

A Appendix

A. Data and Definitions for Outcome Variables

A.1 Texas ERC Data

The Texas Education Research Center (ERC) compiles administrative data from various sources for students in Texas public schools. The Texas ERC dataset encompasses Pre-Kindergarten to twelfth grade (PK-12) educational records from the Texas Education Agency (TEA), post-secondary outcomes from Texas institutions via the Texas Higher Education Coordinating Board (THECB), national post-secondary outcomes from the National Student Clearinghouse (NSC), and employment and earnings records from the Texas Workforce Commission (TWC). This section outlines the specific contributions of each dataset to this study.

TEA Data (1994-2022)

The TEA provides comprehensive student-level educational records from Texas public schools at the PK-12 level. In this study, the TEA data span from the 1994-1995 school year to the 2022-2023 school year. This study utilizes demographic information, including age, gender, race, limited English proficiency, free meal eligibility, special education participation, and annual school attendance. Attendance records are mainly used to identify grade retention, which is defined as a student repeating the same grade in the subsequent year. Absenteeism data is also used to assess the impact of retention on school absences. The dataset also includes high school graduation statuses and other exit information, such as dropout rates, private or home school attendance, out-of-state schooling, expulsions, or death.

The TEA provides student-level test scores from the Texas Assessment of Knowledge and Skills (TAKS), which was administered annually from 2002-2003 to 2011-2012. This study examines the impact of third-grade retention on reading and math test scores for third to eighth-grade

students, or one to five years after third grade. The TEA data includes both raw scores, reflecting the number of correct responses, and scale scores, which facilitate direct comparisons across different test administrations. In this analysis, raw reading scores adjusted by the promotion cutoff serve as the running variable. Both raw and scale scores are standardized across subject-grade/year-cohort to have a mean of zero and a standard deviation of one, separately.

THECB Data (2010-2021)

The THECB data used in this study spans from 2010 through 2021, including detailed records on post-secondary education in Texas. The data further categorizes institutions into five types: public universities, Community colleges, Independent colleges and universities, Health Institutions, and Career schools or colleges. This study examines the impact of third-grade retention on college outcomes across these institution types.

NSC Data (2011-2019)

The NSC data from 2011 through 2019 supplements THECB by providing enrollment records for Texas students attending out-of-state colleges, covering about 96% of U.S. higher education enrollment. However, the NSC data from 2011 through 2016 do not include graduation dates or completion statuses.

TWC Wages Data (2007-2023)

The wage data used in this study come from the Texas Workforce Commission (TWC) and span from 2007 to 2023. These data provide quarterly wage records for individuals employed in Texas. TWC mandates that all liable employers report Unemployment Insurance (UI) wages and pay UI taxes electronically quarterly. Failure to comply with these reporting requirements may result in penalties under Sections 213.023 and 213.024 of the Texas Unemployment Compensation Act (TUCA).

Texas liable employers include a wide range of entities, such as sole proprietorships, partnerships, limited liability companies, limited partnerships, professional corporations, professional associations, corporations, foundations, trusts, estates, banking institutions, political subdivisions, and governmental agencies.

Employers become liable once they meet at least one of the following criteria:

1. **Federal Liability:** The employing unit is subject to the Federal Unemployment Tax Act (FUTA) and pays wages to employees in Texas.
2. **General Wage or Employment Threshold:** The employing unit either:
 - Pays at least \$1,500 in total gross wages within a single calendar quarter, **or**
 - Has at least one employee (full-time or part-time) for twenty separate weeks during a calendar year.

(The employee does not need to be the same individual for all twenty weeks, and these weeks do not need to be consecutive.)
3. **Acquisition of Liable Business:** The employing unit acquires all or part of another organization's trade, business, or workforce, provided the other entity was a liable employer at the time of acquisition.
4. **Nonprofit Organizations:** The employing unit is a 501(c)(3) nonprofit organization employing at least four individuals (full-time or part-time) for twenty separate weeks during a calendar year.

(These employees need not be the same individuals, and the weeks do not have to be consecutive.)
5. **Voluntary Liability:** The employing unit voluntarily elects to become liable even if none of the above requirements are met.
6. **Political Subdivisions:** All political subdivisions of Texas, including municipalities, counties, utility districts, and public educational institutions, are automatically liable.
7. **Domestic Employment:** The employing unit pays at least \$1,000 in cash wages within any calendar quarter for domestic services.

8. **Farm or Ranch Employment:** The employing unit engages in farm or ranch labor and either:

- Employs at least three workers (full-time or part-time) for twenty or more weeks within a calendar year, **or**
- Pays total gross wages of at least \$6,250 within a single calendar quarter.

(These weeks do not need to be consecutive, and workers do not have to be the same individuals throughout. Seasonal and migrant agricultural workers, including those employed on truck farms, orchards, and vineyards, or hired by labor agents, are included.)

Exemptions: types of employment are excluded from TWC wage reporting, including:

1. Services performed for a church or an organization primarily operating for religious purposes.
2. Services performed by a minor child (under 21 years old), spouse, or parent of a sole proprietor. A sole proprietor is an individual who owns and operates their own business.
3. Work done as part of an unemployment work-relief or work-training program funded or supported by a federal or state agency.
4. Employment of a student by a school, college, or university, where the student is enrolled, attending classes regularly, and earning academic credit for their work.

In brief, TWC wage data exclude wage records for individuals who are not participating in the labor force, are unemployed, are employed outside of Texas, or are self-employed without employees. Therefore, missing wage records in the dataset likely indicate labor market disengagement, unemployment, self-employment, or employment outside the state.

