TAKS-ing Students? Evaluating Exit Exam Effects on Long-Term Student Outcomes in Texas

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Abstract

This paper considers how exit exams in place in Texas impact post-secondary outcomes for students around the threshold score for passing. Employing a regression discontinuity framework on the four separate sections of the TAKS exit exam, I examine the impact of passing the exam for students within a small window of scores around the passing threshold. While I find suggestive evidence that passing the exam sections do increase the probability of obtaining a high school diploma, I do not find any longer term effects: just passing the exit exam does not seem to impact enrollment or graduation in post-secondary education or subsequent labor force outcomes. This lack of an estimated effect suggests that this policy does not have large unintended consequences years beyond the end of high school for students who fail to pass the exams.

1 Introduction

The United States has a long history of incorporating testing as a way to evaluate student knowledge[1]. Beginning in the late 1950s, there have been several waves of policies at the state and federal level, from minimum competency standards to "high-stakes" testing. High stakes assessments are those that impose strict consequences for failing to meet the high academic standards set by the assessment [4].

One visible aspect of this trend in educational assessment is the implementation of "exit exams", which are an additional testing requirement compelling students to meet some minimum threshold score in addition to completing traditional high school coursework in order to be awarded a diploma. Because these exams impose rewards for proficiency and penalties for sub-par achievement on both the district and individual level, these are considered "high stakes" exams. States get to set their own content standards, level of difficulty, and performance standards for proficiency; these requirements are not a nationally unified system. Like other states, Texas has created its academic standards and is currently in the process of bringing all students up to proficiency.

While, on paper, exit exams only impact high school graduation, they conceivably have the ability to impact students in far reaching ways much beyond high school. This paper uses Texas data to improve understanding of the effects of implementing exit exams on these individual outcomes. Using administrative data from high school, higher education, and workforce records to match observations for each student allows for estimation of the local average treatment effect. Additionally, Texas is a large state that holds some influence in formation of education policy in other states. Finally, using data from the 2008-2009

[1]The research presented here utilizes confidential data from the State of Texas supplied by the Texas Education Research Center (ERC) at The University of Texas at Austin. The author gratefully acknowledges the use of these data. The views expressed are those of the author and should not be attributed to the ERC or any of the funders or supporting organizations mentioned herein, including The University of Texas, the State of Texas, or the study's sponsor. Any errors are attributable to the author.

high school cohorts improves on previous research on Texas exit exams because it studies a new testing regime for students graduating from high school in an economic recession and also allows for recent advancements in the implementation of regression discontinuities to be employed as well.

I use a regression discontinuity approach to take advantage of institutional features of the TAKS exit exams as a way to examine the impact of just barely passing. I look at high school diploma receipt, post-secondary enrollment, persistence to a second year of post-secondary education, probability of transferring to a four-year institution, graduation from a two-year college, employment, and total earnings. After carefully selecting my preferred specification, I use students in two cohorts of Texas public high schools and examine scores for each section of the TAKS test for a small window of scores around the passing threshold the first time the exam is administered to them. While I find suggestive evidence that passing the exams do increase the probability of obtaining a high school diploma, I do not estimate any statistically significant longer term effects: just passing the exit exam does not seem to impact enrollment or graduation in post-secondary education or labor force outcomes.

The paper proceeds as follows: Section 2 offers a review of current literature and Section 3 explains the Texas Assessment of Knowledge Skills in more detail. Section 4 describes the data used, Section 5 presents the empirical framework and results; the subsequent section offers possible policy considerations and conclusions.

2 Review of Current Literature

Exit exams and high-stakes testing have been around for decades, and as such have several robust veins of study in the economic and education literature. Much of the older research uses datasets that could be susceptible to attenuation bias or are not well suited for a regression discontinuity approach. Furthermore, many of the datasets only have outcomes for students through the end of high school. This study aims to not only compliment previous research with more credible local average treatment effects for students around the exit exam's minimum cutoff, but also to expand our knowledge of the effects on longer-term outcomes.

Betts and Grogger (2003) examine the impact of increasing high school standards on student outcomes using data from High School and Beyond, a national survey administered by the National Center for Education Statistics (NCES). The authors construct a measure of grading standards out of standardized testing achievement needed to receive a letter grade. The authors then run ordinary least squares of the standard on student outcomes controlling for individual and school characteristics. The authors also employ quartile regressions to look at the distributional effects, and find higher standards increase test scores but have no positive effect on educational attainment and may even reduce attainment for minorities. While these results are supported in other studies, the timing of the data is such that Texas scores, included in the sample, do not have high-stakes exit exams in place.

Using a difference-in-difference approach, Baker and Lang (2013) evaluate the effects of high school exit exams on high school graduation, incarceration, employment, and wages. Using the Current Population Survey (CPS) to construct a dataset of graduation cohorts by state and information on which states have exit exam policies in place, they exploit the staggered timing of the implementation of exit exams across states. The authors find that more challenging standards for exit exams reduce graduation and increase incarceration rates coinciding with an increase in GED receipt. Furthermore, the authors additionally find no consistent effects of exit exams on employment or wages. While these results are meaningful, using the CPS does not allow for isolating the effect of passing or failing an exit exam for an individual student.

Dee and Jacob (2006) get at the signaling theory of a high school degree using data from the NCES Common Core of Data and the 2000 Census. The authors examine how exit exams influence educational attainment and labor market outcomes and find that exit exams are negatively correlated with high school completion. Using the universe of students enrolled in public high schools in Texas should allow for further testing of the signaling theory of human capital with respect to high school completion.

In addition to the copious literature considering theoretical concerns and implementation of regression discontinuity frameworks[2], there are several papers that apply to the research question at hand. Jepsen, Muser and Troske (2012) employ a regression discontinuity framework to examine the returns to passing the GED tests[3]. While this is clearly a different educational outcome and local average treatment effect than high school exit exams, there are several similarities in the testing regimes that create issues for estimation. Individuals who fail the GED, which has several sections with minimums for each, are able to retake it multiple times as is allowed with Texas exit exams. The authors show that considering only the final outcome of the test, the sample right above and below the cutoff differs in observable characteristics which violates one of the assumptions of the regression discontinuity approach. However, focusing on the first administration is a valid design, even if the difference in treatment is less pronounced. The authors also discuss considerations when using a multivariate functional form. All of these insights will directly inform this study.

Ou (2010) ties the regression discontinuity and exit exam literature together by examining the impact of exit exams in New Jersey on high school completion. While the paper mentions that concurrent research considers exit exams in Massachusetts and California, state-by-state analysis is still fairly sparse. The data also only allows for study of high school completion and not longer-term outcomes, which is a benefit of this Texas research.

Perhaps the paper most closely related to this research is Martorell's (2004) "Do High School Graduation Exams Matter? A Regression Discontinuity Approach", which studies a

[2]See Imbens and Lemieux (2008), McCrary (2008), and Han, Todd, and Van der Klaauw (2001) among many others.

[3]General Education Development.

previous standardized testing regime in Texas. Martorell has similar data from a previous decade in Texas when the Texas Assessment of Academic Skills (TAAS) was the standardized test in place. He employs a regression discontinuity approach to examine the effect of lowest single section score around the cutoff on graduation, dropout, college enrollment and workforce data. While closely related to this study, I have the benefit of looking at more recent high stakes exit exams in Texas for the period during and after the Great Recession. Additionally, I consider the four sections of the TAKS test individually rather than as a composite value in order to examine whether there are any differential effects of the subject areas of the exam. Moreover, I consider scores from the first time students take the exam, before any subsequent retakes. While this makes for smaller estimated effects on the impact of exit exams on high school diploma receipt, it considers a less restricted group of students and should make for results that are more applicable for the broader high school population in Texas.

3 Texas Assessment of Knowledge Skills

Since 1980 Texas has had some form of standardized exam in place[4]. In addition to the state mandated curriculum tested on the Texas Assessment of Knowledge Skills (TAKS) exam, two other formats–accommodated and modified–exist. The TAKS Accommodated form is for special education students who meet additional eligibility criteria and assesses the same curriculum standards but offers changes in formatting and permits accommodations the student may require. The TAKS Modified is for special education students that satisfy standard eligibility requirements and assesses modified academic standards. While the TAKS-M covers the same grade-level content, the format and design of the test has been changed. Because students who take either the TAKS-A or TAKS-M and score right around the cutoff will not compare to the marginal student on other observable characteristics, individuals taking the TAKS-A or TAKS-M are omitted from subsequent analysis.

