The Impact of School Facility Investments on Students and Homeowners: Evidence from Los Angeles

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This Paper

1. Study largest school construction program in US history:
   - Los Angeles Unified School District (LAUSD) 2002-2017
   - Analyze $9.2 billion in spending on new schools
2. Use variation in construction timing to estimate:
   - Student cognitive and behavioral outcomes
   - Real estate prices in new school attendance areas
   - Spillovers on nearby untreated schools and neighborhoods
3. Use simple model to assess valuation of spending:
   - Use relative house price difference to identify MWTP
   - Informs under-/over-provision of school infrastructure

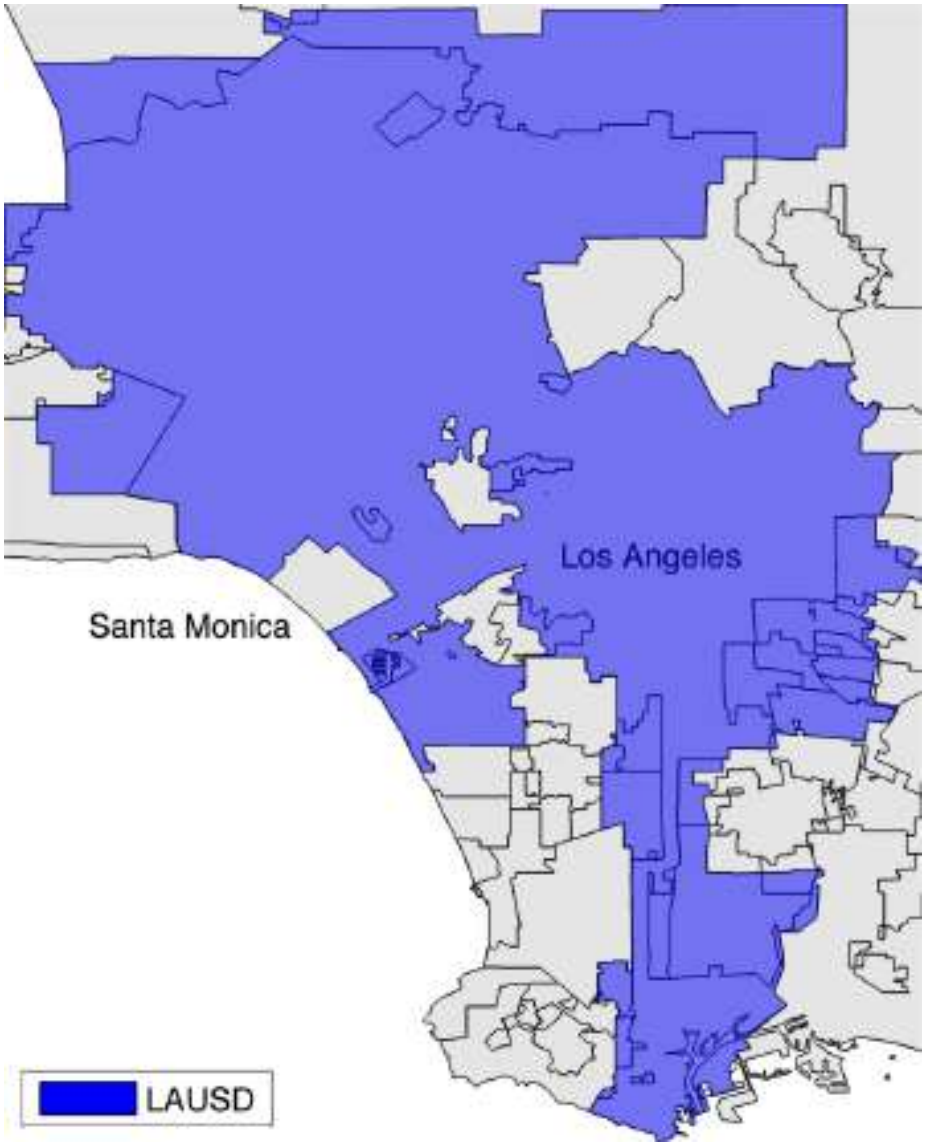
Preview of Findings

1. Student gains at new school facilities:
   - Robust student test score gains
   - Large effects on student attendance and some effort effects
   - Smaller indirect effects on students at nearby existing schools
   - Facility quality as main mechanism
2. Robust capitalization in real estate market:
   - House prices $\uparrow$ 6% when new school built
   - Little evidence of anticipatory effects, spillovers
3. Facility spending valued (more than) 1:1
   - Implied household WTP: 1.6
   - Implies prior *underprovision* and welfare gains

