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High school course selection can have important implications for future student success as both the rigor and number of high school courses taken have been associated with the likelihood of dropping out of high school (Werblow et al., 2013), preparation for college-level courses (Gaertner et al., 2014; Long et al., 2008), and college enrollment and completion (Kim et al., 2015). These outcomes also may be influenced by statewide policies that mandate the number of courses, the types of courses, and the course standards that must be mastered before students can graduate from high school (e.g. Nomi, 2012; Phaett et al., 2016). Policymakers therefore must consider whether policies affecting course selection may have unintended consequences for students who are redirected from a more or less advanced course track that is better suited for their level of preparation.

In 2008, Florida implemented a statewide policy that changed the requirement for the type of math and/or English course taken during grade 12 by non-college-ready students. While college readiness is often considered to include several dimensions including cognitive strategies, content knowledge, academic skills, and contextual skills (e.g. Conley, 2007), Florida's reform focused more narrowly on academic readiness. The Florida College and Career Readiness Initiative (FCCRI) mandated that students scoring below college-ready in math or reading on a college placement test in grade 11 take college readiness and success (CRS) courses in grade 12. These courses were intended to align with college developmental education (DE) courses, with the goal of helping more students enroll in for-credit courses once in college. Math CRS courses typically reviewed material from Algebra 1 through Algebra 2, while English CRS courses had many different structures (Identifying Reference, 2014).

Initiatives like the FCCRI have grown in popularity, as thirty-nine states had adopted similar state or local efforts to implement college readiness courses by 2017 (Fay et al., 2017). These types of college readiness reforms may have had mixed effects on subsequent student success (Identifying Reference, 2019). This may be due in part to policies that assign students from too broad of a range of achievement levels to college readiness courses. Little is known about which students are most likely to benefit or how college readiness courses compare to the types of courses that students would otherwise take in grade 12.

Our research provides further insight into the intended and unintended consequences of the FCCRI for students from different high school coursetaking tracks by analyzing the impact of the initiative on grade 12 course-taking overall and by high school course-taking history. We also add to prior research on the impact of the FCCRI (Identifying Reference, 2017) by analyzing first-year college outcomes by high school course-taking history to determine whether the FCCRI inappropriately diverted students into CRS courses when they might have had better outcomes otherwise. Separating students by course-taking tracks serves two functions. First, it allows us to identify the students most likely to have complied with and benefitted from assignment to CRS courses. Even among students with similar college placement test scores, there is considerable heterogeneity in prior coursework, so we explore whether the initiative had differential impacts based on students' academic backgrounds. This has implications for considering whether the FCCRI should have been targeted toward all students scoring below college-ready or a more narrowly tailored subgroup. Second, it helps to address mismatch between course-taking history and assessment scores. For example, consider a student who has taken advanced math courses but has poor placement scores. If the discrepancy were due to measurement error on the placement test, assignment to a less advanced course could harm that

student's postsecondary outcomes. However, the discrepancy could also exist because the student had been taking overly advanced courses and might benefit from additional review. These scenarios will each be true for some students; we aim to determine their net effect.

Specifically, we address the following research questions:

1) How did the FCCRI affect choice of grade 12 courses levels and subjects, both overall and by course taking history in grades 9 through 11?
2) How did the FCCRI affect enrollment and pass rates in different college course levels based on these course taking histories?

Using a regression discontinuity design with data from the population of targeted students statewide, we find that students targeted for CRS courses from different high school coursetaking tracks were all more likely to enroll in standard and CRS courses, but would have taken different sets of courses absent the FCCRI. In math, the effect of assignment to CRS on enrollment in postsecondary course levels and subsequent pass rates varied by track, with some students appearing to benefit from the FCCRI while other students seem to be worse off. In English, students who took chiefly standard-level courses in high school were less likely to enroll in gateway college courses (which many would have failed) and instead enrolled in upper DE courses (which they were more likely to pass). Students on the most advanced high school English track were more likely to enroll in college in the semester after high school graduation and more likely to take and pass a gateway English course in their first year.

We conclude by discussing the implications of the results. First, many students assigned to CRS courses were induced away from more advanced courses. While some students were diverted to more appropriate courses, others may have been better prepared for college if they had greater flexibility to enroll in higher-level courses. Second, since students in CRS courses

had a wide range of test scores and course taking histories, teaching to any one ability level would fail to serve a large number of students. Third, the FCCRI had disparate impacts by course taking history; some students were better prepared to pass gateway college courses, others may have been diverted to college courses for which they were unprepared, and still others may have been dissuaded from more advanced courses for which they were in fact prepared. This suggests that even though the FCCRI may have been well-intentioned in targeting all students below college-ready, it would have been better implemented if it focused on students from a narrower range of academic backgrounds.

Policy Context

Florida has required students to complete 24 credits for a standard high school diploma since 1989, although there have been changes in the types of courses that students must complete. During the timeframe for our analysis, students were required to complete four credits in English (with major concentrations in composition, reading, and literature) and four in math (including Algebra 1, Geometry, and two electives) (Florida Statutes § 1003.428, 2011). The number of courses in each subject and the state standards for core courses remained the same under the FCCRI; the only change was to the type of math and/or English course taken in grade 12. After high school, students who enrolled in a public two-year college were required to take a computer adaptive placement test called the Postsecondary Education Readiness Test (PERT) to determine their initial placement in college math and English courses.[1] Students who scored below the college-ready cutoff on the PERT were placed into non-credit bearing DE courses, while those scoring above the cutoff were placed into college-level courses. Prior to the statewide mandate for the FCCRI, approximately 70% of entering first-time-in-college (FTIC)

[1] DE courses in Florida are provided almost exclusively at two-year colleges.

students scored below college-ready in at least one subject area (Underhill, 2013). Among these students, 91% were assigned to developmental math and 49% were assigned to developmental reading. Just over half of students (52%) assigned to developmental education courses successfully completed their developmental requirements.

Senate Bill 1908 (2008) introduced the voluntary FCCRI, which required high schools to provide access to the placement assessment for DE or college-level math and English courses at public two-year colleges. High schools were also required to provide CRS courses in math and English in grade 12 for students scoring below college-ready on this assessment. However, students were not required to participate in either the placement assessment or CRS coursework. Beginning in 2011/12, House Bill 1255 (2011) required all students with mid-range scores in math or reading on the grade 10 state assessment (the Florida Comprehensive Assessment Test, or FCAT) to take PERT in grade 11 in the corresponding content area. Students who scored below college-ready on either section of the PERT were required to complete (but not necessarily pass) a corresponding CRS course to meet new high school graduation requirements.[2] However, schools did not always adhere to the criteria used to target students for the FCCRI, as the data indicate imperfect compliance with both PERT testing and CRS course enrollment rates. This may be due to the lack of enforcement or sanctions for non-compliance by the state department of education. Student-level participation rates in college readiness testing among FCAT targeted students were 76.0% in math and 74.6% in reading (authors' calculations). Fifty-six percent of students scored below college-ready in math and 36% took the math CRS course. Thirty-eight percent of students scored below college-ready in reading and

[2] Students who had already completed four credits in math or English were not required to pass the CRS course to graduate since the FCCRI did not change the number of credits required for graduation. There were concerns that requiring students to pass the CRS course could set standards too high that some students would not be able to graduate.

24% took the English CRS course.[3] The FCCRI did not require students who scored below college-ready in grade 11 to retake the PERT in grade 12, but many students did. Students who scored college-ready in high school were exempt from developmental education in college for up to two years.

The Florida Department of Education defined the topics to be covered in CRS courses; however, districts, high schools, and teachers had considerable discretion in how they were implemented. A description of course content, instructional practices, and standards for the most common CRS course in each subject area is provided in Appendix A. While all CRS courses shared the same title, CRS teachers often had to develop their own lesson plans and materials, so content and pedagogy varied even within schools (Identifying Reference, 2014). Many CRS courses aimed to help students test college-ready, develop the academic and soft skills needed in college along with career-related skills, and decide what to do after high school, though emphases varied. In some schools, CRS courses were very similar to standard courses that existed prior to the FCCRI. Thus, it is important to examine whether the FCCRI changed not only the course levels that students took in grade 12 (basic, standard, honors, or AP) but the specific subjects in which they were enrolled.

Literature Review

It is important to understand how the FCCRI alters students' coursetaking patterns, since high school course selection is associated with students' short-term and long-term academic success. Nationwide, there is considerable variation both across and within schools in the rigor of courses that satisfy high school graduation requirements; this rigor is correlated with various student characteristics. Low-income and underrepresented racial/ethnic students tend to take

[3] See appendix table B7 for additional details on student-level compliance.

fewer advanced courses, which is largely attributed to differences in factors such as test scores prior to high school entry (Archbald & Farley-Ripple, 2012; Conger et al., 2009). The social influence of family and friends may influence the number of advanced courses that students take in math and science (Gottfried et al., 2017). Differences in school characteristics may also contribute to variation in course taking patterns. For example, there is some evidence that rural schools and high-poverty schools tend to offer fewer AP courses (Klopfenstein, 2004). These results may differ by context, as Conger et al. (2009) found no differences in the availability of AP or IB courses by school demographic characteristics in Florida.

High school course taking rigor may influence students' educational attainment. Course taking patterns set a long-term trajectory, as students who take more rigorous courses in grade 9 are more likely to complete college-preparatory courses (Finkelstein & Fong, 2008) and advanced subjects like Precalculus (Tyson & Roska, 2017) by grade 12. Students on higher academic tracks are also less likely to drop out of high school (Werblow et al., 2013).