I reference external labor force statistics to identify the primary causes of missing wage records. The [US Census Bureau \(2023\)](#) reports that approximately 35% of Texans over age 16 are out of the labor force. Low labor force participation is more pronounced among young adults, which

likely explains a significant share of missing wages among individuals between the ages of 23 and 26 observed in this study. The unemployment rate in Texas is around 3%. Additionally, [Hipple and Hammond \(2016\)](#) reports that the nationwide self-employment rate among young adults is just 1.9%, underscoring its rarity. Out-of-state employment is minimal: the [Internal Revenue Service \(2022\)](#) indicates that only 1.8% of Texans relocated and paid tax outside of Texas in 2021–22. These statistics reveal that missing wages mainly reflect labor force disengagement and unemployment rather than data attrition due to self-employment and employment outside of Texas. As a result, this study codes missing wage records as zero to reflect labor market disengagement. Table [A4](#) provides detailed definitions for all earnings-related outcome variables.

Table A1: Employment Status From American Community Survey

Total Class of Worker	(1) Employed	(2) Not in Labor Force	(3) Unemployed	(4) Unincorporated self-employed	(5) Working w/o pay in family business
23,027,304	12,958,586	8,009,820	765,803	1,235,292	57,803
100%	56.3%	34.8%	3.3%	5.4%	0.3%

Notes: This table presents Texas employment status based on the American Community Survey 5-Year Estimates Public Use Microdata Sample (2023). The sample excludes individuals younger than 16.

A.2 Data Linkage and Cleaning

Each dataset includes a unique student identifier (ID2) as a substitute for Social Security Numbers (SSNs), enabling longitudinal tracking across datasets. Students without valid SSNs receive state-assigned ID2 numbers. These identifiers are regularly verified and updated across the TEA, THECB, and TWC datasets, reflecting changes such as the assignment of valid SSNs. Further details regarding the matching process and crosswalk are provided [here](#). To verify the accuracy of longitudinal tracking using ID2, I merge the primary sample from TEA data with community college enrollment data from 2014 and examine gender matching rates across these datasets. The resulting gender match accuracy using ID2 is approximately 99%.

The primary analysis sample comprises three cohorts of first-time third-graders from the 2002–03 through 2004–05 school years. Third-graders from the 2002–03 cohort were the first affected by the Texas test-based third-grade retention policy and are approximately 28 years old in 2023. Stu-

dents from the final cohort (2004–05) will be around 26 in 2023. Table A2 presents a detailed timeline for each cohort. These three cohorts were selected to ensure a sufficient sample size for the fuzzy regression discontinuity analysis and to facilitate the observation of earnings outcomes through age 26.

Additionally, I restrict the sample to third-graders whose ID2 is available in the TEA test-score files.⁹ This restriction is necessary because employment and earnings data from the TWC can only be matched using ID2. Nearly all records from the TWC dataset contain valid ID2 entries, as SSNs are required for employment reporting.

Table A2: Cohorts 2003 to 2005 Timeline Without Retention

Calendar Year	Cohort 2002-2003		Cohort 2003-2004		Cohort 2004-2005	
	Grade	Age	Grade	Age	Grade	Age
2003	3	8	2	7	1	6
2004	4	9	3	8	2	7
2005	5	10	4	9	3	8
2006	6	11	5	10	4	9
2007	7	12	6	11	5	10
2008	8	13	7	12	6	11
2009	9	14	8	13	7	12
2010	10	15	9	14	8	13
2011	11	16	10	15	9	14
2012	12	17	11	16	10	15
2013		18	12	17	11	16
2014		19		18	12	17
2015		20		19		18
2016		21		20		19
2017	The 8 th year post-grade 9	22		21		20
2018	The 9 th year post-grade 9	23	The 8 th year post-grade 9	22		21
2019	The 10 th year post-grade 9	24	The 9 th year post-grade 9	23	The 8 th year post-grade 9	22
2020	The 11 th year post-grade 9	25	The 10 th year post-grade 9	24	The 9 th year post-grade 9	23
2021	The 12 th year post-grade 9	26	The 11 th year post-grade 9	25	The 10 th year post-grade 9	24
2022	The 13 th year post-grade 9	27	The 12 th year post-grade 9	26	The 11 th year post-grade 9	25
2023	The 14 th year post-grade 9	28	The 13 th year post-grade 9	27	The 12 th year post-grade 9	26
Ever Dropout	2004 to 2018		2004 to 2018		2004 to 2018	
Ever HG Grad.	2009 to 2022		2009 to 2022		2009 to 2022	
On-Time HG Grad.	By 2013		By 2014		By 2015	
On-Time College Enroll.	By 2013		By 2014		By 2015	
Ever College Enroll.	2010 to 2021		2010 to 2021		2010 to 2021	

A.3 Outcome Definition and Attrition

Earnings outcomes: This study employs two types of measures for earnings outcomes. The primary category defines earnings by age, including annual earnings at each age from 23 to 26, as

⁹Only a tiny fraction of students in the TEA files lack an ID2.

well as the average earnings across these years. Additionally, this category assesses the presence of positive earnings at each age from 23 to 26 and the average over these years. The second category measures annual earnings from the 8th to the 11th year post-ninth grade and calculates average earnings across this period. This category also includes indicators for positive earnings each year and overall during this period.

College enrollment outcomes: College enrollment outcomes are classified into two categories: "ever enrolling" in a college or university and "on-time" college enrollment. The ever enrolling category tracks any college enrollment from 2010 through 2021, while on-time enrollment specifically refers to enrolling in college by the ninth year post-grade three (coded as one if enrolled on time and zero otherwise). These outcomes are further differentiated by the selectivity and type of institution, including community colleges in Texas, public universities in Texas, and colleges outside Texas. Additionally, I define variables to track college enrollment status annually for each age from 18 to 26, providing a detailed view of the impact of third-grade retention on college enrollment.

College graduation outcomes: The NSC files within the Texas ERC lack detailed information on graduation status and dates. Therefore, this study focuses solely on college graduations within Texas. Graduation outcomes are categorized similarly to college enrollment outcomes, differentiated as "ever graduated" and "on-time graduation" from either a community college or a public university in Texas. Ever graduated tracks students who graduated at any time between 2010 and 2021. On-time graduation from a community college is defined as graduating by age 20, while for a public university, it is described as graduating by age 22. Additionally, on-time graduation from any college is also expected by the age of 22.

