Effects of Maturing Private School Choice Programs on Public School Students

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Online Appendix

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Online Appendix A. Competition Measures

Our primary competition measure used throughout the paper is an index – Competitive Pressure Index – based on five measures of pre-policy private school penetration in the community. These are what we call “Density”, “Distance”, “Diversity”, “Slots”, and “Houses of Worship”. The “Density” measure captures the number of private schools serving the same grade range of students (i.e., elementary or middle school grades) within a five-mile radius of each public school. The “Distance” measure captures the distance between each public school and the nearest private competitor serving the same grade range; this measure is multiplied by -1 so that a positive sign on the measure will indicate greater competitive pressure. The “Diversity” measure captures the number of different religious denominational categories represented among the private schools within a five-mile radius of each public school; we group each school into one of ten denominational categories (including non-religious) for this measure. The ten categories are Non-religious, Catholic, Protestant, Baptist, Evangelical, Non-denominational, Jewish, Islamic, Christian Other, and Religious Other. The “Slots” measure captures the number of private school students served in the same grade range within a five-mile radius, standardized by the number of grades served. The “Houses of Worship” measure captures the number of houses of worship in a five-mile radius. This measure captures the underlying religiosity of the community, which may be associated with demand for private religious education, as well as the possibility that private schools may co-locate in the buildings that serve as houses of worship (Figlio & Hart, 2014). This measure is related to others commonly used to capture demand for religious education in the literature on private school competition, such as the share of a population that is Catholic (Hoxby, 1994; Dee, 1998; Jepsen, 2002) or the density of Catholic churches in a locality (Jepsen, 2002), but captures religiosity across a greater number of faith traditions. We combine these measures into a single index using principal components analysis. Main results using each of the measures separately are presented in Online Appendix Table A3.

Online Appendix B. Composition of Students in Florida Public Schools

Here we explore the extent to which competitive pressures affect the composition of students ever appearing in Florida public schools. Recall that, during this paper’s study period, voucher participants must either have spent the previous year in Florida public schools or been entering kindergarten or first grade, and the latter would never be observed in the sample. Since the empirical strategy in our paper relies on student fixed effects, would-be peers never observed in the public schools will not contribute to changes in students' schooling environments and thus our coefficients should remain unbiased. Who is in the sample, however, could affect the external validity and interpretation of our results.

To address this question, we analyze whether the voucher program's roll-out affected which children were present in the birth records but not in the school records. To do so, we proxy for the zip code of birth's level of competition pressure in any given year by re-weighting our measures of competition pressure (introduced in Section III C.) for birth cohorts expected to enter first grade after the program started (September 1995 to December 2002 births) with empirically observed flows of students born in any given zip code to all possible grade one (G1) schools as observed for birth cohorts entering schooling before the program started (January 1994 to August 1995 births). Online Appendix Table A7 shows how the voucher program roll-out affected the probability that a child would ultimately appear in the Florida public school data, both overall (panel A) and stratified for samples with a given characteristic (e.g. child of high school dropout mother in panel D or child of immigrant mother in panel J).

We observe that, unsurprisingly, as the program expanded fewer students born in communities with greater competitive pressures ended up in public schools, meaning that locales with more competition pressure straightaway were the places sending more children to private schools as the voucher program expanded. These results are concentrated in the set of children whose births were funded by Medicaid and those with relatively poorly-educated mothers which makes sense since the program supports vouchers for low-income families. At the same time, as the program expanded, Black children and the children of immigrants were disproportionately likely to never appear in public schooling in communities with greater competitive pressures. It is also worth highlighting that the estimates from Online Appendix Table A7 are very modest in magnitude with effect sizes not exceeding 6 percent of sample mean. In summary, the voucher program led to a public school sector that is modestly more affluent with higher parental education. These composition changes, albeit small in magnitude, underscore the importance of gauging heterogeneity in the effects of competition pressure, as we report in Section IV D. On the one hand, such selection could reduce the estimated competitive effects if higher-SES individuals are less responsive to the effects of competition. On the other hand, it could increase them if there is complementarity between school-level student ability and competitive pressure. Assuming that student fixed effects account for time-invariant characteristics related to these selection processes and there are no time-varying covariates differentially correlated with scale up in more vs. less competitive areas, in neither case the estimates will be biased. We view these results as additional contribution to prior literature that, due to data limitations, was not able to examine selection processes of that sort. Nonetheless, we acknowledge that this could affect external validity of our findings to a small degree.

Online Appendix C. Analyses Presented in Figure 3

Event studies in Figure 3 are based on two samples. First is a subset of our matched birth-school records restricted to school years 2002-03 to 2006-07 and students who started grade one (G1) school in the last pre-policy year 2000-01. These students are generally born prior to September 1st 1994. We execute two regression analyses in this sample based on school fixed effects (equation 1) and based on individual fixed effects (equation 2):

$$Y_{isglt} = \beta_t \sum_{t=2004}^{2007} Year_t \times Competition_{sl} + \gamma_{sl} + \delta_{gt} + \pi X_{it} + \varepsilon_{isglt} \tag{1}$$

$$Y_{isglt} = \beta_t \sum_{t=2004}^{2007} Year_t \times Competition_{sl} + \theta_{il} + \delta_{gt} + \varepsilon_{isglt} \tag{2}$$

where Y_{isglt} captures an outcome measure for student i who entered the FLDOE data in grade one (G1) school s, observed in grade g corresponding to academic stage (elementary or middle school) l in year t, θ_{il} is a student-by-stage fixed effect, γ_{sl} is a school-by-stage fixed effect, and δ_{gt} is a grade-by-year fixed effect. Control variables (X_{it}) in equation 1 include gender, racial and ethnic categories, free and reduced price lunch status (time varying) as well as birth year and birth month dummies. School year 2002-03 serves as a reference category in this event study. Robust standard errors (ε_{isglt}) are clustered at student's G1 school level.

Our second sample is based on all public school students who were tested between 1998-99 and 2006-07 school years and born prior to September 1st 1994. Unlike in the pervious sample here students are not tested in each subject in each grade and therefore we cannot execute our individual fixed effects strategy. We estimate the following equation:

$$\begin{aligned} Y_{isgt} = &\beta_t^{pre} \sum_{t=1999}^{2000} Year_t \times Competition'_s + \beta_t^{post} \sum_{t=2002}^{2007} Year_t \times Competition'_s + \\ &\omega_s + \delta_{gt} + \pi X_{it} + \varepsilon_{isgt} \end{aligned} \tag{3}$$

where Y_{isgt} captures an outcome measure for student i in school s, observed in grade g in year t, ω_s is a school fixed effect, and δ_{gt} is a grade-by-year fixed effect. Control variables (X_{it}) in equation 3 include gender, racial and ethnic categories, free and reduced price lunch status (time varying) as well as birth year and birth month dummies. School year 2000-01, last pre-policy year, serves as a reference category in this event study. Robust standard errors (ε_{isgt}) are clustered at school level.

In equation 3 we denote variable $Competition'_s$ with a prime because we assign it to currently attended school rather than to grade one (G1) school (weighted with middle school flows). Thus, our variation here is defined at school-by-year level rather than at G1 school-by-stage-by-year level. We are forced to make this adjustment because in the expanded data we can only observe students in grades in which they are being tested and testing in Florida commences in grade 3 at the earliest. Furthermore, until school year 2000-01 students were only tested in grades four, five, and eight. Therefore, we do not know either the school a student was attending in grade one or their transitions between elementary and middle school stages.

