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An Evaluation of Arkansas' Developmental Coursework Policy at Postsecondary Institutions

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An Evaluation of Arkansas' Developmental Coursework Policy at Postsecondary Institutions

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Abstract

This dissertation is an evaluation of the impacts of assignment to and enrollment in postsecondary remedial coursework in the state of Arkansas. In this study, I evaluate the impacts of the policy on students' academic achievement and attainment as measured by graduation rates and persistence. I include subgroup analyses of these outcomes to determine whether there are heterogeneous effects for students enrolling at two-year or four-year institutions, institutions with the highest remediation rates, and students of different races, genders, and baseline achievement. Like previous evaluations of remediation in other settings, the results here point to negative impacts of remediation on students' persistence and earning a degree, regardless of institution type. Secondary analyses show that students who were assigned to English Language Arts remediation but tested out of the course earned higher grades in the first college-level course compared to their peers who were unable to test out of remedial courses. There was no detectable difference in course performance for math students. Similarly, there were few substantial differences in noncognitive skills for students enrolling in remedial English courses compared to their nonremedial peers. These studies contribute to the literature on college remediation policies by providing the first rigorous evaluation of the policy in Arkansas, a comparison of noncognitive skills of remedial and nonremedial students, and a descriptive analysis of course performance for students who avoided remedial courses.

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Dedication

This edition of *An Evaluation of Arkansas' Developmental Coursework Policy at Postsecondary Institutions* is dedicated to my brother, Robbie and sister, Madeline. I couldn't have asked for better role models.

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Chapter I – Introduction

This dissertation is a comprehensive evaluation of Arkansas's statewide postsecondary remedial[1] coursework policy for first-time college enrollees, spanning from 2004 through 2016. Like most states, Arkansas has implemented a remedial coursework policy intended to help students deemed academically unprepared for the challenges of college-level coursework. The Arkansas policy is implemented at all thirty-two public two-year and four-year institutions and placement into these courses is determined through the use of placement exams such as the ACT and SAT. Specifically, this study looks to answer the question of whether or not this policy was successful in helping students persist beyond the first year of postsecondary education and attain a degree or certificate. I look to answer this question using students who were assigned to remedial courses and those who ever enrolled in remedial courses during the time-period of interest.

In this first chapter, I examine the issues of postsecondary access and preparation, as a means for explaining the need for remedial coursework.

A. The Issues

Education has long been viewed as one of the most important means of improving an individual's economic outcomes (Heckman, 2008). At one time, the United States was one of the world leaders in educational attainment. However, the percentage of the population ages 25-34

[1] It is important to note that in this study, I use the term "remediation" in place of "developmental coursework". "Developmental coursework" is the preferred terminology among practitioners, whereas "remediation" or "remedial coursework" is the more common term in quantitative research and in the mainstream. Research in other states often uses the terms "remediation" and "developmental" interchangeably, however, these are not necessarily the same thing. These differences are setting-specific, where "remedial" is reserved for courses meant for students who have scored the lowest on placement exams and "developmental" is reserved for students scoring just below the cutoff for college-level coursework (e.g. Boatman & Long, 2010). In Arkansas only a few institutions implement multiple levels of basic-level courses. Therefore, I use "remediation" as a blanket term for non-credit bearing, basic-level courses in Arkansas.

earning a college degree has stagnated in recent years and the United States has gradually been passed by other nations (OECD, 2016). Despite this, demand for college educated workers has continued to increase. Levy and Murnane (2003) argue that there has been an increased demand for trained workers, leading to differential wage increases for workers performing routine tasks compared to those performing non-routine tasks. This has led to a growing wage gap between those with postsecondary education and those without. As Carnevale, Rose, and Cheah (2011) show, "Having some postsecondary education, even without earning a degree, adds nearly one-quarter of a million dollars to lifetime earnings…These numbers demonstrate conclusively the advantage of non-baccalaureate postsecondary education." Increases in potential earnings by simply enrolling in postsecondary education is a likely explanation for the increased number of students attempting to earn a postsecondary degree.

Despite only one-in-three American adults having a bachelor's degree or higher, (Ryan and Bauman, 2016), many view postsecondary education as a requirement for economic stability and success. This has led to debates on equality of access to postsecondary education in the U.S. In January of 2015, President Barack Obama proposed making two years of community college education free of charge to all "'willing to work for it.'" (Hudson, 2015) True to form, the 2016 presidential election saw the issue of student loan debt and tuition-free college move into the spotlight as well, as Senator Bernie Sanders (I-VT) called for all public postsecondary institutions to be free for all students (Sanders, 2015) and eventual democratic nominee Secretary Hillary Clinton proposed a similar policy for all families with an income of less than $125,000 (Saul & Flegenheimer, 2016). However, these proposals calling for improved access have failed to address the problem of students who lack adequate preparation for college coursework.

Every year, a large percentage of students enrolling in postsecondary education do so without adequate skills to succeed in college-level coursework. Early studies of college readiness using high school transcript data and NAEP scores found that roughly one-third of the high school class of 2001 graduated at levels below what is believed to be college-ready (Greene & Forster, 2003). Low college–readiness rates have existed since at least the early 1990s, when only a quarter of the high school class of 1991 graduated at the college-ready level (Greene & Winters, 2005).

Taken at face value, low readiness rates are less concerning if a small portion of unprepared high school graduates pursue postsecondary education. However, descriptive research from Petrilli (2016) and Finn (2017) finds that at least two thirds of recent high school graduates have enrolled in postsecondary education. Simply put, large portions of high schoolers graduate at levels that are below the college-ready benchmark, but enroll in college anyway. This has led some to posit that there is a potential disconnect between what high schools expect from their graduates and what colleges demand of applicants, resulting in the high percentages of first-time college enrollees who require remediation (Karruz, 2010; Butrymowicz, 2017). This leaves colleges—the gateway to improving economic outcomes (Heckman, 2008)—with the decision of either admitting or turning away students who have shown they are unprepared for the rigors of postsecondary education. Rather than say no, colleges have implemented remedial-level courses to help students recover missing skills, with 74 percent of public universities and 99 percent of community colleges offering remedial courses to their first-year students (USDOE, 2016).

Evidence on the overall lack of preparation for postsecondary education is not limited to NAEP results, as national trends on the ACT from the last two years have shown similar patterns of unpreparedness for many high school graduates. For the class of 2015, nearly one-third of students taking the nation's most popular college placement test did not meet the college-ready benchmark in any of the four tested subjects (ACT, 2015). Similarly, 34 percent of the nearly 2.1 million students who took the ACT failed to meet the readiness benchmark in any of the tested subjects (ACT, 2016). The number of students taking the ACT represents nearly two-thirds of the graduating class of 2016, showing that nearly two-thirds (64 percent) of recent high school graduates have at least considered enrolling in postsecondary education. According to the ACT, 84 percent of the students who took the ACT stated they do in fact plan to enroll in postsecondary education, giving evidence to what Arum and Roksa (2001) found a majority of "high school students [*expect*] to attend college." This expectation of attending college makes the problem of being unprepared all the worse. The administrators of the ACT have taken notice of the dismal readiness rates, stating recently these are an "alarming number, an indication those students are likely to struggle with first-year courses and end up in remedial classes that will delay completion and increase college costs." (Associated Press, 2016)

True to the ACT's prediction, the lack of preparation has resulted in large percentages of students enrolling in remedial classes. During the 2007-08 academic year, public postsecondary institutions in the U.S. saw approximately one quarter of first-time enrollees assigned to remedial coursework in at least one subject (Sparks and Malkus, 2013). More recent estimates of remediation rates found that 29 percent of students at universities and 41 percent of students at community colleges enrolled in remedial courses during their first two years of college (Skomsvold, 2014). These rates are likely lower than if reports were based on transcripts (Radford & Horn, 2012) or if all students assigned to remedial courses followed through on their enrollment (Bailey & Cho, 2010). Estimates based on BPS: 2009 survey data suggests half of all undergraduate students will take at least one remedial course during their college career (Scott-Clayton & Rodriguez, 2015). This percentage has likely increased in the years since, especially considering the proportion of students who fail to meet readiness benchmarks on college admissions tests like the ACT.

The prevalence of remedial courses and remediation policies across the higher education landscape, along with the nontrivial percentage of students impacted by these courses makes the conclusion from Markus and Zeitlin (1993) all the more true: "Remedial education is, has, and will continue to be an integral component of the undergraduate curriculum." But, how did college remediation get its start and what exactly is college remediation? The next section aims to answer those questions, along with providing some insights into the debate over this topic.

B. Postsecondary Remedial Coursework Policies

The divide between college preparation and college aspiration is by no means a new occurrence in US higher education. In its simplest form, remedial coursework on college campuses is basically high school level material taught in courses that do not count towards a degree. The purpose of these remedial courses is to give the necessary skills and knowledge to help students succeed in the college-level version of the course (Valentine, Konstantopoulos, & Goldrick-Rab, 2016). While debates over college remediation are relatively young, college remediation itself is as old as college education itself. Not long after its founding in 1636, Harvard began offering Latin and Greek tutors to its less prepared students (Spann & McCrimmon, 1998). In 1852, University of Michigan president Henry P. Tappan argued "American colleges were spending too much time teaching courses on an elementary level that could be more properly taught in primary schools (Markus & Zeitlin, 1993)." Later, the Morrill Acts of 1862 and 1878 opened the world of higher education to a larger portion of the population and led to the creation of the College Entrance Board in 1890 to bring more uniformity to university admissions policies. With the increased competition for students at the start of the twentieth century, more prestigious institutions found themselves lowering their admissions criteria (Markus & Zeitlin, 1993) and having to rectify student weaknesses.

Lowering the standard for admission led to a more widespread problem of underprepared students enrolling in postsecondary education and led many universities to open college preparatory departments charged with improving the academic skills of the newly admitted students (City University of New York, 1997). While the first half of the twentieth century saw remedial courses move almost exclusively to community and technical colleges, the increased access to education resulting from programs like the G.I. Bill and higher high school graduation rates led to four-year universities offering courses for underprepared students again, though, not without scrutiny from policymakers and higher education administrators (CUNY, 1997). As Arum and Roksa (2011) argue, "Massive expansion of higher education, led by the public sector, has created unprecedented opportunities for students to continue their education beyond high school." Postsecondary institutions responded by opening their doors to more students, which Martin Trow (1970) argues has transformed higher education into an assumed right rather than a privilege. We see this in the number of students participating in the ACT and enrolling in college, despite the obvious lack of student preparedness and the rising costs of higher education.

While seemingly negative, relaxing some of the admissions standards previously in place has expanded access to higher education beyond the privileged elite. Even though recently proposed policies have focused on access, they have not addressed the problems of lack of preparation, nor have these proposals come with any solutions to decreasing the remediation rates. Instead, states have attempted to rectify the high remediation rates by limiting access to remedial courses, decreasing available funds used for remediation, and moving all remedial courses from four-year universities to community colleges (Calcagno & Long, 2008).

In spite of the legislative changes that will impact postsecondary education, the primary goal of these remedial coursework policies has remained relatively unchanged: expand access to higher education to students who may lack the same level of rigor in K-12 education and to compensate for deficiencies in student learning (Boylan, 2001). More recently, the National Association of Developmental Education (NADE) has written in their mission that the purpose of postsecondary remediation is "meeting underprepared students where they are academically, afford[ing] them the chance to begin their higher education on a firm and equal footing with those who do not need remediation (Goudas & Boylan, 2012)." Additionally, the NADE looks to "convey the fundamental belief that developmental education services enhance academic, personal, and professional achievement for all learners (NADE.net, 2016)."

Even with the admirable purposes of remedial coursework, these policies still have critics who argue the benefits of remediation do not outweigh the costs, especially considering that credits earned in remedial courses do not count towards graduation and the near uniform results of research showing that remediation is having a negative impact on students (Valentine et al, 2016; Bettinger & Long, 2005; Calcagno & Long, 2007; Calcagno & Long, 2008; Deil-Amen & Rosenbaum, 2002; Levin & Koski, 1998; Rosenbaum, 2001; Karruz, 2010). However, the results of recent research have led to a debate whether the research questions asked, the comparisons made, and outcomes measured are the most appropriate (Goudas & Boylan, 2012). This critique of recent research hinges on a broader criticism of remediation researchers "cherry-picking" research yielding negative results, overlooking methodological problems in research, and pushing research that supports a reform-agenda designed to replace developmental education with co-requisite models. (Goudas & Boylan, 2012). However, researchers have responded that the purpose of research on remediation is not to eliminate remediation wholesale, but, rather, to improve the impact of a widespread program designed to help often underrepresented college-going students.

Recent findings in remediation research point to these courses being an added barrier to college education, lowering the probability of persistence and completion by increasing the number of hurdles students must clear before enrolling in college-level courses (Bettinger & Long, 2005; Valentine et al, 2016). This is especially concerning when considering the population of students who are most often recommended to remedial coursework, i.e. underrepresented minorities. Critics of remedial coursework also argue these policies are expensive for students and that postsecondary institutions should not have to pay for the academic preparation students should have received in high school (Bahr, 2008).

The estimated costs of remedial coursework vary and are limited by a lack of available data, but they are by no means small. A widely-cited study from Breneman and Haarlow (1998) estimates the cost to be between $1 billion and $2 billion annually at public postsecondary institutions in the United States. A study from Strong American Schools (2008) estimates the cost to be over $2 billion, with community colleges spending between $1.9 and $2.3 billion and 4-year institutions spending about $500 million. Karruz (2010) calculated the per-student costs of taking two remedial courses using the Strong American Schools estimates, finding two-year colleges spend between $1,607 and $2,008, and four-year institutions spend between $2,025 and $2,531. Additionally, Scott-Clayton and Rodriguez (2015) estimate the annual cost at community colleges could be as high as $4 billion. While the budget for remediation is a small drop in the $150.7 billion federal higher education budget's bucket, it is still money being spent to teach college students topics they should have already learned.

Policymakers questioning the value of remediation have begun to push limiting the availability of these services (Bettinger & Long, 2007; Merisotis & Phipps, 2000). Other states have begun to limit the number of available remedial courses at public institutions, while others have tried to move all remedial courses to community colleges only (see Florida) and others have even begun to limit when these courses are available. Connecticut's General Assembly has come under fire from remedial coursework supporters after the Connecticut Legislature adopted a policy prohibiting community colleges from offering more than one semester of developmental coursework (Fain, 2012).

While the costs above are taken for all students enrolling in remedial courses, the forgotten point is that institutions are asking taxpayers to pay twice for a high school level course, both for tax-based K-12 schools and at tax-supported public postsecondary institutions. This latter point is a large concern for state legislatures (Merisotis & Phipps, 2000). As Strong American Schools (2008) describes remediation, "[F]or the taxpayer, the underwriting of remedial education is a lot like buying a car, discovering the transmission is broken within weeks of pulling off the lot, and then having to pay for the repairs out of pocket."

Because of the problems associated with remediation and the contentiousness of the debate surrounding remediation, researchers have begun applying rigorous evaluation methods to measure the impacts of these policies on students. Prior to the early 2000s, research on remediation was mostly qualitative and/or subject to serious methodological flaws that left researchers knowing very little on the impact of such programs. However, recent evaluations of community college networks in California, Florida, and Virginia, along with statewide evaluations in Ohio and Texas using student-level data have shed more light on remediation. The research presented here aims to continue filling in the gaps in remediation research by estimating the impacts of remediation in Arkansas as well as offering potential explanations for the findings. The next section describes the research questions and the structure of this dissertation.

C. Research Questions

Over the last three decades, remediation at the college level has evolved dramatically, both legislatively and institutionally. These changes have come in an effort to improve postsecondary education and remedial courses themselves. Arkansas, much like other states, has a large percentage of college students enrolling in remedial courses every year. However, there has yet to be a comprehensive, rigorous evaluation of the impacts of this policy on students in Arkansas. This leads to the primary question that guides this research:

1. What is the impact of remedial coursework on student outcomes in the state of Arkansas?

The outcomes of interest include persistence into the second year and beyond, ever earning a degree of any type, and earning a degree in 100 percent and 150 percent of the standard time allotment after enrollment. Along with results for the primary research question, I ask the following additional questions that relate to the primary analysis:

a) What is the impact of remedial coursework on students enrolling at 4-year universities?
b) What is the impact of remedial coursework on students enrolling at 2-year community colleges
c) What is the impact of remedial coursework on subgroups of students at these institutions, including, Black students, female students, and students enrolling in college with a high school GPA of 3.0 or higher?

To answer these questions, I make use of a rich student-level dataset provided by the Arkansas Department of Higher Education, covering all first-time enrollees at Arkansas public colleges and universities between 2004 and 2016. This yields a sample of 12 cohorts of students, consisting of over 260,000 students. This is larger than previous studies of college remediation, in terms of cohorts of students, but is similar in size for analytic samples of individual students.

Postsecondary institutions in Arkansas require nearly all first-time entering freshmen to either submit an entrance exam score (such as the ACT or SAT) or participate in placement testing at the point of enrollment (such as the COMPASS or ASSET exams). This allows for the identification of students who would be assigned to remedial courses by scoring below the state-established minimum. Additionally, the dataset provided includes an indicator for whether or not students enrolled in remedial courses at any time during their college career.

Findings from this analysis show that students who are assigned to remedial courses have a lower probability of persisting beyond their first year of college and a lower probability of ever earning a degree as compared to their peers who score immediately above the placement cutoff. These results hold when measuring impacts at only 4-year institutions, only 2-year institutions, the institutions with the highest remediation rates, and for subgroups of students. Additionally, this study finds that students who comply with their course placement and enroll in remedial courses experience even lower probabilities of persisting and attaining degrees.

These larger negative impacts for students enrolling in remedial courses compared to students who are simply assigned to remedial courses is an outcome in need of exploration. Not every student who is assigned to remedial coursework enrolls, as the state policy allows students to submit secondary test scores in order to replace a score that would assign them to remediation. These students who avoid their remedial courses may be different academically compared to their peers who enroll in remedial courses. With that in mind I ask the following question to explore a possible explanation for the differences in outcomes for students assigned to remediation compared to students who enroll in remediation

1. How do students who were assigned to remediation and tested out perform in their gatekeeper course compared to their peers who were assigned to remediation and complied with their placement?

To answer this question I use student-level data from a Large Arkansas University (LAU) for all students who enrolled between 2003 and 2015. Initial results show that students who are able to test out of remedial courses are more advantaged than their peers who are unable to test out. Also, students who avoid their remedial English course placement outperform their remediated peers by earning higher grades in their gatekeeper English course. This result offers a potential explanation for the differences in results found in the primary analysis, as the students who enroll after being assigned to remedial courses may lack the skills and supports to succeed in college.

While the overall results presented here are similar to previous studies of remediation in other settings, answering questions on the impacts of remediation leads to questions of why the impacts of remediation run counter to the purpose of remediation. The primary analysis here shows that students who are assigned to and enroll in remedial courses perform worse than their peers who avoid remediation. The secondary question shows that students who are able to test out of remedial courses after being assigned to remediation are likely different from their peers who are unable to test out of remediation. These noncomplying students actually outperform their complying peers in the gatekeeper course, showing that actually enrolling in remediation is having negative impact on students. This could be due to differences in remedial students' noncognitive skills compared to their nonremediated peers. This leads to the following question:

2. Do students enrolling in remedial courses differ from their nonremediated peers on short-term noncognitive outcomes as measured at the point of entry into postsecondary education?

To answer this question, I use student-reported responses to a survey administered at a Large Arkansas University in the fall semester of the 2016-17 school year for students in remedial English courses and students in Composition I. Student responses show that remedial students are less likely to agree their remedial course is going to be helpful for their future plans. While not statistically significant, there is a pattern of results suggesting potential reference group bias along with students in remedial courses not being exposed to an academic environment that is helpful to creating realistic expectations for their academic endeavors.

While these analyses do not employ the ideal random assignment methodologies (e.g. Wolf et al., 2008), I am still able to implement rigorous research designs that take advantage of the state's course placement score cutoff. This strict placement score policy allows for a regression discontinuity design, comparing students who score just below the cutoff to their peers who score just above the cutoff. This allows for causal estimates of the impacts of remedial courses at postsecondary institutions in the state of Arkansas (Imbens & Lemieux, 2008).

The following chapter of this dissertation presents a systematic review of the rigorous research that evaluates the impacts of remedial coursework in the United States. This includes a calculation of the meta-analytic averages of the impacts, which, while often yielding few statistically significant results, tends to show negative impacts of remediation. Additionally, it aims to provide a complete picture of remediation.

The third chapter presents the data and methods used to answer the primary question of interest in this research. This includes a description of the study setting and the use of a regression discontinuity design to analyze the impacts of remediation in the state of Arkansas. The section leads directly into chapter four, which presents the results of the primary analysis of remediation in Arkansas. This is the first rigorous evaluation of the state's postsecondary remediation policy. Much like previous evaluations of remediation in other settings, remediation in the state of Arkansas has negative impacts on students. However, unlike other studies of remediation, many of the results presented are statistically significant. Along with the overall results, this analysis provides insights into how different types of institutions affect students who are deemed unprepared and examines the impacts of remediation on specific subgroups of students. This study is particularly timely, as Arkansas shifts it higher education funding mechanism to an entirely outcomes-based model.

Chapters five and six present the results of the secondary research questions. Chapter five is a descriptive evaluation examining student performance in the introductory (gatekeeper) courses for those students who score below the state-mandated cutoff and subsequently avoid enrolling in remedial courses, compared to their peers who score below the cutoff and comply with their course assignment at LAU. This analysis is directly influenced by the results of the primary analysis showing differences in outcomes for students who are assigned to remediation and for those who actually enroll in remedial courses. To do so, I use student-level data from LAU, finding that students who are recommended to English remediation and avoid enrollment outperform their peers who enroll in remedial courses in Composition I, while finding no statistically significant impacts for math students. Chapter six is a qualitative study using survey data from students at LAU enrolling in either remedial English/reading courses or Composition I. This survey is meant to determine if there are any differences in students' noncognitive skills at the point of entry into college as a means of explaining why remediation may not be having the impact for which it is intended.

The final chapter concludes this dissertation with a discussion of the results and how they may influence policy. Taken together, the results uncovered in this dissertation contribute to the overall understanding of the effectiveness of college remediation policies and the impacts of these policies on students in the state of Arkansas.

Chapter II – Systematic Review of Literature

Remedial coursework policies are state and institution specific, which has a heavy influence on available research methodologies and data. One of the main aspects of these policies is determining how students are placed into courses. A vast majority of postsecondary institutions--community colleges and four-year universities--require an entrance exam to determine course placement. Students' whose scores fall below a certain cutoff are assigned to remedial courses. A recent article from the Hechinger Report stated more than half of students enrolling in postsecondary education at colleges and universities in 44 states are deemed unprepared for college education (Butrymowicz, 2017). In these cases, unprepared students enroll in non-credit bearing courses designed to build knowledge, improve study skills, and prepare students for college-level academics. With such a large portion of the college-going population being assigned to remedial courses, it has become an increasingly popular topic for researchers. Groups like the National Association of Developmental Education and Complete College America--while representing opposite ends of the debate on remediation--have a vested interest in the impacts of remedial coursework on students and have published a large amount of qualitative and observational research.

While remediation is a popular topic of research, it is a relatively young topic for rigorous methodologies of analysis. A review of remediation research from Merisotis and Phipps (2000) states, "Research about the effectiveness of remedial education programs has typically been sporadic, underfunded, and inconclusive (p. 75)." Another review from Grubb (2001) adds, "Unfortunately, while debates for and against have been vociferous, the effectiveness of these programs has not been visible as an issue. Relatively few evaluations of remedial programs have been conducted, and many existing evaluations are useless (p.1)." As datasets like the National Educational Longitudinal Study (NELS:88) became available, researchers had an easier time of making simple comparisons of students assigned to remediation and students who avoided remediation. These comparison and matching studies often find students who enrolled in these remedial courses were less likely to persist and attain their degrees (see Attewell et al, 2006).

This chapter begins by presenting a review of the research examining college remediation. In this review, I emphasize the need for research on remediation to examine and compare remedial and nonremedial students who are similar on observable characteristics, as these will lead to the most effective comparisons of outcomes. I then synthesize the findings of remediation research to calculate meta-analytic averages of the impacts of being assigned to remediation on students' probability of persisting in college, earning a certificate/graduating, and student success in the subsequent "gatekeeper" course.

A. Reviews of Research on Remediation

Remediation has been a policy in higher education for as long as the system of higher education in the US has existed. Educational historians have pointed to the use of basic skills courses in place at Harvard as the start of what would later become classified as remediation. Additionally, policies designed to increase access to college for more than just the elites showed the disparities in skills for college-bound students. In order to rectify these skill deficiencies, universities offered remedial courses. While percentages of remediation-eligible students vary by state and institution type, it is clear that a large percentage of college-bound students enroll without the necessary skills for college-level coursework (Greene & Forster, 2003). However, research to examine the impacts of these remedial courses often came in the form of case studies. Only recently have researchers begun to use rigorous methods to evaluate remediation policies.

With increased data availability and the growing concern regarding remediation, it is more feasible for researchers to evaluate remediation. However, there are still problems with trying to estimate the causal impacts of remediation. One of the first is disentangling the differences between the groups of students enrolling in college. Raw comparisons of remedial and nonremedial students introduce large amounts of bias, as students who avoid remediation by scoring well above the cutoff are remarkably different from students who score far below and even right at the remedial cutoff on baseline ability. Also, not all students who are assigned to remedial courses enroll in these courses, and not every student who enrolls in remedial courses is able to pass. Therefore, researchers looking to evaluate remediation have a variety of students with a multitude of observable and unobservable difference to control for.

These last two situations are of greater concern to researchers. According to both Bailey, Jeong, and Cho (2010) and Scott-Clayton and Rodriguez (2015), students who avoid remediation could do so either by testing out of remedial courses or avoid enrolling in college all together after receiving the information they will have to enroll in remedial courses. Both cases can lead researchers to under or overstate the true impacts of remedial education. This is especially true in studies of remediation using matching or simple comparisons, which we discuss further later in this chapter. This leads to another issue in evaluating remediation: determining causality.

Simply put, the true impacts of remediation have only recently come to light. In reviewing the research on remediation, Grubb (2001) writes, "The evidence is sparse, and partly it is for lack of trying: most states and most colleges that provide remediation have not yet started to evaluate their programs in any way (p.18)." There have been multiple reviews of the research that does exist, ranging from mostly qualitative studies in the earliest efforts to evaluate remediation, to more rigorous evaluations of the impacts of remediation in recent years. Table 2.1 lists the systematic reviews of remediation since the early 1980s, two of which are meta-analytic reviews of the results. Overall, research on remediation is, at best, mixed. However, the common theme in remediation is that research is flawed and that early studies into the impacts of remediation were often unable to take advantage of data and were unable to effectively measure the impacts of remediation on students.

Table 2.1: Systematic Reviews of Remediation

Author (Year)	Years Analyzed	Institutions Included	Results	Author conclusions
Kulik et al (1983)	1964-1979; 60 studies	2- and 4-year institutions	• 0.25 GPA point increase • 10 percentage point increase in persisting	Included research examining impacts for "high-risk and disadvantaged students"
O'Hear & MacDonald (1995)	1984-1994; 52 studies	2- and 4-year institutions	Nearly two-thirds of the 52 available studies was unacceptable methodologically	Concluded the field "could greatly benefit from more research studies and researchers"
Merisotis & Phipps (2000)	1995-1999	All postsecondary institutions	Research on remediation is sporadic and inconclusive	The costs of remediation are minimal, but not all remediation is delivered effectively or efficiently
Grubb (2001)	1979-2000	All postsecondary institutions	Field is in desperate need of evaluation in order to improve outcomes	Most researchers ask the wrong questions when evaluating remediation
Melguizo et al (2011)	1994-2010; 18 studies	Community colleges	Results are mixed	Researchers should implement regression discontinuity designs to analyze the impacts of remediation
Goudas & Boylan (2012)	2000-2011; 22 studies	All postsecondary institutions	Remediation is more positive than posited	Researchers extrapolate beyond remediation's true purpose
Long & Boatman (2013)	1998-2012; 9 studies	All postsecondary institutions	Studies of remediation are mixed and likely dependent on programs and students	Remediation is not a singular policy and the course placement policies are flawed
Clark et al (2014)	2010-2014; 10 studies	All postsecondary institutions	Research on single institutions are more likely to be positive, but is overall flawed	Research is overall inconclusive and large –scale studies often do not take advantage of qualitative opportunities

Table 2.1: Systematic Reviews of Remediation, continued

Author (Year)	Years Analyzed	Institutions Included	Results	Author conclusions
Valentine et al (2016)	2006-2015 10 studies	2- and 4-year institutions	• 1.86 fewer college-level credits • No impacts on GPA • 3 percent less likely to graduate • 7.9 percent less likely to pass college-level course	"Placement into developmental education is associated with effects that are negative, statistically significant, and substantively large."

While there have been several reviews of remediation literature, there is still a need for a review of the rigorous research on remediation. Most of the literature reviews have covered studies taking place during the period of sparse data and weak methods. These literature reviews provide limited background on what one would expect from a rigorous analysis of remediation in Arkansas. Because of this, there is a need for a systematic, rigorous review of the research making use of rigorous methods. In the review of the literature included here, I include studies that are most similar to my own in both methodology and outcomes of interest. The following section presents the methods used in systematically selecting and reviewing the available rigorous research and the resulting meta-analytic average impacts of remediation on student outcomes.

B. Systematic Review of Research on Remediation

In order to conduct this meta-analysis, I identified publications and research on remediation through a variety of online databases and network searches. This made use of specific, key search terms and phrases that would be as inclusive as possible in the preliminary search. This included searches through EBSCO, ERIC, JSTOR, and ProQuest databases through the University of Arkansas library. It also included a Google Scholar search for any sources that may be overlooked in the other databases. The four search phrases of interest were: (1) "college remedia*", (2) "postsecondary remedia*", (3) "college developmental ed* OR coursework", and (4) "postsecondary developmental ed* OR coursework". Including the phrase "developmental" allows a more complete examination as some researchers use the terms "remediation/remedial" and "developmental" interchangeably, as well as differences in the treatment level based on individual state policy (see Boatman, 2012).

Initially, the searches included no timeframe limitation, but due to the criticisms of methodologies and weak data of the early research on remediation, the focus of the searches shifted to studies made available as working papers or published after 2004. This date was not chosen arbitrarily, as a comprehensive report on the state of research at community colleges from Bailey and Alfonso (2005) describes the methodological and data problems associated with research prior to the release of their report. Much like the literature reviews included here argue, Bailey and Alfonso point to the many weaknesses of data and methodological problems in the research on college-level interventions like remediation. Because of these two issues of data and methods, I believe it is reasonable to limit the searches to include only those published as working papers just prior to this report from Bailey and Alfonso (2005) and those published after, as data became more readily available at the state level for remediation research.

Initial search and inclusion/exclusion focused only on studies reporting regression discontinuity methods, as these often report results in a uniform fashion and often compare the most similar students who do and do not qualify for remediation, i.e. those immediately surrounding the cutoff score. However, in order to be thorough and present the most complete results of remediation research as possible, I include studies using reasonable designs and student comparisons. Following this, the searches expanded to include studies that make use of methods other than RD to compare students assigned to remediation to those not assigned to remediation.

In total there were 12 studies providing estimates of the impacts of remediation on three outcomes of interest, persistence, graduation and success in the first subject specific college level course. Study selection was based on a systematic search procedure using the previously described terms and phrases. In all, these searches yielded 3,630 titles that could be relevant to the systematic review of research. The results of the search criteria are as follows:

Table 2.2: Original Search Terms and Yielded Results

Database	Search Terms	Number of Articles
EBSCOhost	(Subject terms) "College remedia*" ; "Postsecondary remedia*"; "College developmental ed* OR coursework"; "Postsecondary developmental ed* OR coursework" **AND** (date) 2004 - 2017	122
ERIC	(SU Descriptors ALL) "College remedia*" ; "Postsecondary remedia*"; "College developmental ed* OR coursework"; "Postsecondary developmental ed* OR coursework" **AND** (date) 2004 - 2017	257
JSTOR	(Full-Text) ("College remediation") **AND** LA (eng OR en) **From** 2004 **To 2017** ; (Full-Text) ("Postsecondary remediation") **AND** LA (eng OR en) **From** 2004 **To 2017;** (Full-Text) ("College developmental education) **OR** ("College developmental coursework") **AND** LA (eng OR en) **From** 2004 **To 2017;** (Full-Text) ("Postsecondary developmental education) **OR** (Postsecondary developmental coursework) **AND** LA (eng OR en) **From** 2004 **To 2017;**	89
ProQuest Digital Dissertations	(Keywords) "College remedia*" ; "Postsecondary remedia*"; "College developmental ed* OR coursework"; "Postsecondary developmental ed* OR coursework" **AND** (date) 2004 - 2017	222
Google Scholar	**Find articles w/ exact phrase:** "College remedia*" ; "Postsecondary remedia*"; "College developmental ed* OR coursework"; "Postsecondary developmental ed* OR coursework" **Return articles dated between** 2004 - 2017	2,863
	Total Titles for Review	3,630
	Total Number of Abstracts for Review	172
	Total Number of Articles for Review	70
	Total number of Articles Retained	12 (Marginal Effects)

On first glance, the number of returned results appears quite large. However, Google Scholar returns newspaper articles among other less rigorous sources, therefore, a large percentage of these returned citations were immediately dropped. In many cases, searches returned similar results with slight variations in the title, along with earlier working paper versions of published research.

In total, 12 studies report what are believed to be outcomes that are comparable and can be used to calculate a meta-analytic average marginal effect. In most research into remediation, outcomes of interest are dichotomously coded, leading many researchers to use logit, probit, and linear probability models. In order to appropriately interpret a probit coefficient, most authors report marginal effects, which measure the discrete change in predicted probability as the outcome changes from 1 to 0 (Cameron & Trivedi, 2010). This resulting estimation of the differences in outcomes for remediated and nonremediated students presents the predicted probability of successfully completing an outcome such as graduating. Similarly, researchers can use an OLS regression to predict the probability of success or failure on a binary outcome, using linear probability models. The resulting interpretation of a linear probability model is a marginal effect (Angrist & Pischke, 2008; Deke, 2014). Therefore, we include studies that report results as a marginal effect resulting from a probit. Logit, or linear probability model.

In total, 12 studies met all selection criteria and are included in this review. However, not all studies report on all of the outcomes of interest. Of the 12 studies included, 11 studies report marginal effects for persistence outcomes, 9 report attainment outcomes as measured by degree completion, and 4 report successfully passing gatekeeper courses. In all cases, studies report their results as differences in percent probability of success or failure on the outcomes for remedial students compared to their nonremedial peers.

Each study included underwent a review for methodological quality and how the results were reported. This included the clarity with which authors reported the course placement process, whether or not all students were eligible for remediation, if it included all eligible "treatment" (i.e. remedial) and "control" (nonremedial) students, and if the treatment group was limited to only students who successfully passed remediation. Additionally, we evaluated the reporting of coefficients and whether the authors used outcomes that were coded as dichotomous to report marginal effects.

For studies making use of probit/logit models or linear probability models, we assume marginal effects to be reported at means. Reporting of the magnitude of differences from these three models requires a transformation of these coefficients to represent the percent probability of success/failure on a dichotomous outcome, i.e. the marginal effect. Therefore, I believe this is a relatively safe assumption given the nature of the results that are reported.

The main study quality problem centered on groups included for comparison. Peter Bahr has conducted a great deal of research on remediation in the California Community College system in the time period of interest. However, his studies often only make comparisons of students who were able to pass their remedial courses and compares their outcomes to nonremedial students, which answers the question of impacts on students who are able to successfully navigate the remediation process, rather than what are the overall impacts of remediation. Additionally, this excludes studies from Attewell et al (2006 and 2011) because remediation is not determined using a placement test and their use of propensity score matching often excludes the students who do not pass remedial courses, because they often lack a valid match who avoided remediation. This became a common theme of propensity score matching studies and studies using national survey datasets like NELS:88 and the BPS Longitudinal Study.

C. Causal Estimates of Remediation

While the ideal study of any policy intervention makes use of the "gold standard" random assignment study, this is often not feasible with remediation. In order to conduct a random assignment study, participants are randomly assigned to treatment and the rest of the sample serves as the comparison group. In remediation, this would entail randomly assigning similar students to enroll in remedial courses and others to college-level courses. Two different studies make use of experimental designs and find different impacts of assigning underprepared students to skip the remedial course sequence. The first from Moss, Yeaton, and Lloyd (2014) found that students within a certain test score bandwidth below the cutoff score who were randomly assigned to skip their remedial math course earned grades that were 9.12 percent lower than their peers who completed the remedial course prior to enrolling in their gatekeeper course. It is important to note that this study's sample is quite small (63 students).

The second random assignment study from Logue, Watanabe-Rose, and Douglas (2016) randomly assigned remediation-eligible students at three CUNY community colleges to either standard remedial math, remedial math with a weekly workshop, or college-level statistics with a weekly workshop. In total, there were 907 students randomly assigned to one of the three groups. They found that students enrolling in statistics were 14 percentage points more likely to pass the CUNY algebra end-of-course examination than students in traditional remedial math and 11 percentage points more likely to pass than students in remedial math with a workshop component (Logue et al, 2016). Statistics students also earned more college-level credits (excluding statistics) than their peers who were placed in either remedial math section. All differences were statistically significant. Thus, the students in the two remedial groups clearly did less well than the students who were randomly assigned to skip remediation, despite the fact all of the students in the study qualified for remediation.

Compared to the study from Moss et al (2014), the study from Logue et al paints a rather bleak picture for remediation, at least in the CUNY context. It is unfortunate there are not more random assignment studies of remediation policies to help policymakers and educators sort out the effects of these policies. However, there is a growing base of causal research on remediation that has taken advantage of remediation policy's placement rules to use a "best available" study design. Because remedial/college-level course placement is often determined using a strict cutoff on placement tests, researchers seeking to provide causal estimates of remediation are able to make use of regression discontinuity (RD) methods to compare outcomes of seemingly similar students who score within a certain range on both sides of the cutoff.

Since 2006, there have been at least 11 studies of remediation made available as working papers or published articles using data from a large urban community college system, a Northeastern university, Texas, Florida, Tennessee, and Virginia.[2] The study of the unidentified community college system from found little evidence of remediation helping or harming students, rather, it appears from these results that remediation simply diverts students from college-level coursework (Scott-Clayton & Rodriguez, 2015). A large scale study of all first-time enrollees at two-year and four-year college students who qualified for remediation in Texas, finding remediation had no impact on delay graduation, improving students' likelihood of graduating, or long-term labor market outcomes (Martorell & McFarlin, 2011). A single analysis of Florida—where remediation is only available to community college students—found remedial students were slightly more likely to persist into their second semester, but found no difference in an Associate's degree, transferring up to a four-year institution, and found no difference in college-level credits earned across remedial subjects (Calcagno & Long, 2008). Similarly, a study using data from a single Northeastern university found students who enroll in remedial mathematics were more likely to pass their first college-level math score, but this study did not examine long-term impacts (Lesik, 2006).

Two separate analyses of student-level data in Tennessee examine the impacts of being assigned to multiple levels of remediation and the impact of a course redesign initiative, with the first finding students who scored slightly below the cutoff and were classified as having the highest

[2] The number of RD studies increases when considering unpublished dissertations, but for the sake of brevity, I focus only on working papers and published articles. It is important to note that the results of dissertations provide similar estimates of remediation, leading one to believe there are likely few issues of "file drawer" bias.

skills among remedial students were less likely to earn a degree, while students in the lowest-tier remedial writing course saw positive impacts on persistence and degree attainment compared to their peers in higher level remedial courses (Boatman & Long, 2010). The second study of remediation in Tennessee found positive, statistically significant impacts on persistence and attempted credits, but these results disappear over time (Boatman, 2012). A similar study of multi-tiered remediation in Virginia community colleges finds that students on the margins of qualifying for remediation experiences no impacts as a result of remediation, while students placed into the lower-tiers of remediation show a marginally significant decrease in the likelihood of being retained following their first year, a decrease in the probability of passing the first college-level English course, fewer college-level credits earned, and a decrease in the likelihood of transferring to a 4-year institution or earning a degree within 5 years (Xu, 2016).

Table 2.3: Overview of Non-RCT Studies Included and Results[3]

Study Name	Institution	Study Years	Placement Test	Total Sample Size	Analytic Sample Size of Interest	Outcome: Course Performance	Outcome: Persistence	Outcome: Graduation
Bettinger & Long (2004)	4-year Institution	1998	Various	8,604	8,604	N/A	Positive***	Negative
Rhinesmith (2016)	4-year Institution	2003-2014	ACT	37,163	1,682-3,016	N/A	Negative*	Negative
Bettinger & Long (2009)	2- and 4-year institutions	1998	Various	28,376	28,376	N/A	Negative*	Positive**
Boatman & Long (2010)	2- and 4-year institutions	2000-2003	COMPASS	1,879	490	N/A	Negative	Negative
Martorell & McFarlin (2011)	2- and 4-year institutions	1991-2000	TASP	255,344	33,910/59,344	N/A	Negative	Negative
Boatman (2012)	2- and 4-year institutions	2006-2011	ACT	111,546	1309	N/A	Positive	N/A
Calcagno & Long (2008)	Community Colleges	1997-2000	CPT	96724	9,593	Negative	Negative*	Negative
Dadgar (2012)	Community Colleges	2004	COMPASS	5,110	1,918	Positive	N/A	Negative
Hodara (2012)	Community Colleges	2001-2007	CUNY	46,466	16,269	N/A	Negative***	Negative
Clotfelter et al. (2015)	Community Colleges	2001-2009	Various	17,167	7,651	Negative***	Negative**	N/A

[3] Results are overall effects for the study, and therefore include both math and English estimates when determining if the outcome is considered positive or negative. Additionally, this table is not reporting on significance levels.

Table 2.3: Overview of Non-RCT Studies Included and Results, continued

Study Name	**Institution**	**Study Years**	**Placement Test**	**Total Sample Size**	**Analytic Sample Size of Interest**	**Outcome: Course Performance**	**Outcome: Persistence**	**Outcome: Graduation**
Scott-Clayton & Rodriguez (2015)	Community Colleges	2001-2007	COMPASS	100,250	2,122-25,970	Negative***	Negative	Negative
Xu (2016)	Community Colleges	2004-2011	COMPASS	46,000	3,540-9,039	N/A	Negative	Negative

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

As marginal effects are not translatable into an effect size with the information provided, the impacts reported are a meta-analytic average marginal effect rather than a standard effect size. This represents the difference in the probability of a positive outcome (i.e. graduate) for students given whether or not they were eligible for remediation compared to the probability of a positive outcome for students who were not in the remedial group.

For the main outcomes reported, I conduct an overall meta-analysis that separates math and English results and will report twice from the same study in some instances (Boatman & Long, 2010; Calcagno & Long, 2008; Martorell & McFarlin, 2011; Scott-Clayton & Rodriguez, 2015; and Rhinesmith, 2016). When researchers reported results for two-year and four-year institutions separately, I report these separately. Within study estimates are treated as independent, but it is entirely possible that some students who require math remediation also require English remediation. This would result in double counting of students and the effects they have. The probability of a student requiring remediation in multiple subjects is likely greater than zero, but small enough to not have a sizable impact on the effect of remediation in these studies.

Overall, observations within studies are separated into three categories: institutions type limiter, subject limiter, and optimal bandwidth limiter. In some cases, researchers examine both two-year and four-year institutions. When that is the case, results are separated to examine the impacts of remediation at the different institution types. As remediation rates are often much higher at community colleges, researchers are more likely to study the impacts in these settings. As a result, there is a higher representation of research from community colleges compared to four-year institutions. The second limiter is by subject, where researchers separate the impacts of math and English remediation from each other.

