Online Appendix

Nutrition and Cognitive Achievement: An Evaluation of the School Breakfast Program

Data Appendix

This appendix section provides further details about the data and the construction of the analysis samples.

In the ECLS-K, direct cognitive assessments are available in each wave for reading and mathematics and in the third and fifth grade waves for science. The direct cognitive assessments are administered through a two-stage process, where the difficulty of the second stage of the assessment is based on the student's performance on the first stage. This process ensures that the assessments were administered at the appropriate level of difficulty and there were no floor or ceiling effects (Pollack et al., 2005). I use the Item Response Theory scale scores of reading, mathematics, and science as the measures of cognitive achievement.

For the measure of the availability of the SBP, of the 9,860 students with non-missing values for the parent and school administrator reported variables in the fifth grade wave, the responses disagree for 740 students. One possible reason for this discrepancy is that parents are asked whether the school offers breakfast, while school administrators are asked whether the school participates in the USDA's School Breakfast Program. If the school administrator did not complete the survey or the response is missing, then I use the parent's report of whether breakfast is offered in the school as long as there are at least three students surveyed from the school and all parents' responses for the school are the same. I also use the modal response of parents in the school in the fifth grade wave as long as the parents' modal response in the third grade wave was consistent with the school administrators' response in the third grade wave and the student didn't change schools. To verify the validity of using parents' responses, I examined the similarity of the parents' and school administrators' responses among the set of students with non-missing responses from the school administrator and from parents, as long as there were at least three students surveyed from the school with similar parents' responses to whether the school provides breakfast. The responses are nearly identical for the 5,110 students matching these criteria in the fifth grade wave.

About parental reports of breakfast consumption in school, there are at least five primary sources of measurement error. In the ECLS-K, school administrators are asked whether the school participates in the USDA's School Breakfast Program. In contrast, parents who positively respond that breakfast is offered at school are asked whether their child usually receives a breakfast provided by the school. First, parents may provide information about other breakfast sources such as vending machines or a la carte foods instead of the SBP. Second, parents may be unaware whether their child eats breakfast at school. Third, parents may not want to report that their child eats breakfast at school because of any perceived stigma. Fourth, parents' reports may reflect current breakfast consumption instead of breakfast consumption throughout the year. Finally, current reports of breakfast consumption may not reflect the history of breakfast consumption in prior elementary school years and the preferred estimates in the paper reflect the impact of the cumulative potential availability of the SBP during multiple years of elementary school on the stock of achievement. Overall, the measurement error is likely non-classical since breakfast consumption in school is binary and the measurement error is correlated with the binary variable that the school is required to offer breakfast through the SBP (since parents' reports are coded as zero if the school does not offer breakfast specifically through the SBP). Gundersen, Pepper, and Kreider (2012) document the significant influence of misclassification error on the estimated effects of consuming lunch through the NSLP. Paxton-Aiken et al. (2002) find that misclassification error in parents' reports of school meal

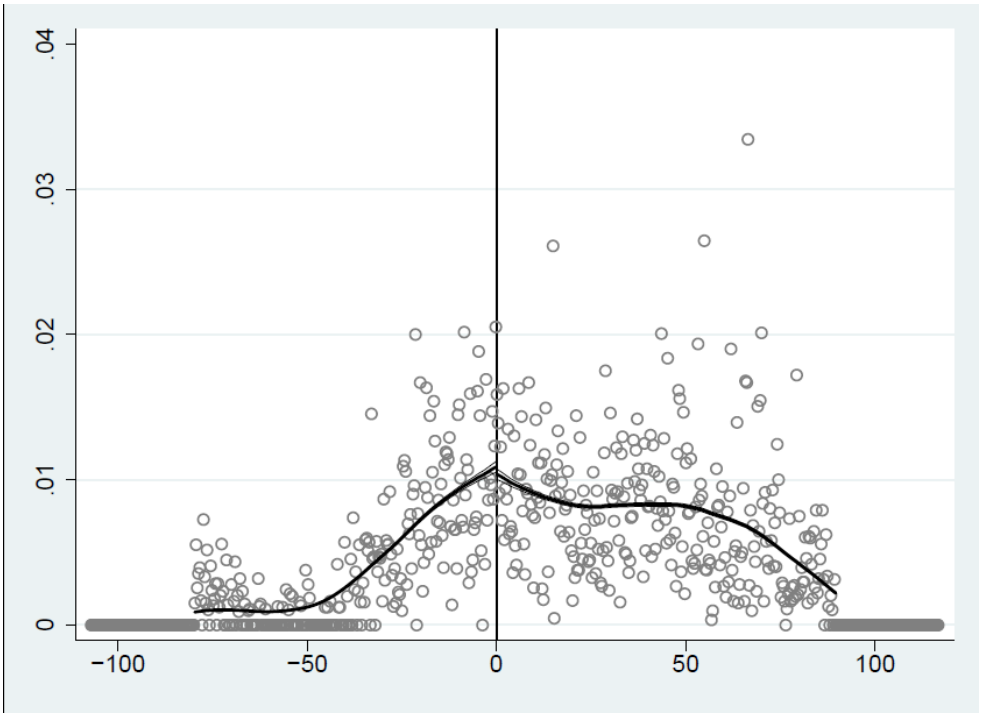
consumption is substantially greater for breakfast consumption through the SBP than for lunch consumption through the NSLP. Moore et al. (2009) show that parents' reports of current breakfast consumption are not highly correlated with participation in the SBP throughout the school year and that parents' reports of usual consumption are less accurate measures of annual participation for the SBP than for the NSLP. In contrast, the availability of the SBP should be measured with less error because the response is provided by a school administrator, the question specifically asks about the USDA's School Breakfast Program, and the SBP is provided throughout the school year so that current reports would not differ from annual reports.