References

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Online Appendix Tables

Table A1: Construction of Competitive Pressure Index Based on Principal Components Analysis

	(1)	(2)	(3)	(4)
	Grades 1 to 5		Grades 6 to 8	
	First component	Second component	First component	Second component
Diversity	0.47	0.14	0.47	0.17
Density	0.50	-0.21	0.49	-0.22
Distance	0.30	0.90	0.33	0.87
Number of houses of worship	0.46	-0.23	0.46	-0.27
Number of slots	0.48	-0.26	0.46	-0.30
Eigenvalue	3.61	0.81	3.83	0.73

Notes: This table reports the results of a principal components analysis of number of denominational types represented (diversity), number of local private schools (density), miles to nearest private school competitor (distance), number of churches, synagogues, and mosques, and number of private school slots per grade. The eigenvectors associated with the first (columns 1 and 3) and second (columns 2 and 4) components are reported separately for grades 1 to 5 and 6 to 8, as well as their associated eigenvalues.

Table A2: Descriptive Statistics

	(1)	(2)	(3)	(4)
			Competition index	
	All births	Empirical sample	Above median	Below median
	Panel A. Sociodemographic characteristics			
White	55.4	50.9	37.3	68.0
Black	19.4	23.3	30.2	14.5
Hispanic	22.8	23.9	30.5	15.6
Mother foreign born	23.2	23.0	29.7	14.5
Male	51.2	51.1	51.1	51.1
Mother HS dropout	20.9	24.9	25.0	24.6
Mother HS graduate	58.8	60.4	60.7	60.1
Mother college graduate	20.2	14.7	14.3	15.2
Mother age at birth	27.1	26.6	26.6	26.5
Parents married at birth	64.9	59.2	54.6	65.1
Ever on FRPL	N/A	71.8	75.8	66.6
Infant birth weight (grams)	3314.0	3294.5	3272.4	3322.4
Gestational age (weeks)	38.8	38.8	38.7	38.8
Mother's health problems	23.7	24.2	22.0	26.9
	Panel B. Competition measures			
Diversity	N/A	5.1	6.8	2.9
Density		15.6	24.0	5.0
Distance		-1.9	-1.0	-3.0
Number of houses of worship		143.0	207.9	61.0
Number of slots		2.9	4.7	0.7
Competition index (PCA)		0.3	1.6	-1.5
	Panel C. Outcomes			
Math+reading score	N/A	0.0	-4.4	5.6
Math score		0.0	-4.1	5.0
Reading scores		0.0	-4.8	6.0
Likelihood suspended		13.7	14.3	12.9
Absence rate		5.0	5.0	5.2
Maximum # observations	2,028,798	6,971,914	3,890,161	3,081,753
Maximum # children	2,028,798	1,255,084	755,254	609,646

Notes: Panel A presents means of sociodemographic variables (all indicator variables multiplied by 100); panel B presents means of competition measures with distance reverse coded (more positive values indicate higher competition); panel C presents outcome variables (all multiplied by 100). Column 1 presents characteristics of full sample of births between 1992 and 2002; column 2 presents characteristics of our preferred empirical sample for school years 2002/03 to 2016/17; columns 3 and 4 divide sample from column 2 into two mutually exclusive categories based on median of the PCA competition index.

Table A3: Effects of Voucher Expansion. Estimates Using Components of the Competition Index.

	(1) Math + Reading	(2) Mathematics	(3) Reading	(4) Suspensions	(5) Absences
			Panel A. Diversity		
Expansion × above median competition	4.23	1.94	6.54	-0.50	-0.26
	(0.60)	(0.74)	(0.62)	(0.27)	(0.05)
			Panel B. Density		
Expansion × above median competition	5.29	2.82	7.57	-1.11	-0.26
	(0.59)	(0.73)	(0.61)	(0.27)	(0.05)
			Panel C. Distance		
Expansion × above median competition	1.65	-0.31	3.54	-0.43	-0.15
	(0.59)	(0.71)	(0.62)	(0.26)	(0.05)
			Panel D. Houses of worship		
Expansion × above median competition	3.92	1.64	5.97	-1.43	-0.22
	(0.60)	(0.73)	(0.63)	(0.26)	(0.05)
Mean [SD] of Y	0.03 [93.10]	0.00 [100.00]	0.00 [100.00]	13.63 [34.31]	5.04 [5.79]
Observations	6,187,563	6,131,878	6,611,067	5,453,653	5,453,653
# children	1,222,165	1,221,912	1,223,799	1,228,461	1,228,461
			Panel E. Slots per grade		
Expansion × above median competition	6.06	3.36	8.68	-1.75	-0.29
	(0.59)	(0.73)	(0.60)	(0.27)	(0.05)
Mean [SD] of Y	0.00 [93.08]	-0.04 [99.98]	-0.02 [99.98]	13.67 [34.35]	5.04 [5.79]
Observations	6,160,525	6,104,889	6,584,014	5,427,985	5,427,985
# children	1,221,023	1,220,753	1,223,123	1,225,713	1,225,713

Notes: Sample is based on individual-level observations in grades 3 to 8 for students attending Florida public schools between 2002/03 and 2016/17 and born between 1992 and 2002. Each child has to be observed at least in grade 1 so that we can assign them school-level competition measures which are based on Figlio and Hart (2014); these are assigned to individuals for the schools they attend in grades 1 and 6. Thus, there are up to two values of competition observed for each individual. Expansion is measured at annual level between 2002/03 and 2016/17 as logarithm of number of scholarships awarded. Test scores are based on FCAT developmental scores for years 2000/2001 to 2013/2014 and on FSA developmental scores for years 2014/2015 to 2016/2017, and we standardize them in-sample by year and grade to have mean 0 and standard deviation of 100. Averaged mathematics and reading as well as mathematics test scores are available up to school year 2013/2014 while reading test scores are available up to school year 2016/2017. Suspensions (indicator for ever being suspended in a given year) and absences (absence rate in a given year net of suspension days) are measured for years 2002/03 to 2011/2012, and they are multiplied by 100. Each column represents a separate outcome variable. Competition measures are: number of denominational types represented (panel A); number of local private schools (panel B); miles to nearest private school competitor multipliede by -1 (panel C); number of churches, synagogues, and mosques (panel D); and number of private school slots per grade (panel E). Regression table presents interactions between competition measure (dummy for competition above median in the full sample of schools) and log of expansion measure, and all regressions include student-by-school level FE and grade-by-school year FE. School level is defined as indicator for grade 6 to 8 vs. 3 to 5. Standard errors are clustered at grade one school level.

Table A4: Heterogeneity in the Effects of Voucher Expansion: Socioeconomic Status Measures

	(1) Math + Reading	(2) Mathematics	(3) Reading	(4) Suspensions	(5) Absences
	Panel A. Ever on free or reduced price lunch				
Expansion × above median competition	6.50	3.66	9.19	-1.95	-0.43
	(0.62)	(0.77)	(0.67)	(0.34)	(0.06)
Mean [SD] of Y	-21.41 [89.40]	-21.40 [97.32]	-21.01 [96.39]	17.31 [37.83]	5.59 [6.31]
Observations	4,362,211	4,324,143	4,696,426	3,803,417	3,803,417
	Panel B. Never on free or reduced price lunch				
Expansion × above median competition	3.97	2.78	4.86	-0.92	-0.14
	(0.76)	(0.97)	(0.77)	(0.25)	(0.05)
Mean [SD] of Y	51.93 [80.55]	51.84 [86.44]	52.22 [89.05]	5.15 [22.10]	3.76 [4.04]
Observations	1,798,314	1,780,746	1,887,588	1,624,568	1,624,568
	Panel C. Mother high school dropout				
Expansion × above median competition	5.26	2.96	7.50	-2.16	-0.34
	(0.76)	(0.95)	(0.85)	(0.48)	(0.10)
Mean [SD] of Y	-43.26 [88.54]	-42.50 [97.76]	-43.51 [95.36]	21.77 [41.27]	6.46 [7.18]
Observations	1,504,461	1,492,865	1,609,399	1,334,914	1,334,914
	Panel D. Mother high school graduate				
Expansion × above median competition	5.67	2.90	8.30	-1.11	-0.34
	(0.60)	(0.75)	(0.62)	(0.29)	(0.05)
Mean [SD] of Y	1.32 [87.36]	0.98 [94.29]	1.43 [94.68]	12.66 [33.25]	4.87 [5.42]
Observations	3,739,944	3,709,186	3,989,457	3,304,238	3,304,238
	Panel E. Mother college graduate				
Expansion × above median competition	3.16	1.86	3.81	-0.78	-0.06
	(0.90)	(1.15)	(0.94)	(0.29)	(0.06)
Mean [SD] of Y	65.64 [82.76]	65.99 [88.95]	65.16 [91.14]	4.18 [20.02]	3.36 [3.79]
Observations	916,120	902,838	985,158	788,833	788,833

Notes: Specifications are based on those from panel A of Table 2 with the baseline sample split by child's free or reduced price lunch history (panels A and B) and maternal education (panels C to E). Outcome variables are averaged mathematics and reading test scores (column 1), mathematics test scores (column 2), reading test scores (column 3), likelihood of being suspended (column 4), and absence rate (column 5). All outcomes are multiplied by 100. Standard errors are clustered at grade one school level.