The final limiter is based on bandwidth of interest around the cutoff score. Many of the included studies also use multiple bandwidths around the placement cutoff to analyze the impacts of remediation, especially in regression discontinuity research. In cases of placement being determined by COMPASS exam scores, these bandwidths can vary from +/- 2 or 3 points to as much as +/- 20 points. Authors determine the optimal bandwidth of study by examining differences in student characteristics and report results for bandwidths that compare students who are most similar.

Table 2.4 below shows the number of observations after limiting on the categories of interest. In total, there are 12 studies reporting marginal effects coefficients. These include published articles, working papers, and dissertations. There are 106 observations of remediation and its effects on student persistence in postsecondary education, 89 observations of the impacts of remediation on student graduation, and 15 observations of the impacts of remediation on student performance in their first college-level course. These studies are not limited by institution type, subject of remediation, or bandwidth of interest.

Table 2.4: Marginal Effects Observations

	Number of Outcomes	**Institution Type Limiter**			**Subject Limiter**			**Outcomes Analyzed**
		4-Year	2-Year	All	Math	English	Any	
Outcome								
Course Performance	14	0	14	0	10	4	0	7
Persistence	106	41	57	0	42	48	16	11
Graduation	89	38	45	6	35	40	14	9

D. Meta-Analytic Review of Research

The included studies use a variety of outcomes of interest to assess the effectiveness of remediation at the postsecondary level. These outcomes can be classified into three broad categories. The first outcome of interest is performance in the first college-level course, which has 7 marginal effects available for analysis. The second outcome of interest is persistence beyond the first year of postsecondary education and varies from one year to four years, for which there are 11 studies. The final outcome of interest is graduation/attainment, which is defined in multiple ways including:

- Earned an Associate's or Bachelor's degree
- Earning a certificate
- Received a credential in 4 years
- Graduating within 4, 5, or 6 years
- Transferring up to a 4-year/more selective institution

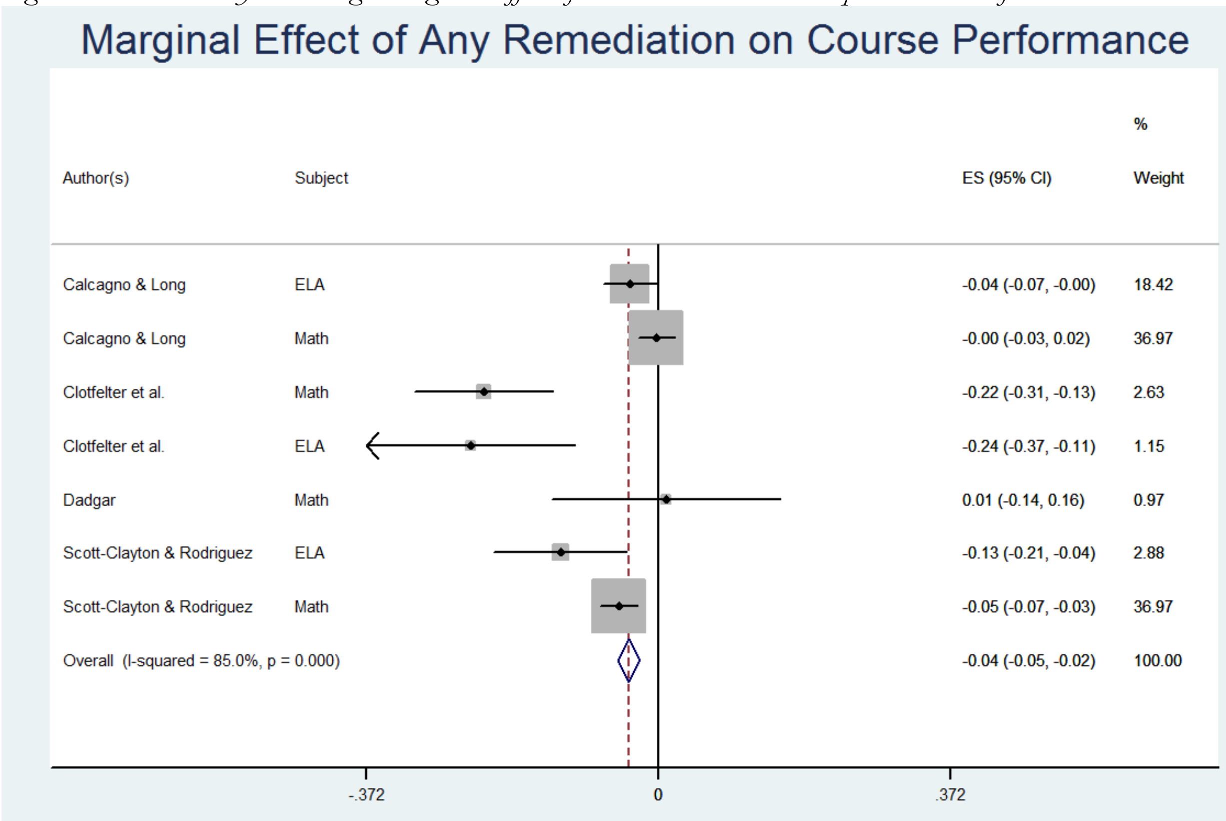
In total, there are 9 marginal effects studies reporting graduation outcomes.

I first present the full results that are limited by optimal bandwidth without differentiating by institution type or remedial subject. Next, I split the findings by subject and then by institution type. Each of these impacts is reported as the meta-analytic average marginal effect and include a 95% confidence interval around the estimates. I present results with various forest plots, showing the effect size and confidence interval for each study. Individual studies are represented by box and whisker plots. A larger box represents the relative weight of individual studies and whiskers represent the confidence interval. Confidence intervals that include zero are effects that are not statistically distinguishable from zero, and the diamonds represent the composite effects across observations included in the study.

1. Overall Marginal Effects Impact: Gatekeeper Course Performance

The first outcome of interest is performance in the first college-level course following remediation. This is a less studied area in the research literature, and has a small sample size. For the full sample, there is a large, statistically significant negative impact of remediation on college level course performance, as students undergoing remediation experience a 4 percentage point decrease in the probability of taking and passing their gatekeeper course after completing remedial coursework. Results are presented in Figure 2.1.

Figure 2.1: Meta-analytic Average Marginal Effect of Remediation on Gatekeeper Course Performance

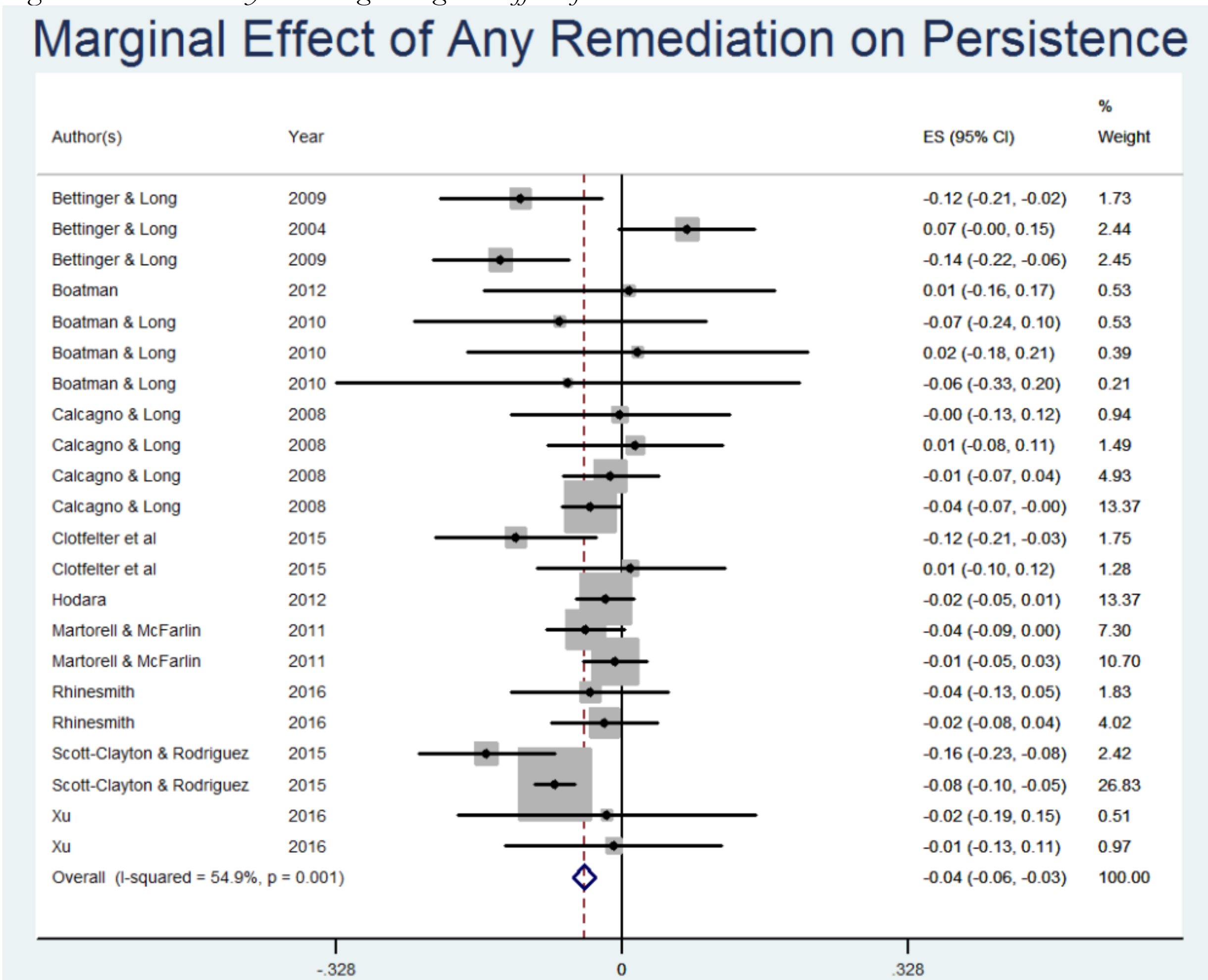


It should be noted that gatekeeper course performance is sensitive to the decisions researchers make in coding the outcomes. For example, Calcagno and Long (2008) code this outcome as "Completion of first college-level course", while Scott-Clayton and Rodriguez (2015) code this outcome as "passed college level course". Calcagno and Long define completion as passing the course, but there is no statement on the actual grade earned. Additionally, Scott-Clayton and Rodriguez include three different measures of success in college-level course as "passing", "earning a B or higher", and "earning a C or higher". I use the "passing" outcome as it appears to be the most relaxed standard students must meet. However, there is the chance it is biased in the math results, as this is the largest negative coefficient among the three course outcomes. Changing the outcome in the Scott-Clayton and Rodriguez studies to the other specifications still yields a statistically significant result, though, slightly smaller in its effect size. (3 percentage points instead of 4 percentage points).

2. Overall Marginal Effects Impact: Persistence

Figure 2.2 presents the full impact of postsecondary remediation, unconstrained by subject and institution type on persistence outcomes. This is limited by optimal bandwidth reported in the research, as this is the most comparable group of students. I include additional analyses separating by subject and institution type, which can be found in the Appendix. The meta-analytic average marginal effect of remediation is a 4.4 percentage point decrease in the probability of students who qualify for remediation persisting beyond the first semester of their postsecondary educational career and is significant at the 95 percent level. The overall effect is largely driven by the results from Scott-Clayton and Rodriguez's math results, which account for nearly half of the weight. The overall I^2 for this model is 54.9 percent, which shows a moderate amount of variation across studies. This is likely driven by the large sample sizes in the Scott-Clayton and Rodriguez and Martorell and McFarlin research, which are based in a large urban community college system and all public institutions in the state of Texas respectively.

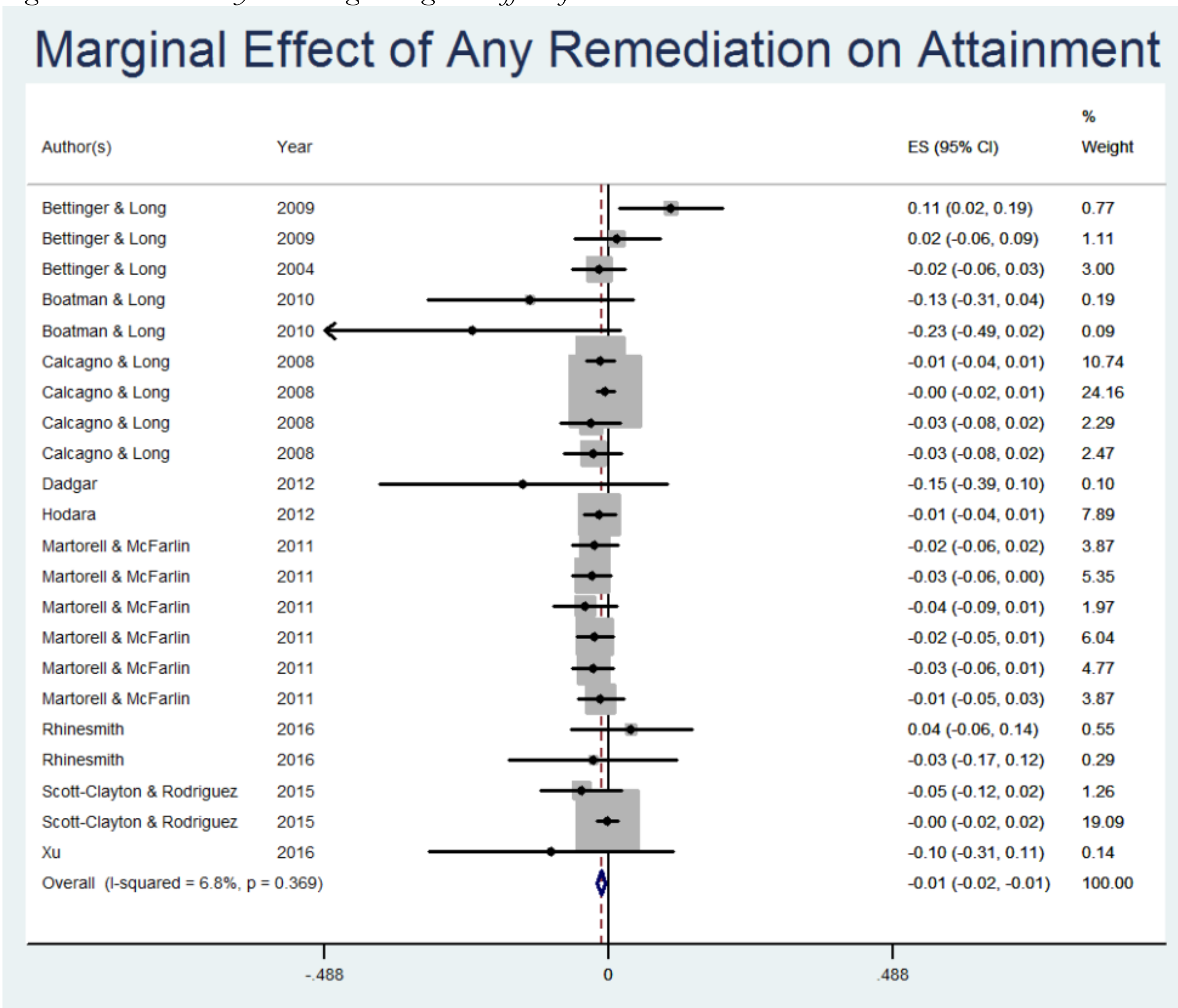
Figure 2.2: *Meta-analytic Average Marginal Effect of Remediation on Persistence*



3. Overall Marginal Effects Impact: Graduation

Results for graduation impacts of remediation are presented in Figure 2.3. For the pooled marginal effect, there is a 1 percentage point decrease in the probability of graduating as a result of remediation, which is similarly statistically significant.

Figure 2.3: Meta-analytic Average Marginal Effect of Remediation on Attainment



E. Literature Review Findings

In conclusion, my review of the existing rigorous studies on remediation suggests that the policy is not having the intended effect of helping prepare academically unprepared students to perform better in future academic endeavors. I find that remediation has small, but negative and statistically significant impacts on students' performance in their first college-level course, persistence beyond the first year, and attainment. When examining the impacts of remediation by institution type and subject, the results are similar. Studies at community colleges account for most of the weight in the review. Many states have limited remedial coursework to community college campuses, therefore, it makes intuitive sense these studies would have greater weight. There is little difference in the impacts of English remediation compared to math remediation on all three outcomes.

The 12 methodologically rigorous studies included here support the overall results of small and negative impacts, however, individual studies often do not find statistically significant impacts of remediation in the specific studies. The study presented in this dissertation is a statewide examination of the impacts of a remedial coursework policy similar to that of Martorell and McFarlin and Bettinger and Long. The data used in this analysis allows for an examination of persistence and attainment outcomes for the full, statewide sample of students, and an examination of course performance for students at one of the institutions. Given that Arkansas uses a state-established cutoff like that of Martorell and McFarlin, there is reason to believe there will be small negative impacts on students who qualify for remediation in Arkansas. It is my hope that this full evaluation of remediation in Arkansas will contribute to the growing literature on what we might expect from statewide college remediation programs.

Chapter III – Study Setting & Methodology

Arkansas has implemented a mandatory course placement-testing policy for all students enrolling in postsecondary education at one of the state's public two-year or four-year institutions.[4] The remediation rate in the state has gradually decreased over the past 5 years, but nearly 40 percent of students enrolling in postsecondary education in Arkansas were assigned to remediation in at least one subject (ADHE, 2015a). Remedial courses do not count as credit towards graduation, but are required at cost to students.

This analysis uses data on over 250,000 first-time college enrollees in the state of Arkansas to analyze the causal impacts of assignment to and enrollment in remedial courses using a regression discontinuity (RD) design. The nature of the statewide testing policy, using a strict test score determining course placement, makes this an ideal setting for using RD to determine causality. The analysis uses student-level data obtained through an agreement with Arkansas Department of Higher Education (ADHE).

Throughout the rest of this chapter, I provide a brief overview of postsecondary education and remediation in the state of Arkansas, followed by a description of the sample of students included in this study. Then, I describe the data and methodology used to estimate the causal impacts of remediation on students who are assigned to and enroll in college remediation in Arkansas.

A. Study Setting

The postsecondary education system in Arkansas consists of 22 community colleges, 10 universities, and one medical college that is excluded from this analysis as it does not offer remedial

[4] Arkansas has implemented remedial courses since the state's flagship institutions was founded in 1871, in order to ensure all students seeking a college education were adequately prepared for the rigors of postsecondary education. An abbreviated timeline of recent developments in Arkansas' remediation policy is available in Appendix A.

coursework. While the state provides many options for its citizens to enroll in college, Arkansas is below the national average number of residents who hold a two- or four-year degree (U.S. Census Bureau, 2015). This lack of college graduates has been a concern for the state for many years. Former Governor Mike Beebe established a statewide goal for 60 percent of Arkansans to have a postsecondary credential of some type by the year 2025 (ADHE, 2015b). Recently, Arkansas has approved a change in its higher education funding formula to be entirely outcomes-based, placing a higher priority on student retention, program completion, on-time graduation, and job placement (Associated Press, 2017). A central focus of improving postsecondary attainment in the state is reducing the need for college remediation. Additionally, the types of students enrolling in the different institutions varies both across and within school types. Tables 3.1 and 3.2 below provide descriptive statistics of students in each school for the sample. As these tables show, student populations vary dramatically across the state, both in enrollment size and types of students. Additionally, we see higher graduation rates in the four-year institutions than community colleges.

Arkansas has a long history of remediation at the college level, but it became more systematic in 1991, when the Arkansas State Legislature passed Act 1101, mandating all public institutions test first-time college enrollees. These tests are used to determine if students should enroll in remedial- or college-level courses in English/reading and/or math. Students who score below the state-established proficiency threshold of 19 on the ACT English, math, and/or reading sections are assigned to non-credit-bearing remedial courses. Individual institutions are free to establish a higher cutoff than the state minimum, but this is typically reserved for specific majors, such as a higher math proficiency threshold for engineering students.

Like most postsecondary remediation policies, Arkansas' does not count successful completion of these courses toward graduation. Arkansas also has a higher remediation rate than the national average. According to the most recent "Profile of Undergraduate Students: 2011-12" released by the U.S. Department of Education, 33 percent of students were required to enroll in at least one remedial course nationally (Chen & Simone, 2014). In Arkansas, the remediation rate in the same year was 46 percent. While the remediation rate in Arkansas has been on the decline over the past 5 years, over two-thirds of students enrolling in community colleges and just under one-third of students enrolling in public universities required remediation in at least one subject during the 2015 academic year (ADHE, 2015a).

Table 3.1: Demographic Information, Four Year Institutions from 2004 to 2016

4-Year Institution	N	Avg. Yearly Enrollment	Graduation Rate	4 Year Grad Rate	6 Year Grad Rate	Avg. HS GPA	ACT Composite	White	Female
A	20,363	1,566	41.0%	24.8%	31.9%	3.29	22.2	76.7%	55.3%
B	20,558	1,581	40.7%	29.4%	36.9%	3.22	22.1	83.4%	51.0%
C	9,012	693	33.9%	23.5%	30.9%	3.19	21.7	68.6%	53.4%
D	8,172	629	34.1%	22.5%	28.1%	3.20	20.9	66.2%	52.6%
E	45,473	3,498	46.0%	44.4%	51.3%	3.59	25.5	83.7%	51.6%
F	13,259	1,020	32.0%	17.5%	25.9%	3.22	21.9	76.9%	55.4%
G	9,592	738	30.1%	15.5%	21.7%	3.10	21.0	50.7%	56.9%
H	7,851	604	34.6%	14.3%	20.3%	2.83	19.2	60.8%	51.5%
I	9,159	705	26.0%	17.8%	27.0%	2.51	16.6	1.5%	51.6%
J	27,592	2,122	44.0%	28.8%	37.4%	3.30	23.3	71.4%	58.7%
All 4-Year	171,031	13,156	39.7%	28.3%	35.6%	3.28	22.7	71.3%	53.8%

Source: Author's calculations using data provided by the Arkansas Department of Higher Education

Table 3.2: Demographic Information, Two Year Institutions from 2004 to 2016

Two-Year Institution	N	Avg. Yearly Enrollment	Graduation Rate	3 Year Grad Rate	4 Year Grad Rate	Avg. HS GPA	ACT Composite	White	Female
A	3,558	274	33.7%	20.7%	22.5%	2.84	18.8	66.2%	60.3%
B	8,877	683	41.0%	22.7%	24.3%	2.93	20.2	88.4%	56.9%
C	2,321	179	42.8%	23.9%	26.2%	2.93	21.0	94.0%	54.9%
D	2,329	179	18.7%	10.6%	12.3%	2.60	18.0	37.0%	60.5%
E	1,986	153	32.3%	37.9%	24.0%	2.80	18.9	79.0%	55.3%
F	3,563	274	36.4%	28.0%	23.7%	2.83	19.5	96.1%	58.0%
G	1,591	122	36.1%	32.8%	25.5%	3.00	18.6	66.7%	64.0%
H	1,864	143	38.3%	27.7%	24.9%	2.79	19.1	81.6%	62.4%
I	3,118	240	24.3%	17.6%	15.1%	2.60	18.9	45.7%	61.0%
J	5,178	398	37.4%	27.5%	24.3%	2.89	20.4	92.8%	52.9%
K	4,292	330	28.3%	22.4%	18.5%	2.79	19.5	81.9%	57.0%
L	9,533	733	23.5%	16.0%	12.0%	2.90	20.3	76.0%	53.5%
M	2,159	166	35.4%	26.6%	24.4%	2.59	19.7	96.8%	63.0%
N	1,803	139	31.9%	25.7%	21.9%	2.70	19.6	49.9%	68.2%
O	11,646	896	28.8%	21.8%	18.9%	2.11	18.5	48.5%	56.0%
P	1,487	114	30.9%	21.8%	18.8%	2.91	20.2	90.7%	64.2%
Q	1,922	148	30.5%	24.8%	20.3%	1.73	18.1	55.0%	68.4%
R	1,869	144	42.4%	41.1%	33.9%	2.67	17.8	58.5%	48.6%
S	2,802	216	29.7%	23.5%	19.9%	2.67	18.1	39.7%	62.3%
T	2,689	207	43.3%	37.9%	32.1%	2.56	20.3	89.7%	59.6%
U	2,172	167	34.8%	34.9%	26.3%	2.81	18.8	58.5%	61.1%
V	5,916	455	33.9%	25.5%	21.3%	2.61	20.6	85.4%	52.8%
All 2-Year	82,675	6,360	32.6%	25.3%	21.0%	2.68	19.6	72.6%	57.5%

Source: Author's calculations using data provided by the Arkansas Department of Higher Education

With a higher priority on outcomes, it is essential for the state's postsecondary institutions to meet student needs and consider the efficacy of current policies. One of the first goals the ADHE articulated in improving outcomes is reducing the percentage of students who require remediation. It is the belief of the ADHE that college remediation is not as helpful to students as previously thought, stating, "For too many Arkansas students, achieving their goal of completing a certificate or degree program is delayed, or thwarted, by required enrollment in remedial courses. Although these courses are essential to preparing students for success in college-level courses, they also add to the cost and time required to complete." (ADHE, 2015b) The ADHE has been aware of the costs remediation poses to students in the state since 1998, when a study of costs per full-time equivalent student in the state ranged from $2,400 in community colleges to $4,400 in universities (Merisotis & Phipps, 2000).

With the cost of remediation and the high remediation rates in the state, it comes as no surprise Arkansas has made lowering the remediation rate one of the main issues to help improve the state's postsecondary attainment rates. The study presented here is meant to provide a causal estimate of the impacts of remediation on students in the state of Arkansas. This is the first rigorous analysis of the state's remediation policy, designed to measure the impacts on student persistence and attainment. The next section describes the data, sample, and methods used to evaluate the Arkansas remediation policy.

B. Sample

The analysis here uses a rich, student-level dataset provided by the Arkansas Department of Higher Education (ADHE), covering all first-time enrollees from 2004 through 2016. This yields 11 cohorts of students to include in the analyses here. Compared to previous studies of college remediation, this is a much larger sample of *cohorts* of students, though the number of individual observations is similar to other studies. The data provided includes the academic year in which a student first enrolled, the first institution where each student enrolled, entrance exam score, and subject score. Additionally, ADHE provided student's home state, high school, and high school GPA. Demographic information includes students' age at enrollment, self-reported race, and self-reported gender. Institutions track student enrollment and submit data annually to the ADHE, which tracks student progress including subsequent semesters and years of enrollment, courses in which students enroll, credits earned, semester of graduation, type of degree sought at enrollment, and highest completed degree. Therefore, this study measures students' persistence into subsequent years, time to graduation, and ever earning a degree. In total, this includes data for 253,709 students enrolling at one of the state's public institutions.

It is important to note that not all students are required to submit an entrance exam score, and FERPA Laws allow students withhold gender and race/ethnicity information, along with other information students choose to keep private (Family Educational Rights and Privacy Act, 2017). Because of this, there are data coded as missing due to students' self-reports and refusal to disclose information. Any student who identified with a specific race/ethnicity in later years was coded with that race information for all years. Students listing a different race in subsequent years were reclassified as "multi-racial". Additionally, high school GPA uses a 5-point scale, as AP courses in high school can lead a student's GPA to exceed the standard 4.0 scale.

As Arkansas bases its course assignment on student placement test scores, an overwhelming majority of students either submitted a score for admissions or have a score on file courtesy of institutional testing. In total, 97 percent of students have a matched mathematics placement score and 99 percent of students have a matched English placement score. Arkansas accepts ACT, SAT, COMPASS, and ASSET exam scores for course placement purposes. While scores on these tests are not meant to be viewed as equivalent, there is concordance between tests ("ACT-SAT Concordance Tables", 2016). This is similarly possible with COMPASS and ASSET exam scores. A majority of students submitted an ACT score (78 percent of math scores and 76 percent of English scores), while the second most common exam students submitted was from the COMPASS (17 percent of math and 18 percent of English). For ease of interpretation and determination of intention-to-treat (ITT) groups, all test scores are transformed to concordant ACT scores.

Along with the demographic, baseline achievement, and college data, the ADHE data provides information on whether students enrolled in a remedial English or math course. Therefore, I use this as a treatment-on-treated (TOT) indicator. The primary measures of impacts of assignment to and enrollment in remedial courses includes: earning an associate's degree or certificate in 3, 4, or 5 years; earning a bachelor's degree in 4, 6, or 8 years; ever earning a degree of any type; amount of time to earning a degree; and persistence into the second, third, and fourth year. Unfortunately, the data does not track students who transfer to an institution outside of Arkansas or to a private institution. Therefore, these students must be treated as drop outs. For the degree outcomes, any community college student who earns a bachelor's degree after earning an associate's degree is excluded from the associate's degree analysis so as not to produce a biased result. There are a small number of students who enroll multiple times as first-time enrollees at separate institutions. These cases are resolved using the first year of enrollment and are treated as transfer students. These records represent less than one-tenth of a percent of the sample, so their influence on outcomes should be trivial.

1. Student Sample

As previously mentioned, the total number of student-level observations is 253,709 first-time college freshmen enrolling at one of Arkansas's thirty-two public postsecondary institutions. Of these, 171,031 (67.4 percent) students enrolled in a four-year institution and 82,675 (32.5 percent) students enrolled at a community college. The analysis presented here relies on a non-random sample of students for whom there is a placement test score. Overall, 97 percent of students submitted an entrance exam score. The analytic sample relies on reported data for each of the outcomes and bandwidths of interest (discussed in detail below), therefore leading the observations to vary with each specification and outcome. Every institution in the state assigns underprepared students to remedial coursework, ensuring that each institution is included.

In total, 28 percent of students in the sample at four-year institutions were assigned to math remediation and 21 percent were assigned to English remediation. A total of 55 percent of community college students were assigned to math remediation and 50 percent were assigned to English remediation. Both represent the full ITT sample. Arkansas's remediation policy, while imposing a strict score cutoff for course placement, does not guarantee that all students assigned to remediation will comply with the course placement. For four-year institutions, 27 percent and 19 percent of students enrolled in math and English remediation respectively. Interestingly, 57 percent of community college students enrolled in a remedial math course and 43 percent enrolled in a remedial English course. I discuss these noncompliance issues in the methods section of this chapter.

Tables 3.3 and 3.4 present descriptive statistics for the English samples by bandwidth around the cutoff and at universities and community colleges separately. Similarly, Tables 3.5 and 3.6 present demographic information for the math sample. In general, students who enroll in postsecondary education in Arkansas are more likely to be female and white, a result that holds across institution types. Students at community colleges are more likely to have lower high school GPAs and are more likely to take the COMPASS exam to determine course placement. Interestingly, students are more likely to comply with their course placement in math than in English at both community colleges and universities. Overall, the students who enroll in the different types of institutions are different from one another. Therefore, analyses of all students combined likely do not tell the whole story of the impacts of remediation in Arkansas.

Table 3.3: Characteristics of English Sample

	Global Sample		**University Sample**		**Community College Sample**		**Non-tested Sample**	
	No. of Students	**% of Total**	**No. of Students**	**% of Total**	**No. of Students**	**% of Total**	**No. of Students**	**% of Total**
Observations	253,709	97%	171,022	65%	82,682	32%	9,054	3%
Gender								
Female	139,591	55%	92,084	54%	47,509	57%	4,308	48%
Male	114,113	45%	78,947	46%	35,166	43%	4,746	52%
Race/Ethnicity								
Black	48,176	20%	33,113	20%	16,065	20%	1,830	21%
Hispanic	7,774	3%	4,967	3%	3,213	4%	255	3%
White	176,477	72%	117,551	71%	58,639	73%	6,422	74%
Other Race	13,462	5%	9,934	6%	3,213	4%	180	2%
Age								
17-22	231,520	91%	165,583	97%	66,015	80%	5,760	64%
Non Traditional Age	22,173	9%	5,443	3%	16,654	20%	3,294	36%
High School GPA								
0.0 – 1.0	3,636	2%	755	0.1%	2,881	5%	15	0.0%
1.01 – 2.0	9,344	5%	3,159	2%	6,185	11%	955	17%
2.01 – 2.75	43,218	21%	23,918	17%	19,308	33%	2,296	41%
2.76 – 3.25	50,297	25%	33,727	23%	16,704	28%	1,461	26%
3.26 – 3.50	29,147	14%	22,898	16%	6,460	11%	441	8%
3.51 – 4.0	55,102	27%	47,560	31%	6,698	11%	397	7%
>4.0	11,025	5%	11,085	8%	390	1%	21	0.0%
English Placement Test Type								
ACT	193,073	76%	153,100	90%	39,974	48%	504	6%
ASSET	8,230	3%	2,747	2%	5,483	7%	382	4%
COMPASS	45,996	18%	8,857	5%	37,140	45%	1,037	11%
SAT	6,405	3%	6,327	3%	78	0.1%	6	0.1%
Remediation Information								
Recommended English	77,274	31%	35,595	21%	41,685	50%	1,152	60%
Enrolled English	67,782	27%	32,659	19%	35,125	43%	3,129	35%
Cohort Year								
2004 – 2006	51,592	20%	34,705	20%	16,887	20%	1,903	21%
2007 – 2010	74,358	29%	49,634	29%	24,725	30%	3,274	36%
2011	21,263	8%	13,973	8%	7,290	9%	1,004	11%
2012	21,588	9%	14,564	8%	7,024	9%	798	9%
2013	21,802	9%	14,618	9%	7,184	9%	476	5%
2014	21,092	8%	14,049	8%	7,043	9%	578	6%
2015	20,919	8%	14,587	9%	6,333	8%	533	6%
2016	21,090	8%	14,901	9%	6,189	7%	488	5%

Note: Some students refuse race and gender information under FERPA protections, therefore some observations have missing data for demographics. Additionally, students have missing GPA data and not all students are required to submit an entrance exam score. These cases are rare and therefore, are not believed to have an impact on the estimates.
Source: Author calculations based on provided ADHE data.

Table 3.4: Characteristics of English Sample

	Global Sample		+/- 1.5 Points		+/- 0.5 Points	
	No. of Students	**% of Total**	**No. of Students**	**% of Total**	**No. of Students**	**% of Total**
Observations	253,709	97%	58,346	22%	27,730	11%
Gender						
Female	139,591	55%	31,433	54%	14,831	53%
Male	114,113	45%	26,917	46%	12,901	47%
Race/Ethnicity						
Black	48,176	20%	13,040	23%	6,490	24%
Hispanic	7,774	3%	2,200	4%	1,036	4%
White	176,477	72%	38,151	68%	17,756	67%
Other Race	13,462	5%	2,950	5%	1,350	5%
Age						
17-22	231,520	91%	51,758	89%	24,595	89%
Non Traditional Age	22,173	9%	6,589	11%	3,135	11%
High School GPA						
0.0 – 1.0	3,636	2%	923	2%	447	2%
1.01 – 2.0	9,344	5%	2,103	5%	958	5%
2.01 – 2.75	43,218	21%	13,310	30%	6,474	31%
2.76 – 3.25	50,297	25%	15,848	35%	7,471	36%
3.26 – 3.50	29,147	14%	6,495	14%	2,980	14%
3.51 – 4.0	55,102	27%	5,789	13%	2,539	12%
>4.0	11,025	5%	216	0%	84	0%
English Placement Test Type						
ACT	193,073	76%	40,171	69%	18,987	68%
ASSET	8,230	3%	2,729	5%	1,564	6%
COMPASS	45,996	18%	14,389	25%	6,531	24%
SAT	6,405	3%	1,061	2%	650	2%
Remediation Information						
Recommended English	77,274	31%	22,062	38%	11,614	42%
Enrolled English	67,782	27%	19,515	33%	9,730	35%
Institution Type						
Community College	82,682	33%	24,807	43%	11,680	42%
University	171,022	67%	33,543	57%	16,052	58%
Cohort Year						
2004 – 2006	51,592	20%	12,326	21%	6,322	23%
2007 – 2010	74,358	29%	17,649	30%	8,465	31%
2011	21,263	8%	4,897	8%	2,304	8%
2012	21,588	9%	4,834	8%	2,279	8%
2013	21,802	9%	4,865	8%	2,351	8%
2014	21,092	8%	4,793	8%	2,088	8%
2015	20,919	8%	4,466	8%	2,000	7%
2016	21,090	8%	4,520	8%	1,923	7%

Source: Author calculations based on provided ADHE data.
Note: Some students refuse race and gender information under FERPA protections, therefore some observations have missing data for demographics. Additionally, students have missing GPA data and

not all students are required to submit an entrance exam score. These cases are rare and therefore, are not believed to have an impact on the estimates.

Table 3.5: Characteristics of Math Sample

	Global Sample		University Sample		Community College Sample		Non-tested Sample	
	No. of Students	**% of Total**	**No. of Students**	**% of Total**	**No. of Students**	**% of Total**	**No. of Students**	**% of Total**
Observations	253,709	97%	171,022	65%	82,682	32%	9,054	3%
Gender								
Female	139,591	55%	92,084	54%	47,509	57%	4,308	48%
Male	114,113	45%	78,947	46%	35,166	43%	4,746	52%
Race/Ethnicity								
Black	48,176	20%	33,113	20%	16,065	20%	1,830	21%
Hispanic	7,774	3%	4,967	3%	3,213	4%	255	3%
White	176,477	72%	117,551	71%	58,639	73%	6,422	74%
Other Race	13,462	5%	9,934	6%	3,213	4%	180	2%
Age								
17-22	231,520	91%	165,583	97%	66,015	80%	5,760	64%
Non Traditional Age	22,173	9%	5,443	3%	16,654	20%	3,294	36%
High School GPA								
0.0 – 1.0	3,636	2%	755	0.1%	2,881	5%	15	0.0%
1.01 – 2.0	9,344	5%	3,159	2%	6,185	11%	955	17%
2.01 – 2.75	43,218	21%	23,918	17%	19,308	33%	2,296	41%
2.76 – 3.25	50,297	25%	33,727	23%	16,704	28%	1,461	26%
3.26 – 3.50	29,147	14%	22,898	16%	6,460	11%	441	8%
3.51 – 4.0	55,102	27%	47,560	31%	6,698	11%	397	7%
>4.0	11,025	5%	11,085	8%	390	1%	21	0.0%
Math Placement Test Type								
ACT	193,589	76%	154,069	90%	39,524	48%	509	6%
ASSET	9,997	4%	3,066	2%	6,931	8%	421	5%
COMPASS	43,576	17%	7,451	4%	36,123	44%	984	11%
SAT	6,542	3%	6,445	4%	97	0.1%	4	0.0%
Remediation Information								
Recommended Math	93,116	37%	48,547	28%	48,371	59%	1,193	62%
Enrolled Math	92,410	36%	45,518	27%	47,085	57%	3,846	43%
Cohort Year								
2004 – 2006	51,592	20%	34,705	20%	16,887	20%	1,903	21%
2007 – 2010	74,358	29%	49,634	29%	24,725	30%	3,274	36%
2011	21,263	8%	13,973	8%	7,290	9%	1,004	11%
2012	21,588	9%	14,564	8%	7,024	9%	798	9%
2013	21,802	9%	14,618	9%	7,184	9%	476	5%
2014	21,092	8%	14,049	8%	7,043	9%	578	6%
2015	20,919	8%	14,587	9%	6,333	8%	533	6%
2016	21,090	8%	14,901	9%	6,189	7%	488	5%

Note: Some students refuse race and gender information under FERPA protections, therefore some observations have missing data for demographics. Additionally, students have missing GPA data and

not all students are required to submit an entrance exam score. These cases are rare and therefore, are not believed to have an impact on the estimates.
Source: Author calculations based on provided ADHE data.

Table 3.6: Characteristics of Math Sample

	Global Sample		**+/- 1.5 Points**		**+/- 0.5 Points**	
	No. of Students	**% of Total**	**No. of Students**	**% of Total**	**No. of Students**	**% of Total**
Observations	253,709	97%	69,429	27%	32,955	13%
Gender						
Female	139,591	55%	40,566	58%	19,270	58%
Male	114,113	45%	28,863	42%	13,685	42%
Race/Ethnicity						
Black	48,176	20%	14,846	22%	6702	21%
Hispanic	7,774	3%	2,699	4%	1,277	4%
White	176,477	72%	46,563	69%	22,339	70%
Other Race	13,462	5%	3,374	5%	1,596	5%
Age						
17-22	231,520	91%	64,946	94%	31,010	94%
Non Traditional Age	22,173	9%	4,483	6%	1,941	6%
High School GPA						
0.0 – 1.0	3,636	2%	1,015	2%	421	2%
1.01 – 2.0	9,344	5%	2,177	4%	885	3%
2.01 – 2.75	43,218	21%	15,272	28%	6,879	26%
2.76 – 3.25	50,297	25%	19,549	35%	9,497	36%
3.26 – 3.50	29,147	14%	8,733	16%	4,300	16%
3.51 – 4.0	55,102	27%	8,135	15%	3,968	15%
>4.0	11,025	5%	302	1%	134	1%
Math Placement Test Type						
ACT	193,589	76%	55,190	80%	27,285	83%
ASSET	9,997	4%	1,804	3%	979	3%
COMPASS	43,576	17%	11,407	16%	4,103	12%
SAT	6,542	3%	1,028	1%	588	2%
Remediation Information						
Recommended Math	93,116	37%	39,124	56%	17,860	54%
Enrolled Math	92,410	36%	35,881	52%	16,218	49%
Institution Type						
Community College	82,682	33%	25,463	37%	10,911	33%
University	171,022	67%	43,966	63%	22,044	67%
Cohort Year						
2004 – 2006	51,592	20%	15,055	22%	7400	22%
2007 – 2010	74,358	29%	20,703	30%	9,997	30%
2011	21,263	8%	5,889	9%	2708	8%
2012	21,588	9%	5,859	8%	2740	8%
2013	21,802	9%	5,763	8%	2723	8%
2014	21,092	8%	5,315	8%	2499	8%
2015	20,919	8%	5,260	8%	2401	7%
2016	21,090	8%	5,585	8%	2487	8%

Note: Some students refuse race and gender information under FERPA protections, therefore some observations have missing data for demographics. Additionally, students have missing GPA data and

not all students are required to submit an entrance exam score. These cases are rare and therefore, are not believed to have an impact on the estimates.
Source: Author calculations based on provided ADHE data.

C. Analytic Strategy

This section provides a detailed description of the analytic strategy used to estimate the effect of assignment to and enrollment in postsecondary remediation in Arkansas. Because of the nature of the state's strict course assignment policy, I implement a regression discontinuity (RD) design to measure the impact of remediation on students. I begin with a description of the primary analysis using both ITT and TOT analyses of students within the full score range on both sides of the cutoff, a wide band sample consisting of students two points above and below the cutoff, and a narrow band sample consisting of students immediately surrounding the cutoff. I then describe a series of subgroup analyses to examine possible heterogeneous effects of remediation, along with analyses of limited samples to test for differential impacts of the policy.

The preferred methodology to easily interpretable, unbiased estimates of the impacts of any policy would be a random assignment study. Unfortunately, Arkansas does not randomly assign college students to remedial courses. Rather, each institution takes advantage of the strict placement score cutoff, so a regression discontinuity analysis is in order.

Given the nature of Arkansas's non-random assignment of students to remediation, the quasi-experimental RD-approach is more appropriate. According to Cook et al (2008), RD is one of the non-experimental methods—when implemented correctly—that provides researchers with estimates similar to that of random assignment studies. By using an RD in Arkansas, I am able to take advantage of the exogenously determined cutoff established by the state and compare subsequent academic achievement and attainment outcomes of students on the margins of meeting the required minimum preparedness standard. In this case, students on the margins of the cutoff are those who score just below and right above the cutoff score. Comparisons between these students provide unbiased estimates of the causal effect of enrollment in remedial courses (Shadish et al, 2002; DesJardins & McCall, 2007).