Outline of Presentation

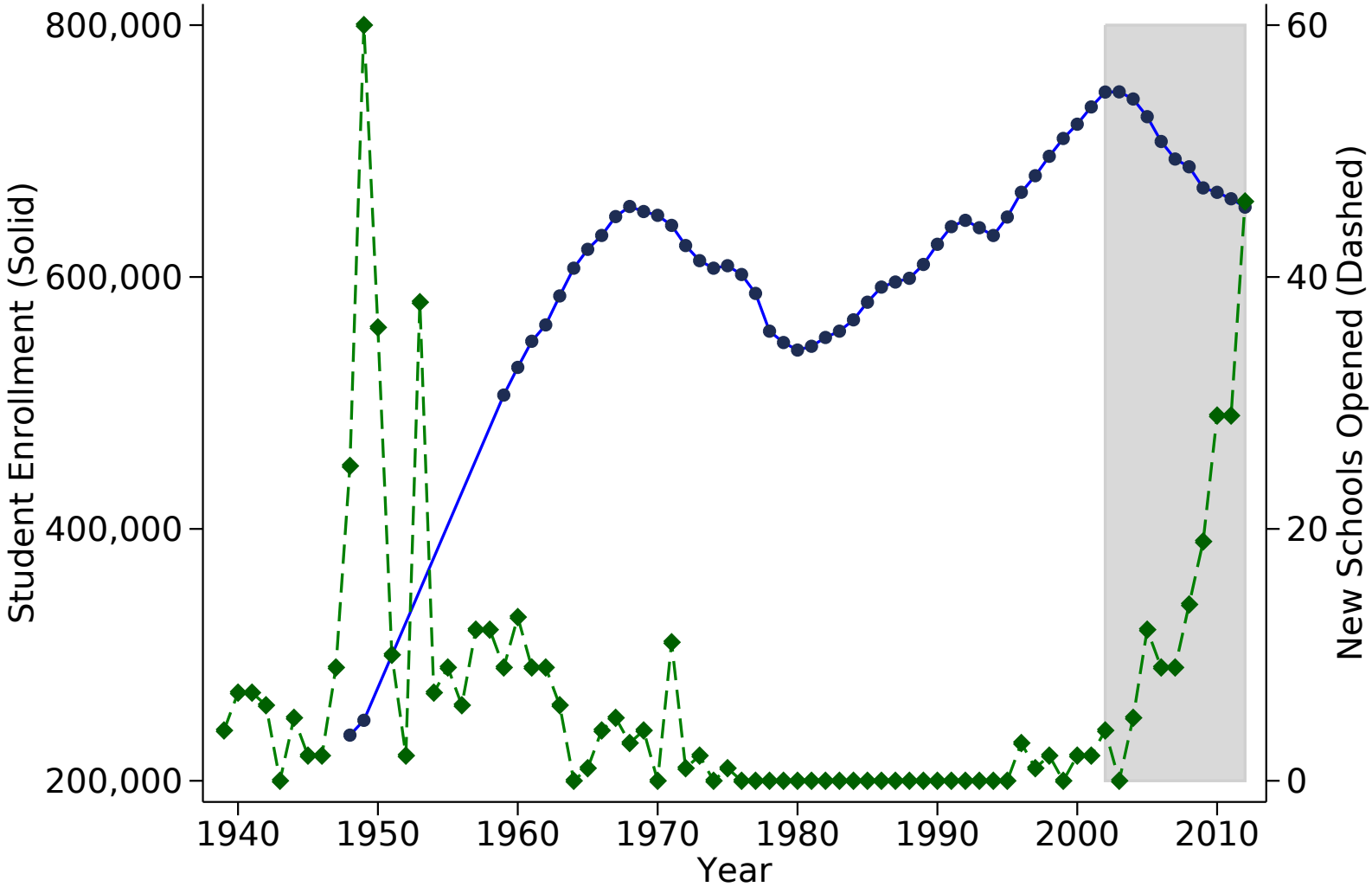
1. Context: School Capital Spending and LAUSD Program
2. Students Effects
   - Data and Research Design
   - Student Results
3. Real Estate Capitalization
   - Data and Research Design
   - Capitalization Results
   - Cost-benefit Analysis