The exams are administered statewide on four consecutive days, one day for each subject. The guidelines for administering the test are created in such a way to minimize distractions for test takers and to remove any unfair advantages for students[4]. The tests are untimed, and students are allowed as much time to respond to every question as is necessary[5]. There are 73 questions in the English language arts section, 60 questions on the mathematics section, 55 questions on the science portion of the test, and 55 social studies questions. This means students are capable of scoring integer values between 0-73 for ELA, 0-60 for math, 0-55 for science, and 0-55 for history. Because the difficulty of the specific exam administered varies from year to year even trying to keep the standards constant, raw scores are then converted to a scaled score, which is comparable between years. The minimum standard for passing is 2100 each year, and students who score 2400 or above achieve "commended performance."

It is unlikely that the TAKS test is subject to administrative manipulation. The guidelines for administration set forth very clear procedures about what test administrators can and cannot do or say with regards to the testing materials, student questions, and the answer sheets. Tests and answer sheets are kept in a locked storage locker when not actively administrated. At the end of each testing administration (daily) all materials must be collected by the campus administrator, boxed up and mailed to the district coordinator, who then forwards them on to Pearson, a third-party corporation that specializes in high-stakes tests. They are not scored by the students' teachers (TEA 2014).

[4] Guidelines require, among other concerns, no talking, no cell phones, and covering up any information around the classroom that could offer aid on a test.

[5] While not a requirement that administration of the exam continue beyond school hours, districts are allowed to offer students even that additional time.

4 Data and Outcomes of Interest

4.1 Data

Data for this project was collected from the Texas Education Resource Center (TERC), which houses administrative data from the Texas Education Agency (TEA), the Texas Higher Education Coordinating Board (THECB), and the Texas Workforce Commission (TWC)[6]. It is therefore possible to take individual student observations with their high school enrollment and graduation files and link them with their higher education records, and employment outcomes for longitudinal study of individuals for a substantial amount of time after high school graduation.

The main sample for our analysis consists of two cohorts, all the individuals who graduated from public high schools in Texas in the spring of 2008 and in 2009. The files from the Texas Education Agency contain demographic information on students along with the courses they completed while in high school, their scores on the Texas Assessment of Knowledge and Skills (TAKS) exit exam, and their graduation information. For the TAKS scores, a student's scores on each individual subsection (math, reading, social studies, and science) are recorded for each time the test was taken.

This information is then paired with two datasets containing information from the Texas Higher Education Coordinating Board. For each student, the THECB datbase contains enrollment and graduation information by semester for any student who was enrolled in a higher education institution in the state of Texas. This data includes all institutions an individual enrolls in for a semester, whether full or part time. This makes it possible for students to show up multiple times at different institutions in the same semester. We

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therefore identify a student's primary institution for students with multiple institutional records in a given semester by selecting the one with the highest number of credit hours attempted.

The final major dataset employed in this study is from the Texas Workforce Commission. These files contain quarterly information on wages for a job, industry code for a job, county of employment, and local unemployment rates for each job worked by an employee. This again creates the possibility of an individual appearing in the data more than once in a given quarter, if they work more than one job, which creates problems when linking these files to other information. In an attempt to overcome this issue, we report both the primary occupation, defined as the job with the highest wages earned in a quarter, and the total wages earned in a given quarter.

We identify our sample of interest by starting with the full sample of high school enrollees in our cohorts, 2008 and 2009. After linking this group of students with the datasets from the THECB, and TWC by a unique identifier supplied by the Texas Education Research Center, we restrict our sample to only those students with at least one round of TAKS scores reported.

The Texas Education Agency reports two student scores for each subsection of the test for each administration of the exam: a raw score (the number of questions a student got correct) and a scaled score (an affine transformation of the raw score that makes tests easily comparable across dates). Because the TAKS test can vary slightly in difficulty and length, the scaled score reflects a consistent cutoff across subsections[7] that is pegged to a number of correct answers on the test section itself. These corresponding cutoffs for the raw scores vary slightly over time and between subjects, but give the impression that the score cutoff was in fact very consistent over time[8]. Because the scaled score is non-smooth in possible

[7]For all administrations and sections of the TAKS test during the period of observation, the cutoff score was 2100.

[8]The raw cutoff scores were either 29 or 30 for science, ranged between 41-44 for English language arts,

scores, an adjusted raw score is used to determine whether a student passed or not, created by adjusting scores on each section up or down for a given test wave so each section has a single passing threshold for all administrations of the test[9]. The TAKS score data is very important, as it constitutes the running variable for the empirical strategy described below.

4.2 Outcome Variables

The outcomes of interest are then constructed from both the TWC and THECB files. One possible way the results of the TAKS test could affect students beyond high school is through their employment opportunities. In order to examine this, I construct two variables to try and measure whether the individual was ever employed and whether individuals earn more in wages upon graduation. It is possible that examining workforce outcomes are subject to a negative selection bias: students who do not pursue any form of post-secondary education and enter the workforce immediately could initially have higher wages or employment rates than students who enroll in two- or four-year colleges. However, over time these students who enrolled in tertiary education will graduate and ostensibly find employment in higher-earning jobs. These sorts of trends would only become more apparent over time, so estimates on employment levels and wages earned can be thought of as intermediate outcomes for this period of observation, through the second fiscal quarter of 2012.

I define "employment" as having non-zero earnings for any quarter for which data is available. Because the timing of the data puts high school graduates earning their diploma during the height and aftermath of the Great Recession, making employment harder to obtain for high school graduates, I consider whether individuals have non-zero earnings during the whole period after graduation rather than examine outcomes on a per-quarter or annual basis. The second measure of workforce success I employ is "total earnings" for the

were between 32 and 34 for mathematics, and were either 27 or 28 for social studies.

[9]The adjusted raw score cutoff points are: 30 for science, 44 for English language arts, 33 for mathematics, and 28 for social studies.

period of observation, which is the sum of all reported earnings from the Texas Workforce Commission across all quarters of observation. Again, to try and get a clearer picture of whether individuals right around the cutoff score are working in Texas whether or not they actually obtained a high school diploma, I sum the reported earnings across all periods available rather than examine the data on a quarterly or annual basis. Individuals who enter the labor force right after high school will not have additional years of schooling to differentiate them from other job candidates. Therefore, I expect to find either a small increase in the probability of employment or in the level of wages for those students who just passed the TAKS if employers are screening on having a high school diploma, or no effect on these labor force outcomes if high school dropouts and graduates appear to be the same labor pool for these jobs.

Receiving a clear "pass" or "fail" signal from the TAKS exams could also impact enrollment, retention, and graduation from post-secondary institutions. Not having a high school diploma is not a deterrent to enrolling in any tertiary school with an open enrollment policy, so failing the TAKS exit exam and not obtaining a high school diploma would not directly restrict enrollment but could have unintended consequences by encouraging students of relatively the same ability to enroll in post-secondary education or not as if randomly. Data from the Texas Higher Education Coordinating Board allows for the construction of several variables of interest. The first is whether a student ever enrolls in any post-secondary institution in Texas, two- or four- year. This is constructed by creating an indicator for whether a student ever appears in the enrollment data from the THECB. In the event that a student appears in more than one institution in the same semester, the institution reporting more credit hours attempted is classified as the "primary institution" and kept. I expect individuals who pass the TAKS test to have higher enrollment rates across all types of institutions.

While simply enrolling in a post-secondary institution is an important first step in educational attainment, persistence to a second year of study is another important measure to consider. If students enroll in some program only to drop out before the first semester is over it might not have that much of an impact on their long term workforce outcomes. I define "persistence to a second year of study" as an indicator for whether a student is still enrolled in their primary institution three to five semesters after initial enrollment. This three semester window accounts for students who might not take any classes during the summer but re-enroll in the fall. A similar outcome of interest is "transfer to a four-year institution," which is an indicator for whether a student starts in a two-year institution and then after some study transfers to a four-year institution. If failing the TAKS test makes it so individuals can only continue their education in open enrollment institutions and then transfer for access to four-year degrees, it is possible that we would see individuals who failed the TAKS test but are still interested in higher education to have higher transfer rates. On the other hand, if passing the TAKS test is positive reinforcement that encourages individuals to enroll and subsequently succeed in a two-year institution and want to transfer to a four-year university, those who passed the TAKS exam may have higher transfer rates. Therefore the predictions on the probability of transferring are ambiguous.

The final major educational outcome of interest is whether an individual ends up obtaining an additional degree from a post-secondary institution. The THECB also supplies graduation information from all tertiary institutions in Texas that allows for this kind of study. The two educational attainment outcomes I consider are "Associates Degree" and "Receipt of Certificate," which are defined as an indicator variable for being awarded an associates degree from any institution during the period of observation and an indicator variable for ever earning any type of certificate offered, respectively[10]. For individuals who obtained more than one post-secondary degree during the time frame of the study, the most

[10]Bachelors degrees, while in the data, were not awarded with enough frequency in the student sample of interest to be a possible outcome.

recent degree awarded is considered.