The underlying assumptions of inferring causality in an RD is that, aside from placement into the treatment (in this case, remediation), students immediately surrounding the cutoff are approximately equal in both their observed and unobserved expectation prior to the treatment. In the case of remediation, students who score below the preparedness level are recommended for treatment and students who score at or above the cutoff are assigned to college-level courses and comprise the comparison group. Controlling for the value at the cutoff in the regressions allows me to account for the unobserved difference in the remedial and nonremedial students. RD methods are heavily dependent on participants complying with the placement policy. When there is strict compliance, it is possible to implement the ideal "sharp" RD strategy.

1. Sharp RD Strategy

Estimating the treatment effects using an RD—and any non-experimental approach—has the potential of selection bias. If selection into remediation is completely transparent and perfectly measured, then adjusting for the differences in selection to obtain unbiased estimates of the impacts of remediation in Arkansas would be simple. Along with strict compliance assumptions, RD methods are based on complete knowledge of the placement cutoff, but this does not guarantee knowledge of the functional form of the rating variable. This could take many forms functionally, including linear with a treatment interaction, quadratic, and quadratic with a treatment interaction. Additionally, RD analyses can make use of local linear regression to ensure the chosen functional form is as close to the correct form as possible. In the case of Arkansas remediation research, I make use of the linear form of the rating variable interacted with the treatment along with local linear regressions at the cutoff.

According to Bloom (2012), there are two types of strategies to correctly specify the functional form in a RD using a single-rating variable corresponding to the "discontinuity at the cutoff" and "local randomization" characterizations of RD. The "local randomization" is based on the principle that any differences between students directly below the cutoff and those scoring right above a cutoff based on placement tests like the ACT occur arbitrarily based on random measurement error in scoring said test. Therefore, students who score immediately below the cutoff and those who score at the cutoff would be identical in expectation, with the exception being exposure to remedial coursework. Comparing these students allows for unbiased estimates of the causal effect of assignment to and enrollment in remedial courses (Shadish et al, 2002; DesJardins & McCall, 2007; Murnane & Willett, 2011). Here, the underlying assumptions of inferring causality using a RD is that, aside from placement into a remedial or college-level course, students immediately surrounding the cutoff are highly likely to be equal in both their observed and unobserved expectations prior to treatment.

The RD approach's use of the state policy's placement rules and cutoff allows for the estimate of the impact of remediation on students' educational outcomes, the goal of this research. In this case, let A represent a student's subject test score (the rating variable), and $\overline{A}$ represent the minimum score required to be assigned to college-level courses at the point of entry in college. In this case, a student who earns a score below the preparedness threshold $\overline{(A)}$ is assigned to remediation. Those scoring at or above this value are assigned to the standard college curriculum. Conducting a regression on the student observations immediately surrounding the preparedness threshold yields the estimated treatment effect, represented by the difference between the average outcome measures on either side of the cutoff $\overline{A}$.

Because of the nature of assignment to remediation, there is an inherent selection problem for first-time college enrollees who choose to comply with placement compared to their peers who do not. However, as is the case with "local randomization" RD analysis, first-time college enrollees in Arkansas scoring an 18 are assigned to remedial courses, whereas students scoring 19 or above are free to enroll in college-level courses. Thus, this is the most relevant comparison due to the minute differences in scoring an 18 or 19 on the ACT, differences that are as likely to be due to measurement error in the imprecise nature of determining academic preparation based on test scores as they are on actual student ability. If this is the correct assumption, the only systematic difference in the case of students scoring an 18 and those scoring a 19 is enrollment in remediation. This sample of students scoring 18 or 19 on the placement test make up the narrow band sample. In order to provide an additional check, I relax this restriction to create a wide band sample including students scoring between 17 and 20 on the subject test of interest.

For the "discontinuity at the cutoff" analyses, a global strategy uses every observation in the sample to address the outcomes of interest as a function of the placement test cutoff and treatment status. For RD analysis in the context of the sharp discontinuity strategy described above, the basic RD equation takes the following form, where all observations are included:

$$(3.1)\ \mathrm{Y_{is}} = \alpha + \beta_1 \overline{\mathrm{A}}_{is} + \mathrm{f}(A_{is}) + \varepsilon_{\mathrm{is}}$$

- $\mathbf{Y_{is}}$ is the outcome measure of interest
- $\overline{\mathbf{A}}_{is}$ is a binary indicator taking the value of 1 if student *i*'s test score fell below the preparedness threshold, assigning that student to remediation
- $\boldsymbol{A}_{\mathrm{is}}$ is the rating variable (ACT score) taking a linear functional form
- $\boldsymbol{\varepsilon}_{\mathbf{is}}$ is the error term

In the case of equation 3.1, β_1 is the coefficient of interest, representing the marginal impact of remediation at the cutoff.

In this model, the rating variable is included to correct for selection bias that arises from selection on observables. To correct for this, I center the rating variable at the cutoff, creating a new variable: $A_{center} = \ (A_i - cutoff)$ and then using this new variable in the model. To center the variable, I subtract 18.5 from student *i*'s ACT score. While the cutoff is 19 in Arkansas, students who score a 19 are assigned to college-level courses, therefore, the centering value must fall between the maximum allowable score to classify a student as unprepared for college coursework (in this case, 18) and the minimum allowable score to classify a student as adequately prepared (in this case, 19). This allows for easier interpretation of results, as the intercept of the regression moves to the cutoff value and makes this cutoff value the new "zero", allowing any observed shifts at the cutoff to be interpreted as a shift in the intercept.

After including this newly created variable, the model used in equation 3.2 is modified to include an interaction term. This allows for a more accurate interpretation of results across the sample distribution. The model takes the following form with a linear interaction, similar to that described by Jacob et al (2012):

(3.2) $Y_{is} = \alpha + \beta_1 \overline{\mathrm{A}}_{is} + \beta_2 A_{iscenter} {}^{*}\, \overline{\mathrm{A}}_{is} + \beta_3 A_{iscenter} + \varepsilon_i$

- $\boldsymbol{A}_{\mathbf{is}}$ is now the centered cutoff using student *i*'s test score minus 18.5 in subject *s*
- $\boldsymbol{A_{iscenter}} * \overline{\mathrm{A}}_{is}$ is the centered rating variable interacted with a binary indicator taking value 1 if the students placement test score fell below the cutoff

The remaining variables are the same as equation 3.1. As previously discussed, centering the rating variable allows a shift at the cutoff to be interpreted as a shift in the intercept and allows for more easily interpretable results. Including the interaction term between the treatment indicator and centered placement score accounts for the impact of remediation on both the intercept and any possible changes in the slope of the regression line. This is especially important in an analysis of the global sample, as it includes students whose test scores are far from the cutoff on both sides.

An issue with a global strategy is that students who score either far above the cutoff or far below the cutoff are likely to not be similar on observable and unobservable characteristics. This is one of the main criticisms of early remediation research, where evaluators compared all students enrolling in remediation to all students not enrolling in remediation. Therefore, in comparisons of all remedial and nonremedial students, it is highly likely that differences in ability of the highest and lowest scoring students will likely show worse long-term performance for remedial students (Bettinger & Long, 2005). Thus, comparisons of these groups and any estimates of the causal impacts of remediation are going to be heavily biased (Fan & Gijbels, 1992; Hardle & Linton, 1994). Analyzing the impacts of remediation in a more localized bandwidth around the cutoff and using only observations within the immediate vicinity of the cutoff to estimate the impacts of remediation helps to shrink this bias. Also, this local strategy results in a functional form that is more likely to be linear, or at least very close to it.

Once this smaller bandwidth is established, only observations within that range are used to estimate a potential discontinuity in outcomes. In order to reduce the potential bias involved in the local strategy approach, Hahn et al (2001) recommend using a local linear regression. This is the estimation of a linear regression on the observations immediately adjacent to the cutoff. This is the same as estimating a linear regression on the narrow bandwidth of students scoring 18 or 19 on the placement test. Unlike the global strategy described in equation 3.2, a local linear regression will exclude the interaction of the centered placement score and treatment indicator, as the changes in intercept and slope are captured in the nature of the observations surrounding the bandwidth. These observations capture the change in slope and intercept and are simplified interpretations of the average impacts of remediation.

Including student level covariates in the full model (3.2) helps to minimize any imbalances around the discontinuity (Lee, 2008) and accounts for any confounding effects observable student characteristics may have on the outcomes. However, there is still the potential for unobservable differences between the remedial and nonremedial student groups. Additionally, there is a concern that students are able to avoid these courses through secondary placement tests or are reassigned to remedial courses after initial evaluation in nonremedial courses. These two forms of noncompliance with the state's course placement policy could be nonrandom and, therefore, related to the educational outcomes of interest. If this is the case, the strict assumptions of RD design would be violated.

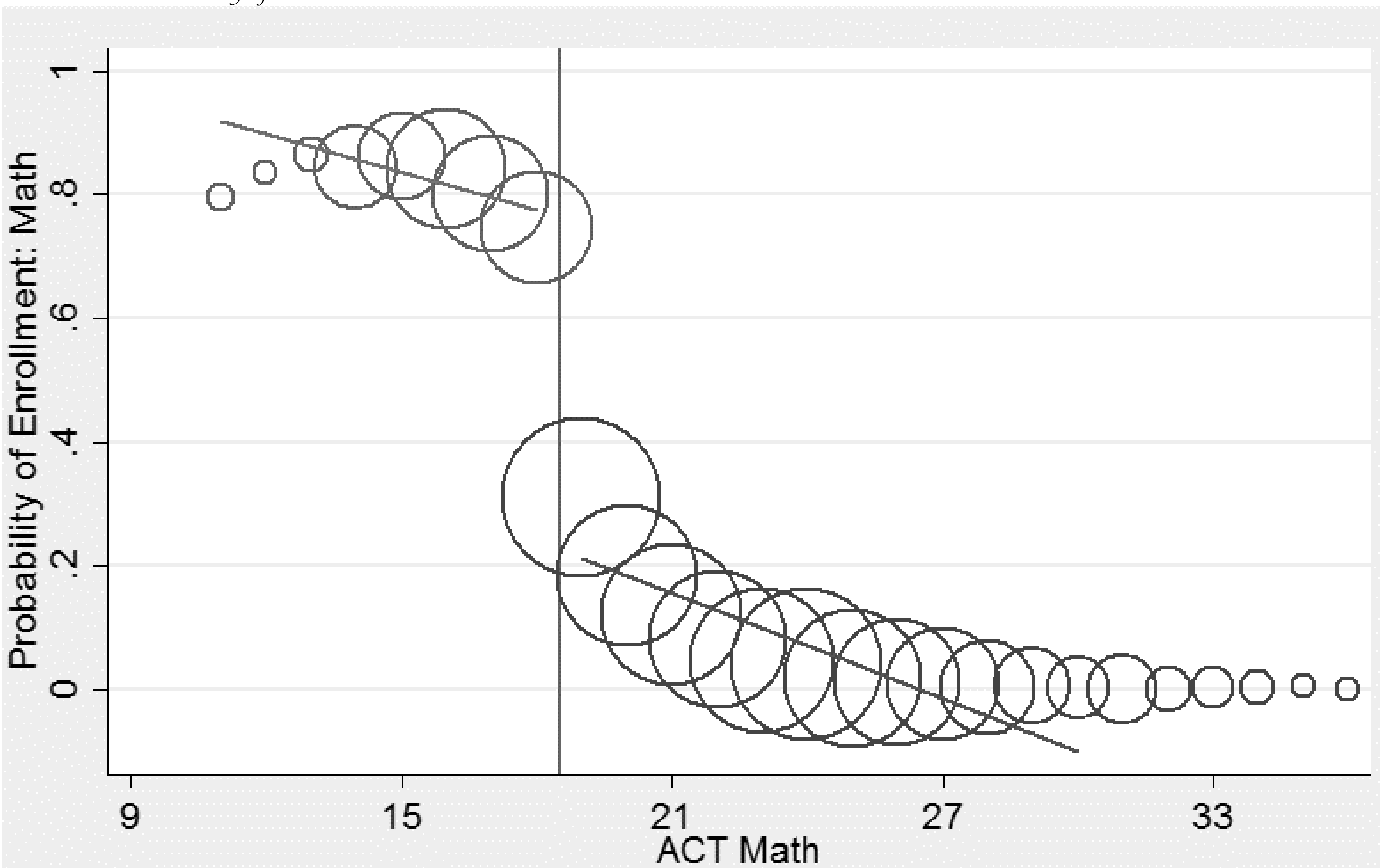
The use of RD methods to examine the impacts of remediation is quite common, as evidenced by the growing literature base discussed in this chapter. Nonetheless, while Arkansas uses a distinct cutoff score for the state's course placement policy, there is still noncompliance with the policy. This is clear from the existence of differences in percentages of students assigned to remediation and enrolling in remediation, showing a violation of the strict compliance assumption of a sharp RD. Additionally, figure 3.1 shows the predicted probability of enrolling in remedial math courses by subject test score. As shown in the graphs, there is at least a 75 percent chance that a student who is assigned to remediation will enroll, with a noticeable decrease in the average probability the closer a student scored to the cutoff. There is a noticeable non-zero probability of enrolling in remedial courses for students who score above the cutoff, most noticeably for students scoring right above. In addition to showing the existence of noncompliance with the placement policy, the noticeable convergence of probabilities shows some students deemed unprepared based on placement tests are likely placed incorrectly.

Figure 3.2 shows a similar story for English students, where there is a noticeable decrease in the probability of enrolling in English remediation for students scoring within the wide bandwidth, and a convergence in probabilities for students scoring right around the cutoff. Interestingly, there is a noticeable jump in the proportion of students whose scores qualify for nonremedial courses. This is likely due to students taking the COMPASS exam to test out of remediation, which is an untimed test by the ACT. In this case, it is highly likely students who scored just below the preparedness cutoff on the ACT were capable of passing the exam but struggled with the timed aspect.

Knowing that noncompliance could lead to biased estimates of the true impacts of remediation, I treat the "sharp" RD design as a simple ITT estimate of the impacts of being assigned to remediation. In this case, I use a standard probit regression model for dichotomous outcomes and cluster standard errors by institution where students enrolled.[5] These models explain the effects of assignment to treatment using the divergence in outcomes between students assigned to remediation based on test score (A_{is}) and scoring below the cutoff ($\overline{A}_{is}$) value. Using this "sharp" RD design, I am able to maintain the assumption of randomness around the assignment cutoff that is likely violated in the TOT estimates.

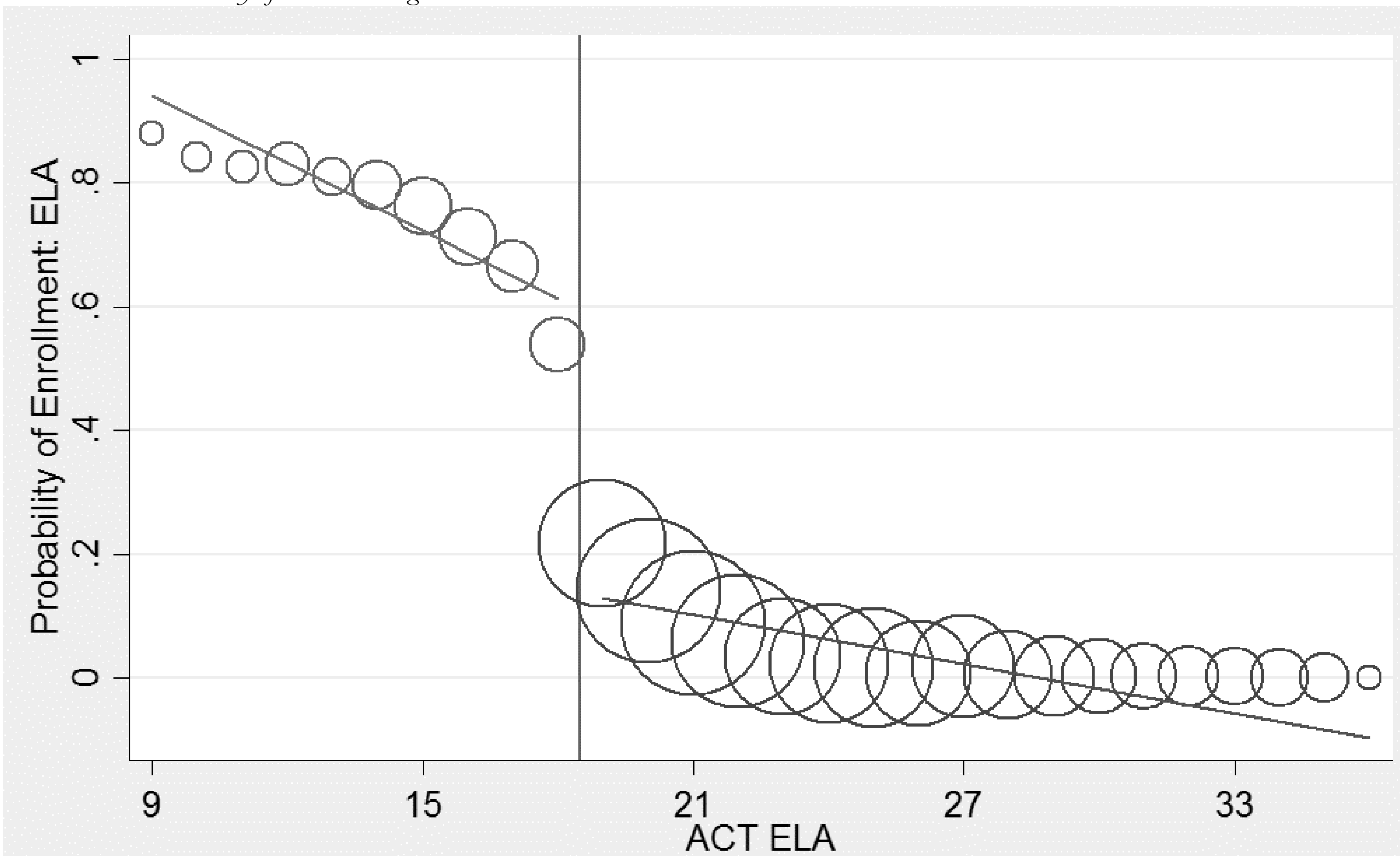
[5] I also estimated the probability of success in the outcomes using a linear probability model as a specification, finding no differences in magnitude or statistical significance between the linear probability model and probit model with marginal effects.

Figure 3.1: Predicted Probability of Remedial Math Enrollment



Note: All math scores are transformed to be concordant to the ACT. Each circle represents the probability (0 to 1) of enrolling in the associated remedial math course based on students' score on the ACT. Circles are weighted based on the frequency of students in the sample earning that ACT concordant score.

Figure 3.2: Predicted Probability of Remedial English Enrollment



Note: All English scores are transformed to be concordant to the ACT. Each circle represents the probability (0 to 1) of enrolling in the associated remedial math course based on students' score on the ACT. Circles are weighted based on the frequency of students in the sample earning that ACT concordant score.

(3.3) $Y_{is} = \alpha + \beta_1 \mathrm{T}_{is} + \beta_2 A_{iscenter} * \mathrm{T}_{is} + \beta_3 A_{iscenter} + \beta_4 X_i + \varepsilon_{is}$

- $\mathbf{T}_{is}$ is a binary indicator for student *i*'s placement test score assigning students to remediation
- $\boldsymbol{A}_{iscenter}$ is the centered cutoff using student *i*'s test score minus 18.5
- $\boldsymbol{A}_{iscenter} * \mathbf{T}_{is}$ is the centered rating variable interacted with a binary indicator taking value 1 if the student's placement test score fell below the cutoff
- $\boldsymbol{X}_i$ is a vector of student demographics including race, gender, high school GPA, institution attended, and year of first enrollment

It should be noted that equation 3.3 does not allow for an estimation that accounts for issues of noncompliance, nor does it allow for an estimation of the impacts of truly enrolling in remedial courses. In order to estimate the impact of enrolling in a remedial course, I implement a similar model as equation 3.3, where I simply replace T_{is} with a binary indicator taking value 1 for students who enrolled in a remedial course. This provides a TOT estimate of the impacts of enrolling in remediation.

It is common in research on college remediation to use an Instrumental Variable analysis, where assignment to remedial courses is used to predict the probability of enroll in remedial courses (Calcagno & Long, 2008; Boatman & Long, 2010; Boatman, 2012). In each of these studies, there were fewer cohorts analyzed than in the analysis presented here.

In equation 3.3, β_1 is the coefficient of interest, representing the causal effect of enrolling in remediation. This equation, along with the narrow bandwidth ITT and TOT estimates, provides an unbiased estimate of the local average treatment effect (LATE), which captures the variation in the outcome of interest based on the students only in the bandwidth of interest. Additionally, this model excludes students who were recommended to remediation based on something other than a placement test score (Imbens & Angrist, 1994; Angrist, Imbens, & Rubin, 1996; Calcagno & Long, 2008; Jacob et al, 2012).

2. Outcomes

Equation 3.3 uses $\boldsymbol{Y_{is}}$ as a generic outcome, but is representative of the eight outcomes of interest. These outcomes are designed to measure both short and long term effects of students who are both successful and unsuccessful in passing their remedial courses. In this analysis all outcomes are dichotomous, leading me to use a probit model with average marginal effects as a post-estimation to determine the predicted probability of success or failure for students assigned/enrolling in remedial courses. These are broadly defined as short-term persistence and long-term attainment outcomes, but more specifically:

- <u>Year 2, 3, and 4 Persistence</u> – The first outcome of interest estimates the impact of having to enroll in remedial courses on students' persistence beyond the first year of enrollment. As most students are required to enroll in remedial courses in the first year, and in some cases, limited in the number of credits in which they can enroll, this is a proxy measure of discouragement. Year 3 persistence which also captures the impact of losing credits earned in a basic skills course that could artificially increase a student's GPA and maintain good academic standing. A final outcome of persistence, persistence to the fourth year, measures the impact on longer term persistence towards earning a degree. In all persistence outcomes, I account for students who have earned a degree in the timeframe.
- <u>Bachelor's in 4 or 6 Years</u> – Limited only to students who sought a bachelor's degree at the point of enrollment or enrolled in a four-year institution. These are 100% and 150% time to graduation as defined by ADHE, which also captures that average time to graduation is now extending beyond the previous 4-year track. Graduation outcomes are measured cumulatively, where any student who graduates in the 4-year timeframe is automatically coded as a graduate in the longer timeframe.
- <u>Associate's/Certificate in 3 Years or 4 Years</u> – This includes a measure of 150% and 200% time to graduation as higher percentages of community college students are required to take at least one remedial course, likely increasing time to graduation and could potentially present an unnecessary and incomplete negative result. Similar to the Bachelor's degree outcomes, Associate's/Certificate earning outcomes are measured cumulatively, where any

student earning a degree in 3 years is counted as a successful graduate in the longer timeframe.

- Earn Degree – Dichotomous indicator variable of ever earning a degree of any type, regardless of initial intent or transferring up or down between two- and four-year institutions. Transferring down by remedial students would present high levels of self-awareness from students who change their expectations to what they believe to be more reasonable academic attainment goals.

With all outcomes, the preferred bandwidth is the narrowest bandwidth, providing a local average treatment effect (LATE) estimate. I include wider bandwidth estimates as a robustness check. For this study, the main analyses include a full sample analysis of all students, regardless of institution type; community college-specific outcomes, with the sample limited to students who first enrolled in a community college; and university-specific outcomes, with the sample limited to students who first enrolled in a university.

Figures 3.3 and 3.4 below represent the initial graphical representations of how placement test scores relate to outcome variables of interest. All models represent wide band sample ITT estimates, conditional on placement test score for easier interpretation. All models make use of the centered placement test score and condition on students being assigned to remediation based on their subject-specific placement test. Since it is the wide band width sample, observations are restricted to those scoring within 1.5 points of the cutoff on both sides (i.e. 17 through 18 and 19 through 20). Since the strict compliance with assignment assumption is violated, these should be viewed as ITT estimates.

Results in both figure 3.3 and 3.4 suggest negative impacts on persistence and graduation across types of degree. Tables 3.6 and 3.7 present raw mean differences, testing for significance using t-tests. As the graphs in figures 3.3 and 3.4 and tables 3.6 and 3.7 show, there are statistically significant differences in raw outcomes for the two groups of students here. It is important to note that these are simple mean differences that do not control for student characteristics. Therefore, these graphical representations should be interpreted as strictly descriptive and not estimates of the causal impacts of remediation.

For the outcomes of interest, not all students would have been enrolled long enough to have an impact on these outcomes. Students who have been enrolled for less than a year (i.e. academic year 2016) would not be able to persist into their second year. Similarly, students who have been enrolled less than 4 years and near the cutoff score are highly unlikely to have graduated in less than the 100 percent time allotment for the degree of interest. Therefore, these students would be excluded from the full analysis.

Table 3.7 Mean Outcomes and Comparisons, English

	English						
	18			19			
	Mean	**SD**	**N**	**Mean**	**SD**	**N**	**Diff.***
Persist to Year 2	0.62	0.49	11,615	0.65	0.48	16,115	-0.03
Persist to Year 3	0.48	0.50	11,615	0.51	0.50	16,115	-0.03
AA/Cert in 3 Years	0.25	0.46	4,974	0.30	0.43	5,654	-0.05
AA/Cert in 4 Years	0.28	0.45	5,196	0.33	0.47	5,952	-0.05
BA in 4 Years	0.09	0.29	8,234	0.13	0.34	11,136	-0.04
BA in 6 Years	0.16	0.37	6,208	0.21	0.41	8,580	-0.05
Ever Earn a Degree	0.31	0.46	11,615	0.34	0.47	16,115	-0.03

	English						
	17-18			19-20			
	Mean	**SD**	**N**	**Mean**	**SD**	**N**	**Diff.***
Persist to Year 2	0.61	0.49	22,063	0.65	0.48	36,283	-0.04
Persist to Year 3	0.47	0.50	22,063	0.51	0.50	36,283	-0.04
AA/Cert in 3 Years	0.24	0.43	9,874	0.30	0.46	12,781	-0.06
AA/Cert in 4 Years	0.27	0.44	10,279	0.33	0.47	13,440	-0.06
BA in 4 Years	0.09	0.28	15,666	0.14	0.35	24,040	-0.05
BA in 6 Years	0.15	0.36	11,931	0.22	0.41	18,045	-0.07
Ever Earn a Degree	0.30	0.46	22,063	0.34	0.47	36,283	-0.04

*All differences significant at $p<0.01$

Notes: For attainment outcomes, not all cohorts are considered as they would not have been enrolled long enough to reasonably expect students to graduate.

Source: Author's calculations

Table 3.8: Mean Outcomes and Comparisons, Math

	Math						
	18			19			
	Mean	**SD**	**N**	**Mean**	**SD**	**N**	**Diff.***
Persist to Year 2	0.63	0.48	20,000	0.65	0.48	18,719	-0.02
Persist to Year 3	0.49	0.50	20,000	0.52	0.50	18,719	-0.03
AA/Cert in 3 Years	0.25	0.43	8,442	0.31	0.46	6,275	-0.06
AA/Cert in 4 Years	0.28	0.45	8,825	0.34	0.47	6,595	-0.06
BA in 4 Years	0.12	0.32	13,987	0.16	0.37	12,745	-0.04
BA in 6 Years	0.20	0.40	10,441	0.22	0.42	9,650	-0.03
Ever Earn a Degree	0.33	0.47	20,000	0.35	0.48	18,719	-0.03

	Math						
	17-18			19-20			
	Mean	**SD**	**N**	**Mean**	**SD**	**N**	**Diff.***
Persist to Year 2	0.62	0.49	41,833	0.67	0.47	33,929	-0.05
Persist to Year 3	0.48	0.50	41,833	0.53	0.50	33,929	-0.05
AA/Cert in 3 Years	0.24	0.43	17,753	0.31	0.46	10,737	-0.07
AA/Cert in 4 Years	0.27	0.44	18,540	0.35	0.48	11,309	-0.08
BA in 4 Years	0.11	0.31	28,710	0.18	0.38	22,826	-0.07
BA in 6 Years	0.18	0.39	21,415	0.25	0.43	17,051	-0.07
Ever Earn a Degree	0.31	0.46	41,833	0.37	0.48	33,929	-0.06

*All differences significant at p<0.01

Notes: For attainment outcomes, not all cohorts are considered as they would not have been enrolled long enough to reasonably expect students to graduate.

Source: Author's calculations

Figure 3.3: Outcome variables by centered English placement score

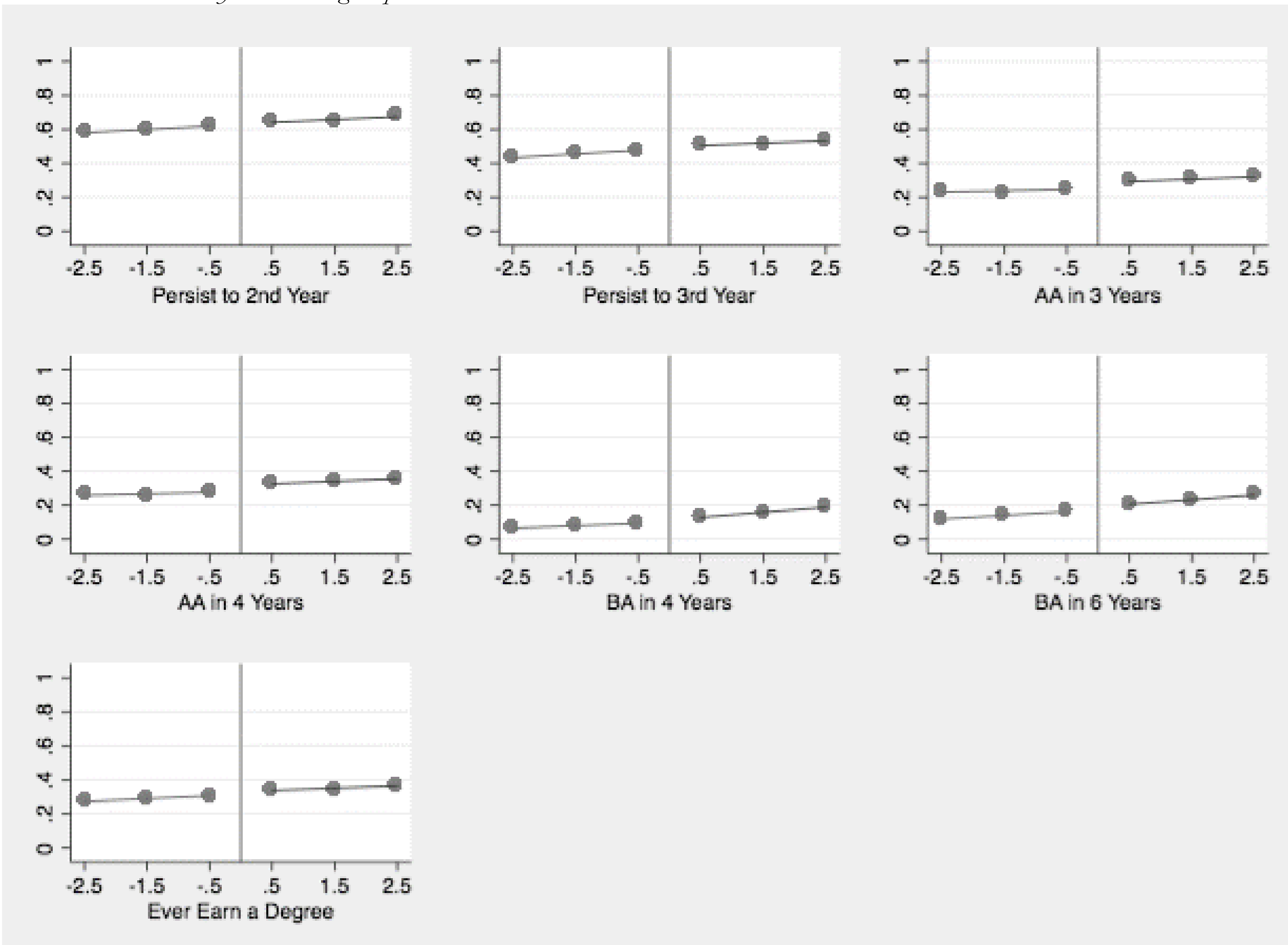
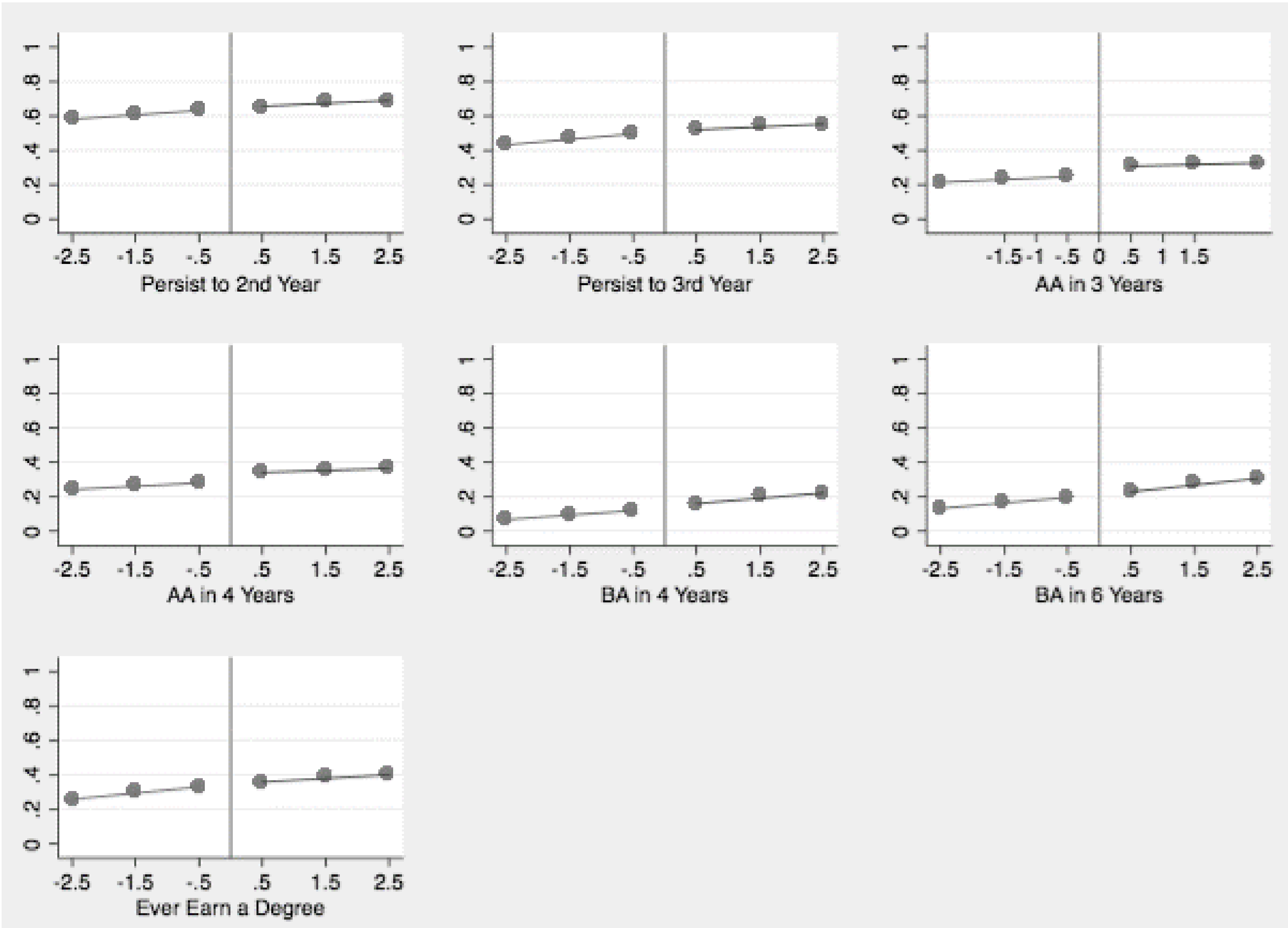


Figure 3.4: Outcome variables by centered math placement score



The results shown in Tables 3.7 and 3.8 are simply descriptive differences in means that do not control for student-level covariates. Therefore, these results are likely biased as they do not control for student characteristics that likely influence the impacts of remediation. In order to gain more accurate causal estimates of remediation, I implement the ITT and TOT estimates in equation 3.3. These results are presented in chapter 4 of this study.

Chapter IV – Results of Postsecondary Remediation in Arkansas

In this section, I present the overall estimated results of the effects of assignment to and enrollment in remedial coursework at public postsecondary institutions in the state of Arkansas. Overall, the results suggest small, but statistically significant negative impacts of both being recommended to and enrolling in remediation. This general result is robust across bandwidths, with the differences being magnified when comparing students further away from the centered cutoff. While there do not appear to be differences in early persistence, there are systematic, negative impacts on long-term persistence and ever earning a degree. Furthermore, the negative impacts of remediation are robust when limiting the analysis to two-year and four-year institutions separately, institutions with the highest remediation rates, and for Black students, female students, and students who earned a high school GPA above 3.0. In the following sections, I present the results of the first rigorous analysis of remediation in Arkansas, along with specifications tests and subgroup analyses to determine heterogeneous effects of remediation across the sample of students.

Overall, the results presented in the chapter show that scoring below the remedial placement cutoff in either math or English is associated with a decrease in the probability of persisting beyond the first year of the college education. Additionally, students assigned to math or English remediation have a lower probability of ever earning a college degree. When examining the impacts of enrolling in remedial courses, students complying with their placement have lower probability of ever graduating than their peers who avoid remediation. These results are statistically significant and are similar to results found throughout the literature of college remediation research.

A. Primary RD Analysis

To estimate the effects of remediation on student outcomes, I make use of a sharp regression discontinuity. In the tables below I present results of the ITT estimates of being assigned to remediation and TOT estimates of enrolling in remedial courses based on subject and type of institution where students enrolled. To gain an accurate estimate of the impacts of remediation, I run separate analyses of students enrolling in two-year and four-year institutions. For these analyses, I present the impacts on persistence into the second and third year, along with impacts on ever earning a degree of any type. Results for English are presented in Table 4.1 and math in Table 4.2 below.

It should be noted that there is noticeable sample attrition when moving from the full demographic sample to the analytic sample. Students with unavailable demographic information are automatically excluded from the analytic sample. This is often due to missing race or gender information, leading to students being excluded. When limiting the sample to the narrow bandwidth (i.e. students scoring immediately above and below the cutoff), there is a decrease in the sample resulting from students who do not submit a high school GPA. As this is the lone available baseline achievement measure for students in the narrow bandwidth sample, it leads to greater missing observations. Students who do not submit a high school GPA are often non-traditional age college students who have delayed college enrollment. These students are often more likely to enroll in remedial courses (ADHE, 2015a) and have lower retention/graduation rates at the college level (ADHE, 2015c). Excluding these students may bias the results upward. However, this is likely a more accurate depiction of the full impacts of remediation, as an overwhelming majority of students in the sample are traditional college age.

Table 4.1: Narrow Band RD Impacts of English Remediation, All Institutions

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	Enroll Year 2	Enroll Year 3	Ever Earn a Degree	Enroll Year 2	Enroll Year 3	Ever Earn a Degree
Treatment Effect	-0.009 (0.007)	-0.022*** (0.006)	-0.026*** (0.006)	-0.026*** (0.008)	-0.044*** (0.009)	-0.068*** (0.009)
Black	0.017 (0.017)	-0.015 (0.012)	-0.047*** (0.009)	0.020 (0.017)	-0.009 (0.012)	-0.039*** (0.009)
Hispanic	0.043 (0.028)	0.035* (0.019)	0.007 (0.016)	0.044 (0.028)	0.035* (0.019)	0.008 (0.016)
Other Race	0.005 (0.013)	-0.020* (0.011)	-0.039*** (0.015)	0.006 (0.013)	-0.019* (0.011)	-0.037** (0.015)
Female	0.004 (0.007)	0.006 (0.009)	0.006 (0.011)	0.005 (0.007)	0.008 (0.009)	0.008 (0.011)
Age	0.001 (0.001)	0.001 (0.001)	0.003** (0.001)	0.001 (0.001)	0.000 (0.001)	0.003* (0.001)
High School GPA	0.120*** (0.016)	0.119*** (0.016)	0.129*** (0.020)	0.119*** (0.017)	0.117*** (0.016)	0.125*** (0.019)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	20,141	20,141	20,141	20,141	20,141	20,141
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses

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

Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.

Source: Author's calculations

Table 4.1a Global Sample RD Impacts of English Remediation, All Institutions

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Ever Earn a Degree	Enroll Year 2	Enroll Year 3	Ever Earn a Degree
Treatment Effect	-0.001	-0.016***	-0.026***	-0.019***	-0.045***	-0.085***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.008)
English Test Score	0.006***	0.006***	0.006***	0.006***	0.006***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
English Score X Treatment	0.005***	0.004***	0.004***	0.003***	0.003***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Black	0.002	-0.014	-0.046***	0.003	-0.009	-0.037***
	(0.012)	(0.009)	(0.009)	(0.013)	(0.009)	(0.009)
Hispanic	0.036	0.038***	0.015	0.037	0.038***	0.016
	(0.025)	(0.013)	(0.012)	(0.025)	(0.013)	(0.012)
Other Race	-0.015**	-0.022***	-0.033***	-0.014**	-0.021***	-0.031***
	(0.006)	(0.006)	(0.004)	(0.006)	(0.006)	(0.004)
Female	0.021***	0.021***	0.026***	0.022***	0.022***	0.028***
	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)
Age	0.002***	0.002***	0.004***	0.002***	0.002***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.111***	0.117***	0.141***	0.110***	0.116***	0.138***
	(0.015)	(0.017)	(0.022)	(0.015)	(0.017)	(0.022)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	196,107	196,107	196,107	196,107	196,107	196,107

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Figure 4.1: Global Sample English Outcomes

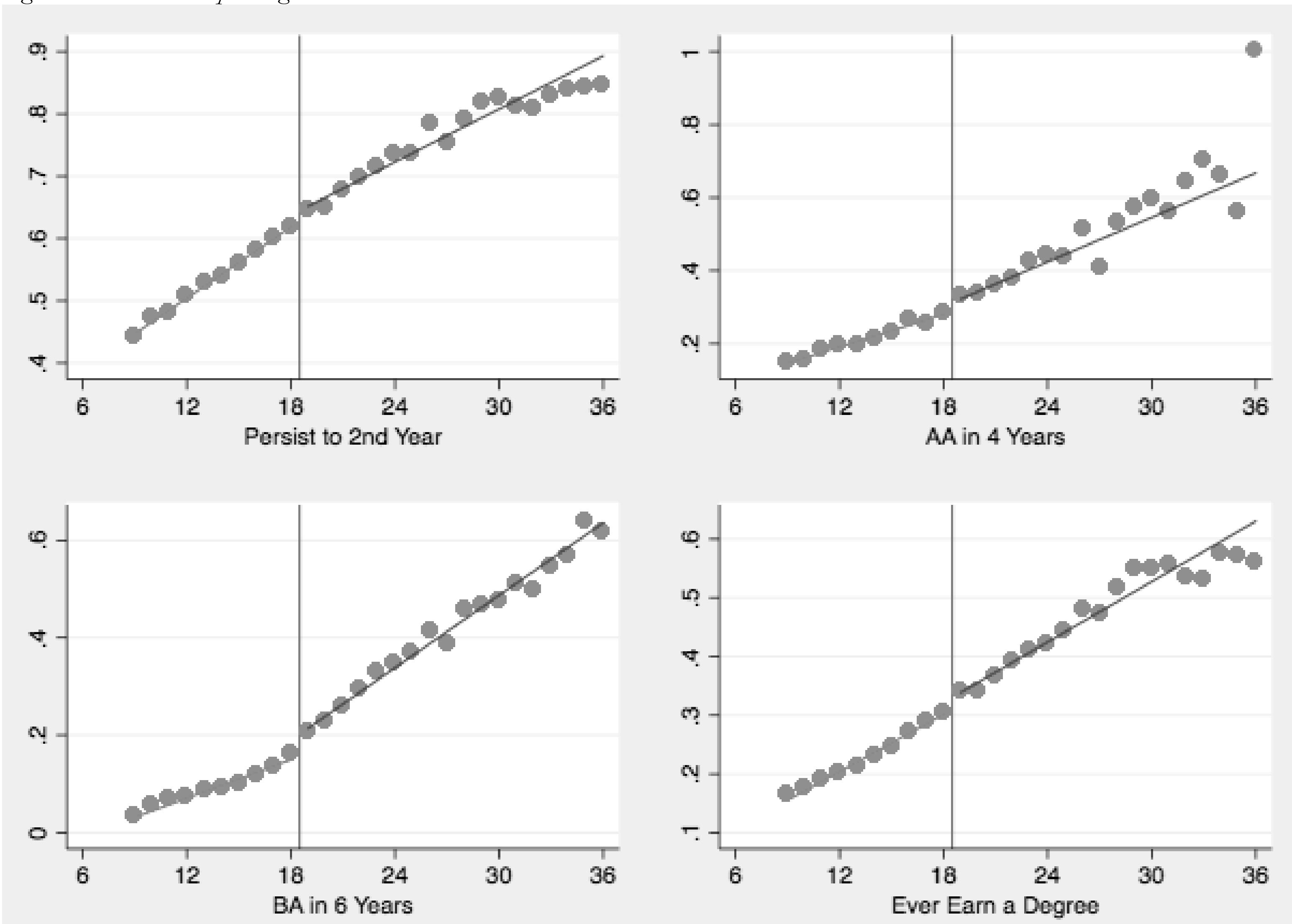


Table 4.2: Narrow Band RD Impacts of Math Remediation, All Institutions

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Ever Earn a Degree	Enroll Year 2	Enroll Year 3	Ever Earn a Degree
Treatment Effect	-0.028***	-0.034***	-0.039***	-0.015*	-0.043***	-0.060***
	(0.007)	(0.007)	(0.006)	(0.009)	(0.008)	(0.009)
Black	0.000	-0.007	-0.045***	-0.001	-0.006	-0.044***
	(0.015)	(0.014)	(0.012)	(0.015)	(0.014)	(0.012)
Hispanic	0.053**	0.042***	0.015	0.053**	0.043***	0.017
	(0.027)	(0.014)	(0.013)	(0.027)	(0.014)	(0.013)
Other Race	-0.029***	-0.044***	-0.045***	-0.029***	-0.044***	-0.045***
	(0.009)	(0.012)	(0.013)	(0.009)	(0.012)	(0.013)
Female	0.028***	0.033***	0.036***	0.027***	0.033***	0.037***
	(0.007)	(0.009)	(0.009)	(0.007)	(0.009)	(0.009)
Age	0.002**	0.002*	0.004***	0.002**	0.002*	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.117***	0.129***	0.140***	0.118***	0.126***	0.136***
	(0.015)	(0.018)	(0.021)	(0.015)	(0.018)	(0.021)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	28,825	28,825	28,825	28,825	28,825	28,825
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses

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

Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.