Taking more rigorous math courses in high school is associated with improvements in postsecondary outcomes such as the likelihood of enrolling in college (Aughinbaugh, 2012; Kim et al., 2015) and readiness for college courses (Long et al., 2008; Harwell et al., 2014). Prior math high school coursework is an important predictor of performance in college courses, particularly in math. For example, Harwell et al. (2014) found that both the number and type of high school math courses completed are associated with the likelihood of beginning college with a developmental education course in math. Additionally, research has shown that students who complete Algebra II in high school have a higher probability of passing an intermediate algebra course in college (Woods et al., 2018) and tend to have higher mean GPAs in college compared to their peers (Gaertner et al., 2014). High school performance may also influence subsequent

college coursetaking and major selection, as high school students with high math achievement are more likely to pursue a STEM degree in college (Chen & Weko, 2009; Wang, 2013), while those who demonstrate high proficiency in English tend towards degrees in the arts and humanities (Porter & Umbach, 2006).

Improvement in early college outcomes due to high school coursetaking may also imply longer-term postsecondary success. Completion of higher-level high school math courses is positively correlated with college graduation, even after controlling for variables like ability, motivation, and family characteristics (Gaertner, Kim, DesJardins, & McClarty, 2014; Rose & Betts, 2001). Additionally, students who complete a course more advanced than Algebra II prior to enroll in postsecondary education are twice as likely to complete a bachelor's degree (Adelman, 2005).There is mixed evidence on the impact of highest math course taken in high school on longer-term outcomes such as wages and career advancement (Gaertner et al., 2014; Goodman, 2017).

High school curriculum reforms are often implemented in a way that does not match the original design of the state-approved curriculum since teachers have autonomy on how to present the content (Cuban, 1993). These types of reforms also face challenges due to unintended consequences that vary by student subgroups. For example, Chicago Public Schools attempted to increase the likelihood that students would complete a college preparatory curriculum by requiring all students to complete Algebra 1 and English 1 in grade 9. The policy not only failed to improve test scores or college enrollment rates (Allensworth et al., 2009), it may have reduced higher-performing students' test scores by assigning them to classes with lower-ability peers (Nomi, 2012).

There is relatively little research examining statewide policies on college readiness courses, and the findings tend to be mixed. Our own prior research found the FCCRI had few discernable effects on student outcomes in the first year of college, although the reform may be most beneficial for mid-performing students on the baseline assessment (Identifying Reference, 2018). The FCCRI also had no substantive impacts on longer-term postsecondary outcomes, such as persistence, transfer, or degree completion, for students near the college readiness cutoffs (Identifying Reference, 2019). Another study on a voluntary math college transition course in West Virginia found that students in transition courses were less likely to pass a gatekeeper math course in college and earned fewer college credits (Phaett et al., 2016). One explanation for these negative results may be that students took math transition courses instead of higher-level courses with higher-ability peers. Additionally, a study of a similar program in Tennessee, known as the Seamless Alignment of Integrated Learning Support (SAILS), had mixed results, as students were more likely to be placed into college-level math courses than developmental courses but experienced no gains in their understanding of math concepts (Kane et al., 2018). The SAILS program also had no impact on the likelihood of passing a college-level math course during the first year of college (Kane et al., 2019).

Another important consideration is that initiatives like the FCCRI could have a negative psychological impact on students if being made aware that they are below college-ready results in self-doubt and leads them to change their coursetaking or college trajectories. Previous research has found that community college students assigned to developmental education courses often experience stigma, resulting in lower self-esteem and “cooled-out” aspirations (Deil-Amen & Rosenbaum, 2002). Scoring below college-ready could have worse psychological impacts for

students who were in advanced high school tracks, which further supports the importance of examining whether outcomes differ based on students' prior coursetaking trajectories.

Methods

The FCCRI implicitly assumed that many non-college-ready students chose to take courses in grade 12 that inadequately prepared them for college-level work. CRS courses were intended to be a better choice for all students scoring below college-ready. However, students might have taken a variety of courses even conditional on their course-taking histories and PERT scores. As an increase in the rigor of high school course taking tends to be associated with improved postsecondary outcomes (e.g. Aughinbaugh, 2012; Kim et al., 2015; Long et al., 2008; Harwell et al., 2014), our hypothesis is that the impact of the FCCRI differed depending on students' course taking histories and how their trajectory was altered in grade 12. While we do not know for certain how challenging each course is, and whether this level of challenge is sufficient for any given student, the results of our analyses provide insight into whether the FCCRI inappropriately diverted students into CRS courses when they might have had better outcomes otherwise. We consider three scenarios about how students may have been affected by the FCCRI depending on their incoming level of academic preparation based on their prior coursework. First, students may have been *inappropriately diverted from more advanced courses* if students placed in CRS courses took DE in college, while similar peers just above the college-ready cut sores (and thus not assigned to take CRS) enrolled in gateway courses and passed. Second, students may have been *appropriately placed* in CRS courses if students in these courses enrolled in and passed gateway courses at similar or higher rates than their peers. Third, they may have been *inappropriately diverted from less advanced courses* if students in CRS courses were placed in similar college courses as their peers but were less likely to pass.

We use RD analysis to analyze the impact of the initiative on grade 12 course-taking overall and by high school course-taking history. RD analysis provides causal estimates as long as the data meet strict validity requirements. If students on either side of the treatment cutoff are otherwise similar, differences in their outcomes will be attributable to the treatment alone. The main drawback of RD is that its results are not generalizable far from the cutoff being analyzed.

Students were assigned to take the PERT in grade 11 if they were in the mid-range of performance on the FCAT in grade 10 (levels 2-4 out of 5 in math and levels 3-4 out of 5 in reading). Students who scored below college-ready on the PERT were assigned to CRS courses in grade 12. We focus on the PERT's college readiness cutoff because it directly affected high school course taking. PERT scores between 50 and 150 function as nearly continuous achievement measures, with college readiness cutoffs at 113 in math and 104 in reading. Students on either side of these cutoffs differed primarily in their assignment to treatment, lending our estimates a causal interpretation.

The PERT may have been low-stakes for students who neither planned to attend a postsecondary institution nor cared about course selection in grade 12. Students who did either might view the exam as high-stakes. However, students who met concordance scores on the SAT or ACT (which we do not observe in our data) could avoid taking CRS courses in high school or DE courses in college, lowering the stakes of the PERT.

Our estimates use a sharp RD design:

$$Y_i = \alpha f\left(\widetilde{R_\iota}\right) + X_i\beta + \gamma_i * \mathbf{1}\left\{\widetilde{R_\iota} \leq 0\right\} + \varepsilon_i \qquad (1)$$

where Y_i is an outcome of interest for individual i, $\widetilde{R_\iota} = R_i - c$ is the running variable R_i recentered around cutoff c, X_i is a vector of student characteristics, and ε_i is a mean-zero error term. In our context, R_i is a student's first grade 11 PERT score in math or English and c is the

relevant college readiness cutoff.[4] We use $\{\widetilde{R_i} \leq 0\}$ because students were assigned to treatment if they scored below the college readiness cutoff. We run regressions both overall and by course taking history in grades 9 through 11 to get track-specific estimates of γ_i, the impact on individual i of being in the treatment group; $E[\hat{\gamma}]$ is the average treatment effect at the cutoff when compliance is perfect and the intent-to-treat (ITT) effect at the cutoff otherwise. We present ITT estimates because they reflect the impact of program as it was actually implemented (which has implications for policymakers) and can be interpreted with fewer concerns regarding selection bias. The expectation operator is crucial, as the FCCRI may not have had a uniform effect even within course taking tracks.

Our estimates use local quadratic regression. Many outcomes are not monotonically related to PERT scores, and bandwidths required for accurate linear approximation may sometimes be too narrow for effective RD, so local quadratic regression may be more accurate. We also ran local linear regressions to address the possibility of overfitting; results (available upon request) were generally consistent. To avoid selection bias, we do not condition outcomes on high school graduation or college enrollment.[5] All regressions control for student background variables (gender, free or reduced-price lunch status, race and ethnicity, English language learner status, native English speaker status, disability status, gifted and talented status,[6] cumulative GPA as of grade 10) and a series of dichotomous school level indicators to control for unobserved heterogeneity across institutions; standard errors are clustered by school.

Data

[4] For the small number of students who take the PERT multiple times in grade 11, we do not know which PERT score was used for CRS assignment. We opt to use students' first scores, as they cannot be manipulated through retesting.
[5] Results conditioned on seamless college enrollment are available upon request.
[6] RD results from sensitivity analyses excluding gifted and talented students are included in Appendix C.

The Florida K–20 Education Data Warehouse provided data through 2013/14 on all Florida public school students who first enrolled in grade 11 during 2011/12. This was the first cohort required to take the PERT in grade 11 or CRS coursework in grade 12.[7] We omit students who transferred to an out-of-state, private, or home school; withdrew from school for medical reasons; or did not have an enrollment record. We merged in data on race and ethnicity, gender, free or reduced-price lunch (FRPL) status, English language learner (ELL) status, and grade 10 GPA to control for student characteristics. We merged in college outcomes and high school courses as outcome variables; high school courses also defined student subgroups. The appendix contains descriptive statistics on the school-level characteristics (Table B2) and student-level characteristics (Table B3). Notably, the median school-level compliance rates with assignment to CRS courses were 71.5% in math and 69.4% in English. Tables B4 and B5 provide descriptive statistics on the outcomes at the school level and student level, respectively. In the overall sample, 51.8% of students seamlessly enrolled in college. The percent of students who seamlessly enrolled in college and took a course in each subject area was 44.8% in math and 43.9% in English.