Table A5: Heterogeneity in the Effects of Voucher Expansion: Demographic Characteristics

	(1) Math + Reading	(2) Mathematics	(3) Reading	(4) Suspensions	(5) Absences
			Panel A. White mother		
Expansion × above median competition	4.68	3.80	5.27	-1.12	-0.23
	(0.68)	(0.86)	(0.66)	(0.30)	(0.06)
Mean [SD] of Y	22.89 [88.07]	22.37 [93.93]	23.26 [96.29]	10.15 [30.19]	5.26 [5.73]
Observations	3,156,514	3,132,289	3,348,248	2,815,187	2,815,187
			Panel B. Black mother		
Expansion × above median competition	4.32	3.69	5.28	-0.12	-0.02
	(0.84)	(1.12)	(0.83)	(0.65)	(0.09)
Mean [SD] of Y	-48.82 [88.57]	-49.81 [98.52]	-47.48 [94.43]	25.49 [43.58]	5.31 [6.48]
Observations	1,414,642	1,403,085	1,513,010	1,248,570	1,248,570
			Panel C. Hispanic mother		
Expansion × above median competition	5.49	1.56	9.13	-2.45	-0.17
	(0.99)	(1.27)	(1.09)	(0.42)	(0.08)
Mean [SD] of Y	-6.38 [88.16]	-4.97 [95.25]	-7.61 [95.33]	10.52 [30.68]	4.44 [5.19]
Observations	1,469,512	1,451,296	1,593,065	1,261,615	1,261,615
			Panel D. Mother born in the U.S.		
Expansion × above median competition	3.61	2.14	4.74	-0.90	-0.29
	(0.59)	(0.76)	(0.56)	(0.30)	(0.06)
Mean [SD] of Y	-1.28 [93.90]	-1.95 [100.69]	-0.72 [100.88]	14.87 [35.58]	5.37 [6.01]
Observations	4,739,008	4,701,848	5,049,671	4,198,015	4,198,015
			Panel E. Foreign born mother		
Expansion × above median competition	2.69	-0.95	6.10	-1.63	-0.13
	(0.93)	(1.22)	(1.02)	(0.39)	(0.07)
Mean [SD] of Y	4.27 [90.18]	6.36 [97.29]	2.31 [96.93]	9.56 [29.40]	3.91 [4.81]
Observations	1,421,517	1,403,041	1,534,343	1,229,970	1,229,970

Notes: Specifications are based on those from panel A of Table 2 with the baseline sample split by race/ethnicity (panels A to C) and maternal immigration status (panels D and E). Outcome variables are averaged mathematics and reading test scores (column 1), mathematics test scores (column 2), reading test scores (column 3), likelihood of being suspended (column 4), and absence rate (column 5). All outcomes are multiplied by 100. Standard errors are clustered at grade one school level.

Table A6: School and District Competition Measures Split by the Median

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Math + Reading		Mathematics		Reading		Suspensions		Absences	
Expansion × school above and	5.29	5.09	3.40	2.81	6.82	6.97	-0.76	-0.63	-0.20	-0.17
district below median competition	(1.05)	(1.02)	(1.28)	(1.26)	(1.05)	(1.04)	(0.46)	(0.46)	(0.08)	(0.07)
Expansion × school below and	7.95	7.03	6.67	5.87	8.49	7.48	-1.70	-1.11	-0.14	-0.17
district above median competition	(0.93)	(0.93)	(1.14)	(1.15)	(1.06)	(1.06)	(0.36)	(0.37)	(0.08)	(0.08)
Expansion × school and district	7.44	6.82	4.60	3.88	10.02	9.30	-2.06	-1.30	-0.31	-0.33
both above median competition	(0.65)	(0.64)	(0.81)	(0.82)	(0.66)	(0.65)	(0.31)	(0.33)	(0.06)	(0.06)
Mean of Y	0.00		-0.04		-0.02		13.67		5.04	
SD of Y	93.08		99.98		99.98		34.35		5.79	
F-statistic	48.9	41.1	15.2	11.4	80.2	70.6	16.2	5.4	9.2	9.7
# children	1,221,023		1,220,753		1,223,123		1,225,713		1,225,713	
Observations	6,160,525		6,104,889		6,584,014		5,427,985		5,427,985	
Time varying controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: All regressions include student-by-school level FE and grade-by-school year FE based on modified estimates from column 2 of Table 6. This table presents results for interactions between voucher expansion and the following four competition measures: school- and district-level competition below median (reference category), school-level competition below while district-level competition above median, school-level competition above while district-level competition below median, and both school- and district-level competition above median. Columns 1 and 2 present results for averaged mathematics and reading test scores, columns 3 and 4 present results for mathematics test scores, columns 5 and 6 present results for reading test scores, columns 7 and 8 present results for suspensions, and columns 9 and 10 present results for absences. All outcomes are multiplied by 100. Odd-numbered columns present results without any additional controls while even-numbered columns present results controlling for time-varying school- and district-level variables akin to column 8 in Table 6. F-statistics test for joint equality of the interaction terms. Information on class size is available for years 2006/2007 to 2016/2017, information on charter and magnet schools is available for years 2002/2003 to 2016/2017, information for average salaries is available for years 2004/2005 to 2016/2017, information on teacher characteristics is available for years 2002/2003 to 2011/2012, and information on predicted potential peer effects is available for years 2002/2003 to 2013/2014 for math and averaged math and reading, for years 2002/2003 to 2016/2017 for reading, and for years 2002/2003 to 2011/2012 for suspensions and absences. To maintain constant sample size we perform following imputations for variables with missing values due to differential coverage of years: (1) if available impute mean school level values and (2) if school-level information not available impute sample average. Standard errors are clustered at grade one school level.