High School Graduation: High school graduation is defined as obtaining a high school diploma from a Texas public school between 2009 and 2022, excluding those who earn only a General Educational Development (GED) certificate. The term high school graduation attrition refers to students who leave the Texas public school system before graduation, presumably to attend schools elsewhere. I define high school graduation attrition as one if a student exits the

Texas public school system before graduation and zero otherwise. This coding provides an upper-bound estimate of attrition, recognizing that transferring students may not necessarily complete high school elsewhere.

Dropout: Texas public schools follow the U.S. Department of Education’s National Center for Education Statistics (NCES) definition of dropout, effective from the 2005-06 school year. By this definition, a dropout is a student who is enrolled in a Texas public school in grades 7-12, does not return to public school the following fall, is not expelled, and does not graduate, does not receive a GED, does not continue school outside the Texas public school system, does not begin college, or does not die (Secondary School Completion and Dropouts, 2008-09). In this study, dropout refers to individuals who have ever dropped out of a Texas public school, as defined by the NCES from 2004 through 2018.

Test scores: I conduct same-grade and same-year comparisons when analyzing the effects on reading and math scores. First, I estimate the impact of retention on test scores when both retained and promoted students reach the same grade, spanning from grades four to eight. Second, I compare the test scores by year from the first to the fifth year following the third grade. Reading and math scores are standardized by subject-cohort-grade/year, with mean zero and standard deviation one.

Behavioral Outcomes: The TEA disciplinary reasons and actions files identify incidents of violence and crime, which are detailed in Tables [A5](#) and [A6](#), respectively. I define the outcome variables for violence and crime as the total number of incidents recorded yearly from one to nine years following grade three. Furthermore, I calculate the cumulative total and annual average number of incidents over the entire nine-year period for these outcome variables. Similarly, I define the school absence variables as the number of days a student is absent from school each year, from one to nine years following grade three. Additionally, I calculate the cumulative total and the annual average of days absent over the nine years.

Table A3: Definition and Attrition of Educational and Behavioral Outcomes

Outcomes	Definition	Attrition
Panel A: Educational Outcomes		
Same-year test scores	First-attempt reading or math scores from the first through the fifth year post-grade three	Have test scores outside public schools
Same-grade test scores	First-attempt reading/math scores from grades four to eight	Have test scores outside of public schools
High school graduation	Graduated from a public high school from 2009 through 2022, excluding GED recipient	Graduated outside of the Texas public school
Any college enrollment	Enrolled in any college or university nationwide in the U.S. between 2010 and 2021	N/A
Community college enrollment	Enrolled in a community college in Texas between 2010 and 2021	N/A
Public University enrollment	Enrolled in a public university in Texas between 2010 and 2021	N/A
College enrollment outside Texas	Enrolled in any college outside Texas between 2011 and 2019	N/A
Any college graduation in Texas	Graduated from any college in Texas between 2010 and 2021	N/A
Community college graduation	Graduated from a community college in Texas between 2010 and 2021	N/A
Public University graduation	Graduated from a Public University in Texas between 2010 and 2021	N/A
Panel B: Behavioral Outcomes		
School absence	Total/average/annual days absent from school	Days absent outside of the Texas public schools
Crime	Total/average/annual criminal activities defined in Table A6	Crime committed outside of Texas public schools
Violent behaviors	Total/average/annual violent behaviors defined in Table A5	Violence committed outside Texas public schools

Notes: This table summarizes the definitions and attrition of educational and behavioral outcomes.

Table A4: Definition and Attrition of Labor Market Outcomes

Outcomes	Definition	Attrition
Panel A: earnings by age		
Wages 26	Annual wages at age 26	Have wages at age 26 from self-employment and employment outside of Texas
Wages 25	Annual wages at age 25	Have wages at age 25 from self-employment and employment outside of Texas
Wages 24	Annual wages at age 24	Have wages at age 24 from self-employment and employment outside of Texas
Wages 23	Annual wages at age 23	Have wages at age 23 from self-employment and employment outside of Texas
Av. Wages 23-25	Average wages btw ages 23 and 25	Have earnings from self-employment and employment outside of Texas
Av. Wages 23-26	Average earnings btw ages 23 and 26	Have earnings from self-employment and employment outside of Texas
Positive wages2325	Have positive earnings btw ages 23 & 25	Have positive earnings from self-employment and employment outside of Texas
Positive wages2326	Have positive earnings btw ages 23 & 26	Have positive earnings from self-employment and employment outside of Texas
Panel B: earnings from the 8th to the 11th years post-grade nine		
Earnings grade 9+8 th	Annual earnings in the 8 th year post-grade nine	Have earnings from self-employment and employment outside of Texas
Earnings grade 9+9 th	Annual earnings in the 9 th year post-grade nine	Have earnings from self-employment and employment outside of Texas
Earnings grade 9+10 th	Annual earnings in the 10 th year post-grade nine	Have earnings from self-employment and employment outside of Texas
Earnings grade 9+11 th	Annual earnings in the 11 th year post-grade nine	Have earnings from self-employment and employment outside of Texas
Av.Earnings grade 9+(8 – 11) th	Average earnings btw the 8 th to 11 th years post-grade nine	Have earnings from self-employment and employment outside of Texas

Notes: This table summarizes the definition and attrition of earnings outcome variables.