About the percent of free and reduced-price eligible students in the school in the Common Core of Data (CCD), state education agency officials provide information to the CCD program about the total number of students and the number of free and reduced-price lunch eligible students for all public schools in the state as of October 1 of each year. The Census Bureau works with NCES to process and edit the data. The Census flags schools where the number of free and reduced-price eligible students exceeds the total number of students and sends a list of these schools to the state CCD coordinator. If the state coordinator does not correct these errors, then the total number of free lunch eligible students is coded as the total number of students in the school minus three. In general, the number of free and reduced-price eligible students is top censored at the total number of students in the school minus three to avoid identifying any student as eligible for free lunch, which should have minimal influence on the estimates in this manuscript. If the values of the CCD data that are reported by states are the same values that schools report to the states that are used to determine whether schools are required to offer breakfast through the SBP, then these would be the appropriate values for the identification strategies used in the paper. However, these values could differ if October 1 is not the date used to determine whether the state mandate binds for the SBP. Kansas determines whether the school is required to offer breakfast based on the percent of free and reduced-price eligible students in March of the preceding year, and the estimates are robust to dropping students in Kansas from the sample. The influence of any measurement error in the CCD reports is potentially reduced by using the maximum percent of free and reduced-price eligible students since 1999 to determine whether the state mandates bind and measurement error is likely reduced by the increasing use of direct certification. Overall, there is a possibility of bias due to measurement error in the percent of free and reduced-price eligible students in the school in the CCD, but any measurement error from the administrative data is likely to be less than any measurement error resulting from parental reports (such as with parental reports about breakfast consumption in schools).

For the construction of the analysis samples using the NAEP and ECLS-K data, I restrict the samples to public school students with non-missing values for all achievement measures in states with a partial mandate. Further, in the ECLS-K sample, I exclude students with missing values for the availability of the SBP in school and students in middle school in 2004. The sample begins with 191,440 observations for the NAEP math sample. All observations are students in public schools. I exclude 11,780 students with missing information on the percent of FRP eligible students in the school, which leaves 179,660 observations. Of the 191,140 observations, only 184,330 observations have math scores. After excluding students with missing information on the percent FRP eligible students in the school, I exclude an additional 6,680 students with missing math scores, which leaves 172,980 observations. Then, I focus on students in states with a partial mandate, which leaves 53,430 observations. Similar restrictions are used for the NAEP reading sample. For the ECLS-K sample, after restricting the sample to

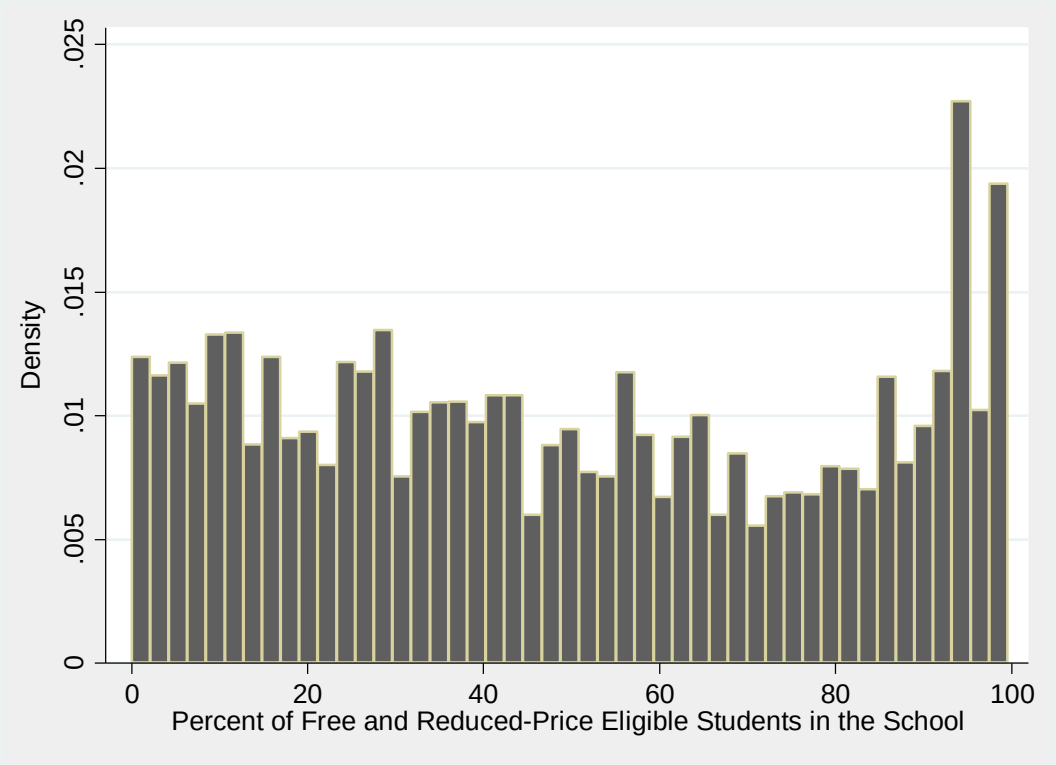
the 9320 students in public schools in the 5th grade wave, I exclude the 20 students in 6th grade because the state mandates apply to elementary schools only. Then I exclude an additional 280 students with missing information about whether the SBP is available in school, which leaves a sample of 9030 students. I next exclude 30 students with missing information about the percent FRP in the school, which leaves a sample of 8990 students. I then exclude 50 students with missing information about the state of residence, which leaves a sample of 8950 students. I next exclude 120 students with missing information for math, reading, or science test scores, which leaves 8830 students. I focus the analysis on the 3040 students in this sample residing in states with a partial SBP mandate.

Appendix Figure 1: Density of the Percent of FRP Students Centered at the State Threshold, NAEP Data



