The Role of the Comprehensive Articulation Agreement on Credit Loss

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Introduction

The need to obtain a postsecondary degree is ever growing, with estimates that at least 65 percent of all jobs by 2020 will require training beyond a high school degree with 35 percent of jobs requiring at least a bachelor's degree (Carnevale, Smith, & Strohl, 2013). As policymakers, educational leaders, and families recognize this need for degree attainment, there is a push to find ways to reduce costs and time to degree.

Community college transfer pathways are an increasingly popular option for students looking to complete a four-year degree. While, it is estimated that 80 percent of community college students plan to transfer to a four-year institution (Horn & Weko, 2009; Provasnik & Planty, 2008), the rates of those who end up transferring and then completing are dismal, with less than 15 percent earning a bachelor's degree (Fink, Jenkins, Kopko, & Ran, 2018). Programs and policies such as high school dual enrollment, guaranteed admissions programs, and articulation agreements all are designed to serve potential transfer students. Commonly, transfer from community college to four-year is thought of as a two + two model, whereby a student spends two years at each institution. Such plans are designed to create an efficiency within the transfer landscape, minimizing the number of excess credits students earn (Fink et a., 2018), however it is estimated that only 8 percent of all students who transfer and graduate follow that pattern (Fink, 2017). Furthermore, there is debate of the extent to which cost is reduced by starting at a community college (Belfield, Fink, & Jenkins, 2017).

Statewide articulation agreements designed to enhance transfer have grown over the past several decades (Hodara, Martinez-Wenzl, Stevens, & Mazzeo, 2017; Roska & Keith, 2008) and

codify two + two models into policy. Ideally, these agreements provide structured pathways for students to transition from two-year institutions to four-year institutions with the intention of creating a streamlined four-year plan to an associate degree without the accumulation of excess credits (Roska & Keith, 2008). Given that so few students are able to successfully transfer and earn a bachelor's degree within two years of transferring from a community college, it is important to understand the extent to which formalized articulation agreements aid in transfer.

Purpose & Research Questions

The purpose of this study is to examine the effects of North Carolina's statewide credit articulation agreement on credit loss. Using difference-in-differences, we examine how the implementation of the Comprehensive Articulation Agreement (CAA) impacted excess credit earning for students transferring from North Carolina Community College System (NCCCS) institutions into the University of North Carolina System Office (UNC-SO) institutions. This study will seek to answer the following research question:

How did the CAA impact excess credit earning behaviors amongst transfer students who graduated from a UNC System institution?

This research question is designed to answer whether or not the CAA influenced credit earning behaviors amongst students who graduated from a UNC System institution following the implementation of the CAA. Excess credit is a concern as it suggests inefficiency within the transfer process. North Carolina's CAA policy promotes completion of Associate in Arts or Associate in Sciences (AA or AS) degrees and ease the two-year to four-year transfer process by guaranteeing transfer of at least 60 credit hours from a North Carolina community college to a UNC System institution. We anticipate that following the implementation of the policy students who transferred with an AA or AS degree will graduate with fewer excess credits than their non-

AA or AS degree holders who transferred. We also anticipate that the number of students who transfer with AA or AS will increase due to the increased incentives and protections that students receive through the CAA.

Overview of the CAA

In 2014, the North Carolina State Board of Community Colleges and the University of North Carolina Board of Governors approved revisions to the CAA. The goal of this CAA is to ease transfer between public two-year and four-year institutions in North Carolina by creating efficiencies to reduce both excess credits earned and time to degree. The revised CAA includes four key components intended to improve the transfer process from NCCCS institutions to UNC-SO institutions: (1) agreed upon guaranteed transfer of certain general education courses from any NCCCS institution to any UNC-SO institution; (2), all UNC-SO institutions are required to publish four-year degree plans with courses mapped to course offerings at NCCCS institutions; (3) all NCCCS students intending to transfer are required to declare their planned transfer major prior to completing 30 hours of coursework; and (4) students who complete a transfer associate degree, Associate in Arts or Associate in Sciences (AA or AS), at an NCCCS institution are guaranteed 60 transferable credit hours to a UNC-SO institution (North Carolina Community Colleges System, 2014). A student who completes an AA or AS degree is guaranteed admission to a UNC system institution, although it may not be at their first-choice school. If a student applies to all institutions and is not accepted, they are eligible to contact the state for assistance. The updated policy changes were implemented across all institutions in fall 2014 semester. Only students who earn a transfer associate degree, defined as an AA or AS, are eligible for the benefits under the CAA.

Review of Current Literature

Role of Community Colleges

Community colleges serve a vital role in providing open-access educational opportunities for students with varied career interests and backgrounds. Community colleges have long served students pursuing technical careers, provided workforce training, basic skills, and a pathway for transfer (Anderson, Sun & Alfonso, 2006; Jurgens, 2010). Importantly, community colleges are also an avenue to increase economic mobility. Associate degree holders earn 27 percent more over their lifetime compared with high school diploma earners (Baum & Payea, 2013). Public community colleges enroll 34 percent of undergraduate students in the country (Ginder, Kelly-Reid, & Mann, 2017). Furthermore, they enroll 44 percent of students from low-income backgrounds, 38 percent of students who are the first in their families to attend college, and 50 percent of Black and Hispanic students (Ginder et al., 2017). By prioritizing open-access and equity, community colleges are able to serve students who are often disenfranchised by our education systems (Dowd, 2003: Jaeger, Dunstan, Dixon, 2015), including low-income students, students of color, and students from rural areas.

In North Carolina, 58 public community colleges in the North Carolina Community College System (NCCCS) serve an estimated 735,000 students each year accounting for approximately 1 in 9 adult North Carolinians (NCCCS, n.d). The mission of the NCCCS is to provide high-quality, accessible education to improve the lives and well-being of individuals with the recognition post-secondary credentials and provide students with access to family sustaining wages and careers. A hallmark of the NCCCS is that the institutions are strategically located so that every citizen is within a 30-minute drive of a community college. This design is noteworthy as it helps to provide equitable access to higher education even for students from the state's most rural and economically depressed regions. The NCCCS facilitates transfer of

community college students to four-year institutions through a state-wide dual enrollment program, statewide articulation agreement with the UNC-System institutions (CAA), and local articulation agreements between individual institutions or programs.

Articulation Agreements

Statewide articulation agreements exist in 36 states with policies including transfer of common coursework and designated transfer associate degrees (Hodara et al., 2016). When the CAA was first introduced it was highlighted for its potential to improve transfer student outcomes across the state of North Carolina, especially for students from underserved backgrounds (Hodara et al., 2017; Jaeger, Dunstan, & Dixon, 2015; Shapiro et al., 2017). To date, there has not been any research on the impact of the 2014 revisions to the CAA.

Previous studies on the effects of community college to university articulation agreements yielded mixed results of outcomes such as transfer rates (Anderson et al., 2006; Cohen, 1996; Higgins & Kastinas, 1999; Roska, 2006; Stern 2016), baccalaureate degree attainment (Baker, 2016; Roska & Keith, 2008; Stern, 2016), and time to degree (Roska & Keith, 2008). In an analysis using the Beginning Postsecondary Students (BPS) dataset, students do not experience any increase in the probability of transferring to a four-year institution when their state has a statewide articulation agreement (Anderson et al., 2006). Financial aid recipients along with white, Hispanic and female students all had an increased likelihood of transferring (Anderson et al., 2006). These findings are similar to Roska's (2006) analysis of National Education Longitudinal Study (NELS) data finding that statewide articulation agreements do not support transfer to four- year institutions. These studies improve on previous research by using nationally representative datasets and contradicting findings of previous research suggesting that articulation can promote transfer (Cohen, 1996) even in rural institutions (Higgins & Kastinas,

1999). These studies are limited in their use of regression to estimate effects even while controlling for predictive factors such as demographics and intent to transfer (Anderson et al., 2006 & Roska, 2006).