Table A5: Definition of Violent Behavior

CODE	TRANSLATION
2	CONDUCT PUNISHABLE AS A FELONY 37.006(A)(2)(A)
4	POSSESSED, SOLD, USED OR WAS UNDER THE INFLUENCE OF MARIHUANA OR OTHER CONTROLLED SUBSTANCE
5	POSSESSED, SOLD, USED OR WAS UNDER THE INFLUENCE OF AN ALCOHOLIC BEVERAGE
6	ABUSE OF A VOLATILE CHEMICAL
7	PUBLIC LEWDNESS OR INDECENT EXPOSURE
8	RETALIATION AGAINST SCHOOL EMPLOYEE
9	TITLE 5 FELONY - OFF CAMPUS AND NOT AT SCHOOL SPONSORED ACTIVITY
10	NON TITLE 5 FELONY CONDUCT-NOT ON CAMPUS OR AT SCHOOL SPONSORED ACTIVITY
11	BROUGHT FIREARM TO SCHOOL - TEC37.007(e) OR UNLAWFUL CARRY OF A HANDGUN
12	UNLAWFUL CARRY OF AN ILLEGAL KNIFE UNDER PENAL CODE 46.02-TEC 37.007(a)(1)
13	UNLAWFUL CARRYING OF A CLUB UNDER PENAL CODE 46.02 - TEC 37.007(a)(1)
14	CONDUCT CONTAINING THE ELEMENTS OF AN OFFENSE RELATING TO PROHIBITED WEAPONS
16	ARSON
17	MURDER, CAPITAL MURDER, CRIMINAL ATTEMPT TO COMMIT MURDER OR CAPITAL MURDER
18	INDECENCY WITH A CHILD
19	AGGRAVATED KIDNAPPING
22	CRIMINAL MISCHIEF
26	TERRORISTIC THREAT - TEC SECTION 37.006(A)(1) OR 37.007(B)
27	ASSAULT UNDER PENAL CODE SECT. 22.01(A)(1) AGAINST A DISTRICT EMPLOYEE/VOLUNTEER
28	ASSAULT UNDER PENAL CODE SECT 22.01(A)(1) OTHER THAN SCHOOL DISTRICT EMPLOYEE/VOLUNTEER
29	AGGRAVATED ASSAULT (PC SECT 22.02) AGAINST SCHOOL DISTRICT EMPLOYEE/VOLUNTEER
30	AGGRAVATED ASSAULT (PC SECT 22.02) AGAINST SOMEONE OTHER THAN DISTRICT EMPLOYEE
31	SEXUAL OR AGGRAVATED ASSAULT AGAINST A SCHOOL DISTRICT EMPLOYEE/VOLUNTEER
32	SEXUAL OR AGGRAVATED SEXUAL ASSAULT AGAINST SOMEONE O/T DISTRICT EMPLOYEE/VOLUNTEER
34	SCHOOL-RELATED GANG VIOLENCE
35	FALSE ALARM/FALSE REPORT - TEC SECTION 37.006(A)(1) AND 37.007(B)
36	FELONY CONTROLLED SUBSTANCE VIOLATION - TEC SECTION 37.007(A)(3)
37	FELONY ALCOHOL VIOLATION - TEC SECTION 37.007(A)(3)
41	FIGHTING/MUTUAL COMBAT
46	AGGRAVATED ROBBERY - TEC 37.007(a)(2)(F), TEC 37.006 (c)-(d)
47	MANSLAUGHTER
48	CRIMINALLY NEGLIGENT HOMICIDE
49	ENGAGES IN DEADLY CONDUCT
53	ENGAGED IN CONDUCT THAT OFFENSES ARE SPEC IN TEC OFF-CAMPUS BUT W/IN 300FT

Notes: This table lists incidents categorized as violence.

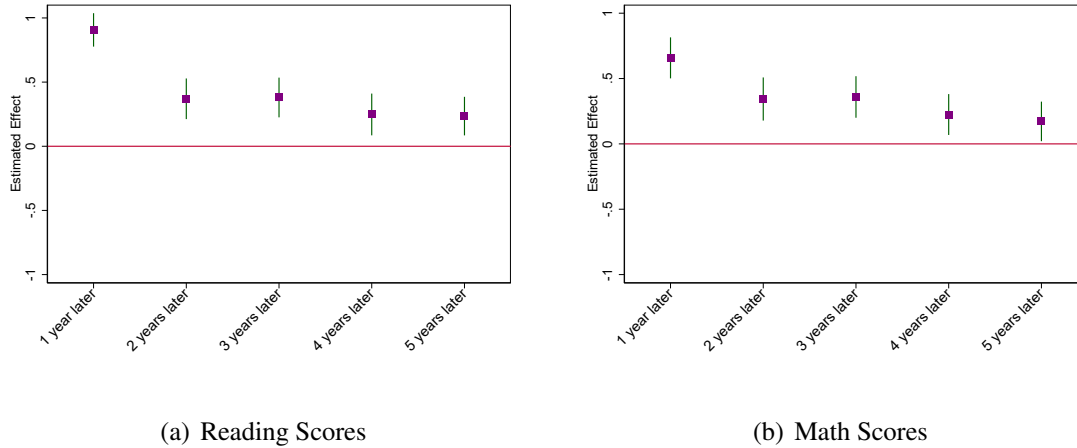
Table A6: Definition of Criminal Behavior