We limited our data to students with valid scores on both the PERT and the FCAT, because students not targeted for the PERT may not have needed to enroll in CRS courses. Among students who took the PERT in grade 11, 73% scored below college-ready in math and 47% scored below college-ready in reading. Casewise deletion of students missing test scores, GPA, grade 12 courses, or background data leaves N = 88,145 for math and N = 51,267 for

[7] Previous cohorts had very low participation in college readiness testing or CRS courses; they also used a different placement exam, precluding comparison across cohorts. While estimates from this cohort may reflect scale-up of the FCCRI, the subsequent cohort was targeted for PERT testing in math using an Algebra 1 end-of-course assessment, which was not taken in a set grade and therefore complicates sample determination and sample size issues.

English.[8] Students in our sample usually came from the center of the FCAT targeting range. Students near the bottom of this range may have been less likely to have postsecondary plans, while students near the top may have been more likely to have concordance scores on the SAT or ACT that exempted them from the FCCRI. However, we do not observe reasons for noncompliance at any stage of the FCCRI.

The first set of outcome variables relates to grade 12 course selection. Most of them equal 1 if a student enrolled in a particular subject or course level and 0 otherwise. However, since assignment to a CRS course could have led students to alter their overall course loads, we also include the total number of courses taken in the relevant content area during grade 12.[9] S*ubject* refers to courses or groups of courses within the *content areas* of math and English; for example, Calculus or Geometry for math and AP Literature or English 4 Honors for English. *Course level*, refers to the basic, standard, honors, and dual credit levels, and uses the Florida Department of Education's definition, splitting their category of "Honors, IB, AP, AICE, advanced college-preparatory courses, and other courses containing rigorous academic curriculum and performance standards" into separate honors and dual credit categories. CRS courses were offered at the standard level. As students may have taken more than one course at a time in either content area, they may have a value of 1 for multiple subjects or course levels simultaneously.

Two math subjects require definition. *Other standard math* contains all standard-level courses that did not count towards specific subject requirements for graduation; *other advanced*

[8] Approximately 14 percent of records from the full sample were missing data; they do not appear to be systematically different from those included in the analytic sample.

[9] For example, one student might take a CRS course in addition to any other courses he or she was planning on taking (presumably replacing a free period), while another who initially planned to take multiple courses might instead choose to focus his or her effort on the CRS course alone. This also corrects for whether a student takes multiple courses within a given subject—for example, there are several very different courses categorized as "other advanced math," and a student who takes more than one of these courses still has an indicator value of 1.

math contains all non-dual credit courses beyond Algebra 2 at the honors level or higher outside of the three most commonly taken subjects (Calculus, Precalculus, and Integrated Math). Appendix table B6 provides the percent of seniors in each type of high school course by school quartile. At the median school in the math sample, the most common courses were CRS math (enrollment rate of 48.7%), followed by "other" standard math (11.8%) and Algebra 2 (10.5%). At the median school in the English sample, the most common courses were English 4 CRS (39.3%), followed by "other" English (27.7%) and English 4 honors (16.8%).[10] There may be differences in school-level enrollment rates in CRS courses due to both differences in compliance with the FCCRI and differences in the number of students who meet the target criteria for the FCCRI.

Our postsecondary analysis expands on Identifying Reference (2017), which found little overall effect of the FCCRI on enrolling in or passing a for-credit postsecondary course in math or English at the grade 11 PERT's college readiness cutoff. Point estimates for both measures share the same denominator to avoid selection on outcomes and allow comparison of coefficients. However, overall results do not take heterogeneous implementation, compliance, or effects into account. To determine whether particular individuals were more likely to comply with or benefit from the FCCRI, we ran subgroup analyses by course taking history in grades 9 through 11. Separating students by course taking history also lets us predict the courses that each would have taken absent the FCCRI. For these analyses, we divide our sample into three mutually exclusive tracks in math and five in English. We use different numbers of tracks in each content area because students are sorted into courses differently. That is, students entering grade 9 are sorted into math classes first by whether they are taking Algebra 1, Geometry, or

[10] Approximately 6% of targeted students did not enroll in any math courses in grade 12, and 4% of targeted students did not enroll in any English courses in grade 12.

some other course, and then by course level; in English, the vast majority take a course with "English 1" in the title, the main distinction being whether it is at the standard or honors level.

In math, students who took one course per year for all four years of high school were most likely to take Algebra 1, Geometry, and Algebra 2 in grades 9, 10, and 11, respectively. However, only a third took one math course per year in grades 9 through 11, and only a fifth took one English course per year. We therefore defined a *standard track* of students as those who took Algebra 1, Geometry, and Algebra 2 prior to grade 12 and did not take a clearly more advanced subject in that time.[11] Those who took more advanced subjects were grouped into an *advanced track*; those in neither track were labeled a *basic track*.

In English, students usually took versions of English 1, English 2, and English 3 in grades 9, 10, and 11, respectively. We group students into tracks based on these courses—a *standard track* for students who took the standard versions of all three, an *honors track* for students who took the honors versions of all three, and a *mixed track* for students who switched between the two.[12] Students who took an AP, IB, or dual-credit course in grade 11 (regardless of grades 9 or 10) were grouped into an *AP track*. A small number of students who took supplemental remediation or basic skills courses in grades 9 through 11 were grouped into a basic track; we omit them from our analysis, as estimates were imprecise. All remaining students were grouped into a fifth *other track.*[13]

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[11] We base this comparison on average FCAT scores among students who took exactly one math course in grade 12. Subjects more advanced than Algebra 2 are Integrated Math, Precalculus, other advanced math, Dual Credit, and Calculus. We omit other standard math, which contains both more- and less-advanced courses.

[12] Courses in American Literature, British Literature, Classical Literature, Contemporary Literature, Great Books, and World Literature count toward these tracks, as some schools used these courses instead of English 1-3.

[13] Students taking ESOL courses are a plurality of this group. However, it also contains students taking English courses above or below their grade level, taking no English courses in a given year, or taking elective courses.

Course selection may also influence student achievement through peer effects. Each track had different demographics and achievement levels. More advanced tracks had more female students and fewer FRPL or special education students. Students in more advanced tracks had higher cumulative GPAs as of grade 10 and higher PERT scores in the corresponding subject. In math, 22,967 targeted PERT-takers were in the basic track, 44,453 were in the standard track, and 20,725 were in the advanced track. In English, 15,642 targeted PERT-takers were in the standard track, 13,817 were in the mixed track, 9,004 were in the honors track, 9,317 were in the AP track, and 1,915 were in the other track.

The second set of outcomes relate to college course enrollments and completions. The sequence of course levels includes no course in math or English, lower-level developmental education (DE), upper-level DE, transitional [math only], gateway (the first college-level course in the subject area), or beyond gateway. Developmental education courses do not count for college-level credit at any of the state colleges. Math is unique in offering a transition course (intermediate algebra) that counts for elective credit but does not count toward the degree requirements in math. Graphical analyses of postsecondary outcomes by high school track and performance on the PERT are provided in appendix figures B1-B4.

Most specifications meet What Works Clearinghouse guidelines (some with reservations, some without). The chief exception is that density checks on the AP English track show a discontinuity with a p-value of 0.017, meaning that the AP track does not meet What Works Clearinghouse (WWC) standards. We still present results from this track, as students' first PERT scores should be immune from manipulation via retesting, but they should be taken with skepticism.[14] For all other tracks, we can confirm that McCrary tests do not show statistically

[14] It is not immediately clear why this discontinuity exists. Scoring college-ready could have been a prerequisite for dual credit enrollment in grade 11; however, because relatively few students took the PERT prior to September 1,

significant discontinuities at the five percent level, satisfying the first WWC standard. Both overall and differential attrition are quite low across all tracks, satisfying the second WWC standard. Several student baseline characteristics vary at the cutoff, but none of these effects reach 25 percent of a standard deviation; controlling for student background characteristics lets us satisfy this standard. We select bandwidths using a cross-validation technique specified in Imbens and Lemeiux (2008).

Results

Effects of the FCCRI on Grade 12 Course-Taking

In Table 1, we show the impact of CRS assignment on the course level taken in each content area. The first half of the table shows results in math, while the second half shows results in English. Rows represent course levels, in increasing order of difficulty. Overall, targeted students in math were 14.4 percentage points more likely to take standard math and 2.2 percentage points less likely to take no math but were 10.2 percentage points less likely to take honors math. Students targeted for CRS courses took approximately 0.06 more math courses. Thus, one in every 17 students took an additional math course (likely CRS) at the college readiness cutoff, while the remaining 16 either pursued their initial plans or took CRS instead of a previously planned course.[15] The most common additional courses taken in grade 12 by students in CRS courses were Algebra 2 or other standard math course for math, and other English or English 4 standard for English (see Table B1). Corresponding results without student

2011, it could not have occurred on a wide scale. Students who took dual credit courses in grade 11 might have had an incentive to study for the PERT if they wished to avoid taking (less-advanced) CRS courses, but this would not produce a discontinuity on initial grade 11 scores.

[15] Assignment to a CRS course should not prompt any students to switch from one non-CRS course to another; however, being labeled college-ready or not college-ready might have this effect.

background variables are graphed in Figure 1, which shows clear discontinuities in standard and honors enrollment.

INSERT TABLE 1 HERE

INSERT FIGURE 1 HERE

When examining the results by high school coursetaking track, targeted math students on both the standard and advanced tracks were more likely to take a math course at the PERT cutoff. All three tracks were between 10.8 and 17.8 percentage points more likely to take standard math (on the basic and standard tracks, respectively). Targeted students on all three tracks were less likely to take honors math ranging from -5.4 percentage points on the basic track to -14.9 percentage points on the standard track), and those on the basic and standard tracks were approximately 2.7 percentage points less likely to take AP, IB, or dual credit math. Targeted students on the advanced track took 0.08 additional math courses (e.g., if 1 in 12 students took CRS math in addition to any other courses and the rest took CRS instead of another course or did not comply).

