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Altering Expectations: Effects of Backloading Merit Scholarship Payments on Postsecondary Enrollment Choices

Katherine Kopotic
Saint Louis University

Jonathan N. Mills
The Coleridge Initiative

Evan Rhinesmith
Saint Louis University

ABSTRACT

While the popularity of state-financed merit-based scholarships has increased since the 1980s, policymakers struggle to maintain these programs because of growing costs. Some have tried to manage this tradeoff through eligibility changes or award amounts; however, little empirical research exists on the effectiveness of these changes. We add to the financial aid literature by determining if college enrollment responded to a 2013 restructuring of Arkansas's Academic Challenge Scholarship from equal annual awards to a backloaded system with progressively higher payouts to students who persisted. We identify no statistically significant impacts associated with the 2013 change; however, point estimates are generally negative. We believe this is the first study to examine if moving to a backloaded payout structure affects college enrollment.
Keywords: financial aid, merit scholarships, college enrollment, post-secondary institutions, difference-in-differences

The popularity of state-financed merit scholarships, which provide grant aid to students satisfying pre-specified academic requirements for attendance at higher education institutions, has dramatically increased since their inception in the 1980s. These programs are expensive, however, especially as more students meet their

qualifications. Several states have considered changes to program requirements or financial aid amounts to allow these popular programs to continue considering budget shortfalls. While there is a robust empirical literature demonstrating the ability of these programs to improve college access and attainment when introduced, few studies, if any, examine how *changes* to these programs impact students (e.g., Cornwell et al., 2005, 2006; Dynarksi, 2000; Henry & Rubinstein, 2002; Zhang et al., 2016). This study addresses this gap in the literature by determining whether a shift from an equal installment payment plan to a backloaded payment structure that provides increasing amounts as students persist through college impacts college enrollment.

Strong empirical evidence indicates positive returns to postsecondary attainment. A college education is associated with higher salaries, improved health, and a decreased likelihood of getting divorced (Lawrence, 2017; Wang, 2015). Additionally, the returns to postsecondary education have steadily increased in the United States' skills-based economy (Oreopoulos & Petronijevic, 2013). Nevertheless, while the college enrollment rate for 18-24 year-olds has consistently increased over the last two decades (National Center for Education Statistics, 2019a), many students fail to complete their degrees. As of 2017, only 60 percent of undergraduate students completed their bachelor's degree within six years. Attainment also varies significantly by institution type, with nearly 90 percent of students graduating within six years from selective four-year institutions, compared to only 31 percent of students graduating from open-admissions four-year institutions within six years (National Center for Education Statistics, 2019a).

Some attribute the uncertain link between enrollment and attainment to dramatically increasing costs of college. From 2000-2017, the inflation-adjusted average cost of attendance at public four-year institutions has increased from $12,000 to $19,000. Private four-year institutions experienced an increase from $30,000 to $41,000, and two-year institutions saw an increase from almost $7,000 to $10,000 over the same time period (National Center for Education Statistics, 2019b). These increasing costs can pose an important barrier to access and enrollment in college, as well as persistence and completion.

Financial aid, which seeks to reduce the upfront cost of college, is one of the most prevalent interventions used to increase both college access and attainment (Dynarski, 2008). Financial aid can take many forms, including loans--which provide borrowed funds while requiring repayment at a later date--or grants and scholarships--which directly subsidize the cost of college for the student (College Board, 2019). With the passage of the *Higher Education Act of 1965*, aid per student has nearly tripled over the last 60 years (Dynarski & Scott-Clayton, 2013; Ma & Pender, 2020). Federal grants, such as the Pell Grant, account for 60 percent of distributed aid, while grants from institutions of higher education account for 19 percent of aid. In 2017, over 80 percent of students enrolled in four-year institutions reported having some type of financial aid (National Center for Education Statistics, 2019c).

While the majority of financial aid is federally awarded, individual states also offer financial aid, typically in the form of merit-based scholarships. State-financed merit-based scholarships are grant aid programs that tie eligibility to student performance on standardized college readiness assessments, such as the SAT or ACT,

and high school performance, often measured by GPA. These programs can be contrasted with need-based grant aid, where eligibility is typically based on parental income. State-financed merit-based scholarships have become increasingly popular to both individual families and policymakers. State policymakers, for example, often promote these programs, arguing they can increase college enrollment, incentivize high-performing students to stay within the state, and promote and reward academic achievement through merit-based eligibility (Cornwell et al., 2005). As of 2015, 29 states had such programs (Legislative Fiscal Office, 2017).

Evaluations of state-financed merit-based scholarships suggest that these programs increase the likelihood of enrollment in postsecondary institutions and, in some cases, attainment. Rigorous quasi-experimental studies find such programs improve the likelihood of college attendance (Cornwell et al., 2006; Dynarski, 2003; Kane, 2003; Scott-Clayton, 2012), persistence past the first year of college (Bettinger, 2004; Castleman & Long, 2016), cumulative GPA (Scott-Clayton, 2012; Swanson & Ritter, 2020), and graduation (Bettinger et al., 2019; Dynarski, 2008; Scott-Clayton, 2012; Scott-Clayton & Zafar, 2019).

While the popularity of these programs has grown due to these positive effects, states have struggled to maintain funding as more students qualify for the awards. In Louisiana, for example, Governor John Bel Edwards attempted to eliminate $233 million in funding for the popular Taylor Opportunity Program for Students in 2018 in response to a budget shortfall (Crisp, 2018). Moreover, funds often run out before all qualified students receive their scholarships; a 2018 analysis by the Hechinger Report found that 900,000 eligible low-income applicants did not receive state-financed scholarships because states ran out of money (Kolodner, 2018).