LAUSD in the L.A. Metro Area

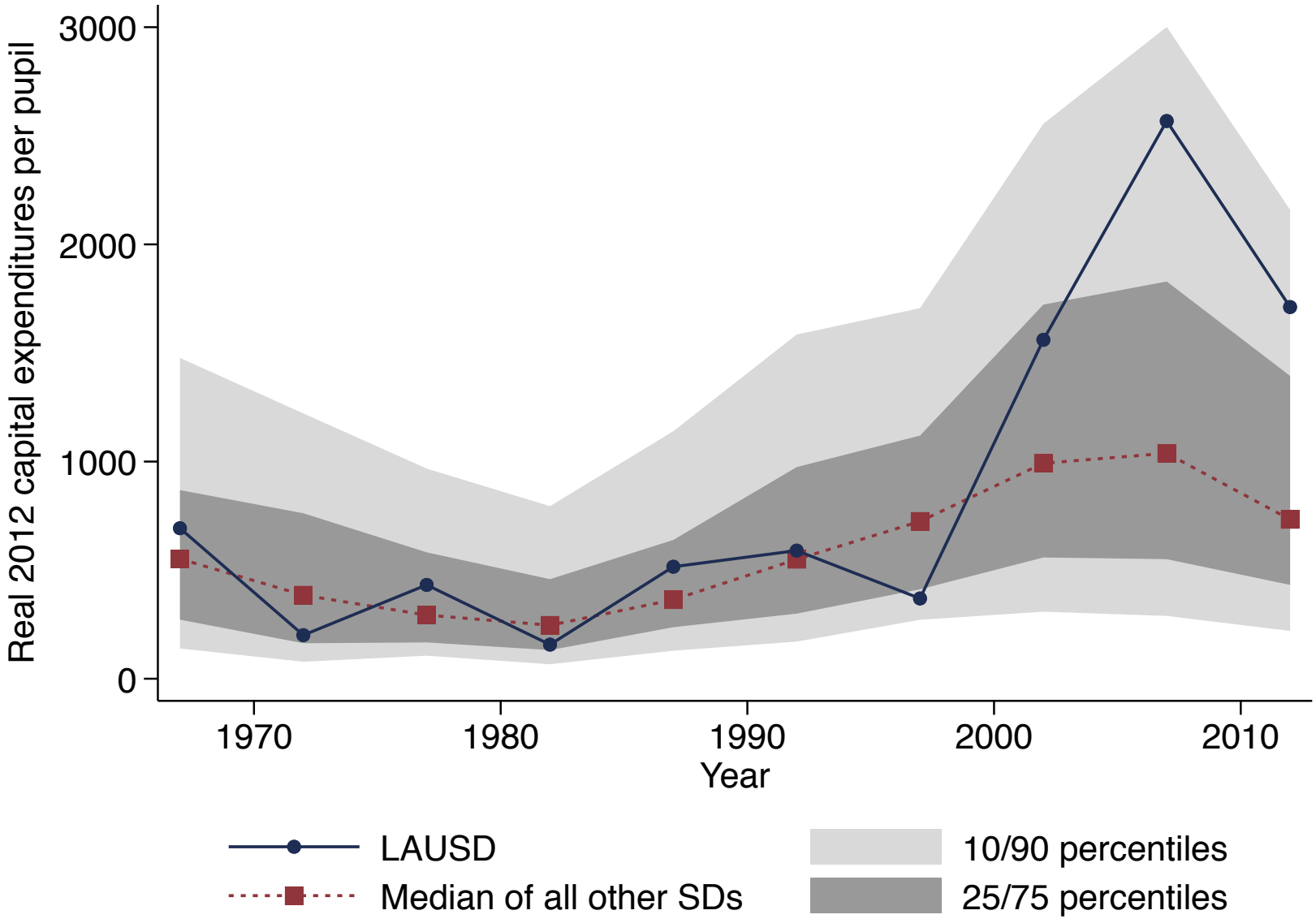


- 2nd largest district in U.S.
- 747,009 students at peak
- Mostly non-white district
- Serves 26 cities:
  - City of L.A.
  - Some gateway cities
  - Unincorporated areas
  - *Not* e.g. Santa Monica
- Underachieving:
  - 0.2 SD below CA in Math
  - 0.25 SD in ELA