In English, targeted students were 14.4 percentage points more likely to enroll in standard English but were 13.3 percentage points less likely to enroll in honors English and 2.6 percentage points less likely to enroll in dual credit English. There was no discernible change in the number of English courses taken. The results by high school courstaking track show that targeted students on all five English tracks were more likely to take a standard course. Point estimates range from 9.5 to 19.7percentage points (on the AP and mixed tracks, respectively). Targeted students on all five tracks were also less likely to take an honors course – significant effects range from 5.1 to 21.4 percentage points on the AP and honors track, respectively. Targeted students on the standard, AP, and other tracks were also less likely to take AP, IB, or

dual credit courses. Targeted students on the honors track took 0.08 fewer English courses while there was no discernible effect on the number of courses for students on other tracks.

Overall these results suggest that students near the college readiness cutoff took less advanced courses due to the FCCRI. However, subject and level margins may offset (e.g., standard Calculus is more advanced than honors Precalculus). Table 2 shows how assignment to a CRS course affected subjects taken. Since English subjects cannot be separated or ranked as clearly as math courses, we instead use the five most common courses taken and an "other" category as our subjects. Columns may not sum to zero, either due to different bandwidth selections or because students may take a different number of courses because of treatment. As this effect was already captured in the "none" and "total courses" rows in Table 1, we have opted to avoid redundancy. Corresponding figures are shown for math in Figure 2 and English in Figure 3.

INSERT TABLE 2 HERE

INSERT FIGURES 2 & 3 HERE

In math across all coursetaking tracks, targeted students were 23.9 percentage points more likely to take CRS courses, and were rarely drawn from lower-level courses—enrollment was 5.4 percentage points lower in Other Advanced Math, 5.2 percentage points lower in Precalculus, and 6.3 percentage points lower in Other Standard Math, versus 0.7 percentage points lower in Geometry. In the results by high school coursetaking track, targeted students were between 16.7 and 32.6 percentage points more likely to take CRS math (on the advanced and standard tracks, respectively). The likelihood of being pushed into CRS therefore varied based on course taking history prior to grade 12. Targeted students on the standard track were 11.1 percentage points less likely to take Other Standard Math, 2.2 percentage points less likely

to take Integrated Math, 6.7 percentage points less likely to take Precalculus, 9.2 percentage points less likely to take Other Advanced Math, and 1.6 percentage points less likely to take dual credit math. Those on the basic track were 4.0 percentage points less likely to take Geometry, 5.8 percentage points less likely to take Other Standard math, and 2.7 percentage points less likely to take dual credit math. Those on the advanced track were 3.9 percentage points less likely to take Precalculus and 3.6 percentage points less likely to take Other Advanced Math. In general, more advanced tracks drew from more advanced courses.

In English, all targeted students were 26.1 percentage points more likely to take CRS English; they were 9.3 percentage points less likely to take English 4 Standard, 13.0 percentage points less likely to take English 4 Honors, and 3.7 percentage points less likely to take a course in the "other" category. On the AP and mixed tracks, targeted students were between 15.7 and 33.4 percentage points more likely to take CRS English, respectively. For the standard and honors tracks, the largest decrease came from the corresponding subject—18.7 percentage points in English 4 on the standard track and 19.4 percentage points in English 4 Honors on the honors track. On the AP track, there were decreases among both English 4 Honors (6.6 percentage points) and AP Literature (5.2 percentage points). The mixed track had decreases of 9.7 and 20.0 percentage points in English 4 and English 4 Honors, respectively. The other track had a decrease of 13.9 percentage points in English 4 and 6.4 percentage points in AP Literature.

Effect on College Course-Taking Outcomes by Grade 12 Course Assignment

Altering students' course selection may affect their college readiness. Identifying Reference (2017) found little or no overall effect of the FCCRI at policy cutoffs on non-DE enrollment and passing in the first year after high school; the only significant effect at either grade 11 PERT cutoff was that students were 2.3 percentage points less likely to enroll in non-

DE English (p=0.0774), with no corresponding effect on passing. However, prior interviews suggested that the FCCRI was most useful for a very specific group of students—those both interested in college and on the margin of college readiness. If these characteristics were correlated with course taking tracks, we would expect stronger effects by subgroup than overall.

While we can observe changes in taking and changes in passing each college course level, there could be differences between the new students induced to take the course due to the FCCRI and the existing students who would have taken the course regardless of the FCCRI. At one extreme, all of the new students entering a course could fail while a corresponding number of existing students who previously would have failed could now pass. At the other extreme, all of the new students entering the course could pass while the existing students could be no more or less likely to pass. The actual result is likely somewhere between these two extremes.

Results of the analyses of the effects of the FCCRI on postsecondary outcomes are shown in Table 3 for math and Table 4 for English. The first three rows of each table represent the transition to college—whether targeted students were more likely to graduate from high school, receive dual credit in the relevant content area, or seamlessly enroll in a postsecondary institution. The second group of outcomes shows whether students enrolled in a given content area at all and whether they enrolled in and passed each course level. Both content areas have lower and upper DE courses that do not count for college credit, gateway courses that represent entry-level for-credit courses, and courses beyond the gateway level. Math is unique in having a transition course, Intermediate Algebra, that counts for elective credit but cannot be used to satisfy major or distributional graduation requirements.

INSERT TABLES 3 & 4 HERE

In math there are two statistically significant effects on the first group of outcomes, but neither was large. Students on the basic track were 1.4 percentage points more likely to earn dual credit, and students on the standard track were 1.4 percentage points less likely to do so. Only the latter effect is robust across specifications. There were no statistically significant differences on any track for high school graduation, seamless college enrollment, or any college math.[16]

There were larger effects on college course enrollment. Each track had lower enrollment in transition courses (4.1 percentage points on the basic track, 2.7 on the standard track, and 3.1 on the advanced track), with no discernible change in pass rates. On the basic track, there was a larger increase in gateway enrollment and a smaller increase in passing (6.7 and 4.5 percentage points, respectively). On the standard track, upper DE passing increased by 1.0 percentage point; the coefficient on enrollment was extremely close in magnitude but statistically insignificant. On the advanced track, gateway enrollment increased by 3.3 percentage points and gateway passing increased by 3.1 percentage points. On the advanced track, there was a negative coefficient of 2.0 percentage points for passing a course beyond the gateway level, a possible sign of unintended consequences for the most advanced students.

These results suggest that some students on the basic track were moved from transition to gateway math courses. However, the coefficient on passing was only two thirds of that on enrollment. Some basic track students encouraged to take higher-level math courses may not have been adequately prepared, and some students who would have taken a gateway course anyway may have been poorly served by CRS courses. On the advanced track, students who would have enrolled in Intermediate Algebra fared better in gateway courses—point estimates on

[16] While results for college course enrollment and passing do not condition on seamless college enrollment, this provides evidence that doing so would not introduce substantial bias from selection on observables. Results conditioning on seamless college enrollment are available upon request.

enrollment and passing are nearly identical. However, assignment to CRS courses (instead of more advanced math courses) may have harmed advanced track students who planned to take advanced college courses. The FCCRI had the smallest effect for students on the standard track. Enrollment in transition courses decreased, but there were no discernible changes in any other course level.

Table 4 shows differences in postsecondary outcomes by English track. In the first set of outcomes, there are several statistically significant effects. The impact on high school graduation on the mixed track is not robust across specifications; however, a 1.6 percentage point decrease in dual credit earned is. On the AP track, seamless college enrollment increased by 7.0 percentage points and English enrollment increased by 9.0 percentage points; however, these effects could be attributable to a failed McCrary density test, with a smaller denominator below college-ready.

Students on the standard English track were 1.0 percentage points more likely to take lower DE English, 3.8 percentage points more likely to take upper DE English, 4.2 percentage points less likely to take gateway English, and 1.3 percentage points less likely to take an English course beyond the gateway level. The upper DE pass rate rose by 2.8 percentage points, while the number passing other course levels remained unchanged. On the mixed track, there was no statistically significant change in enrollment or passing at any level. On the honors track, upper DE enrollment increased by 3.4 percentage points and passing by 2.9 percentage points, but there was no discernible offsetting enrollment decrease elsewhere. On the AP track, gateway enrollment increased by 9.1 percentage points and passing by 8.2 percentage points, but these results could also be attributable to the failed McCrary tests. Beyond gateway enrollment decreased by 6.5 percentage points on the other track, but other results were highly imprecise.

Policy implications vary greatly by English track. On the standard track, many students may have been redirected from taking gateway English and instead enrolled in upper DE, which better suited their abilities. Several students may also have enrolled in upper DE instead of lower DE. While helping students succeed in higher-level courses would have been preferable, helping them avoid failure in lower-level courses was still a good result. Improvements in upper DE enrollment and passing on the mixed and honors tracks were also good outcomes, though we have concerns about our inability to ascertain the college courses that these students were drawn from. Results from the AP track appear to have been the most positive, as many students went from not enrolling in any postsecondary English to passing a gateway course.[17]

Discussion

The FCCRI affected students' grade 12 course selection based on their prior course taking tracks in ways that may have benefitted some students while harming others. These findings consistent with research on other large-scale curricular reform efforts, which have shown that policies may have unintended consequences for students who are redirected from a more or less advanced course track that is better suited for their level of preparation (e.g. Nomi, 2012; Phaett et al., 2016). Most students took CRS courses instead of other standard-level courses, although some students, particularly those with advanced prior trajectories, were diverted from more higher-level courses like honors and dual enrollment. Just as developmental education classes may be associated with stigma that could negatively impact self-esteem (Deil-Amen & Rosenbaum, 2002), similar trends may emerge in CRS courses, particularly if participants' peers were assigned to more rigorous courses.