Null findings may be in part due to a mismatch in the outcome of interest and the true intent of the policies, which are designed to reduce excess credits for students who transfer rather than promote transfer (Roska & Keith, 2008). In a follow-up study using NELS, Roska and Keith (2008) build on the outcomes related to articulation policies by examining statewide policy effects on the probability of transfer, the number of credits transferred, and time to degree, but find no statistically significant findings between students in states with articulation agreements and those without (Roska & Keith, 2008). Their findings suggest that differences in intention of state-wide policy and the subsequent implementation may limit the ability to understand the extent to which articulation agreements impact students when treating the agreements as a monolith even though we know such variation exists. Building on the methodological approaches to study articulation, the use of HLM to analyze BPS corroborates the early findings that articulation agreements do not increase transfer rates (Stern, 2016), however for students in states with articulation they see an increase in bachelor's degree attainment (Stern, 2016).

Credit Loss & Excess Credits

The role of excess credits in degree attainment and evaluation of articulation agreements is essential to understanding the extent to which efficiencies are created in the transfer landscape that reduce cost and time burdens on students. In some states they are explicit in the intent of policies to reduce excess credits (Roska & Keith, 2008) and other work suggests a continuum in the types of articulation policies that may help to facilitate reduction in excess credits (Hodara et al., 2017). Using difference-in-differences-in-differences (DDD) Baker (2016) found that the

implementation of California's articulation agreement policy does not have an initial effect on the number of successful transfer students from the California Community College System to the California State Universities. However, significant differences are seen after two and three years of policy implementation for students attending community colleges with a high number of Associate Degrees of Transfer programs. Using this quasi-experimental design is in line with previous correlational studies suggesting limited effects of such policies.

Accumulation of excess credits is a concern for all undergraduate students, with the bachelor's degree earners graduating with an average of 135 credit hours. Not surprisingly, for students who transfer from community college are on average 10 more credits and take two more semesters to graduate compared with those who start at four-years (Fink et al., 2018). These excess credits have implications for students' overall time to degree and debt accumulation (Kramer, Holcomb, & Kelchen, 2018). Recent studies on credit transfer identify that most credit loss from community colleges occurred because students' grades were low, the course was considered part of developmental or remedial education, or the course was identified as technical or part of Career Technical (CTE) programs (Fink et al., 2018; Texas Higher Education Coordinating Board, 2001).

The consequences of earning excess credits are a concern for both individual students and institutions. For students, earning excess credits may mean they end up paying twice: once at the time of taking the course, through traditional tuition payments (Ziedenberg, 2015) and, in the form of a credit surcharges. For instance, in North Carolina, students are charged 125% of tuition cost for credits earned beyond 140 hours. Excess credit penalties like these may exacerbate issues of student debt, especially for traditionally underserved students (Kramer et al., 2018). In one community college system, an estimates $36 million were spent on credits that were

considered to be excess with students earning an average of 14 additional credits at the community college level (Ziedenberg, 2015).

While accumulation of these credits at the community college level is important for students earning associate level degrees and subsequently entering the workforce, there are clear concerns for students who go on to transfer. For students in California, new state policy that created Associate Degrees for Transfer (ADTs) was designed to streamline this transfer process and reduce the accumulation of excess credits (Baker, 2016). While findings from Baker (2016) regarding transfer rates confirmed previous work on transfer, they highlight the role of that such degree programs and agreements can have on excess credit earning behaviors by examining the number of credits earned for transfer students who graduate under the new policy. These students graduated with on average 10 fewer credits, providing early evidence that such a policy can be effective in creating efficiency and reducing cost (Baker, 2016).

Conceptual Framework

We use Perna and Thomas's (2006; 2008) framework for student success to guide our analysis of North Carolina's CAA policy. Perna and Thomas (2006; 2008) synthesized research from top journals in psychology, sociology, economics, and education, to create an all-encompassing model that incorporates the primary disciplines that inform postsecondary research into a single student success framework. Perna and Thomas's (2006; 2008) conceptual framework was specifically designed to address equity issues in college student success. The authors posit that there are four, inextricably linked layers that contribute to student success: *Internal context* (Layer One), Family context (Layer Two), School context (Layer Three), and Social, economic, and policy context (Layer Four). Research that does not acknowledge these

layers fails to recognize the complexity of student success and the inability to fully separate any one layer from the others (Perna & Thomas, 2006).

Methods

In order to evaluate the CAA we used a difference-in-differences (DID) approach to estimate the impact of the policy on the excess credit earning behaviors of students who transferred from a North Carolina Community College System (NCCCS) institution with an associate degree (AA or AS) compared to those who transferred without a degree. CAA was implemented across the state of North Carolina in 2014, which provides an opportunity to compare transfer behaviors pre and post the policy shift. DID is appropriate because of the nature of our data source: students were not randomly assigned to treatment and control (Murnane & Willett, 2011). Randomized control trials are the gold standard in research, as random assignment to treatment and control groups ensure that group membership is exogenous *and* the researcher is able to assume both groups are equal in expectation--meaning, the researcher would expect similar results if group membership between treatment and control were switched (Murnane & Willett, 2011). These conditions allow the researcher to isolate the treatment effect without concerns of selection bias or quality of covariates. In education policy research, random assignment is rare, as it raises a host of ethical and political issues; therefore, researchers must use quasi-experimental research designs to estimate what might have happened to the participants in the treatment group had they simultaneously been assigned to the control group. This estimate, known as the counterfactual, is impossible to observe, as a person cannot be treated and not treated at once. Because students in this project were not randomly assigned to either take up the policy or not, DID offers us a way to estimate what would have happened to our treatment group had the policy not been implemented (Khandker, S.R., Koolwal, G.B. &

Samad, H.A., 2010). DID compares the treated and control groups before and after treatment by subtracting the difference in the treatment group outcome variable from the same control group outcome variable, before and after the intervention. Assuming that unobserved differences between the groups are time invariant, this calculation isolates the effect of the intervention on the treated (Murnane & Willett, 2011).

Data & Sample

We used administrative data from the sixteen UNC System institutions spanning 15 years (SY 2003-2004 to SY 2018-2019). This dataset includes all students who transferred from any college across the country into the UNC-System. Our initial sample included 945,423 students. These data are collected by the UNC System Office from the UNC System institutions on an ongoing basis.

Our sample for this study is comprised of students who transferred from an NCCCS school to a UNC System college in the fall semester between the years of 2010 and 2016 and have graduated with a bachelor's degree within 3 years of transfer. In order to create our analytic sample, we subset the original sample to students who transferred from one of North Carolina's 58 public community colleges to one of the 16 public UNC-System institutions between fall 2010 and fall 2016. We then eliminated all students who had not graduated from college, which reduced our sample to 19,872. While we had data for students who transferred to a four-year college in fall 2017 and graduated, the cohort n count was not high enough to include them in our analysis.

We then limited the sample to students who entered a four-year college in the fall. We decided to limit the sample in this way to avoid confounding differences in the academic ability of spring transfer students compared to fall transfer students. Trends in enrollment between

students who transferred in the fall and spring were also inconsistent, confirming our decision. Finally, we created two sub datasets: one with students who had graduated from a four-year college (after transfer) in two years or less and one that had graduated in 3 years or less. This reduced our sample to 8,710 and 16,572 respectively. These reductions allowed us to evaluate the effect of the policy on excess credits at graduation for students who started at community colleges both prior to and after the implementation of the CAA policy.