States have modified their scholarships in response to constrained budgets in the hopes of maintaining their popular programs. For example, the Florida Legislature passed a bill that increased the minimum test score needed to qualify for the Bright Futures Scholarship Program, impacting graduating students starting college in 2021 (Mahoney, 2019). While other states have reduced award amounts or implemented more rigorous qualification requirements to shrink the pool of qualifiers, Arkansas decided to shift the award payout structure for its Academic Challenge Scholarship (ACS) from equal annual installments to a backloaded structure in 2013 (Kopotic, 2020). This change awards students progressively higher amounts as they persist through college, incentivizing completion. In theory, the new payout structure would directly benefit the state by increasing its return on investment through more college graduates. On the other hand, Arkansas's move to a backloaded ACS payout structure could disincentivize college enrollment by unambiguously increasing both the overall and initial cost of enrolling at a four-year institution. The overall award amount decreased from $18,000 to $14,000 over four years under the backloaded payout structure (Kopotic, 2020). Our study's goal is to determine how college enrollment in Arkansas was affected by this switch to a backloaded payout structure.

We estimate the impact of the change to Arkansas's scholarship program using a difference-in-differences design applied to state-level panel data on college enrollment available through the Integrated Postsecondary Education Data System (IPEDS). In effect, we estimate the impact of the payout change by comparing trends

in college enrollment in Arkansas to similar southern states before and after the switch to the backloaded structure.

In general, our analysis indicates no statistically significant impact on overall college enrollment or enrollment in four-year institutions resulting from the 2013 switch to a backloaded payout structure. While our results are inconclusive on the overall impacts of the policy change in Arkansas's merit scholarship, we do observe patterns that this change may have had negative impacts on students' willingness to enroll in college. Previous research on statewide merit scholarships in other settings has found that introducing programs similar to that in Arkansas can have a positive impact on students' postsecondary educational outcomes (Cornwell et al., 2005; Cornwell et al., 2006; Dynarksi, 2000; Zhang et al. 2013). However, our findings—while not statistically significant—suggest that dramatic changes in *how* funds are awarded and the amount of funding available can potentially adversely impact students. States should proceed with caution if considering similar changes.

The remainder of this paper is structured as follows. We begin with a detailed description of Arkansas's merit-based scholarship, the ACS, and subsequent alterations to its payout structure in 2013. We then review the current literature examining the impacts of merit-scholarships on postsecondary enrollment and attainment. Next, we detail our empirical methodology and present our results. We conclude with a discussion about the implications of our findings and policy relevance.

DESCRIPTION OF THE ACADEMIC CHALLENGE SCHOLARSHIP PROGRAM

The Arkansas Academic Challenge Scholarship (ACS) Program is a state-wide, broad-based merit scholarship program with multiple qualification standards. The program was originally created in 1991; however, the scholarship was not widely used until it was dramatically expanded in 2010 thanks to funding from Arkansas's first statewide lottery. The Arkansas Scholarship Lottery was approved by voters in November 2008, with the understanding that a portion of the proceeds would go to fund the ACS. Lottery tickets originally went on sale in the fall of 2009 and scholarships were awarded under the expanded program in fall 2010 (Mills, 2015).

ACS eligibility requirements have remained unchanged since its inception in 2010 and 2016, the time period examined in this study. To receive a scholarship, students must be an Arkansas resident for at least 12 months prior to enrolling in college, must either have a 2.5 high school GPA or score a 19 or higher on the ACT (or concordant score on an equivalent test), and graduate high school completing the standard *SmartCore* curriculum. The *SmartCore* requires four English language arts, four mathematics, three science, and three social studies credits, as well as half a credit each in oral communication, physical education, health and safety, and fine arts. An additional six credits in career or other content area are required for graduation. Finally, to receive the scholarship, students must fill out the FAFSA and complete an application (Arkansas Division of Higher Education, 2018).

The ACS additionally has requirements for on-going eligibility. Once awarded a scholarship, students must maintain at least a 2.5 GPA, enroll in at least 12 credit hours for their first semester, and 15 credit hours each semester thereafter, and must be continuously enrolled and working towards a terminal degree (Arkansas Division of Higher Education, 2018). The original ACS award was substantial. Qualified students enrolling in four-year institutions in 2010 received equal installments $5,000 per year, which roughly covered 95 percent of tuition at the state's flagship institution the University of Arkansas-Fayetteville, during the 2010-11 school year (National Center for Education Statistics, Integrated Postsecondary Education Data Systems, 2021a).

To date, over 500,000 scholarships have been awarded, totaling over $965 million in postsecondary financial aid (Arkansas Division of Higher Education, 2018). For the first cohort of recipients, students received up to $20,000 over a four-year period, covering roughly 90 percent of the cost of tuition at the state's flagship institution at the time (Mills, 2015). Table 1 describes how the ACS payouts have changed during the time period examined by this study.

While the award amount decreased slightly for fall 2011 applicants, the overall payout of $18,000 still was sufficient to cover 75 percent of tuition. The first major change to the ACS payout structure occurred for the fall 2013 applicant cohort, due largely to increased numbers of qualified applicants and falling lottery revenue (Beherec, 2013). Unlike previous cohorts, the fall 2013 applicant cohort received a significantly lower award amount in their first year and progressively increasing payouts throughout their college experience. The resulting total award amount decreased from $18,000 to $14,000 over a four-year period. While policymakers at the time argued that this change would incentivize enrollment and persistence, no previous empirical evidence exists which could support such claims. Our research addresses this gap in the literature.

Table 1: ACS Award Amounts by Year

Year (Fall)	Amount by Year	Four-Year School	Two-Year School
2010	All Years	$5,000	$2,500
2011 - 2012	All Years	$4,500	$2,250
2013-2015	Year 1	$2,000	$2,000
	Year 2	$3,000	
	Year 3	$4,000	
	Year 4	$5,000	

Source: Arkansas Department of Higher Education, 2018
(https://scholarships.adhe.edu/scholarships/detail/academic-challenge-scholarships)
Notes. "All Years" indicates that awards were paid out in equal installments to students attending four-year institutions for all four years.