[17] If students who would have been exempt from a first-year English course were instead required to take one, it might have been a net harm. The insignificant coefficient on dual credit, however, makes clear that this did not happen on a wide scale. Students who neither scored in the highest two FCAT levels nor scored college ready on the PERT did not earn enough AP credits for this effect to be noteworthy.

These changes in high school courses had mixed results on college coursetaking outcomes. In math, students on the basic track were moved into gateway college courses at a greater rate; however, because many of them did not pass these gateway courses, they may have been harmed by being induced to take a course that was too difficult based on their incoming preparation. The initiative was more beneficial for students on the advanced math track who were more likely to succeed in those courses (if not in higher-level ones). In English, the FCCRI may have helped some students by diverting them from higher level courses they might have failed. The most positive findings were among students on the AP English track who were significantly more likely to take and pass gateway courses in college; however, the results from this subgroup must be interpreted with caution as they do not meet WWC standards. Results were mixed for students on the standard and honors English tracks, who were more likely to take and pass upper-level DE courses. Some of these changes were due to fewer enrollments in lower DE courses (which could be beneficial), but others were due to fewer enrollments in more advanced courses like the gateway English course (which could be harmful).

Overall, null effects tended to be most common, although statistically significant effects appear to show that more students were helped than harmed by assignment to CRS courses. Each additional college course passed would save approximately $243 per student, based on an average in-state tuition rate of $81 per credit hour for a typical 3-hour course. Based on changes in the number of students passing college courses at each level, we estimate a statewide cost savings of $393,569 in math and $354,318 in English (Tables B8 and B9). However, these estimates should be interpreted with caution because they reflect tuition costs only in the first college course without considering potential impacts of the FCCRI on subsequent performance. Additionally, these estimates focus on costs only to students and only in terms of tuition and do

not account for additional costs to institutions or costs associated with the statewide implementation of the FCCRI, or possible effects on student motivation.

Despite the potential cost savings, findings on several course taking tracks suggest that a one-size-fits-all CRS course may not have been the most effective approach to improving college readiness. In math, some students on the basic track were pushed into courses for which they were unprepared, and some students on the advanced track received inadequate preparation for higher-level college courses. In English, students on the standard track were redirected from taking for-credit courses. During our data analysis, we also discovered that some students who enrolled in CRS courses in grade 12 had taken clearly more advanced courses in grade 11 (such as Calculus or AP English Literature). It is unclear how such students would have benefitted from CRS courses. Policymakers in other states with similar reform efforts should consider whether they are appropriately targeting students for participation based on achievement levels.

Identifying Reference (2014) found that some CRS courses contained both students who were nearly college-ready and others at risk of dropping out of high school. It would be difficult for a single course to benefit both groups. Exempting the most- and least-prepared CRS assignees might have both helped them pursue appropriate coursework and allowed CRS teachers to better target instruction to the remaining students. Schools could also offer multiple types of CRS courses focusing on high school completion, career readiness, college skills, or other topics. Florida created two CRS courses in math and three in English geared toward students with different PERT scores, but since schools were required to offer only one course in each content area, most offered only one. The vast majority of high schools elected to offer the full-year course in each subject area that counted toward the high school graduation requirement (English IV: Florida College Prep and Math for College Readiness). This decision to offer only a

single CRS course in each subject area may have been because the FCCRI was largely unfunded; schools and districts had to repurpose resources to offer PERT testing and CRS courses (Identifying Reference, 2014).

Even a well-designed and well-run CRS course may not have been able to adequately compensate for inadequate preparation in earlier grades. Students who have not passed Algebra 2 by grade 12 need to learn all of its content rather than the selection covered in a review course. Meanwhile, students who have passed Algebra 2 should know its content well enough to pass an analogous college course. That they were often unable to do so is an indictment of how mastery was assessed in prior grades, how courses were aligned across education systems, or both.

Additionally, assignment to participate in the FCCRI had no effect on outcomes such as high school graduation or college enrollment. It seems that the FCCRI may not have adequately considered students' motivations to attend college. The initiative was focused on helping students become college-ready regardless of whether they intended to enroll in college. No additional advising or support was provided to non-college-bound students to improve their career options or to encourage them to consider other postsecondary programs.

Our study also raises questions about the extent to which differences in student outcomes may be attributed to individual practices in schools. Our results show what happens in the context of a statewide reform where institutional variation in implementation is high, rather than in a well-defined intervention tested in controlled conditions. We don't know what have would happened if the state had provided standardized textbooks and lesson plans or if all schools had implemented CRS courses as intended. Instead, our study shows what happens in real world conditions when schools are given a broad mandate to offer a college readiness course and local

autonomy to implement that courses. As a result, some schools may have been more effective in offering CRS courses than others.

Schools may also differ in regards to classroom-level mixing of students with different levels of academic preparation. One avenue for future research would be to explore whether outcomes were influenced through peer effects, as similar students were potentially assigned to different peer groups depending on course assignment procedures at their school. Additionally, qualitative research could explore whether some teachers or schools adopted more effective practices to individualize instruction to students with varying needs and levels of preparation. Further, differences should be explored by school to determine whether school characteristics may contribute to variation in course taking patterns in ways that may disadvantage low-income and underrepresented racial/ethnic students as well as those in rural and high-poverty schools (Archbald & Farley-Ripple 2012; Conger et al., 2009; Klopfenstein, 2004). These types of investigations are important for ensuring that future college readiness reform efforts are designed in a way that support all students in achieving postsecondary success.

References

Adelman, C. (2005). *Moving into town—and moving on: The community college in the lives of traditional-age students.* Washington, DC: U.S. Department of Education, Office of Vocational and Adult Education. Retrieved from https://files.eric.ed.gov/fulltext/ED496111.pdf

Allensworth, E., Nomi, T., Montgomery, N., & Lee, V.E. (2009). College preparatory curriculum for all: Academic consequences of requiring algebra and English I for ninth graders in Chicago. *Educational Evaluation and Policy Analysis, 31* (4), 367-391.

Archbald, D., & Farley-Ripple, E.N. (2012). Predictors of placement in lower level versus higher level high school mathematics. *The High School Journal, 96* (1), 33-51.

Aughinbaugh, A. (2012). The effects of high school math curriculum on college attendance: Evidence from the NLSY97. *Economics of Education Review, 31* (6), 861-870. doi: 10.1016/j.econedurev.2012.06.004

Chen, X., & Weko, T. (2009). *Students who study science, technology, engineering, and mathematics (STEM) in postsecondary education* (NCES 2009-61). Washington, DC: National Center for Education Statistics.

Conley, D. (2007). *Redefining college readiness*. Eugene, OR: Educational Policy Improvement Center. Retrieved from https://eric.ed.gov/?id=ED539251

Conger, D., Long, M.C., & Iatarola, P. (2009). Explaining race, poverty, and gender disparities in advanced course-taking. *Journal of Policy Analysis and Management, 28* (4), 555-576.

Cuban, L. (1993). The lure of curricular reform and its pitiful history. *Phi Delta Kappan, 75* (2): 182-182.

Deil-Amen, R., & Rosenabum, J.E. (2002). The unintended consequences of stigma-free remediation. *Sociology of Education, 75* (3): 249-268.

Fay, M.P., Barnett, E.A., & Chavrin, O. (2017). *How states are implementing transition curricula: Results from a national scan*. CCRC Research Brief, Community College Research Center, New York, NY.

Finkelstein, N.D., & Fong, A.B. (2008). *Course-taking patterns and preparation for postsecondary education in California's public university systems among minority Youth. Issues & Answers*. REL 2008-No. 035. Regional Educational Laboratory West.

Florida Department of Education (2016). *The Fact Book.* Report prepared for the Florida College System, Tallahassee, FL. Retrieved from http://fldoe.org/core/fileparse.php/15267/urlt/FactBook2016.pdf

Florida Department of Education. (2012). Course Code Directory and Instructional Personnel Assignments. http://www.fldoe.org/core/fileparse.php/7746/urlt/0079776-ccdnarrative1213.pdf.

Florida General Requirements for High School Graduation; Revised, Chapter 1003.428 (FL. Stat. 2011). Retrieved from https://www.flsenate.gov/Laws/Statutes/2011/1003.428

Gaertner, M.N., Kim, J., DesJardins, S.L., & McClarty, K.L. (2014). Preparing students for college and careers: The causal role of algebra II. *Research in Higher Education, 55* (2), 143-165.

Goodman, J. (2017). *The labor of division: Returns to compulsory high school math coursework.* NBER Working Paper No.23063, National Bureau of Economic Research, Cambridge, MA.

Gottfried, M., Owens, A., Williams, D., Kim, H., & Musto, M. (2017). Friends and family: A literature review on how high school social groups influence advanced math and science coursetaking. *Education Policy Analysis Archives, 25* (62), doi: 10.14507/epaa.25.2857

Harwell, M., Medhanie, A., Dupuis, D., Post, T.R., & LeBeau, B. (2014). A multisite study of high school mathematics curricula and the impact of taking a developmental mathematics course in college. *Educational Research Quarterly, 37* (3), 3-22.

H.B. 1255, Fla. Stat. § 1008.30 (2011).

Imbens, G.W. & Lemieux, T. (2008). Regression discontinuity designs: A guide to practice. *Journal of Econometrics, 142* (2), 615–635. doi:10.1016/j.jeconom.2007.05.001

Kane, T., Boatman, A., Kozakowski, W., Bennett, C., Hitch, R., & Weisenfeld, D. (2019). *College remediation goes back to high school: Evidence from a statewide program in Tennessee*. NBER Working Paper #26133. Cambridge, MA: National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w26133

Kane, T., Boatman, A., Kozakowski, W., Bennett, C., Hitch, R., & Weisenfeld, D. (2018). *Remedial math goes to high school: An evaluation of the Tennessee SAILS program*. Research Report. Cambridge, MA: Center for Education Policy Research, Harvard University.