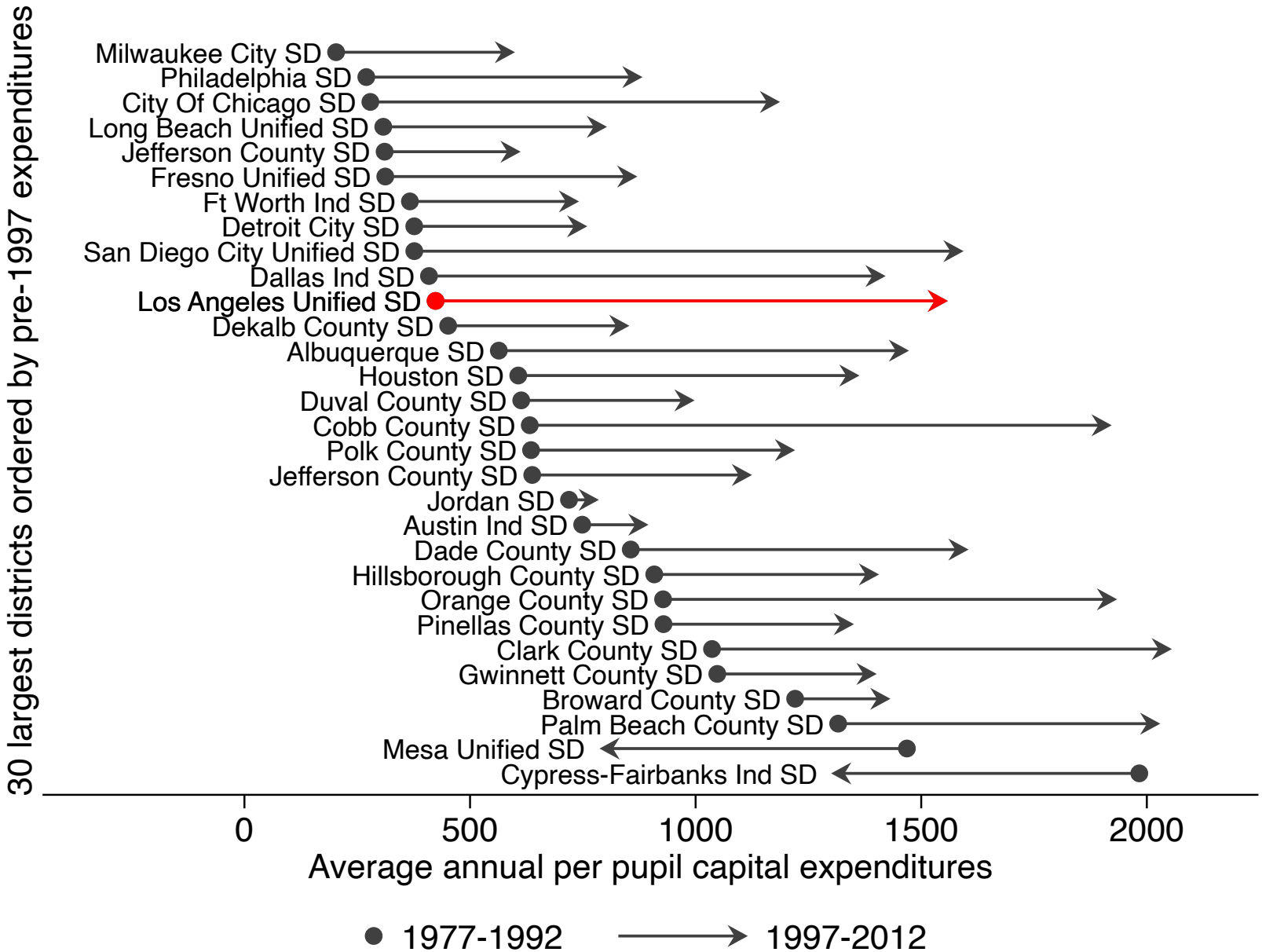
School Construction and Enrollment: LAUSD 1940-2012