LITERATURE REVIEW

Tangible barriers to college access can be broadly grouped into three categories: lacking financial resources, lacking information on how to enroll in college, and lacking preparation for college (Page & Scott-Clayton, 2016). We begin by briefly discussing interventions designed to address the information and preparation barriers. We then turn to the focus of our study: interventions attempting to address the financial barrier.

Information, or a lack thereof, can deter students from pursuing postsecondary education (Avery & Kane, 2014; Castleman & Page, 2014; Hamilton et al., 2018; Hoxby & Avery, 2012). Interventions aimed at providing students with information about the college application process can increase college application and enrollment rates (Barr & Turner, 2017; Hoxby & Turner, 2013; Page & Gehlbach, 2017). Furthermore, interventions with both informational and personal interaction have been shown to increase enrollment at selective institutions (Sanders, 2018).

In addition to informational barriers about the application process and pipeline between high school and college, students may face preparation barriers that prevent them from pursuing postsecondary education (Avery & Kane, 2014; Gonzalez et al., 2011; Hamilton et al., 2018). This could be particularly salient for would-be first-generation students, as they are less likely to take advanced placement courses compared to continuing generation students (Cataldi et al., 2018).

Policymakers and researchers have long considered financial constraints to be significant barriers to college access; and many financial aid programs attempt to reduce this burden. Since the passage of the *Higher Education Act of 1965*, aid amount per student has tripled (Dynarski & Scott-Clayton, 2013), which is unsurprising, as the theory of action is that financial aid for education can work to improve college attendance by reducing the overall cost of college (Dynarski, 2008).

Indeed, the availability of financial support led to over 83 percent of students in four-year institutions between 2010 and 2019 reported receiving some type of financial aid (National Center for Education Statistics, 2021b). Despite this increased availability in financial aid, the amount available has failed to keep pace with the rising cost of tuition at two- and four-year postsecondary institutions (Ma et al., 2020).

Financial aid can take several forms including loans, grants, and scholarships. Most financial aid is federally distributed, with institutional aid and state aid constituting 19 and five percent of distributed aid, respectively (College Board, 2013). While many financial aid programs have a need-based component, several states have aid programs based primarily on merit. These programs link financial aid with performance on standardized tests and high school GPA. One such program is the ACS, funded by the Arkansas state lottery. Similarly, the Georgia HOPE Scholarship and Florida Bright Futures Scholarship Program award financial aid based on merit. To qualify for the Georgia HOPE Scholarship, students must have at least a 3.0 high school GPA, and students qualifying for the Florida Bright Futures Scholarship Program must demonstrate a 3.0-3.5 high school GPA depending on the qualification tier (Dynarski, 2000; Zhang et al., 2013).

The Georgia HOPE Scholarship began distributing scholarship funds gained from the state-run lottery to in 1993. Similarly, the Florida Bright Futures Program began using funds from the state-run lottery in 1997. As these programs have become more established and these states have funneled greater amounts for students to use for college enrollment, researchers have used quantitative methods to analyze the impacts of these programs (e.g., Cornwell et al., 2005; Cornwell et al., 2006; Dynarksi, 2000; Zhang et al. 2013).

Research on the HOPE Scholarship Program has had a positive impact on college enrollment. Dynarski's (2000) analysis of the Georgia HOPE Scholarship uses a difference-in-differences approach to analyze the impact of the program's implementation on college attendance for middle- and upper-income students in Georgia, compared to their peers in surrounding states. Overall, this study finds that the HOPE scholarship increased college enrollment for Georgia students by seven to eight percentage points in comparison to surrounding states (Dynarski, 2000). The results suggest that for each additional $1,000 available in aid, the college matriculation rate in Georgia increases by three to four percentage points (Dynarski, 2000). However, these results suggest that the program may also widen the gap in attendance rates for White and Black students (Dynarski, 2000).

In other studies of the HOPE program, Cornwell et al. (2006), using a difference-in-differences design, find that the Georgia HOPE Program increased freshmen enrollment by nearly six percent, relative to other Southeastern states from 1988-97, with four-year colleges accounting for most of the gain. They conclude that the Georgia HOPE Program helped to keep students in state, and the reduction of students leaving the state for college accounted for over 60 percent of the increase in four-year enrollment.

Additionally, Cornwell et al. (2005) estimate the effects of the program on the course-taking behavior of HOPE recipients. Comparing in-state, HOPE-eligible enrollees to out-of-state enrollees at the University of Georgia, Cornwell et al. found that HOPE recipients enroll in fewer credit hours than their peers who were ineligible for the scholarship. Henry and Rubinstein (2002) examine whether the implementation of the HOPE Scholarship has altered educational quality in high school graduates, finding that the percentage of students earning a B average or higher in high school—thereby qualifying for the scholarship—increased from about 55 percent to 59 percent of graduates. Additionally, African American [sic] students qualifying have increased their average SAT scores by 20 points (Henry & Rubinstein, 2002).

Similarly, results from research on the Florida Bright Futures Scholarship shows overall positive impacts on enrollment. Using a regression-discontinuity, Zhang et al. (2016) find students who just meet the cutscore, and are therefore awarded a scholarship, were 3 to 10 percentage points more likely to enroll in a public four-year institution than their peers who fail to meet the eligibility requirement. The variation in the size of the impact is due to the program's varying award amount based on tier for which students qualify based on their achievement. Another study of the Bright Futures Scholarship from Zhang et al. (2013) finds that being awarded a scholarship yields a 22-percentage point increase in enrollment at four-year institutions and a 19-percentage point increase in enrollment at two-year institutions in Florida.