Variables

Policy Treatment. Treatment in this study is defined at two time points. As discussed previously, mandatory assignment to the treatment (CAA policy) is determined by the year students entered the community college. Students who entered community college in the fall of 2014 in an AA or AS degree program were forced to follow the degree paths articulated by the policy. Students who entered community college before the fall of 2014 but transferred to four-year institutions in or after fall of 2014 were given an *offer* of treatment. While the policy was intended to start in 2014, community colleges were given discretion to allow other students to qualify for the CAA if it was in the best interest of the student. For the purposes of this study, we will run the same outcome models twice: one with the policy at fall of 2014 and one with the policy at fall 2016. Students who entered the four-year college in the fall of 2016 are most likely to have started community college during or after fall 2014, the semester in which the policy was implemented. Thereby being forced to take up treatment. Testing the policy at both points will allow us to gauge the effects of the offer of treatment and forced treatment. We expect to see a stronger treatment effect with the policy at 2016 as the policy may have taken a few years to be implemented fully across the state and, as mentioned before, students who entered the four-year institution in 2016 were more likely to have been forced to take the policy.

Treatment and Control Groups. The treatment group is comprised of students from an NCCCS institution who transferred after the implementation of the CAA (Fall of 2014 or 2016) after having earned a transfer associates degree (AA or AS). The comparison group is comprised of students who transferred from an NCCCS institution without having earned a transfer degree (AA or AS), as they were not afforded the same protections and guarantee of junior level status under the CAA. These students either transferred in with an Associate in Fine Arts, Associate in General Education, Associate in Applied Science, or no degree. Students who transferred with certificates or diplomas were excluded from the sample, as these types of credential are typically vocational and not geared toward four-year college-prep. Therefore, we do not believe these students would serve as a good counterfactual to our population of interest. For the analysis and discussion, we refer to students enrolled in AA and AS degrees as "CAA" and students enrolled in other degree programs "No-CAA."

Outcomes. Our research question focuses on two main outcomes: excess credit hours earned past 120 at graduation and excess credit hours earned past 140 at graduation. We measure this outcome in terms of credits earned beyond those required to earn a bachelor's degree (> 120 credits) and credits earned at the point of the North Carolina tuition surcharge (>140 credits). The outcome variable for excess credits earned past 120 is calculated by subtracting 120 from each student's cumulative credits earned at graduation. Students with a value of 0 for this outcome have earned exactly 120 credits. Because many transfer students were able to graduate with 120 credits, the distribution of excess credits was skewed toward zero. Therefore, we chose to transform this outcome into a logged variable, which moved our distribution closer to a normal distribution. Credits earned at the point of the North Carolina tuition surcharge (>140) is a binary variable. Students were assigned a value of 1 if their cumulative earned credits at

graduation was above 140 and 0 if it was below. We choose to use a binary dependent variable for this analysis because calculating this outcome in the same way as the previous DV would have yielded the exact same regression coefficients.

Covariates. We have included several student level covariates in our model to account for changes in group composition over time and to control for external influences on our outcomes (students' credit earning behaviors). We included several demographic characteristics that are encompassed in the first layer of Perna and Thomas' (2006; 2008) model, internal context, and are linked to persistence and time to degree completion. Our demographic covariates include: race, whether or not a student received a pell grant, gender, and whether or not a student is from a rural county (Ma, Pender, Welch & 2016). Additionally, drawing from the family and school layer of Perna and Thomas' model, we included an indicator for whether or not a student took Advanced Placement and International Baccalaureate courses in high school and the selectivity of the four-year college they attended according to the College Board's selectivity index (College Board, n.d.). We included these indicators because students who have taken advanced courses may be able to transfer more credits into the four-year university, and selective institutions typically have better persistence and time to degree rates than less selective institutions (Hoxby & Turner, 2013). We also controlled for major to account for certain majors that may require more than 120 credits for students to graduate. Finally, we included four-year institutional fixed effects to control institutional differences that may affect students' credit earning behaviors. See Table 1 for covariate descriptive statistics.

Methodology & Assumptions

Parallel Trends. We use a difference-in-differences (DID) estimation strategy to estimate the effect of the CAA policy on excess credit accumulation at graduation at two time

points: 2014 and 2016. The main assumption of difference-in-differences is that the trends of credit earning behaviors are similar between transfer students enrolled in CAA qualifying degrees and those in other degree programs pre-treatment (Wing, Simon, & Bello-Gomez, 2018; Murnane & Willett, 2011). If these trends are not similar, then the researcher will not be able to use the comparison group to estimate what would have happened to the treatment group without the intervention. In order to satisfy the parallel trends assumption, we graphed the raw mean scores of both outcomes for the treatment and control and ran a version of the main outcome model with leads included.

Visual inspection of the raw mean graphs shows evidence that credit earning trends for both the treatment and control group moved in tandem in the years preceding the treatment in 2014 (Wing et al., 2018). See Figure 1. In addition to confirming the that the parallel trends assumption holds through visual inspection, we verified that there were no significant changes in the outcome variables pre-treatment. A statistically significant change in the outcome variable before the treatment would indicate that the parallel trends assumption has been violated, as a significant change in one group means that the treatment and control were not moving in tandem prior to the policy. In order to test this, we ran a variant of our main difference-in-differences model with leads.

DID models with leads include an interaction term of the policy (CAA) multiplied by the years in which the policy was not enacted. In this case, if the parallel trends assumption holds, we would expect to see no significant change in the outcome variable before 2014 (Murnane & Willett, 2011). See Table 2 for model results. All but Model 4 showed no significant change in the outcome before 2014. Model 4 showed a statistically significant change in 2013. In order to assess whether this change was a quirk in the data or an indication of some other secular trend

biasing results, we ran a placebo regression model with the treatment in 2013 (Murnane & Willett, 2011). This model was not statistically significant, therefore, we concluded that the difference-in-differences is an appropriate analytical tool for this dataset. See Table 3 for this placebo model, which will be discussed further later.

Covariate Balance. Another important consideration in DID is the degree to which the treatment and control groups mirror each other in composition both before and after treatment (Murnane & Willett, 2011). Having treatment and control groups that contain similar types of people helps bolster the researcher's claim that their control group serves as a good counterfactual for the treatment. While controlling for demographic factors in the main DID model helps account for any differences between groups, it is important to examine the balance of covariates across both groups to assess their compatibility. In order to confirm that our groups were similar in composition before and after the treatment, we regressed group membership (CAA vs. No-CAA) on each covariate before and after treatment. Significant results for one covariate at *both* time periods would indicate that the treatment and control groups were substantively different. Significant results for one covariate at *one* time period would indicate that group composition changed over time (Wing et al., 2018). See Table 1.

At both time points for both samples, the treatment group had a higher proportion of Pell eligible students. We have included Pell as a control in our DID model; therefore, we are not concerned that it will bias our outcomes. Furthermore, low-income students on average have lower persistence and graduation rates than their higher income peers (Ma, Pender & Welch, 2016). If the presence of more Pell eligible students in the treatment group were to bias our results, it would bias them downward and weaken the treatment effect, as most likely they would accumulate more credits. Given this, we do not feel that this difference between groups is a

concern. Additionally, before the intervention, the control group was more likely to have taken AP and IB courses in high school and after the intervention the treatment group was more likely to have done so. While this estimate was statistically significant, the difference in likelihood before and after the intervention was less than 4 percentage points. Because the difference is so small, we do not believe that this is evidence imbalance between treatment and control.

There were two covariates that were not statistically significant pre-intervention but were significant post intervention: gender and selectivity of the four-year institution. While the distribution of male and female students remained the same in the pre and post period for the treatment group, the control group was five percentage points more likely to be female in the post period that it was in the pre-period. Similar to the AP IB indicator variable, because this change was so small and the composition of the treatment group remained the same, we are not concerned that this will bias our results. Finally, while the indicator for selectivity of four-year institution was significant in the post period, the means of both groups remained in the same College Board selectivity category, two-"somewhat selective", as they did in the pre period. Therefore, we are not concerned that this difference is an indicator that group composition changed over time or that the groups are dissimilar themselves.

