002	0.002	-0.116	-0.846	0.398
Year 2 cumulative credits					
POST-POLICY	9.179	5.290	0.237	1.735	0.083
SAT Score	0.031	0.003	0.208	9.659	0.001***
POST-POLICY × SAT Score	-0.007	0.004	-0.231	-1.671	0.095
Year 1 cumulative GPA					
POST-POLICY	0.127	0.205	0.082	0.616	0.538
SAT Score	0.002	1.233	0.272	12.834	0.001***
POST-POLICY × SAT Score	-1.137	1.727	-0.089	-0.659	0.510

p* < 0.05, *p* < 0.01, ****p* < 0.001

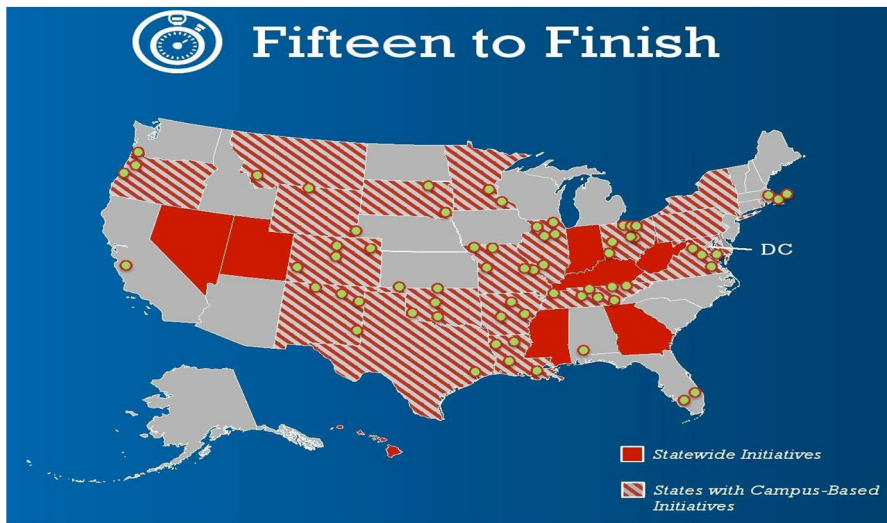
Appendix 8: First Difference Estimates for Treatment Effects across Pre- and Post-Policy Cohorts at IUB and IUPUI

	IU Bloomington (<i>N</i> = 4265) POST-POLICY	IUPUI (<i>N</i> = 3577) POST-POLICY
Year 1 cumulative credits completed		
B	0.723	2.834
SE(B)	0.319	0.400
t-stat	2.26	7.08
Sig	*	***
	(intercept = 35.44, SE = 0.233, <i>p</i> < 0.001; <i>R</i> ² = 0.001)	(intercept = 26.24, SE = 0.318, <i>p</i> < 0.001; <i>R</i> ² = 0.014)
Year 2 cumulative credits completed		
B	0.741	3.031
SE(B)	0.594	0.792
t-stat	1.25	3.83
Sig	ns	***
	(intercept = 60.40, SE = 0.594, <i>p</i> < 0.001; <i>R</i> ² = 0.001)	(intercept = 44.60, SE = 0.628, <i>p</i> < 0.001; <i>R</i> ² = 0.004)
Year 1 cumulative GPA		
B	0.011	0.033
SE(B)	0.024	0.034
t-stat	0.48	0.96
Sig	ns	ns

IU Bloomington ($N=4265$)	IUPUI ($N=3577$)
POST-POLICY	POST-POLICY
(intercept = 2.808, SE = 0.017, $p < 0.001$; $R^2 = 0.001$)	(intercept = 2.520, SE = 0.027, $p < 0.001$; $R^2 = 0.001$)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; p value levels represent significant differences between TFCS recipients and Non-TFCS Pell Recipients; sig = significant; ns = not significant; B = estimate; SE = standard error; Each coefficient is the result of a separate regression

Appendix 9: Complete College America (CCA): 15 to Finish initiative



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