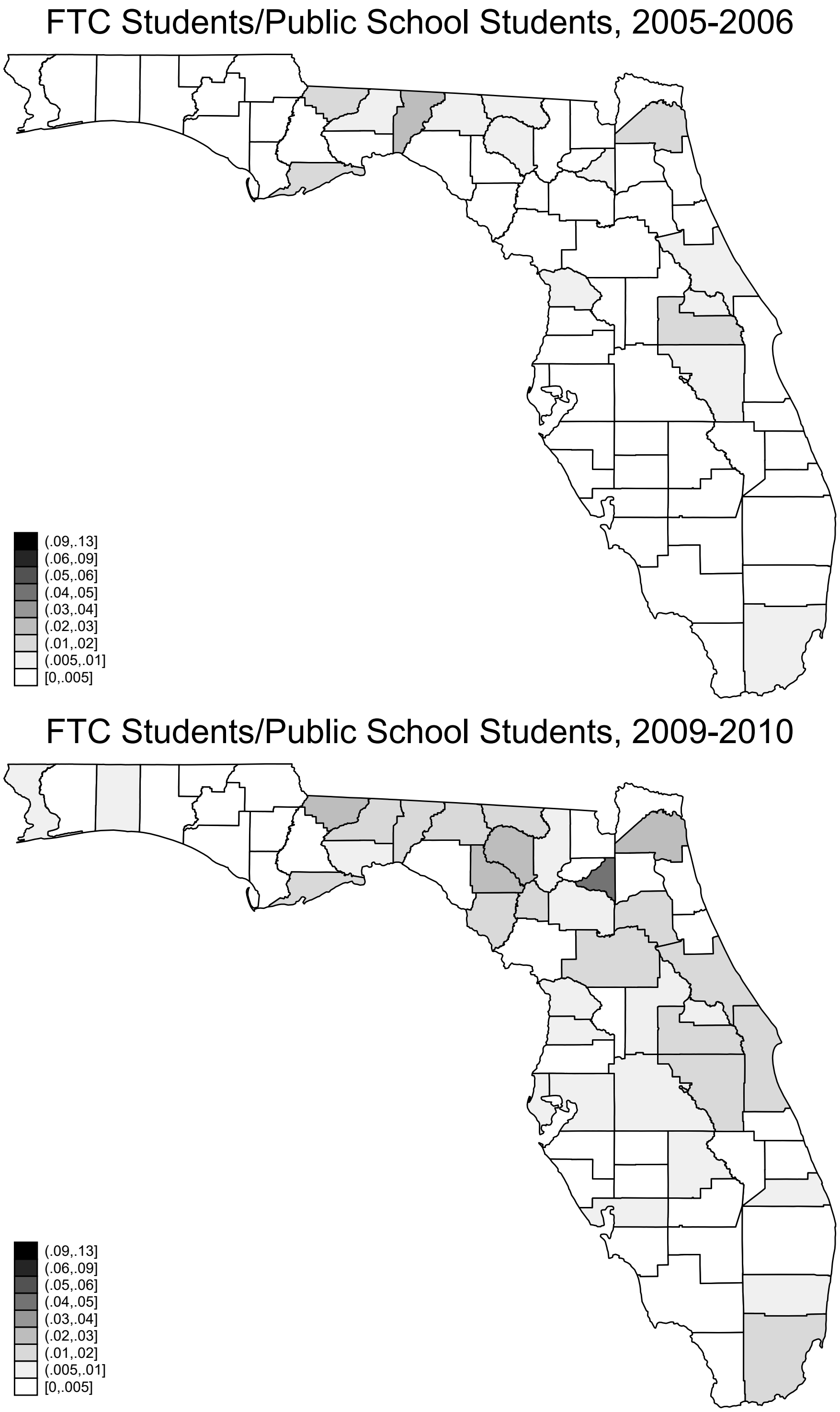
Table A7: Voucher Program Expansion and Likelihood of Being Observed in Matched Birth-Public School Records

	(1)	(2)	(3)	(4)	(5)	(6)
	Outcome: Probability of being matched to school records (*100)					
Competition measures	PCA index	Diversity	Density	Distance	Houses of worship	Slots
	Panel A: Overall (Mean = 79.8; N = 1,279,009)					
Expansion × above median weighted competition	-1.05	-1.22	-1.24	-1.36	-0.96	-1.19
	(0.36)	(0.35)	(0.35)	(0.38)	(0.36)	(0.36)
Implied % effect	-1.3	-1.5	-1.6	-1.7	-1.2	-1.5
	Panel B. Non-Medicaid paid birth (Mean = 74.7; N = 709,570)					
Expansion × above median weighted competition	-0.11	-0.30	-0.26	-1.09	-0.29	-0.13
	(0.50)	(0.49)	(0.51)	(0.53)	(0.50)	(0.51)
Implied % effect	-0.1	-0.4	-0.3	-1.5	-0.4	-0.2
	Panel C. Medicaid paid birth (Mean = 86.1; N = 569,438)					
Expansion × above median weighted competition	-2.34	-2.43	-2.43	-1.69	-2.04	-2.51
	(0.38)	(0.38)	(0.38)	(0.42)	(0.39)	(0.38)
Implied % effect	-2.7	-2.8	-2.8	-2.0	-2.4	-2.9
	Panel D. Mother high school dropout (Mean = 87.1; N = 250,565)					
Expansion × above median weighted competition	-1.45	-1.71	-1.58	-1.11	-1.37	-1.43
	(0.54)	(0.53)	(0.53)	(0.60)	(0.55)	(0.53)
Implied % effect	-1.7	-2.0	-1.8	-1.3	-1.6	-1.6
	Panel E. Mother high school graduate (Mean = 82.2; N = 746,382)					
Expansion × above median weighted competition	-0.77	-0.86	-0.82	-1.26	-0.69	-0.77
	(0.39)	(0.38)	(0.39)	(0.41)	(0.39)	(0.39)
Implied % effect	-0.9	-1.0	-1.0	-1.5	-0.8	-0.9
	Panel F. Mother college graduate (Mean = 66.9; N = 282,062)					
Expansion × above median weighted competition	-0.19	-0.40	-0.42	-0.64	-0.32	-0.68
	(0.85)	(0.82)	(0.83)	(0.78)	(0.77)	(0.83)
Implied % effect	-0.3	-0.6	-0.6	-1.0	-0.5	-1.0
	Panel G. White, non-Hispanic, non-immigrant (Mean = 77.4; N = 640,193)					
Expansion × above median weighted competition	0.03	-0.08	-0.27	-0.70	-0.23	-0.05
	(0.43)	(0.43)	(0.44)	(0.45)	(0.44)	(0.43)
Implied % effect	0.0	-0.1	-0.3	-0.9	-0.3	-0.1
	Panel H. Black, non-Hispanic, non-immigrant (Mean = 89.5; N = 213,720)					
Expansion × above median weighted competition	-2.23	-2.57	-2.37	-2.44	-1.35	-2.26
	(0.60)	(0.57)	(0.59)	(0.61)	(0.62)	(0.58)
Implied % effect	-2.5	-2.9	-2.6	-2.7	-1.5	-2.5
	Panel I. Hispanic, non-immigrant (Mean = 81.4; N = 107,344)					
Expansion × above median weighted competition	-0.74	-0.64	0.10	-0.49	-0.03	-1.25
	(1.05)	(1.03)	(1.04)	(0.86)	(1.02)	(1.05)
Implied % effect	-0.9	-0.8	0.1	-0.6	0.0	-1.5
	Panel J. Immigrant mother (Mean = 77.6; N = 317,752)					
Expansion × above median weighted competition	-4.30	-4.29	-4.23	-2.83	-3.51	-4.34
	(0.82)	(0.81)	(0.83)	(0.87)	(0.83)	(0.78)
Implied % effect	-5.5	-5.5	-5.5	-3.6	-4.5	-5.6
	Panel K: Females (Mean = 80.2; N = 624,677)					
Expansion × above median weighted competition	-1.29	-1.31	-1.47	-1.33	-1.00	-1.22
	(0.42)	(0.41)	(0.42)	(0.44)	(0.43)	(0.42)
Implied % effect	-1.6	-1.6	-1.8	-1.7	-1.2	-1.5
	Panel L. Males (Mean = 79.5; N = 654,332)					
Expansion × above median weighted competition	-0.82	-1.12	-1.01	-1.40	-0.91	-1.12
	(0.44)	(0.44)	(0.44)	(0.46)	(0.44)	(0.44)
Implied % effect	-1.0	-1.4	-1.3	-1.8	-1.1	-1.4