Empirical Strategy

The following model estimates the effect of the CAA on outcomes related to credit accumulation based on the students from NCCCS who transferred post-CAA and having earned a transfer degree compared to students transferring from NCCCS who did not earn one of those degrees. Below is the general model used in this study:

$$Y_{ist} = \beta_1 Post + \beta_2 CAA + \beta_3 Post * CAA + \Upsilon X_i + \lambda X_S + \varepsilon_{ist} \qquad (1)$$

Where $Y_{is}t$ is the series of outcomes (credits earned past 120 and 140) for *i* student, transferring to *s* four-year institution during *t* semester. The coefficient β_3 on the $Post * CAA$ interaction term will estimate the effect of the policy change in the semesters following the policy change for those students who transferred from an NCCCS institution with an AA or AS transfer degree (those covered under CAA). ΥX_i is student level controls, and λX_S are four-year college fixed effects. We clustered standard errors at the four-year institution level.

Table 4 provides an overview of our main analysis for which we estimated four models for each outcome of interest. The four models are broken out in the following ways: effects of the policy at two time points, 2014 and 2016, on two different groups, students who graduated in two years and in three years.

Table 4: Description of Models

Outcome Variable	Model	Policy Year	Time to Graduation at 4-Year University
Log of Excess Credits Past 120	1a	2014	2 Years
	1b	2016	2 Years
	1c	2014	3 Years
	1d	2016	3 Years
Whether or not students graduated with over 140 credits	2a	2014	2 Years
	2b	2016	2 Years
	2c	2014	3 Years
	2d	2016	3 Years

Limitations

There are a few key limitations to this study. First, our dataset did not allow for the measurement of the required credit numbers for each degree program at each institution. We chose to use 120 credit hours based as that is the typical minimum threshold of credits required to earn a bachelor's degree (Kramer et al., 2018). Analysis of excess credits beyond the actual required number of credits required hours for the degree would be preferable (Zeidenberg, 2015). Next, this study uses administrative data with limited covariates to fully address each of the

layers in Perna and Thomas' (2006; 2008). For example, the dataset does not contain many School context (Layer Three) related to the experience of the student while attending college. Meaning that variables that could be predictive of graduation (e.g. GPA) or of earning excess credits (e.g. change of major) are not included, thus potentially biasing our estimates. Finally, while the policy was implemented across the state in the fall of 2014 for students starting in degree programs at the community colleges, students in existing AA or AS programs were in some case given the option to graduate under either the new or old policy. Therefore, our main model with the policy at 2014 intent-to-treat model (ITT). We have included a model with the policy at 2016 as well as lagged models to better account for the uptake of the policy.

Results

Outcome 1: Excess Credits Past 120

Our analysis returned null results for three out of four of our models that examine excess credit accumulation past 120. Our models suggest that the policy had no effect on the amount of excess credits students accumulated past 120 for students who graduated within two and three years with the policy at 2014 and students who graduated in two years with the policy at 2016. However, for students who graduated within three years and entered the four-year university in 2016 or later and transferred with CAA qualifying degrees (AA & AS) graduated with 41.5 percent fewer credits past 120 than those who entered without CAA qualifying degrees (β=-0.4154 $p<0.05$). See Table 5 for results.

Outcome 2: Excess Credits Past 140

Our second model yielded far more statistically significant results. Students in the treatment group who graduated in two or fewer years and entered four-year college with the intervention occurring in fall 2014 were 6.2 percentage points less likely to graduate with credits

past 140, the tuition surcharge threshold (β=-0.0616 *p<0.05*). Similarly, treated students who graduated college in three or fewer years with the treatment in fall 2014 were 6.4 percentage points less likely to graduate with credits past 140 (β=-0.0641 *p<0.05*).

The models with the policy at 2016 showed similar results. Treated students who graduated in two or fewer years were 5.6 percentage points less likely to graduate with over 140 credits (β=-0.0565 *p<0.01*). There was an appreciable leap in the treatment effect for treated students who graduated in 3 or fewer years. These students were 17.1 percentage points less likely to accumulate credits over 140 (β=-0.1713 *p<0.001*). See Table 6 for model results.

Robustness Checks

Leads and lags. One concern specific to using difference-in-differences to evaluate a policy is that the model may be picking up a secular trend and attributing its effect on the outcome to the policy (Wing et al., 2018). Another concern when evaluating the effects of a policy change is fidelity of implementation, which could affect the strength of the treatment effect. In this case, perhaps transfer advisors working with students were not offering all qualifying students the offer of treatment. Or maybe well-resourced institutions were able to better implement than those smaller, less-resourced institutions. In order to test for a confounding secular trend and implementation fidelity we ran a series of models with leads and lags. These models interact group membership (treatment vs control) with each year in question and allows the researcher to identify any suspect trends. See Table 2 for models.

The interaction terms from 2011 to 2013 for all but Model 4 showed no significant change in the regression coefficient. This demonstrates that trends in excess credit earning behavior were relatively stable pre-policy implementation, and any changes we see can be attributed to the policy change. Model 4 shows a statistically significant change in credit earning

behaviors in 2013; however, as discussed above the null results from our placebo model with the policy at 2013 indicated that this is most likely a quirk in the data and not an indication that the model is picking up and misattributing the effects of a secular trend.

The interaction terms after the policy, 2014-2016, are all not statistically significant. This indicates that either treatment implementation was slow, or we do not have the data yet to fully observe the effects of the policy on credit earning behaviors. We suspect that once we have data from 2017 and 2018 four-year college graduates, we will be able to see a fuller picture of the effects of the policy change.

Placebo Models. In addition to including models with leads to diagnose confounding secular trends, we reran our outcome models with policy implementation in 2013 instead of 2014 or 2016. If there are no confounding secular trends, we expect that the regression coefficients for the interaction terms not to be statistically significant (Wing et al., 2018). We did not find any effects with the policy in 2013, so we are more confident that any changes in excess credit earning behaviors can be attributed to the policy change. See Table 3 for placebo analysis with policy at 2013.

Another way to test whether one's analysis is picking up a confounding secular trend is to run the outcome models with placebo outcomes. This placebo outcome should be something that the researcher reasons the policy cannot affect. If the models with the placebo outcome are statistically significant than it is clear that significant findings in the original outcome models are not reliable. For this study, we choose to use Federal Interagency Committee on Education (FICE) codes, which are 6-digit codes used to identify U.S. colleges. These codes are pre-set and do not have substantive meaning; therefore, they should not be impacted by the policy. Upon

running the models, we found no statistically significant results, which further supports the validity of our findings. See Table 7 for model results.

Discussion

This study was motivated by the implementation of a state-wide articulation agreement designed to improve transfer efficiency by providing guaranteed transfer and admission to four-year institutions for students who graduate with a transfer associate degree (AA or AS). Previous research has suggested that such policies are not effective in increasing transfer, but have highlighted the need for empirical evidence to better understand if the such policies meet the intended goal of improving efficiency and reducing cost (Anderson, Sun, & Alfonso, 2006; Cohen, 1996; Higgins & Kastinas, 1999; Roska, 2006; Stern 2016). Using measures of excess credits beyond designated thresholds (120 and 140) allows us to begin to understand to what extent the CAA is streamlining the transfer process in North Carolina.

When estimating the results of the effect of the policy on credits earned past 120, we anticipated that the policy would reduce credits earned past 120. While we did not see any significant findings for the estimates of the policy implementation in 2014, we expect that it may be due to the recency of policy implementation (Baker, 2016). Furthermore, we used 120 with the understanding that this is the minimum credits typically needed for a bachelor's degree (Kramer et al., 2018), but recognize that without required credits per degree program per institutions may lead to bias in the results (Ziedenberg, 2015). Looking at students who transferred in 2016, we see a decrease in the number of excess credits beyond 120 for students who completed their BA three years after transfer to a four-year institution but not for students who completed their BA two years after transfer. Considering that students are limited in the number of courses they can take during a two-year period, it is not entirely surprising that we do

not see a significant decrease in excess credits earned for students who graduate in two years. The significant decrease in excess credits for students who took three years to complete their BA post-transfer under CAA supports the assumption that the policy increases efficiency in degree completion.