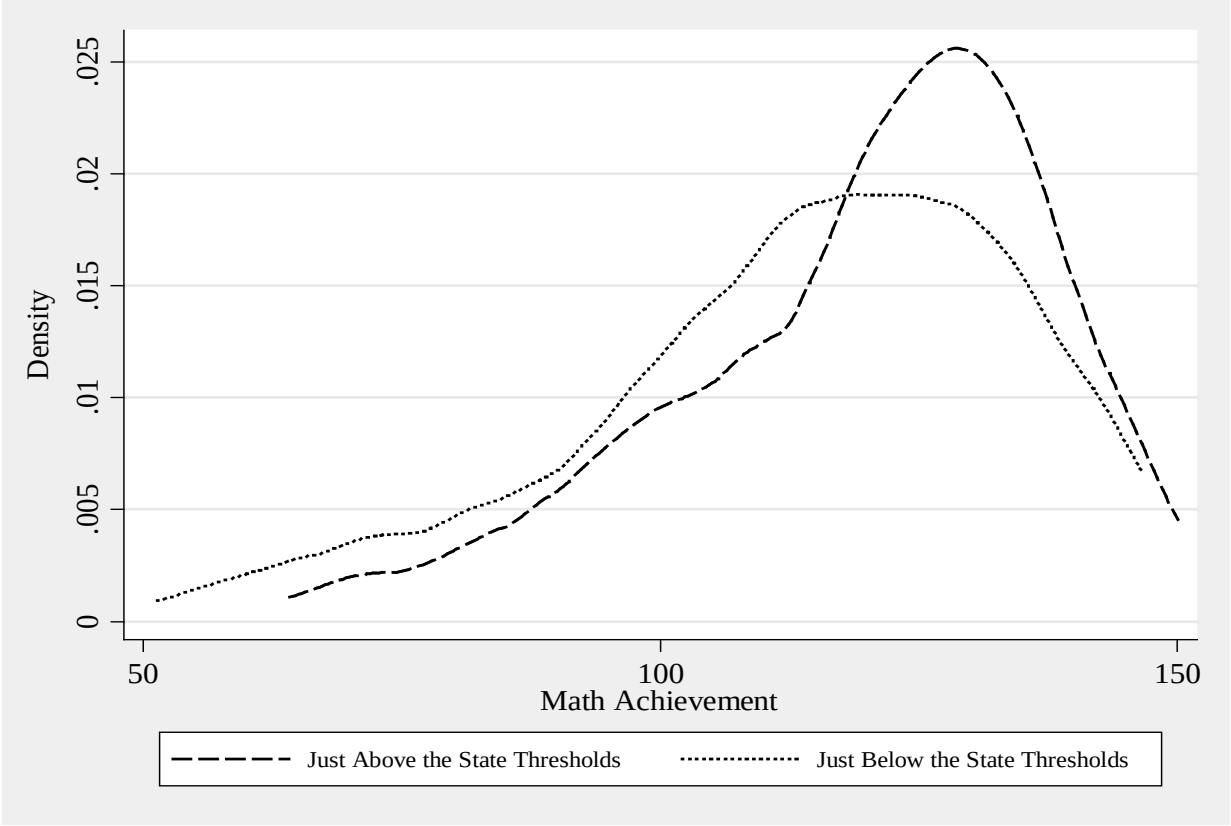
Notes: This figure demonstrates the lack of a discontinuity in the density of the percent of FRP students at the state thresholds requiring participation in the SBP program, which is consistent with a lack of selective sorting around the thresholds
Sources: The data sources are National Assessment of Education Progress (NAEP) 2003 Grade 4 and the Common Core of Data. The source for the code to generate the figure is McCrary (2008).

Appendix Figure 2: Histogram of the Percent of FRP Students, NAEP Data



Notes: This figure shows the distribution of the percent of FRP students in schools. Since I define this variable as the maximum percent of free and reduced-price students in a school since 1999, this distribution contains more mass near 100 percent.
Sources: National Assessment of Education Progress (NAEP) 2003 Grade 4 and Common Core of Data

Appendix Figure 3: The Distribution of Mathematics Achievement within Five Percent of the State Thresholds, ECLS- Data



Notes: This figure shows the skewness of the distributions of math achievement among students in schools within five percent below and above the state thresholds, as well as the shift in achievement throughout the distribution and the left tail in particular.
Source: Early Childhood Longitudinal Study, Kindergarten Cohort

Appendix Table 1: State Mandated Thresholds in 2004 of the Percent of Free and Reduced Price Eligible Students above Which States Must Provide School Breakfast for Elementary School Students

State	Mandate Threshold	Notes
Alabama	.	
Alaska	.	
Arizona	.	
Arkansas	0.20	Schools may apply for a one-year waiver from the mandate if implementing a breakfast program will create a financial hardship due to lack of equipment or facilities. ARK. CODE ANN. § 6-18-705.
California	.	Requires schools to provide at least one meal to FRP students but does not specify whether breakfast must be offered, so that schools may opt to provide lunch only. CAL. EDUC. CODE § 49558.
Colorado	.	
Connecticut	0.80	CONN. GEN. STAT. ANN. § 10-266w.
Delaware	.	
District of Columbia	.	
Florida	0	FLA. STAT. § 1006.06.
Georgia	0.25	GA. CODE ANN. § 20-2-66.
Hawaii	.	
Idaho	.	
Illinois	.	
Indiana	0.25	IND. CODE ANN. § 20-5-13.5-4
Iowa	.	
Kansas	0.35	Schools with less than 35 percent FRP students may apply for a waiver requesting to not participate in the SBP program. The state determines the threshold from the percent of FRP students in March of the preceding year. KAN. STAT. ANN. § 72-5125
Kentucky	.	
Louisiana	0.25	A school may receive a waiver if at least 50 percent of FRP students in the school refuse to participate. LA. REV. STAT. ANN. §17:192.
Maine	.	
Maryland	0	Schools with less than 15 percent FRP students or with at least 25 percent of FRP students in the school refusing to participate may receive a waiver from this mandate. MD. CODE. ANN. EDUC. § 7-701 and §7-702.
Massachusetts	0.40	Determines the threshold from the percent of FRP students in the second preceding October. Schools must also have received at least 50 applications from FRP students in the preceding year. MASS. GEN. LAWS ch.69 §1C.
Michigan	0.20	Determines the threshold from the percent of FRP students in the preceding October. MICH. COMP. LAWS § 380.1272a.
Minnesota	0.33	Determines the threshold from the percent of FRP students in the second preceding year. Mandate applies to schools with at least 25 FRP students. MINN. STAT. ANN. § 124D.117.
Mississippi	.	
Missouri	0.35	Determines the threshold from the percent of FRP students on the preceding October 1. Schools may receive a waiver