CODE	TRANSLATION
1	PERMANENT REMOVAL BY TEACHER FROM CLASS
2	CONDUCT PUNISHABLE AS A FELONY 37.006(A)(2)(A)
4	POSSESSED, SOLD, USED OR WAS UNDER THE INFLUENCE OF MARIHUANA OR OTHER CONTROLLED SUBSTANCE
5	POSSESSED, SOLD, USED OR WAS UNDER THE INFLUENCE OF AN ALCOHOLIC BEVERAGE
6	ABUSE OF A VOLATILE CHEMICAL
7	PUBLIC LEWDNESS OR INDECENT EXPOSURE
8	RETALIATION AGAINST SCHOOL EMPLOYEE
9	TITLE 5 FELONY - OFF CAMPUS AND NOT AT SCHOOL SPONSORED ACTIVITY
10	NON TITLE 5 FELONY CONDUCT-NOT ON CAMPUS OR AT SCHOOL SPONSORED ACTIVITY
11	BROUGHT FIREARM TO SCHOOL - TEC37.007(e) OR UNLAWFUL CARRY OF A HANDGUN
12	UNLAWFUL CARRY OF AN ILLEGAL KNIFE UNDER PENAL CODE 46.02-TEC 37.007(a)(1)
13	UNLAWFUL CARRYING OF A CLUB UNDER PENAL CODE 46.02 - TEC 37.007(a)(1)
14	CONDUCT CONTAINING THE ELEMENTS OF AN OFFENSE RELATING TO PROHIBITED WEAPONS
16	ARSON
17	MURDER, CAPITAL MURDER, CRIMINAL ATTEMPT TO COMMIT MURDER OR CAPITAL MURDER
18	INDECENCY WITH A CHILD
19	AGGRAVATED KIDNAPPING
22	CRIMINAL MISCHIEF
26	TERRORISTIC THREAT - TEC SECTION 37.006(A)(1) OR 37.007(B)
27	ASSAULT UNDER PENAL CODE SECT. 22.01(A)(1) AGAINST A DISTRICT EMPLOYEE/VOLUNTEER
28	ASSAULT UNDER PENAL CODE SECT 22.01(A)(1) OTHER THAN SCHOOL DISTRICT EMPLOYEE/VOLUNTEER
29	AGGRAVATED ASSAULT (PC SECT 22.02) AGAINST SCHOOL DISTRICT EMPLOYEE/VOLUNTEER
30	AGGRAVATED ASSAULT (PC SECT 22.02) AGAINST SOMEONE OTHER THAN DISTRICT EMPLOYEE
31	SEXUAL OR AGGRAVATED ASSAULT AGAINST A SCHOOL DISTRICT EMPLOYEE/VOLUNTEER
32	SEXUAL OR AGGRAVATED SEXUAL ASSAULT AGAINST SOMEONE O/T DISTRICT EMPLOYEE/VOLUNTEER
35	FALSE ALARM/FALSE REPORT - TEC SECTION 37.006(A)(1) AND 37.007(B)
36	FELONY CONTROLLED SUBSTANCE VIOLATION - TEC SECTION 37.007(A)(3)
37	FELONY ALCOHOL VIOLATION - TEC SECTION 37.007(A)(3)
46	AGGRAVATED ROBBERY - TEC 37.007(a)(2)(F), TEC 37.006 (c)-(d)
47	MANSLAUGHTER
48	CRIMINALLY NEGLIGENT HOMICIDE
49	ENGAGES IN DEADLY CONDUCT
50/52	USED, EXHIBITED OR POSSESSED A NON-ILLEGAL KNIFE PER STUDENT CODE CONDUCT
51	USED, EXHIBITED, OR POSSESSED A FIREARM OFF-CAMPUS BUT W/IN 300FT OF SCHOOL
53	ENGAGED IN CONDUCT THAT OFFENSES ARE SPEC IN TEC OFF-CAMPUS BUT W/IN 300FT
54	ENGAGE IN CONDUCT PUNISH AS FELONY OFF-CAMPUS BUT W/IN 300FT

Notes: This table lists the incidents that are categorized as crime.

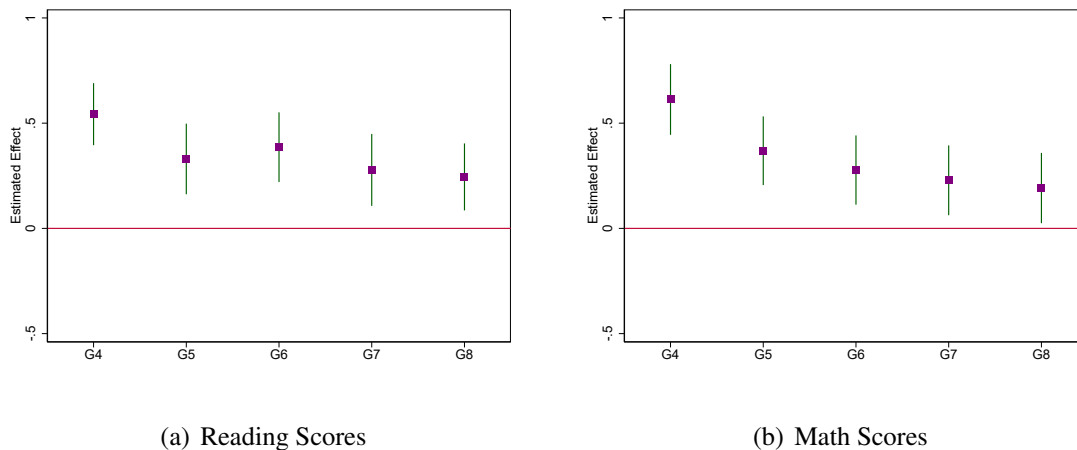
B. Tables and Figures of Main Results

Figure A1: Effects of Grade Retention on Raw Scores by Years



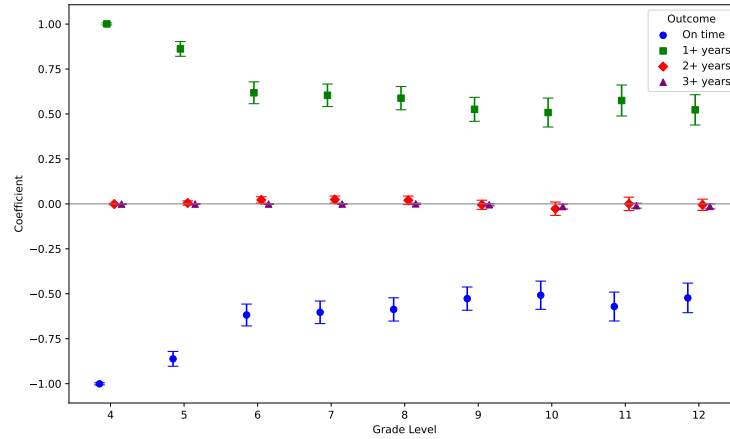
Notes: These figures report estimates of the impacts of third-grade retention on reading and math raw scores from one to five years following third grade. Raw scores indicate the number of questions answered correctly and are standardized within each subject-year-cohort to have mean zero and standard deviation one.