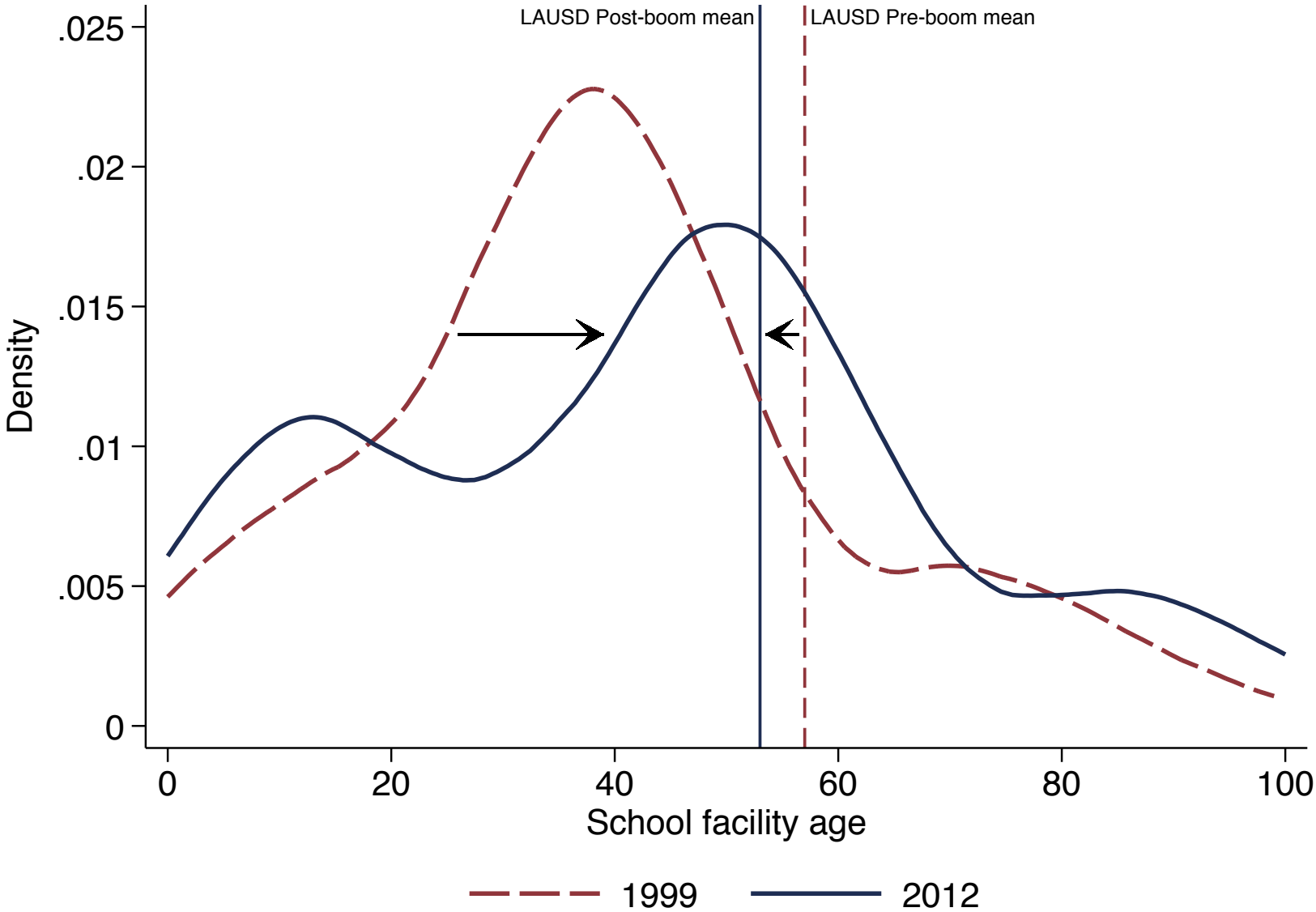
Multi-Decade Period of Capital Investment