		for 3 years through a majority vote of the school board. MO. REV. STAT. § 191.803.
Montana	.	
Nebraska	.	
Nevada	.	
New Hampshire	.	Requires schools to provide at least one meal to FRP students but does not specify whether breakfast must be offered, so that schools may opt to provide lunch only. § 189:11-a.
New Jersey	.	The mandate enacted in 2003 was not effective until the 2005 school year. N. J. STAT. § 18A:33-10.
New Mexico	.	
New York	0	A school may receive a one-year waiver if at least 95 percent of FRP students or at least 90 percent of all students in the school refuse to participate or if the program will result in an increase in real property taxes. N.Y. COMP. CODES R. & REGS. tit. 8, § 114.2.
North Carolina	.	
North Dakota	.	
Ohio	0.33	Schools are also required to provide breakfast if at least 50 percent of the students' parents request the program. OHIO REV. CODE ANN. § 3313.81.3.
Oklahoma	.	
Oregon	0.25	Schools are also required to provide breakfast if the school qualifies for assistance from Title I funds. Schools may apply for a two year waiver from the mandate if the school is financially unable to implement a breakfast program. OR. REV. STAT. §327.535.
Pennsylvania	.	
Rhode Island	0	R.I. GEN. LAWS § 16-8-10.1.
South Carolina	0	Schools may apply for a waiver from the mandate if implementing a breakfast program will create a financial hardship due to lack of equipment or facilities or if it will create scheduling difficulties. SC CODE ANN. §59-63-790.
South Dakota	.	
Tennessee	0.25	TENN. CODE ANN. § 49-6-2302.
Texas	0.10	TEX. EDUC. CODE ANN. § 33.901.
Utah	.	
Vermont	0	Schools may receive a waiver for one year through a majority vote of the local citizens. VT. STAT. ANN. § 1264.
Virginia	0.25	Determines the threshold from the percent of FRP students in the preceding year. VA. CODE ANN. § 22.1-207.3.
Washington	0.40	Determines the threshold from the percent of FRP students in the second preceding year. Schools may be exempt from the mandate under compelling circumstances. WASH. REV. CODE § 28A.235.140(3)(a).
West Virginia	0	Schools may receive a two-year waiver from the mandate under compelling circumstances. W. VA. CODE § 18-5-37.
Wisconsin	.	
Wyoming	.	

Notes: The figures in this table represent the thresholds such that a school must provide the School Breakfast Program if the number of free and reduced price eligible students is equal to or greater than this threshold. Zero means that the all schools must provide the SBP.
Source: Thresholds and state statues are from Food Research and Action Center (2004). Additional information is taken directly from the state statues.

Appendix Table 2: Means (and Standard Deviations), NAEP Data

		Students in States:					
					With a Partial Mandate		
	All Students	Without a Mandate	With a Mandate	With a Full Mandate	All	In Schools with Pct. FRP Above Threshold	In Schools with Pct. FRP Below Threshold
Math Score	233.225	232.494	234.198	233.093	234.628	228.464	247.258
	(28.333)	(28.407)	(28.204)	(28.273)	(28.166)	(27.425)	(25.305)
Reading Score	216.626	215.962	217.512	217.727	217.427	209.801	232.464
	(36.730)	(36.893)	(36.494)	(35.783)	(36.770)	(36.292)	(32.866)
Distance to Threshold	28.864	--	28.864	53.107	19.440	39.848	-22.378
	(38.225)		(38.225)	(29.054)	(37.199)	(24.309)	(20.154)
Above Threshold	0.328	0.000	0.764	1.000	0.672	1.000	0.000
	(0.469)	(0.000)	(0.425)	(0.000)	(0.469)	(0.000)	(0.000)
Percent FRP eligible	49.200	48.352	50.329	53.107	49.248	65.448	16.051
	(29.626)	(29.013)	(30.387)	(29.054)	(30.822)	(23.192)	(12.437)
Age (months)	120.640	120.475	120.861	119.801	121.273	121.853	120.085
	(5.840)	(5.572)	(6.171)	(6.229)	(6.099)	(6.486)	(5.011)
Female	0.491	0.491	0.492	0.494	0.491	0.492	0.489
	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)
Black	0.187	0.145	0.242	0.241	0.243	0.326	0.070
	(0.389)	(0.351)	(0.428)	(0.427)	(0.428)	(0.469)	(0.255)
Hispanic	0.130	0.138	0.118	0.121	0.116	0.152	0.043
	(0.335)	(0.345)	(0.322)	(0.326)	(0.320)	(0.359)	(0.201)
Other Race/Ethnicity	0.071	0.093	0.042	0.047	0.039	0.038	0.042
	(0.256)	(0.289)	(0.199)	(0.211)	(0.194)	(0.191)	(0.201)
White	0.613	0.624	0.599	0.590	0.602	0.483	0.845
	(0.486)	(0.484)	(0.489)	(0.490)	(0.489)	(0.499)	(0.361)
Eligible for Free School Meals	0.374	0.355	0.399	0.422	0.390	0.523	0.118
	(0.477)	(0.470)	(0.483)	(0.487)	(0.482)	(0.495)	(0.310)
Eligible for Reduced-Price School Meals	0.089	0.095	0.080	0.086	0.078	0.092	0.049
	(0.279)	(0.287)	(0.266)	(0.275)	(0.263)	(0.285)	(0.208)
Urban Residence	0.322	0.318	0.327	0.281	0.344	0.450	0.127
	(0.467)	(0.466)	(0.469)	(0.450)	(0.475)	(0.498)	(0.333)
Rural Residence	0.360	0.395	0.315	0.305	0.318	0.329	0.296
	(0.480)	(0.489)	(0.464)	(0.460)	(0.466)	(0.470)	(0.456)
Percent Minority	36.82	35.91	38.04	39.22	37.59	49.23	13.74
	(34.75)	(34.20)	(35.44)	(34.96)	(35.61)	(36.62)	(16.50)
School Size	527.33	524.76	530.74	583.60	510.20	503.22	524.50
	(241.54)	(253.58)	(224.47)	(291.39)	(188.32)	(188.82)	(186.47)
Observations (math sample)	172980	98790	74190	20770	53430	35900	17520
Observations (reading sample)	168070	96060	72010	20370	51640	34260	17380

Notes: Standard deviations in parentheses. Sample sizes rounded to the nearest 10 to comply with NCES nondisclosure requirements. The means and standard deviations for all variables except the reading score are based on the math sample.
Source: National Assessment of Education Progress (NAEP) 2003 Grade 4