5 Empirical Framework and Results

5.1 Regression Discontinuities

The motivating concern for this empirical strategy is that the groups of students who pass or fail the exam are fundamentally different, and so we cannot simply compare the sample means of the two groups. Comparing the whole group of students who pass to the whole group of students who fail would attribute any observable differences to the effect of the TAKS test when many other variables could be causing this gap. However, somehow selecting students around the exam cutoff score who otherwise look similar also make passing or failing appear random. This sample would make it possible to estimate the causal effect of exit exams in Texas. Random assignment of passing or failing the exams for a group of students who otherwise look the same allows the difference in means between the two groups to be an estimate of the impact of the exams on all of the outcomes of interest described above: high school graduation, post-secondary educational enrollment, persistence, graduation, employment, and total earnings. One way to do this is through a regression discontinuity research design.

Regression discontinuity frameworks are popular in the economics literature because if the requirements in order to implement one are satisfied it produces believable estimates of the effect of whatever program or policy causes the fixed difference in treatment status. In order for the Regression Discontinuity framework to be valid in this case, there needs to be:

1. A clear cutoff for treatment status.
2. An inability to manipulate treatment status.
3. Smooth densities around the cutoff.

Passing a portion of the TAKS exit exams is by definition a clear cutoff for treatment. For each subject area and each administration of the test, there is a clearly published cutoff score below which a student does not meet the standards set (fails) and above which the student has met the standard and is able to graduate. Furthermore these raw scores are scaled to a 2100 passing standard after each time the test is administered so they are directly comparable. Empirically, these definitions are almost perfectly applied for students.

Students also do not seem to be able to manipulate their treatment status on the TAKS exit exam. While educators would hope that more effort exerted by the student will result in a higher score, students have no way of guaranteeing exactly what their score will be. Lee and Lemieux (2010) point out that even when individuals have some influence on treatment, if they are not able to precisely manipulate assignment then the variation observed around the cutoff is as good as random. Furthermore, while not private information, the number of questions answered correctly in order to pass the TAKS exam is not widely publicized, so it is difficult for students to know what target score to aim for. The fact that students are unable to perfectly achieve the score they would like satisfies the second assumption of inability to manipulate the treatment status for a regression discontinuity approach to be appropriate.

While the design of the TAKS exam appears to rule out the possibility of perfect manipulation of treatment status by the students, direct examination of the densities of both the treatment variable and any covariates allow for a partial test that these conditions are satisfied. A discontinuity on either side of the pass/fail cutoff could suggest that individuals do have some control in their treatment status. Figure 1 displays the density of TAKS scores for a small window around the cutoff for each subject area of the exam. Students who are in danger of failing the TAKS exit exam are towards the bottom percentiles of the distribution of scores, but these graphs look smooth and increasing around the cutoff. Figure 5 shows the distribution of scores for the entire possible range of scores for each exam. Again, the distribution of scores looks very smooth. A more formal test for a discontinuity in the density of scores around the cutoff is proposed by McCrary (2008). The McCrary test breaks the range of scores into a histogram with a binwidth of one, then smooths the histogram via local linear regression on either side of the cutoff and then calculates a Wald test under the hypothesis that the discontinuity at the cutoff is zero. These results are presented graphically in in Figure 2. Estimates of the discontinuity for each subject are reported in Table 1. Math, Science, and Social Studies have very small estimates of the discontinuity that are statistically insignificant. While the estimate of the discontinuity in test score density around the cutoff for the English section of the TAKS is significant at the five-percent level, the sign is opposite of the way we would expect manipulation to influence the density and the estimate is small. This table and the graphical evidence offer support for the idea that densities for the running variable, TAKS score, are smooth around the cutoff.

In a similar manner, graphs of the densities of any observable covariates should also be smooth around the cutoff to support idea that students appear as good as randomly assigned to their treatment status and that there is not some other observable factor that is driving any estimated result. Control variables available from the Texas Education Agency are gender, free and reduced lunch receipt, being an English as a second language student, and a vector of race indicator variables. For all of these, plotting the frequency by TAKS score look smooth through the cutoff value. A selection of these can be seen in Figure 3 for the Math section. Taken together, this can all be seen as suggestive evidence that it is not a change in some other observable characteristic or manipulation on the part of the student that is driving any effects from the TAKS exam and it is appropriate to employ a regression discontinuity in this situation. Summary statistics for students five points above and below the cutoff can be found for each section of the exam in Table 2. While there is some variation in the given percentages of students classified in these groups above and below the cutoff, the variation does not tell a consistent story of systematic differences between students above and below the cutoff for passing the TAKS exam.

One institutional feature of the TAKS exam that requires extra attention is the ability for students who fail any portion of the exam to retake it in an attempt to pass it in subsequent tries. Retaking is compulsory for all sections a student has not passed every time retakes are offered. As previously mentioned, Jepsen et al. (2012) make the point that, at least when considering retakes for the GED, simply looking at the last score reported is invalid for a regression discontinuity design. Without controlling for the number of retakes, examining the cutoff for the last score is comparing students who just achieved the minimum score the first try with students who never passed ever after multiple retakes, and these students differ on other observable characteristics as well. Two solutions to this are either to only consider the first administration of the exam or to also include retakes, but make each retake examined conditional on the number of retakes. Because test history of a student up until graduation does not factor in to a student's longer term outcomes in a significantly more informative way, I opt for using only the score from the first time a student takes a TAKS exam. Furthermore, while the scores from the first administration are a little less binding for high school graduation, they offer a much cleaner way to try and ensure the assumptions for a regression discontinuity are met and a clearer interpretation of any estimated results. All estimations will only consider the first administration of the TAKS exit exam for a student, pooled across all years of data.

5.2 Model

To look at the effect of barely passing a single section of the TAKS test without accounting for the interaction of passing the other sections, I estimate the standard baseline model for a regression discontinuity:

$$Y_i = \alpha_0 + \alpha_1 * \mathbf{1}\{PASS\_t_i\} + \alpha_2 * SCORE\_t_i + \alpha_3 * \Big(\mathbf{1}\{PASS\_t_i\} * SCORE\_t_i\Big) + \epsilon_i$$

where $PASS\_t_i$ is an indicator variable for whether individual i passed TAKS exit exam subject t, $SCORE_t$ is the individual's score on the TAKS subject of interest, and the model also includes an interaction term of the two. Here α_1 is the parameter of interest, the causal effect of just passing the exit exam in a given subject t: English, Mathematics, Science, and Social Studies.

While this is the standard baseline specification for a regression discontinuity, because mis-specification of the model leads to biased coefficients, a robust literature has developed on ways to try and ensure a model is chosen that best fits the underlying relationship. Before presenting full results on the impact of exit exams on the measures of post-secondary outcomes described in the data section, I first try several alternative models in an attempt to offer credible estimates.

Bandwidth selection, or the size of the window around the cutoff that is considered when estimating a regression discontinuity, is one important consideration in correctly specifying the model. Because the regression discontinuity estimates the local average treatment effect and the bandwidth defines which observations count as "local," the bandwidth chosen could directly influence any coefficient estimates. There could also be a different model that is a better fit of the underlying regression dependent on the data included in the bandwidth. A higher-order polynomial might over-fit a smaller, more linear range of the data, whereas a linear model may not do a good job approximating observations far from the cutoff in a large bandwidth. Ideally, the estimated effect of treatment is fairly robust to bandwidth selection. A further consideration is even though the optimal bandwidth can be calculated by one of several methods for each of the four TAKS sections, it will be easier to compare the impact of passing or failing an individual exam if the bandwidths are the same for each subject[11]. Because of all these considerations, a bandwidth of five is chosen as a reasonable

[11]It is also common to estimate the binwidth, or the number of bins the bandwidth is partitioned into, using non-parametric kernel density estimation or some other technique. However, due to the discrete nature of TAKS score as the running variable the binwidth is always set to one point. There is little danger of

compromise between the four independently calculated optimal bandwidths for each of the four TAKS subjects[12]. This five point bandwidth is roughly 13% of possible English score range, 16.6% of possible math scores, and 18% each of possible science and social studies scores.