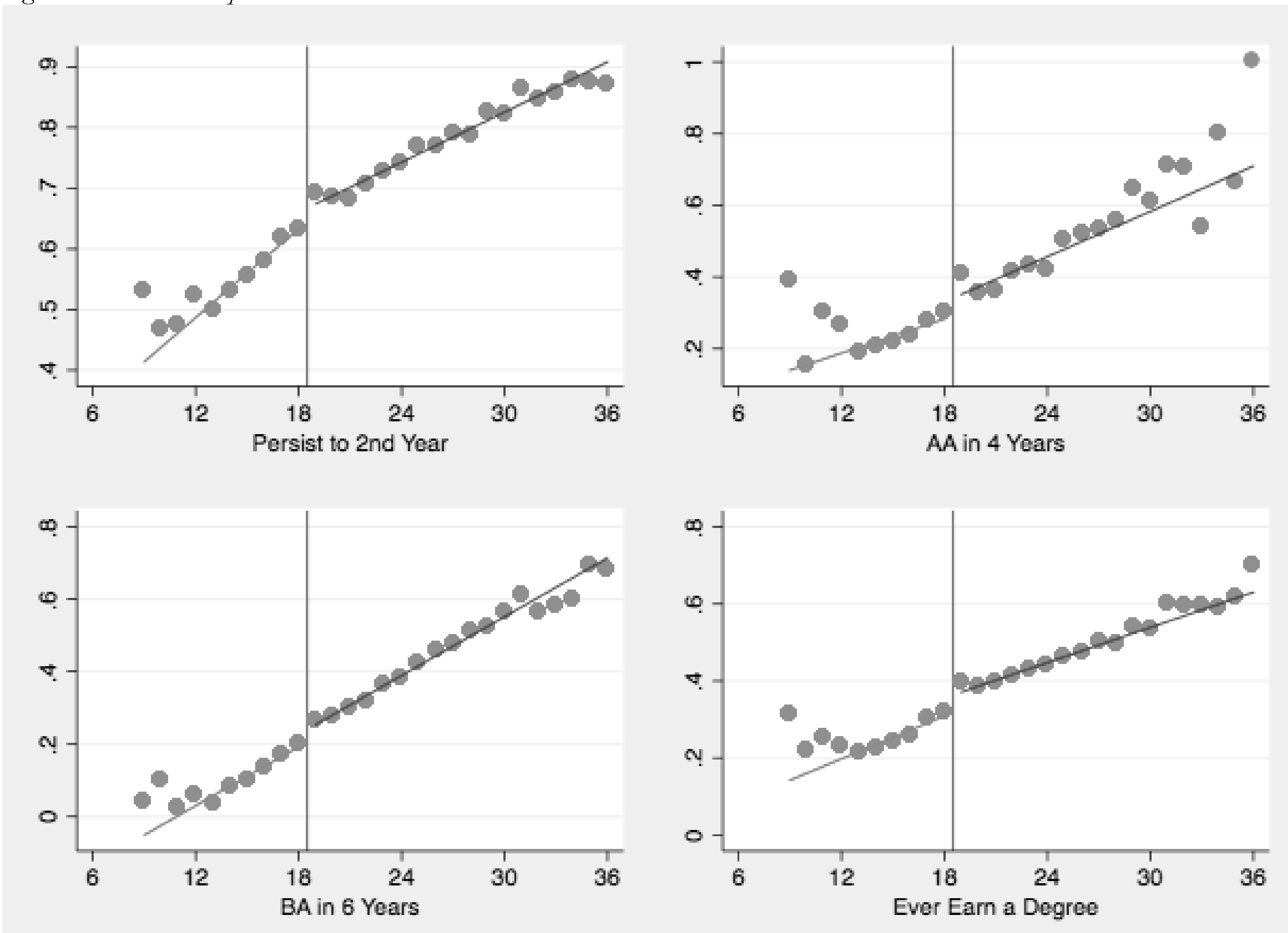
Source: Author's calculations

Table 4.2a: Global Sample RD Impacts of Math Remediation, All Institutions

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	Enroll Year 2	Enroll Year 3	Ever Earn a Degree	Enroll Year 2	Enroll Year 3	Ever Earn a Degree
Treatment Effect	-0.009	-0.020***	-0.038***	-0.003	-0.035***	-0.075***
	(0.005)	(0.006)	(0.007)	(0.008)	(0.007)	(0.009)
Math Test Score	0.006***	0.006***	0.005***	0.007***	0.006***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Math Score X Treatment	0.006**	0.006***	0.006**	0.000	0.002	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Black	-0.004	-0.021**	-0.051***	-0.006	-0.020**	-0.046***
	(0.014)	(0.010)	(0.010)	(0.014)	(0.010)	(0.010)
Hispanic	0.028	0.027**	0.004	0.028	0.028**	0.006
	(0.024)	(0.013)	(0.011)	(0.024)	(0.013)	(0.011)
Other Race	-0.021***	-0.029***	-0.040***	-0.021***	-0.029***	-0.039***
	(0.007)	(0.006)	(0.004)	(0.007)	(0.006)	(0.004)
Female	0.032***	0.033***	0.039***	0.032***	0.034***	0.041***
	(0.006)	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)
Age	0.002***	0.002***	0.005***	0.002***	0.002***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.112***	0.119***	0.141***	0.112***	0.118***	0.137***
	(0.015)	(0.017)	(0.022)	(0.015)	(0.017)	(0.022)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	194,991	194,991	194,991	194,991	194,991	194,991

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Figure 4.2: Global Sample Math Outcomes



For the overall impacts of remediation on persistence and ever earning a degree, there are consistent negative and statistically significant impacts of being assigned to remediation and enrolling in remedial courses. For English remediation, the lone insignificant result is the impact on persistence into the second year after assignment to remediation, as students are neither more nor less likely to persist as a result of being assigned to remedial courses. For students who score right around the cutoff, the impact of enrolling in a remedial English course results in a 6.8 percentage point decrease in the probability of earning a degree and a 6.0 percentage point decrease in the probability of earning a degree after enrolling in remedial math courses. While negative and significant, these results comparing all students regardless of institution may be masking impacts at the different types of institutions. Therefore, the results proceed by limiting the sample to examine the impacts of remediation at community colleges and universities respectively.

B. Impacts by Institution Type

Tables 4.3 through 4.6 present the ITT and TOT estimates of remediation on persistence beyond the first year of enrollment for students enrolling at community college and universities separately. Students who graduated within the timeframe are treated as successful outcomes so as not to bias results downward. For persistence into the second and third years after being assigned to English remediation at community colleges, there is no detectable impact. For the short-term persistence, the impact is positive, but is essentially zero. Students who enroll in remedial English courses experience a 3.3 and 5.6 percentage point decrease in the probability of persisting into the second and third year, both of which are highly statistically significant.

Table 4.3: Narrow Band RD Estimated Impacts of English Remediation on Persistence, Community College

	ITT (Assigned to Remediation)		**TOT (Enrolled in Remediation)**	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Treatment Effect	0.005 (0.013)	-0.015 (0.009)	-0.033*** (0.011)	-0.056*** (0.014)
Black	-0.050*** (0.019)	-0.067*** (0.012)	-0.045** (0.019)	-0.059*** (0.011)
Hispanic	0.092*** (0.028)	0.060*** (0.018)	0.092*** (0.028)	0.060*** (0.018)
Other Race	0.003 (0.031)	-0.030 (0.030)	0.003 (0.032)	-0.029 (0.030)
Female	0.007 (0.014)	0.006 (0.017)	0.008 (0.014)	0.009 (0.017)
Age	0.001 (0.001)	0.000 (0.001)	0.001 (0.001)	0.000 (0.001)
High School GPA	0.090*** (0.021)	0.088*** (0.017)	0.088*** (0.020)	0.085*** (0.017)
Controls				
Cohort Year	X	X	X	X
Institution	X	X	X	X
Observations	7,780	7,780	7,780	7,780
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.

Table 4.3a: Global Sample RD Estimated Impacts of English Remediation on Persistence, Community College

	ITT (Assigned to Remediation)		**TOT (Enrolled in Remediation)**	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Treatment Effect	0.002	-0.017**	-0.014	-0.053***
	(0.008)	(0.007)	(0.010)	(0.010)
English Score	0.005***	0.007***	0.006***	0.006***
	(0.001)	(0.002)	(0.001)	(0.001)
English Score X Treatment	0.006***	0.004**	0.004**	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)
Black	-0.048***	-0.055***	-0.047***	-0.048***
	(0.007)	(0.008)	(0.007)	(0.009)
Hispanic	0.082***	0.062***	0.082***	0.062***
	(0.020)	(0.013)	(0.019)	(0.013)
Other Race	-0.027**	-0.022**	-0.027**	-0.021**
	(0.012)	(0.010)	(0.012)	(0.010)
Female	0.024**	0.019	0.026**	0.023*
	(0.011)	(0.013)	(0.011)	(0.013)
Age	0.003***	0.002***	0.003***	0.002***
	(0.001)	(0.000)	(0.001)	(0.000)
High School GPA	0.094***	0.092***	0.094***	0.090***
	(0.019)	(0.020)	(0.019)	(0.019)
Controls				
Cohort Year	X	X	X	X
Institution	X	X	X	X
Observations	56,666	56,666	56,666	56,666

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.

Impacts of math remediation at community colleges reveal that students who are assigned to basic level courses have a 4.5 percentage point decrease in the probability of persisting into the second and third year of postsecondary education. However, students who enroll in remedial math courses experience an insignificant increase in the probability of persisting to the second year. This impact becomes significant and negative when measuring persistence into the third year, as shown in Table 4.4. Based on the descriptive statistics presented in chapter three, nearly all students comply with their math placement.

Table 4.4: Narrow Band RD Estimated Impacts of Math Remediation on Persistence, Community College

	ITT (Assigned to Remediation)		**TOT (Enrolled in Remediation)**	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Treatment Effect	-0.045***	-0.045***	0.017	-0.031**
	(0.011)	(0.012)	(0.016)	(0.014)
Black	-0.052***	-0.058***	-0.059***	-0.060***
	(0.017)	(0.014)	(0.018)	(0.015)
Hispanic	0.100***	0.059***	0.097***	0.059***
	(0.021)	(0.015)	(0.021)	(0.015)
Other Race	-0.029	-0.032*	-0.031	-0.032*
	(0.022)	(0.018)	(0.022)	(0.018)
Female	0.022	0.031**	0.019	0.032**
	(0.016)	(0.014)	(0.016)	(0.014)
Age	0.004***	0.003***	0.003***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.104***	0.108***	0.109***	0.108***
	(0.020)	(0.023)	(0.021)	(0.023)
Controls				
Cohort Year	X	X	X	X
Institution	X	X	X	X
Observations	11,330	11,330	11,330	11,330
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.4a: Global Sample RD Estimated Impacts of Math Remediation on Persistence, Community College

	ITT (Assigned to Remediation)		**TOT (Enrolled in Remediation)**	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Treatment Effect	-0.031***	-0.047***	0.009	-0.042***
	(0.011)	(0.011)	(0.012)	(0.012)
Math Score	0.001	0.002	0.007***	0.005**
	(0.002)	(0.002)	(0.002)	(0.003)
Math Score X Treatment	0.008***	0.007**	0.001	0.003*
	(0.003)	(0.003)	(0.002)	(0.002)
Black	-0.063***	-0.072***	-0.068***	-0.072***
	(0.008)	(0.008)	(0.008)	(0.009)
Hispanic	0.071***	0.046***	0.070***	0.048***
	(0.020)	(0.014)	(0.020)	(0.015)
Other Race	-0.036***	-0.033***	-0.035***	-0.032***
	(0.011)	(0.009)	(0.011)	(0.009)
Female	0.031***	0.028**	0.031***	0.032**
	(0.011)	(0.013)	(0.011)	(0.013)
Age	0.003***	0.003***	0.003***	0.002***
	(0.001)	(0.001)	(0.001)	(0.000)
High School GPA	0.098***	0.097***	0.100***	0.096***
	(0.019)	(0.021)	(0.020)	(0.020)
Controls				
Cohort Year	X	X	X	X
Institution	X	X	X	X
Observations	55,762	55,762	55,762	55,762

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Students at universities experience more systematic negative impacts of remediation. Students assigned to English remediation are 2 percentage points less likely to persist into the second year. Longer term persistence outcomes are also negative, with a 2.8 and 2.5 percentage point decrease in the probability of persisting into years three and four. Students enrolling in remedial courses experience similar negative impacts on persistence beyond the second year. However, the results for the first measure of persistence (persisting to year 2) is not statistically significant, though it follows the pattern of negative impacts.

Table 4.5: Narrow Band RD Estimated Impacts of English Remediation on Persistence, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Treatment Effect	-0.017**	-0.028***	-0.025***	-0.018	-0.035***	-0.044***
	(0.008)	(0.008)	(0.004)	(0.012)	(0.010)	(0.010)
Black	0.044**	0.007	-0.001	0.045***	0.011	0.004
	(0.017)	(0.011)	(0.012)	(0.016)	(0.012)	(0.013)
Hispanic	0.008	0.016	0.009	0.008	0.016	0.010
	(0.035)	(0.030)	(0.027)	(0.035)	(0.030)	(0.027)
Other Race	0.007	-0.012	-0.017	0.007	-0.011	-0.016
	(0.013)	(0.013)	(0.017)	(0.013)	(0.013)	(0.017)
Female	0.002	0.010	0.004	0.003	0.011	0.005
	(0.009)	(0.011)	(0.015)	(0.009)	(0.011)	(0.015)
Age	0.000	0.002	0.002	0.000	0.002	0.002
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)
High School GPA	0.152***	0.148***	0.144***	0.152***	0.146***	0.141***
	(0.026)	(0.029)	(0.033)	(0.026)	(0.028)	(0.033)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	12,361	12,361	12,361	12,361	12,361	12,361
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.5a: Global Sample RD Estimated Impacts of English Remediation on Persistence, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Treatment Effect	-0.006	-0.013***	-0.017***	-0.020***	-0.026***	-0.041***
	(0.004)	(0.004)	(0.003)	(0.006)	(0.005)	(0.007)
English Score	0.004***	0.005***	0.004***	0.005***	0.005***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
English Score X Treatment	0.006***	0.004***	0.005***	0.003*	0.002**	0.003***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Black	0.022*	0.001	-0.007	0.023*	0.003	-0.004
	(0.012)	(0.008)	(0.009)	(0.012)	(0.008)	(0.009)
Hispanic	0.008	0.019	0.010	0.008	0.020	0.011
	(0.032)	(0.017)	(0.011)	(0.032)	(0.017)	(0.011)
Other Race	-0.010	-0.020***	-0.022***	-0.009	-0.019***	-0.021***
	(0.007)	(0.007)	(0.005)	(0.007)	(0.007)	(0.005)
Female	0.019***	0.021***	0.017***	0.019***	0.021***	0.018***
	(0.005)	(0.006)	(0.006)	(0.005)	(0.007)	(0.006)
Age	0.001	0.002	0.002	0.001	0.002	0.002
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
High School GPA	0.130***	0.141***	0.140***	0.129***	0.140***	0.139***
	(0.022)	(0.024)	(0.024)	(0.022)	(0.024)	(0.024)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	139,441	139,441	139,441	139,441	139,441	139,441

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Impacts of math remediation are similar to the impacts of English remediation at universities. Students assigned to math remediation are 2 percentage points less likely to persist into year two and 3 percentage points less likely to persistence into year 3 and 4. Students enrolling in remedial math courses experience negative impacts on persistence, finding themselves 3.1, 5.0, and 4.5 percentage points less likely to persist into years 2, 3, and 4. Overall, it appears the impacts of remediation on the chances of persisting beyond the first year of postsecondary education are typically negative. There are slight positive, though insignificant impacts at the community college, but overall, the pattern of results points to students being harmed by remedial coursework.

Table 4.6: Narrow Band RD Estimated Impacts on Math Remediation on Persistence, University

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Treatment Effect	-0.018***	-0.030***	-0.029***	-0.031***	-0.050***	-0.045***
	(0.006)	(0.008)	(0.007)	(0.010)	(0.008)	(0.010)
Black	0.022*	0.011	0.003	0.022*	0.012	0.003
	(0.013)	(0.013)	(0.014)	(0.012)	(0.013)	(0.014)
Hispanic	0.015	0.029	0.004	0.016	0.030	0.005
	(0.039)	(0.021)	(0.015)	(0.039)	(0.020)	(0.015)
Other Race	-0.025***	-0.045***	-0.048***	-0.025***	-0.044***	-0.048***
	(0.008)	(0.016)	(0.016)	(0.008)	(0.016)	(0.017)
Female	0.030***	0.033***	0.027**	0.030***	0.032***	0.027**
	(0.008)	(0.012)	(0.011)	(0.008)	(0.011)	(0.011)
Age	0.001	0.002	0.002	0.001	0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
High School GPA	0.130***	0.149***	0.148***	0.127***	0.144***	0.144***
	(0.024)	(0.030)	(0.026)	(0.024)	(0.029)	(0.026)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	17,497	17,497	17,497	17,497	17,497	17,497
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.6a: Global Sample RD Estimated Impacts on Math Remediation on Persistence, University

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Treatment Effect	-0.003	-0.008	-0.010	-0.011	-0.023***	-0.030***
	(0.006)	(0.007)	(0.006)	(0.008)	(0.006)	(0.007)
Math Score	0.005***	0.006***	0.005***	0.006***	0.006***	0.005**
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Math Score X Treatment	0.009***	0.007***	0.010***	0.001	0.002	0.005**
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Black	0.021*	-0.001	-0.009	0.019	-0.001	-0.008
	(0.012)	(0.008)	(0.009)	(0.012)	(0.008)	(0.009)
Hispanic	0.002	0.013	0.004	0.002	0.013	0.005
	(0.031)	(0.017)	(0.011)	(0.032)	(0.017)	(0.011)
Other Race	-0.014*	-0.025***	-0.026***	-0.014*	-0.025***	-0.026***
	(0.008)	(0.008)	(0.006)	(0.008)	(0.008)	(0.006)
Female	0.030***	0.033***	0.029***	0.030***	0.033***	0.029***
	(0.007)	(0.009)	(0.008)	(0.007)	(0.009)	(0.008)
Age	0.002	0.003	0.003*	0.001	0.002	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
High School GPA	0.128***	0.140***	0.139***	0.127***	0.139***	0.137***
	(0.022)	(0.025)	(0.025)	(0.021)	(0.024)	(0.024)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	139,229	139,229	139,229	139,229	139,229	139,229

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

The impacts of assignment to remediation on attainment are negative and statistically significant across both institution types and subjects. Tables 4.7 through 4.10 show that these impacts vary slightly, but are substantially larger for students who enroll in the remedial courses. Students at community colleges enrolling in English remediation experience the largest negative impacts, as they are almost 10 percentage points less likely to ever earn a degree compared to their peers who do not enroll in English remediation. All results are statistically significant at the 95 percent level. It is highly likely that students who require remediation in English and are unable to avoid it lack some of the most important skills to succeed, those being reading and writing skills. Because of this, the impacts of enrolling in English remediation are likely magnified by student ability at entry, along with remedial coursework.

Table 4.7: Narrow Band RD Estimated Impacts of English Remediation on Attainment, Community College

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	AA in 3 Years	AA in 4 Years	Ever Earn a Degree	AA in 3 Years	AA in 4 Years	Ever Earn a Degree
Treatment Effect	-0.025***	-0.026***	-0.029***	-0.086***	-0.089***	-0.094***
	(0.007)	(0.010)	(0.011)	(0.010)	(0.012)	(0.012)
Black	-0.079***	-0.080***	-0.069***	-0.068***	-0.068***	-0.056***
	(0.013)	(0.012)	(0.015)	(0.013)	(0.012)	(0.015)
Hispanic	0.023	0.019	0.024	0.024	0.020	0.024
	(0.023)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Other Race	-0.035	-0.043	-0.016	-0.032	-0.041	-0.014
	(0.023)	(0.026)	(0.030)	(0.023)	(0.027)	(0.031)
Female	-0.022	-0.015	0.007	-0.016	-0.009	0.011
	(0.018)	(0.019)	(0.019)	(0.018)	(0.020)	(0.019)
Age	0.006***	0.006***	0.003***	0.005***	0.005***	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.089***	0.096***	0.107***	0.084***	0.091***	0.102***
	(0.017)	(0.019)	(0.020)	(0.017)	(0.018)	(0.019)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	7,780	7,780	7,780	7,780	7,780	7,780
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.7a: Global Sample RD Estimated Impacts of English Remediation on Attainment, Community College

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	AA in 3 Years	AA in 4 Years	Ever Earn a Degree	AA in 3 Years	AA in 4 Years	Ever Earn a Degree
Treatment Effect	-0.020***	-0.022***	-0.029***	-0.087***	-0.087***	-0.089***
	(0.006)	(0.007)	(0.008)	(0.008)	(0.008)	(0.009)
English Score	0.007***	0.007***	0.009***	0.002*	0.002*	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
English Score X Treatment	-0.001	0.000	0.002	0.005***	0.006***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Black	-0.081***	-0.084***	-0.078***	-0.066***	-0.070***	-0.065***
	(0.017)	(0.014)	(0.014)	(0.016)	(0.014)	(0.014)
Hispanic	0.035***	0.032***	0.040***	0.037***	0.033***	0.041***
	(0.009)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)
Other Race	-0.034***	-0.034***	-0.032***	-0.031***	-0.031***	-0.029***
	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)	(0.008)
Female	-0.010	-0.003	0.010	-0.004	0.003	0.015
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Age	0.005***	0.005***	0.004***	0.005***	0.005***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
High School GPA	0.089***	0.094***	0.107***	0.086***	0.091***	0.104***
	(0.020)	(0.021)	(0.021)	(0.020)	(0.020)	(0.020)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	51,162	51,162	51,162	51,162	51,162	51,162

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.

Source: Author's calculations

Table 4.8: Narrow Band RD Estimated Impacts of Math Remediation on Attainment, Community College

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	AA in 3 Years	AA in 4 Years	Ever Earn a Degree	AA in 3 Years	AA in 4 Years	Ever Earn a Degree
Treatment Effect	-0.051***	-0.048***	-0.059***	-0.080***	-0.078***	-0.076***
	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)
Black	-0.083***	-0.086***	-0.091***	-0.080***	-0.084***	-0.090***
	(0.016)	(0.018)	(0.016)	(0.018)	(0.020)	(0.018)
Hispanic	0.024	0.022	0.038**	0.027	0.025	0.039**
	(0.017)	(0.019)	(0.017)	(0.019)	(0.020)	(0.018)
Other Race	-0.035*	-0.034**	-0.020	-0.036**	-0.035**	-0.020
	(0.018)	(0.015)	(0.019)	(0.018)	(0.016)	(0.019)
Female	0.002	0.007	0.025	0.008	0.013	0.030**
	(0.017)	(0.017)	(0.015)	(0.016)	(0.017)	(0.015)
Age	0.006***	0.006***	0.004***	0.006***	0.006***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.105***	0.111***	0.123***	0.101***	0.107***	0.120***
	(0.021)	(0.022)	(0.023)	(0.021)	(0.021)	(0.022)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	11,328	11,328	11,328	11,328	11,328	11,328
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.8a: Global Sample RD Estimated Impacts of Math Remediation on Attainment, Community College

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	AA in 3 Years	AA in 4 Years	Ever Earn a Degree	AA in 3 Years	AA in 4 Years	Ever Earn a Degree
Treatment Effect	-0.061***	-0.062***	-0.070***	-0.099***	-0.096***	-0.097***
	(0.009)	(0.009)	(0.009)	(0.008)	(0.008)	(0.009)
Math Score	0.000	0.000	0.002	-0.002	-0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Math Score X Treatment	0.006*	0.006**	0.007*	0.011***	0.011***	0.009***
	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)
Black	-0.091***	-0.095***	-0.097***	-0.083***	-0.088***	-0.091***
	(0.017)	(0.015)	(0.014)	(0.016)	(0.014)	(0.014)
Hispanic	0.022**	0.018*	0.021**	0.026**	0.022*	0.025**
	(0.009)	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)
Other Race	-0.043***	-0.043***	-0.044***	-0.041***	-0.041***	-0.042***
	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)	(0.008)
Female	-0.002	0.006	0.022	0.007	0.015	0.029**
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)
Age	0.006***	0.005***	0.004***	0.005***	0.005***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.092***	0.097***	0.112***	0.088***	0.093***	0.108***
	(0.021)	(0.021)	(0.022)	(0.020)	(0.020)	(0.021)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	50,364	50,364	50,364	50,364	50,364	50,364

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Students at universities experience negative impacts of remediation on attainment as well. Being assigned to English remediation results in students being nearly 3 percentages points less likely to ever earn a degree, and increases to 5.3 percentage points for students who enroll in remedial English courses. These results are similar for math remediation, though they are slightly larger in magnitude for students enrolling in remedial math courses. It is important to note that the 4-year graduation rates are highly likely to be negative, given that remediation often prevents students from enrolling in a full course load during their first semester. Also, many students take six years or less to graduate from college. However, the negative impacts on ever earning a degree are the most concerning as this does not include a timeframe limitation and allows for an extended period of time for students to earn degrees.

Table 4.9: Narrow Band RD Estimated Impacts of English Remediation on Attainment, Universities

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	BA in 4 Years	BA in 6 Years	Ever Earn a Degree	BA in 4 Years	BA in 6 Years	Ever Earn a Degree
Treatment Effect	-0.023***	-0.032***	-0.027***	-0.051***	-0.051***	-0.053***
	(0.008)	(0.011)	(0.006)	(0.011)	(0.015)	(0.011)
Black	-0.030**	-0.008	-0.045***	-0.024*	-0.002	-0.038***
	(0.013)	(0.018)	(0.011)	(0.012)	(0.017)	(0.011)
Hispanic	0.013	0.048	-0.011	0.013	0.050	-0.010
	(0.017)	(0.041)	(0.020)	(0.017)	(0.040)	(0.020)
Other Race	-0.051*	-0.034	-0.042**	-0.048*	-0.032	-0.040**
	(0.029)	(0.035)	(0.017)	(0.028)	(0.035)	(0.017)
Female	-0.021**	-0.037***	0.001	-0.019*	-0.035***	0.002
	(0.011)	(0.007)	(0.012)	(0.010)	(0.007)	(0.012)
Age	-0.004	-0.008	0.003	-0.004	-0.008	0.003
	(0.004)	(0.006)	(0.004)	(0.004)	(0.006)	(0.004)
High School GPA	0.182***	0.191***	0.171***	0.177***	0.188***	0.167***
	(0.033)	(0.038)	(0.029)	(0.034)	(0.039)	(0.030)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	12,361	12,361	12,361	12,361	12,361	12,361
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.9a: Global Sample RD Estimated Impacts of English Remediation on Attainment, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	BA in 4 Years	BA in 6 Years	Ever Earn a Degree	BA in 4 Years	BA in 6 Years	Ever Earn a Degree
Treatment Effect	-0.031***	-0.028***	-0.021***	-0.090***	-0.076***	-0.060***
	(0.004)	(0.006)	(0.005)	(0.008)	(0.009)	(0.008)
English Score	0.006***	0.003	0.004***	0.006***	0.003*	0.004***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
English Score X Treatment	0.013***	0.016***	0.004**	0.005***	0.008***	0.002**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Black	-0.029**	0.001	-0.040***	-0.023*	0.004	-0.035***
	(0.012)	(0.011)	(0.011)	(0.012)	(0.010)	(0.011)
Hispanic	-0.011	0.006	-0.008	-0.010	0.007	-0.008
	(0.013)	(0.012)	(0.012)	(0.013)	(0.012)	(0.012)
Other Race	-0.026**	-0.010	-0.030***	-0.025**	-0.009	-0.029***
	(0.013)	(0.011)	(0.006)	(0.013)	(0.011)	(0.006)
Female	0.001	-0.022***	0.030***	0.001	-0.021***	0.030***
	(0.008)	(0.007)	(0.006)	(0.008)	(0.007)	(0.006)
Age	-0.003	-0.006**	0.005**	-0.003	-0.006**	0.005*
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
High School GPA	0.233***	0.217***	0.182***	0.230***	0.214***	0.179***
	(0.037)	(0.029)	(0.026)	(0.037)	(0.029)	(0.026)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	83,723	83,723	83,723	83,723	83,723	83,723

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.10: Narrow Band RD Estimated Impacts on Math Remediation on Attainment, University

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	BA in 4 Years	BA in 6 Years	Ever Earn a Degree	BA in 4 Years	BA in 6 Years	Ever Earn a Degree
Treatment Effect	-0.044***	-0.032**	-0.036***	-0.063***	-0.054***	-0.060***
	(0.009)	(0.014)	(0.006)	(0.012)	(0.019)	(0.009)
Black	-0.019	-0.009	-0.035**	-0.018	-0.007	-0.034**
	(0.012)	(0.017)	(0.014)	(0.012)	(0.017)	(0.014)
Hispanic	-0.009	0.026	-0.004	-0.008	0.026	-0.003
	(0.020)	(0.027)	(0.020)	(0.019)	(0.026)	(0.020)
Other Race	-0.036	-0.021	-0.055***	-0.037	-0.021	-0.054***
	(0.024)	(0.026)	(0.016)	(0.024)	(0.026)	(0.016)
Female	0.023**	0.003	0.039***	0.022**	0.002	0.039***
	(0.011)	(0.009)	(0.012)	(0.010)	(0.009)	(0.011)
Age	-0.004	-0.008	0.004	-0.004	-0.008	0.004
	(0.005)	(0.007)	(0.003)	(0.005)	(0.007)	(0.003)
High School GPA	0.188***	0.194***	0.174***	0.182***	0.188***	0.168***
	(0.040)	(0.029)	(0.028)	(0.039)	(0.029)	(0.028)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	17,497	17,497	17,497	17,497	17,497	17,497
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.10a Global Sample RD Estimated Impacts on Math Remediation on Attainment, University

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	BA in 4 Years	BA in 6 Years	Ever Earn a Degree	BA in 4 Years	BA in 6 Years	Ever Earn a Degree
Treatment Effect	-0.035***	-0.033***	-0.025***	-0.077***	-0.071***	-0.058***
	(0.010)	(0.012)	(0.006)	(0.006)	(0.010)	(0.007)
Math Score	0.007***	0.004	0.005***	0.007***	0.004*	0.005**
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)
Math Score X Treatment	0.017***	0.018***	0.008***	0.003	0.003	0.002
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Black	-0.026***	0.002	-0.038***	-0.026***	0.001	-0.036***
	(0.010)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)
Hispanic	-0.019*	-0.000	-0.014	-0.018*	0.002	-0.013
	(0.010)	(0.011)	(0.011)	(0.010)	(0.012)	(0.011)
Other Race	-0.032***	-0.015	-0.034***	-0.031***	-0.015	-0.033***
	(0.012)	(0.012)	(0.006)	(0.012)	(0.012)	(0.006)
Female	0.020*	-0.007	0.043***	0.021*	-0.007	0.043***
	(0.011)	(0.010)	(0.009)	(0.012)	(0.010)	(0.009)
Age	-0.001	-0.005*	0.007**	-0.001	-0.005*	0.006**
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
High School GPA	0.227***	0.212***	0.176***	0.223***	0.208***	0.173***
	(0.037)	(0.029)	(0.026)	(0.037)	(0.029)	(0.026)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	83,600	83,600	83,600	83,600	83,600	83,600

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Tables 4.11 through 4.16, present a summary of the full ITT and TOT findings for all institutions, universities, and community colleges by subject. In summary, there is a clear pattern of negative impacts across nearly all outcomes. The lone exceptions are insignificant positive on ITT impacts for community college students who were recommended to English remediation and similar small, insignificant positive effects on TOT estimates of community college students enrolling in remedial math courses. For the English estimates at community colleges, it is important to remember these are ITT estimates, therefore, not all students assigned to remediation enroll, making these estimates conservative but unbiased. Students who are able to avoid remediation are likely different on unobservable characteristics, leading them to have slightly better outcomes. However, given the self-selective nature of enrollment in remedial courses, the TOT estimates are much more vulnerable to bias. However, the longer-term persistence and graduation outcomes are statistically significant and negative, making these potentially positive outcomes less encouraging. The additional analysis examining gatekeeper course performance in the next chapter provides some additional explanations for these potential differences in early persistence outcomes for remedial math students.

Table 4.11: Full Sample Treatment Effects, English

	ITT Effect			TOT Effect		
	Band +/- 0.5	*Band +/- 1.5*	*Global*	*Band +/- 0.5*	*Band +/- 1.5*	*Global*
Persist – 2 yr	-0.009	-0.000	-0.001	-0.026***	-0.019***	-0.021***
Persist – 3 yr	-0.022***	-0.010	-0.016***	-0.044***	-0.045***	-0.048***
Attain – ever earn a degree	-0.026***	-0.014*	-0.026***	-0.068***	-0.067***	-0.095***
Observations	20,141	43,241	196,107	20,141	43,241	196,107

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

Table 4.12: University Sample Treatment Effects, English

	ITT Effect			TOT Effect		
	Band +/- 0.5	*Band +/- 1.5*	*Global*	*Band +/- 0.5*	*Band +/- 1.5*	*Global*
Persist – 2 yr	-0.017**	-0.012	-0.006	-0.018	-0.009	-0.018***
Persist – 3 yr	-0.028***	-0.019*	-0.013***	-0.035***	-0.032***	-0.025***
Attain – BA in 4 years	-0.023***	-0.014	-0.031***	-0.051***	-0.066***	-0.083***
Attain – BA in 6 years	-0.032***	-0.022	-0.028***	-0.051***	-0.056***	-0.067***
Observations	12,361	26,487	139,441	12,361	26,487	139,441

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

Table 4.13: Community College Sample Treatment Effects, English

	ITT Effect			TOT Effect		
	Band +/- 0.5	*Band +/- 1.5*	*Global*	*Band +/- 0.5*	*Band +/- 1.5*	*Global*
Persist – 2 yr	0.005	0.019	0.002	-0.033***	-0.030***	-0.019*
Persist – 3 yr	-0.015	0.002	-0.017**	-0.056***	-0.059***	-0.059***
Attain – AA in 3 years	-0.025***	-0.016	-0.020***	-0.086***	-0.088***	-0.100***
Attain – AA in 4 years	-0.026***	-0.015	-0.022***	-0.089***	-0.090***	-0.099***
Observations	7,780	16,754	56,666	7,780	16,754	56,666

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

Table 4.14: Full Sample Treatment Effects, Math

	ITT Effect			TOT Effect		
	Band +/- 0.5	*Band +/- 1.5*	*Global*	*Band +/- 0.5*	*Band +/- 1.5*	*Global*
Persist – 2 yr	-0.028***	-0.023**	-0.009	-0.015*	-0.003	-0.000
Persist – 3 yr	-0.034***	-0.034***	-0.020***	-0.043***	-0.033**	-0.033***
Attain – ever earn a degree	-0.039***	-0.038***	-0.038***	-0.060***	-0.062***	-0.075***
Observations	28,825	57,644	194,991	28,825	57,644	194,991

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

Table 4.15: University Sample Treatment Effects, Math

	ITT Effect			TOT Effect		
	Band +/- 0.5	*Band +/- 1.5*	*Global*	*Band +/- 0.5*	*Band +/- 1.5*	*Global*
Persist – 2 yr	-0.018***	-0.012	-0.003	-0.031***	-0.013	-0.020***
Persist – 3 yr	-0.030***	-0.032***	-0.008	-0.050***	-0.038***	-0.027***
Attain – BA in 4 years	-0.044***	-0.041***	-0.035***	-0.063***	-0.056***	-0.065***
Attain – BA in 6 years	-0.032**	-0.026	-0.033***	-0.054***	-0.056***	-0.057***
Observations	17,497	35,453	139,229	17,497	35,453	139,229

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

Table 4.16: Community College Sample Treatment Effects, Math

	ITT Effect			TOT Effect		
	Band +/- 0.5	*Band +/- 1.5*	*Global*	*Band +/- 0.5*	*Band +/- 1.5*	*Global*
Persist – 2 yr	-0.045***	-0.051***	-0.031***	0.017	0.012	0.007
Persist – 3 yr	-0.045***	-0.046***	-0.047***	-0.031**	-0.032***	-0.045***
Attain – AA in 3 years	-0.051***	-0.059***	-0.061***	-0.080***	-0.086***	-0.103***
Attain – AA in 4 years	-0.048***	-0.055***	-0.062***	-0.078***	-0.085***	-0.101***
Observations	11,328	22,191	55,762	11,328	22,191	55,762

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

In summary, the main analyses using the narrow bandwidths to estimate the impacts of assignment to and enrollment in remediation show statistically significant decreases in the percentage point probability of ever earning a degree. Similarly, assignment to remediation in either subject when enrolling at either a two-year or four-year institution shows statistically significant decreases in the probability of persisting. These results are similarly large and negative and statistically significant when expanding the sample to include all students scoring on both sides of the placement cutoff. Community college students assigned to math remediation experience a marginally significant increase in the probability of persisting into the second year, but this advantage disappears in persisting to year 3 and does not provide any sort of advantage in attaining a degree. Students at community colleges who enroll in remedial math courses appear to benefit from the skills they are able to recover in these basic courses, but not enough to maintain momentum to earning a degree.

Even after limiting these results to compare only students at the two different institution types, it is likely there are differential impacts at institutions. This is to be expected given that the rates of assignment to and enrollment in remedial courses varies dramatically by institution. In the next section, I present results of remediation at four-year institutions and two-years institutions with the highest percentages of assignment to and enrollment in remedial courses.

C. Differential Impacts by Institution Type

One of the main concerns with the overall analyses is that it could be masking the impacts of remediation across different institutions in the state. As shown in the description of the sample, the population of students at each institution varies quite a bit. Therefore, it makes intuitive sense that remediation rates would vary at each institution. In Tables 4.17a and 4.17b, we see the differences in the percentages of students who are assigned to and enroll in remediation for both English and math.

Table 4.17a: Remediation Information, Four Year Institutions

		Math		**English**	
Four-Year Institution	**N**	Assigned to Remediation	Enrolled in Remediation	Assigned to Remediation	Enrolled in Remediation
I	9,159	79.1%	68.2%	69.9%	63.6%
H	7,851	52.3%	50.1%	48.2%	43.5%
G	9,592	42.8%	41.5%	30.0%	29.6%
D	8,172	36.1%	35.6%	30.2%	31.4%
B	20,558	35.2%	31.8%	27.7%	24.2%
C	9,012	31.2%	31.5%	23.0%	22.9%
A	20,363	29.1%	29.4%	20.1%	23.0%
J	27,592	26.3%	20.2%	16.0%	9.9%
F	13,259	22.6%	32.8%	17.4%	18.2%
E	45,473	6.7%	6.9%	3.3%	2.5%
All 4-Year	171,031	27.9%	26.6%	20.8%	19.1%

Source: Author's calculations

For students enrolling in one of the ten four-year institutions, the percentage of students assigned to remedial math courses varies from 7 percent at four-year institution E to 79 percent at four-year institution I. These percentages also show the noncompliance associated with placement at each of the institutions. Remediation rates show similar variation for assignment to and enrollment in English remediation. Most institutions typically assign one-third of its first-time enrollees to remedial math and roughly one-quarter of students are assigned to remedial English. These differences in student population in terms of preparedness and demographics likely lead to different impacts of remediation at different institutions. This is especially true given that the remedial course placement cutoff is the same at all institutions across the state.

Table 4.17b shows the percentages of students assigned to and enrolling in remediation at community colleges in Arkansas. There is a noticeably higher percentage of students being assigned to remedial coursework at community colleges, with a higher prevalence of noncompliance as well. The percentage of students assigned to remediation ranges from just over a third of math students at two-year institution G to 82 percent of students at two-year institution R. Most community colleges see roughly half of their students score at levels that assigned them to remediation in math or

English. These differences in percentage of students who qualify for remediation make sense given the differences in baseline achievement for students selecting into the different types of institutions.