Appendix Table 3: Means (and Standard Deviations), ECLS-K Data

		Students in States:							
					With a Partial Mandate:				
	All Students	Without a Mandate	With a Mandate	With a Full Mandate	All	In Schools That Offer SBP	In Schools That Do Not Offer SBP	In Schools with Pct. FRP Above Threshold	In Schools with Pct. FRP Below Threshold
Reading Score	137.157	135.842	138.697	139.605	138.390	136.716	147.311	135.172	147.391
	(23.467)	(23.917)	(22.835)	(21.925)	(23.131)	(23.438)	(19.108)	(23.300)	(20.090)
Math Score	112.642	110.999	114.567	115.661	114.196	112.688	122.233	111.324	122.231
	(21.857)	(22.433)	(21.002)	(21.428)	(20.846)	(20.941)	(18.363)	(21.086)	(17.865)
Science Score	56.561	55.367	57.958	56.745	58.370	57.254	64.315	56.403	63.872
	(14.612)	(14.883)	(14.162)	(14.353)	(14.075)	(14.132)	(12.157)	(14.110)	(12.428)
School Offers SBP	0.829	0.799	0.865	0.931	0.842	1.000	0.000	0.979	0.459
	(0.376)	(0.401)	(0.342)	(0.253)	(0.365)	(0.000)	(0.000)	(0.143)	(0.499)
Distance to Threshold	30.350	--	30.350	50.372	23.562	32.452	-23.814	39.796	-21.853
	(37.814)		(37.814)	(34.200)	(36.559)	(31.158)	(24.905)	(26.382)	(18.118)
Above Threshold	0.370	0.000	0.803	1.000	0.737	0.857	0.098	1.000	0.000
	(0.483)	(0.000)	(0.398)	(0.000)	(0.441)	(0.351)	(0.298)	(0.000)	(0.000)
Percent FRP eligible	54.924	58.981	50.171	50.372	50.103	56.864	14.071	63.083	13.790
	(31.834)	(31.790)	(31.226)	(34.200)	(30.158)	(27.404)	(14.578)	(23.813)	(8.782)
Age (months)	134.615	134.455	134.801	133.454	135.258	135.386	134.577	135.363	134.966
	(4.499)	(4.415)	(4.588)	(4.368)	(4.572)	(4.610)	(4.305)	(4.624)	(4.413)
Female	0.497	0.500	0.493	0.496	0.492	0.499	0.458	0.496	0.483
	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.499)	(0.500)	(0.500)
Black	0.130	0.117	0.145	0.160	0.140	0.161	0.033	0.183	0.020
	(0.336)	(0.321)	(0.352)	(0.366)	(0.347)	(0.367)	(0.180)	(0.387)	(0.140)
Hispanic	0.200	0.219	0.177	0.246	0.154	0.173	0.048	0.188	0.057
	(0.400)	(0.414)	(0.381)	(0.431)	(0.360)	(0.378)	(0.214)	(0.391)	(0.231)
Other Race/Ethnicity	0.128	0.164	0.086	0.088	0.086	0.085	0.090	0.079	0.105
	(0.334)	(0.370)	(0.281)	(0.283)	(0.280)	(0.279)	(0.286)	(0.270)	(0.307)
White	0.542	0.500	0.591	0.507	0.620	0.581	0.830	0.549	0.817
	(0.498)	(0.500)	(0.491)	(0.500)	(0.485)	(0.493)	(0.377)	(0.498)	(0.386)
Family Income (000s)	58.493	54.471	63.203	66.759	61.997	54.247	103.299	48.812	98.881
	(49.848)	(46.277)	(53.351)	(57.654)	(51.766)	(45.082)	(64.116)	(40.473)	(61.240)
Poverty	0.227	0.249	0.202	0.187	0.207	0.237	0.046	0.267	0.038
	(0.402)	(0.416)	(0.383)	(0.365)	(0.389)	(0.409)	(0.197)	(0.425)	(0.178)
Family Size	4.612	4.680	4.534	4.489	4.549	4.554	4.523	4.555	4.531
	(1.354)	(1.428)	(1.257)	(1.233)	(1.265)	(1.300)	(1.060)	(1.317)	(1.110)
Parents' Highest Education	14.103	13.924	14.313	14.677	14.189	13.882	15.824	13.644	15.714
	(2.571)	(2.552)	(2.577)	(2.588)	(2.562)	(2.482)	(2.354)	(2.434)	(2.280)
Birth Weight	117.932	117.577	118.348	118.121	118.425	117.772	121.904	117.209	121.827
	(18.370)	(18.240)	(18.514)	(19.250)	(18.261)	(18.054)	(18.972)	(18.162)	(18.119)
Grade	4.888	4.895	4.880	4.894	4.875	4.862	4.946	4.853	4.938
	(0.331)	(0.322)	(0.342)	(0.332)	(0.345)	(0.362)	(0.227)	(0.373)	(0.242)
Urban Residence	0.337	0.309	0.371	0.437	0.348	0.387	0.141	0.419	0.150
	(0.465)	(0.455)	(0.474)	(0.488)	(0.467)	(0.478)	(0.334)	(0.483)	(0.346)
Rural Residence	0.259	0.324	0.184	0.072	0.222	0.231	0.172	0.234	0.187
	(0.431)	(0.462)	(0.379)	(0.252)	(0.406)	(0.413)	(0.365)	(0.414)	(0.381)
School with ≥ 80 Pct. Minority	0.275	0.318	0.224	0.283	0.204	0.240	0.017	0.276	0.004
	(0.447)	(0.466)	(0.417)	(0.451)	(0.403)	(0.427)	(0.128)	(0.447)	(0.061)
School with ≥ 750 Students	0.185	0.180	0.191	0.335	0.142	0.157	0.065	0.146	0.133
	(0.388)	(0.384)	(0.393)	(0.472)	(0.349)	(0.364)	(0.246)	(0.353)	(0.339)
School with < 300 Students	0.136	0.163	0.104	0.075	0.115	0.118	0.096	0.131	0.068
	(0.343)	(0.369)	(0.306)	(0.263)	(0.319)	(0.323)	(0.295)	(0.338)	(0.251)
Eat School Breakfast	0.329	0.334	0.323	0.287	0.335	0.407	0.000	0.438	0.066
	(0.470)	(0.472)	(0.468)	(0.453)	(0.472)	(0.491)	(0.000)	(0.496)	(0.249)
Eat FRP School Breakfast	0.257	0.262	0.252	0.230	0.259	0.315	0.000	0.348	0.027
	(0.437)	(0.440)	(0.434)	(0.421)	(0.438)	(0.464)	(0.000)	(0.476)	(0.161)