After choosing a bandwidth, another important consideration is the order of polynomial chosen. I next estimate the regression discontinuity for several higher order polynomials, from a linear model up to a quartic, on each section of the TAKS test independently. This is done in order to try to select the appropriate model for the underlying regression. I estimate:

$$Y_i = \alpha_0 + \alpha_1 * \mathbf{1}\{PASS\_t_i\} + \sum_{j=1-4}^{J} \alpha * SCORE\_t_i{}^j + \sum_{j=1-4}^{J} \alpha * \left[\left(\mathbf{1}\{PASS\_t_i\} * SCORE\_t_i\right)\right]^j + \epsilon_i$$

where again $PASS\_t_i$ is an indicator variable for whether individual i passed TAKS exit exam subject t, $SCORE_t$ is the individual's score on the TAKS subject of interest, and an interaction of the Pass indicator and Score is included. The subscript j is the power to which a specific term is raised, so when $j = 1$ the polynomial is simply $\alpha_3 * SCORE\_t_i + \alpha_4 * (\mathbf{1}\{PASS\_t_i\} * SCORE\_t_i)$ but for $j = 3$ the polynomial becomes

$$\alpha_3 * SCORE\_t_i + \alpha_4 * SCORE\_t_i^2 + \alpha_5 * SCORE\_t_i^3 + \alpha_6 * \left(\mathbf{1}\{PASS\_t_i\} * SCORE\_t_i\right)$$
$$+ \alpha_7 * \left(\mathbf{1}\{PASS\_t_i\} * SCORE\_t_i^2\right) + \alpha_8 * \left(\mathbf{1}\{PASS\_t_i\} * SCORE\_t_i^3\right)$$

The higher order polynomials give the model additional flexibility to try to better fit the underlying relationship. After estimating the models for each of these terms, I calculate

biasing estimates due to under-smoothing, and bins cannot be partitioned into segments smaller than one point in this setting.

[12] This was calculated by employing cross validation on nonparametric regressions with a rectangular kernel for each of the four exam subjects and then choosing a number to try to account for the small variation in the reported optimal bandwidths.

Akaike's Information Criterion (AIC) for each model and use this test to select the preferred specification for the results presented here[13]. Jacob and Zhu (2012) point out that the AIC can be thought of as a measure of the relative goodness of fit between models, one based on the tradeoff between variance and bias. Then the practitioner selects the minimum AIC value between models. For the majority of outcome variables of interest among all subjects of the TAKS, the simple linear model is the model that minimizes the AIC, which is logical because of the relatively narrow bandwidth and smooth underlying trend for the scores. Arguably the second-best fitting model under the Information Criterion is the cubic model; results are also reported using this model to give an idea of the robustness of the estimates from the preferred model.

An additional method to employ in order to check that the conditions of the regression discontinuity are satisfied is to look at the predicted values that result from regressing outcomes of interest on the vector of observable controls. Figure 4 does just this by calculating the predicted values for the regression of high school degree on the vector of covariates, averaging the predicted value by test score, and plotting them. In Figure 4 Plot (a) shows the average fitted value by test score for the social studies section, plot (b) displays average fitted values for math, plot (c) shows average fitted values for English, and plot (d) reports average fitted value by science score. Again, the graphs all look fairly smooth through the cutoff score, suggesting that there is not some jump in the observable characteristics that occurs around the cutoff that could instead be driving any estimated results.

In a final attempt to control for any underlying bias in the sample, it is also possible to include covariates as controls in the model. In theory, the way a regression discontinuity mimics a randomized experiment implies that any baseline covariates are irrelevant. However, in practice including additional controls can help decrease sampling variation in the

[13]The AIC is calculated by estimating the log likelihood function for the model and then calculating $AIC = 2k - 2\log(l)$, where $($k) is the number of parameters and l is the value of the maximized log-likelihood function.

estimates. Furthermore, as reported in the panel in Figure 3, while the control variables are relatively smooth around the threshold score for passing, the overall trends in the full sample of the data suggest they are important to consider. Thus, all reported estimates include controls in the model[14].

5.3 Results

Using the preferred specification[15] outlined above, the estimates of the impact of just passing a subject of the TAKS test are reported in Table 3. Each column is one subject of the TAKS test. Column (1) reports estimates for students near the passing threshold for Social Studies. Column (2) reports estimates for students near the passing threshold for English. Column (3) reports estimates for students included in the bandwidth around the cutoff for Math. Column (4) reports estimates for students included in the bandwidth around the cutoff for Science. Each panel in Table 3 reports estimates for a different outcome of interest. Each cell in the table reports an estimate, standard error, F-statistic and R-squared value from a separate regression. The number of observations is reported at the bottom of the table. There is the same number of observations for each outcome in a given column of the table; the number of observations varies between columns because the different distribution of scores for each subject means there is a different number of students residing within the bandwidth. Due to the large number of students in the state of Texas, in all cases the estimates should not suffer from small sample size.

The **HS Diploma** panel reports the impact just barely passing a given TAKS subject has on obtaining a high school diploma by the expected graduation date for each cohort[16].

[14]The full vector of controls included in each specification is a vector of dummy variables for female, Asian, Hispanic, African American, limited English Proficiency, free and reduced lunch receipt, special education status, and Title 1 receipt.

[15]Due to the considerations above, the preferred specification is a parametric linear model with a bandwidth of 5 and controlling for a vector of indicator variables: female, Asian, Hispanic, Black, limited English proficiency, free and reduced lunch receipt, Title 1 funding receipt, and special education status.

[16]While it is possible to take the TAKS exam after the end of high school in order to obtain a diploma,

This is arguably where we would expect to see the most direct effect of passing or failing the TAKS exit exam on student outcomes. While statistically insignificant, there is a small estimated effect of around 1.8% increase in the probability of receiving a high school diploma for students who just barely pass the TAKS social studies exit exam. Barely passing the English TAKS exam does not seem to have a measurable effect, as reported in Column (2). The reported point estimate is actually negative, but very close to zero and also statistically insignificant. Barely passing the Math portion of the TAKS exam, reported in Column (3), has a larger, statistically significant impact on receiving a high school diploma. Students who score just above the threshold are an estimated 2.44% more likely to obtain a high school diploma, and this is significant at the 0.1% significance level. The impact of just passing the science portion of the TAKS exit exam, reported in Column (4), again shows no real estimated effect. While positive, the estimate for being just above the threshold score for science is statistically insignificant and close to zero. Results for the model with a third-order polynomial are reported in Table 4. While these estimates have a bit more variation and are still statistically insignificant, they again suggest that the impact of just passing the TAKS exit exam increase the probability of graduation by between one and two percent. The differential effects for the impact of passing a given exam on high school diploma are interesting, given that in reality a student must pass all four sections in order to receive a diploma. Perhaps some exams are easier to study for and pass the retake than others. Alternatively, the threshold could be picking up on innate student ability that other covariates, or even the effective randomization for a close region around the threshold that a regression discontinuity provides, are unable to control for. Because examining the first administration of the exam offers cleaner randomization at the cost of not being a strictly binding outcome, it is also interesting to see a statistically significant effect of the Math exam at all.

the traditional timeline for high school graduation is four years, and is measured as so here.

While the TAKS exit exams are designed to have an impact on students in high school, they arguably do not have a long term impact on students through any mechanism other than receipt of high school diploma, which research has shown is tied to a host of long term outcomes. One possible outcome where the effect of TAKS exit exams could impact students beyond the intended scope of the program is enrollment in a post-secondary institution. While failing the TAKS exit exam and subsequently not receiving a high school diploma constrains a student's ability to enroll in most four-year programs, many community colleges in Texas are "open enrollment" institutions that only require registration, and no other credential or application, to enroll. Students may need to take additional remedial courses before being granted a degree, but they count as enrolled in administrative records even before fulfilling the Texas Success Initiative (TSI) requirement. The **Enrollment** panel of Table 3 reports estimates of the impact of passing the TAKS exit exam on enrolling in a post-secondary institution in Texas. Estimates for each of the four exams are smaller than the coefficients on high school diploma receipt, but still statistically insignificant and close to zero. Estimated effects are slightly larger in magnitude and positive from the cubic model, but almost all confidence intervals still contain zero. These estimates do not give the impression that the results of the TAKS test are encouraging or constraining students in their choice whether to enroll in any tertiary program.