Table 4.17b: Remediation Information, Two Year Institutions

		Math		English	
Two-Year Institution	**N**	Assigned to Remediation	Enrolled in Remediation	Assigned to Remediation	Enrolled in Remediation
R	2,802	81.6%	80.3%	72.0%	64.5%
O	11,646	76.4%	68.6%	58.2%	50.5%
Q	1,922	73.4%	75.1%	66.7%	59.1%
C	2,329	66.9%	55.8%	65.2%	63.8%
N	1,803	64.1%	74.1%	60.1%	54.1%
I	3,118	63.4%	39.6%	64.8%	56.0%
U	2,172	62.7%	51.5%	60.2%	46.8%
E	1,986	61.6%	46.4%	55.0%	21.0%
F	3,563	60.5%	72.7%	58.0%	54.1%
T	2,689	57.4%	63.3%	48.8%	43.7%
S	1,869	56.8%	48.9%	68.2%	47.9%
V	5,916	52.8%	57.9%	47.2%	40.9%
M	2,159	50.7%	51.3%	51.6%	44.6%
D	2,321	50.5%	47.1%	35.8%	27.5%
B	8,877	49.2%	49.0%	35.4%	34.3%
L	9,533	44.1%	60.0%	38.8%	28.0%
K	5,178	41.6%	33.8%	44.1%	30.8%
H	1,591	40.9%	49.3%	49.3%	55.2%
P	1,487	40.3%	55.0%	37.3%	36.1%
A	3,558	39.6%	57.3%	53.9%	33.1%
J	4,292	37.7%	42.9%	43.6%	46.2%
G	1,864	37.4%	72.9%	50.6%	40.7%
All 2-Year	82,675	55.3%	57.0%	50.4%	42.5%

Source: Author's Calculations

Because of the differences in remediation rates across and within institution types, there is a high likelihood that there are differential impacts of remediation at the different institutions. To examine if there are heterogeneous effects by institutions, I limit the sample to include only the institutions with the highest remediation rates for both community colleges[6] and universities.[7] I implement similar ITT and TOT estimates as the main analyses with similar bandwidths of interest. Tables 4.18a and 4.18b show the estimates of the impacts of English and math remediation at the community colleges with the highest percentages of remediation. Tables 4.18c and 4.18d show the attainment outcomes at these same community colleges.

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[6] For community colleges, the institutions with the highest remediation rates in English are two-year institution R, two-year institution S, two-year institution Q, two-year institution C, two-year institution I, and two-year institution U. The community colleges with the highest math remediation rates include: two-year institution R, two-year institution O, two-year institution N, two-year institution Q, two-year institution C, and two-year institution I.

[7] For universities, the institutions with the highest remediation rates are the same for both subjects. These are four-year institution I, four-year institution H, four-year institution G, and four-year institution D.

Table 4.18a: High Remediation Narrow Band Sample RD Estimated Impacts on Persistence, English Community College

	ITT (Assigned to Remediation)		TOT (Enrolled in Remediation)	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Treatment Effect	-0.016	-0.030	-0.041*	-0.085*
	(0.032)	(0.037)	(0.025)	(0.050)
Black	-0.072*	-0.086***	-0.065*	-0.070***
	(0.038)	(0.025)	(0.036)	(0.020)
Hispanic	0.048	0.083	0.049	0.084
	(0.082)	(0.079)	(0.082)	(0.079)
Other Race	0.053	0.149***	0.050	0.139***
	(0.075)	(0.048)	(0.073)	(0.047)
Female	0.055	0.027	0.059	0.034
	(0.041)	(0.049)	(0.041)	(0.052)
Age	0.002	0.002	0.002	0.001
	(0.002)	(0.003)	(0.002)	(0.003)
High School GPA	0.106***	0.121**	0.105***	0.118**
	(0.039)	(0.052)	(0.038)	(0.052)
Controls				
Cohort Year	X	X	X	X
Institution	X	X	X	X
Observations	1,247	1,247	1,247	1,247
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.18b: High Remediation Narrow Band Sample RD Estimated Impacts of Math remediation on Persistence, Community College

	ITT (Assigned to Remediation)		**TOT (Enrolled in Remediation)**	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Treatment Effect	-0.048**	-0.067***	0.051	-0.005
	(0.019)	(0.012)	(0.036)	(0.021)
Black	-0.043	-0.071***	-0.054*	-0.081***
	(0.028)	(0.018)	(0.030)	(0.019)
Hispanic	0.020	-0.012	0.018	-0.015
	(0.066)	(0.051)	(0.066)	(0.049)
Other Race	-0.022	0.007	-0.031	0.001
	(0.034)	(0.032)	(0.034)	(0.034)
Female	0.028	0.059***	0.023	0.057***
	(0.024)	(0.013)	(0.025)	(0.013)
Age	0.002*	0.002	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.087***	0.071**	0.093***	0.074***
	(0.026)	(0.028)	(0.026)	(0.028)
Controls				
Cohort Year	X	X	X	X
Institution	X	X	X	X
Observations	2,892	2,892	2,892	2,892
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

In general, there are few significant impacts on attainment due to enrolling in remedial courses at community colleges, but there are trends like that of the full community college sample. The impacts on attainment, however do reveal statistically significant negative impacts that are quite a bit larger in magnitude than the full community college sample. This is especially true for students who enroll in remedial English courses on earning an associate's degree in 3 or 4 years. Impacts for math attainment are of a similar magnitude as the full sample. It is highly likely the results for the limited sample of the institutions are influencing the community college results. While these institutions account for about one-fifth of the total sample, the size of the impacts are large enough that the full impact of remediation at community colleges may be heavily influenced by the impacts of remediation at these select institutions.

Table 4.18c: High Remediation Narrow Band Sample RD Estimated Impacts of English Remediation on Attainment, Community College

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	AA in 3 Years	AA in 4 Years	Earn a Degree	AA in 3 Years	AA in 4 Years	Earn a Degree
Treatment Effect	-0.031	-0.024	-0.039	-0.139***	-0.138***	-0.145***
	(0.026)	(0.027)	(0.034)	(0.029)	(0.031)	(0.035)
Black	-0.065**	-0.066**	-0.057*	-0.040*	-0.042*	-0.031
	(0.027)	(0.027)	(0.031)	(0.024)	(0.024)	(0.027)
Hispanic	-0.037	-0.032	-0.006	-0.030	-0.026	-0.005
	(0.096)	(0.085)	(0.104)	(0.093)	(0.084)	(0.102)
Other Race	-0.002	-0.009	0.037	-0.009	-0.018	0.019
	(0.033)	(0.034)	(0.045)	(0.031)	(0.032)	(0.043)
Female	-0.008	0.004	0.033	0.007	0.017	0.044
	(0.043)	(0.043)	(0.048)	(0.046)	(0.047)	(0.051)
Age	0.005***	0.006***	0.004**	0.004**	0.005**	0.003
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
High School GPA	0.111**	0.115**	0.121**	0.104**	0.109**	0.115**
	(0.054)	(0.056)	(0.059)	(0.050)	(0.052)	(0.056)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	1,247	1,247	1,247	1,247	1,247	1,247
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.18d: High Remediation Narrow Band Sample RD Estimated Impacts of Math Remediation on Attainment, Community College

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	AA in 3 Years	AA in 4 Years	Earn a Degree	AA in 3 Years	AA in 4 Years	Earn a Degree
Treatment Effect	-0.094***	-0.092***	-0.097***	-0.082***	-0.074***	-0.067**
	(0.011)	(0.011)	(0.009)	(0.019)	(0.019)	(0.026)
Black	-0.079***	-0.088***	-0.089***	-0.087***	-0.097***	-0.098***
	(0.022)	(0.024)	(0.025)	(0.025)	(0.027)	(0.027)
Hispanic	-0.017	-0.018	0.028	-0.025	-0.026	0.021
	(0.050)	(0.054)	(0.052)	(0.053)	(0.057)	(0.050)
Other Race	-0.018	-0.016	-0.005	-0.017	-0.015	-0.005
	(0.037)	(0.030)	(0.022)	(0.038)	(0.031)	(0.024)
Female	0.029*	0.037*	0.052***	0.031*	0.039**	0.053***
	(0.017)	(0.020)	(0.013)	(0.016)	(0.019)	(0.013)
Age	0.005***	0.005***	0.003***	0.004***	0.004***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.060***	0.067***	0.079***	0.058***	0.066***	0.079***
	(0.021)	(0.025)	(0.030)	(0.021)	(0.024)	(0.030)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	2,892	2,892	2,892	2,892	2,892	2,892
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Tables 4.19a and 4.19b show the impacts of remediation on persistence at universities in the state with the highest remediation rates, while Tables 4.20a and 4.20b show the impacts on attainment. Much like the full community college and university analyses, being recommended to remedial English courses yields a negative result, however, these results are not statistically significant until the third persistence measure. Universities with the highest English remediation show statistically significant negative results, but these are smaller than the findings from the full sample of students who are assigned to remediation. The TOT estimates are larger, however, than the full sample of universities. Interestingly, the impacts on four-year graduation are both insignificant and essentially zero in their magnitude for ITT and TOT English remediation. This makes sense, as such a high percentage of students attending these institutions are recommended to remediation, that it is the norm and remediated students experience normal, and generally unsatisfactory, outcomes for their school. However, the estimates for students who enroll in remedial English courses yield statistically significant results that are quite large in magnitude.

The impacts of math remediation tell similar stories on both attainment and persistence, where enrolling in the associated remedial courses leads to a large and statistically significant decrease in the probability of graduating in 4-years, 6-years, or ever. Students at universities who are recommended to remediation experience a marginally significant decrease in the probability of earning a degree in 4 years compared to their peers who were not recommended to remediation. This difference becomes insignificant for both 6-year graduation and ever earning a degree. However, the negative and significant differences disappear for students who enroll in remedial math courses. These results exhibit similar negative patterns.

Table 4.19a: High Remediation Narrow Band Sample RD Estimated Impacts of English Remediation on Persistence, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Treatment Effect	-0.018	-0.016*	-0.018***	-0.024	-0.039***	-0.057***
	(0.015)	(0.010)	(0.003)	(0.029)	(0.013)	(0.003)
Black	0.027	0.007	-0.010	0.029	0.013	-0.001
	(0.028)	(0.030)	(0.029)	(0.026)	(0.026)	(0.028)
Hispanic	-0.033	0.067	0.014	-0.032	0.069	0.016
	(0.053)	(0.097)	(0.053)	(0.053)	(0.095)	(0.053)
Other Race	0.038	0.056	-0.012	0.041	0.060	-0.006
	(0.058)	(0.061)	(0.039)	(0.056)	(0.061)	(0.038)
Female	0.010	0.023	0.036***	0.011	0.023	0.037***
	(0.012)	(0.016)	(0.013)	(0.012)	(0.016)	(0.013)
Age	-0.006	-0.002	-0.003	-0.006	-0.002	-0.003
	(0.004)	(0.005)	(0.003)	(0.004)	(0.005)	(0.003)
High School GPA	0.104***	0.084***	0.078***	0.103***	0.081***	0.074***
	(0.030)	(0.025)	(0.029)	(0.031)	(0.023)	(0.028)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	3,250	3,250	3,250	3,250	3,250	3,250
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.19b: High Remediation Narrow Band Sample RD Estimated Impacts of Math Remediation on Persistence, Universities

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Treatment Effect	-0.057***	-0.072***	-0.040**	-0.008	-0.033	-0.026
	(0.010)	(0.012)	(0.020)	(0.013)	(0.026)	(0.031)
Black	0.037	0.021	-0.003	0.027	0.010	-0.008
	(0.027)	(0.030)	(0.031)	(0.029)	(0.033)	(0.032)
Hispanic	-0.038	0.063	0.012	-0.033	0.067	0.014
	(0.051)	(0.095)	(0.052)	(0.052)	(0.096)	(0.052)
Other Race	0.042	0.065	-0.007	0.038	0.060	-0.010
	(0.056)	(0.060)	(0.037)	(0.057)	(0.062)	(0.038)
Female	0.019*	0.033**	0.043***	0.012	0.026	0.039***
	(0.010)	(0.015)	(0.014)	(0.012)	(0.017)	(0.014)
Age	-0.006	-0.001	-0.003	-0.006	-0.002	-0.003
	(0.004)	(0.005)	(0.003)	(0.004)	(0.005)	(0.004)
High School GPA	0.097***	0.076***	0.074**	0.104***	0.080***	0.075**
	(0.028)	(0.022)	(0.030)	(0.031)	(0.026)	(0.032)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	3,250	3,250	3,250	3,250	3,250	3,250
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.20a: High Remediation Narrow Band Sample RD Estimated Impacts of English Remediation on Attainment, Universities

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	Grad in 4 Years	Grad in 6 Years	Ever Earn Degree	Grad in 4 Years	Grad in 6 Years	Ever Earn Degree
Treatment Effect	0.002	-0.004	-0.018**	-0.085***	-0.089***	-0.072***
	(0.014)	(0.016)	(0.008)	(0.011)	(0.018)	(0.007)
Black	0.006	0.048	-0.027	0.025	0.071	-0.016
	(0.033)	(0.076)	(0.034)	(0.028)	(0.069)	(0.032)
Hispanic	0.053	0.135	-0.026	0.056	0.133	-0.024
	(0.055)	(0.147)	(0.084)	(0.056)	(0.140)	(0.083)
Other Race	-0.007	0.076***	-0.013	0.005	0.081***	-0.005
	(0.063)	(0.021)	(0.036)	(0.063)	(0.017)	(0.035)
Female	-0.002	-0.021**	0.035***	0.000	-0.021**	0.035***
	(0.019)	(0.009)	(0.007)	(0.017)	(0.009)	(0.006)
Age	-0.035***	-0.009	-0.005	-0.032***	-0.009	-0.005
	(0.008)	(0.011)	(0.003)	(0.009)	(0.011)	(0.003)
High School GPA	0.116***	0.106***	0.106***	0.106***	0.097***	0.100***
	(0.027)	(0.032)	(0.031)	(0.026)	(0.033)	(0.030)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	3,250	3,250	3,250	3,250	3,250	3,250
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.20b: High Remediation Narrow Band Sample RD Estimated Impacts of Math Remediation on Attainment, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Grad in 4 Years	Grad in 6 Years	Ever Earn Degree	Grad in 4 Years	Grad in 6 Years	Ever Earn Degree
Treatment Effect	-0.047*	-0.069**	-0.064***	-0.050	-0.059	-0.062***
	(0.024)	(0.032)	(0.018)	(0.034)	(0.038)	(0.023)
Black	0.019	0.065	-0.016	0.016	0.056	-0.020
	(0.036)	(0.078)	(0.035)	(0.037)	(0.075)	(0.035)
Hispanic	0.059	0.139	-0.026	0.058	0.135	-0.023
	(0.054)	(0.145)	(0.081)	(0.053)	(0.143)	(0.081)
Other Race	0.001	0.077***	-0.007	-0.008	0.069***	-0.009
	(0.063)	(0.022)	(0.035)	(0.067)	(0.022)	(0.036)
Female	0.005	-0.012***	0.046***	0.004	-0.016**	0.042***
	(0.018)	(0.004)	(0.009)	(0.020)	(0.007)	(0.007)
Age	-0.034***	-0.009	-0.004	-0.033***	-0.010	-0.005
	(0.008)	(0.010)	(0.003)	(0.007)	(0.011)	(0.003)
High School GPA	0.109***	0.098***	0.098***	0.107***	0.097***	0.097***
	(0.027)	(0.033)	(0.030)	(0.031)	(0.036)	(0.031)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	3,250	3,250	3,250	3,250	3,250	3,250
ACT Score Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Overall, the results for the limited sample of institutions with the highest remediation rates show that there are likely differential impacts for students based on where they enroll. It appears that these institutions with the highest remediation rates experience the largest disparities in outcomes for students scoring just below the preparedness cutoff compared to those scoring just above the cutoff. This should be an area of great concern for these institutions as the state's funding mechanism shifts to an entirely outcomes-based focus.

While the results for different institutions in the state show limited heterogeneous effects, there is the chance that remediation impacts different subgroups of students at the different types of institutions in various ways. The final section of this analysis examines the impacts of remediation on subgroups of students enrolling at the different types of institutions in the state.

D. Subgroup Analyses

While the overall ITT and TOT analyses show an overall negative impact of assignment to and enrollment in remedial courses, there is the possibility these analyses grouping all students together may be hiding some of the potential benefits of remediation to certain groups of students. To examine if these impacts exist, I conduct subgroup analyses for three groups of students based on demographic characteristics: Black students compared to other students, females versus males, and students assigned to remediation who had a high school GPA of 3.0 or higher versus students who had lower than a 3.0 high school GPA.

To conduct analyses of the differences in impacts of remediation on the subgroups of interest, I run similar ITT and TOT RD models as the main analysis. In each of these models, the subgroup indicator of interest is dichotomous and interacted with the dichotomous ITT variable (scoring below the preparedness cutoff) and the TOT variable (enrolling in a remedial course) in the separate models. Each of the subgroup variables of interest is part of a constructed interaction term to yield the following models:

1. Assignment to remediation interacted with a dichotomous indicator for Black students compared to students who are not Black.
2. Assignment to remediation interacted with the gender variable to examine the impacts of remediation on female versus male students.
3. Assignment to remediation interacted with a dichotomous indicator of having a high school GPA above 3.0 compared to students with a high school GPA below 3.0.

Each of these subgroup analyses is conducted for students enrolling at community college and universities separately, as the students selecting into different institutions are likely different on a variety of unobservable and observable characteristics. Therefore, comparisons of these students are likely to be heavily biased.

Tables 4.21a and 4.21b show the impacts of English remediation on persistence and attainment. The results of the subgroup analyses for English remediation at community colleges shows that while male students may be more likely to persist into the second year after enrolling in remedial courses, these outcomes switch going beyond the second year. Additionally, there is some evidence of the discouragement effect for students who enroll with higher baseline achievement as measured by high school GPA. Students enrolling in community colleges with a GPA of 3.0 of higher are substantially less likely to persist compared to their peers. The method for measuring persistence accounts for students who may have transferred up to other institutions, as persistence is defined as either earning a degree/certificate in the timeframe or enrolling at any institution. Therefore, these students would only be lost from the sample if they drop out entirely or transfer to private institutions or out of state.

Table 4.21a: Estimated RD Effects of English Remediation on Subgroups Persistence, Community College

	ITT (Assigned to Remediation)		**TOT (Enrolled in Remediation)**	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Overall Treatment Effects	0.005	-0.015	-0.033***	-0.056***
	(0.013)	(0.009)	(0.011)	(0.014)
Gender				
Female	0.013	-0.009	-0.049***	-0.048***
	(0.016)	(0.012)	(0.017)	(0.017)
Male	-0.005	-0.034**	-0.032**	-0.061***
	(0.017)	(0.016)	(0.015)	(0.022)
Race/Ethnicity				
Black	0.022	-0.058	-0.030	-0.069***
	(0.021)	(0.036)	(0.022)	(0.023)
Not black	0.003	-0.012	-0.044***	-0.050***
	(0.011)	(0.010)	(0.013)	(0.017)
High Achieving High Schoolers				
GPA ≥3.00	-0.040***	-0.034**	-0.072***	-0.091***
	(0.010)	(0.017)	(0.018)	(0.022)
GPA<3.00	0.025*	-0.012	-0.017	-0.057***
	(0.014)	(0.012)	(0.017)	(0.017)
Observations	7,780	7,780	7,780	7,780
ACT Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.21b shows a similar story for the subgroups of interest as the full community college sample, that there is little evidence of positive outcomes of attainment as a result of being assigned to or enrolling in English remediation at community colleges. It does appear that female students experience slightly less harmful impacts, but there is no evidence of any positive impacts of remediation for these subgroups.

Table 4.21b: Estimated RD Effects of English Remediation on Subgroups Attainment, Community College

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	AA in 3 Years	AA in 4 Years	Ever Earn a Degree	AA in 3 Years	AA in 4 Years	Ever Earn a Degree
Overall Treatment Effects	-0.025***	-0.026***	-0.029***	-0.086***	-0.089***	-0.095***
	(0.007)	(0.010)	(0.011)	(0.010)	(0.012)	(0.012)
Gender						
Female	-0.011	-0.013	-0.012	-0.060***	-0.067***	-0.078***
	(0.011)	(0.012)	(0.012)	(0.012)	(0.014)	(0.013)
Male	-0.044***	-0.043***	-0.052***	-0.124***	-0.122***	-0.119***
	(0.011)	(0.014)	(0.015)	(0.017)	(0.020)	(0.017)
Race/Ethnicity						
Black	-0.049***	-0.057***	-0.060***	-0.093***	-0.104***	-0.101***
	(0.018)	(0.015)	(0.016)	(0.020)	(0.021)	(0.025)
Not black	-0.021***	-0.021**	-0.024**	-0.085***	-0.086***	-0.093***
	(0.008)	(0.010)	(0.011)	(0.011)	(0.013)	(0.012)
High Achieving High Schoolers						
GPA ≥3.00	-0.044***	-0.046**	-0.052***	-0.097***	-0.092***	-0.078***
	(0.016)	(0.019)	(0.019)	(0.011)	(0.014)	(0.020)
GPA<3.00	-0.015	-0.017	-0.013	-0.078***	-0.077***	-0.069***
	(0.009)	(0.012)	(0.014)	(0.009)	(0.011)	(0.013)
Observations	6,972	6,972	7,780	6,972	6,972	7,780
ACT Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Tables 4.22a and 4.22b show the impacts of assignment to and enrollment in math remediation at community colleges on the subgroups of interest. These results show similar discouragement effects for students who enroll with higher high school GPAs, both on persistence and attainment rates. For math remediation, specifically enrollment in remedial math courses, there are statistically significant *positive* impacts of enrolling in remedial math courses on persistence for both female students and Black students.

While these persistence outcomes are positive, they are somewhat troublesome when considered with the attainment outcomes. Students may persist longer in college, but this result may actually be negative when considering these students are still less likely to graduate than their nonremediated peers. This means students are staying enrolled longer without earning the credential to allow for more economic prosperity.

Table 4.22a: Estimated RD Effects of Math Remediation on Subgroups Persistence, Community College

	ITT (Assigned to Remediation)		**TOT (Enrolled in Remediation)**	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Overall Treatment Effects	-0.045*** (0.011)	-0.045*** (0.012)	0.017 (0.016)	-0.031** (0.014)
Gender				
Female	-0.045*** (0.013)	-0.023 (0.014)	0.043*** (0.017)	0.008 (0.015)
Male	-0.012 (0.014)	-0.023* (0.013)	0.008 (0.024)	-0.003 (0.022)
Race/Ethnicity				
Black	-0.033 (0.030)	-0.027 (0.025)	0.055* (0.029)	0.054 (0.035)
Not black	-0.033*** (0.010)	-0.024** (0.012)	0.025 (0.018)	-0.004 (0.018)
High Achieving High Schoolers				
GPA ≥3.00	-0.050*** (0.014)	-0.046*** (0.013)	-0.054*** (0.012)	-0.085*** (0.017)
GPA<3.00	-0.019 (0.012)	-0.017 (0.012)	0.050** (0.022)	0.016 (0.020)
Observations	10,323	9,452	10,323	9,452
ACT Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.22b: Estimated RD Effects of Math Remediation on Subgroups Attainment, Community College

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	AA in 3 Years	AA in 4 Years	Ever Earn a Degree	AA in 3 Years	AA in 4 Years	Ever Earn a Degree
Overall Treatment Effects	-0.051***	-0.048***	-0.059***	-0.080***	-0.078***	-0.076***
	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)
Gender						
Female	-0.039***	-0.036**	-0.038***	-0.057***	-0.053***	-0.053***
	(0.014)	(0.014)	(0.013)	(0.010)	(0.010)	(0.010)
Male	-0.012	-0.012	-0.022	-0.112***	-0.113***	-0.110***
	(0.014)	(0.014)	(0.013)	(0.018)	(0.018)	(0.020)
Race/Ethnicity						
Black	-0.016	-0.016	-0.037*	-0.082***	-0.077***	-0.076***
	(0.024)	(0.024)	(0.022)	(0.025)	(0.024)	(0.029)
Not black	-0.031***	-0.028**	-0.031***	-0.079***	-0.078***	-0.076***
	(0.012)	(0.012)	(0.011)	(0.013)	(0.012)	(0.012)
High Achieving High Schoolers						
GPA ≥3.00	-0.058***	-0.057***	-0.053***	-0.119***	-0.125***	-0.139***
	(0.014)	(0.014)	(0.012)	(0.008)	(0.009)	(0.010)
GPA<3.00	-0.013	-0.009	-0.024**	-0.076***	-0.071***	-0.062***
	(0.011)	(0.011)	(0.010)	(0.014)	(0.015)	(0.017)
Observations	9,909	9,909	11,330	9,909	9,909	11,330
ACT Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Tables 4.23a and 4.23b show the impacts of English remediation on persistence and attainment at universities, while Tables 4.24a and 4.24b show the impacts of math remediation for the subgroups of interest. The results of subgroups analyses support the overall analyses of remediation actually being harmful to students' probability of persisting or attaining a degree within the specified timeframes. High achieving students experience similarly negative impacts of remediation at universities, showing there may be issues of grade inflation at the high school level for some students.

Table 4.23a: Estimated RD Effects of English Remediation on Subgroups Persistence, Universities

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Overall Treatment Effects	-0.017**	-0.028***	-0.025***	-0.018	-0.035***	-0.044***
	(0.008)	(0.008)	(0.004)	(0.012)	(0.010)	(0.010)
Gender						
Female	-0.032***	-0.036***	-0.025***	-0.032**	-0.061***	-0.055***
	(0.009)	(0.013)	(0.009)	(0.016)	(0.018)	(0.017)
Male	-0.008	-0.028**	-0.043***	-0.015	-0.027*	-0.059***
	(0.013)	(0.012)	(0.012)	(0.009)	(0.014)	(0.014)
Race/Ethnicity						
Black	-0.025*	-0.031**	-0.039**	-0.010	-0.033**	-0.067***
	(0.014)	(0.014)	(0.015)	(0.015)	(0.014)	(0.016)
Not black	-0.017*	-0.032***	-0.032***	-0.031***	-0.050***	-0.051***
	(0.010)	(0.012)	(0.008)	(0.012)	(0.019)	(0.015)
High Achieving High Schoolers						
GPA ≥3.00	-0.034***	-0.036***	-0.044***	-0.044***	-0.055***	-0.073***
	(0.007)	(0.012)	(0.012)	(0.009)	(0.011)	(0.011)
GPA<3.00	-0.012	-0.036***	-0.024***	-0.032***	-0.058***	-0.056***
	(0.011)	(0.006)	(0.007)	(0.011)	(0.017)	(0.015)
Observations	12,361	12,361	12,361	12,361	12,361	12,361
ACT Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.23b: Estimated RD Effects of English Remediation on Subgroups Attainment, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	BA in 4 Years	BA in 6 Years	Ever Earn a Degree	BA in 4 Years	BA in 6 Years	Ever Earn a Degree
Overall Treatment Effects	-0.023***	-0.032***	-0.027***	-0.051***	-0.051***	-0.053***
	(0.008)	(0.011)	(0.006)	(0.011)	(0.015)	(0.011)
Gender						
Female	-0.017	-0.027**	-0.026***	-0.053***	-0.045***	-0.052***
	(0.014)	(0.010)	(0.010)	(0.011)	(0.013)	(0.013)
Male	-0.029***	-0.037**	-0.029**	-0.048***	-0.057***	-0.055***
	(0.009)	(0.016)	(0.013)	(0.015)	(0.020)	(0.013)
Race/Ethnicity						
Black	0.000	-0.032	-0.030*	-0.050***	-0.061***	-0.054***
	(0.022)	(0.020)	(0.016)	(0.014)	(0.007)	(0.011)
Not black	-0.034***	-0.032*	-0.027***	-0.052***	-0.046**	-0.054***
	(0.008)	(0.017)	(0.006)	(0.012)	(0.019)	(0.014)
High Achieving High Schoolers						
GPA ≥3.00	-0.038***	-0.040***	-0.025**	-0.060***	-0.058***	-0.012
	(0.007)	(0.012)	(0.011)	(0.015)	(0.019)	(0.019)
GPA<3.00	0.000	-0.011	-0.004	-0.040**	-0.044***	-0.031***
	(0.015)	(0.007)	(0.012)	(0.015)	(0.012)	(0.011)
Observations	7,847	5,427	12,365	7,847	5,427	12,365
ACT Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Tables 4.24a and 4.24b show the impacts of math remediation at universities for the subgroups of interest. These results reflect the overall impacts of university outcomes, as there are systematic negative impacts of remediation both in students assigned to remediation and for students who enroll in these courses. While these impacts remain small, they are negative and show that subgroups of students experience impacts that are similar to the full university sample,

Table 4.24a: Estimated RD Effects of Math Remediation on Subgroups Persistence, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Overall Treatment Effects	-0.018***	-0.030***	-0.029***	-0.031***	-0.050***	-0.045***
	(0.006)	(0.008)	(0.007)	(0.010)	(0.008)	(0.010)
Gender						
Female	-0.007	-0.019**	-0.009	-0.040***	-0.053***	-0.049***
	(0.011)	(0.009)	(0.009)	(0.010)	(0.010)	(0.015)
Male	-0.036***	-0.046***	-0.056***	-0.050***	-0.065***	-0.065***
	(0.010)	(0.017)	(0.011)	(0.010)	(0.016)	(0.019)
Race/Ethnicity						
Black	-0.035**	-0.040**	-0.046**	-0.060***	-0.074***	-0.074***
	(0.014)	(0.017)	(0.018)	(0.011)	(0.014)	(0.020)
Not black	-0.015*	-0.028***	-0.024***	-0.039***	-0.053***	-0.049***
	(0.008)	(0.010)	(0.008)	(0.008)	(0.010)	(0.014)
High Achieving High Schoolers						
GPA ≥3.00	-0.017	-0.019	-0.020	-0.067***	-0.071***	-0.071***
	(0.013)	(0.015)	(0.012)	(0.022)	(0.020)	(0.024)
GPA<3.00	-0.027**	-0.049***	-0.049***	-0.049***	-0.074***	-0.068***
	(0.012)	(0.012)	(0.016)	(0.005)	(0.010)	(0.014)
Observations	15,840	14,362	12,826	15,840	14,362	12,826
ACT Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table 4.24b: Estimated RD Effects of Math Remediation on Subgroups Attainment, Universities

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	BA in 4 Years	BA in 6 Years	Ever Earn a Degree	BA in 4 Years	BA in 6 Years	Ever Earn a Degree
Overall Treatment Effects	-0.044***	-0.032**	-0.036***	-0.063***	-0.054***	-0.060***
	(0.009)	(0.014)	(0.006)	(0.012)	(0.019)	(0.009)
Gender						
Female	-0.030***	-0.009	-0.019**	-0.057***	-0.034	-0.058***
	(0.008)	(0.020)	(0.009)	(0.013)	(0.027)	(0.010)
Male	-0.056***	-0.053***	-0.042***	-0.072***	-0.082***	-0.064***
	(0.013)	(0.014)	(0.008)	(0.016)	(0.014)	(0.012)
Race/Ethnicity						
Black	-0.038***	-0.037***	-0.026*	-0.051**	-0.057**	-0.064***
	(0.009)	(0.014)	(0.013)	(0.022)	(0.027)	(0.015)
Not black	-0.041***	-0.023*	-0.029***	-0.067***	-0.053***	-0.060***
	(0.008)	(0.014)	(0.008)	(0.012)	(0.018)	(0.008)
High Achieving High Schoolers						
GPA ≥3.00	-0.049***	-0.032***	-0.018*	-0.084***	-0.076***	-0.084***
	(0.008)	(0.011)	(0.009)	(0.017)	(0.019)	(0.028)
GPA<3.00	-0.030***	-0.032*	-0.027**	-0.060***	-0.069***	-0.064***
	(0.011)	(0.018)	(0.013)	(0.008)	(0.014)	(0.013)
Observations	11,048	7,528	17,491	11,048	7,528	17,491
ACT Bandwidth	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

E. Robustness Check

An important consideration in examining the impacts of remediation using an RD is the sensitivity of the analysis on specified bandwidths. By expanding the bandwidth, there is the potential for more variation in the outcomes, but doing so introduces seemingly less likely groups of students in the form of slightly higher ability students compared to slightly lower ability students.

This could potentially bias results, but does allow for more students in the analysis who could potentially benefit more from remedial courses. Using similar ITT and TOT estimates with controls, I expand the bandwidth to a wider band including students who scored a 17 on the ACT placement test below the cutoff and those who scored a 20 above the cutoff. Full results for these bandwidth specifications are available in Appendix D.

In increasing the sample size, some ITT estimates tended to become insignificant, though were still in the same negative direct. However, TOT estimates remained stable, showing negative and significant impacts on both persistence and attainment outcome for students who enrolled in the remedial courses. These results were robust to using probit and linear probability models. Coefficient estimates remained relatively similar across subgroups, making the main analyses appear even more consistent. Additionally, models were not sensitive to specification of standard errors in the models.

F. Discussion of Results

This study presents the results of the first rigorous analysis of the statewide remediation policy in the state of Arkansas. By using a rigorous research design that takes advantage of the course placement policy, I am able to estimate both intent-to-treat and treatment-on-treated effects of the policy for those students scoring directly above and directly below the cutoff. These students are most likely to be the same in their expectations, therefore making them the most comparable groups of students from which to draw causal estimates. In general, the results indicate that students who are recommended to and enroll in remedial courses experience decreases in the probability of persisting beyond the first year of college and ever earning a degree. These negative impacts are larger for students who actually enroll in the remedial courses, posing some levels of concern about the efficacy of the policy.

Table 4A: Narrow Sample English Treatment Impacts

	Persist Year 2		**AA in 4 Years**		**BA in 6 Years**		**Ever Earn a Degree**	
	ITT	**TOT**	**ITT**	**TOT**	**ITT**	**TOT**	**ITT**	**TOT**
Statewide	-0.009	-0.026***	-	-	-	-	-0.026***	-0.085***
Community College	0.005	-0.033***	-0.026***	-0.089***	-	-	-0.029***	-0.094***
High Remediation	-0.016	-0.041*	-0.024	-0.138***	-	-	-0.039	-0.145***
Female	0.013	-0.049***	-0.013	-0.067***	-	-	-0.012	-0.078***
Male	-0.005	-0.032**	-0.043***	-0.122***	-	-	-0.052***	-0.119***
Black	0.022	-0.030	-0.057***	-0.104***	-	-	-0.060***	-0.101***
Not Black	0.003	-0.044***	-0.021**	-0.086***	-	-	-0.024**	-0.093***
GPA ≥ 3.00	-0.040***	-0.072***	-0.046**	-0.092***	-	-	-0.052***	-0.078***
GPA < 3.00	0.025*	-0.017	-0.017	-0.077***	-	-	-0.013	-0.069***
University	-0.017**	-0.018	-	-	-0.032***	-0.051***	-0.027***	-0.053***
High Remediation	-0.018	-0.024	-	-	-0.004	-0.089***	-0.018**	-0.072***
Female	-0.032***	-0.032**	-	-	-0.027**	-0.045***	-0.026***	-0.052***
Male	-0.008	-0.015	-	-	-0.037**	-0.057***	-0.029**	-0.054***
Black	-0.025*	-0.010	-	-	-0.032	-0.061***	-0.030*	-0.054***
Not Black	-0.017*	-0.031***	-	-	-0.032*	-0.046**	-0.027***	-0.012
GPA ≥ 3.00	-0.034***	-0.044***	-	-	-0.040***	-0.058***	-0.025**	-0.031***
GPA < 3.00	-0.012	-0.032***	-	-	-0.011	-0.044***	-0.004	-0.052***

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

Table 4B: Narrow Sample Math Treatment Impacts

	Persist Year 2		AA in 4 Years		BA in 6 Years		Ever Earn a Degree	
	ITT	**TOT**	**ITT**	**TOT**	**ITT**	**TOT**	**ITT**	**TOT**
Statewide	-0.028***	-0.015*	-	-	-	-	-0.039***	-0.060***
Community College	-0.045***	0.017	-0.048***	-0.078***	-	-	-0.059***	-0.076***
High Remediation	-0.048**	0.051	-0.092***	-0.074***	-	-	-0.097***	-0.067**
Female	-0.045***	0.043***	-0.036**	-0.053***	-	-	-0.038***	-0.038***
Male	-0.012	0.008	-0.012	-0.113***	-	-	-0.022	-0.053***
Black	-0.033	0.055*	-0.016	-0.077***	-	-	-0.037*	-0.022
Not Black	-0.033***	-0.054***	-0.028**	-0.078***	-	-	-0.031***	-0.110***
GPA ≥ 3.00	-0.050***	0.050**	-0.057***	-0.125***	-	-	-0.053***	-0.037*
GPA < 3.00	-0.019	0.043***	-0.009	-0.071***	-	-	-0.024**	-0.076***
University	-0.018***	-0.031***	-	-	-0.032**	-0.054***	-0.036***	-0.060***
High Remediation	-0.057***	-0.008	-	-	-0.069**	-0.059	-0.064***	-0.062***
Female	-0.007	-0.040***	-	-	-0.009	-0.034	-0.019**	-0.058***
Male	-0.036***	-0.050***	-	-	-0.053***	-0.082***	-0.042***	-0.064***
Black	-0.035**	-0.060***	-	-	-0.037***	-0.057**	-0.026*	-0.064***
Not Black	-0.015*	-0.039***	-	-	-0.023*	0.053***	-0.029***	-0.060***
GPA ≥ 3.00	-0.017	-0.067***	-	-	-0.032***	-0.076***	-0.018*	-0.084***
GPA < 3.00	-0.027**	0.049***	-	-	-0.032*	-0.069***	-0.027**	-0.064***

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

Chapter V – Policy Noncompliance and Gatekeeper Performance at LAU

This chapter presents a descriptive evaluation of the impacts of skipping remediation on first college-level course performance, as a potential explanation for the differences in the ITT and TOT estimates presented in the primary analysis. It uses student-level data from a Large Arkansas University (LAU) for all students enrolling between 2003 and 2015. As described in the previous chapter, not all students who are assigned to remedial coursework comply with their course placement. These students who avoid remedial courses after assignment could be different on both observable characteristics, and their performance in the first college-level course, a measure that remediation proponents argue is a more valid outcome on which to compare students. With that in mind, this chapter presents a comparison of first college-level course performance for these two groups of students at LAU.

A. Prior Gatekeeper Course Performance Evaluations

In the primary analysis presented in this study, students who were assigned to remedial courses (ITT sample) experienced systematic decreases in the probability of persisting and earning degrees, when compared to their peers who were not assigned to remediation. Similarly, students who enrolled in remedial courses (TOT) experienced larger decreases in these outcomes. This could be due to differences between the students who are able to take advantage of the policy allowing students to test out of remediation after assignment and those who are unable to test out of their assigned remedial course. That leads the guiding question of this chapter:

1. How do students who were assigned to remediation and tested out perform in their gatekeeper course compared to their peers who were assigned to remediation and complied with their placement?

This comparison offers a descriptive analysis of the students who are assigned to remediation and examines any differences in observable characteristics and immediate academic abilities for the two groups of students.

Gatekeeper course performance is a less popular outcome in remediation research, though often within the confines of a regression discontinuity[8], comparing remedial and nonremedial students around the placement cutoff. However, there are three studies comparing only students who are assigned to remedial courses and examining their performance in the first college-level course. Two studies use random assignment to measure the impacts of remediation on gatekeeper course performance, while the third is a descriptive study examining student progression through remedial course sequences and subsequent course performance.

Bailey, Jeong, and Cho (2010) conduct an analysis of course completion using data from Achieving the Dream supplemented with data from NELS:88. The reported results of this study are somewhat confusing, but do not paint a great picture for remediation. While remediation supporters point to this study as showing the positive impacts of remediation, the authors provide a different explanation, stating the results are easily misinterpreted because of the ambiguous use of the phrase "pass rate" (Bailey et al, 2013). For students in the sample, 79 percent who were recommended to math remediation and 67 percent who were recommended to reading remediation complied with the course placement at their institutions and enrolled in remedial courses. The authors report 79 percent of remedial math students and 75 percent of remedial reading students who complete their remedial courses pass their gatekeeper course. While seemingly positive, it is important to note that the sample consists of only those students who *complete* their remedial coursework and, therefore, lacks a counterfactual. The authors make an important note that only 20 percent of math and 37 percent of reading students who were referred to remediation pass their gatekeeper courses.

In this study, 17 percent of math students and 45 percent of reading students enrolled directly into their college-level gatekeeper course. These noncompliers fared much better in their

[8] For a more complete description of this research, see the systematic review in this dissertation

gatekeeper course than the total percentage of students who enrolled in their recommended remedial course, with 70 percent of math noncompliers and 71 percent of reading noncompliers passing their gatekeeper course. As Bailey et al (2010) write, "It appears that the students in this sample who ignored the advice of their counselors and proceeded directly to college-level courses made wise decisions (p. 261)." These results are similar when using data from NELS:88.

Two different studies use experimental designs and find different impacts of assigning underprepared students to skip the remedial course sequence. The first from Moss, Yeaton, and Lloyd (2014) find that students within a certain test score bandwidth below the cutoff score who were randomly assigned to skip their remedial math course earned grades that were 9 percent lower than their peers who completed the remedial course prior to enrolling in their gatekeeper course. It is important to note that this study's sample is quite small (63 students).

The second random assignment study from Logue, Watanabe-Rose, and Douglas (2016) randomly assigned remediation-eligible students at three CUNY community colleges to either standard remedial math, remedial math with a weekly workshop, or college-level statistics with a weekly workshop. Compared to the study from Moss et al (2014), the study from Logue et al paints a rather bleak picture for remediation, at least in the CUNY context. In total, there were 907 students randomly assigned to one of the three groups. Logue et al. find that students who enroll directly in the gatekeeper math course are 14 percentage points more likely to pass the CUNY algebra end-of-course examination than students in traditional remedial math and 11 percentage points more likely to pass than students in remedial math with a workshop component (Logue et al, 2016). Statistics students also earn more college-level credits (excluding statistics) than their peers who in either remedial math section. All differences were statistically significant. Thus, the students in the two remedial groups clearly perform less well than the students randomly assigned to skip remediation, despite the fact all of the students in the study qualified for remediation.

The pattern of results of gatekeeper course success in studies comparing all remedial eligible students has varied, but tends toward negative with larger sample sizes. With that in mind, the operating hypothesis is that noncomplying LAU students will fare better than their remediation compliant peers in passing their first non-remedial course.

The remainder of this chapter proceeds as follows: section B briefly describes remediation at LAU and how students are able to avoid remediation; next, I describe the data and analytic strategy to estimate differences in performance of policy compliers and noncompliers. Finally, I conclude by describing the results and concluding with a discussion of the results.

B. Remediation at LAU and Opportunities for Noncompliance

To examine the impacts of noncompliance with Arkansas's remediation policy on students' performance in gatekeeper courses at LAU, I use data provided by the Office for Institutional Research at the LAU for all students enrolling between 2003 and 2015. The sample includes over 45,000 students in total, which I then limit to only students who were assigned to remedial coursework. The sample is by no means representative of all college students in the state and, therefore, results should not be extrapolated beyond the students at the LAU. Rather, it is an exploratory, descriptive analysis designed to examine the impacts of actual enrollment in remediation on gatekeeper course performance.

Remediation at LAU is similar to the statewide policy: students who score below the state-established minimum of a 19 on the ACT are assigned to remedial coursework in the corresponding subject(s) as described in chapter 3 earlier. Students scoring below the required level must register for the remedial course during their first semester of enrollment at the university. Recently (Spring 2016), LAU changed its math placement policy to reflect the more rigorous quantitative skill requirements of certain majors. Additionally, students wishing to take standard College Algebra to fulfill their quantitative skill requirements must score a 23 or above on the math section of the ACT, while students scoring between 19 and 23 will enroll in College Algebra with Review. Any student scoring below the state cutoff of 19 will enroll in Beginning/Intermediate Algebra, which does not count as credit towards graduation. Any student who scores below the cutoffs may replace their insufficient score by scoring above the University-established achievement level on the Math Placement Test. This allows students to avoid remediation and mainstream into the appropriate credit-bearing courses.

For English students, scoring below a 19 on the English and/or reading sections of the ACT leads to assignment to enroll in Basic Writing or Reading Strategies. Students in Basic Writing are now required to concurrently enroll in Composition I, however, that has not always been the case at LAU. Students are able to "test out" of Basic Writing by scoring an 80 or above on the COMPASS Exam (now an 83 on the ACCUPLACER) or by "demonstrating college-level writing skills on a required essay administered during the first week of class ("2016-17 Catalog", uark.edu)." Similarly, students can avoid reading remediation by scoring an 83 or higher on the COMPASS Exam (now a 78 on the ACCUPLACER) or by earning a B or higher in Composition I and Composition II while maintaining a cumulative GPA of 3.0 or higher.[9]

As this shows, students who are assigned to remediation do not necessarily have to enroll. Students who are able to avoid remediation are likely of higher ability than their peers who are not able to avoid remediation, which their ACT section scores may not necessarily reflect.