Kim, J., Kim, J., DesJardins, S.L., & McCall, B.P. (2015). Completing Algebra II in High School: Does It Increase College Access and Success*? The Journal of Higher Education, 86* (4), 628-662.

Klopfenstein, K. (2004). The advanced placement expansion of the 1990s: How did traditionally underserved students fare? *Education Policy Analysis Archives, 12* (68).

Long, M.C., Iatarola, P., & Conger, D. (2008). Explaining gaps in readiness for college-level math: The role of high school courses. *Education Finance and Policy, 4* (1), 1-33. doi: 10.1162/edfp.2009.4.1.1

Nomi, T. (2012). The unintended consequences of an algebra-for-all policy on high-skill students: Effects on instructional organization and students' academic outcomes. *Educational Evaluation and Policy Analysis, 34* (4), 489-505.

Porter, S.R., & Umbach, P.D. (2006). College major choice: An analysis of person-environment fit. *Research in Higher Education, 47*(4), 429-449.

Phaett, L., Trimble, M.J., & Barnett, E.A. (2016). *Improving the transition to college: Estimating the impact of high school transition courses on short-term college outcomes*. Working Paper No. 86, Community College Research Center, New York, NY.

Rose, H., & Betts, J.R. (2001). *Math matters: The links between high school curriculum, college graduation, and earnings.* San Francisco, CA: Public Policy Institute of California. Retrieved from http://www.ppic.org/content/pubs/report/R_701JBR.pdf

S.B. 1908, Fla. Stat. § 1008.30 (2008).

Tyson, W., & Roksa, J.R. (2017). Importance of grades and placement for math attainment. *Educational Researcher, 46* (3), 140-142.

Underhill, B. (2013, February). *College remediation.* Presentation at the Florida Senate 2013 Regular Session Appropriations Subcommittee on Education Meeting, Tallahassee, FL. Retrieved from http://www.flsenate.gov/PublishedContent/Committees/2012-2014/AED/MeetingRecords/MeetingPacket_2056.pdf

Wang, X. (2013). Why students choose STEM majors: Motivation, high school learning, and postsecondary context of support. *American Educational Research Journal, 50*(5), 1081-1121

Werblow, J., Urick, A., & Duesbery, L. (2013). On the wrong track: How tracking is associated with dropping out of high school. *Equity & Excellence in Education, 46* (2), 270-284. doi: 10.1080/10665684.2013.779168

Woods, C.S., Park, T., Hu, S., & Bertrand Jones, T. (2018). How high school coursework predicts introductory college-level course success. *Community College Review, 46*(2), 176-196.

Table 1
Effect of FCCRI on Taking a Given Course Level in Grade 12 by Course Taking Track

Math track				
	(1)	(2)	(3)	(4)
Level	Overall	Basic	Standard	Advanced
None	-0.0217 **	-0.0269	-0.0074+	-0.0462**
	(0.0052)	(0.0233)	(0.0041)	(0.0137)
Basic or fundamental	0.0003	-0.0076	-0.0019	0.0015
	(0.0032)	(0.0101)	(0.0030)	(0.0019)
Regular or standard	0.1441 **	0.1077**	0.1778**	0.1335**
	(0.0263)	(0.0289)	(0.0174)	(0.0197)
Honors	-0.1017 **	-0.0544*	-0.1486**	-0.0769**
	(0.0235)	(0.0243)	(0.0163)	(0.0163)
AP, IB, or dual credit	-0.0053	-0.0276+	-0.0271**	0.0054
	(0.0091)	(0.0145)	(0.0091)	(0.0162)
Total courses	0.0596 **	0.0390	0.0080	0.0784**
	(0.0189)	(0.0437)	(0.0215)	(0.0231)

English track						
	(1)	(2)	(3)	(4)	(5)	(6)
Level	Overall	Standard	Mixed	Honors	AP	Other
None	0.0023	0.0062	-0.0050	0.0048	-0.0009	0.0194
	(0.0047)	(0.0066)	(0.0067)	(0.0053)	(0.0104)	(0.0353)
Basic or fundamental	0.0004	-0.0024	0.0012	0.0060	-0.0009	-0.0146
	(0.0023)	(0.0039)	(0.0045)	(0.0048)	(0.0026)	(0.0153)
Regular or standard	0.1440 **	0.0965**	0.1965**	0.1521**	0.0953**	0.1351*
	(0.0188)	(0.0141)	(0.0232)	(0.0306)	(0.0291)	(0.0644)
Honors	-0.1330 **	-0.0737**	-0.1969**	-0.2136**	-0.0512*	-0.604**
	(0.0252)	(0.0132)	(0.0240)	(0.0325)	(0.0246)	(0.0695)
AP, IB, or dual credit	-0.0261 *	-0.0260*	-0.0184	0.0043	-0.0713*	-0.1141**
	(0.0122)	(0.0109)	(0.0156)	(0.0222)	(0.0314)	(0.0435)
Total courses	-0.0227	-0.0177	0.0096	-0.0844**	0.0310	-0.0808
	(0.0195)	(0.0271)	(0.0350)	(0.0324)	(0.0401)	(0.0908)

NOTE. – Cohorts represent students first enrolling in grade 11 in 2012/13. Point estimates represent the marginal percentage point change in the probability of taking a course at the indicated level by treatment status. All regressions control for student background variables (gender, free or reduced-price lunch status, race and ethnicity, English language learner status, native English speaker status, disability status, gifted and talented status, cumulative GPA as of grade 10) and high school fixed effects to control for unobserved heterogeneity across institutions. N varies by specification from 21,754 to 69,983 in math and 39,980 to 43,200 in English. Standard errors (clustered by school) in parentheses. Bandwidths selected via cross-validation and range from 5 to 20 in math and 17 to 20 in English.

+p<.10, *p<.05, **p<.01

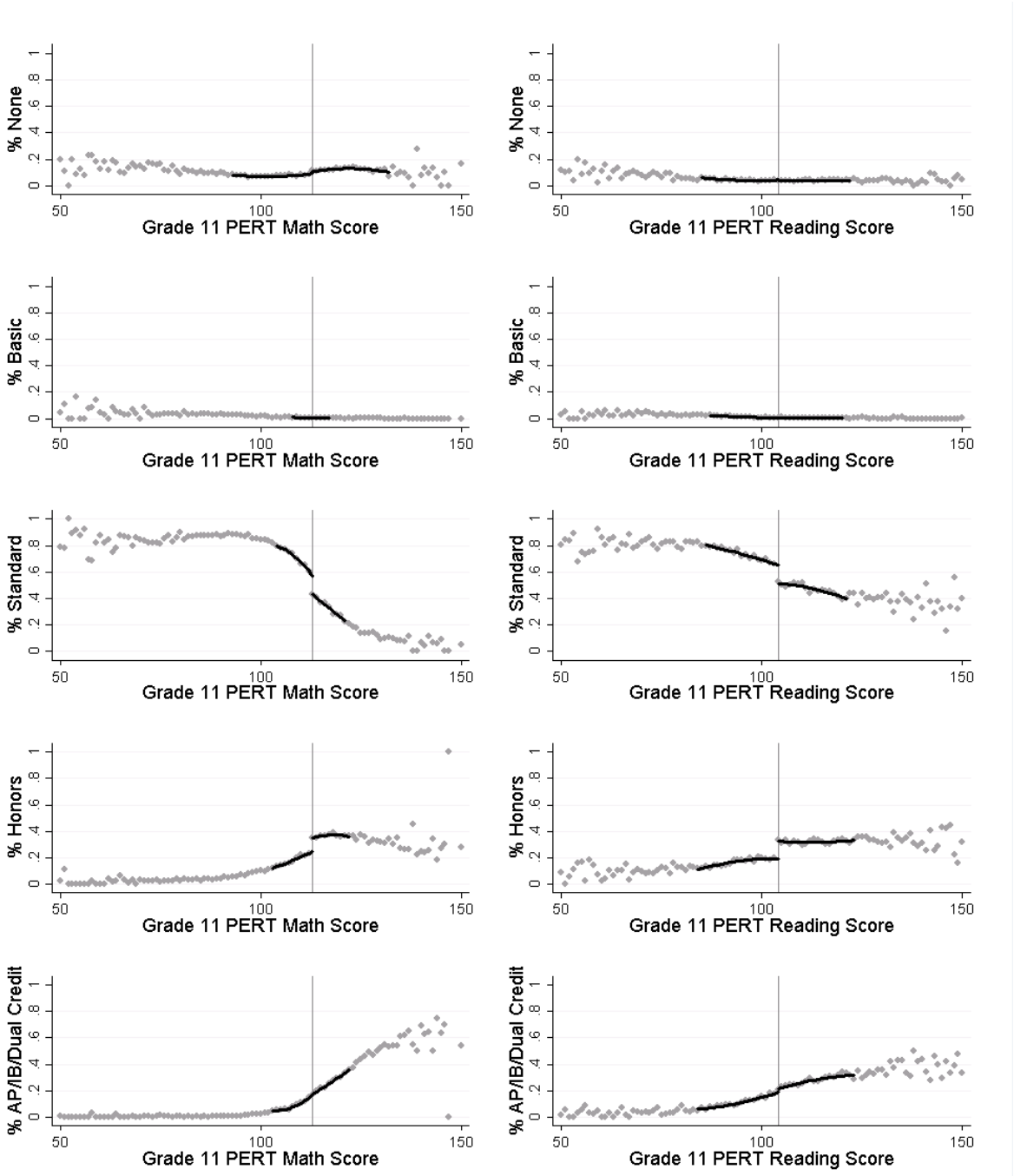

Figure 1. Effect of FCCRI on Taking a Given Course Level in Grade 12

NOTE. – PERT = Postsecondary Education Readiness Test. Gray dots represent the average level of the given outcome at the indicated PERT score, while black curves represent a local quadratic; neither controls for baseline covariates. Columns represent math and English respectively, while rows represent any enrollment in different course levels within the given content area.