Overall, the literature suggests that financial aid, specifically in the form of merit-aid can increase enrollment at postsecondary institutions, however, there is a gap in the literature on how the construction of the payout structure can influence student choices. Typically, aid programs provide a consistent dollar amount while students are enrolled. While this was true of the ACS at the time of its expansion, we have shown that Arkansas program has undergone significant changes in both dollar amount and payout schedule since its inception. The research we present here seeks to fill this gap by first evaluating the impact of the ACS on postsecondary enrollment patterns in Arkansas, as well as the degree to which the shift in award payout structure affects subsequent student secondary enrollment behaviors in Arkansas. The results from Arkansas can serve as an example of *how* a state might provide aid to students, and whether initial dollar amount and the payout schedule are important for students' postsecondary enrollment expectations.

METHODOLOGY

We determine the impact of changing the award payout structure from equal installments to a backloaded payout system on postsecondary enrollment patterns in Arkansas using a difference-in-differences design (DD). The following sections detail our empirical strategy and the data used for this study.

Empirical Strategy

Ideally, we would estimate the impact of the ACS payout change in an experimental research setting by randomly assigning students to receive scholarship awards in either equal installments or via ACS's backloaded system. Comparisons between these two groups would accurately identify how disbursing money to students influences their decisions on where to enroll in college. Unfortunately, this ideal setting does not exist, as students must apply and qualify for the award and the state changed the policy for all students in a single year.

Using existing administrative data, we could attempt to estimate the enrollment impact of the ACS change by comparing the number of students enrolled in Arkansas postsecondary institutions before and after the 2013 change. Nevertheless, while this may provide an informative starting place, this naïve pre-post comparison would be misleading if college enrollments were increasing in all states over time due to a stronger college-going culture in the US generally. If this trend exists, college enrollments would likely increase regardless of how the ACS awards money. What is needed, therefore, is a method that will allow us to differentiate changes in Arkansas enrollments due to the ACS payout change from general trends in college enrollment.

Our empirical strategy is modeled on Cornwell et al.'s (2006) study of the Georgia HOPE program and Zhang et al.'s study of the Florida Bright Futures Scholarship program's effects on college enrollment, as these studies' use a similar approach intended to analyze the impacts of the introduction of a merit scholarship policy, like what we observe in Arkansas. Specifically, we use a difference-in-differences (DD) design to estimate the impact of the switch to a backloaded payout

structure by comparing changes in enrollment patterns within the state of Arkansas before and after 2013 to that of enrollment patterns in similar states whose students did not experience such a change in payout structure. In effect, the college enrollment trends of the comparison group states serve as our estimate of the counterfactual, or what would have occurred in Arkansas had the ACS payments not switched to a backloaded payout structure.

Our empirical model takes the following form:

$$\ln(E_{it}) = \delta_1(AR_i \times After2010_t) + \delta_2(AR_i \times After2013_t) + X'_{it}\beta + \gamma_i + \theta_t + \epsilon_{it} \quad (1)$$

where:

- E_{it} is enrollment in state *i* in year *t,*
- AR_i is an indicator taking on a value of 1 for Arkansas and 0, otherwise,
- $After2010_t$ identifies the period following the initial expansion of the ACS in 2010 by taking on a value of 1 when $t \geq 2010$ and 0 otherwise,
- $After2013_t$ identifies when the backloaded payout structure went into effect (equal to 1 when t$\geq$ 2013),
- X_{it} is a vector of covariates capturing state demographics and economic indicators,
- γ_i is a vector of state fixed effects,
- θ_t is a vector of year fixed effects, and
- ϵ_{it} is an error term accounting for nesting within states (Bertrand et al., 2003).

This model is a slightly augmented version of the standard DD model employed by Cornwell et al. (2006). Specifically, we include two interactions involving the Arkansas state identifier: $AR_i \times After2010_t$ and $AR_i \times After2013_t$. The first interaction identifies the general impact of the ACS expansion in 2010 on college enrollment in Arkansas, which is represented by δ_1. The second interaction term, $AR_i \times After2013_t$, identifies the parameter of interest in our analysis, δ_2: the differential impact on enrollment that occurred following the ACS change to a backloaded payout structure in 2013. Finally, the sum of δ_1 and δ_2 represents the general difference in enrollment in Arkansas following the switch to the backloaded payout structure relative to the period before 2010 (i.e., the pre-ACS expansion period). If, for example, the expansion of ACS in 2010 generally increased college enrollment afterward, but the switch to a backloaded payout structure made college attendance less attractive to students by increasing the overall cost of attendance, we would expect to observe $\hat{\delta}_1 > 0$, $\hat{\delta}_2 < 0$, and $\hat{\delta}_1 > (\hat{\delta}_1 + \hat{\delta}_2) > 0$.

Our preferred model controls for natural variation in enrollment trends explained by student demographics and economic conditions. Specifically, we account for changes in the population of potential college-going students by controlling for the number of high school graduates each year. We additionally control for state economic conditions, which have been found to influence the decision to attend college (Cornwell et al., 2006). These variables, along with state and year fixed effects, help us to isolate the specific effect of the ACS's payout structure change on college enrollment from other confounding factors affecting college enrollment trends in general.

DATA

The chief challenge facing any empirical analysis is the identification of an appropriate estimate for the counterfactual, or the way the world would have been in absence of the intervention. For our analysis, we use two groups of comparison states to proxy for Arkansas' counterfactual: the other member states of the Southern Regional Education Board (SREB) Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia and the states that border Arkansas—Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, and Texas . These comparison groups mirror those used in Cornwell et al. (2006), and for good reason: states in both groups share regional and economic similarities that make them suitable proxies for the Arkansas counterfactual.

The outcomes for this analysis—college enrollment data—are drawn from the National Center for Education Statistics' (NCES) Integrated Postsecondary Education Data System (IPEDS). Specifically, we collected state-level aggregate data on first-time resident enrollment for all postsecondary institutions as well as separately for public four-year, private four-year, and public two-year institutions for even years between 2004 and 2016. We limit our data to first-time, first-year residents to mirror ACS's residential requirement for eligibility. This requirement further limits our analysis to even years only, as NCES only requires institutions to report residential data in even years. We replicated our analysis for both comparison groups (SREB and Border States) using enrollment counts including non-residents for students enrolled full-time only (Tables A1 and A2) and full- and part-time (Tables A3 and A4). This allows us to additionally include odd-numbered years. In general, results are consistent across enrollment specifications.