Figure A2: Effects of Grade Retention on Raw Scores by Grades



Notes: These figures display estimates of the effects of third-grade retention on reading and math raw scores from the fourth through the eighth grades. Raw scores indicate the number of questions answered correctly and are standardized within each subject-grade-cohort to have mean zero and standard deviation one.

Figure A3: Effects of Retention on Timing of Reaching Each Grade



Notes: This figure reports estimates of the impacts of third-grade retention on the likelihood of reaching each grade from four to twelve on time, 1+, 2+, 3+, and 4+ more years relative to the expected time.

Table A7: Summary Statistics by Test Performance and Retention Status

	Below Cutoff				Above Cutoff			
	Retained	Promoted	Diff.	t-stat	Promoted	Retained	Diff.	t-stat
Age	8.15	8.44	-0.29	-32.5	8.25	8.15	0.10	4.8
Eligible for Free Meals	0.65	0.65	0.01	0.6	0.61	0.63	-0.01	-0.5
Male	0.55	0.57	-0.02	-2.0	0.52	0.53	-0.01	-0.4
Limited English Proficiency	0.38	0.33	0.05	5.9	0.35	0.31	0.04	2.0
Bilingual Program	0.20	0.15	0.04	6.3	0.17	0.14	0.03	1.7
Migrant	0.04	0.04	0.01	2.3	0.04	0.03	0.01	0.8
Special Education	0.05	0.09	-0.04	-8.1	0.06	0.05	0.01	1.4
Hispanic	0.63	0.57	0.06	6.8	0.60	0.60	-0.00	-0.0
Black	0.26	0.28	-0.02	-2.1	0.24	0.27	-0.03	-1.6
White	0.09	0.14	-0.05	-8.2	0.14	0.11	0.03	2.1
Third Grade Reading Score	-4.34	-3.94	-0.39	-9.5	3.44	2.87	0.57	5.5
High school graduation	0.58	0.58	-0.01	-0.7	0.65	0.57	0.08	3.8
Any College Enrollment	0.34	0.34	-0.00	-0.2	0.41	0.37	0.04	1.8
Average Earnings btw Ages 23 to 25	14466	14916	-450	-1.4	16076	14722	1354	1.8

Notes: This table presents summary statistics for retained students versus those promoted, further categorized by whether their reading scores fell eight points below or above the cutoff.

Table A8: Effect of Failing the Reading Test on Earnings between Ages 23 and 26

	(1)	(2)	(3)	(4)	(5)	(6)
	Annual Earnings at Each Age from 23 to 26				Average Earnings	
	Age23	Age24	Age25	Age26	Ages23-25	Ages23-26
Below cutoff	-1,682 (665)	-1,243 (695)	-1,399 (764)	-1,338 (795)	-1,493 (666)	-1,508 (675)
Above cutoff mean	14,864	15,948	17,221	18,557	16,012	16,645
Effect size	-11.32%	-7.79%	-8.12%	-7.21%	-9.32%	-9.06%
Observations	14509	14509	14507	14468	14509	14509

Notes: This table displays reduced form estimates of the effects of failing the third-attempt reading test on annual earnings at each age from 23 to 26 and the average earnings between 23 and 25 and 23 and 26. These estimates are obtained by replacing "Retention" on left-hand side of equation (1) with earnings outcomes. The "Above cutoff mean" indicates the average earnings outcome for students whose reading scores are zero to eight points above the cutoff.

Table A9: Effect of Grade Retention on Earnings Outcomes by Cohort

	(1)	(2)	(3)	(4)	(5)	(6)
	Annual Earnings at Each Age from 23 to 26				Average Earnings	
	Age23	Age24	Age25	Age26	Ages23-25	Ages23-26
Cohorts 2003-05	-4,324 (1,535)	-2,921 (1,583)	-3,278 (1,753)	-3,477 (1,843)	-3,516 (1,468)	-3,518 (1,493)
Observations	19,784	19,784	19,782	19,731	19,784	19,784
Cohorts 2003-04	-5,691 (2,153)	-3,192 (2,140)	-4,388 (2,265)	-5,882 (2,475)	-4,502 (2,049)	-4,931 (2,096)
Observations	9,792	9,792	9,791	9,789	9,792	9,792
Cohort 2003	-6,352 (3,566)	-4,305 (3,645)	-2,663 (3,710)	-2,166 (4,292)	-4,583 (3,402)	-4,184 (3,498)
Observations	3,786	4,594	3,785	3,783	3,786	3,786
Cohort 2004	-5,088 (2,364)	-1,603 (2,382)	-4,754 (2,635)	-8,325 (2,638)	-3,861 (2,276)	-5,015 (2,301)
Observations	5,958	5,958	6,619	6,619	5,958	5,958
Cohort 2005	-3,201 (2,922)	-3,819 (3,062)	-2,283 (3,416)	-173 (3,687)	-3,147 (2,849)	-2,514 (2,886)
Observations	7,502	8,470	8,469	8,420	8,470	8,470

Notes: This table displays fuzzy RDD estimates of the effects of third-grade retention on annual earnings at age 23 to 26 and earnings averaging across these periods by cohort. The sample includes the 2003 to 2005 cohorts of first-time third-grade students who took the third-attempt reading test.

Table A10: Effect of Third-Grade Retention on First Earnings Outcomes and Work Experience

	(1) Age at First Wages Earned	(2) First Positive Earnings	(3) Total Work Experience btw Ages 21 to 26
Retention	0.085 (0.143)	-1,649 (685)	-0.359 (0.213)
Above cutoff mean	18.56	7,174	4.01
Effect size	0.46%	-23.0%	-8.96%
Observations	14925	19764	19909

Notes: This table displays fuzzy RDD estimates of the effects of third-grade retention on the age of first earnings, first earnings, and total work experience between ages 21 and 26.