All of our models examining credit earning behavior beyond 140 credit hours showed a significant decrease in excess credits under CAA, suggesting that the policy is effectively encouraging students to earn fewer credits. This is an encouraging outcome of the policy as students who earn credit beyond 140 credit hours will be charged an additional fee per credit earned by their institution as per the UNC Surcharge Policy. This aligns with Baker's (2016) findings that policy can lead to a reduction in excess credits, but may not fully alleviate the issues of excess credit.

Implications for Policy and Future Research

The use of policy and articulation agreements to address transfer is continuing to grow. While the use of statewide articulation agreements are important as they apply to all students within a system, we recognize that institutions are developing additional transfer agreements that work to support state-wide articulation. These include institution specific articulation agreements, program specific articulation agreements, and guaranteed acceptance programs. It is important for researchers to evaluate these programs as they develop in order to aid policymakers in designing more effective articulation programs in the future.

One limitation of this project is that, due to the nature of our data, we were not able to measure credit applicability, the degree to which students were able to directly apply courses taken at the community college to their degree of study. Credit efficiency has implications for time to degree completion, as the more credits students are able to apply to their major, the fewer

courses they will need to take at the four-year college. Accordingly, students who spend less time at the four-year university will invariably pay less for their education. Future research should focus on credit efficiency to further evaluate the efficacy of articulation agreements in easing transfer.

Additionally, future research should work to understand how students are being advised about transfer articulation agreements. Do they receive information in high school about this program, or do they learn of it once in college? How many students enroll in non-CAA associate degree programs with the intention to transfer to a four-year college? If there are gaps in knowledge about the CAA, it is important to diagnose where this gap occurs in order to offer develop best practices for academic and transfer advisors.

Next Steps on Project

This preliminary analysis of the CAA suggests that the policy may be impacting the student credit earning behavior. In order to further understand this trend, we plan to conduct additional analyses that improve our ability to isolate the treatment of the policy. While our pre and post treatment groups are similar across covariates, we plan to employ propensity score matching (PSM) to create a more balanced treatment and control groups before using DID. This will allow us to create a matched sample of our treated and untreated, pre and post policy group and further refining the counterfactual to which the policy is compared.

Additionally, we are interested in the extent to which the policy impacted overall graduation and time to degree for participating students. Future analysis will explore if the CAA impacted overall graduation of four-year degrees in the post-policy landscape for both two and three year post transfer. While graduation is a vital outcome for both the individual and

institution, the policy is designed to create efficiencies within the transfer landscape that ought to lead to graduation within two years of transfer for a full-time student.

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Appendix

Table 1: Covariate Descriptive Statistics

	Graduated in 2 Years						Graduated in 3 Years					
	Pre Intervention		Post Intervention		Pre Intervention Balance Check Results	Post Intervention Regression Results	Pre Intervention		Post Intervention		Pre Intervention Balance Check Results	Post Intervention Regression Results
	CAA	No CAA	CAA	No CAA			CAA	No CAA	CAA	No CAA		
Variable												
Race					0.00	-0.03					0.02	-0.03
Black	0.08	0.10	0.08	0.12	(0.04)	(0.04)	0.10	0.12	0.09	0.13	(0.03)	(0.03)
	(0.27)	(0.31)	(0.27)	(0.33)			(0.29)	(0.33)	(0.29)	(0.34)		
Hispanic	0.07	0.05	0.09	0.06			0.07	0.05	0.09	0.06		
	(0.25)	(0.23)	(0.28)	(0.24)			(0.25)	(0.22)	(0.29)	(0.24)		
Asian	0.03	0.03	0.03	0.03			0.04	0.03	0.04	0.04		
	(0.18)	(0.16)	(0.18)	(0.17)			(0.19)	(0.18)	(0.18)	(0.19)		
Other	0.04	0.04	0.04	0.05			0.03	0.04	0.04	0.05		
	(0.19)	(0.20)	(0.19)	(0.21)			(0.18)	(0.20)	(0.29)	(0.21)		
Unknown Race	0.03	0.03	0.03	0.03			0.03	0.03	0.03	0.03		
	(0.17)	(0.17)	(0.16)	(0.17)			(0.17)	(0.16)	(0.16)	(0.16)		
Transferred from Rural	0.26	0.28	0.26	0.24	-0.02	0.00	0.26	0.26	0.27	0.25	-0.02	0.01
2-Year	(0.44)	(0.45)	(0.44)	(0.44)	(0.01)	(0.01)	(0.44)	(0.44)	(0.44)	(0.43)	(0.00)	(0.01)
Received Pell Grant	0.63	0.49	0.59	0.48	0.14***	0.11***	0.68	0.55	0.61	0.51	0.13***	0.11***
	(0.48)	(0.50)	(0.49)	(0.49)	(0.01)	(0.02)	(0.47)	(0.50)	(0.49)	(0.50)	(0.01)	(0.01)
Female	0.58	0.50	0.59	0.64	-0.01	-0.05***	0.56	0.55	0.57	0.57	0.01	0.00
	(0.49)	(0.49)	(0.49)	(0.48)	(0.01)	(0.02)	(0.50)	(0.50)	(0.50)	(0.50)	(0.01)	(0.01)
Selectivity of 4-Year	2.38	2.43	2.38	2.49	-0.05	-0.17***	2.46	2.46	2.35	2.46	0.01	-0.12***
	(1.38)	(1.42)	(1.38)	(1.44)	(0.04)	(0.04)	(1.43)	(1.48)	(1.42)	(1.49)	(0.03)	(0.04)
Took AP/IB course	0.03	0.05	0.47	0.43	-0.02***	0.03***	0.03	0.05	0.39	0.34	-0.02	0.06***
	(0.16)	(0.21)	(0.50)	(0.50)	(0.01)	(0.02)	(0.16)	(0.21)	(0.49)	(0.47)	(0.00)	(0.01)
Major	2.62	2.62	2.62	2.64	0.01	-0.01	2.56	2.55	2.55	2.57	0.01	-0.03
	(0.69)	(0.68)	(0.71)	(0.68)	(0.02)	(0.02)	(0.76)	(0.76)	(0.78)	(0.75)	(0.02)	(0.02)
N	2,491	2,192	2,294	1,733	9,788	4,027	4,167	5,621	3,128	3,656	9,788	6,784

Note: * p<0.05 ** p<0.01 *** p<0.001.