Table 2

Effect of FCCRI on Taking a Given Subject in Grade 12 by Course Taking Track

	Math track			
	(1)	(2)	(3)	(4)
Subject	Overall	Basic	Standard	Advanced
Basic/ Vocational	-0.0005	-0.0099	-0.0012	-0.0002
	(0.0027)	(0.0107)	(0.0031)	(0.0019)
Algebra 1	0.0050	0.0110	0.0027	0.0024
	(0.0035)	(0.0115)	(0.0034)	(0.0035)
Geometry	-0.0074 *	-0.0398**	0.0021	0.0056
	(0.0029)	(0.0142)	(0.0036)	(0.0043)
Algebra 2	-0.0057	-0.0155	-0.0032	-0.0072
	(0.0073)	(0.0282)	(0.0075)	(0.0102)
Other Standard	-0.0630 **	-0.0582+	-0.1121**	-0.0152
	(0.0221)	(0.0322)	(0.0191)	(0.0150)
CRS	0.2386 **	0.2155**	0.3255**	0.1668**
	(0.0370)	(0.0437)	(0.0262)	(0.0199)
Integrated Math	-0.0115	-0.0059	-0.0221**	-0.0041
	(0.0112)	(0.0055)	(0.0079)	(0.0055)
Precalculus	-0.0515 **	-0.0205	-0.0673**	-0.0387**
	(0.0107)	(0.0152)	(0.0110)	(0.0096)
Other Advanced	-0.0539 *	-0.0239	-0.0922**	-0.0358*
	(0.0228)	(0.0204)	(0.0148)	(0.0174)
Dual Credit	-0.0041	-0.0273*	-0.0159*	0.0003
	(0.0069)	(0.0123)	(0.0077)	(0.0117)
Calculus	0.0011	0.0013	-0.0029	0.0038
	(0.0053)	(0.0037)	(0.0033)	(0.0117)

	English track					
	(1)	(2)	(3)	(4)	(5)	(6)
Subject	Overall	Standard	Mixed	Honors	AP	Other
Intensive Reading	0.0008	-0.0020	-0.0007	0.0034	0.0003	-0.0142
	(0.0019)	(0.0035)	(0.0039)	(0.0042)	(0.0013)	(0.0131)
English 4 Standard	-0.0925 **	-0.1866**	-0.0970**	-0.0324*	-0.0114	-0.1387**
	(0.0125)	(0.0224)	(0.0175)	(0.0156)	(0.0165)	(0.0521)
English 4 CRS	0.2608 **	0.3078**	0.3338**	0.2275**	0.1573**	0.2391**
	(0.0276)	(0.0241)	(0.0282)	(0.0303)	(0.0249)	(0.0694)
English 4 Honors	-0.1302 **	-0.0740**	-0.1959**	-0.1937**	-0.0661**	-0.0751
	(0.0216)	(0.0127)	(0.0239)	(0.0318)	(0.0228)	(0.0588)
AP Literature	-0.0123	-0.0063	0.0012	-0.0047	-0.0524+	-0.0636+
	(0.0088)	(0.0047)	(0.0108)	(0.0160)	(0.0302)	(0.0360)
Other	-0.0370 **	-0.0395*	-0.0311	-0.0552*	-0.0270	-0.0495
	(0.0136)	(0.0197)	(0.0225)	(0.0262)	(0.0302)	(0.0701)

NOTE. – Cohorts represent students first enrolling in grade 11 in the 2012/13 school year. Point estimates represent the marginal percentage point change in the probability of taking a course in the indicated subject by treatment status. All regressions control for student background variables (gender, free or reduced-price lunch status, race and ethnicity, English language learner status, native English speaker status, disability status, gifted and talented status, cumulative GPA as of grade 10) and high school fixed effects to control for unobserved heterogeneity across institutions. N varies by specification from 25,870 to 47,183 in math, and 39,980 to 43,200 in English. Standard errors (clustered by school) in parentheses. Bandwidths selected via cross-validation and range from 6 to 12 in math, and 17 to 20 in English.

+p<.10, *p<.05, **p<.01

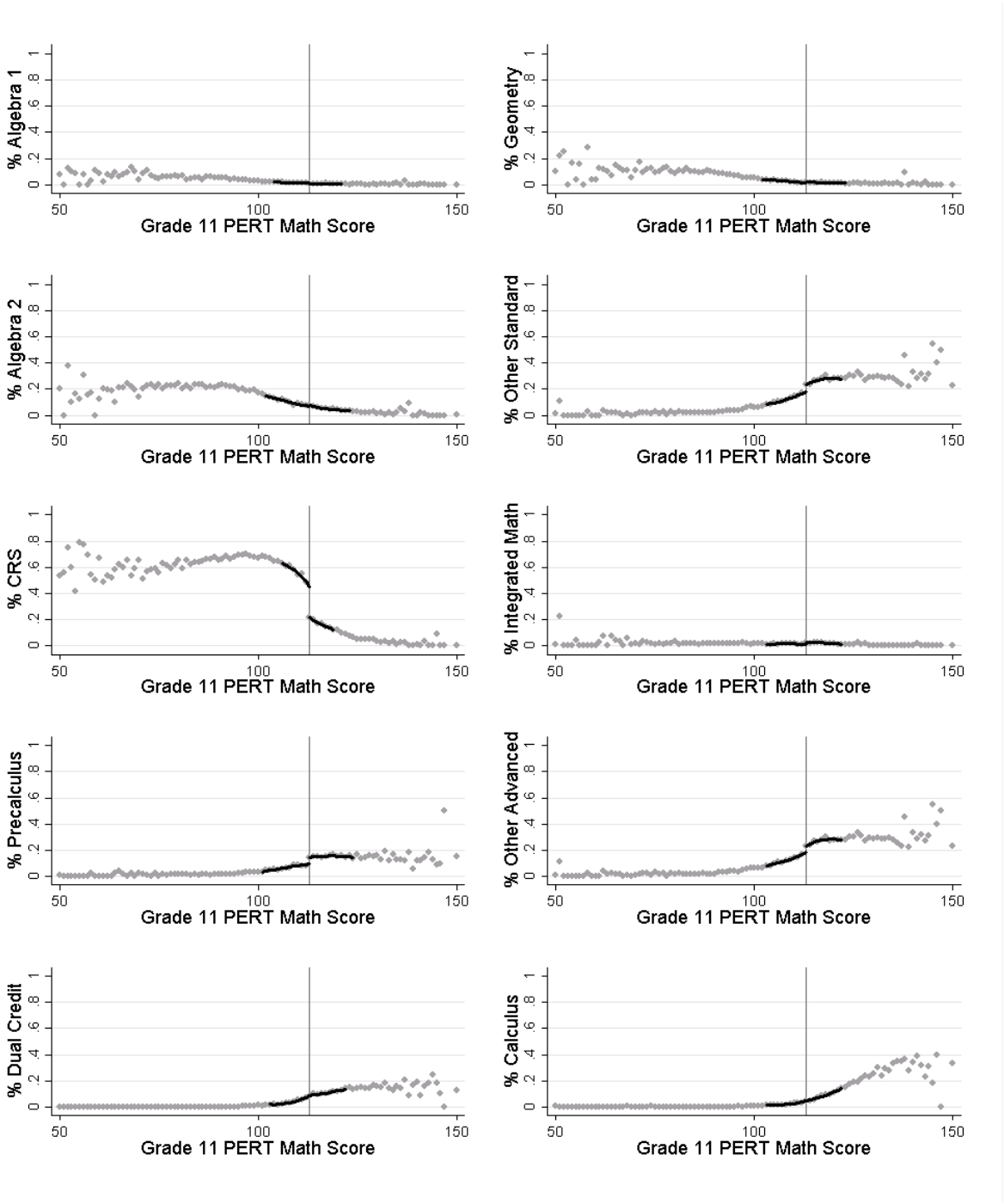

Figure 2. Effect of the FCCRI on Taking a Given Math Subject in Grade 12

NOTE. – PERT = Postsecondary Education Readiness Test. Gray dots represent the average level of the given outcome at the indicated PERT score, while black curves represent a local quadratic; neither controls for baseline covariates. Each graph represents any enrollment in the given math subject.