Although there does not seem to be a discernible impact on enrollment in post-secondary education, that does not mean exit exams have no impact on educational outcomes beyond high school. The timing of the data are such that all students are enrolling in post-secondary education shortly after high school. There are not enough years of data after students graduate from high school to examine whether students around the threshold return to school at different rates, suggesting that they require additional training to further their career or want to pick up new skills to transition to a different role in the labor market. It is possible for students to enroll in post-secondary education at the same rate after high school, but to drop out at different rates. The third panel of Table 3 reports coefficients for the impacts of passing a given TAKS exit exam on obtaining a one-year certificate of any type from a post-secondary institution in Texas. Again, no estimate for any subject test is statistically significant; each coefficient is of roughly the same magnitude, although suggestively just passing the English section reduces an individual's probability of earning a certificate while the other three subjects have a positive effect. Moreover, the R-squared, which can be considered a measure of goodness of fit, is an order of magnitude lower for Certificates than for either high school diploma receipt or post-secondary enrollment. Taken as a whole, it appears that passing any given subject of the TAKS exit exam does not impact an individual's probability to earn a one-year certificate after high school.

Earning a one-year certificate from an open enrollment institution is one post-secondary educational outcome that passing a given section of the TAKS exit exam may impact, but it is clearly not the only one. There is a rich economics literature on the positive financial returns to an additional year of schooling. The **Persistence** panel of Table 3 examines whether students just above the passing threshold are more like to persist to a second year of post-secondary education. Persistence is an important outcome because re-enrolling for a second year of study means that students have a better chance of completing a degree. The coefficients for each of the four subjects are small and statistically insignificant; social studies and math have a slightly negative effect while English and science have a small positive effect. Taken together, these results suggest that the TAKS exam is not driving a difference in students persisting to a second year of post-secondary education. The magnitudes are slightly larger but still statistically insignificant when estimating the model with the higher order polynomial, reported in Table 4.

An alternative choice students face in post-secondary education is whether to transfer from a two-year institution where they are currently enrolled to a four-year institution. This is potentially a very important pathway for students, especially for individuals who do not end up obtaining a high school diploma. Without a high school diploma, the only pathway for students to obtain a four-year degree is to start at an open enrollment institution and then transfer. The **Transfer** panel of Table 3 reports estimates of the impact of just passing a given segment of the TAKS exam on the probability of transferring. The point estimates for just passing a section are in line with the estimates that have been reported for other outcomes, but are once again statistically insignificant. Just passing the math section has a coefficient of -0.2% which could conceivably tell the story of students with higher ability in Science, Technology, Engineering, and Math (STEM) fields being more likely to enroll in their terminal institution the first time, but the point estimate on science is positive and of a larger magnitude (although still very small in real terms) which discredits this theory. While the coefficients from the cubic model, reported in Table 4, are larger in magnitude they are still statistically insignificant and again do not tell a consistent story of exit exams having an impact on the probability of transferring from a two-year institution to a four-year one.

The sixth panel of Table 3 estimates the effect of passing a given TAKS subject on the probability of earning an Associates degree by the end of the observation period in the sample (three years after the final cohort graduated[17]). Results are again statistically insignificant and close to zero, but three of the four subjects have point estimates that are mildly negative. While it is possible to tell a story where students who pass the TAKS are more likely to either enter a job or a four-year university, the more probably story is that while the TAKS test does have a direct impact on high school graduation, it does not effect the probability that an individual will go on to earn an Associates Degree or not. While the sign flips from positive to negative for students around the threshold for the English section, telling a more consistent story of students just passing being less likely to graduate with an associates degree, the estimates are still very close to zero for the model with the cubic term reported

[17]Three years is still 150% of the time needed to earn an Associates Degree, which is a time horizon often used to study completion rates.

in Table 4. Like certificate receipt, the R-squared is an order of magnitude lower than for the other regressions, suggesting that TAKS exit exams are not very informative for earning additional credentials beyond the high school diploma.

The measure of labor force participation reported in the **Employment** panel of Table 3 tells a more consistent story between different subjects of the TAKS exam but still does not find any statistically significant results. For social studies, English, and math the model estimates a small, less than one percentage point increase in the probability of being classified as employed during the sample period. The coefficient on science is negative, but much smaller than the others reported and thus very close to zero. The suggestion that exit exams do not have a real impact on subsequent labor force outcomes is an interesting conclusion, and mirrors that of Clark and Martorell (Forthcoming) that finds little evidence of a signaling effect of high school degrees for Texas students. The students included in their estimation sample are chosen on stricter criteria, so supporting their findings with a wider segment of TAKS students lends further evidence to the idea that students who do not pass the exams are being overly constrained in their future opportunities. Estimates for the impact of exit exams on employment using the cubic model are slightly larger in magnitude but again tell the same story as the linear model, and are reported in Table 4.

The final outcome I am able to examine is a different measure of labor market success: total earnings over the complete sample period. While wages could also have been considered annually or quarter by quarter, because of the relatively low labor force attachment during the observation period, defining earnings in this way gives a rough idea of an individual's labor force attachment during the period of interest. Again the estimates are small and statistically insignificant. While only suggestive, these coefficients find very small differences in earning: only a difference in $108 in total wages over the period of observation. One other interesting fact is that the estimates for both math and science suggest that individuals who just barely pass those exams earn slightly less. If these test results can be taken as a proxy for aptitude in STEM fields, perhaps these individuals are collecting additional years of education or entering professions with more initial training, so the estimates pick up short term biases due to the timing of the observation window. Irregardless, estimates for all four subjects are small and contain zero in their confidence interval. Perhaps this can be taken as more evidence in support of Clark and Martorell's conclusions on the relatively small impact of exit exams on labor force outcomes.

6 Policy Implications and Conclusion

Using a regression discontinuity framework, I examine the impact of the TAKS exit exam on a host on several student outcomes beyond the end of high school. Looking at students right around the cutoff score that pass the first time the test is administered, I am able to estimate the impact of just barely passing the exam on high school graduation, post-secondary enrollment, persistence, transferring to a four-year institution, graduation, employment, and total earnings for the observation period. While the TAKS test seems to have some impact on graduation rates, the effects wash out after high school and do not seem to affect students in other meaningful ways.

The results above track students for several years, from the time they first take the TAKS exit exam, and can follow them through high school graduation whether or not they enroll in a post-secondary institution and whether or not they enter the labor force. While none of the estimated results tell much of a story on their own, taken as a whole they do suggest how exit exams impact college students. Overall, I find suggestive evidence of a small effect on the probability of graduating from high school, which overlaps with the intended design of the program. Passing the exit exam does not guarantee a high school diploma; it is only a necessary condition. Additionally, while considering the first administration of the exam makes for cleaner random variation, the fact that students have several subsequent opportunities to pass the remaining portions of the exam and fulfill the requirement will further bias effects downward. Even accounting for this, it does seem like TAKS exit exams factor into graduation as they were designed to do.

However, beyond high school diploma receipt, there are no estimated effects for high school exit exams impacting other longer term outcomes. Moreover, there is not even suggestive evidence of large effects with large confidence intervals; all the estimates reported are close to zero and statistically insignificant. While beforehand it would have been reasonable to assume that the results of the TAKS exit exam could impact a student's educational and labor force prospects for years after the end of high school, empirically that does not seem to be the case.

From a policy perspective, this lack of a result may not be as distressing as it first seems. This policy was designed and implemented to impact high school instruction and graduation. While the data collected here are unable to inform changes in educational quality, there are suggestive results in line with what might be expected from the segment of students actually studied. A fear is that one possible unintended consequence of exit exams could be artificially constraining students by withholding a diploma from a segment of them. If students right above and below the cutoff are, in fact, of the same quality, it is therefore possible that giving some a high school diploma and withholding it for others could severely impact the post-secondary educational opportunities and jobs of those who fail. However, the estimates reported here do not tell that story. If exit exams are helping to achieve the goals they were implemented to achieve, then policy makers can rest a little easier knowing they are not overly damaging the opportunities of those who fail to pass the program while in high school.

This study continues to illuminate the impacts that exit exams in Texas have on long-term student outcomes for students who are at risk of failing the TAKS test. While these estimates are in line with other estimates of the impact of exit exams on labor force outcomes and educational attainment in Texas, this is not the final say. Future work on this question could incorporate more cohorts and more years of observation to gain further understanding of how students' labor force participation evolves further out from the test administration date. Future work could also consider other definitions of employment and earnings to estimate a clearer wage profile over time, and estimate impacts on labor force attachment for younger workers under the influence of this program. Additional work on this important issue could only add to our understanding of how programs in high school have a lasting impact on students in Texas.

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Table 1: Discontinuity Estimates Using the McCrary Test

	Science	English	Math	Social Studies
Discontinuity Est.	0.0077	-0.0470*	-0.0005	0.0397
S.E.	0.0123	0.0105	0.0119	0.0226
Bandwidth	5.5075	6.5231	7.6204	5.2746

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

Table reports nonparametric estimates of the discontinuity at the passing cutoff in the distribution of scores for each segment of the TAKS exam.