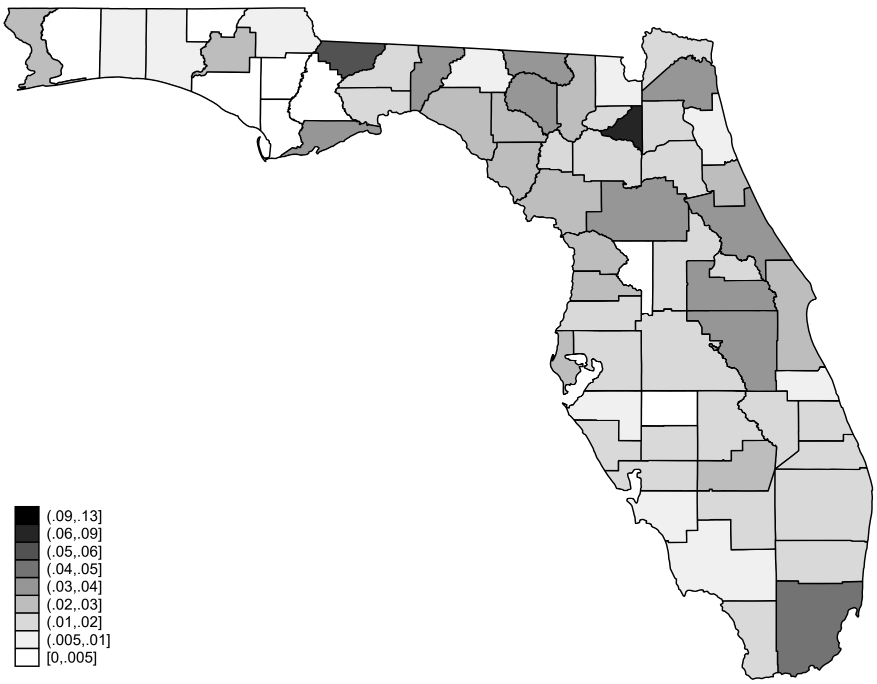
Notes: This table presents estimates where the outcome variable is an indicator for being matched between birth and school records multiplied by 100. Panel A presents overall probability while panels B to L present results for various subsamples. Independent variable of interest is an interaction between annual voucher expansion and weighted competition at zip code level. Analysis is based on data for cohorts entering grade one after the program stated (September 1995 and later) while weights are created based on pre-program grade one cohorts (January 1994 to August 1995). Weighting is based on observed flows of individuals born in a given zip code to all possible schools. Models further include zip code level and year fixed effects. Standard errors are clustered at zip code level. Additional details on this analysis are provided in Online Appendix B.

Online Appendix Figures

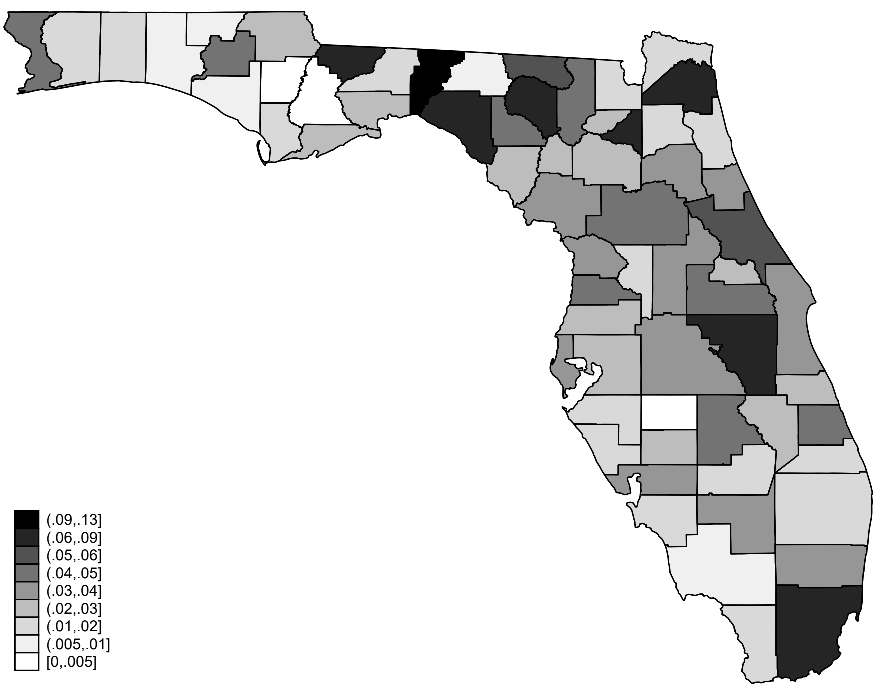
Figure A1: Spatial and Time Variation in Voucher Utilization



FTC Students/Public School Students, 2013-2014



FTC Students/Public School Students, 2017-2018

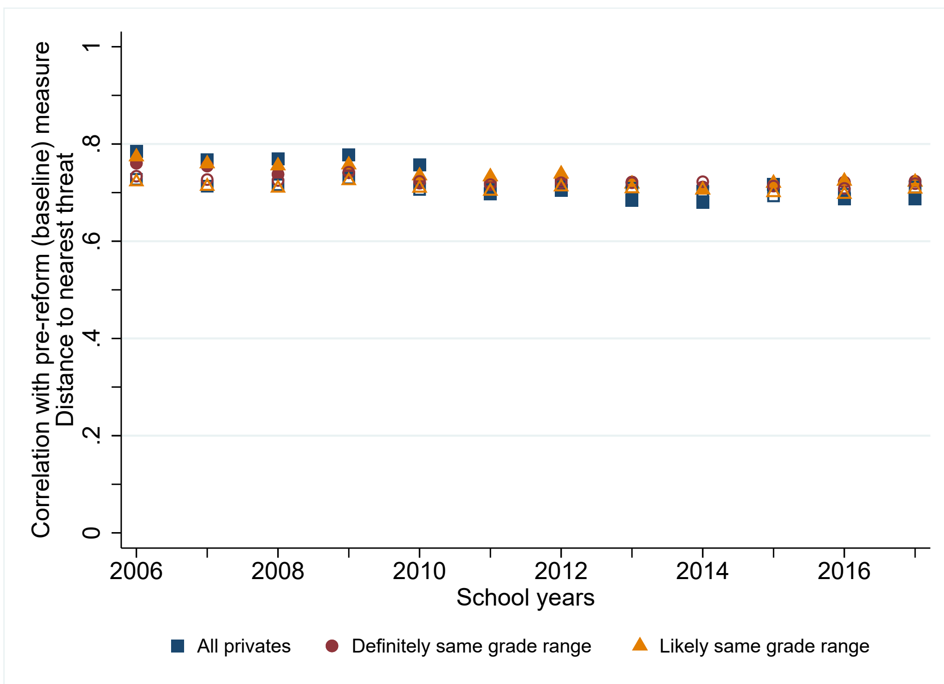


Notes: District-level enrollment figures in the FTC program were drawn from quarterly reports produced by the Florida Department of Education (http://www.fldoe.org/schools/school-choice/k-12-scholarship-programs/ftc/quarterly-reports.stml). FTC enrollment figures for each district were taken from September reports, and were standardized by the number of K-12 students reported in NCES Common Core of Data reports. Students in certain types of specialized schools (special education, vocational education, or adult schools) in the NCES data were dropped.