Our analysis includes two covariates to control for extraneous factors that may explain pre-existing trends in college enrollment. First, we control for state economic conditions using the Federal Reserve Bank of St. Louis's Coincident Economic Activity (CEA) Index, which captures the expansion and contraction of state economies using data on employment trends, real earnings, unemployment rate, and the average weekly hours worked in manufacturing. An increase in the CEA Index is interpreted to mean the state economy is expanding, while a decrease represents a contraction in the state's economy.

Second, we control for high school graduation cohorts as they represent the primary pool of potential first-time college enrollees. We collected these data each year for each state in our sample from NCES's Digest of Education Statistics. NCES reports the actual high school graduation total for 2004 through 2013 and the projected high school graduation totals for 2014 through 2016. While, we would prefer using actual counts of high school graduates in our analysis, we use projections when no other data are available. Fortunately, a comparison of the projections with a separate data set containing information on all Arkansas high school graduates suggests the projections are fairly accurate. The projected headcount for Arkansas in 2010-11 was 28,440 high school graduates, the actual number of high school graduates for that year totaled 28,205.

Analytical Samples

Our analysis focuses on three time periods:

- Pre-ACS Expansion: Years 2003-2009
- Initial ACS Expansion: Years 2010-2012
- Change to Backloaded Payouts: Years 2013-2016

Table 2 provides descriptive statistics for Arkansas and the two comparison group samples—SREB and border states—in the three time periods indicated. Specifically, Table 2 displays the average enrollment figures for
Arkansas and each group of comparison states for each of the specified time periods, as well as the average number of high school graduates and average values of the local economic condition as captured by the CEA index.
Table 2 indicates that college enrollments in Arkansas, the SREB states, and Arkansas's border states generally increased between the Pre-ACS Expansion period (2003-2009) and the Initial ACS Expansion period (2010-2012). In contrast, we observe slight declines in average enrollment across all states in the time period following Arkansas's change to a backloaded payout structure (2013-2016). The number of high school graduates in Arkansas and both comparison groups, in contrast, progressively increases as we move forward from each time period. Finally, the economic conditions of Arkansas and each group of comparison states appear to be expanding, as evidenced by a generally increasing average CEA index value across all states over time.

An important requirement of any DD analysis is that the comparison group and treatment group share similar trends in the outcome of interest away from the discontinuity point (Bertrand et al., 2003). Figure 1 illustrates overall trends in logged enrollment for even years in Arkansas and the SREB states from 2004 to 2016 for all institutions, public four-year, private four-year, and public two-year institutions. The vertical lines at 2010 and 2013 show the implementation of the ACS and the change to the award payout structure, respectively. While the SREB states consistently have higher numbers of enrollees on average, their enrollment trends largely track those of Arkansas across all institution types. This provides some assurance for using the SREB states as a comparison group for Arkansas in the DD analysis.

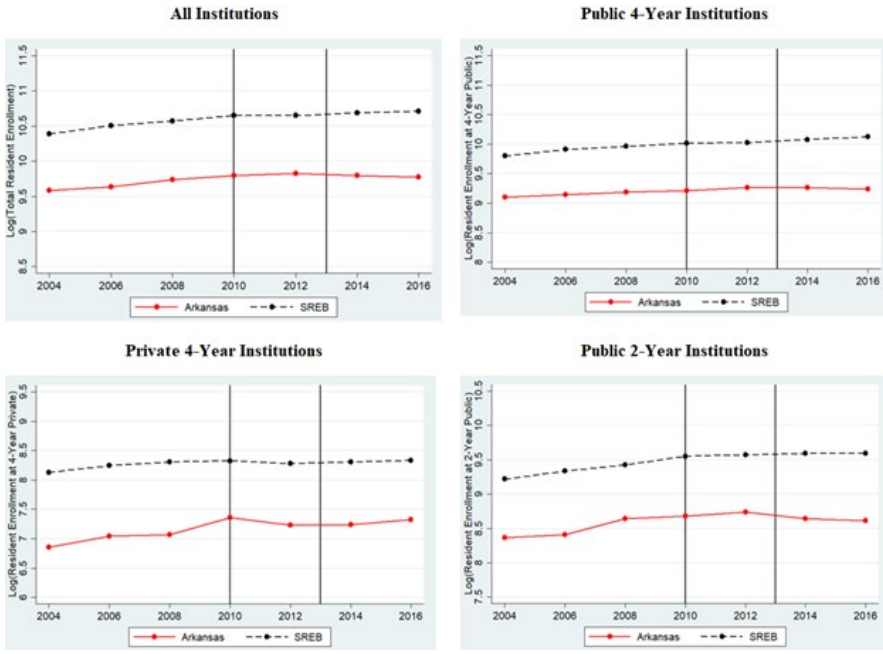
Table 2: Means and Standard Deviations of Variables