Table A11: Effect of Retention on Earnings from the 8th to 11th Year after Grade Nine

	(1) Annual Earnings from the 8 th to the 11 th Year Post-Grade Nine Grade 9+8 th	(2) Grade 9+9 th	(3) Grade 9+10 th	(4) Grade 9+11 th	(5) Average Earnings Grade 9+8 th to 11 th
Retention	-2,687 (1,484)	-2,649 (1,616)	-1,917 (1,711)	-2,518 (1,791)	-2,425 (1,514)
Above cutoff mean	13,742	14,805	16,066	17,035	15,412
Effect size	-20%	-18%	-12%	-15%	-16%
Observations	19909	19909	19909	22070	19909

Notes: This table displays fuzzy RDD estimates of the effects of third-grade retention on earnings from the 8th to 11th years following grade nine and the average earnings during this period. The bandwidth for each outcome is determined by minimizing the mean squared error, following the approach outlined in [Calonico et al. \(2017\)](#). Variations in bandwidth across outcomes account for differences in observations.

Table A12: Effect of Retention on Earnings Attrition and Imputed Earnings

	(1) Attrition	(2) Average Earnings btw ages 23-26	(3) mean	(4) Imputed Earnings mean-one sd	(5) mean+one sd
Retention	0.01 (0.01)	-3,518 (1,493)	-3,488 (1,530)	-3,475 (1,517)	-3,501 (1,561)
Above cutoff mean	0.021	16,645	17071	16,704	17,438
Effect size	48%	-21%	-20%	-21%	-20%
Observations	19909	19784	19784	19784	19784

Notes: This table displays fuzzy RDD estimates of the effects of third-grade retention on earnings attrition and imputed earnings outcomes. Earnings attrition is defined as attending schools or colleges outside Texas and missing wage records in the TWC data between ages 23 and 26. In columns (3) to (5), zero wage records for students ever attending educational institutions outside of Texas are replaced with three scenarios: the average positive earnings of their peers who are initially promoted and have the same reading scores, this average minus one standard deviation, and this average plus one standard deviation.

Table A13: Effect of Third-Grade Retention on Retention Probability after Third Grade

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Retention in Each Grade Post-Grade Three								
	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
Third-grade Retention	-0.124 (0.022)	-0.206 (0.025)	-0.012 (0.012)	-0.019 (0.012)	-0.042 (0.013)	-0.064 (0.030)	0.040 (0.021)	-0.009 (0.015)	-0.015 (0.013)
Above cutoff mean	0.075	0.125	0.020	0.024	0.029	0.140	0.050	0.030	0.028
Effect size	-165.33%	-164.8%	-60%	-79.17%	-144.83%	-45.71%	80%	-30%	-53.57%
Observations	37201	37201	37201	37201	37201	37201	37201	37201	37201

Notes: This table provides fuzzy RDD estimates of the impacts of third-grade retention on the likelihood of repeating each subsequent grade after third grade.

Table A14: Effect of Grade Retention on the Likelihood of Enrolling in a College at Each Age

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Age 18	Age 19	Age 20	Age 21	Age 22	Age 23	Age 24	Age 25	Age 26
College Enrollment	-0.041 (0.031)	-0.006 (0.034)	0.028 (0.031)	-0.028 (0.027)	0.011 (0.025)	-0.007 (0.020)	0.012 (0.019)	0.011 (0.013)	0.000 (0.007)
Observations	22070	19909	19909	19909	19909	22070	19909	19909	19909

Notes: This table presents estimates of the impacts of third-grade retention on the status of college enrollment at each age from 18 to 26, analyzed using a fuzzy RDD approach. Data on college outcomes are sourced from the Texas Higher Education Coordinating Board (THECB) and the National Student Clearinghouse (NSC). College enrollment is defined as enrolling in any college in Texas or other states from 2010 through 2021.

Table A15: Effect of Retention on Grade Progression to Subsequent Grade

	(1) On time attendance	(2) 1+ years later	(3) 2+ years later	(4) 3+ years later	(5) Do not attend this grade in public schools
Grade 4	-1.001 (0.003)	1.001 (0.003)	-0.001 (0.002)	-0.001 (0.001)	0.065 (0.016)
Observations	19308	19308	19308	19308	19909
Grade 5	-0.862 (0.021)	0.862 (0.021)	0.005 (0.006)	-0.001 (0.001)	0.036 (0.019)
Observations	20936	18882	20936	16522	22070
Grade 6	-0.618 (0.031)	0.618 (0.031)	0.022 (0.009)	-0.001 (0.001)	0.032 (0.021)
Observations	18495	18495	20496	18495	22070
Grade 7	-0.603 (0.032)	0.604 (0.032)	0.024 (0.010)	-0.001 (0.001)	0.014 (0.022)
Observations	18328	18328	20323	18328	22070
Grade 8	-0.587 (0.033)	0.588 (0.033)	0.020 (0.012)	0.000 (0.002)	0.018 (0.025)
Observations	18076	18076	20029	18076	19909
Grade 9	-0.527 (0.033)	0.526 (0.034)	-0.005 (0.013)	-0.005 (0.003)	0.014 (0.024)
Observations	20065	18104	20065	20065	22070
Grade 10	-0.508 (0.040)	0.508 (0.041)	-0.027 (0.019)	-0.015 (0.007)	0.030 (0.036)
Observations	15278	15278	16898	16898	22070
Grade 11	-0.571 (0.041)	0.575 (0.044)	-0.000 (0.019)	-0.010 (0.007)	0.131 (0.042)
Observations	13680	11965	13680	13680	19909
Grade 12	-0.523 (0.042)	0.523 (0.043)	-0.005 (0.016)	-0.014 (0.007)	0.112 (0.045)
Observations	13223	13223	13223	13223	17404

Notes: This table presents fuzzy RDD estimates of the impacts of third-grade retention on the timing of progression through subsequent grades. "On-time attendance" indicates advancing to fourth grade immediately after third grade. "1+ years" denotes entering fourth grade (and subsequent grades) one or more years later than the standard schedule. Similarly, "2+ years" and "3+ years" indicate delays of two and three more years, respectively, relative to the expected schedule.