Figure A2: Correlations in Competition Measures

A. Density

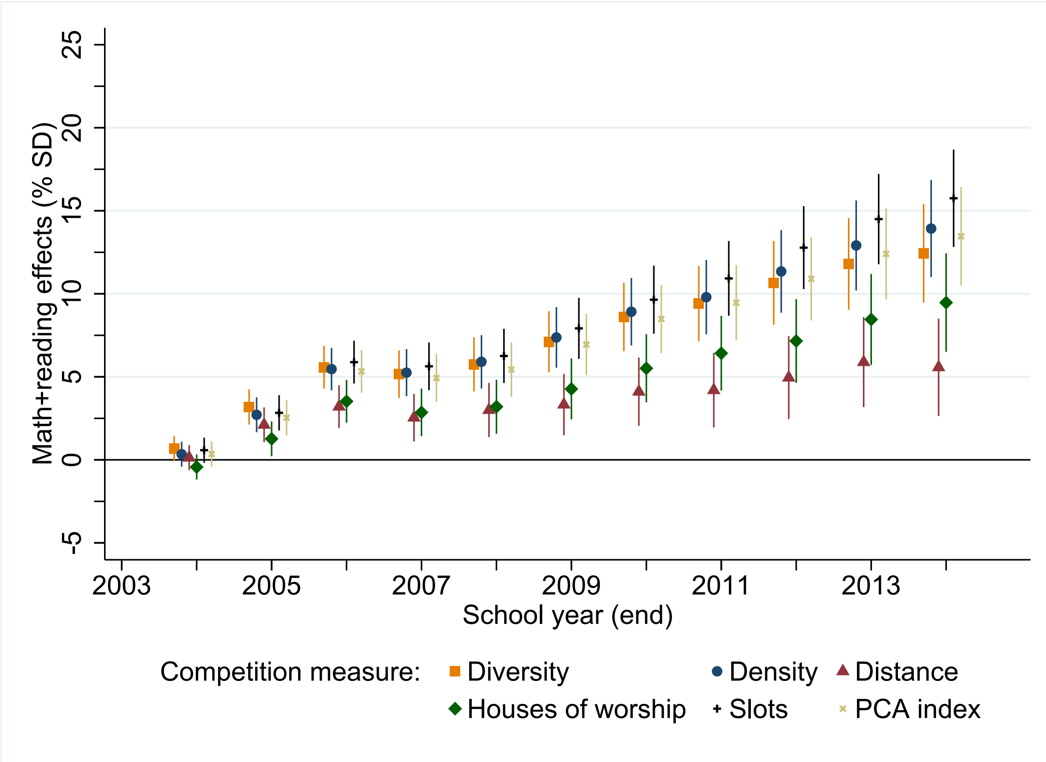
B. Distance



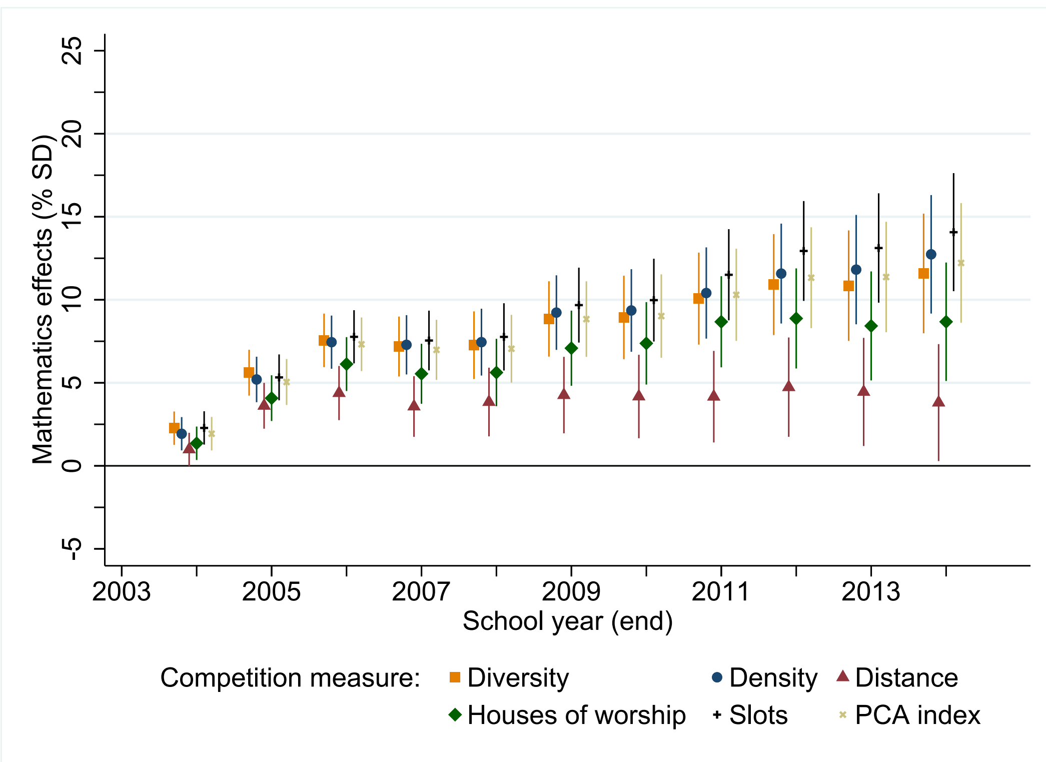
Notes: These figures present Pearson correlation coefficients over time for two of our competition measures: school density (panel A) and distance to nearest competitor (panel B). In that we correlate competition measure defined for each year with our initial pre-program competition measure defined in spring semester of school year 1999/2000. There are six series of coefficients presented in each graph depending on how we define competing schools. These include all private schools (navy squares), private schools where we are certain that they are serving the same grade range as public school in question (maroon circles), and private schools where we are quite certain ("likely") that they are serving the same grade range as public school in question (orange triangle). We define being quite certain ("likely") if (a) we see evidence that they definitely do serve same grades based on FLDOE or (b) we can match the FLDOE Private School Directory data to NCES data at a high level of confidence in a fuzzy match (> 85% of similarity) of district and school name and see evidence in NCES that the school serves that grade level. Furthermore, solid markers consider all private schools within the defined categories while hollow markers only consider private schools participating in Florida Tax Credit Program. These figures are based on raw measures provided in Florida Department of Education (n.d.a., n.d.b.) and National Center for Education Statistics (n.d.).