	2003-2009			2010-2012			2013-2016		
	Arkansas	SREB States	Border States	Arkansas	SREB States	Border States	Arkansas	SREB States	Border States
Full-time, first time freshmen									
All institutions	22,382	49,564	53,966	26,082	56,480	61,548	25,027	55,973	61,866
	(1,420)	(34,811)	(39,917)	(168)	(42,087)	(48,854)	(220)	(42,490)	(51,423)
4-year institutions	15,277	31,591	32,411	17,873	36,907	36,245	18,011	38,559	38,023
	(765)	(21,181)	(22,760)	(261)	(28,129)	(27,387)	(421)	(29,863)	(30,849)
2-year institutions	7,105	17,973	21,556	8,209	19,573	25,303	7,016	17,414	23,842
	(857)	(14,658)	(18,248)	(224)	(16,261)	(22,040)	(586)	(15,293)	(21,000)
Resident first-time undergraduates*									
All institutions	15,589	36,077	42,187	18,235	42,215	50,288	17,799	44,307	53,132
	(1,275)	(29,947)	(38,037)	(452)	(37,046)	(47,791)	(226)	(40,622)	(54,117)
4-year public	9,400	19,802	20,282	10,304	22,485	22,758	10,424	24,406	24,726
	(393)	(18,294)	(18,480)	(351)	(22,676)	(22,039)	(137)	(25,044)	(26,712)
4-year private	1,090	3,751	4,370	1,476	4,034	4,873	1,457	4,096	4,765
	(126)	(3,393)	(4,401)	(139)	(3,542)	(4,837)	(87)	(3,659)	(4,823)
2-year public	4,817	11,279	15,917	6,061	14,217	20,663	5,583	14,679	21,892
	(736)	(11,662)	(15,295)	(226)	(15,172)	(20,337)	(112)	(16,138)	(21,463)

	2003-2009			2010-2012			2013-2016		
	Arkansas	SREB States	Border States	Arkansas	SREB States	Border States	Arkansas	SREB States	Border States
	(902)	(58,601)	(78,598)	(109)	(68,457)	(94,182)	(818)	(74,461)	(102,537)
Coincident Economic Activity Index	141.44	145.68	140.35	152.2	152.78	148.84	166.25	174.77	167.68
	(6.11)	(13.43)	(14.99)	(3.40)	(17.75)	(20.98)	(6.59)	(24.15)	(28.34)

Note. Resident first-time undergraduates (FTUG) are restricted to students who graduated from high school in the previous 12 months. Resident FTUG available for even-numbered years only. SREB States: Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. Border States: Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, and Texas. Standard deviations are noted in parentheses.

Figure 1: Trends in Log Enrollment for All, Public 4-Year, Private 4-Year, and Public 2-Year Arkansas and SREB Postsecondary Institutions, 2004-2016 Even Years



RESULTS

This section presents the results of our primary analysis. While we find that the expansion of the ACS in 2010 is associated with an initial increase in postsecondary enrollment in Arkansas, we generally do not identify statistically significant impacts of the 2013 shift to a backloaded payout structure on enrollment. The notable exception is for two-year institutions, which experienced significant declines in enrollment following the 2013 ACS payout change.

Table 3 presents the estimated impacts of both the implementation of the ACS lottery scholarship in 2010 and the change to the award payout structure in 2013 using the SREB comparison sample. Odd numbered columns present simple models that do not control for additional covariates and even-numbered columns include controls for state economic conditions and high school graduation cohorts. Each model includes state and year fixed effects. Estimated impacts of expanding the scholarship in Arkansas using lottery funds in 2010 relative to the pre-time period are presented in row 1 (*Arkansas x After 2010).* Row 2 (*Arkansas x After 2013*) is the focus of our

study: the estimated impacts backloading the ACS award payout structure above and beyond the impact of expanding the scholarship. Adding the two coefficients together, we are also able to see the impact of back-loading the payout structure relative to the Pre-Expansion period in 2010.

Our results indicate that the expansion of the ACS in 2010 is associated with a statistically significant five percent increase in enrollment in all Arkansas postsecondary institutions relative to the time period prior to the expansion. In contrast, there is no conclusive evidence to suggest that the subsequent change from equal annual installments to a backloaded award payout structure produced a significant change in enrollment rates in all postsecondary institutions throughout Arkansas. In general, the coefficient estimates suggest enrollment declined six percent compared to pre-ACS expansion levels following the switch to a backloaded structure; however, these estimates are not statistically significant at conventional levels. Combining the estimated effects of expanding the scholarship in 2010 and changing the award payout structure in 2013, we see that the backloaded award payout structure is associated with a one percent overall decrease in enrollment in Arkansas postsecondary institutions relative to the time period prior to the scholarship expansion.

Table 3 also presents estimated effects by institution type: public four-year, private four -year, and public two-year institutions. In general, the results for public four-year institutions in Arkansas mirror the results for total enrollment. Expanding the scholarship in 2010 is associated with a four percent increase in enrollment in public four-year institutions while backloading the payout structure is associated with a non-significant six percent decrease in public four-year institutions. The results for private four-year institutions indicate that the initial expansion of the ACS in 2010 yielded a sizeable jump in enrollment (23 percent), yet there is no noticeable change in enrollment due to the 2013 switch to backloaded payouts. Interestingly, the only case in which we observe that the 2013 payout change significantly impacted enrollment is for public two-year institutions. Specifically, our models indicate that the 2013 switch led to between 11 and 16 percent declines in enrollment at public two-year institutions. Combining the estimated effects, we see that the backloaded award payout structure is associated with an overall 10 percent decrease in enrollment in Arkansas public two-year institutions, compared to the time period prior to the ACS expansion.

Table 4 presents our analysis using the states that border Arkansas as the comparison group rather than the SREB states. Generally, we find similar results when comparing Arkansas to border states rather than SREB states, non-significant, negative impacts following the 2013 payout change. Because of this, we cannot say conclusively whether the post-2013 payout shift had a measurable impact on overall college enrollment decisions in Arkansas.

Table 3: Difference-in-Difference Estimates of the Impact of the ACS Expansion and Award Payout Change on Arkansas Enrollment, Compared to SREB States

	All Institutions		4 Year Public		4 Year Private		2 Year Public	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Arkansas x After 2010	0.0184	0.0488**	0.0189	0.0423	0.138***	0.226***	-0.0545	0.0553
	(0.0260)	(0.0225)	(0.0395)	(0.0253)	(0.0399)	(0.0473)	(0.0589)	(0.0444)
Arkansas x After 2013	-0.0815*	-0.0604	-0.0859	-0.0594	0.00555	-0.00833	-0.111**	-0.155*
	(0.0432)	(0.0460)	(0.0619)	(0.0513)	(0.0366)	(0.0452)	(0.0493)	(0.0799)
Covariates		Yes		Yes		Yes		Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	128	112	128	112	128	112	117	103
R-squared	0.985	0.987	0.978	0.979	0.985	0.986	0.992	0.994

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note. Unit of analysis is state-by-year. The dependent variable in all analyses is the natural log of resident first-time undergraduates (FTUG) who graduated from high school in the previous 12 months. Resident FTUG are only available for even-numbered years. *After 2010* takes on a value of 1 for the fall of 2010 and thereafter. *After 2013* takes on a value of 1 for the fall of 2013 and thereafter. *Covariates* are the CEA index (which captures state economic conditions) and the natural log of high school graduates in the previous spring. *SREB States* include Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. Standard errors account for nesting within states.