Table 2: Student Summary Statistics by Test within Five Points of Cutoff

	English		Math		Soc. Stud.		Science	
	Below	Above	Below	Above	Below	Above	Below	Above
Female	0.52	0.51	0.53	0.44	0.52	0.37	0.54	0.42
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.48)	(0.50)	(0.49)
FRL	0.38	0.41	0.38	0.43	0.39	0.53	0.38	0.43
	(0.48)	(0.49)	(0.49)	(0.49)	(0.49)	(0.50)	(0.48)	(0.50)
LEP	0.05	0.02	0.06	0.04	0.06	0.11	0.06	0.03
	(0.23)	(0.12)	(0.24)	(0.19)	(0.23)	(0.31)	(0.24)	(0.17)
Asian	0.03	0.03	0.03	0.02	0.03	0.01	0.03	0.02
	(0.17)	(0.16)	(0.18)	(0.12)	(0.17)	(0.12)	(0.18)	(0.14)
Afr. Am.	0.14	0.16	0.14	0.19	0.15	0.20	0.14	0.18
	(0.35)	(0.37)	(0.35)	(0.39)	(0.35)	(0.40)	(0.35)	(0.38)
Hispanic	0.41	0.47	0.41	0.49	0.42	0.61	0.40	0.50
	(0.49)	(0.50)	(0.49)	(0.50)	(0.49)	(0.49)	(0.49)	(0.50)
White	0.42	0.34	0.41	0.31	0.40	0.18	0.42	0.30
	(0.49)	(0.47)	(0.49)	(0.46)	(0.49)	(0.38)	(0.49)	(0.46)
N	606760	114320	599829	52196	669784	23966	593706	65778

Notes: For each of the four TAKS segments, the columns represent the summary statistics of student characteristics below and above the cutoff score for passing.

Table 3: Regression Discontinuity Estimates by TAKS Section

	Social Studies	English	Math	Science
	(1)	(2)	(3)	(4)
HS Diploma	0.0181	-0.00346	0.0244***	0.00164
	(0.0123)	(0.00564)	(0.00681)	(0.00608)
F-Test	2.167	0.376	12.89	0.0723
R-Squared	0.0411	0.0245	0.0306	0.0272
Enrollment	-0.0137	0.00148	-0.00570	0.00355
	(0.0118)	(0.00617)	(0.00750)	(0.00663)
F-Test	1.349	0.0573	0.578	0.286
R-Squared	0.0609	0.0528	0.0592	0.0624
Certificate	0.00285	-0.00332	0.00431	0.00223
	(0.00300)	(0.00190)	(0.00228)	(0.00226)
F-Test	0.902	3.056	3.573	0.973
R-Squared	0.00329	0.00325	0.00395	0.00739
Persistence	-0.00510	0.00316	-0.00123	0.00350
	(0.00537)	(0.00415)	(0.00460)	(0.00430)
F-Test	0.901	0.579	0.0713	0.665
R-Squared	0.0204	0.0285	0.0247	0.0280
Transfer	-0.0173	0.00495	-0.00262	0.00737
	(0.0226)	(0.0106)	(0.0123)	(0.0109)
F-Test	0.586	0.216	0.0456	0.456
R-Squared	0.0351	0.0364	0.0348	0.0382
AA Degree	-0.00195	0.00135	-0.00170	-0.00141
	(0.00299)	(0.00214)	(0.00230)	(0.00235)
F-Test	0.425	0.398	0.547	0.358
R-Squared	0.00417	0.00448	0.00469	0.00662
Employment	0.00569	0.000392	0.01000	-0.000151
	(0.0122)	(0.00636)	(0.00769)	(0.00683)
F-Test	0.216	0.00380	1.688	0.000486
R-Squared	0.0495	0.0159	0.0187	0.0214
Total Earnings	62.82	92.25	-108.9	-91.41
	(296.9)	(151.8)	(175.9)	(160.7)
F-Test	0.0448	0.369	0.383	0.324
R-Squared	0.0426	0.0252	0.0266	0.0298
N	35499	154847	84150	106494

Standard errors in parentheses

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

Notes: Displays estimated impact of passing a segment of the TAKS exam for each segment of the TAKS exam using a bandwidth of 5 for a linear regression discontinuity and a vector of covariates.

Table 4: Regression Discontinuity Estimates by TAKS Section - Cubic

	Social Studies	English	Math	Science
	(1)	(2)	(3)	(4)
HS Diploma	-0.0755	0.00928	0.0145	0.0103
	(0.0745)	(0.0356)	(0.0407)	(0.0164)
F-Test	1.027	0.0679	0.127	0.390
R-Squared	0.0412	0.0245	0.0306	0.0272
Enrollment	-0.0796	0.00193	0.00203	0.0337
	(0.0717)	(0.0390)	(0.0448)	(0.0179)
F-Test	1.233	0.00246	0.00206	3.542
R-Squared	0.0610	0.0528	0.0592	0.0625
Certificate	0.0170	-0.0131	0.00336	-0.00144
	(0.0182)	(0.0120)	(0.0136)	(0.00611)
F-Test	0.874	1.183	0.0608	0.0552
R-Squared	0.00347	0.00326	0.00395	0.00743
Persistence	-0.0273	-0.0206	-0.0303	0.0211
	(0.0325)	(0.0262)	(0.0275)	(0.0116)
F-Test	0.706	0.614	1.220	3.295
R-Squared	0.0205	0.0285	0.0247	0.0280
Transfer	-0.0496	-0.0446	-0.0887	0.0467
	(0.141)	(0.0688)	(0.0735)	(0.0290)
F-Test	0.124	0.420	1.456	2.587
R-Squared	0.0354	0.0365	0.0349	0.0383
AA Degree	-0.0253	-0.0114	-0.00598	0.00519
	(0.0181)	(0.0135)	(0.0137)	(0.00634)
F-Test	1.940	0.716	0.190	0.671
R-Squared	0.00439	0.00451	0.00473	0.00670
Employment	0.0887	0.0197	0.00564	-0.000444
	(0.0741)	(0.0401)	(0.0460)	(0.0185)
F-Test	1.431	0.240	0.0151	0.000579
R-Squared	0.0496	0.0159	0.0188	0.0215
Total Earnings	3269.9	128.1	-853.9	-623.6
	(1798.9)	(958.4)	(1050.6)	(434.2)
F-Test	3.304	0.0179	0.661	2.062
R-Squared	0.0429	0.0253	0.0267	0.0299
N	35499	154847	84150	106494

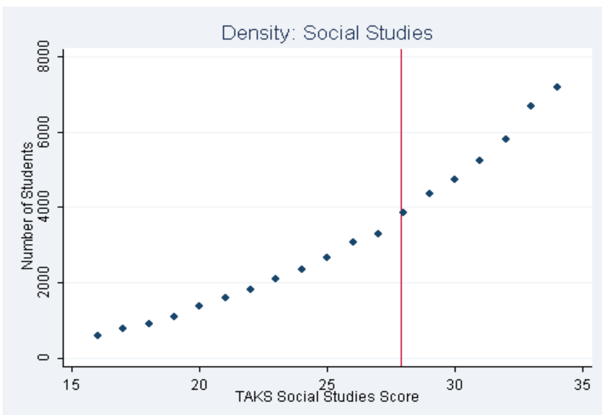
Standard errors in parentheses

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

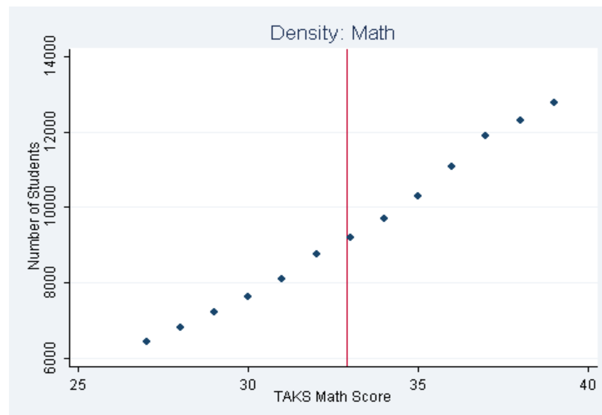
Notes: Displays estimated impact of passing a segment of the TAKS exam for each segment of the TAKS exam using a bandwidth of 5 for a parametric third-order polynomial and a vector of covariates.

Figure 1: Densities of TAKS scores by subject for a small window around the cutoff score.