Comparison of LA to Other Large Districts



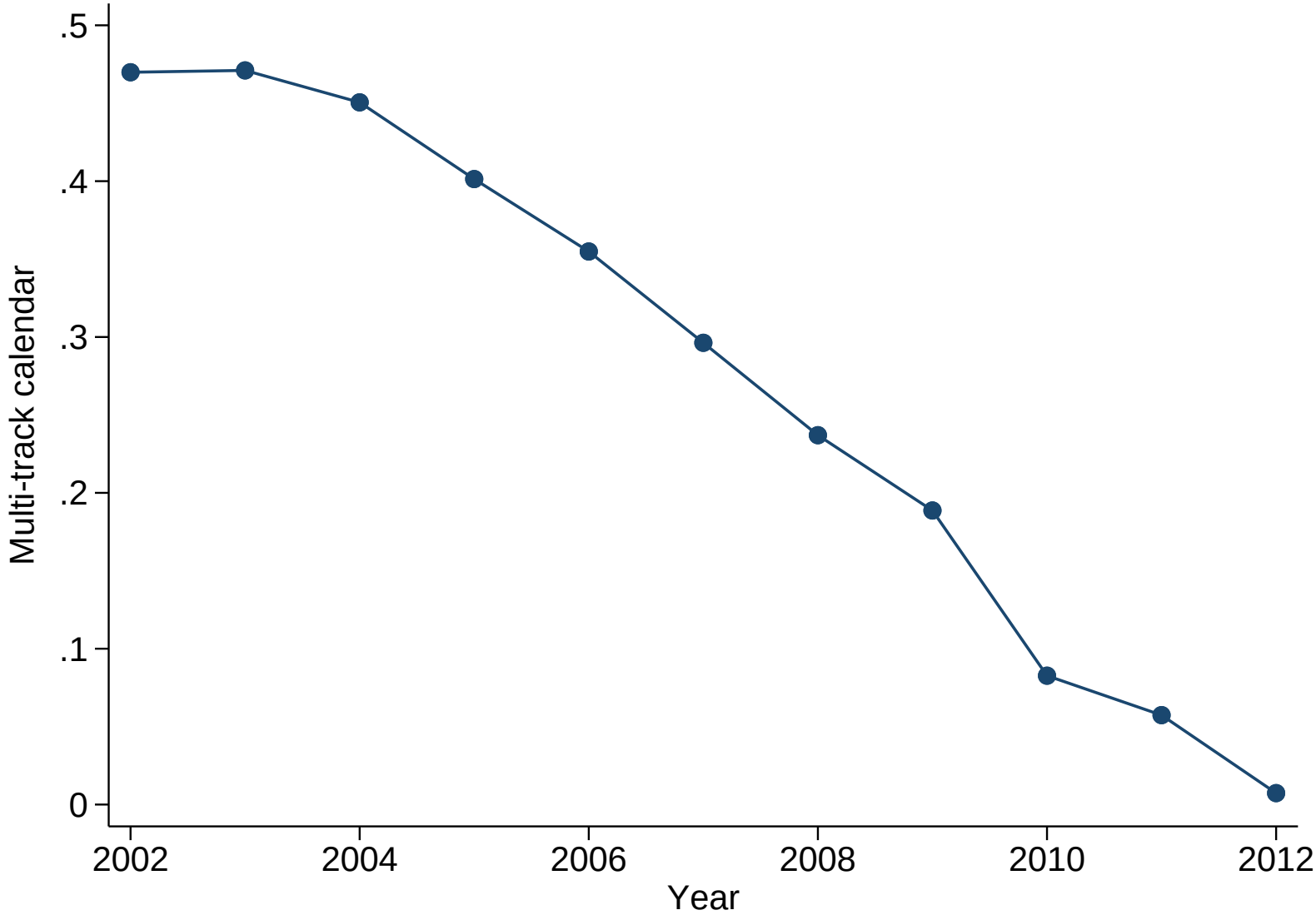
Distribution of School Facility Age



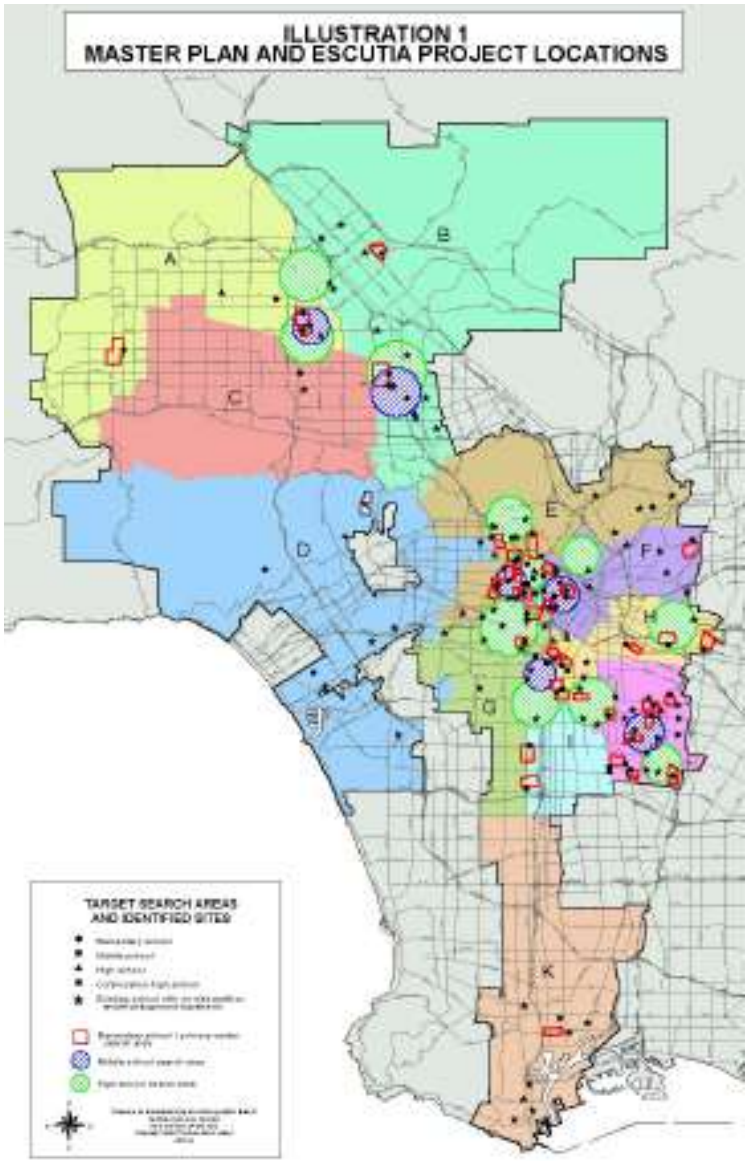
New School Constructions

- School facilities in LAUSD:
  - Zero new schools 1975-1995 despite growing need
  - Starting 1997: voter approval of several facility bonds
- Pre-building boom conditions:
  1. Poor facility quality
  2. Overcrowding
  3. Multi-track schools
- Effects at new schools:
  1. Direct facility improvements
  2. Overcrowding and multi-track elimination
  3. Reallocation of resources
- Data to study building boom:
  - 7.5M administrative student records
  - 560k assessor records on residential house sales