Days Eating Bkfast w/ Family	5.567	5.588	5.542	5.556	5.537	5.575	5.343	5.591	5.394
	(1.533)	(1.542)	(1.522)	(1.533)	(1.519)	(1.535)	(1.417)	(1.547)	(1.432)
Days Eating Breakfast	5.678	5.701	5.651	5.682	5.641	5.686	5.414	5.705	5.472
	(1.361)	(1.372)	(1.348)	(1.338)	(1.351)	(1.358)	(1.291)	(1.364)	(1.301)
% Excused Absences	2.650	2.687	2.607	2.183	2.741	2.678	3.069	2.624	3.064
	(3.230)	(3.050)	(3.429)	(2.721)	(3.613)	(3.673)	(3.272)	(3.844)	(2.861)
% Unexcused Absences	0.980	0.902	1.071	1.379	0.974	1.056	0.544	1.184	0.395
	(2.191)	(2.136)	(2.249)	(2.806)	(2.033)	(2.109)	(1.503)	(2.193)	(1.346)
% Excused Tardies	0.690	0.641	0.747	0.765	0.742	0.651	1.171	0.684	0.889
	(1.994)	(1.706)	(2.289)	(2.255)	(2.300)	(1.942)	(3.509)	(2.231)	(2.463)
% Unexcused Tardies	0.765	0.752	0.781	1.302	0.626	0.697	0.286	0.687	0.470
	(2.867)	(2.738)	(3.014)	(4.639)	(2.296)	(2.460)	(1.201)	(2.419)	(1.942)
Approaches to Learning	3.049	3.043	3.057	3.085	3.048	3.023	3.180	3.003	3.175
	(0.680)	(0.683)	(0.677)	(0.691)	(0.672)	(0.680)	(0.614)	(0.686)	(0.615)
Self-Control	3.227	3.211	3.244	3.281	3.232	3.209	3.353	3.191	3.348
	(0.599)	(0.598)	(0.599)	(0.613)	(0.594)	(0.598)	(0.557)	(0.606)	(0.545)
Interpersonal Skills	3.064	3.052	3.078	3.131	3.060	3.038	3.174	3.024	3.158
	(0.637)	(0.635)	(0.640)	(0.638)	(0.640)	(0.642)	(0.616)	(0.648)	(0.607)
Externalizing Prob. Behaviors	1.651	1.658	1.643	1.614	1.653	1.673	1.553	1.689	1.556
	(0.587)	(0.580)	(0.595)	(0.611)	(0.589)	(0.598)	(0.533)	(0.607)	(0.527)
Internalizing Prob. Behaviors	1.646	1.650	1.641	1.620	1.648	1.660	1.588	1.664	1.606
	(0.545)	(0.535)	(0.557)	(0.551)	(0.559)	(0.565)	(0.521)	(0.562)	(0.548)
Fall Kindergarten Math	22.488	21.823	23.245	22.714	23.432	22.733	26.837	22.167	26.802
	(8.475)	(8.242)	(8.673)	(8.707)	(8.655)	(8.454)	(8.821)	(8.234)	(8.851)
Fall Kindergarten Reading	29.057	28.603	29.553	29.713	29.497	28.943	32.053	28.460	32.092
	(9.320)	(9.400)	(9.208)	(9.793)	(8.998)	(8.832)	(9.319)	(8.537)	(9.584)
School Receives Title I	0.695	0.736	0.646	0.543	0.682	0.736	0.396	0.801	0.353
	(0.460)	(0.441)	(0.478)	(0.498)	(0.466)	(0.441)	(0.490)	(0.399)	(0.478)
Years of Experience, Principal	9.478	9.446	9.516	8.222	9.956	9.749	10.998	9.077	12.338
	(7.420)	(7.357)	(7.493)	(7.334)	(7.497)	(7.296)	(8.372)	(7.045)	(8.146)
Days/Wk. Vigorous Exercise	3.719	3.669	3.776	3.682	3.807	3.809	3.797	3.809	3.804
	(1.905)	(1.910)	(1.897)	(1.949)	(1.879)	(1.914)	(1.693)	(1.921)	(1.764)
Servings of Milk	10.446	10.535	10.342	10.136	10.412	10.162	11.748	9.846	11.995
	(9.366)	(9.398)	(9.329)	(9.305)	(9.337)	(9.359)	(9.111)	(9.269)	(9.351)
Servings of Juice	5.499	5.693	5.273	6.017	5.020	5.037	4.931	5.110	4.770
	(7.294)	(7.422)	(7.136)	(7.557)	(6.971)	(7.106)	(6.211)	(7.246)	(6.136)
Servings of Soda	6.324	6.278	6.377	6.107	6.469	6.666	5.419	6.760	5.655
	(7.732)	(7.759)	(7.702)	(7.451)	(7.784)	(7.969)	(6.623)	(8.065)	(6.878)
Servings of Salad	2.322	2.340	2.300	2.775	2.139	2.124	2.217	2.082	2.298
	(4.390)	(4.406)	(4.371)	(5.038)	(4.109)	(4.180)	(3.710)	(4.208)	(3.816)
Servings of Potatoes	2.029	2.170	1.864	1.966	1.829	1.874	1.592	1.864	1.733
	(3.830)	(4.028)	(3.578)	(3.912)	(3.458)	(3.589)	(2.640)	(3.679)	(2.745)
Servings of Carrots	2.985	3.208	2.725	2.840	2.687	2.558	3.369	2.525	3.139
	(5.601)	(5.818)	(5.326)	(5.339)	(5.321)	(5.253)	(5.625)	(5.229)	(5.549)
Servings of Other Vegetables	5.204	5.495	4.863	4.893	4.852	4.831	4.965	4.793	5.018
	(6.524)	(6.789)	(6.183)	(5.968)	(6.255)	(6.337)	(5.807)	(6.450)	(5.675)
Servings of Fruit	7.916	8.324	7.439	7.450	7.435	7.505	7.060	7.555	7.099
	(8.338)	(8.569)	(8.034)	(7.946)	(8.065)	(8.262)	(6.919)	(8.351)	(7.199)
Observations	8830	4770	4070	1030	3040	2560	480	2240	800