Table 4: Difference-in-Difference Estimates of the Impact of the ACS Expansion and Award Payout Change on Arkansas Enrollment, Compared to Border States

	All Institutions		4 Year Public		4 Year Private		2 Year Public	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Arkansas x After 2010	-0.000367	0.0301	-0.00705	0.0506	0.161*	0.214**	-0.0811	-0.0383
	(0.0524)	(0.0529)	(0.0589)	(0.0436)	(0.0699)	(0.0590)	(0.116)	(0.0917)
Arkansas x After 2013	-0.0432	-0.0326	-0.0101	-0.00427	-0.000910	0.0111	-0.175	-0.196
	(0.0513)	(0.0626)	(0.0364)	(0.0171)	(0.0465)	(0.0527)	(0.0941)	(0.138)
Covariates		Yes		Yes		Yes		Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56	49	56	49	56	49	56	49
R-squared	0.980	0.986	0.985	0.990	0.989	0.994	0.953	0.958

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note. Unit of analysis is state-by-year. The dependent variable in all analyses is the natural log of resident first-time undergraduates (FTUG) who graduated from high school in the previous 12 months. Resident FTUG are only available for even-numbered years. *After 2010* takes on a value of 1 for the fall of 2010 and thereafter. *After 2013* takes on a value of 1 for the fall of 2013 and thereafter. *Covariates* are the CEA index (which captures state economic conditions) and the natural log of high school graduates in the previous spring. *Border States* include Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, and Texas. Standard errors account for nesting within states.

DISCUSSION

While the popularity of state-financed merit-based scholarships has increased since their creation in the 1980s, state policymakers struggle to maintain these programs in the face of growing costs. Some states have tried to manage this tradeoff through changes to program eligibility or award amounts; however, little empirical research exists that can speak to the effectiveness of these changes. This study adds to the financial aid literature by examining how one state's changes to the payout structure of its merit-scholarship program affects college enrollment and providing some evidence on how a policy decision altering the structure of a merit-aid scholarship program impacts college-intending students.

Using a difference-in-differences (DD) design comparing Arkansas to other southern states, we determine whether college enrollment responded to a 2013 restructuring of Arkansas' Academic Achievement Scholarship (ACS) from equal annual awards to a backloaded system which provided progressively higher payouts to students who continued to persist in college. To our knowledge, this is the first study to examine if moving to a backloaded payout structure affects college enrollment.

While we observe statistically significant increases in enrollment following the initial expansion of the ACS in 2010, our results do not indicate the 2013 payout change significantly impacted college enrollment. Specifically, we fail to identify statistically significant impacts to enrollment across all institutions as well as for both public and private four-year institutions following the 2013 payout change.

Despite the general finding of null effects, several findings are worth highlighting. First, we note a striking 23 percent increase in enrollment in Arkansas four-year private school institutions relative to other states following the initial expansion of the ACS in 2010. When comparing with results for other institutions, it appears that the result for private schools is the primary driver behind the observed significant impact of the ACS expansion on overall enrollment. It is possible that the initial scholarship award—which could be used at Arkansas private institutions—was sufficiently large enough to encourage students who otherwise were considering private schools outside the state to remain in Arkansas, as intended by the state aid program. In contrast, we observe no discernable impact following the 2013 payout change as the estimate is both nonsignificant and trivial in magnitude. The backloaded payout structure—which translated to a $4,000 drop in total payout over four years—may have represented a small deterrent to Arkansas students already intending to attend an in-state private institution because they were confident that they would complete their education in four years, as private non-profit institutions tend to have the highest four-year graduation rates among post-secondary institutions (National Center for Education Statistics, 2018). This is, however, only a speculation as our study cannot definitively answer this question. In addition, it should be noted that private school enrollment in Arkansas is generally quite low and thus more susceptible to fluctuations.

Second, we observe consistent evidence of a negative and statistically significant impact on enrollment for public two-year institutions in Arkansas relative to comparison states following the change in payout structure. While this finding is surprising given the payouts decreased slightly for two-year institutions, it is important to note the US Department of Education altered Pell Grant eligibility requirements that reduced the number of eligible students in 2012 (Mabel, 2017). If community college students in Arkansas were more adversely impacted by this policy change as prior research suggests (Katsinas et al., 2013), these students may be losing more than just the slight decrease in ACS dollars. While all students nationwide would be impacted by the Pell Grant change, this may have intensified the slight decrease in the ACS award experienced by community college students by decreasing the total aid available.

Finally, we caution that, while our findings generally do not indicate statistically significant impacts on college enrollment associated with the 2013 switch to a backloaded payout structure, the results suggest the potential for negative impacts. Specifically, the coefficient estimates are negative across most models and institution types. Moreover, there is evidence suggesting noticeable statistical noise in these estimations, as the reported standard errors are quite large. We therefore recommend that any state looking to implement a similar change to their merit-scholarship program should do so with caution, as there may be significant unintended consequences for students on the margin of enrolling in college. Future research will need to examine whether these changes to payout structure did in fact *pull* students through to finish their degrees at differential rates.