The next section examines the data and describes the students who are able to avoid enrolling in remedial English and math courses at the LAU, along with the methods used in this study.

[9] Instructors in the English Department expressed concern over the lack of clarity and explanation for why students are placed into remedial reading.

C. Data & Analytic Strategy

The data used in this chapter come from the Office for Institutional Research at LAU, which tracks student enrollment and progress. It includes

- Student demographics: race, gender, first-generation college student status, home state, and Pell-grant eligibility.
- Student baseline achievement: high school GPA; ACT Composite score; and ACT section scores for math, English, reading, and science.
- Student course patterns and grades: dummy variable for enrolling in remedial courses and a grade in the first college-level course for English and math

Because of the nature of the data, I am able to see students who avoid enrolling in remedial coursework, even though they qualify based on their placement test score. In total, there are 45,266 students in the dataset who enrolled between 2003 and 2015. For the purposes of this analysis, I limit the sample to include only those students who scored at a level that would assign them to remedial math, English, or reading (i.e. those scoring below a 19). Therefore, I am left with a sample of 3,060 students assigned to remedial math and 1,522 students assigned to remedial English. I exclude the reading sample, as there is a high level of noncompliance with the policy, making any comparisons flawed. Of these students remaining, 2,505 (82 percent) enrolled in remedial math and 1,132 (74 percent) enrolled in remedial English. Because of the nature of remediation, the students who are able to test-out of their basic courses are likely different on some observable and unobservable characteristics. Therefore, this is a nonrandom sample of students and any results are likely not causal. In Table 5.1 below, I present demographic information for remediation-eligible students as a whole, remedial compliers, and remedial noncompliers. I note differences that are statistically distinguishable from zero determined using t-tests.

Table 5.1: Remediation Demographics, Mathematics

	All eligible	Enrollees	Noncompliers	Difference
Female	65.7%	66.2%	63.4%	2.8%
White	71.3%	70.7%	74.1%	-3.4%
Black	14.9%	16.0%	9.7%	6.3%***
All Other Races	13.0%	12.5%	15.3%	-2.8%*
AR Resident	66.4%	70.5%	47.7%	22.8%***
1st Gen college	54.4%	55.8%	47.0%	8.8%***
Pell Grant Eligible	32.1%	34.5%	21.3%	13.2%***
HS GPA	3.22	3.21	3.29	-0.08***
ACT Comp	20.7	20.6	21.2	-0.6***
ACT Math	17.2	17.2	17.3	-0.1***
Enroll College Algebra	72.8%	78.4%	55.3%	23.1%***
Observations	3,060	2,505	555	

*** - p<.01, ** - p<.05, * - p<.1

Table 5.2: Remediation Demographics, English

	All eligible	Enrollees	Noncompliers	Difference
Female	34.2%	33.7%	35.9%	-2.2%
White	64.9%	62.3%	72.6%	-10.3%***
Black	15.8%	18.4%	8.2%	10.2%***
All Other Races	18.7%	18.8%	18.4%	0.4%
AR Resident	49.3%	57.9%	24.4%	33.5%***
1st Gen college	57.4%	61.5%	42.2%	19.3%***
Pell Grant Eligible	32.7%	36.7%	21.0%	15.7%***
HS GPA	3.22	3.19	3.31	-0.12***
ACT Comp	20.4	19.9	21.8	-1.9***
ACT English	16.7	16.7	16.6	0.1*
Observations	1,522	1,132	390	

*** - p<.01, ** - p<.05, * - p<.1

The results in tables 5.1 and 5.2 show significant differences between remedial enrollees and remedial noncompliers in both math and English. For math remediation, students who qualify and avoid enrolling in the non-credit course are more likely to be white, non-Arkansas residents, have at least one parent who graduated from college, and are less likely to be eligible for a Pell grant. Noncompliers are also likely to have a slightly higher high school GPA, and score better on the Composite and math sections of the ACT. Results are similar for noncompliance in English, with a greater difference in students' baseline ability compared to students enrolling in remedial English.

Based on these differences, it appears that more advantaged students who are assigned to remediation are more readily able to avoid non-credit bearing courses.

1. Analytic Strategy

To analyze the differences in gatekeeper course achievement, I examine students' scores in the first non-remedial course (College Algebra or Composition I) as an outcome in an ordinary least squares (OLS) regression. I code students' A-F grades as a simple 4.0 grade scale, which is then standardized to a z-score. In the main analysis, I code students who received a grade of "pass" as equivalent to a D/1.0 on the grade scale. Pass/Fail grades do not count towards a student's cumulative GPA, only as credit towards graduation. Equation (5.1) provides the general OLS regression model:

$$(5.1) \qquad Y_{ist} = \alpha + \beta_1 NC_{is} + \beta_2 A_{bsi} + \beta_3 X_i + \beta_4 \tau_i + \varepsilon_{it}$$

- $\mathbf{Y_{ist}}$ is the standardized grade earned (A-F) in the introductory class for a specific subject *s* for student *i* in year *t* of enrollment (2003-2015). The grades have been standardized as z-scores to ease interpretation.
- $\mathbf{NC_{is}}$ is an indicator for student *i* who tested below the ACT cutoff in subject *s* and tested out of the remedial course in some other way
- $\mathbf{A_{bsi}}$ is the baseline achievement (High School GPA) and a control for student *i*'s ACT Composite score and ACT score in subject *s*.
- $\mathbf{X_i}$ is a vector of demographic characteristics for student *i*, including race/ethnicity, gender, whether a parent graduated from college, Arkansas residency, and Pell grant eligibility as a proxy for poverty
- $\boldsymbol{\tau_i}$ represents a control for student *i*'s year of enrollment at LAU
- $\boldsymbol{\varepsilon_{it}}$ is the error term

Additionally, I control for students enrolling in different gatekeeper math courses (College Algebra versus College Algebra with Review) in the math models. In this equation, β_1 is the coefficient of interest, as it indicates a student was successful in avoiding the remedial course to which they were assigned. A statistically significant result on this coefficient reveals a difference in the average achievement level between students who avoided remediation and students who complied with their course placement. As there is a great deal of selection bias for which I am unable to completely control, I cannot state with confidence that differences are due to students successfully avoiding remediation. However, students who avoid remediation are likely to be different on both observable and unobservable characteristics compared to students who enroll in remediation, and students who successfully pass their remedial courses are likely to be different from students who do not pass their remedial courses (Bailey, Jeong, & Cho, 2010; Bailey et al, 2013). The nature of the outcome variable should capture some of these differences, as only students who successfully pass their remedial course and enroll in a gatekeeper course are included in the research sample. As Table 5.3 shows, a vast majority of both groups of students go on to complete their gatekeeper course and earn a grade.

Table 5.3: Student Gatekeeper Course Completion Rates

	Math		**English**	
	Enrollees	Noncompliers	Enrollees	Noncompliers
Complete	90.1%	89.7%	95.1%	97.4%
Withdraw	9.9%	10.3%	4.9%	2.6%
Observations	2,505	555	1132	390

Additionally, there are questions in how to correctly specify grades received for students who took their first non-remedial course pass/fail. The lowest passing grade achievable is a D (GPA equal to 1.0), though, at LAU, students are not eligible to graduate with a cumulative GPA below 2.0 ("2016-17 Catalog", uark.edu). Therefore, it may be incorrect and could bias the achievement results to classify a "pass" grade as equivalent to a D. However, it is important to consider the signal a student sends when making a decision to enroll in a course pass/fail. Students making this choice may have some level of self-awareness that makes them believe they would be unable to earn a grade high enough to maintain a cumulative GPA above the graduation threshold. If that is indeed the case, then students enrolling pass/fail may believe they are capable of earning at best a D in the course. I believe this to be a likely scenario, as students who qualify for remediation would likely be more concerned with earning credits to graduate than high letter grades. Nevertheless, the main analyses presented here make use of "pass" grades coded as the minimal passing grade, and I include the more forgiving coding method as a sensitivity check.

Before moving on to the full empirical analysis of achievement differences, I present simple mean differences of achievement in the first non-remedial course taken. It is important to note the differences in sample size for enrollees and completers. Not all students who enroll in a course complete it. Because of this, I observe sample attrition for students withdrawing prior to the end of the semester. I present simple difference-in-difference means in Table 5.3 below. As the differences show, enrollees who finished their remedial course and took a college-level course earned lower grades than their noncomplying peers. These results were robust to coding the pass/fail grades using a more relaxed grading scale (D versus C). However, there is no difference in earning a passing grade for the course.

Table 5.3: Mean Differences in Gatekeeper Course Performance

	Enrollees			**Noncompliers**			**Mean Difference**
	Mean	SD	N	Mean	SD	N	
Math First Grade (pass=1)	2.36	0.92	1,001	2.58	0.89	339	0.22***
English First Grade (pass=1)	2.64	0.91	787	2.96	0.85	280	0.32***
Math First Grade (pass=2)	2.47	0.81	1,001	2.61	0.85	339	0.14***
English First Grade (pass=2)	2.73	0.79	787	3.01	0.75	280	0.28***
Math First Grade (pass/fail)	0.99	0.11	1,001	0.99	0.08	339	0.00
English First Grade (pass/fail)	0.99	0.07	787	0.99	0.08	280	0.00**

*** - p<.01, ** - p<.05, * - p<.1

D. Results

The analysis here examines the differences in average achievement of students assigned to remedial math or English, comparing students who qualified for and avoided remediation to those who qualified for and enrolled in the corresponding remedial course. The main analysis uses students who received a grade of “pass” as equivalent to earning a D, the minimal grade to pass a course, and are presented in columns (1) through (3) of tables 5.4 and 5.5. Columns (4) through (6) present the sensitivity check, where a grade of “pass” is coded as a C, the minimum GPA allowed to graduate. Table 5.4 presents results for math students and table 5.5 presents results for English.

In general, the results are mixed for students who do not comply with their course placement, based on subject. Table 5.4 presents results for students who qualified for remedial math, where an inclusion of the full model yields no statistically significant results. Prior to controlling for student achievement and demographics, students who do not comply with their placement earn grades nearly a quarter of a standard deviation higher than their peers who enroll in remedial math prior to college algebra. These differences shrink as controls are added, and become statistically indistinguishable from zero. These results are similar when the “pass” grade is recoded to be more lenient.

Table 5.4: Estimates of Achievement Results for Math Remediation Noncompliance

	(1)	(2)	(3)	(4)	(5)	(6)
Math Noncompliers	0.236***	0.169***	-0.017	0.177***	0.108*	-0.027
	(0.062)	(0.062)	(0.058)	(0.063)	(0.062)	(0.064)
ACT Math		0.098***	0.084***		0.098***	0.100***
		(0.034)	(0.031)		(0.033)	(0.034)
ACT Composite		0.010	-0.008		-0.004	-0.012
		(0.018)	(0.016)		(0.017)	(0.017)
HS GPA		0.604***	0.598***		0.697***	0.687***
		(0.088)	(0.078)		(0.084)	(0.082)
Race		0.067*	-0.006		0.032	-0.002
		(0.035)	(0.033)		(0.035)	(0.036)
Female		0.041	0.025		0.024	0.020
		(0.060)	(0.053)		(0.058)	(0.057)
Pell Grant Eligible			0.047			0.059
			(0.061)			(0.069)
1st Gen. College Student			0.043			0.054*
			(0.030)			(0.032)
AR Resident			-0.047			-0.045
			(0.053)			(0.057)
Gatekeeper Math Course			-0.107*			-0.118*
			(0.058)			(0.062)
Includes Cohort Year			X			X
Constant	-0.545***	-4.532***	-5.060***	-0.521***	-4.459***	-4.833***
	(0.032)	(0.64)	(0.657)	(0.0305)	(0.620)	(0.726)
Observations	1,340	1,321	1,282	1,340	1,321	1,282
R-squared	0.010	0.066	0.301	0.006	0.076	0.157

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses
Grade achievement standardized across years
Note: Sample attrition is due to missing data in the covariates.

Table 5.5: Estimates of Achievement Results for English Remediation Noncompliance

	(1)	(2)	(3)	(4)	(5)	(6)
English Noncompliers	0.351***	0.269***	0.210***	0.352***	0.278***	0.240***
	(0.066)	(0.069)	(0.063)	(0.066)	(0.069)	(0.071)
ACT English		-0.014	-0.008		-0.015	-0.012
		(0.022)	(0.018)		(0.022)	(0.021)
ACT Composite		0.015	-0.011		0.001	-0.015
		(0.017)	(0.015)		(0.017)	(0.017)
HS GPA		0.545***	0.462***		0.625***	0.544***
		(0.091)	(0.073)		(0.087)	(0.081)
Race		0.046	-0.023		0.004	-0.033
		(0.037)	(0.034)		(0.039)	(0.040)
Female		0.124**	0.092*		0.128**	0.112*
		(0.063)	(0.052)		(0.061)	(0.059)
Pell Grant Eligible			0.047			0.059
			(0.061)			(0.069)
1st Gen. College Student			0.116***			0.129***
			(0.032)			(0.036)
AR Resident			-0.012			-0.009
			(0.054)			(0.062)
Includes Cohort Year			X			X
Constant	-0.453***	-2.369***	-3.527***	-0.476***	-2.272***	-2.790***
	(0.036)	(0.412)	(0.340)	(0.0351)	(0.403)	(0.389)
Observations	1,067	1,056	1,038	1,067	1,056	1,038
R-squared	0.024	0.075	0.389	0.025	0.086	0.207

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses
Grade achievement standardized across years

On the other hand, students who are able to avoid English remediation courses are found to achieve grades that are one fifth of a standard deviation higher than their peers who enroll in remedial courses first. This result is highly statistically significant and reflects the results found in research from Bailey et al (2010) and Logue et al (2016). Additionally, when recoding the outcome variable to be more lenient, the differences increase in favor of students who are able to avoid remediation. These results are presented in Table 5.5.

The regression models show some of the baseline covariates provide some confidence that this is a valid model to estimate the differences. For math, we see that a student's ACT math subsection score and high school GPA are highly predictive of their future achievement in their college-level math course. Additionally, it appears that female students outperform their male counterparts in both math and English, though the math result is only marginally statistically significant.

It is important to remember that these results are based on a subset of students who have qualified for remedial coursework. Also, these results are based on data that do not fully encompass students' achievement. I am unable to observe students' achievement on the placement tests to avoid enrolling in remediation. Because of this, there are unobserved differences in ability that are likely leading to comparisons of students across the ability distribution, rather than comparing similar students.

E. Subgroup Analyses

To analyze the full impact of skipping a remedial course, I examine how achievement levels differ across subgroups: 1) females relative to males, 2) Black students relative to all other students in the analytic sample, 3) Pell Grant eligible students, and 4) First Generation College Students. These analyses are motivated by the large percentages of underrepresented groups enrolling in college and the high percentage of minority students who enroll in remedial courses in college. Because there is a great concern that students enrolling in remedial courses are less likely to graduate and that minority students, first generation college students, and Pell Grant eligible students enroll in college at lower rates, it is vital to know if placing students into remedial courses is the most effective policy for helping students to graduate. Table 5.7 shows the sample size for each of the subgroups of interest.

Table 5.7: Sample Sizes of Subgroups of Interest

	Math		English	
	Enrollees	Noncompliers	Enrollees	Noncompliers
Female	1,658	352	381	140
Black	401	54	208	32
Pell Grant	864	118	416	82
1st Gen College Student	894	142	480	87
Observations	2,505	555	1,132	390

Note: Not all students provided information on parent's education status. Roughly two-thirds of the analytic sample for both subjects provided this information.

To analyze the impacts of not complying with remedial course placements, I use a standard OLS regression similar to equation 5.1. Equation 5.2 includes an interaction term to allow for an estimate of achievement differences for the subgroups of interest.

$$(5.2) \qquad Y_{ist} = \alpha + \beta_1 NC_{is} * C_{is} + \beta_2 NC_{is} + \beta_3 C_{is} + \beta_4 A_{bsi} + \beta_5 X_i + \beta_6 \tau_i + \varepsilon_{it}$$

- $\mathbf{Y_{ist}}$ is the standardized grade earned (A-F) in the introductory class for a specific subject *s* for student *i* in year *t* of enrollment (2003-2015). The grades have been standardized as z-scores to ease interpretation.
- $\mathbf{NC_{is} * C_{is}}$ is an interaction term for student *i* in subject *s* being a part of a subgroups of interest (i.e. female, Black, etc.) who tested out of remediation in subject *s*
- $\mathbf{NC_{is}}$ is an indicator for student *i* who tested below the ACT cutoff in subject *s* and tested out of the remedial course
- $\mathbf{C_{is}}$ is a dummy variable indicating student *i* in subject *s* is a member of a specific subgroup of interest
- $\mathbf{A_{bsi}}$ is the baseline achievement (High School GPA) and a control for student *i*'s ACT Composite score and ACT score in subject *s*.
- $\mathbf{X_i}$ is a vector of demographic characteristics for student *i*, including race/ethnicity, gender, whether a parent graduated from college, Arkansas residency, and Pell grant eligibility as a proxy for poverty. This vector is modified for specific analyses
- $\boldsymbol{\tau_i}$ represents a control for student *i*'s year of enrollment at LAU
- $\boldsymbol{\varepsilon_{it}}$ is the error term

In regression equation 5.2, the coefficient of interest is β_1, where a statistically significant difference shows an achievement effect that is not due to random chance for student in the subgroup of interest who skip their remedial courses. Results for subgroup analyses are presented in Table 5.8 below.

Table 5.8: Estimated Achievement Effects of Skipping Remediation by Subgroup

	Math		English	
	Strict Pass/Fail	Relaxed Pass/Fail	Strict Pass/Fail	Relaxed Pass/Fail
Black	-0.134 (0.169)	-0.146 (0.182)	-0.079 (0.141)	-0.132 (0.193)
Female	0.074 (0.116)	0.074 (0.124)	0.163* (0.100)	0.181 (0.112)
Pell Grant Eligible	-0.200 (0.124)	-0.234* (0.137)	0.010 (0.110)	0.186 (0.112)
1st Generation College Student	-0.050 (0.121)	-0.059 (0.130)	-0.017 (0.118)	0.205 (0.082)
Enroll College Algebra	-0.003 (0.112)	-0.011 (0.121)	X	X
Observations	1,321	1,321	1,062	1,062

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses
Grade achievement standardized across years

Overall, the results presented below do not show substantial differences in the impacts of not complying with remediation on achievement in gatekeeper courses. However, significant results appear for two subgroups. The first is a marginally significant advantage for female students who do not comply with their remedial English placement, scoring 16 percent of a standard deviation higher in Composition I. Additionally, there is a marginally significant negative impact on Pell Grant eligible students who skip their remedial math course, scoring nearly a quarter of a standard deviation lower in their first college-level math course than their peers who first enroll in remedial math.

F. Discussion

This chapter presents a descriptive analysis of the differences in first college-level course achievement for students who qualified for remediation at LAU. While by no means a causal estimation of the impacts of remediation, these results are similar to those shown in Bailey et al (2010), which also does not provide a causal estimate of the impacts of avoiding remediation, but shows that students who are able to test out of remediation may perform better when they avoid the basic level course than their peers who are unable to test out of remediation. Despite the descriptive nature of this research, it still contributes to the literature on remediation. Remediation proponents argue measuring gatekeeper course performance between students who are assigned to, but do not enroll in remediation compared to those who are assigned to and enroll in remediation is the most valid comparison.

The results indicate significant differences in first course achievement for students who are able to avoid remediation, specifically in English. In general, students enrolling in remedial English earn lower grades in the associated gatekeeper course than their peers who test out of remediation. These results hold when using a more relaxed interpretation of grades that are reported as “pass”, as well. While the results on the full sample in English show a clear advantage for students avoiding remediation, the lack of significant results for subgroups and in math present a more obscure picture. Students enrolling in math remediation appear to perform no worse than their peers who qualified for and skipped remediation, but this is by no means a clear victory for remediation.

The results from the English students who do not comply with their course assignment represent a potential explanation for the differences between the ITT and TOT estimates presented in the primary analysis. Students who are able to successfully avoid remedial courses appear to be more academically able as well as more advantaged than their peers who are unable to test out of remedial courses. The students who are present in the TOT sample are likely of lower academic ability and lack the same supports their more advantaged peers who test out remediation possess.

Chapter VI – Noncognitive Skills of Remedial and Nonremedial Students at LAU

The overall results of the primary analysis presented here show that students assigned to and enrolling in remedial courses experience decreases in both achievement and attainment outcomes. While these results are by no means novel in the field of remediation research, there is little to explain why remediation policies are not having the intended impact. The previous chapter showed that there are differences in the academic abilities of students who test out of remediation and those who enroll in remediation after being assigned to remedial courses. However, there may be differences in the nonacademic characteristics of students in remedial courses compared to their peers who enroll in college-level courses. This chapter presents the results of a student survey conducted at LAU in the fall of 2016 looking to answer the question of whether or not there are differences between these two groups of students at enrollment. The English Department at LAU allowed students in remedial courses and Composition I to participate in this study. This chapter looks to add to the growing body of research examining nonacademic skills of remedial students in Arkansas. Additionally, it is the first study to examine grit in the context of college remediation.

A. Nonacademic Outcomes for Underprepared Students

Policymakers and practitioners concerned with college remediation often focus, for obvious reasons, on students' academic outcomes such as persistence and graduation. This is a necessary focus, as remedial courses are implemented to help academically underprepared students admitted to postsecondary education succeed and graduate. Unfortunately, the results of rigorous research generally find negative, though not always significant, impacts of remediation on students' academic outcomes (Valentine et al, 2016). The primary analysis presented here follows that same pattern, finding negative impacts for remedial students. However, there is a growing body of research examining whether students in remedial courses differ from their nonremedial peers on nonacademic outcomes.

There have been several studies examining the noncognitive skills of remedial college students, often examining measures like motivation, expectations, and students' impressions of college-level coursework. These studies find that students who qualify for remedial courses in college often enroll with inflated expectations of success and lack of knowledge of placement policies, which potentially contribute to their negative outcomes (Deil-Amen & Rosenbaum, 2002; Melzer & Grant, 2016; Gati et al, 2011). Research from Martorell, McFarlin, and Xue (2014) finds that students being told they will need to take remedial classes prior to enrolling has no impact on the likelihood these students will enroll in college. In general, the existing literature suggests underprepared students who enroll in college are not likely aware their remedial course do not count towards graduation and have different beliefs in their academic abilities than what their test scores show.

In a survey of students enrolling at community colleges, the Center for Community College Student Engagement (CCSE) found that a vast majority of students believe they are academically prepared to succeed in college, even though a majority of respondents have to take at least one remedial course (McClenney, 2016). This becomes even more problematic when asking about student expectations, as a majority believe they will graduate on time, even though a majority do not (p. 9). The results of this survey present some of the problems inherent in college remediation, as students who are deemed academically unprepared do not change their expectations. This is due to either a lack of information regarding remediation or simply not believing their placement test reflects their true ability. The latter possibility is apparent in the results of a study from Fielstein and Bush (1998).

An early study of self-perceptions of academic ability for underprepared students from Fielstein and Bush (1998) surveyed a sample of first-time college enrollees. Of the students surveyed, a majority qualified for at least one remedial course. In this study, the authors seek to answer whether being assigned to remedial education had any effect on students' enrollment decisions and self-perceptions of academic ability. Overall, their study found that students who qualified for remedial courses were likely to delay their decision to enroll and that being assigned to remediation had no impact on their perceptions of difficulty of college. The authors hypothesize that students in remedial courses may be protected from the true challenges of college coursework because of the very nature of remedial courses. Perhaps the most pertinent finding in this survey is students' perceived academic ability. The authors found that the more remedial courses students were required to take, the less likely they were to believe their ACT scores reflected their true ability as students.

One of the most cited studies examining the impacts of information for remedial students comes from Deil-Amen and Rosenbaum (2002), whose research examines community college students' perceptions and beliefs as a result of their own aspirations, college-for-all counseling, and other impacts of the prevalence of remediation on college campuses. In studying a "stigma-free" model of remediation at community colleges, they found that students did not feel demoralized, but this may lead students to ignore other options that may be more suitable for their skill set. Additionally, they found that students were often unaware of the fact that their remedial courses did not count towards graduation. Students who took multiple remedial courses were even less likely to be aware that their courses did not count towards graduation. Additionally, they find that students in remediation had high expectations of attaining their degree goals and even had a stronger belief they would be able to earn a bachelor's degree. The authors conclude that while removing the stigma of remediation may improve students' self-confidence, it may come with a large cost of delay the time until students realize their goals may be misplaced.

In a recent, non-survey based, study of remediation, Martorell, McFarlin, and Xue (2014) use a regression discontinuity to examine differences in the likelihood of enrolling in postsecondary education for underprepared students. Specifically, they seek to find if students who perform poorly on a mandatory placement test and are labeled as "academically underprepared" affects students' enrollment decisions. The authors hypothesize that students who are told they are underprepared may choose not to enroll because of the extra costs of remediation, the stigma associated with being labeled as underprepared, and the new information showing they aren't prepared for college. However, they find that students labeled as underprepared show no differences in the likelihood of enrolling compared to students who are not labeled as underprepared. Unlike the results of Deil-Amen and Rosenbaum (2002) showing removing stigma may introduce unrealistic expectations for underprepared students, Martorell et al's work shows that the stigma of the underprepared label may not make a difference in tempering students' expectations.

In general, a review of the available evidence on the nonacademic skills of remedial college students shows that underprepared students do little to change their expectations of college education, despite having to enroll in courses that do not count towards their eventual goal. This could be due to several potential explanations. The first is that students simply do not believe their placement test score is an accurate depiction of their abilities, as shown in research from Fielstein and Bush (1998). Another possible explanation is that students are not aware remedial courses do not count towards graduation and simply maintain their original expectations. A majority of this research focuses on students' expectations. This chapter aims to add to this literature by examining any potential differences in remedial and non-remedial students' self-perceived abilities, grit, and beliefs in the utility of their remedial course. The next section outlines the methodology used in this study.

B. Methods

The purpose of this chapter is to examine any potential differences in the noncognitive skills of remedial and nonremedial students as a potential explanation for the negative impacts of remediation on students' academic achievement and attainment. This study is based on in-person, paper-pencil surveys of students enrolling in face-to-face remedial writing and reading courses, along with students who enrolled in nonremedial English courses offered at LAU. It includes six sections of Basic English, one section of Basic Reading, and four sections of Composition I. By surveying remedial and nonremedial students, I am able to compare and measure potential differences in students' noncognitive skills.

The survey makes use of two established and validated scales designed to measure students' noncognitive skills, as well as several questions designed to measure multiple additional outcomes related to students' noncognitive skills. Surveys were conducted during the month of September as this would give students ample time to withdraw from school, while also allowing students who performed poorly on their first writing sample to be reassigned to remedial courses. In total, 142 students participated in the survey.

In order to conduct the surveys, the English Department provided information on which instructors might be willing to participate. Instructors for the entry-level courses consented to allow a time for in-person survey administration. Students present were given the opportunity to opt-out of participation. Any student present on the day of survey administration was assumed to be enrolled in the course. This survey only included students who enrolled in face-to-face, fall sections of the courses, as they are the most common sections in which students enroll. In accordance with IRB approval, all students who were under the age of 18 were excluded from the survey, as this requires a higher level of consent.

The author administered surveys in person to all students with the instructor of record observing. This was designed to ensure that student information would remain anonymous and survey administration would be as uniform as possible. In an effort to limit survey bias, there was no mention of surveys being administered to non-remedial students and vice-versa, simply that the survey was a part of research on introductory courses at the University. The following section describes the survey instrument and constructs that form the basis of this study.

C. Survey Instrument

It is important to note that the pre-validated scales were not chosen at random. The grit scale has been included in a variety of evaluations of education, though often at the K-12 level, including charter schools (Dobbie & Fryer, 2014; West et al, 2014) and private school vouchers (Mills et al, 2015). However, to my knowledge, the grit scale has not been used in a survey of remedial college students. The Relative Autonomy Index (RAI) has previously been used in evaluations of motivation for remedial college students (Mayer et al, 2016). In addition, while the grit scale and RAI have been pre-validated, the rest of the survey has not. This, along with the slight changes made to the RAI for this specific study, likely add some noise to the final results. The survey is comprised of two versions, one for remedial students (Basic English/Reading) and a separate survey for students enrolling in standalone Composition I.[10] With two versions, more specific data were collected on both groups of students, depending on relevant course-taking information. With that in mind, I proceed with a description of the scales and constructs used in this analysis.

One of the main noncognitive skills measured in this study is grit. Angela Duckworth and colleagues (2007) define grit as an individual's "perseverance and passion for long-term goals." In this study, I use the shorter 8-item grit scale developed by Duckworth and Quinn (2012), as it is likely going to be more appropriate for the potentially lower reading levels of remedial students.[11]

[10] It is important to note that students enrolling remedial English courses are concurrently enrolled in Composition I. Therefore, I conducted surveys of only those Composition I students who were not enrolled in either remedial English or remedial reading.
[11] The 8-item Grit scale is available on Dr. Duckworth's website: https://upenn.app.box.com/v/8itemgritchild

The grit scale is a five-point Likert-type scale, where higher scores mean students are "grittier". It includes questions such as "I often set a goal but later choose to pursue a different one" and "I finish whatever I begin". The reported internal reliability score of the Grit scale for the full sample is 0.62, 0.56 for the Basic Reading sample, 0.58 for the Basic English sample, and 0.69 for the Composition students on the entry survey.

The Relative Autonomy Index (RAI) is designed to measure individuals' intrinsic motivation, external motivation, and autonomous behaviors and was developed by Deci and Ryan, 1985/2000. In this case, I use a modified RAI scale that is shortened to 8-items, designed to measure students' motivation.[12] An individual's average relative autonomy and motivation are based on their average responses to the scale's Likert-type items including questions like "I finish my assignments because I feel guilty if I do not" and "If I attend class regularly, it's because I want to get a good grade". The scale is designed to range from -18 to 18, where higher values are representative of greater levels of autonomy and/or internally-driven motivation. For the RAI scale on the survey, the internal reliability score is 0.68 for the full sample, 0.73 for Basic Reading, 0.73 for Basic English, and 0.59 for Composition students.

The first construct created for this survey is the measure of students' academic self-perceptions. Here, students are asked to compare their own ability to those in their class and how they believe they will be able to perform in the class. These include items such as "I believe I am capable of passing this course" and "I can do well on tests, even when they're difficult". Students are asked to indicate if they "Strongly disagree", "Disagree", "Agree", or "Strongly agree" with the

[12] This scale was adopted from Mayer et al (2016) who were measuring differences in motivation for remedial students at community colleges in Ohio who were randomly assigned to be offered a performance-based scholarship. In their study, students who were offered a scholarship were hypothesized to have better outcomes due to the offer of the scholarship.

statement. For this scale, the internal reliability on the survey is 0.63 overall, 0.55 for Basic English students, 0.69 for Basic Reading students, and 0.70 for Composition students.

The next construct is the course utility/university resources scale, designed to measure students' beliefs in the usefulness of the course for their future success and their knowledge of the resources the university offers to improve students' writing. These include statements like "What I learn in this course will help me in other subjects" and "I know where I can get on-campus writing help". The internal reliability for the full sample is 0.64 for Basic English students, 0.62 for Basic Reading students, and 0.71 for Composition students.

The final scale is used only for students in remedial courses and is designed to measure students' knowledge of the course placement policy. Composition students were assumed to have no need to possess an awareness of course placement policies, therefore, these students are not asked to answer these questions. Items on this scale were all True/False, including items such as "Earning credits in this course can be counted towards graduation" and "I can take the COMPASS test to place out of this course". Internal reliability for the full sample is 0.44, Basic English students have an internal reliability of 0.44 and Basic Reading students' reliability is 0.51. Table 6.1 presents the constructs' operational definitions and an example item for each construct. The survey for remedial students contained forty-seven items with six constructs, compared to the non-remedial survey, which contained thirty-nine items.

As shown in Table 6.1Each construct underwent a reliability check to reveal that four of the constructs have a reliability between 0.6 and 0.7, which is slightly below the appropriate and desirable level 0.7. Reliability did vary across groups. The course placement knowledge construct was the lone construct to fall well below the desirable level. There were three questions that were not included in any of the constructs, as they lowered the reliability dramatically. This is likely due to the wording of the questions influencing student responses. Additionally, the university resources construct is a more specific sub-construct taken from the course utility construct, designed to measure students' knowledge of such resources and intentions to make use of these, while the purpose of the full construct is designed to measure to what extent students believe the course will be useful and how much help the course is providing for their success.

Table 6.1: Survey constructs, operational definition, and item example

Construct	Operational Definition; Item Example	Cronbach's Alpha
Entry Survey		
University resources	• Operational Definition: A knowledge of the university-based resources offered to all students to ensure student success • Example Item: I know where I can get on-campus writing help	0.708
Course utility	• Operational Definition: Student's beliefs regarding the usefulness of the course they are taking or their success • Example Item: What I learn in this course will help me in other subjects	0.636
Academic self-perceptions	• Operational Definition: Student's beliefs in their own academic skills and how they compare to their peers • Example Item: I can earn A's in most or all of my courses	0.627
Relative Autonomy Index (RAI)	• Operational Definition: Student's level of internal motivation and regulation • Example Item: I finish assignments because I feel guilty if I do not (Deci & Ryan)	0.678
Grit	• Operational Definition: Able to persist for long-term goal; does not easily give up • Example Item: I am diligent (Duckworth)	0.624
Course placement knowledge	• Operational Definition: Remedial students' knowledge of the remedial coursework policy in Arkansas • Example Item: True/False – Earning credit in this course can be counted towards graduation	0.443

D. Sample Description

The entry surveys were collected in September of the 2016 school year. In total, 14 students in Basic Reading, 65 students in Basic English, and 63 students in Composition I participated in the survey for a full sample of 142 students. It is important to note that this is a selected, nonrandom sample of students who opted into participation based on their instructor's willingness to participate in the study. Additionally, this study takes place at a single four-year institution that is also the state's flagship institution. This makes it highly likely that the sample is neither representative of remedial students at LAU as a whole, nor of remedial students in Arkansas in general.

Table 6.2 presents descriptive statistics for student characteristics collected at baseline for students in each of the three courses. The data presented are based on student's self-reports.

Table 6.2: Student Demographics

	Full Survey Sample		**Remedial**		**Non-Remedial**		**Diff**
	N	Mean	N	Mean	N	Mean	
Race							
Black	142	0.12	79	0.16	63	0.06	0.10*
Hispanic	142	0.07	79	0.10	63	0.03	0.07
White	142	0.64	79	0.58	63	0.71	-0.13
Multiple Races	142	0.10	79	0.09	63	0.11	0.02
Other Race	142	0.17	79	0.15	63	0.19	0.04
AR Resident	142	0.43	79	0.51	63	0.33	0.18**
Private	142	0.20	79	0.15	62	0.26	-0.11
Special Ed.	142	0.12	79	0.20	63	0.02	0.18***
Joining Greek Life	142	0.35	78	0.32	63	0.38	-0.06
Employment Status							
Not working	142	0.56	79	0.51	63	0.62	-0.11
On Campus	142	0.17	79	0.20	63	0.13	0.07
Off Campus	142	0.25	79	0.29	63	0.21	0.08
Both On & Off Campus	142	0.02	79	0.00	63	0.05	-0.05*
Grade level							
1st Year	142	0.97	79	1.00	63	0.94	-0.06
2nd Year	142	0.01	79	0.00	63	0.03	-0.03
3rd Year	142	0.01	79	0.00	63	0.02	-0.02
4th Year+	142	0.01	79	0.00	63	0.02	-0.02

*** - p<.01, ** - p<.05, * - p<.1

In general, the results in Table 6.2 reveal an intriguing pattern for students in remedial English courses compared to students in Composition I. Overall, students enrolling in remediation were more likely to be Black (marginal significant difference), more likely to be Arkansas residents, and more likely to have been diagnosed with a learning disability prior to enrolling in college. Remedial students are also more likely to have jobs either on or off campus during the school year.

These patterns are also fairly similar to the full population of remedial English students throughout the state of Arkansas and at LAU in general, where minority students and Arkansas residents are more likely to enroll in remedial English. Unfortunately, there is no way to determine if the students participating in the survey are different from the general population of remediation-eligible students, students enrolling in remedial math courses, or unobservable impacts of other courses students may be taking.

E. Analytic Methods

The analysis of the survey results relies on correlations and regressions to predict student scores and changes from the beginning to the end of the semester. To begin, I present raw mean comparisons of survey responses for remedial and nonremedial students in Table 6.3 with tests for significance using t-tests. As these tables show, there are significant differences in the survey for the Course Utility construct. This shows a distinctly more positive response from nonremedial students being more likely to strongly agree with the items on this construct.

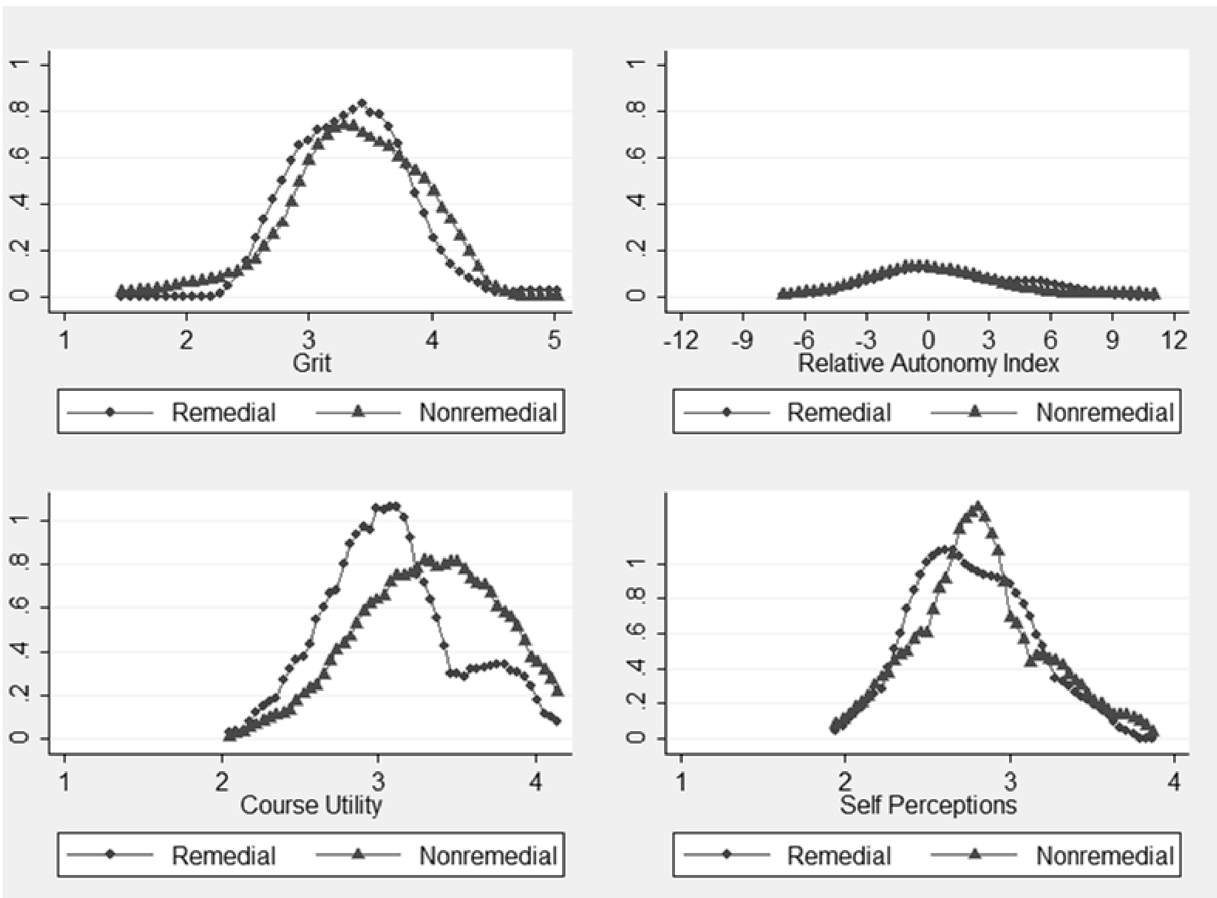
Table 6.3: Mean responses

	Remedial Students	**Nonremedial Students**	**Difference**
University Resources	3.02	3.19	-0.17*
Course Utility	3.09	3.33	-0.24***
Academic Self-Perceptions	2.77	2.81	-0.04
Relative Autonomy Index[1]	1.13	0.56	0.57
Grit (8-Item)[2]	3.35	3.37	-0.02

*** p<0.01, ** p<0.05, * p<0.1, measured using T-Tests.
Note: Higher values represent a higher propensity to state they would strongly agree on a 4-point Likert-type scale. Relative Autonomy Index scores range from -18 to 18, with higher values showing greater individual autonomy. The Grit scale is transformed to a 5-point scale, with higher values signaling higher levels of grit.

Along with the mean differences, I present distributions of student responses to the four main measures (University resources is included in the Course Utility construct). Figure 6.1 presents kernel density plots of the distributions of student responses on the surveys, comparing remedial and nonremedial students' average "scores" for each of the scales. For three of the four scales, the distributions appear rather similar. The lone exception in Figure 6.1 displaying the entry surveys shows a difference in the distributions for course utility responses, showing a more positive distribution for nonremedial students. This is a significant difference in distributions, as the Kolmogorov-Smirnov test shows a statistically significant difference in distributions for the two groups at the 1% level.

Figure 6.1: Kernel density distributions of entry survey responses to noncognitive skill measures for remedial and nonremedial students

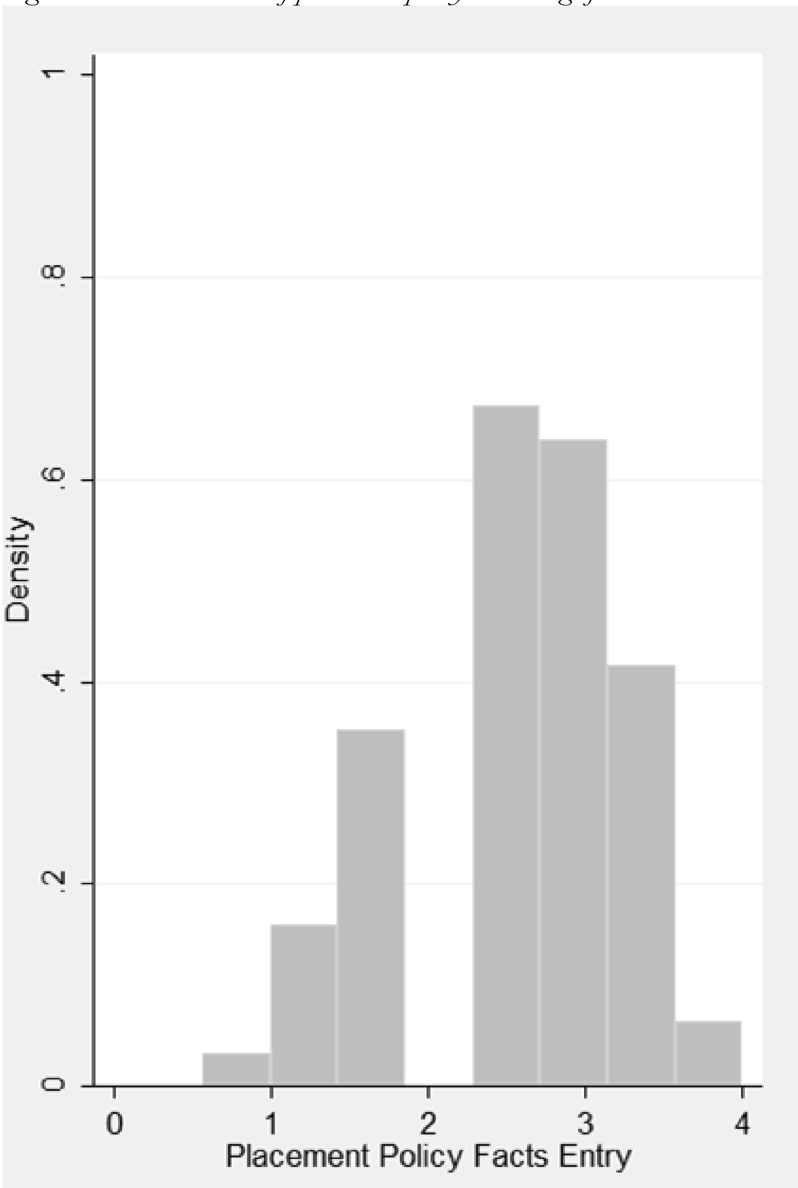


Along with the survey constructs, remedial students were asked a series of questions regarding their knowledge of the course placement policy. All seven questions were true/false, and were used to create a 4-point GPA scale. Table 6.4 shows the questions and percent of students who answered each question correctly. Overall, a vast majority of students were aware of why they were recommended to enroll in remedial courses. However, the entry survey shows that a majority of students thought they were earning credit towards graduation in remedial courses. Figure 6.2 shows the distribution of GPAs for these questions. Most students knew the answer to more than half of the questions. This is encouraging for students to limit some of the complications resulting from the delayed recognition of failed goal attainment hypothesized by Deil-Amen and Rosenbaum (2002).