Notes: Standard deviations in parentheses. Sample sizes rounded to the nearest 10 to comply with NCES nondisclosure requirements.
Source: Early Childhood Longitudinal Study, Kindergarten Cohort

Appendix Table 4: Examining the Robustness of the Difference-in-Differences Estimates of the Influence of a Binding State Mandate on Math and Reading Achievement, NAEP Data

	Primary Specification	No State Fixed Effects	No School Characteristics	Only Basic Individual Characteristics	No Control Variables
Panel A: Math					
Above State Threshold	2.174	2.186	2.354	2.498	3.705
	(0.902)	(0.934)	(0.948)	(1.054)	(1.452)
	[0.077]	[0.078]	[0.084]	[0.089]	[0.132]
Observations	53430	53430	53430	53430	53430
Panel B: Reading					
Above State Threshold	2.001	1.851	2.115	2.445	4.034
	(1.124)	(1.153)	(1.131)	(1.200)	(1.594)
	[0.054]	[0.043]	[0.058]	[0.066]	[0.110]
Observations	51640	51640	51640	51640	51640

Notes: Standard errors, shown in parentheses, allow for clustering within states. The figures in brackets represent the marginal effect expressed in units of a standard deviation, where the estimate is divided by the standard deviation of the achievement score for all students in states with partial mandates. The estimates shown represent the combined estimates of the five plausible values for each achievement score. The variable denoting that the school is above the state threshold is defined as 1 if the percent of free and reduced-price eligible (FRP) students in the school exceeds the state threshold mandating the availability of the SBP and 0 if the percent of FRP students in the school is below the state threshold. In the primary specification, additional variables include state fixed effects, dummy variables denoting whether the percent of FRP students in the school exceeds each of the levels used to define the state mandates (10, 20, 25, 30, 33, 35, 40, and 80 percent), age in months, gender, race/ethnicity (black, Hispanic, and other race, with white excluded), poverty status, urban/rural, the percent of the student body who are nonwhite, the number of students in the school, and a continuous measure of the percent of FRP students in the school. Column (2) replaces the state fixed effects with a set of dummy variables defining the state mandate for the state of residence. Column (3) displays the results of column (1) without the school variables: the percent of the student body who are nonwhite, the number of students in the school, and a continuous measure of the percent of FRP students in the school. Column (4) displays the results of the specification in column (1) but only controls for age in months, gender, and race/ethnicity. Column (5) displays the results of the specification in column (1) but without any control variables. Sample sizes rounded to the nearest 10 to comply with NCES nondisclosure requirements.
Source: NAEP 2003 Grade 4

Appendix Table 5: Regression Discontinuity Design Estimates at False Thresholds, NAEP Data

	0	-10	-5	+5	+10
Math	2.554	1.582	-0.292	-3.312	1.834
	(1.242)	(1.669)	(1.656)	(1.908)	(1.699)
Observations	53430	53430	53430	53430	53430
Reading	4.413	2.312	0.575	-3.097	1.196
	(1.820)	(2.356)	(2.357)	(2.559)	(2.426)
Observations	51640	51640	51640	51640	51640

Notes: This table displays local linear regression estimates using a triangle kernel and bandwidth of 5 at false thresholds that are 5 and 10 percentage points above and below the actual threshold. Standard errors are shown in parentheses. Sample sizes rounded to the nearest 10 to comply with NCES nondisclosure requirements.
Source: NAEP 2003 Grade 4

Appendix Table 6: Estimates from a Regression Discontinuity Design with Alternate Bandwidths and Functional Form, NAEP Data

	LLR					OLS	
	2.5	5	7.5	10	20	Quadratic	Quadratic
Reading	3.669	4.413	4.011	3.766	2.946	5.709	5.487
	(1.445)	(1.820)	(1.633)	(1.450)	(1.088)	(1.529)	(1.467)
Math	0.645	2.554	3.430	3.482	3.035	5.598	4.651
	(1.659)	(1.242)	(1.096)	(1.090)	(0.784)	(1.047)	(0.990)
Covariates						No	Yes

Notes: Standard errors are shown in parentheses. Local linear regressions use a triangle kernel and the bandwidth is specified in the table. OLS regressions include an indicator variable denoting that the percent of free and reduced-price eligible (FRP) students in the school exceeds the state threshold, the percent of FRP students in the school centered at the state threshold, and the interaction of the centered percent of FRP students in the school and the indicator variable denoting that the percent of FRP students in the school exceeds the state threshold. Covariates include age in months, gender, race/ethnicity (black, Hispanic, and other race, with white excluded), poverty status, urban/rural, the percent of the student body who are nonwhite, the number of students in the school, and a continuous measure of the percent of FRP students in the school. The quadratic specification was chosen based on the Schwarz criterion and joint hypothesis tests of higher order polynomial terms. The sample for the last two columns includes only students in schools where the percent of free and reduced-price eligible students is within 20 percentage points of the state threshold. The sample size for reading is 19,690 and the sample size for math is 20,110. The local linear regression estimates are based on the full sample of 53,430 observations for math and 51,640 observations for reading. Sample sizes rounded to the nearest 10 to comply with NCES nondisclosure requirements.
Source: NAEP 2003 Grade 4 Assessment

Appendix Table 7: Examining the Robustness of the Difference-in-Differences Estimates of the Influence of a Binding State Mandate on Math, Reading, and Science Achievement, ECLS-K Data