Figure A3: Effects of Voucher Expansion Over School Years

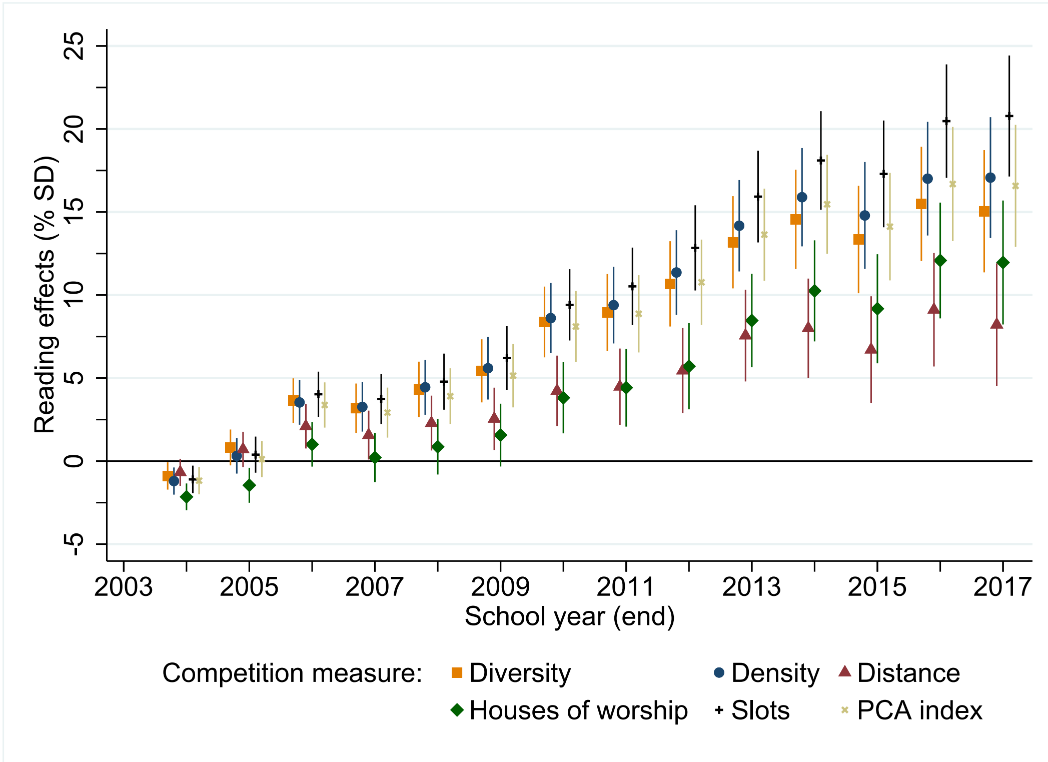
A. Averaged Mathematics and Reading



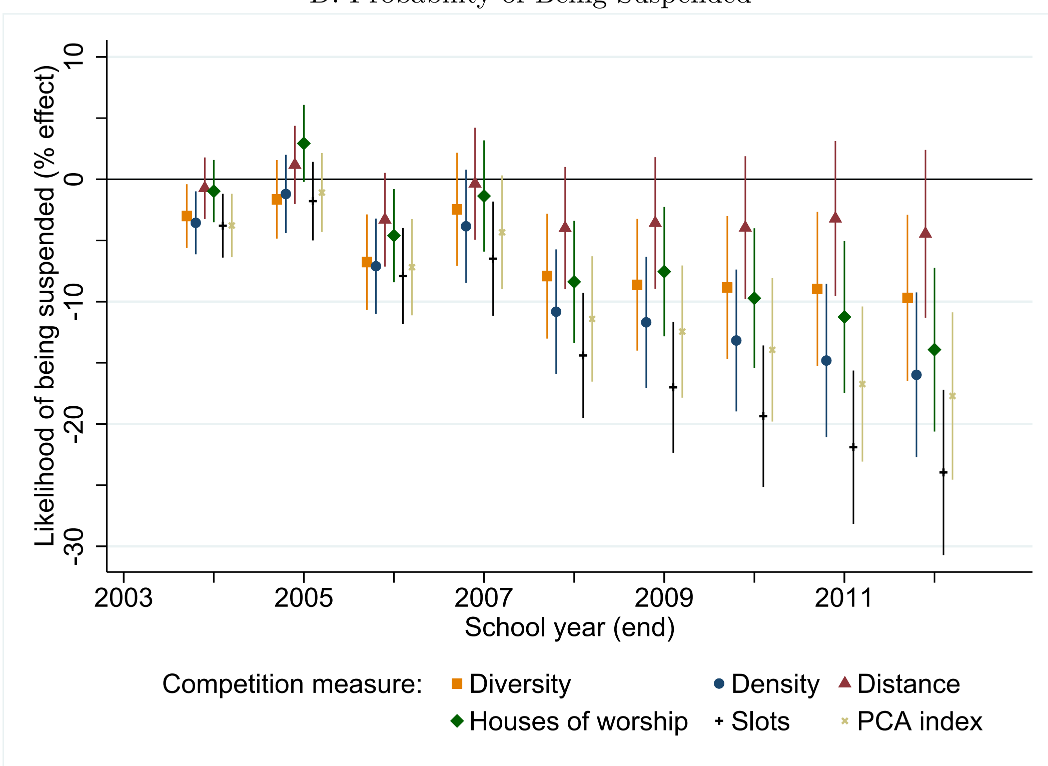
B. Mathematics



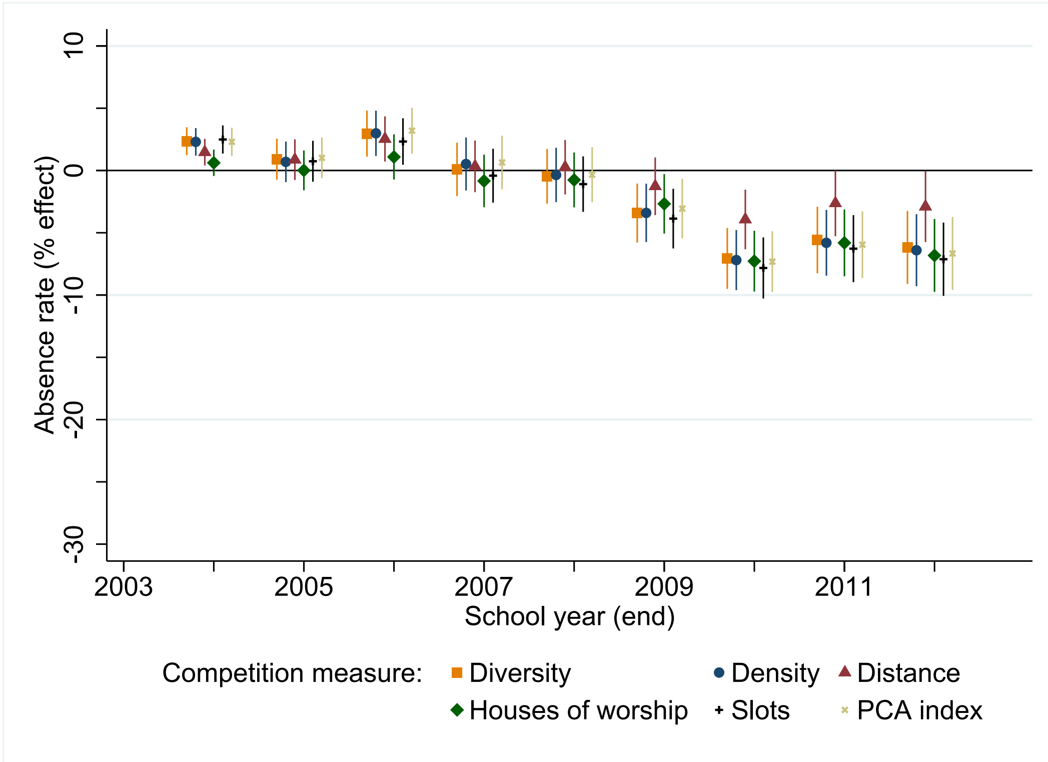
C. Reading



D. Probability of Being Suspended

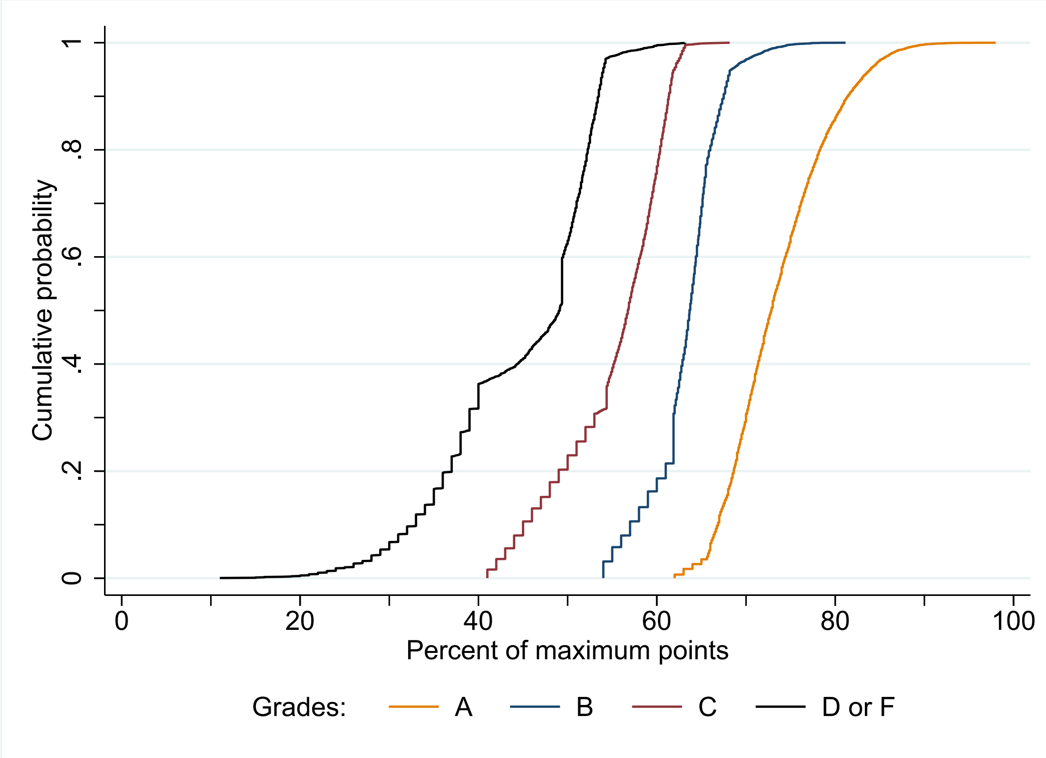


E. Absence Rate



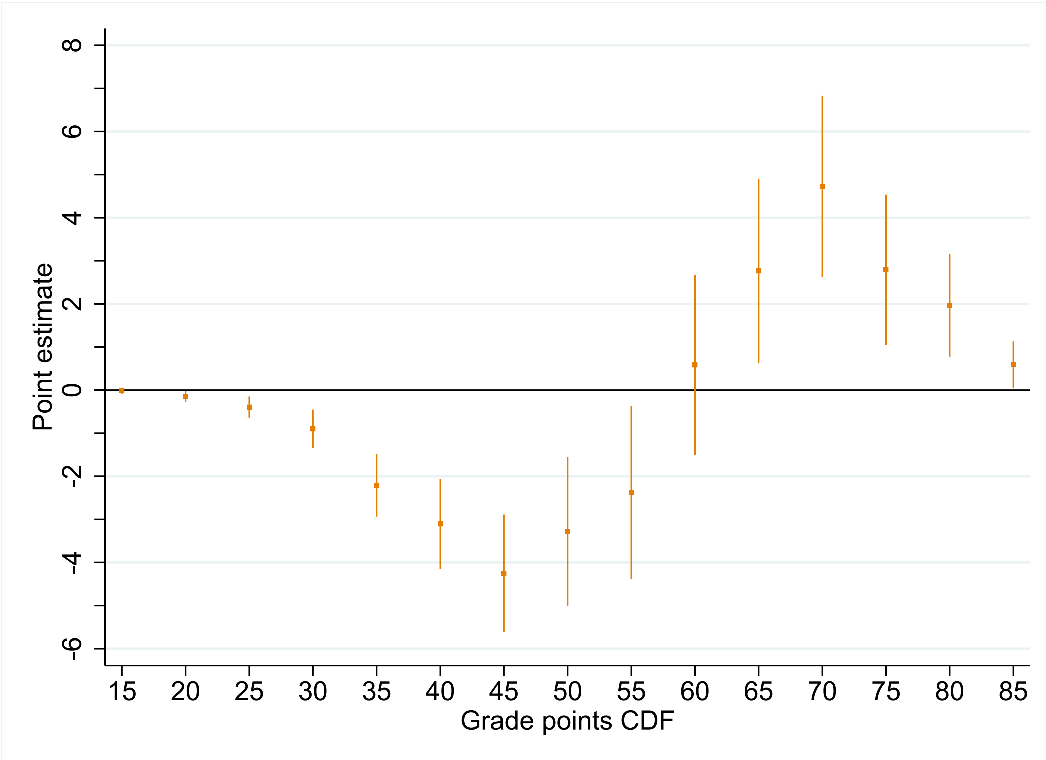
Notes: These figures plot estimates from the specifications estimated in panels A to E of Online Appendix Table A3 and specification from panel A of Table 2 where instead of interaction between competition measures and log number of scholarships we plot competition measures interacted with school years, and with baseline omitted year 2002/2003. Outcomes are averaged test scores in mathematics and reading (panel A); mathematics test scores (panel B); reading test scores (panel C); likelihood of being suspended (panel D); and absence rate (panel E). Competition measures are: number of denominational types represented (orange square); number of local private schools (navy circle); miles to nearest private school competitor multiplied by -1 (maroon triangles); number of churches, synagogues, and mosques (green diamonds); number of private school slots per grade (black pluses); and composite index of all five measures (khaki exes). Spikes present 95% confidence intervals based on standard errors clustered at grade one school level.

Figure A4: Mapping Between Percent Possible Points and School Grades in the State Accountability Formula



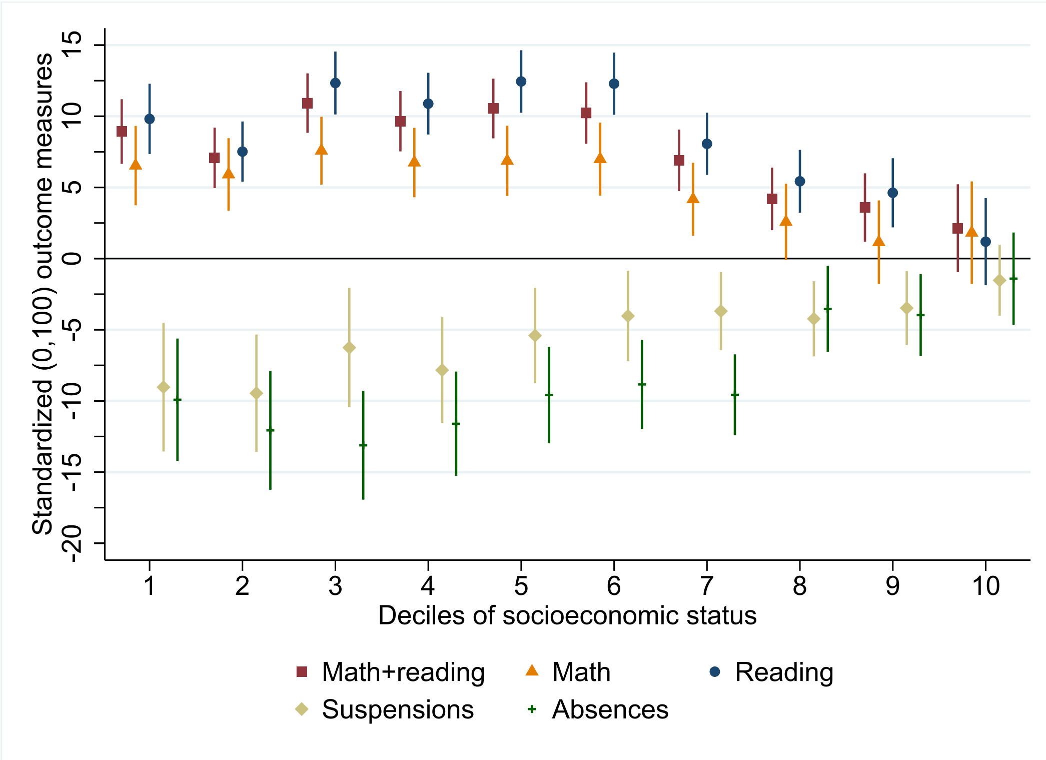
Notes: This figure plots CDFs of score points assigned by the Florida Department of Education to schools which determine their grade (A, B, C, D, or F) ratings. Since the points formula changes across years we standardize the range to be between 0 and 100. Sample is based on school years 2002/03 to 2016/17.

Figure A5: Effects on Distribution of School Quality