Table 6.4: Remedial student knowledge of course placement policy, Entry

	Entry Survey
I need to pass this class to enroll in Composition I. (T)	0.187
This class is required for students who scored below a 19 on the English section of the ACT (470 SAT Verbal) (T)	0.893
All students in this class have to enroll in ENGL 0013. (F)	0.613
Earning credit in this course can be counted towards graduation. (F)	0.432
All students have to earn Composition I credit to graduate. (T)	0.893
I can only take this course in the fall semester of my first year. (F)	0.527
I can take the COMPASS test to place out of this course. (T)	0.840

Figure 6.2: Distribution of placement policy knowledge for remedial students



To this point, the results have all been simple mean comparisons and correlations and have not taken into account the potential impacts of covariates on the differences in noncognitive skills of the two groups of students. In order to analyze the impact of remedial coursework on LAU student non-cognitive skills and beliefs, I use an Ordinary Least Squares (OLS) model shown in Equation 6.1:

$$(6.1)\ Y_i = \alpha + \beta_1 REMEDIAL_i + \beta_2 X_i + \beta_3 PRESCORE_i + \varepsilon_{it}$$

- Where $\mathbf{Y_i}$ is the change in student i's "score" from entry to exit on the construct of interest

- **REMEDIAL$_i$** is a binary indicator for student i enrolling in a remedial course
- **X$_i$** represents student demographic characteristics including race, age, attended a private high school, an in-state student, age, whether a student is working, ever diagnosed with a learning disability and if they are joining Greek Life.
- **PRESCORE$_i$** represents a control for student i's response on the entry survey.
- ε_{it} is the error term.

In equation 6.1, β1 is the coefficient of interest, indicating participation in remedial coursework. A statistically significant result on this coefficient shows a difference in students assigned to remedial education on the construct, all else equal.

F. Results

Table 6.5 shows the results of the regressions on student responses to the constructs measuring noncognitive skills, as shown in equation 6.1 for remedial students. There is a lone marginally statistically significant result on the course utility construct, showing that students in remedial courses were less likely to state they either agreed or strongly agreed the course would be useful. This is an intriguing result, as it shows that remedial students believe the course will likely be less helpful to their future success in college.

Table 6.5: Regression adjusted treatment coefficients

	Entry Survey
Non-Cognitive Constructs	
University resources	-0.120 (0.129)
Academic self-perceptions	0.137 (0.103)
Course utility	-0.184* (0.101)
Relative Autonomy Index	0.455 (0.866)
Grit	-0.037 (0.111)

*** p<0.01, ** p<0.05, * p<0.1
Note: Ordinary least squares regression model adjusted with race, gender, school, and grade-level.

While there are few statistically significant results, there is a chance this is due to the small sample size. There are interesting patterns that emerge in the surveys, specifically the academic self-perceptions construct. At the beginning of the semester, remedial students had a positive view of their own abilities and were more likely to agree/strongly agree with the statements on the construct. Additionally, remedial students had a small, insignificant result showing they were less "gritty" than their nonremedial peers.

Overall, the results presented suggest—at best—minimal differences between remedial and non-remedial students. The lone exception is course utility in the eyes of remedial students, where most students were likely to state they would only agree with the statements. The lack of significant findings presented here may reveal some other patterns in the impacts of remediation. In the case of remedial English at LAU, students concurrently enroll in Composition I with Basic English. Therefore, students in remedial education do not delay their experience in the course for which they were deemed unprepared. Additionally, there are some concerns about confidence in the models used. The size of the standard errors, which are roughly equal in magnitude to the coefficient of interest, show the results are quite noisy. This could be due to issues of validity in the survey items or sample size.

With that in mind, there are some other possible explanations for these results that stem from the implementation of remediation at LAU. Supporters of remedial coursework have argued that the purpose of college remediation is simply to prepare students for the introductory course in a subject which students have shown they are unprepared (Goudas & Boylan, 2012). In focus group interviews with instructors, a common theme emerged. Instructors for remedial courses expressed concern with the focus on preparing students for the end-of-course COMPASS exam, rather than teaching skills they would need for Composition I. However, instructors in remedial courses stated they had a strong focus on preparing students' main essays for Composition I. In doing so, remedial instructors made the course more worthwhile for their students and positive feedback could lead to the increases in positive responses. Also, instructors for both remedial courses and college-level courses believed their courses were disconnected from the course in which students enrolled next (Composition II). While these are instructor self-reports, it appears there may be some differences in the noncognitive skills of remedial and nonremedial students at LAU.

G. Discussion

In summary, the overall comparison of remedial and nonremedial students' noncognitive skills suggest few significant differences between groups throughout the semester. The results show that remedial students had a negative view of the course at the beginning of the semester, but this disappeared by the end of the course. This could be due to course implementation, as explained by instructors.

In general, these findings do not suggest remedial and nonremedial students differ in noncognitive skills, however, there is a pattern that emerges that could offer a potential explanation for the primary results presented here. The lone statistically significant result for the full sample comparison shows remedial students were less likely to respond positively to questions on the course utility scale, showing on average, remedial students questioned the usefulness of the course for their future success. Additionally, remedial students were less gritty, but were more likely to respond positively to questions concerning academic self-perceptions. These results were not statistically significant, which is likely due to the small sample size.

Research into noncognitive skills and education has grown in popularity, especially at the K12 level (Dobbie & Fryer, 2014; West et al, 2014). Researchers caution against placing too much emphasis on these results, as they are sensitive to multiple issues that could overstate their importance (Duckworth & Yeager, 2015). One of the biggest issues with survey research is reference group bias, which these surveys, unfortunately, cannot account for. Remedial and nonremedial students likely compare themselves to different groups of students when considering their responses, likely biasing responses. In the case of remedial students, they are comparing themselves to other remedial students. This aspect of classroom characteristics shows one of the potential issues of remedial coursework policies: negative peer effects. Students in remedial courses are surrounded by other low-ability students, likely leading many remedial students to believe they are of higher ability than they truly are and giving students expectations that are unrealistic (Sacerdote, 2001; Hoxby, 2000; Zimmerman, 2003). The problems of reference group bias for remedial students and the emerging pattern of inflated self-perceptions (though insignificant) may be a potential explanation for the negative impacts of remediation on students. If remedial students are experiencing negative peer effects, then this could lead to misplaced expectations and cancel out any potential positive effects these courses may have. This may not be enough to cancel out the full negative impact of remediation, but could potentially shrink them.

Additionally, there are other qualifying characteristics to consider. The findings reported here include a sample of students in remedial education in one subject at one university. This sample is not dramatically different from the full sample of students, but students in remedial English courses are likely quite different from students in remedial mathematics. Also, this is a quite small sample of students and includes only those enrolling in face-to-face offerings of these courses. It is highly likely students opting to take these courses either online or doing an abbreviated intersession are likely quite different. Finally, the survey items and scales were not pre-validated.

Chapter VII – Discussion & Conclusions

This study presents the results of the first rigorous evaluation of the college remediation policy in the state of Arkansas. Using a regression discontinuity design that takes advantage of the state-mandated test score cutoff, I am able to compare students who are similar in observable characteristics and expectations. Overall, the results are statistically significant and negative, which is especially true for students who enroll in remedial courses. These results are by no means novel in the literature, as a majority of research using similar methodologies finds negative impacts as well. However, this research does find systematic significant negative impacts and is one of the few to examine the impacts at different institutions and for subgroups of students. Even when doing so, the results are consistent in showing that students who are recommended to and those who enroll in remediation have significantly decreased probabilities of success in college in Arkansas.

These differences in outcomes for the ITT and TOT sample are potentially due to the differences in students who are able to test out of remediation after assignment. The results presented in Chapter V show that there are observable differences in ability between the students who are assigned to avoid remediation and the students who are assigned to and enroll in remediation. Therefore, it seems likely that the students who enroll in remedial course have lower academic ability. Additionally, the survey study presented here shows potential evidence of negative peer group effects, where students who enroll in remedial courses likely have misplaced expectations that could potentially cancel out any positive impacts the remedial course policy may have on students.

When considering the magnitude of the findings, these percentages may seem relatively small. However, nearly 1,000 students enroll in public four-year universities with a math placement test score of 18 every year in this analysis, making them eligible for remedial math courses. If one were to assume the percentage of these students enrolling in remediation will remain relatively constant, then 69 percent of the cohort of students attending a public postsecondary institution in Arkansas will enroll in remedial math courses. Students who score an 18 on the math placement test currently have a six-year graduation rate of 29 percent, regardless of remediation status. With the expected decrease in the probability of graduating in six year for students enrolling in remedial math at 5.4 percentage points, we can reasonably estimate that the state of Arkansas can expect to award 37 fewer bachelor's degrees to the next class of incoming first-time college enrollees. For a state looking to increase the percentage of its citizens holding bachelor's degrees, remediation seems highly unlikely to help in meeting that goal.

Examining subgroups, results show that students who earn a higher high school GPA are often performing worse than their peers who enroll in college with lower high school GPAs when assigned to and enrolling in remedial courses. This result could present two issues: the first is the concern that high schools may inflate their students' grades, sending signals that students are more prepared than they actually are for postsecondary education; the second concern has been an area of debate in the literature on college remediation, which is using a single measure to determine course placement. In this case, students who are assigned to and subsequently enroll in remedial courses may have the ability to succeed in college level courses and are misplaced, leading to the discouragement effect described by Scott-Clayton and Rodriguez (2015).

However, not all students who are assigned to remediation enroll. These students represent an intriguing population, who remediation supporters believe represent the most valid group with whom to compare remedial students. Comparing these students' performance in their first college-level course at the LAU, I find that students who qualify for and avoid English remediation outperform their peers who enroll in remedial English in Composition I. There is no statistically significant difference for math remediation. Taken with the full analysis of the impacts of remediation, this shows that students who qualify for and are unable to test out of English remediation likely lack other academic skills that would be helpful to their future success. Because of this, there is a high likelihood that some other unobservable student characteristics are influencing student performance along with remediation.

A possible explanation for students skipping remediation and outperforming their peers who enroll in remediation is the nature of the testing-out process. Students recommended to remedial English are categorized as such because of their ACT score. The ACT is a timed test, so some students may have the ability to succeed in college level courses, but were assigned to remediation incorrectly. Students are able to test out of remediation by meeting a certain standard on the COMPASS test, which is designed by the ACT. The COMPASS test is not timed, therefore allowing students who may not be able to quickly analyze questions on the ACT may do so on the COMPASS exam and place out of remedial courses. Therefore, it is likely these students who do test out are more capable at baseline, as evidenced by the differences in high school GPA for students who avoid English remediation to those who comply with their placement.

Additionally, Arkansas has adopted the ACT Aspire as its new K-12 testing battery (Arkansas Department of Education, 2014). Starting in grade 9, students taking the ACT Aspire are given a predicted ACT score (ACT Aspire, 2015). This provides an indicator of college and career readiness for students. Given that the ACT is the most popular college entrance exam amongst Arkansas high schoolers, this is an important indicator of readiness. Arkansas would do well to move the intervention to help underprepared students to an earlier point in students' academic career.

Based on the stated goals of remediation policies, one would expect students who underwent remediation to outperform—or at the very least perform on par with—their peers who did not experience the intervention. However, we do not see any difference in the performance for these two groups, which is cause for concern when coupled with the effects reported in the main analysis of remediation, showing that students who enroll in remedial courses, regardless of their placement test scores have a significantly lower probability of earning a bachelor's degree than their peers who do not enroll in a remedial course.[13] Therefore, while there may be no statistically significant difference in math gatekeeper course performance, the impacts of enrolling in remedial courses do not provide much confidence in these students succeeding long-term in college.

While these results are similar to that shown in previous literature, I can only speculate as to why there may not be any differences in math achievement and significant differences in English achievement. The current hypothesis is that mathematics and English differ substantially in what is taught and how students are assessed. Math remediation may be more straightforward in helping students to learn the steps in solving math problems, which students can clearly connect to what they are taught in their first college-level course. Conversely, English remediation may have a more difficult task in connecting what is taught to the needs of Composition I, and concepts of being a "good writer" may be more abstract. Similarly, grading in English courses is likely to be more subjective, and could potentially bias the results.

However, interviews with instructors in the English department revealed that many of the students who enroll in remedial English lack some of the most basic skills (e.g. structuring a sentence) for writing. Students in remedial English must earn a passing grade on the COMPASS exam at the end of the semester. Instructors stated this has put a large focus on simply preparing students to pass the exam rather than teaching the skills students will need to succeed in Composition I. If this is in fact the case, remedial English may have too heavy a focus on passing the COMPASS exam rather than teaching skills that will help students to pass a writing-intensive course like Composition I. This result for English remediation furthers the argument of Scott-

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[13] As bachelor's degrees are the only type of undergraduate degree students can earn at the LAU, this is the most valid outcome to report.

Clayton et al (2014), where test scores alone do not capture the true ability of students and likely results in students being recommended to courses below their true ability level.

A. Caveats & Limitations

It should be noted that the impacts of attainment are likely not portraying a complete picture of the effect of remediation on the college experience. The sample is limited to only those students enrolled long enough to have reached a point in their postsecondary education where they might reasonably be expected to graduate. This is partially mitigated by the sample extending back several years, but changes in remediation policy at the state-level could lead to differential impacts for later cohorts of students. As is rapidly becoming the new normal in college education, students appear more likely to require more than the socially expected four years to earn a degree (NSC Research Center, 2016). Therefore, it makes intuitive sense that students who are deemed unprepared and therefore assigned to remedial courses will likely have an even longer expected timeframe to graduation. If that is indeed the case, it is likely the results presented here are not yet capturing the full effect of remediation's impact on attainment outcomes, especially for students attending four-year universities.

Arkansas, like several other states, has joined the consortium of states using the Dana Center Mathematics Pathways (DCMP), a program designed to implement multiple pathways for students to meet their postsecondary institution's math requirements. This includes allowing students to enroll in college algebra, statistics, or quantitative reasoning, based on their program of study and decrease the percentage of students who need remedial math courses (ADHE, 2017). A select group of Arkansas institutions have adopted this model already, with the ADHE expecting to recommend all institutions adopt the DCMP model in 2017. This model is similar to the underlying policy used by Logue et al (2016) in their random assignment study. If the results from the CUNY random assignment study hold in Arkansas, there is reason to hope for improved math outcomes in the future.

While the results presented for the limited sample of community colleges and universities show sizable and significant decreases in the probability of persisting and earning a degree, many of these outcomes are larger in magnitude compared to the full sample. It is possible that these institutions could be driving some of the negative results found in the full sample, as these institutions enroll one-fourth of remedial English students and one-third of remedial math students. Therefore, it is not unreasonable to assume that some institutions are less harmful in their implementation of remedial courses.

An additional limitation involves students at community colleges, which enroll a large percentage of students who score far below the cutoff for placement decisions. It could be the case that community colleges have a positive impact on students who fall into this category of being labeled as least prepared, and therefore are not captured in either the narrow band, or the wider bandwidth, samples. While these students are included in the global RDD, this may not be the most valid comparison of students, as students far below the cutoff are likely different from the small sample of community college students scoring far above the cutoff. Future iterations of this research should examine other potential discontinuities below the main placement cutoff to evaluate the impacts of potential heterogeneous impacts within the distribution of students assigned to remediation based on test scores.

Finally, there is the issue of noncompliance with the policy, as evidenced by Chapter V in this dissertation. Previous literature has dealt with this concern using a two-stage least square estimation with an instrumental variable predicting the probability of enrollment in remedial courses based on students' placement test scores, making use of a "fuzzy regression discontinuity" (Gennetian et al, 2005). The intuition behind this methodology is to account for the students who are recommended to remediation but do not enroll in remedial classes (Calcagno & Long, 2008; Boatman & Long, 2010; Boatman, 2012). Accounting for this in the instrumental variable approach estimates a local average treatment effect only for those students who enrolled in remediation after qualifying and provides the estimated effects of the treatment only for those who qualified for it (Imbens & Angrist, 1994; Angrist, Imbens, & Rubin, 1996). While I do not use that approach here, because the instrument available to me was invalid, it is a worthwhile avenue for future evaluations of remedial coursework. There is the concern, however, that noncompliance with the remediation policy could be strongly correlated with institution and cohort year, as the policy has evolved over the years and is implemented differently at each institution. I intend to address these concerns in future versions of this research.

Overall, the main lesson of this study is that Arkansas' mandatory postsecondary remediation policy for low-scoring college-going students, as implemented across the state and in different types of colleges and universities, tends to have negative effects on student success. It would seem the remediation policy, itself, needs to be remediated.

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Appendix A: Timeline of Arkansas Remediation Policy, abbreviated[14]

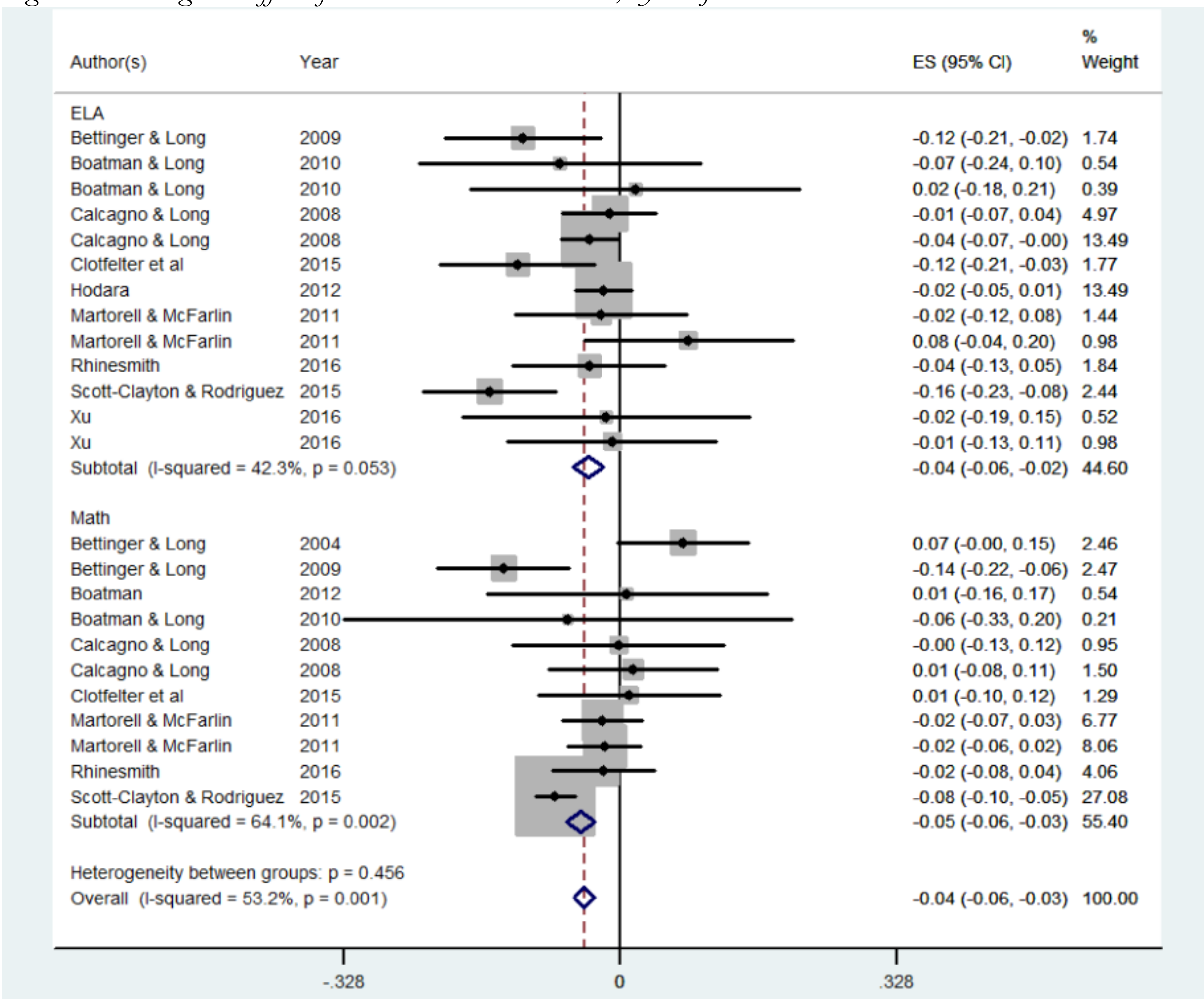
- 1983 – Arkansas implements Competency Based Education Program in K-12 schools
    - Evolves into ACTAAP program in 2003
    - Requires statewide testing of students in Arkansas schools
    - A minimum of 85 percent of students in each K-12 school and district should score at or above mastery
    - Students scoring below "mastery" level placed on "academic skills development plan"
- 1988 – Arkansas Business Council released *In Pursuit of Excellence*, calling for reform and increased support for schools at all levels in the state
    - Set in motion the conversation about remediation for underprepared high school students enrolling in college
- 1988-89 – Multiple appropriations made to improve reporting of college achievement levels of high school graduates
- 1989 – Act 11 (later amended by Act 659) established voluntary postsecondary preparation program for high schoolers, included a clause to reduce the costs of college remediation
- 1989 – Act 14 required the Departments of Education and Higher Education to report on percentages of high school graduates requiring remediation in Arkansas
- 1991 – Act 355 required districts to track information on students who require remediation
- 1991 – Act 880 required Department of Higher Education to report to high schools on remediation
    - Number of graduates who required remediation
    - Number of graduates who had a high school GPA of 3.0 or higher requiring remediation
    - Number who graduated with core college preparatory courses requiring remediation
- 1991 – Act 1101 required all colleges and universities to test first-time enrollees for placement in English, reading, and math
- 1993 – Act 1141 required state universities to reduce the amount of state funds spent on remediation for students enrolling in postsecondary education immediately after high school
    - Also, capped amount spent on remediation at the university level
- 1999 – Act 769 school performance reports to include college remediation rates for high schools
- 1999 – Act 999 called for early intervention and remediation when a student fails to demonstrate mastery on state exams
- 2003 – Act 35 state assessment's (ACTAAP) purpose is for all students to have the opportunity to enter postsecondary education or the workforce without the need for remediation
- 2005 – Act 2243 required school districts to develop student improvement plans for those scoring at remediation levels on end-of-course exams
- 2007 – Act 564 Department of High Education releases report on state spending on remediation
    - 2003-04, state spent $48 million on college remediation

[14] Information courtesy of the Arkansas Bureau of Legislative Research, 2010

- 2007 – Act 570 created Arkansas Legislative Task Force on Higher Education Remediation, Retention, and Graduation Rates to improve the state's system of postsecondary institutions
- 2007 – Act 881 established the Voluntary Universal ACT Assessment Program to improve college readiness for all students in grade 11 and reduce college remediation rates
- 2009 – Act 222 established the School Leadership Coordinating Council to reduce the need for college remediation
- 2009 – Act 730 created the College and Career Readiness Planning Program in part to reduce the need for college remediation
- 2009 – Act 970 expanded the reporting requirements on college remediation in the state
    - Students requiring remediation in the first year of college enrollment
    - Students requiring remediation and graduation
    - Attempts to pass remedial courses
- 2010 – Students enrolling in remedial courses now required to take a post-test
- 2010 – Act 110 required all institutions to establish a minimum score for college-level course entry that is based on ACT benchmarks for the probability of student success
- 2015 – Arkansas Higher Education Coordinating Board adopts *Closing the Gap 2020: A Master Plan for Arkansas High Education*
    - Goal 1 to raise completion/graduation rates by 10 percent includes a reduction in the percentage of students needing remediation
    - Goal 2 increase adult enrollment by 75 percent and reduce need for remediation by 50 percent
    - Goals 3 and 4 include raising graduation rates and reducing time needed to complete
- 2015 – Anytime remediation rates decrease in Arkansas to 39.7 percent, the lowest in 5 years
- 2017 – Legislature passes and Governor approves change to higher education funding to be based on outcomes rather than enrollment

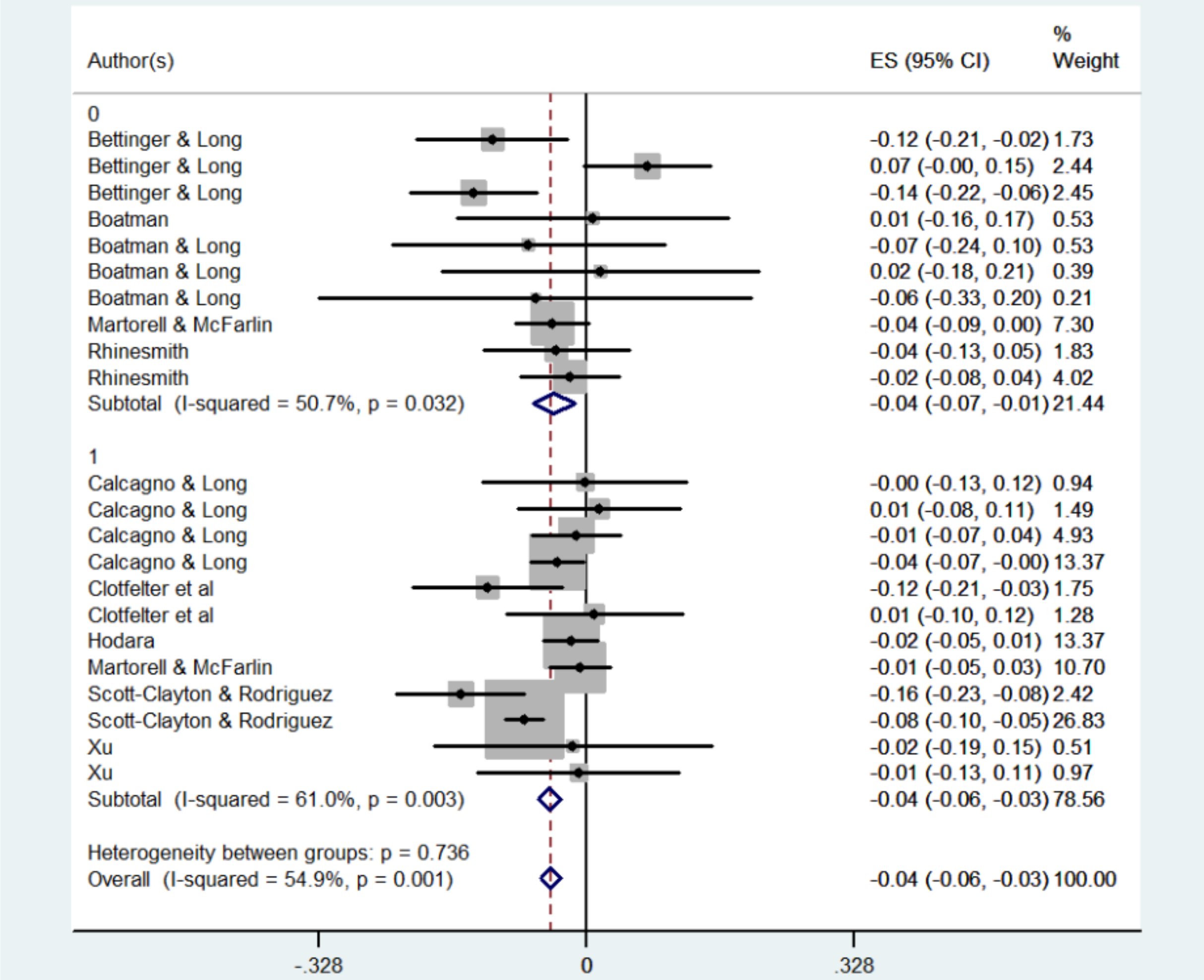
Appendix B: Specification Checks of Meta-Analysis

Figure B.1: Marginal Effect of Remediation on Persistence, by Subject



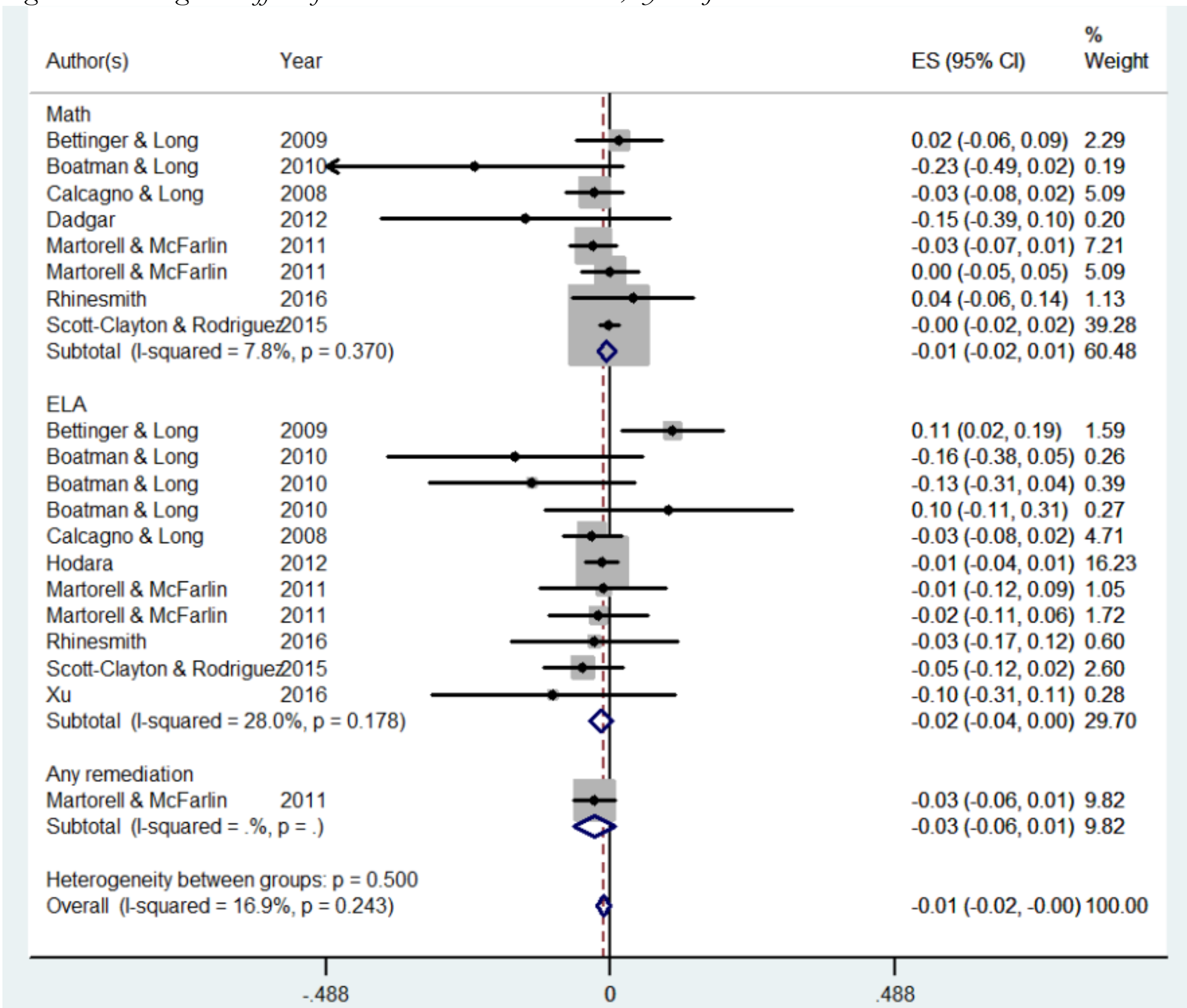
Note: By breaking the results down by subject, we see the overall result is likely driven by mathematics remediation. The between study variation is much higher for math, as evidenced by the I^2.

Figure B.2: Marginal Effect of Remediation on Persistence, by Institution Type



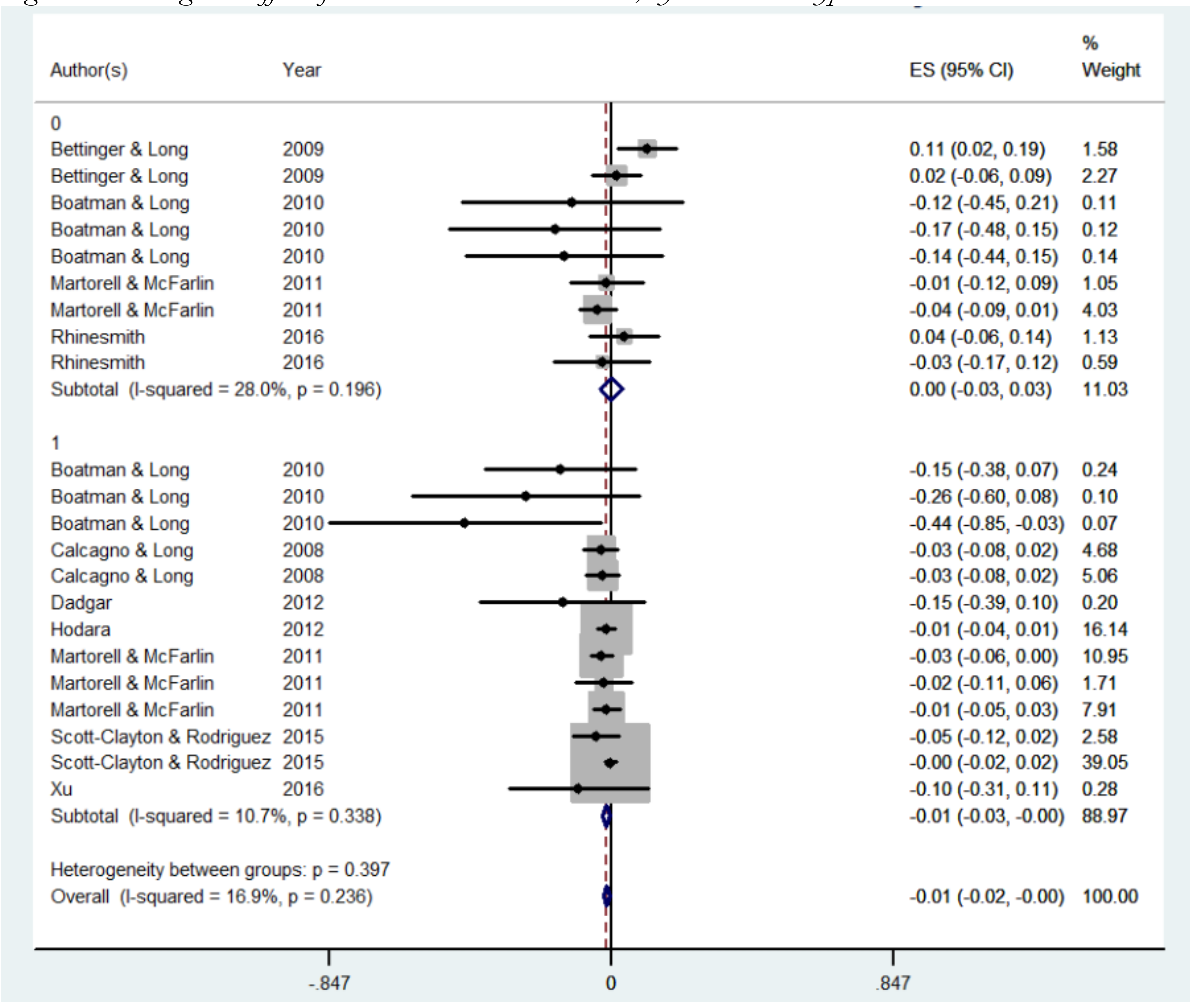
Note: Institution type 0 represents results from universities and 1 represents results from community colleges. A majority of the weight in the result comes from studies taking place at community colleges. The I^2 value for both institution types shows there is between study variation, though it is only marginally large.

Figure B.3: Marginal Effect of Remediation on Attainment, by Subject



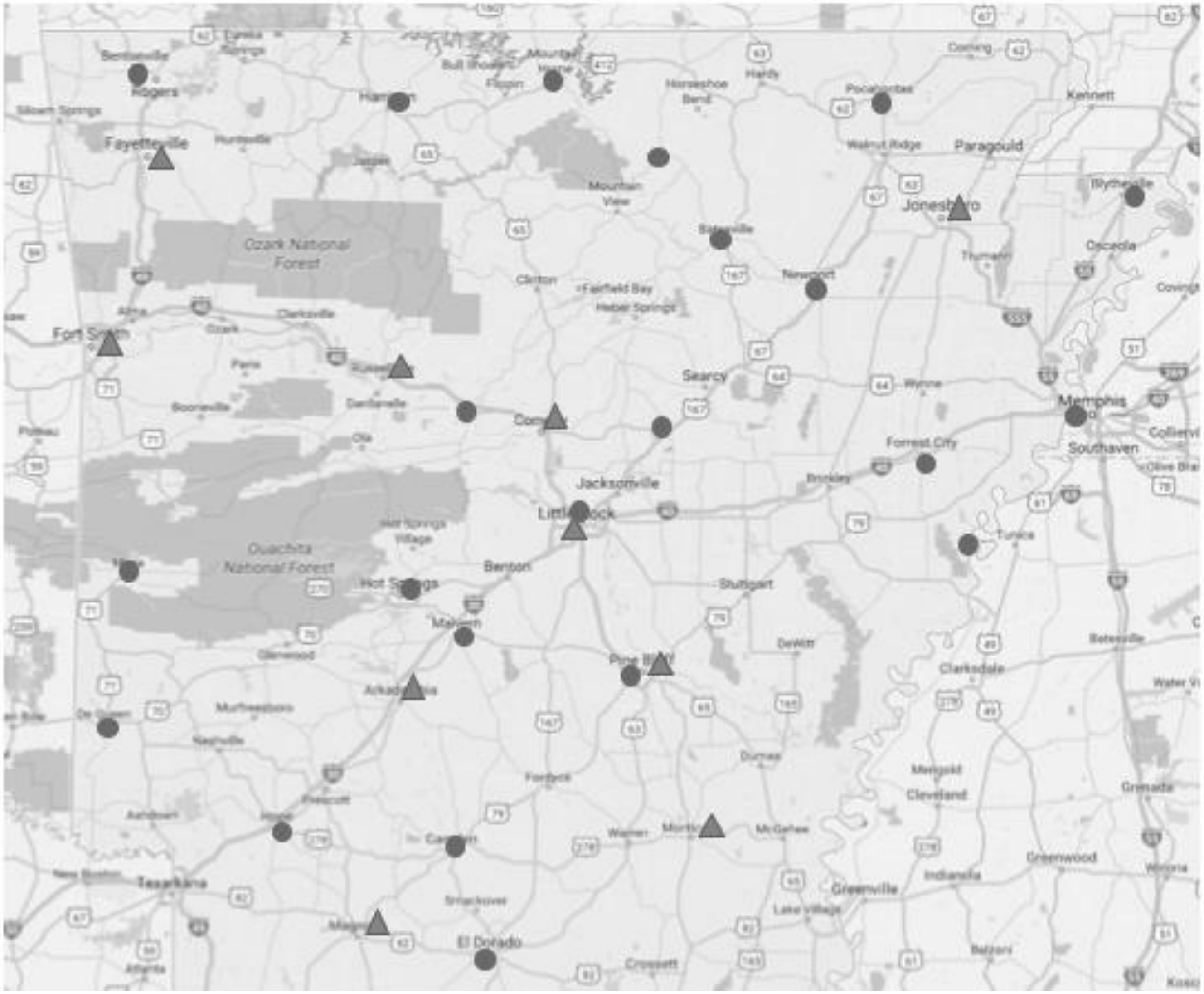
Note: There is similarly no significant effect of remediation on attainment when breaking down the results by subject.

Figure B.4: Marginal Effect of Remediation on Attainment, by Institution Type



Note: There is similarly no significant effect of remediation on attainment when breaking down the results by institution type. Similar to attainment outcomes, institution type 0 represents results from universities and 1 represents results from community colleges.

Appendix C: Map of Arkansas Institutions



Note: Four-year institutions denoted with triangles and two-year institutions with circles

Appendix D: Wide Bandwidth Robustness Check

Table D.1: RD Impacts of English Remediation on All Students

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Earn a Degree	Enroll Year 2	Enroll Year 3	Earn a Degree
Treatment Effect	-0.000	-0.010	-0.014*	-0.019***	-0.045***	-0.067***
	(0.011)	(0.009)	(0.009)	(0.007)	(0.007)	(0.008)
English Test Score	0.008	0.011***	0.009*	0.007**	0.008***	0.001
	(0.006)	(0.004)	(0.005)	(0.003)	(0.002)	(0.003)
English Score X Treatment	0.002	0.001	0.004	-0.002	-0.001	0.007**
	(0.009)	(0.008)	(0.007)	(0.004)	(0.003)	(0.003)
Black	0.017	-0.013	-0.049***	0.020	-0.007	-0.041***
	(0.014)	(0.010)	(0.008)	(0.013)	(0.010)	(0.008)
Hispanic	0.046*	0.043**	0.006	0.047*	0.044**	0.008
	(0.028)	(0.019)	(0.017)	(0.027)	(0.019)	(0.017)
Other Race	-0.020**	-0.038***	-0.049***	-0.019**	-0.036***	-0.047***
	(0.009)	(0.006)	(0.008)	(0.009)	(0.006)	(0.008)
Female	0.020***	0.018**	0.018**	0.020***	0.019**	0.021**
	(0.006)	(0.009)	(0.009)	(0.006)	(0.009)	(0.009)
Age	0.002***	0.002**	0.004***	0.002***	0.002**	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.117***	0.117***	0.131***	0.116***	0.114***	0.127***
	(0.014)	(0.015)	(0.018)	(0.014)	(0.015)	(0.017)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	43,241	43,241	43,241	43,241	43,241	43,241
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.1: RD Impacts of Math Remediation on All Students

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Earn a Degree	Enroll Year 2	Enroll Year 3	Earn a Degree
Treatment Effect	-0.021**	-0.030***	-0.031***	-0.003	-0.029***	-0.055***
	(0.009)	(0.008)	(0.009)	(0.009)	(0.007)	(0.009)
Math Test Score	0.006	0.001	0.003	0.013***	0.002	-0.002
	(0.006)	(0.006)	(0.006)	(0.005)	(0.003)	(0.003)
Math Score X Treatment	-0.010	-0.001	0.002	-0.008	0.006	0.010*
	(0.010)	(0.009)	(0.008)	(0.007)	(0.005)	(0.006)
Black	0.009	-0.008	-0.042***	0.009	-0.007	-0.039***
	(0.012)	(0.010)	(0.010)	(0.012)	(0.010)	(0.009)
Hispanic	0.049**	0.035***	0.014	0.049**	0.036***	0.016
	(0.022)	(0.011)	(0.010)	(0.022)	(0.012)	(0.010)
Other Race	-0.018***	-0.030***	-0.041***	-0.018***	-0.029***	-0.040***
	(0.006)	(0.010)	(0.007)	(0.006)	(0.010)	(0.007)
Female	0.027***	0.030***	0.033***	0.027***	0.030***	0.035***
	(0.006)	(0.008)	(0.009)	(0.006)	(0.008)	(0.009)
Age	0.001	0.001	0.003***	0.001	0.001	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.117***	0.127***	0.141***	0.117***	0.125***	0.136***
	(0.015)	(0.017)	(0.022)	(0.015)	(0.017)	(0.022)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	53,766	53,766	53,766	53,766	53,766	53,766
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.