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APPENDIX

Table A1: Difference-in-Difference Estimates of the Impact of the ACS Expansion and Award Payout Change on Arkansas Enrollment, Compared to SREB States

	All Institutions		4 Year Institutions		2 Year Institutions	
	(1)	(2)	(3)	(4)	(5)	(6)
Arkansas x After 2010	0.0424***	0.0580***	0.0363	0.0512*	0.0296	0.106*
	(0.0142)	(0.0142)	(0.0331)	(0.0285)	(0.0501)	(0.0567)
Arkansas x After 2013	-0.0286*	-0.0178	-0.0279	-0.00753	-0.0198	-0.0670**
	(0.0145)	(0.0136)	(0.0164)	(0.0201)	(0.0276)	(0.0283)
Covariates		Yes		Yes		Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	256	208	256	208	256	208
R-squared	0.994	0.997	0.986	0.993	0.966	0.968

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note. Unit of analysis is state-by-year. The dependent variable in all analyses is the natural log of post-secondary enrollment for both residents and non-residents who were enrolled full-time. *After 2010* takes on a value of 1 for the fall of 2010 and thereafter. *After 2013* takes on a value of 1 for the fall of 2013 and thereafter. *Covariates* are the CEA index (which captures state economic conditions) and the natural log of high school graduates in the previous spring. *SREB States* include Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. Standard errors account for nesting within states.

Table A2: Difference-in-Difference Estimates of the Impact of the ACS Expansion and Award Payout Change on Arkansas Enrollment, Compared to Border States

	All Institutions		4 Year Institutions		2 Year Institutions	
	(1)	(2)	(3)	(4)	(5)	(6)
Arkansas x After 2010	0.0541*	0.0638**	0.0635	0.0828***	-0.0113	0.00285
	(0.0264)	(0.0183)	(0.0394)	(0.0188)	(0.0799)	(0.0832)
Arkansas x After 2013	-0.0244	-0.0212	-0.0216	-0.0201	-0.0871**	-0.0958*
	(0.0169)	(0.0136)	(0.0260)	(0.0265)	(0.0353)	(0.0404)
Covariates		Yes		Yes		Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	112	91	112	91	112	91
R-squared	0.991	0.996	0.990	0.995	0.973	0.977

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note. Unit of analysis is state-by-year. The dependent variable in all analyses is the natural log of post-secondary enrollment for both residents and non-residents who were enrolled full-time. *After 2010* takes on a value of 1 for the fall of 2010 and thereafter. *After 2013* takes on a value of 1 for the fall of 2013 and thereafter. *Covariates* are the CEA index (which captures state economic conditions) and the natural log of high school graduates in the previous spring. *Border States* include Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, and Texas. Standard errors account for nesting within states.

Table A3: Difference-in-Difference Estimates of the Impact of the ACS Expansion and Award Payout Change on Arkansas Enrollment, Compared to SREB States

	All Institutions		4 Year Institutions		2 Year Institutions	
	(1)	(2)	(3)	(4)	(5)	(6)
Arkansas x After 2010	0.0059	0.0190	-0.0026	0.0134	0.0142	0.0886
	(0.0183)	(0.0237)	(0.0416)	(0.0417)	(0.0577)	(0.0736)
Arkansas x After 2013	-0.0294	-0.0239	-0.0228	-0.000757	-0.0302	-0.0884**
	(0.0196)	(0.0195)	(0.0203)	(0.0223)	(0.0293)	(0.0403)
Covariates		Yes		Yes		Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	256	208	256	208	256	208
R-squared	0.993	0.995	0.981	0.988	0.963	0.964

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note. Unit of analysis is state-by-year. The dependent variable in all analyses is the natural log of total post-secondary enrollment (i.e., full and part time, not limited to residents). *After 2010* takes on a value of 1 for the fall of 2010 and thereafter. *After 2013* takes on a value of 1 for the fall of 2013 and thereafter. *Covariates* are the CEA index (which captures state economic conditions) and the natural log of high school graduates in the previous spring. *SREB States* include Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. Standard errors account for nesting within states.

Table A4: Difference-in-Difference Estimates of the Impact of the ACS Expansion and Award Payout Change on Arkansas Enrollment, Compared to Border States

	All Institutions		4 Year Institutions		2 Year Institutions	
	(1)	(2)	(3)	(4)	(5)	(6)
Arkansas x After 2010	0.0251	0.0377	0.0479	0.0692**	-0.0578	-0.0391
	(0.0289)	(0.0223)	(0.0420)	(0.0204)	(0.0802)	(0.0819)
Arkansas x After 2013	-0.0223	-0.0242	-0.0211	-0.0184	-0.0845*	-0.104
	(0.0204)	(0.0238)	(0.0273)	(0.0271)	(0.0348)	(0.0560)
Covariates		Yes		Yes		Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	112	91	112	91	112	91
R-squared	0.991	0.995	0.989	0.995	0.975	0.979

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note. Unit of analysis is state-by-year. The dependent variable in all analyses is the natural log of total post-secondary enrollment (i.e., full and part time, not limited to residents). *After 2010* takes on a value of 1 for the fall of 2010 and thereafter. *After 2013* takes on a value of 1 for the fall of 2013 and thereafter. *Covariates* are the CEA index (which captures state economic conditions) and the natural log of high school graduates in the previous spring. *Border States* include Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, and Texas. Standard errors account for nesting within states.

Katherine Kopotic, PhD, (she/her/hers) is the Manager of External Reporting in the Office of Institutional Research at Saint Louis University. Research interests include college ranking analysis, student interventions, and program evaluation. Email: katherine.kopotic@slu.edu

Jonathan N. Mills, PhD, (he/him/his) is a Research Scientist with the Coleridge Initiative. His research interests include financial aid, school choice, and research methods.. Email: jon.mills@coleridgeinitiative.org

Evan Rhinesmith, PhD, (he/him/his) is the Executive Director of the PRiME Center at Saint Louis University. His research interests include educational policy, postsecondary access and success, and research methods. Email: evan.rhinesmith@slu.edu