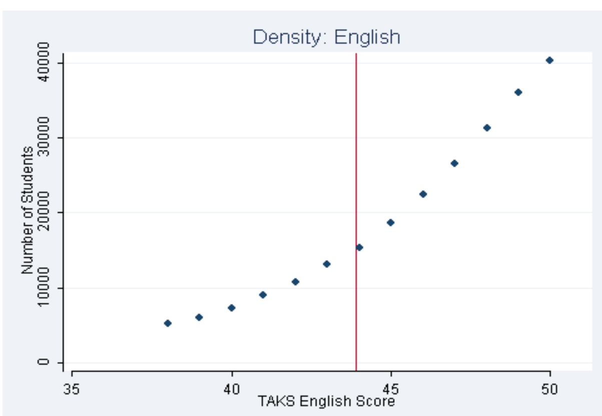
(a)



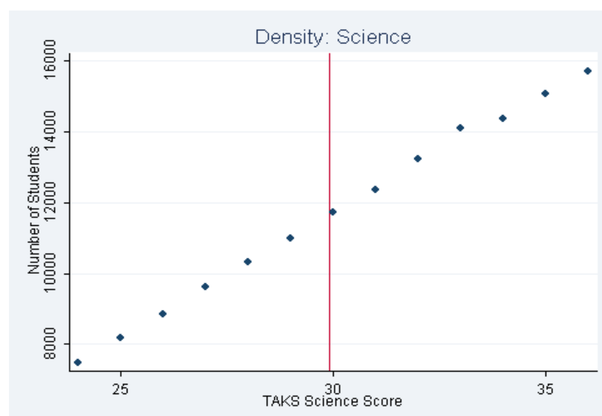
(b)



(c)



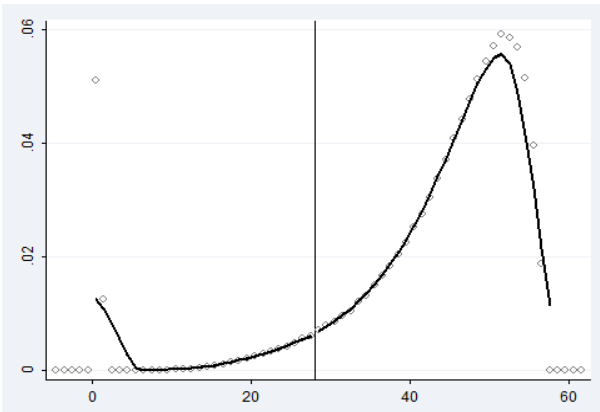
(d)



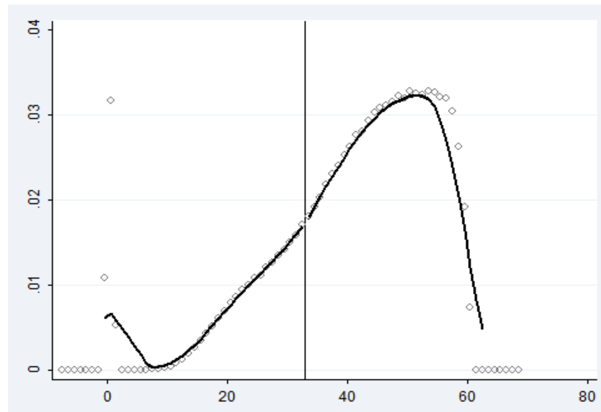
Notes: Vertical line represents the pass threshold.

Figure 2: Graph of the density of each TAKS section score for the McCrary test.

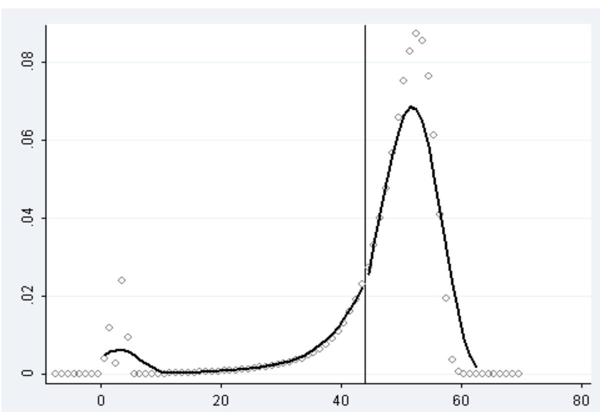
(a) Social Studies



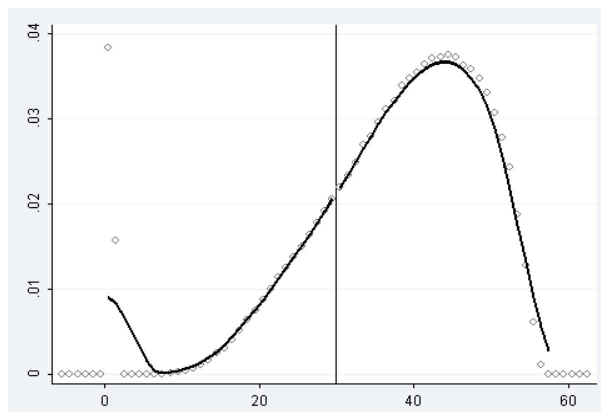
(b) Math



(c) English



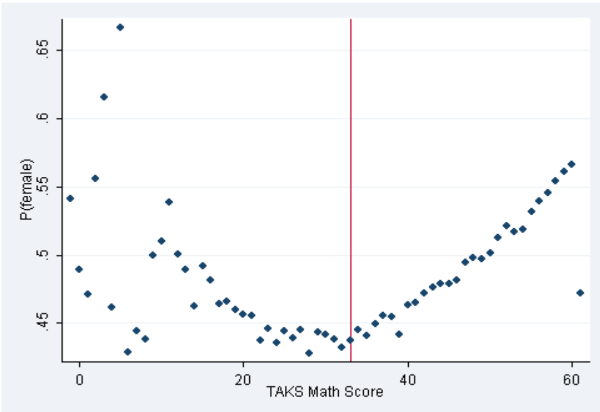
(d) Science



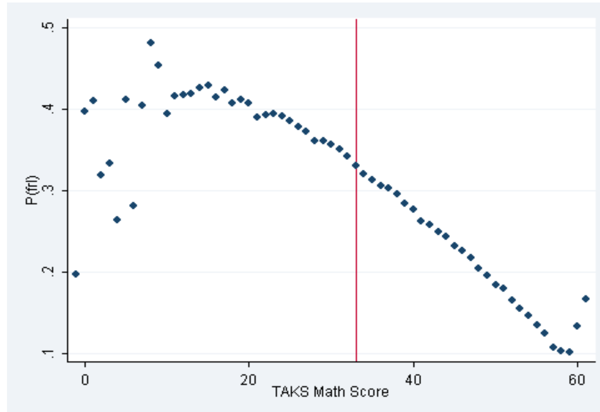
Notes: Vertical line represents the pass threshold.

Figure 3: Graph of the percentage makeup of covariates for the TAKS Math exam.