Table D.2: RD Estimated Impacts of English Remediation on Persistence, Community College

	ITT (Assigned to Remediation)		TOT (Enrolled in Remediation)	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Treatment Effect	0.019 (0.020)	0.002 (0.013)	-0.030*** (0.009)	-0.059*** (0.011)
English Test Score	0.013 (0.009)	0.017* (0.009)	0.005 (0.004)	0.008** (0.003)
English Score X Treatment	0.005 (0.015)	0.004 (0.013)	-0.004 (0.007)	-0.001 (0.005)
Black	-0.025 (0.018)	-0.046*** (0.009)	-0.021 (0.017)	-0.038*** (0.009)
Hispanic	0.092*** (0.030)	0.057*** (0.019)	0.092*** (0.029)	0.058*** (0.019)
Other Race	-0.029 (0.022)	-0.051*** (0.016)	-0.028 (0.022)	-0.049*** (0.016)
Female	0.018 (0.012)	0.020 (0.016)	0.019 (0.012)	0.023 (0.016)
Age	0.003*** (0.001)	0.002*** (0.001)	0.003*** (0.001)	0.002** (0.001)
High School GPA	0.095*** (0.016)	0.090*** (0.016)	0.094*** (0.016)	0.086*** (0.016)
Controls				
Cohort Year	X	X	X	X
Institution	X	X	X	X
Observations	16,754	16,754	16,754	16,754
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.

Table D.3: RD Estimated Impacts of Math Remediation on Persistence, Community College

	ITT (Assigned to Remediation)		**TOT (Enrolled in Remediation)**	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Treatment Effect	-0.040**	-0.029	0.016	-0.024**
	(0.019)	(0.018)	(0.013)	(0.010)
Math Test Score	-0.019	-0.008	0.012	0.006
	(0.012)	(0.011)	(0.008)	(0.006)
Math Score X Treatment	0.019*	0.017	-0.006	0.006
	(0.011)	(0.011)	(0.010)	(0.008)
Black	-0.043***	-0.054***	-0.045***	-0.053***
	(0.013)	(0.013)	(0.013)	(0.014)
Hispanic	0.090***	0.044***	0.089***	0.045***
	(0.016)	(0.012)	(0.015)	(0.012)
Other Race	-0.018	-0.026**	-0.019	-0.026**
	(0.014)	(0.013)	(0.014)	(0.013)
Female	0.026*	0.025*	0.025*	0.027**
	(0.014)	(0.013)	(0.013)	(0.013)
Age	0.003***	0.002**	0.003***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.102***	0.108***	0.104***	0.107***
	(0.020)	(0.021)	(0.021)	(0.021)
Controls				
Cohort Year	X	X	X	X
Institution	X	X	X	X
Observations	18,721	18,721	18,721	18,721
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.4: RD Estimated Impacts of English Remediation on Persistence, Universities

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Treatment Effect	-0.012 (0.013)	-0.019* (0.011)	-0.011 (0.008)	-0.009 (0.011)	-0.031*** (0.009)	-0.038*** (0.008)
English Test Score	0.005 (0.007)	0.008** (0.004)	0.009* (0.006)	0.009** (0.004)	0.011*** (0.003)	0.007** (0.003)
English Score X Treatment	-0.001 (0.013)	-0.002 (0.011)	0.003 (0.011)	-0.003 (0.006)	-0.006 (0.005)	0.000 (0.006)
Black	0.034** (0.016)	0.000 (0.011)	-0.007 (0.010)	0.035** (0.016)	0.004 (0.012)	-0.002 (0.010)
Hispanic	0.013 (0.031)	0.032 (0.031)	-0.002 (0.017)	0.013 (0.031)	0.034 (0.031)	-0.001 (0.017)
Other Race	-0.015* (0.009)	-0.029*** (0.005)	-0.035*** (0.009)	-0.015* (0.009)	-0.028*** (0.005)	-0.034*** (0.009)
Female	0.020** (0.009)	0.017 (0.011)	0.012 (0.012)	0.020** (0.009)	0.018 (0.011)	0.013 (0.011)
Age	0.000 (0.001)	0.002 (0.002)	0.003 (0.002)	0.000 (0.001)	0.002 (0.002)	0.003 (0.002)
High School GPA	0.143*** (0.024)	0.146*** (0.026)	0.142*** (0.028)	0.142*** (0.024)	0.143*** (0.026)	0.139*** (0.028)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	26,487	26,487	26,487	26,487	26,487	26,487
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.5: RD Estimated Impacts on Math Remediation on Persistence, University

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Treatment Effect	-0.015	-0.034***	-0.028***	-0.014	-0.036***	-0.036***
	(0.009)	(0.008)	(0.009)	(0.013)	(0.008)	(0.009)
Math Score	0.016***	0.003	0.005	0.011	0.000	-0.002
	(0.005)	(0.007)	(0.005)	(0.007)	(0.004)	(0.003)
Math Score X Treatment	-0.022*	-0.010	-0.007	-0.010	0.002	0.007
	(0.013)	(0.013)	(0.010)	(0.012)	(0.006)	(0.005)
Black	0.025**	0.004	-0.001	0.026**	0.004	-0.001
	(0.012)	(0.010)	(0.010)	(0.012)	(0.010)	(0.010)
Hispanic	0.019	0.028	0.015	0.019	0.029	0.015
	(0.032)	(0.019)	(0.014)	(0.032)	(0.020)	(0.014)
Other Race	-0.015**	-0.025*	-0.028**	-0.015**	-0.025*	-0.027**
	(0.007)	(0.014)	(0.011)	(0.007)	(0.014)	(0.011)
Female	0.025***	0.031***	0.026***	0.025***	0.030***	0.025***
	(0.006)	(0.010)	(0.010)	(0.006)	(0.010)	(0.009)
Age	-0.000	0.001	0.001	-0.000	0.001	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
High School GPA	0.132***	0.146***	0.146***	0.131***	0.143***	0.143***
	(0.022)	(0.026)	(0.026)	(0.023)	(0.026)	(0.026)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	35,045	35,045	35,045	35,045	35,045	35,045
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.6: RD Estimated Impacts of English Remediation on Attainment, Community College

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	AA in 3 Years	AA in 4 Years	Ever Earn a Degree	AA in 3 Years	AA in 4 Years	Ever Earn a Degree
Treatment Effect	-0.016	-0.015	-0.012	-0.087***	-0.089***	-0.088***
	(0.011)	(0.013)	(0.016)	(0.008)	(0.009)	(0.009)
English Score	0.008	0.007	0.013	-0.001	-0.001	0.004
	(0.009)	(0.010)	(0.010)	(0.004)	(0.004)	(0.004)
English Score X Treatment	0.002	0.008	0.009	0.007	0.010***	0.008**
	(0.013)	(0.013)	(0.013)	(0.004)	(0.004)	(0.004)
Black	-0.059***	-0.060***	-0.056***	-0.047***	-0.049***	-0.045***
	(0.011)	(0.010)	(0.011)	(0.011)	(0.010)	(0.011)
Hispanic	0.040**	0.033**	0.036*	0.042***	0.035**	0.038*
	(0.016)	(0.017)	(0.019)	(0.016)	(0.017)	(0.019)
Other Race	-0.035**	-0.049***	-0.032**	-0.031*	-0.044**	-0.029*
	(0.017)	(0.017)	(0.015)	(0.018)	(0.018)	(0.016)
Female	-0.013	-0.006	0.013	-0.008	-0.000	0.017
	(0.016)	(0.017)	(0.016)	(0.017)	(0.017)	(0.017)
Age	0.007***	0.006***	0.004***	0.006***	0.006***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.100***	0.105***	0.115***	0.095***	0.100***	0.111***
	(0.016)	(0.017)	(0.017)	(0.015)	(0.016)	(0.016)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	16,754	16,754	16,754	16,754	16,754	16,754
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.7: RD Estimated Impacts of Math Remediation on Attainment, Community College

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	AA in 3 Years	AA in 4 Years	Ever Earn a Degree	AA in 3 Years	AA in 4 Years	Ever Earn a Degree
Treatment Effect	-0.052***	-0.047***	-0.051***	-0.075***	-0.075***	-0.071***
	(0.019)	(0.018)	(0.018)	(0.007)	(0.007)	(0.008)
Math Test Score	-0.023*	-0.019	-0.016	-0.007	-0.006	0.001
	(0.013)	(0.013)	(0.014)	(0.005)	(0.006)	(0.006)
Math Score X Treatment	0.032**	0.028**	0.029**	0.020***	0.017**	0.014**
	(0.013)	(0.014)	(0.013)	(0.007)	(0.007)	(0.007)
Black	-0.071***	-0.076***	-0.080***	-0.064***	-0.070***	-0.074***
	(0.015)	(0.014)	(0.013)	(0.015)	(0.014)	(0.013)
Hispanic	0.023	0.015	0.022	0.025	0.017	0.024
	(0.016)	(0.019)	(0.019)	(0.017)	(0.019)	(0.020)
Other Race	-0.029***	-0.037***	-0.022*	-0.029***	-0.036***	-0.021
	(0.011)	(0.010)	(0.013)	(0.011)	(0.010)	(0.013)
Female	-0.006	0.001	0.020	0.000	0.007	0.025*
	(0.015)	(0.016)	(0.014)	(0.015)	(0.016)	(0.014)
Age	0.007***	0.006***	0.004***	0.007***	0.006***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High School GPA	0.105***	0.111***	0.123***	0.101***	0.107***	0.118***
	(0.022)	(0.021)	(0.023)	(0.022)	(0.021)	(0.022)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	18,721	18,721	18,721	18,721	18,721	18,721
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.8: RD Estimated Impacts of English Remediation on Attainment, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	BA in 4 Years	BA in 6 Years	Earn a Degree	BA in 4 Years	BA in 6 Years	Earn a Degree
Treatment Effect	-0.013	-0.030	-0.018**	-0.018**	-0.018**	-0.052***
	(0.015)	(0.019)	(0.009)	(0.009)	(0.009)	(0.008)
English Test Score	0.016*	0.014	0.006	0.006	0.006	0.004
	(0.009)	(0.010)	(0.005)	(0.005)	(0.005)	(0.005)
English Score X Treatment	-0.009	-0.016	0.003	0.003	0.003	0.000
	(0.014)	(0.021)	(0.009)	(0.009)	(0.009)	(0.006)
Black	-0.033***	-0.015	-0.052***	-0.052***	-0.052***	-0.046***
	(0.012)	(0.018)	(0.010)	(0.010)	(0.010)	(0.011)
Hispanic	-0.027	0.002	-0.020	-0.020	-0.020	-0.018
	(0.019)	(0.029)	(0.017)	(0.017)	(0.017)	(0.018)
Other Race	-0.025	-0.004	-0.050***	-0.050***	-0.050***	-0.049***
	(0.021)	(0.019)	(0.009)	(0.009)	(0.009)	(0.008)
Female	-0.012	-0.029**	0.017*	0.017*	0.017*	0.019*
	(0.013)	(0.014)	(0.010)	(0.010)	(0.010)	(0.010)
Age	-0.002	-0.006*	0.005	0.005	0.005	0.004
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
High School GPA	0.173***	0.178***	0.164***	0.164***	0.164***	0.160***
	(0.035)	(0.036)	(0.028)	(0.028)	(0.028)	(0.028)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	13,860	13,860	26,487	13,860	13,860	26,487
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.9: RD Estimated Impacts on Math Remediation on Attainment, University

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	BA in 4 Years	BA in 6 Years	Earn a Degree	BA in 4 Years	BA in 6 Years	Earn a Degree
Treatment Effect	-0.024* (0.013)	-0.003 (0.020)	-0.030*** (0.009)	-0.053*** (0.013)	-0.058*** (0.021)	-0.059*** (0.009)
Math Test Score	0.007 (0.009)	0.028** (0.014)	0.008 (0.006)	0.011*** (0.004)	0.018** (0.007)	0.001 (0.005)
Math Score X Treatment	0.007 (0.011)	-0.025 (0.018)	-0.006 (0.009)	-0.012 (0.008)	-0.039*** (0.009)	-0.003 (0.005)
Black	-0.026** (0.011)	0.005 (0.013)	-0.034*** (0.011)	-0.024** (0.011)	0.006 (0.014)	-0.033*** (0.011)
Hispanic	-0.021 (0.015)	0.019 (0.023)	0.005 (0.013)	-0.019 (0.014)	0.022 (0.023)	0.006 (0.013)
Other Race	-0.024 (0.020)	-0.009 (0.024)	-0.044*** (0.008)	-0.023 (0.020)	-0.007 (0.024)	-0.043*** (0.008)
Female	0.021* (0.012)	-0.002 (0.014)	0.036*** (0.011)	0.020* (0.011)	-0.002 (0.014)	0.036*** (0.010)
Age	-0.003 (0.004)	-0.010 (0.007)	0.003 (0.003)	-0.003 (0.004)	-0.010 (0.007)	0.003 (0.003)
High School GPA	0.184*** (0.033)	0.189*** (0.030)	0.173*** (0.029)	0.179*** (0.033)	0.184*** (0.030)	0.167*** (0.028)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	18,513	18,513	35,045	18,513	18,513	35,045
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.10: High Remediation Sample RD Estimated Impacts on Persistence, English Community College

	ITT (Assigned to Remediation)		TOT (Enrolled in Remediation)	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Treatment Effect	-0.015	-0.037	-0.029	-0.059**
	(0.050)	(0.051)	(0.025)	(0.029)
English Test Score	-0.017	-0.020	0.001	0.001
	(0.022)	(0.029)	(0.010)	(0.013)
English Score X Treatment	0.045	0.035	0.015	0.008
	(0.029)	(0.042)	(0.021)	(0.016)
Black	-0.048***	-0.070***	-0.044***	-0.060***
	(0.017)	(0.019)	(0.015)	(0.017)
Hispanic	0.005	-0.020	0.006	-0.021
	(0.057)	(0.051)	(0.056)	(0.050)
Other Race	-0.045	0.044*	-0.046	0.042
	(0.030)	(0.025)	(0.031)	(0.027)
Female	0.029	0.031	0.031	0.036
	(0.038)	(0.050)	(0.037)	(0.050)
Age	0.004*	0.002	0.004*	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
High School GPA	0.108**	0.106**	0.106***	0.102**
	(0.042)	(0.050)	(0.041)	(0.049)
Controls				
Cohort Year	X	X	X	X
Institution	X	X	X	X
Observations	2,567	2,567	2,567	2,567
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.11: High Remediation Sample RD Estimated Impacts of Math remediation on Persistence, Community College

	ITT (Assigned to Remediation)		**TOT (Enrolled in Remediation)**	
	Enroll Year 2	Enroll Year 3	Enroll Year 2	Enroll Year 3
Treatment Effect	-0.034	-0.055***	0.032	-0.015
	(0.047)	(0.017)	(0.028)	(0.021)
Math Test Score	0.003	-0.004	0.025**	0.014
	(0.025)	(0.017)	(0.010)	(0.011)
Math Score X Treatment	-0.019	-0.008	-0.026**	-0.005
	(0.026)	(0.023)	(0.012)	(0.010)
Black	-0.031**	-0.068***	-0.034**	-0.068***
	(0.013)	(0.015)	(0.015)	(0.015)
Hispanic	0.061*	0.037	0.064*	0.036
	(0.037)	(0.033)	(0.037)	(0.031)
Other Race	-0.060***	-0.040	-0.065***	-0.041
	(0.012)	(0.029)	(0.012)	(0.030)
Female	0.040**	0.051***	0.036*	0.052***
	(0.019)	(0.014)	(0.019)	(0.014)
Age	-0.001	-0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)
High School GPA	0.076***	0.078***	0.076***	0.077***
	(0.024)	(0.024)	(0.024)	(0.024)
Controls				
Cohort Year	X	X	X	X
Institution	X	X	X	X
Observations	4,349	4,349	4,349	4,349
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.12: High Remediation Sample RD Estimated Impacts of English Remediation on Attainment, Community College

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	AA in 3 Years	AA in 4 Years	Earn a Degree	AA in 3 Years	AA in 4 Years	Earn a Degree
Treatment Effect	-0.038 (0.034)	-0.021 (0.034)	-0.041 (0.047)	-0.107*** (0.026)	-0.115*** (0.025)	-0.109*** (0.022)
English Test Score	-0.016 (0.029)	0.003 (0.031)	-0.003 (0.030)	-0.007 (0.009)	-0.003 (0.012)	-0.001 (0.014)
English Score X Treatment	0.021 (0.044)	0.005 (0.042)	0.006 (0.035)	0.010 (0.012)	0.007 (0.011)	0.012 (0.016)
Black	-0.056** (0.023)	-0.064*** (0.021)	-0.058** (0.025)	-0.041** (0.020)	-0.048** (0.019)	-0.042* (0.022)
Hispanic	-0.067 (0.051)	-0.078 (0.049)	-0.050 (0.069)	-0.064 (0.049)	-0.075 (0.046)	-0.050 (0.066)
Other Race	-0.029 (0.019)	-0.052*** (0.016)	-0.033* (0.018)	-0.028 (0.019)	-0.049*** (0.016)	-0.032** (0.015)
Female	-0.017 (0.050)	-0.003 (0.052)	0.021 (0.053)	-0.007 (0.050)	0.006 (0.052)	0.030 (0.053)
Age	0.007*** (0.002)	0.007*** (0.002)	0.005** (0.002)	0.006*** (0.002)	0.007*** (0.002)	0.005** (0.002)
High School GPA	0.113** (0.046)	0.122** (0.051)	0.123** (0.053)	0.105** (0.043)	0.113** (0.047)	0.115** (0.051)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	2,567	2,567	2,567	2,567	2,567	2,567
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.13: High Remediation Sample RD Estimated Impacts of Math Remediation on Attainment, Community College

	ITT (Assigned to Remediation)			**TOT (Enrolled in Remediation)**		
	AA in 3 Years	AA in 4 Years	Earn a Degree	AA in 3 Years	AA in 4 Years	Earn a Degree
Treatment Effect	-0.093***	-0.083***	-0.077***	-0.072***	-0.067***	-0.068***
	(0.024)	(0.023)	(0.011)	(0.016)	(0.016)	(0.019)
Math Test Score	-0.045***	-0.047***	-0.039***	0.009	0.008	0.013
	(0.009)	(0.007)	(0.010)	(0.009)	(0.007)	(0.010)
Math Score X Treatment	0.057***	0.067***	0.062***	0.005	0.006	0.003
	(0.014)	(0.015)	(0.014)	(0.014)	(0.012)	(0.015)
Black	-0.071***	-0.077***	-0.077***	-0.070***	-0.077***	-0.077***
	(0.019)	(0.016)	(0.016)	(0.019)	(0.016)	(0.016)
Hispanic	0.047	0.051	0.067**	0.042	0.045	0.062*
	(0.033)	(0.031)	(0.034)	(0.032)	(0.031)	(0.033)
Other Race	-0.091**	-0.087***	-0.094***	-0.088**	-0.083***	-0.089***
	(0.037)	(0.020)	(0.017)	(0.037)	(0.023)	(0.021)
Female	0.021**	0.032***	0.044***	0.026**	0.036***	0.049***
	(0.011)	(0.011)	(0.010)	(0.011)	(0.012)	(0.009)
Age	0.006***	0.005***	0.003*	0.005***	0.005***	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
High School GPA	0.064***	0.074***	0.084***	0.061***	0.071***	0.081***
	(0.020)	(0.022)	(0.029)	(0.020)	(0.021)	(0.029)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	4,349	4,349	4,349	4,349	4,349	4,349
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.14: High Remediation Sample RD Estimated Impacts of English Remediation on Persistence, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Treatment Effect	0.002 (0.026)	0.003 (0.017)	0.007 (0.014)	-0.004 (0.027)	-0.034** (0.016)	-0.046*** (0.007)
English Test Score	0.020** (0.009)	0.005 (0.010)	0.017*** (0.005)	0.020*** (0.007)	0.007 (0.007)	0.014*** (0.005)
English Score X Treatment	-0.006 (0.013)	0.021 (0.023)	0.011 (0.015)	-0.011 (0.015)	0.001 (0.015)	-0.007 (0.012)
Black	0.006 (0.029)	-0.005 (0.024)	-0.003 (0.020)	0.007 (0.027)	-0.001 (0.022)	0.004 (0.019)
Hispanic	-0.011 (0.029)	0.057 (0.052)	0.022 (0.033)	-0.011 (0.029)	0.057 (0.052)	0.022 (0.034)
Other Race	-0.007 (0.034)	-0.015 (0.024)	-0.064** (0.026)	-0.007 (0.032)	-0.014 (0.024)	-0.062** (0.027)
Female	0.039** (0.016)	0.036** (0.015)	0.042*** (0.015)	0.039** (0.016)	0.036** (0.015)	0.042*** (0.013)
Age	-0.002 (0.004)	-0.002 (0.004)	-0.001 (0.003)	-0.002 (0.004)	-0.002 (0.004)	-0.001 (0.003)
High School GPA	0.098*** (0.030)	0.094*** (0.030)	0.090*** (0.031)	0.098*** (0.031)	0.092*** (0.030)	0.087*** (0.031)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	6,698	6,698	6,698	6,698	6,698	6,698
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses

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

Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.

Source: Author's calculations

Table D.15: High Remediation Sample RD Estimated Impacts of Math Remediation on Persistence, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Enroll Year 2	Enroll Year 3	Enroll Year 4	Enroll Year 2	Enroll Year 3	Enroll Year 4
Treatment Effect	0.001 (0.028)	-0.019 (0.021)	-0.005 (0.010)	0.012 (0.028)	-0.006 (0.013)	-0.013 (0.018)
Math Test Score	0.014** (0.005)	0.010** (0.005)	0.009*** (0.003)	0.017*** (0.004)	0.013*** (0.002)	0.010*** (0.002)
Math Score X Treatment	-0.004 (0.007)	0.002 (0.007)	0.009** (0.004)	-0.010*** (0.004)	-0.000 (0.003)	0.005 (0.005)
Black	0.017 (0.029)	0.014 (0.025)	0.013 (0.021)	0.017 (0.030)	0.013 (0.025)	0.014 (0.021)
Hispanic	-0.015 (0.028)	0.053 (0.050)	0.016 (0.032)	-0.017 (0.028)	0.052 (0.051)	0.017 (0.031)
Other Race	-0.001 (0.030)	-0.007 (0.020)	-0.056** (0.025)	-0.002 (0.030)	-0.008 (0.022)	-0.057** (0.026)
Female	0.049*** (0.016)	0.048*** (0.016)	0.054*** (0.016)	0.049*** (0.016)	0.048*** (0.016)	0.054*** (0.016)
Age	-0.001 (0.005)	0.000 (0.005)	0.002 (0.004)	-0.000 (0.005)	0.000 (0.005)	0.001 (0.003)
High School GPA	0.090*** (0.029)	0.084*** (0.028)	0.080*** (0.030)	0.091*** (0.029)	0.084*** (0.029)	0.080*** (0.031)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	6,668	6,668	6,668	6,668	6,668	6,668
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.17: High Remediation Sample RD Estimated Impacts of English Remediation on Attainment, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Grad in 4 Years	Grad in 6 Years	Ever Earn Degree	Grad in 4 Years	Grad in 6 Years	Ever Earn Degree
Treatment Effect	0.013	0.012	0.001	-0.103***	-0.099***	-0.064***
	(0.031)	(0.017)	(0.014)	(0.017)	(0.030)	(0.011)
English Test Score	0.020	0.019	0.009	-0.001	0.003	0.005
	(0.021)	(0.021)	(0.015)	(0.006)	(0.004)	(0.007)
English Score X Treatment	0.001	0.007	0.013	-0.006	-0.006	-0.004
	(0.026)	(0.046)	(0.018)	(0.009)	(0.008)	(0.006)
Black	0.010	0.056	-0.038	0.028	0.074	-0.029
	(0.035)	(0.054)	(0.030)	(0.029)	(0.050)	(0.028)
Hispanic	0.059***	0.110	0.003	0.057***	0.110	0.003
	(0.014)	(0.077)	(0.022)	(0.012)	(0.079)	(0.023)
Other Race	-0.018	0.018	-0.047*	-0.014	0.009	-0.044*
	(0.045)	(0.059)	(0.025)	(0.041)	(0.066)	(0.026)
Female	0.015	-0.002	0.048***	0.017	-0.004	0.049***
	(0.025)	(0.018)	(0.012)	(0.021)	(0.016)	(0.010)
Age	-0.003*	-0.006	-0.001	-0.004*	-0.006	-0.001
	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)
High School GPA	0.106***	0.102***	0.105***	0.099***	0.095***	0.101***
	(0.036)	(0.033)	(0.032)	(0.035)	(0.034)	(0.032)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	6,698	6,698	6,698	6,698	6,698	6,698
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.
Source: Author's calculations

Table D.18: High Remediation Sample RD Estimated Impacts of Math Remediation on Attainment, Universities

	ITT (Assigned to Remediation)			TOT (Enrolled in Remediation)		
	Grad in 4 Years	Grad in 6 Years	Ever Earn Degree	Grad in 4 Years	Grad in 6 Years	Ever Earn Degree
Treatment Effect	0.002 (0.026)	0.040** (0.017)	-0.019 (0.013)	-0.024 (0.023)	-0.012 (0.033)	-0.043*** (0.007)
Math Test Score	0.014** (0.006)	0.029*** (0.004)	0.010** (0.005)	0.014*** (0.005)	0.022*** (0.005)	0.011*** (0.002)
Math Score X Treatment	0.010 (0.009)	-0.011 (0.012)	0.006 (0.007)	0.003 (0.005)	-0.011*** (0.004)	-0.000 (0.005)
Black	0.037 (0.036)	0.079 (0.054)	-0.017 (0.031)	0.038 (0.036)	0.080 (0.054)	-0.016 (0.030)
Hispanic	0.057*** (0.016)	0.106 (0.085)	-0.002 (0.021)	0.058*** (0.017)	0.106 (0.085)	0.000 (0.020)
Other Race	-0.009 (0.048)	0.001 (0.071)	-0.040* (0.024)	-0.009 (0.048)	0.003 (0.069)	-0.039 (0.024)
Female	0.033 (0.026)	0.016 (0.022)	0.064*** (0.013)	0.033 (0.025)	0.017 (0.022)	0.064*** (0.012)
Age	0.000 (0.002)	-0.003 (0.002)	0.003 (0.004)	-0.001 (0.002)	-0.003 (0.003)	0.002 (0.003)
High School GPA	0.088*** (0.032)	0.087*** (0.033)	0.093*** (0.031)	0.087*** (0.033)	0.086** (0.034)	0.091*** (0.030)
Controls						
Cohort Year	X	X	X	X	X	X
Institution	X	X	X	X	X	X
Observations	6,668	6,668	6,668	6,668	6,668	6,668
ACT Score Bandwidth	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5

Standard errors clustered at institution in parentheses

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

Note: Coefficients reported as average marginal effects. All models control for institution where student enrolled and first year of enrollment and centered placement test score.

Source: Author's calculations

Appendix E: Student Surveys

Office for Education Policy

Dear Student,

Greetings from the Office for Education Policy at the University of Arkansas! This research is part of a dissertation designed to evaluate and measure the impact of intro-level courses at universities in Arkansas. Part of the evaluation is to survey students about their experiences, expectations, opinions, and self-perceptions. Because the policies are designed at the state level, this survey is meant to give a voice to the students affected by them. There is no risk to you completing this survey, however, completing it will be extremely helpful to research and gaining a better understanding of student experiences.

Following this letter, you will find a survey regarding your experiences and perceptions at the beginning of this course. By completing it, you certify that you are at least 18 years of age and are consenting to have your responses included in this research. Please fill out the survey and return it. **Please do not write your name anywhere ON THE SURVEY following this introductory letter so your responses remain anonymous**. Your privacy is important for this research. You will have an opportunity to provide more information on your experiences and perceptions of this course at the end of the semester with an exit survey.

If you have any additional questions about this survey, please contact the principal research via email (etrhines@email.uark.edu) or call (479) 575-3773. This project has been reviewed by the Institutional Review Board at the University of Arkansas which oversees research involving human subjects. Any questions or concerns can be directed to Ro Windwalker at irb@uark.edu or via phone at 479-575-2208.

Thank you for your cooperation and participating in this survey! It is helpful to gaining a better understanding of student experiences at the University.

Evan Rhinesmith

If you would like to participate in a focus group session to provide more information on your experiences in this course, please write your name and email in the space provided and detach this portion and give it to the person conducting this survey. If you are selected to participate, you will be notified via email of the date and time.
Thank you!

Your name:
____

Email: ________________________________@uark.edu

English 0002 Beginning of Semester Survey

Directions: This survey asks questions about you, your experiences with English, and ENGL 0002. Please fill it out honestly and clearly by circling only one answer unless otherwise indicated. Thank you; we appreciate your time.

Please indicate your level of agreement with each of the following statements		**1: Strongly Agree**	**2: Agree**	**3: Disagree**	**4: Strongly Disagree**
1.	I feel good about who I am as a student.	1	2	3	4
2.	I take pride in the quality of my coursework.	1	2	3	4
3.	I can do well on tests, even when they're difficult.	1	2	3	4
4.	I can earn A's in most or all of my courses.	1	2	3	4
5.	I believe I am capable of passing this course.	1	2	3	4
6.	What is taught in this course will help me pass Comp. I.	1	2	3	4
7.	Taking this course has made me rethink my intended major.	1	2	3	4
8.	Taking this course will delay my time to graduation.	1	2	3	4
9.	What I learn in this course will help me in other subjects.	1	2	3	4
10.	My high school English courses did not prepare me for college-level writing and reading	1	2	3	4
11.	This class will be too easy for me.	1	2	3	4
12.	I am a better writer/reader than most of my classmates	1	2	3	4
13.	I enjoy reading outside of class.	1	2	3	4
14.	I know what resources the University offers that will help me pass my classes.	1	2	3	4
15.	I know where I can get on-campus writing help.	1	2	3	4

16.	I plan to use the writing center to help with my writing assignments.	1	2	3	4

Please consider the following 8 statements and indicate how much they describe you. Be honest—there are no right or wrong answers!		**Very much like me**	**Mostly like me**	**Somewhat like me**	**Not much like me**	**Not like me at all**
17.	New ideas and projects sometimes distract me from previous ones.	○	○	○	○	○
18.	Setbacks don't discourage me.	○	○	○	○	○
19.	I have been obsessed with a certain idea or project for a short time but later lost interest.	○	○	○	○	○
20.	I am a hard worker.	○	○	○	○	○
21.	I often set a goal but later choose to pursue a different one.	○	○	○	○	○
22.	I have difficulty maintaining my focus on projects that take more than a few months to complete.	○	○	○	○	○
23.	I finish whatever I begin.	○	○	○	○	○
24.	I am diligent.	○	○	○	○	○

Please continue to next page…

Please consider the following 8 statements and indicate how much they describe you. Be honest—there are no right or wrong answers.		**1: Not true at all**	**2: Somewhat untrue**	**3: Somewhat true**	**4: Very True**
25.	I finish my assignments because I feel guilty if I do not.	1	2	3	4
26.	If I do my assignments, it's because I want to better understand the material.	1	2	3	4
27.	I follow advice on how to do well in my courses because it will help me become a better student.	1	2	3	4

28.	If I attend class regularly, it's because I want to get a good grade.	1	2	3	4
29.	If I turn in a class assignment on time, it's because it makes me happy to be on time.	1	2	3	4
30.	If I raise my hand in class, it's because I want to receive a good participation grade.	1	2	3	4
31.	If I turn in a class assignment on time, it's because I want people to think that I am a good student.	1	2	3	4
32.	If I attend class often, it's because I enjoy learning.	1	2	3	4

Please indicate whether you consider the following 7 statements to be true or false.		**True**	**False**
33.	I need to pass this class to enroll in Composition I.	T	F
34.	This class is required for students who scored below a 19 on the English section of the ACT (470 SAT Verbal)	T	F
35.	All students in this class have to enroll in ENGL 0013.	T	F
36.	Earning credit in this course can be counted towards graduation.	T	F
37.	All students have to earn Composition I credit to graduate.	T	F
38.	I can only take this course in the fall semester of my first year.	T	F
39.	I can take the COMPASS test to place out of this course.	T	F

40.	What is your race/ethnicity? (Circle ALL that apply)	Black	American Indian	Asian/Pacific Islander	Hispanic	White
41.	What high school did you attend? Please provide city and state.					
42.	Have you ever been diagnosed with a learning disability	Yes		No		
43.	Are you currently working either on or off campus?	On Campus		Off Campus		Both

44.	Are you joining Greek life?	Yes		No		
45.	What year are you in school?	1st year	2nd year	3rd year	4th year	5th year +
46.	How old are you at the start of this school year?					
47.	What is your major/intended major?					

If you have any other comments or concerns, please write them here.

English 0013 Beginning of Semester Survey

Directions: This survey asks questions about you, your experiences with English, and ENGL 0013. Please fill it out honestly and clearly by circling only one answer. Thank you; we appreciate your time.

Please indicate your level of agreement with each of the following statements		**1: Strongly Agree**	**2: Agree**	**3: Disagree**	**4: Strongly Disagree**
1.	I feel good about who I am as a student.	1	2	3	4
2.	I take pride in the quality of my coursework.	1	2	3	4
3.	I can do well on tests, even when they're difficult.	1	2	3	4
4.	I can earn A's in most or all my courses.	1	2	3	4
5.	I believe I am capable of passing this course.	1	2	3	4
6.	What is taught in this course will help me pass Comp. I.	1	2	3	4
7.	Taking this course has made me rethink my intended major.	1	2	3	4
8.	Taking this course will delay my time to graduation.	1	2	3	4
9.	What I learn in this course will help me in other subjects.	1	2	3	4
10.	My high school English courses did not prepare me for college-level writing and reading	1	2	3	4
11.	This class will be too easy for me.	1	2	3	4
12.	I am a better writer/reader than most of my classmates	1	2	3	4
13.	I enjoy reading outside of class	1	2	3	4
14.	I know what resources the University offers that will help me pass my classes.	1	2	3	4
15.	I know where I can get on-campus writing help.	1	2	3	4
16.	I plan to use the writing center to help with my writing assignments.	1	2	3	4

Please consider the following 8 statements and indicate how much they describe you. Be honest—there are no right or wrong answers!		Very much like me	Mostly like me	Somewhat like me	Not much like me	Not like me at all
17.	New ideas and projects sometimes distract me from previous ones.	○	○	○	○	○
18.	Setbacks don't discourage me.	○	○	○	○	○
19.	I have been obsessed with a certain idea or project for a short time but later lost interest.	○	○	○	○	○
20.	I am a hard worker.	○	○	○	○	○
21.	I often set a goal but later choose to pursue a different one.	○	○	○	○	○
22.	I have difficulty maintaining my focus on projects that take more than a few months to complete.	○	○	○	○	○
23.	I finish whatever I begin.	○	○	○	○	○
24.	I am diligent.	○	○	○	○	○

Please continue to next page…

Please consider the following 8 statements and indicate how much they describe you. Be honest—there are no right or wrong answers!		1: Not true at all	2: Somewhat untrue	3: Somewhat true	4: Very True
25.	I finish my assignments because I feel guilty if I do not.	1	2	3	4
26.	If I do my assignments, it's because I want to better understand the material.	1	2	3	4
27.	I follow advice on how to do well in my courses because it will help me become a better student.	1	2	3	4
28.	If I attend class regularly, it's because I want to get a good grade.	1	2	3	4

29.	If I turn in a class assignment on time, it's because it makes me happy to be on time.	1	2	3	4
30.	If I raise my hand in class, it's because I want to receive a good participation grade.	1	2	3	4
31.	If I turn in a class assignment on time, it's because I want people to think that I am a good student.	1	2	3	4
32.	If I attend class often, it's because I enjoy learning.	1	2	3	4

Please indicate where you consider the following 7 statements to be true or false.		**True**	**False**
33.	I need to pass this class to enroll in Composition I.	T	F
34.	This class is required for students who scored below a 19 on the English section of the ACT (470 SAT Verbal)	T	F
35.	All students in this class have to enroll in ENGL 0002.	T	F
36.	Earning credit in this course can be counted towards graduation.	T	F
37.	All students have to earn Composition I credit to graduate.	T	F
38.	I can only take this course in the fall semester of my first year.	T	F
39.	I can take the COMPASS test to place out of this course.	T	F

40.	What is your race/ethnicity? (Circle ALL that apply)	Black	American Indian	Asian/ Pacific Islander	Hispanic	White
41.	What high school did you attend? Please provide city and state.					
42.	Have you ever been diagnosed with a learning disability	Yes		No		

43.	Are you currently working either on or off campus?	On Campus	Off Campus	Both		
44.	Are you joining Greek life?	Yes	No			
45.	What year are you in school?	1st year	2nd year	3rd year	4th year	5th year +
46.	How old are you at the start of this school year?					
47.	What is your major/intended major?					

If you have any other comments or concerns, please write them here.

English 1013 Beginning of Semester Survey

Directions: This survey asks questions about you, your experiences with English, and ENGL 1013. Please fill it out honestly and clearly by circling only one answer unless otherwise indicated. Thank you; we appreciate your time.

Please indicate your level of agreement with each of the following statements		**1: Strongly Agree**	**2: Agree**	**3: Disagree**	**4: Strongly Disagree**
1.	I feel good about who I am as a student.	1	2	3	4
2.	I take pride in the quality of my coursework.	1	2	3	4
3.	I can do well on tests, even when they're difficult.	1	2	3	4
4.	I can earn A's in most or all of my courses.	1	2	3	4
5.	I believe I am capable of passing this course.	1	2	3	4
6.	What is taught in this course will help me in other English courses.	1	2	3	4
7.	Taking this course has made me rethink my intended major.	1	2	3	4
8.	Taking this course will delay my time to graduation.	1	2	3	4
9.	What I learn in this course will help me in other subjects.	1	2	3	4
10.	My high school English courses did not prepare me for college-level writing and reading	1	2	3	4
11.	This class will be too easy for me.	1	2	3	4
12.	I am a better writer/reader than most of my classmates	1	2	3	4
13.	I enjoy reading outside of class.	1	2	3	4
14.	I know what resources the University offers that will help me pass my classes.	1	2	3	4
15.	I know where I can get on-campus writing help.	1	2	3	4
16.	I plan to use the writing center to help with my writing assignments.	1	2	3	4

Please consider the following 8 statements and indicate how much they describe you. Be honest—there are no right or wrong answers!		Very much like me	Mostly like me	Somewhat like me	Not much like me	Not like me at all
17.	New ideas and projects sometimes distract me from previous ones.	○	○	○	○	○
18.	Setbacks don't discourage me.	○	○	○	○	○
19.	I have been obsessed with a certain idea or project for a short time but later lost interest.	○	○	○	○	○
20.	I am a hard worker.	○	○	○	○	○
21.	I often set a goal but later choose to pursue a different one.	○	○	○	○	○
22.	I have difficulty maintaining my focus on projects that take more than a few months to complete.	○	○	○	○	○
23.	I finish whatever I begin.	○	○	○	○	○
24.	I am diligent.	○	○	○	○	○

Please continue to next page…

Please consider the following 8 statements and indicate how much they describe you. Be honest—there are no right or wrong answers.		1: Not true at all	2: Somewhat untrue	3: Somewhat true	4: Very True
25.	I finish my assignments because I feel guilty if I do not.	1	2	3	4
26.	If I do my assignments, it's because I want to better understand the material.	1	2	3	4
27.	I follow advice on how to do well in my courses because it will help me become a better student.	1	2	3	4
28.	If I attend class regularly, it's because I want to get a good grade.	1	2	3	4

29.	If I turn in a class assignment on time, it's because it makes me happy to be on time.	1	2	3	4
30.	If I raise my hand in class, it's because I want to receive a good participation grade.	1	2	3	4
31.	If I turn in a class assignment on time, it's because I want people to think that I am a good student.	1	2	3	4
32.	If I attend class often, it's because I enjoy learning.	1	2	3	4

33.	What is your race/ethnicity? (Circle ALL that apply)	Black	American Indian	Asian/ Pacific Islander	Hispanic	White
34.	What high school did you attend? Please provide city and state.					
35.	Are you currently working either on or off campus?	On Campus		Off Campus		Bot h
36.	Are you joining Greek life?	Yes			No	
37.	What year are you in school?	1st year	2nd year	3rd year	4th year	5th year +
38.	How old are you at the start of this school year?					
39.	What is your major/intended major?					

If you have any other comments or concerns, please write them here.

Appendix F: IRB Approval

UNIVERSITY OF ARKANSAS

Office of Research Compliance
Institutional Review Board

April 18, 2017

MEMORANDUM

TO:	Evan Rhinesmith Leesa Foreman Katherine Kopotic Sarah McKenzie Gary Ritter
FROM:	Ro Windwalker IRB Coordinator
RE:	PROJECT MODIFICATION
IRB Protocol #:	16-05-761
Protocol Title:	*An Evaluation of Arkansas's Developmental Coursework Policy at Post-Secondary Institutions*
Review Type:	☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB
Approved Project Period:	Start Date: 04/18/2017 Expiration Date: 05/18/2017

Your request to modify the referenced protocol has been approved by the IRB. **This protocol is currently approved for 300,200 total participants.** If you wish to make any further modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

Please note that this approval does not extend the Approved Project Period. Should you wish to extend your project beyond the current expiration date, you must submit a request for continuation using the UAF IRB form "Continuing Review for IRB Approved Projects." The request should be sent to the IRB Coordinator, 109 MLKG Building.

For protocols requiring FULL IRB review, please submit your request at least one month prior to the current expiration date. (High-risk protocols may require even more time for approval.) For protocols requiring an EXPEDITED or EXEMPT review, submit your request at least two weeks prior to the current expiration date. Failure to obtain approval for a continuation *on or prior to* the currently approved expiration date will result in termination of the protocol and you will be required to submit a new protocol to the IRB before continuing the project. Data collected past the protocol expiration date may need to be eliminated from the dataset should you wish to publish. Only data collected under a currently approved protocol can be certified by the IRB for any purpose.

If you have questions or need any assistance from the IRB, please contact me at 109 MLKG Building, 5-2208, or irb@uark.edu.

109 MLKG • 1 University of Arkansas • Fayetteville, AR 72701-1201 • (479) 575-2208 • Fax (479) 575-6527 • Email irb@uark.edu

UNIVERSITY OF
ARKANSAS

Office of Research Compliance
Institutional Review Board

March 22, 2016

MEMORANDUM

TO:	Gary Ritter Evan Rhinesmith Elise Swanson
FROM:	Ro Windwalker IRB Coordinator
RE:	New Protocol Approval
IRB Protocol #:	16-02-559
Protocol Title:	*Profiles of Successful College Students and Best Predictors of Success*
Review Type:	☐ EXEMPT ☒ EXPEDITED ☐ FULL IRB
Approved Project Period:	Start Date: 03/18/2016 Expiration Date: 03/17/2017

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (https://vpred.uark.edu/units/rscp/index.php). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 45,000 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 109 MLKG Building, 5-2208, or irb@uark.edu.

109 MLKG • 1 University of Arkansas • Fayetteville, AR 72701-1201 • (479) 575-2208 • Fax (479) 575-6527 • Email irb@uark.edu