	Primary Specification	No State Fixed Effects	No School Characteristics	Only Basic Individual Characteristics	No Control Variables
Panel A: Math					
Above State Threshold	2.003	2.230	1.858	1.965	2.580
	(1.739)	(1.673)	(1.786)	(2.136)	(2.779)
	[0.096]	[0.107]	[0.089]	[0.094]	[0.123]
Panel B: Reading					
Above State Threshold	2.749	3.204	2.650	3.078	4.093
	(1.923)	(1.978)	(1.978)	(2.221)	(2.533)
	[0.119]	[0.139]	[0.115]	[0.133]	[0.177]
Panel C: Science					
Above State Threshold	2.238	2.390	2.134	2.204	2.835
	(1.328)	(1.388)	(1.426)	(1.454)	(2.012)
	[0.159]	[0.170]	[0.152]	[0.157]	[0.201]
Panel D: School Offers SBP					
Above State Threshold	0.329	0.349	0.337	0.333	0.330
	(0.141)	(0.139)	(0.145)	(0.143)	(0.144)
Observations	3040	3040	3040	3040	3040

Notes: Standard errors, shown in parentheses, allow for clustering within states. The figures in brackets represent the marginal effect expressed in units of a standard deviation, where the estimate is divided by the standard deviation of the achievement score for all students in states with partial mandates. The variable denoting that the school is above the state threshold is defined as 1 if the percent of free and reduced-price eligible (FRP) students in the school exceeds the state threshold mandating the availability of the SBP and 0 if the percent of FRP students in the school is below the state threshold. In the primary specification, additional variables include state fixed effects, dummy variables denoting whether the percent of FRP students in the school exceeds each of the levels used to define the state mandates (10, 20, 25, 30, 33, 35, 40, and 80 percent), age in months, gender, race/ethnicity (black, Hispanic, and other race, with white excluded), family income, family size, parent's education, birth weight, grade, urban/rural, poverty status, the percent of the student body who are nonwhite, the number of students in the school, and the percent of FRP students in the school. Column (2) replaces the state fixed effects with a set of dummy variables defining the state mandate for the state of residence. Column (3) displays the results of column (1) without the school variables: the percent of the student body who are nonwhite, the number of students in the school, and the percent of FRP students in the school. Column (4) displays the results of the specification in column (1) but only controls for age in months, gender, and race/ethnicity. Column (5) displays the results of the specification in column (1) but without any control variables. Sample sizes rounded to the nearest 10 to comply with NCES nondisclosure requirements.
Source: Early Childhood Longitudinal Study, Kindergarten Cohort

Appendix Table 8: Discontinuities in Other Characteristics, ECLS-K Data

Characteristic	Estimated Discontinuity
Age	-0.678
	(0.483)
Female	-0.101
	(0.074)
Black	0.005
	(0.028)
Hispanic	0.000
	(0.042)
Other Race	-0.013
	(0.054)
Family Income	4.162
	(8.583)
Poverty	0.030
	(0.036)
Family Size	-0.314
	(0.171)
Parents' Highest Education	0.218
	(0.376)
Urban	-0.051
	(0.055)
Rural	-0.153
	(0.058)
Birth weight	-2.069
	(2.491)
Grade	-0.016
	(0.045)
Predicted Reading Score	0.526
	(1.642)
Predicted Math Score	0.989
	(1.227)
Predicted Science Score	0.577
	(0.968)
Fall Kindergarten Reading Score	1.313
	(1.452)
Fall Kindergarten Math Score	0.543
	(1.344)
School Receives Title I Funds	0.020
	(0.068)
Days of Vigorous Exercise	0.305
	(0.272)
Observations	3040

Notes: Standard errors are shown in parentheses. The regression discontinuity estimates are calculated using local linear regression with a triangle kernel and a bandwidth of 20. Sample sizes rounded to the nearest 10 to comply with NCES nondisclosure requirements.
Source: Early Childhood Longitudinal Study, Kindergarten Cohort

Appendix Table 9: Estimates from a Regression Discontinuity Design with Alternate Bandwidths and Functional Form, ECLS-K Data

	LLR				OLS	
	10	15	20	25	Linear	Linear
Math	11.681	9.383	7.647	6.920	6.234	6.842
	(5.253)	(4.084)	(3.432)	(2.896)	(2.438)	(2.153)
Reading	5.866	7.430	6.599	6.045	5.538	5.950
	(4.732)	(3.523)	(3.014)	(2.615)	(2.793)	(2.434)
Science	8.353	6.763	5.538	5.078	4.738	4.948
	(3.562)	(2.496)	(2.079)	(1.836)	(1.646)	(1.488)
Covariates					No	Yes
Observations	3040	3040	3040	3040	1180	1180

Notes: Local linear regression estimates using a triangle kernel and bandwidth as shown in the table. OLS regressions include an indicator variable denoting that the percent of free and reduced-price eligible (FRP) students in the school exceeds the state threshold, the percent of FRP students in the school centered at the state threshold, and the interaction of the centered percent of FRP students in the school and the indicator variable denoting that the percent of FRP students in the school exceeds the state threshold. age in months, gender, race/ethnicity (black, Hispanic, and other race, with white excluded), family income, family size, parent's education, birth weight, grade, urban/rural, poverty status, the percent of the student body who are nonwhite, the number of students in the school, and the percent of FRP students in the school. The linear specification was chosen based on the Schwarz criterion and joint hypothesis tests of higher order polynomial terms. The sample for the last two columns includes only students in schools where the percent of free and reduced-price eligible students is within 20 percentage points of the state threshold. Sample sizes rounded to the nearest 10 to comply with NCES nondisclosure requirements.
Source: Early Childhood Longitudinal Study, Kindergarten Cohort

Appendix Table 10: Regression Discontinuity Estimates at False Thresholds, ECLS-K Data

	0	-10	-5	+5	+10
Reading	6.599	-5.036	1.883	-0.828	0.238
	(3.014)	(2.916)	(3.491)	(2.441)	(2.060)
Math	7.647	-2.111	-2.825	-0.204	-0.433
	(3.432)	(2.623)	(2.399)	(2.158)	(2.102)
Science	5.538	-0.618	-1.354	-0.683	0.770
	(2.079)	(1.658)	(1.967)	(1.335)	(1.499)
Observations	3040	3040	3040	3040	3040

Notes: Standard errors are shown in parentheses. Local linear regression estimates using a triangle kernel and bandwidth of 20. Sample sizes rounded to the nearest 10 to comply with NCES nondisclosure requirements.
Source: Early Childhood Longitudinal Study, Kindergarten Cohort