Table A16: Attrition Rates Among Students Above and Below the Cutoff

	(1) Above Cutoff Mean	(2) Below Cutoff Mean	(3) Difference	(4) t-statistic
Attend private or home school	0.099	0.114	-0.015	-3.7
Attend out-of-state school	0.059	0.061	-0.002	-0.7
Attend out-of-state college	0.012	0.008	0.004	3.0
Attrition Rate of High School Graduation				
Leave and attend school elsewhere before grade 9	0.016	0.018	-0.002	-1.3
Leave and attend school elsewhere before grade 10	0.051	0.066	-0.014	-4.7
Leave and attend school elsewhere before grade 11	0.083	0.105	-0.021	-5.7
Leave and attend school elsewhere before grade 12	0.112	0.133	-0.021	-4.9
Ever leave and attend school elsewhere	0.131	0.151	-0.020	-4.4
Attrition Rate of Earnings Outcome				
Attend school/college outside Texas with zero earnings at age 23	0.028	0.031	-0.004	-1.6
Attend school/college outside Texas with zero earnings at age 24	0.028	0.031	-0.003	-1.3
Attend school/college outside Texas with zero earnings at age 25	0.029	0.031	-0.002	-0.8
Attend school/college outside Texas with zero earnings at age 26	0.029	0.031	-0.002	-0.9
Attend school/college outside Texas with zero earnings btw ages 23-25	0.022	0.025	-0.003	-1.3
Attend school/college outside Texas with zero earnings btw ages 23-26	0.021	0.024	-0.002	-1.2

Notes: This table compares attrition rates for students whose third-grade reading scores fall within eight points above or below the promotion cutoff. High school graduation attrition is defined as leaving the public school system without graduating and enrolling elsewhere, including private, home, or out-of-state schools. Attrition for earnings outcomes refers to attending an educational institution outside Texas and having zero wages in the Texas TWC data during the corresponding age period.

Table A17: Effect of Retention on High School Graduation Attrition

	(1)	(2)	(3)	(4)	(5)
	High School Graduation Attrition				
	Exit before Grade 9	Exit before Grade 10	Exit before Grade 11	Exit before Grade 12	Ever exit
Retention	-0.010 (0.010)	-0.004 (0.020)	0.031 (0.027)	0.027 (0.031)	0.030 (0.032)
Above cutoff mean	0.016	0.051	0.083	0.112	0.131
Effect size	-62.50%	-7.84%	37.35%	24.11%	22.90%
Observations	19909	19909	19909	17404	19909

Notes: This table shows fuzzy RDD estimates of the effects of retention on high school graduation attrition outcomes. In this context, attrition refers to students who leave for other schools and do not obtain a high school graduation diploma from the Texas public school system. This includes scenarios where students transferred to schools outside of Texas, switched to private or homeschooling, enrolled in the Texas University high school diploma program, or completed high school through alternative pathways, such as enrolling in college without a high school diploma.

Table A18: Effect of Retention on Attending School Outside Texas Public School System

	(1) Attending Out-of-State School	(2) Attending Private or Home School
Retention	0.042 (0.024)	-0.003 (0.025)
Above cutoff mean	0.059	0.099
Effect size	71%	-3%
Observations	17404	22070

Notes: This table presents estimates of the effects of third-grade retention on leaving Texas public school without graduation to attend private or home schools and out-of-state schools using the fuzzy RDD method. Out-of-State School indicates a student who left the Texas public school and attended a school outside Texas between 2004 and 2018. Private or home school is defined as attending a private or home school between 2004 and 2018.

Table A19: Effect of Grade Retention on Earnings Outcomes using Math Cutoff

	(1) Annual Earnings at Each Age from 23 to 26	(2)	(3)	(4)	(5) Average Earnings	(6)
	Age23	Age24	Age25	Age26	Ages23-25	Ages23-26
RDD Estimates	-439 (732)	-583 (781)	-435 (867)	-110 (883)	-470 (740)	-363 (755)
Observations	12,496	12,496	12,495	15,731	12,496	12,496
Fuzzy RDD Estimates	-7,966 (14,762)	-11,479 (15,471)	-11,316 (15,827)	-7,367 (16,226)	-12,472 (13,878)	-11,060 (13,966)
Observations	12,496	12,496	15,758	15,731	15,759	15,759

Notes: The top panel of this table shows reduced form estimates of the effect of failing the minimum standard cutoff of the first math test in third grade on earnings outcomes. The bottom panel of this table displays fuzzy RDD estimates of the effects of third-grade retention due to failing the math test on earnings at each age from 23 through 26 and the average earnings between ages 23 to 25 and ages 23 to 26.

Table A20: Effect of Grade Retention on Earnings by Methods

	(1)	(2)	(3)	(4)	(5)	(6)
	Annual Earnings at Each Age from 23 to 26				Average Earnings	
	Age23	Age24	Age25	Age26	Ages23-25	Ages23-26
Local linear regression	-4,324 (1,536)	-2,921 (1,583)	-3,278 (1,752)	-3,477 (1,842)	-3,516 (1,468)	-3,518 (1,492)
Bias-corrected	-4,737 (1,536)	-3,750 (1,583)	-4,244 (1,752)	-4,352 (1,842)	-4,353 (1,468)	-4,414 (1,492)
Robust	-4,737 (2,076)	-3,750 (2,109)	-4,244 (2,386)	-4,352 (2,473)	-4,353 (1,942)	-4,414 (1,974)
Observations	36,970	36,970	36,966	36,874	36,970	36,970

Notes: This table presents estimates of the effects of grade retention on earnings outcomes using rdrobust methods introduced in (Calonico et al., 2017). Three estimation procedures are employed: (i) local linear estimates with heteroskedasticity-robust standard errors, (ii) bias-corrected estimates with heteroskedasticity-robust standard errors, and (iii) bias-corrected estimates with robust standard errors.