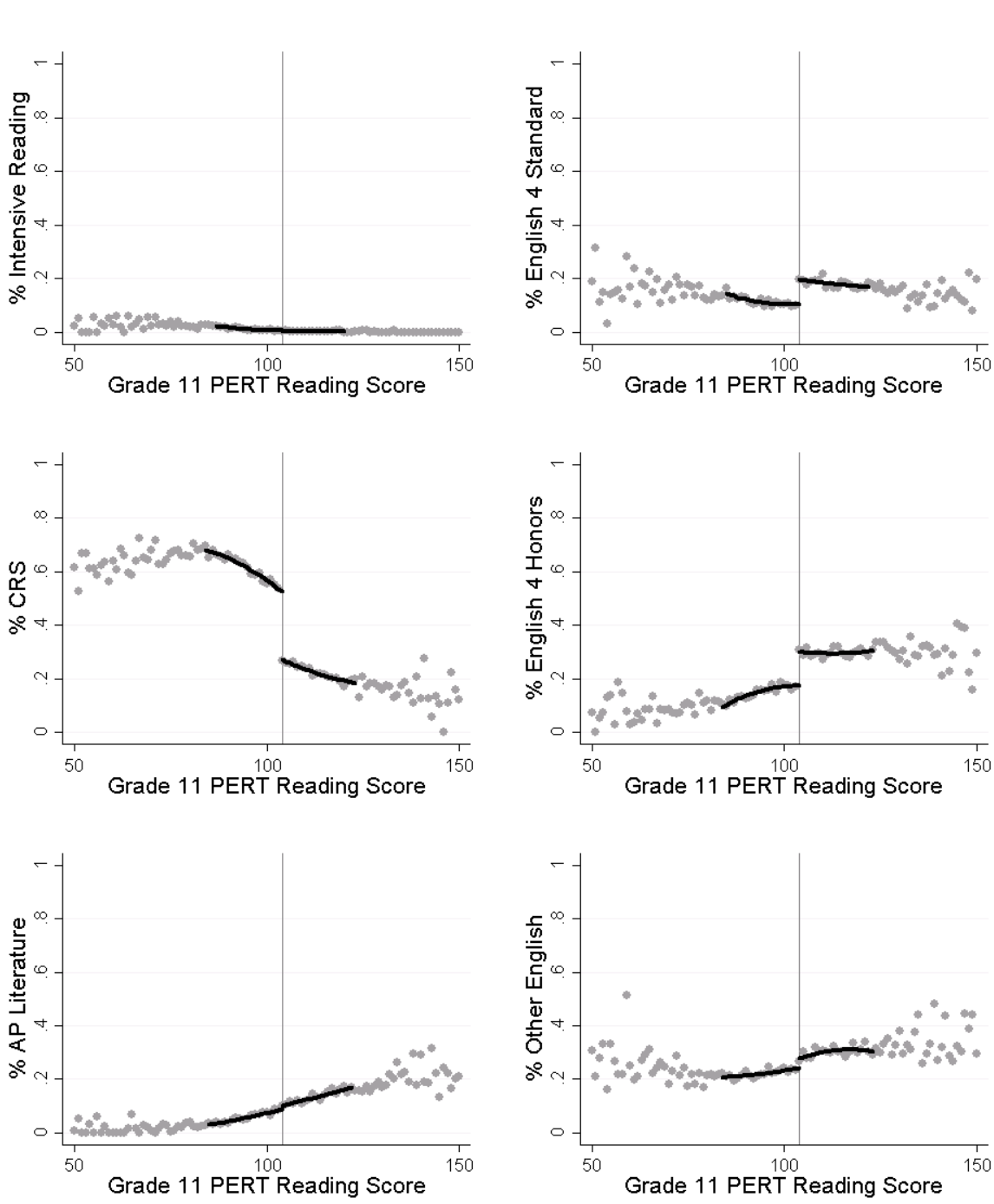

Figure 3. Effect of the FCCRI on Taking a Given English Subject in Grade 12

NOTE. – PERT = Postsecondary Education Readiness Test. Gray dots represent the average level of the given outcome at the indicated PERT score, while black curves represent a local quadratic; neither controls for baseline covariates. Each graph represents any enrollment in the given English subject.

Table 3

Effect of the FCCRI on Postsecondary Outcomes by Math Course Taking Track

	(1)	(2)	(3)	(4)
Outcome	Overall	Basic	Standard	Advanced
Transition outcomes:				
Any high school diploma	0.0052 (0.0038)	-0.0123 (0.0107)	-0.0023 (0.0053)	0.0113 (0.0091)
Any dual enrollment credit (math only)	-0.0057 + (0.0032)	0.0138+ (0.0080)	-0.0139** (0.0046)	-0.0013 (0.0093)
Seamless college enrollment	-0.0049 (0.0095)	0.0011 (0.0256)	0.0086 (0.0144)	0.0008 (0.0188)
Course outcomes:				
Any college math	-0.0095 (0.0112)	0.0122 (0.0255)	-0.0077 (0.0163)	-0.0060 (0.0194)
Lower DE enroll	-0.0002 (0.0013)	-0.0040 (0.0034)	-0.0005 (0.0023)	0.0080** (0.0031)
Lower DE pass	-0.0003 (0.0009)	0.0017 (0.0033)	-0.0012 (0.0019)	0.0051+ (0.0036)
Upper DE enroll	0.0186 ** (0.0057)	-0.0062 (0.0117)	0.0109 (0.0071)	0.0124* (0.0063)
Upper DE pass	0.0172 ** (0.0049)	0.0028 (0.0103)	0.0103+ (0.0057)	-0.0106+ (0.0058)
Transition enroll	-0.0277 ** (0.0103)	-0.0407* (0.0206)	-0.0273* (0.0126)	-0.0306* (0.0150)
Transition pass	-0.0066 (0.0104)	-0.0141 (0.0192)	0.0130 (0.0139)	-0.0147 (0.0147)
Gateway enroll	0.0275 * (0.0120)	0.0670** (0.0202)	0.0203 (0.0129)	0.0334+ (0.0179)
Gateway pass	0.0155 (0.0099)	0.0454** (0.0166)	-0.0026 (0.0111)	0.0313* (0.0156)
Beyond gateway enroll	0.0057 (0.0062)	-0.0089 (0.0107)	0.0029 (0.0061)	-0.0050 (0.0108)
Beyond gateway pass	-0.0020 (0.0049)	-0.0029 (0.0061)	0.0001 (0.0049)	-0.0201* (0.0079)

NOTE. – Sample consists of students first enrolling in grade 11 in the 2012/13 school year. Point estimates represent the marginal percentage point change in the given outcome by treatment status at the college readiness cutoff. All regressions control for student background variables (gender, free or reduced-price lunch status, race and ethnicity, English language learner status, native English speaker status, disability status, gifted and talented status, cumulative GPA as of grade 10) and high school fixed effects to control for unobserved heterogeneity across institutions N varies by specification from 30,858 to 65,427. Standard errors (clustered by school) in parentheses. Bandwidths selected via cross-validation and range from 7 to 18.

+p<.10, *p<.05, **p<.01

Table 4

Effect of the FCCRI on Postsecondary Outcomes by English Course Taking Track

	(1)	(2)	(3)	(4)	(5)	(6)
Outcome	Overall	Standard	Mixed	Honors	AP	Other
Transition outcomes:						
Any high school diploma	0.0019 (0.0025)	-0.0134 (0.0102)	0.0174^{+} (0.0091)	0.0021 (0.0077)	0.0056 (0.0091)	0.0121 (0.0272)
Any dual enrollment credit (English only)	-0.0126 $^{+}$ (0.0070)	-0.0027 (0.0064)	-0.0164^{+} (0.0092)	-0.0156 (0.0114)	-0.0103 (0.0189)	0.0244 (0.0592)
Seamless college enrollment	0.0103 (0.0145)	-0.0108 (0.0229)	-0.0163 (0.0254)	0.0087 (0.0290)	0.0698** (0.0301)	-0.0896 (0.0774)
Course outcomes:						
Any college English	-0.0006 (0.0163)	-0.0248 (0.0224)	-0.0177 (0.0259)	-0.0127 (0.0287)	0.0897** (0.0317)	-0.0883 (0.0725)
Low DE enroll	-0.0034 $^{+}$ (0.0020)	-0.0102* (0.0047)	-0.0014 (0.0036)	-0.0030 (0.0060)	-0.0006 (0.0026)	0.0263 (0.0176)
Low DE pass	-0.0026 (0.0017)	-0.0054 (0.0038)	-0.0013 (0.0033)	-0.0030 (0.0052)	-0.0006 (0.0026)	0.0270 (0.0174)
Upper DE enroll	0.0178 ** (0.0059)	0.0379** (0.0123)	0.0084 (0.0113)	0.0336* (0.0158)	0.0049 (0.0123)	-0.0385 (0.0370)
Upper DE pass	0.0182 ** (0.0053)	0.0281** (0.0103)	0.0121 (0.0103)	0.0291* (0.0145)	0.0060 (0.0111)	-0.0424 (0.0353)
Gateway enroll	-0.0045 (0.0175)	-0.0417* (0.0207)	-0.0257 (0.0247)	-0.0169 (0.0319)	0.0905** (0.0307)	-0.0121 (0.0777)
Gateway pass	0.0061 (0.0138)	-0.0223 (0.0193)	-0.0205 (0.0256)	-0.0122 (0.0284)	0.0812** (0.0287)	0.0258 (0.0736)
Beyond gateway enroll	-0.0143 (0.0091)	-0.0129^{+} (0.0073)	0.0011 (0.0120)	-0.0247 (0.0193)	-0.0023 (0.0259)	-0.0653^{+} (0.0375)
Beyond gateway pass	-0.0089 (0.0075)	-0.0091 (0.0069)	0.0013 (0.0106)	-0.0204 (0.0181)	0.0178 (0.0263)	-0.0480 (0.0345)

NOTE. – Sample consists of students first enrolling in grade 11 in the 2012/13 school year. Point estimates represent the marginal percentage point change in the given outcome by treatment status at the college readiness cutoff. All regressions control for student background variables (gender, free or reduced-price lunch status, race and ethnicity, English language learner status, native English speaker status, disability status, gifted and talented status, cumulative GPA as of grade 10) and high school fixed effects to control for unobserved heterogeneity across institutions N varies by specification from 34,909 to 42,734. Standard errors (clustered by school) in parentheses. Bandwidths selected via cross-validation and range from 13 to 19.

+p<.10, *p<.05, **p<.01