Table 2: Outcome Models with Leads and Lags

	Excess Credits Past 120		Excess Credits Past 140	
	Model 1	Model 2	Model 3	Model 4
	Graduated in 2 Years	Graduated in 3 Years	Graduated in 2 Years	Graduated in 3 Years
2011	-0.0462	-0.0584	-0.0263	-0.0389*
	(0.1006)	(0.0583)	(0.0299)	(0.0162)
2012	-0.0999	-0.0922	-0.0171	-0.0419
	(0.0755)	(0.0778)	(0.0284)	(0.0266)
2013	-0.0229	-0.1259	0.0450	-0.0498
	(0.1565)	(0.0780)	(0.0557)	(0.0288)
2014	-0.2092	-0.2490*	-0.0135	-0.0723**
	(0.1356)	(0.0889)	(0.0423)	(0.0223)
2015	-0.1410	-0.3130**	-0.0285	-0.1032**
	(0.1339)	(0.1012)	(0.0306)	(0.0255)
2016	-0.3617	-0.5830*	-0.0660	-0.1454**
	(0.2008)	(0.2271)	(0.0338)	(0.0400)
Enrolled in CAA	-0.1200	0.0595	-0.0578	-0.0068
Qualifying Degree	(0.0854)	(0.0696)	(0.0282)	(0.0320)
CAA X 2011	-0.0454	-0.0196	0.0056	0.0440
	(0.1264)	(0.0865)	(0.0336)	(0.0335)
CAA X 2012	-0.0052	-0.0214	0.0303	0.0487
	(0.1270)	(0.1015)	(0.0246)	(0.0306)
CAA X 2013	0.0948	0.1590	0.0003	0.0987**
	(0.1449)	(0.0778)	(0.0334)	(0.0306)
CAA X 2014	0.1007	0.1412	-0.0091	0.0574
	(0.1209)	(0.0830)	(0.0316)	(0.0278)
CAA X 2015	-0.0949	0.0126	-0.0637	0.0020
	(0.1711)	(0.0951)	(0.0414)	(0.0302)
CAA X 2016	-0.1810	-0.3729	-0.0741	-0.1314*
	(0.2062)	(0.1975)	(0.0432)	(0.0465)
Black	-0.1518	-0.0904	-0.0068	-0.0099
	(0.1058)	(0.0879)	(0.0273)	(0.0245)
Hispanic	-0.0640	-0.0503	-0.0231	-0.0147
	(0.0544)	(0.0426)	(0.0195)	(0.0216)
Asian	-0.0588	0.0201	-0.0036	0.0064
	(0.0951)	(0.0480)	(0.0369)	(0.0291)
Other	0.0377	-0.0032	0.0373	0.0154
	(0.0806)	(0.0646)	(0.0337)	(0.0242)
Unknown Race	0.1593*	0.0594	0.0477*	0.0171
	(0.0622)	(0.0474)	(0.0215)	(0.0276)
Transferred from Rural	0.0185	0.0464	0.0119	0.0269
2-Year	(0.0635)	(0.0565)	(0.0182)	(0.0149)
Received Pell Grant	-0.0934*	0.0305	-0.0299*	0.0195
	(0.0370)	(0.0361)	(0.0122)	(0.0106)
Female	0.0064	-0.0034	0.0122	0.0018
	(0.0527)	(0.0428)	(0.0143)	(0.0132)
Selectivity of 4-Year	0.2656	0.2219*	0.0245	0.0279
	(0.1334)	(0.0962)	(0.0263)	(0.0210)
Took AP/IB course	0.0048	0.0700	0.0478	0.0474*
	(0.1230)	(0.0882)	(0.0250)	(0.0221)
Major	-0.1114	-0.2216*	-0.0442	-0.0916**
	(0.0716)	(0.0848)	(0.0229)	(0.0253)
4-Year Institution	-0.0031	-0.0020	-0.0013	-0.0010
Fixed Effect	(0.0030)	(0.0018)	(0.0010)	(0.0008)
Constant	11.1494	8.1864	4.1041	3.3283
	(9.0573)	(5.2905)	(2.9383)	(2.3481)
N	8710	16572	8710	16572
adj. R-sq	0.12	0.11	0.05	0.05

Note: * p<0.05 ** p<0.01 *** p<0.001. Standard errors culstered at 4-year institution

Table 3: Outcome Models with Policy at 2013

	Excess Credits Past 120		Excess Credits Past 140	
	Graduated in 2 Years	Graduated in 3 Years	Graduated in 2 Years	Graduated in 3 Years
CAA X Post Interaction	-0.0013	0.0358	-0.0511	-0.0086
	(0.0902)	(0.0519)	(0.0282)	(0.0196)
Enrolled in CAA Qualifying Degree	-0.1452	0.0344	-0.0470	0.0215
	(0.0816)	(0.0722)	(0.0260)	(0.0224)
Post Policy Implementation	-0.0593	-0.1469*	0.0211	-0.0348
	(0.0927)	(0.0588)	(0.0320)	(0.0224)
Black	-0.1595	-0.1011	-0.0093	-0.0131
	(0.1083)	(0.0878)	(0.0279)	(0.0250)
Hispanic	-0.0683	-0.0566	-0.0236	-0.0166
	(0.0581)	(0.0461)	(0.0212)	(0.0218)
Asian	-0.0646	0.0140	-0.0039	0.0055
	(0.0956)	(0.0473)	(0.0357)	(0.0290)
Other	0.0354	-0.0104	0.0372	0.0136
	(0.0833)	(0.0638)	(0.0335)	(0.0238)
Unknown Race	0.1693*	0.0631	0.0490*	0.0178
	(0.0648)	(0.0516)	(0.0219)	(0.0280)
Transferred from Rural 2-Year	0.0233	0.0489	0.0130	0.0275
	(0.0647)	(0.0558)	(0.0192)	(0.0150)
Received Pell Grant	-0.0830	0.0455	-0.0274*	0.0241*
	(0.0395)	(0.0378)	(0.0123)	(0.0106)
Female	0.0046	-0.0070	0.0118	0.0011
	(0.0537)	(0.0437)	(0.0146)	(0.0135)
Selectivity of 4-Year	0.2554	0.2112*	0.0209	0.0247
	(0.1318)	(0.0939)	(0.0263)	(0.0208)
Took AP/IB course	-0.2158*	-0.2267**	-0.0217	-0.0439
	(0.0987)	(0.0717)	(0.0284)	(0.0250)
Major	-0.1140	-0.2279*	-0.0444	-0.0933**
	(0.0714)	(0.0861)	(0.0229)	(0.0257)
4-Year Institution Fixed Effect	-0.0035	-0.0023	-0.0014	-0.0010
	(0.0030)	(0.0018)	(0.0010)	(0.0008)
Constant	12.1157	9.1279	4.4482	3.5982
	(8.9515)	(5.2162)	(2.8809)	(2.3401)
N	8710	16572	8710	16572
adj. R-sq	0.12	0.10	0.04	0.04

Note: * p<0.05 ** p<0.01 *** p<0.001. Standard errors clustered at 4-year institution

Table 5: Effects of CAA on Log of Excess Credits Past 120 at 4-Year College Graduation

	Graduated in 2 Years		Graduated in 3 Years	
	Model 1a Policy at 2014	Model 1b Policy at 2016	Model 1c Policy at 2014	Model 1d Policy at 2016
CAA X Post Interaction	-0.0682	-0.0662	-0.1842	-0.4154*
	(0.0919)	(0.0504)	(0.1353)	(0.1628)
Enrolled in CAA	-0.1125	0.0840	-0.1180	0.1000
Qualifying Degree	(0.0899)	(0.0753)	(0.0888)	(0.0815)
Post Policy	-0.1152	-0.1731*	-0.1961	-0.3169
Implementation	(0.0887)	(0.0638)	(0.1146)	(0.1690)
Black	-0.1571	-0.0973	-0.1566	-0.1000
	(0.1072)	(0.0875)	(0.1077)	(0.0884)
Hispanic	-0.0626	-0.0484	-0.0696	-0.0631
	(0.0563)	(0.0431)	(0.0562)	(0.0445)
Asian	-0.0669	0.0136	-0.0594	0.0158
	(0.0968)	(0.0498)	(0.0912)	(0.0436)
Other	0.0341	-0.0135	0.0349	-0.0170
	(0.0842)	(0.0650)	(0.0828)	(0.0635)
Unknown Race	0.1670*	0.0589	0.1667*	0.0581
	(0.0646)	(0.0515)	(0.0642)	(0.0495)
Transferred from Rural	0.0224	0.0515	0.0203	0.0480
2-Year	(0.0642)	(0.0559)	(0.0638)	(0.0563)
Received Pell Grant	-0.0842	0.0420	-0.0907*	0.0380
	(0.0395)	(0.0385)	(0.0373)	(0.0356)
Female	0.0053	-0.0068	0.0044	-0.0054
	(0.0529)	(0.0434)	(0.0539)	(0.0433)
Selectivity of 4-Year	0.2584	0.2138*	0.2619	0.2184*
	(0.1325)	(0.0945)	(0.1336)	(0.0954)
Took AP/IB course	-0.1506	-0.1639*	-0.0766	-0.0637
	(0.0800)	(0.0652)	(0.1119)	(0.0804)
Major	-0.1131	-0.2278*	-0.1123	-0.2230*
	(0.0715)	(0.0863)	(0.0718)	(0.0859)
4-Year Institution Fixed	-0.0034	-0.0022	-0.0032	-0.0020
Effect	(0.0030)	(0.0018)	(0.0030)	(0.0018)
Constant	11.8635	8.9012	11.2760	8.1794
	(8.8664)	(5.2244)	(8.9097)	(5.1592)
N	8710	16572	8710	16572
adj. R-sq	0.12	0.10	0.12	0.11