Notes: This figure plots effects of voucher scale up on the CDF of school quality. School quality is measured as points assigned to schools by the Florida Department of Education. Since the points formula changes across years we standardize the range to be between 0 and 100. Dependent variables are then defined as indicators for score above specific number of points P plotted on x-axis. All indicator variables are multiplied by 100. Each regression is based on cells aggregated to school in grade one by school-level by school year level. Figure displays coefficient of interest which is interaction between the preferred competition and expansion measures from panel A of Table 2, and each regression includes school in grade one by school-level fixed effects and year fixed effects. No additional controls are included and data span school years 2002/03 to 2016/17. Standard errors are clustered at grade one school level.

Figure A6: Effects of Voucher Expansion: Heterogeneity by Socioeconomic Status Index



Notes: This figure plots heterogeneity estimates for the main specification estimated from panel A of Table 2. These are computed separately for each outcome and each decile of socioeconomic status distribution. SES index is computed as first component from Principal Components Analysis (PCA) of maternal years of education, marital status, maternal age at birth, indicator for Medicaid paid birth, and zip code neighborhood income at the time of birth. Sample is restricted to births between 1994 and 2002. Outcomes are averaged test scores in mathematics and reading (maroon squares); mathematics test scores (orange triangles); reading test scores (navy circles); likelihood of being suspended (khaki diamonds); and absence rate (green pluses). Each outcome variable is standardized in its empirical sample to have mean 0 and standard deviation of 100. Spikes present 95% confidence intervals based on standard errors clustered at grade one school level.