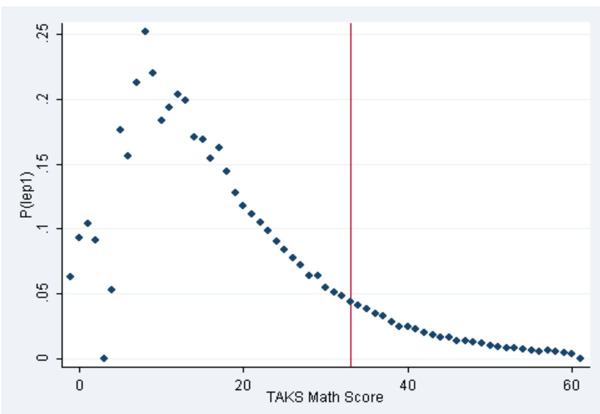
(a) Female



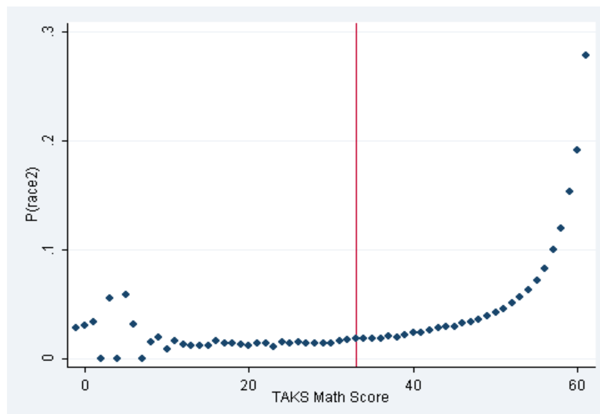
(b) Free and Reduced Lunch



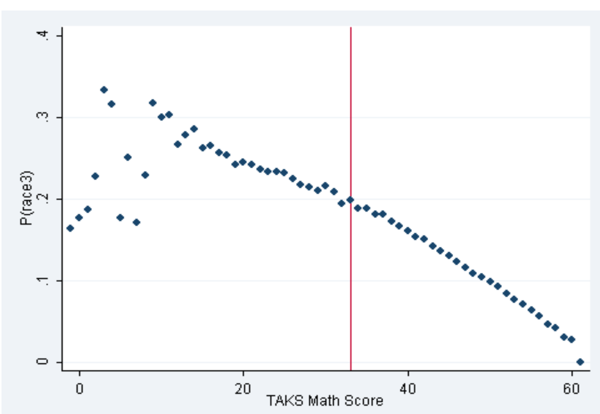
(c) Limited English Proficiency



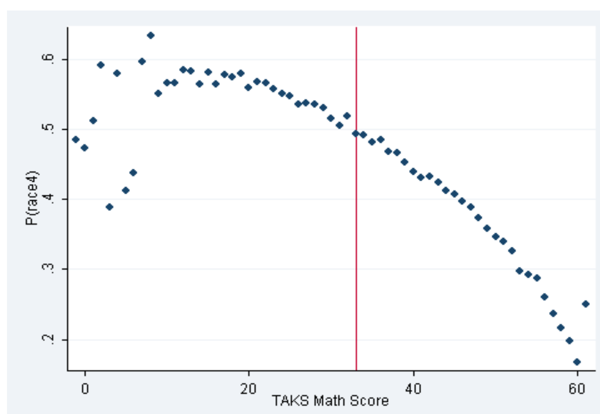
(d) Percent Asian



(e) Percent African American



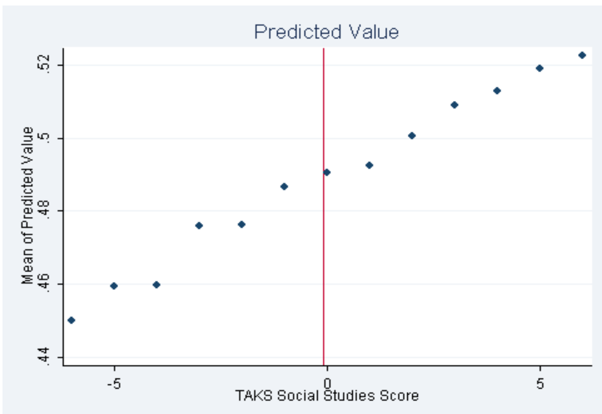
(f) Percent Hispanic



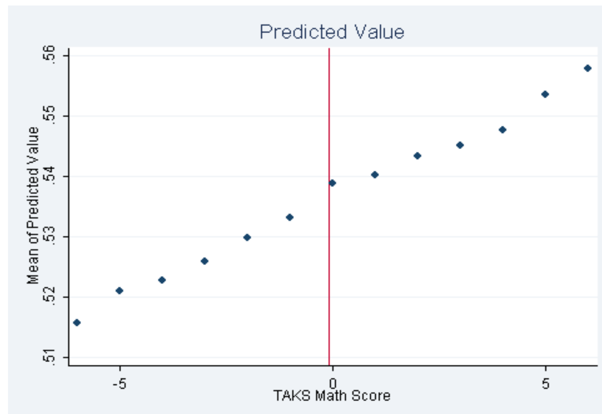
Notes: Vertical line represents the pass threshold.

Figure 4: Calculates the mean of the predicted value for each possible TAKS score by subject.

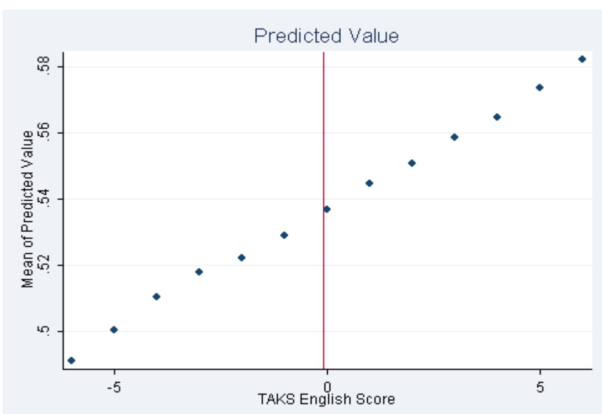
(a) Social Studies



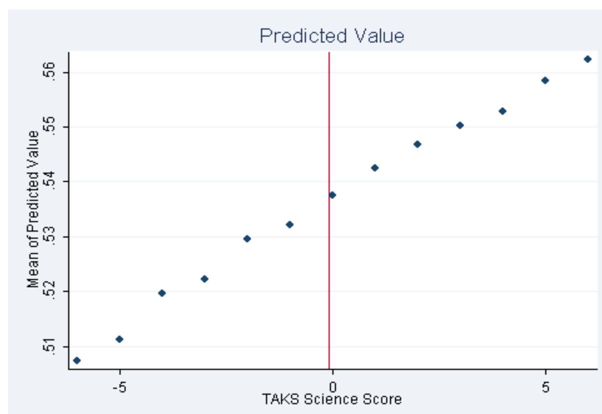
(b) Math



(c) English



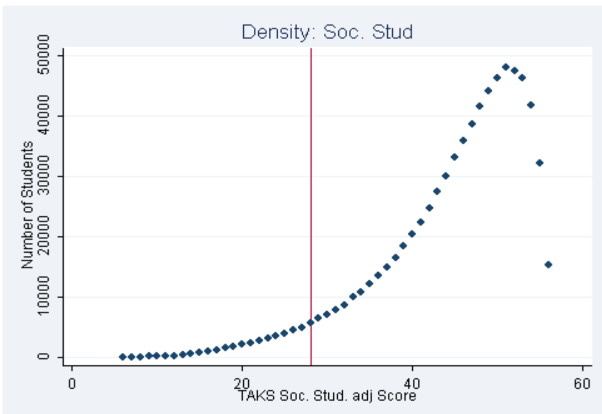
(d) Science



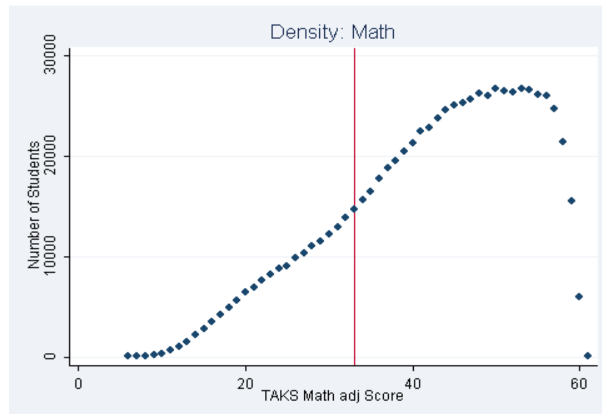
Notes: Red line indicates the minimum score required to “pass.”

Figure 5: Full Support of the Densities of TAKS scores by subject.

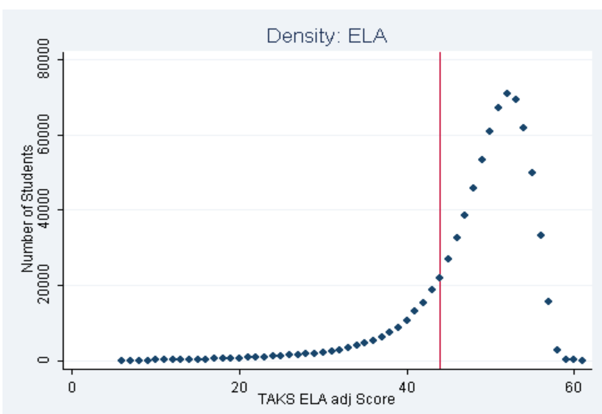
(a) Social Studies



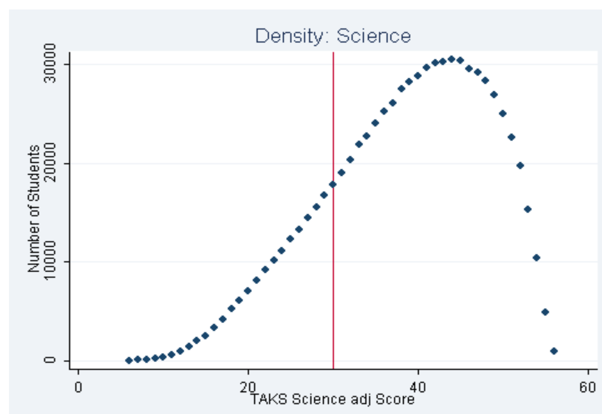
(b) Math



(c) English



(d) Science



Notes: Vertical line indicates the minimum score required to “pass.”