Note: * p<0.05 ** p<0.01 *** p<0.001. Standard errors clustered at 4-year institution

Table 6: Effects of CAA on Excess Credits Past 140 at 4-Year College Graduation

	Graduated in 2 Years		Graduated in 3 Years	
	Model 2a Policy at 2014	Model 2b Policy at 2016	Model 2c Policy at 2014	Model 2d Policy at 2016
CAA X Post Interaction	-0.0616*	-0.0565**	-0.0641*	-0.1713***
	(0.0295)	(0.0161)	(0.0304)	(0.0414)
Enrolled in CAA Qualifying Degree	-0.0480	0.0407	-0.0684*	0.0323
	(0.0262)	(0.0223)	(0.0236)	(0.0233)
Post Policy Implementation	-0.0139	-0.0398	-0.0229	-0.0489
	(0.0338)	(0.0224)	(0.0216)	(0.0359)
Black	-0.0083	-0.0119	-0.0087	-0.0133
	(0.0271)	(0.0247)	(0.0278)	(0.0251)
Hispanic	-0.0219	-0.0137	-0.0242	-0.0187
	(0.0204)	(0.0217)	(0.0213)	(0.0220)
Asian	-0.0057	0.0050	-0.0036	0.0059
	(0.0366)	(0.0290)	(0.0353)	(0.0302)
Other	0.0379	0.0128	0.0377	0.0116
	(0.0335)	(0.0246)	(0.0336)	(0.0239)
Unknown Race	0.0482*	0.0164	0.0486*	0.0166
	(0.0217)	(0.0281)	(0.0221)	(0.0275)
Transferred from Rural 2-Year	0.0123	0.0283	0.0119	0.0271
	(0.0189)	(0.0148)	(0.0189)	(0.0147)
Received Pell Grant	-0.0277*	0.0228	-0.0287*	0.0222*
	(0.0125)	(0.0110)	(0.0121)	(0.0103)
Female	0.0124	0.0012	0.0122	0.0012
	(0.0142)	(0.0132)	(0.0148)	(0.0136)
Selectivity of 4-Year	0.0218	0.0255	0.0223	0.0266
	(0.0264)	(0.0210)	(0.0264)	(0.0210)
Took AP/IB course	0.0041	-0.0218	0.0080	-0.0019
	(0.0228)	(0.0233)	(0.0295)	(0.0260)
Major	-0.0441	-0.0933**	-0.0440	-0.0918**
	(0.0228)	(0.0258)	(0.0229)	(0.0257)
4-Year Institution Fixed Effect	-0.0014	-0.0010	-0.0013	-0.0010
	(0.0010)	(0.0008)	(0.0010)	(0.0008)
Constant	4.3958	3.5255	4.3022	3.3550
	(2.8710)	(2.3392)	(2.8635)	(2.3153)
N	8710	16572	8710	16572
adj. R-sq	0.04	0.05	0.04	0.05

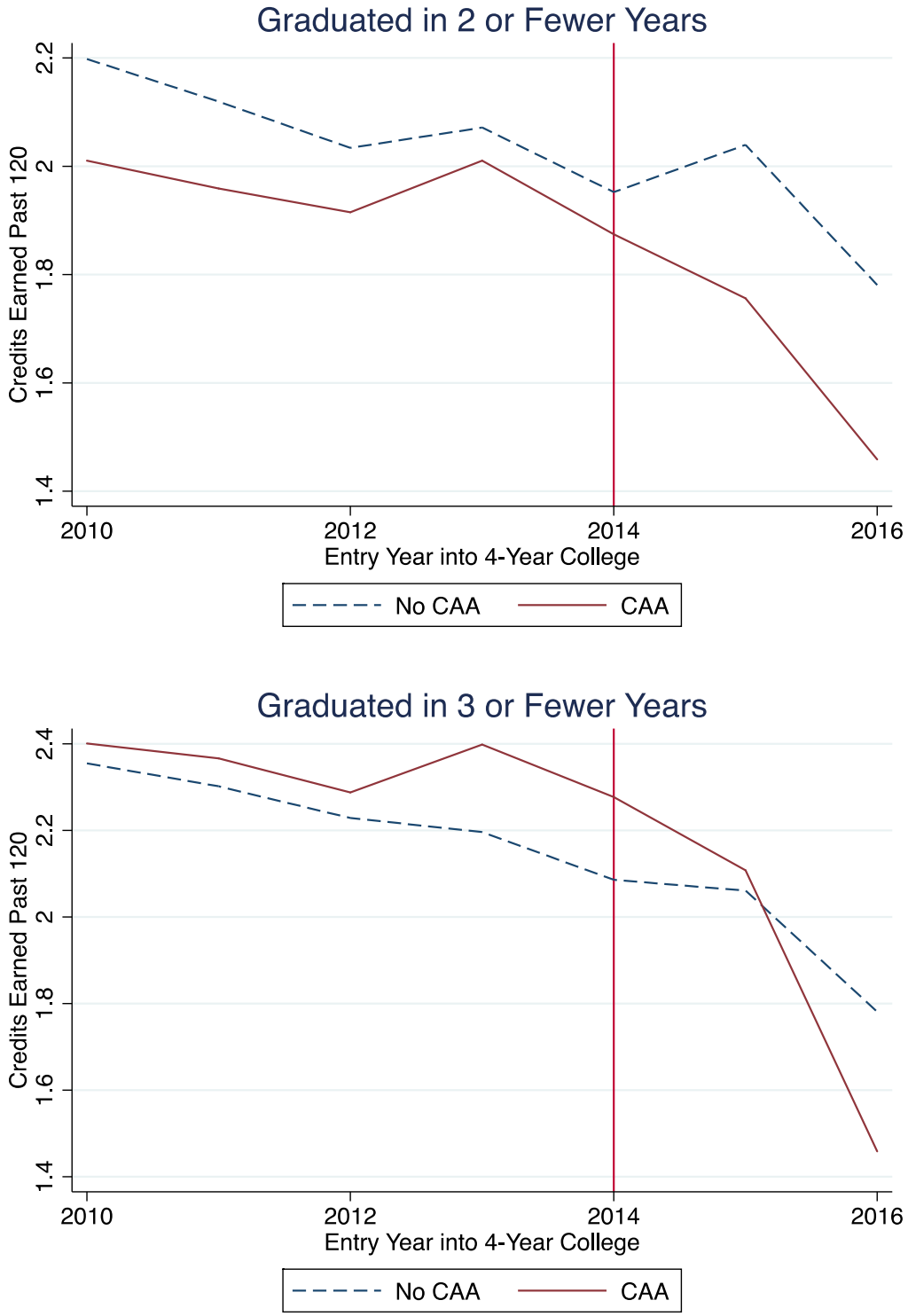
Note: * p<0.05 ** p<0.01 *** p<0.001. Standard errors clustered at 4-year institution

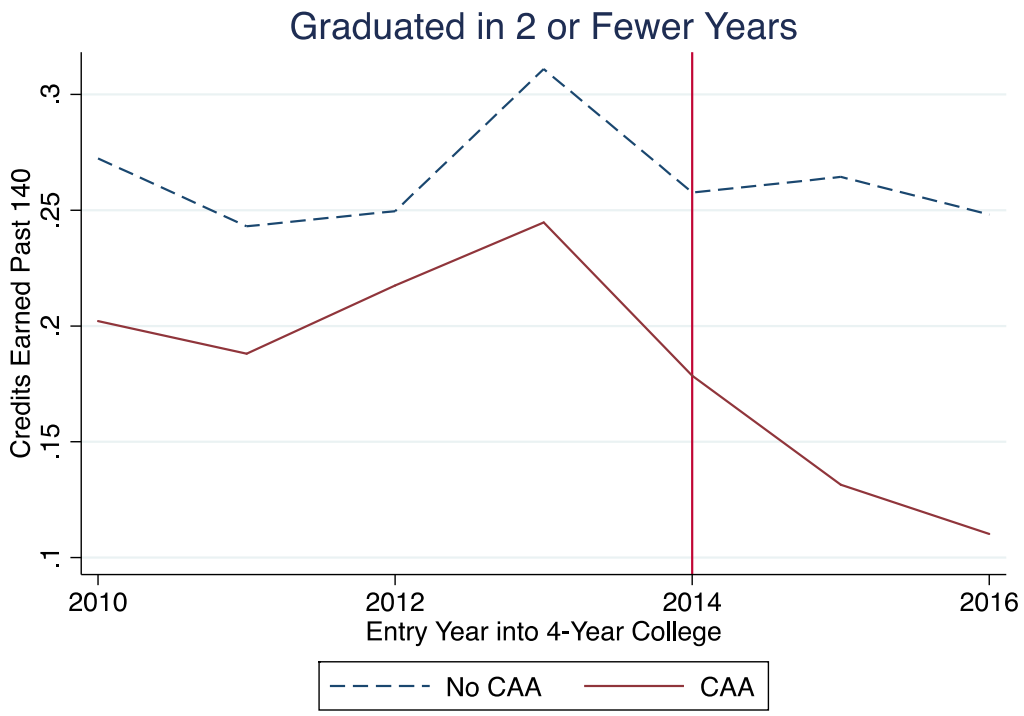
Table 7: Placebo Analysis with Fice Code as Outcome

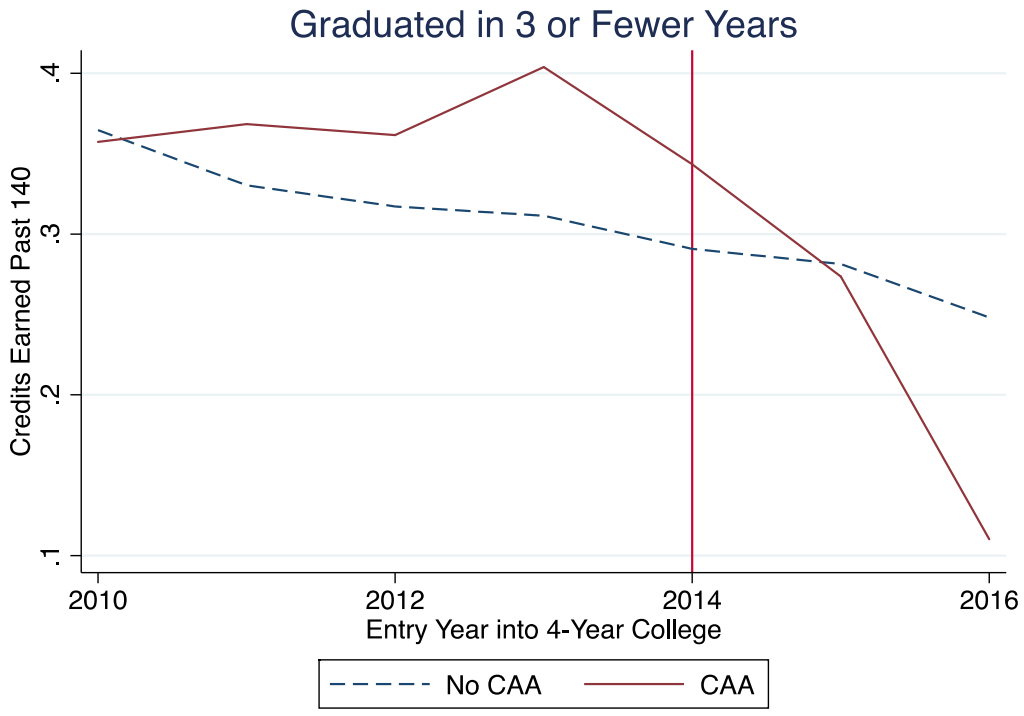
	Graduated in 2 Years		Graduated in 3 Years	
	Policy at 2014	Policy at 2016	Policy at 2014	Policy at 2016
CAA X Post Interaction	-108.9291	-55.4932	-59.9386	-152.1366
	(73.6919)	-187.9174	(75.5971)	(164.1523)
Enrolled in CAA Qualifying Degree	26.9683	-13.3392	73.4504	56.9005
	(142.2848)	(154.5776)	(139.9560)	(134.4822)
Post Policy Implementation	90.2465	-49.5859	14.5652	112.7573
	(81.2542)	-173.3028	(34.8022)	(130.0349)
Black	164.1405	166.5723	55.6680	54.1158
	(218.6052)	(217.2037)	(191.3748)	(190.9748)
Hispanic	-337.8854	-335.9989	-236.2594	-237.4708
	(188.4631)	(189.4991)	(144.1177)	(144.0333)
Asian	-317.9874**	-315.7626**	-372.5118**	-372.3874**
	(88.7115)	(89.1261)	(99.0123)	(99.3220)
Other	453.3053*	454.1127*	325.4584	324.4888
	(206.9931)	(206.8692)	(154.7743)	(154.9032)
Unknown Race	-9.0708	-9.6735	-94.3704	-93.5713
	(243.9024)	(244.0648)	(203.5909)	(203.8989)
Transferred from Rural 2-Year	629.7117	627.7534	694.9920*	694.6513*
	(328.1338)	(326.1916)	(294.5356)	(294.0942)
Received Pell Grant	79.3416	77.5923	120.3157*	121.2816*
	(46.5415)	(47.3816)	(52.1017)	(52.0740)
Female	106.4947	108.5240	79.9212	78.8140
	(83.3661)	(84.1278)	(61.6180)	(61.8491)
Selectivity of 4-Year	185.3640	187.8046	181.6486	181.2963
	(128.8268)	(128.9440)	(117.9198)	(117.9538)
Took AP/IB course	133.9101	194.5523	143.8690	127.7485
	(95.5023)	(141.4350)	(86.7137)	(113.9761)
Major	20.5511	21.4340	-16.8329	-16.5990
	(29.3639)	(29.5101)	(23.4552)	(23.2663)
4-Year Institution Fixed Effect	10.6328	10.7069	8.1053	8.0834
	(6.1359)	(6.1330)	(5.3646)	(5.3557)
Constant	-27014.6820	-27210.6603	-19480.2270	-19411.1270
	(18310.8287)	(18298.6851)	(16009.8364)	(15986.4310)
N	8710	8710	16572	16572
adj. R-sq	0.03	0.03	0.03	0.03

Note: * p<0.05 ** p<0.01 *** p<0.001. Standard errors culstered at 4-year institution

Figure 1: Parallel Trends Inspection




Graduated in 2 or Fewer Years
Credits Earned Past 140
.1
.15
.2
.25
.3
2010
2012
2014
2016
Entry Year into 4-Year College
No CAA
CAA


Graduated in 3 or Fewer Years
Credits Earned Past 140
.1
.2
.3
.4
2010
2012
2014
2016
Entry Year into 4-Year College
No CAA
CAA