Multi-calendar Schools



New School Site Selection Process



- Select old schools most...
  1. overcrowded
  2. multi-track calendar

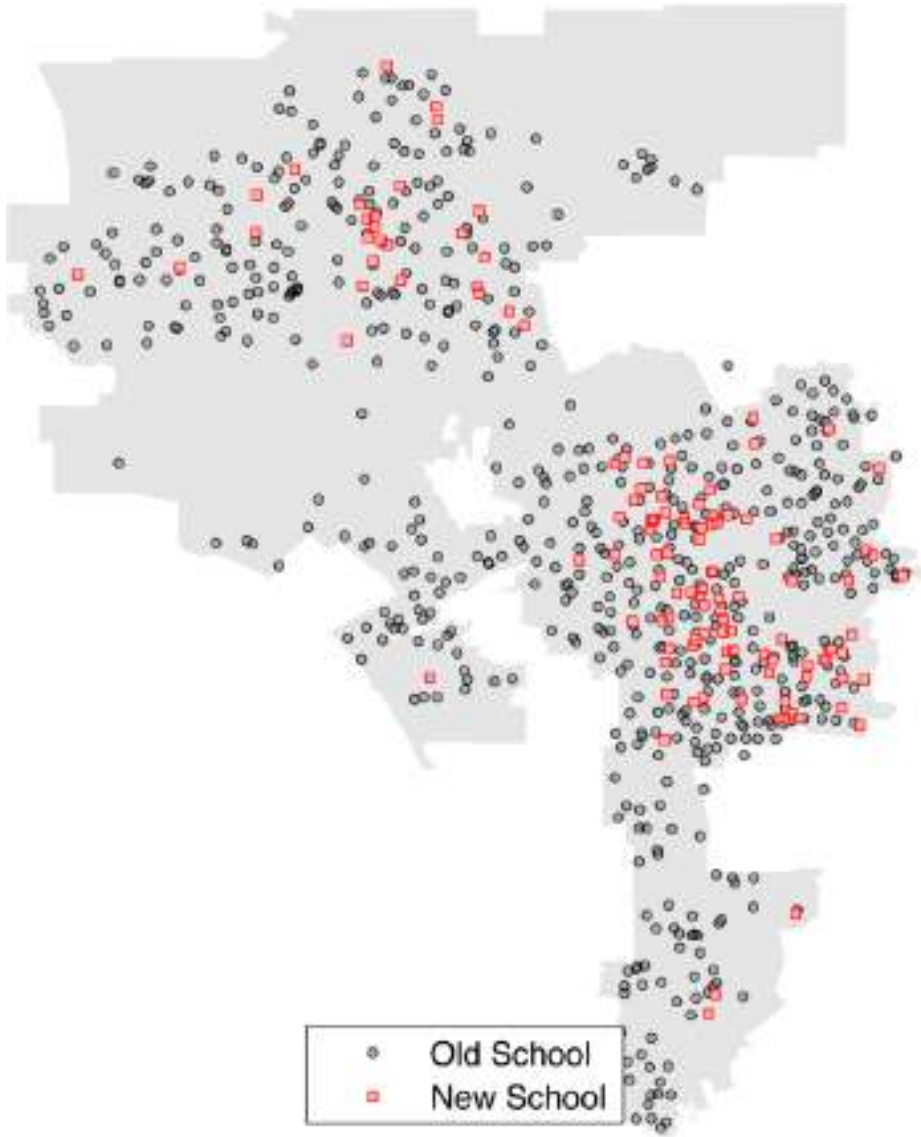
  $\Rightarrow$ 109 schools identified (black dots)
- Assign search areas nearby:
  - Red: elementary schools
  - Blue: middle schools
  - Green: high schools
- Select sites from areas:
  - Feasibility study
  - CEQA
  - Property purchase
  - Public tender
  - Construction (1-3 years)

New School Projects

	Mean	Median	Min	Max
Total cost (million USD)	81.9	56.5	11.1	578.7
New student seats	1,050	800	162	3,440
New classrooms	40.3	32	6	130
Building SQFT	100,585	70,115	12,507	391,840
Completion year	2008	2008	2002	2012
Site designation to completion (yrs)	5.18	5	2	9
Construction to completion (yrs)	2.12	2	1	5
New School Codes	1.26	1	1	5

Total New School Campuses	114
Total New School Codes	144

New and Old School Sites in LAUSD



Outline

Empirical Framework

Problem: matriculation at new schools (negatively) selected

- Identification strategy 1: use variation in *timing* of student switching to new school
  - Examine *within-student* changes in outcome over time, before versus after being at a new school

  $\Rightarrow$ Exploit variation induced by construction timing

  $\Rightarrow$ **Key assumption**: non-switching students make good counterfactuals to switching students
- Identification strategy 2: Using school residential assignment of students instead of actual school attendance
  - Examine changes of students in new attendance zones

  $\Rightarrow$ Eliminates concern that students who might benefit most are the ones that switch

Estimation Sample

Two treatments:

1. Direct effects on students attending new schools
2. Indirect effects on students who stay behind at old schools, yet experience *peer outflows* to new facilities

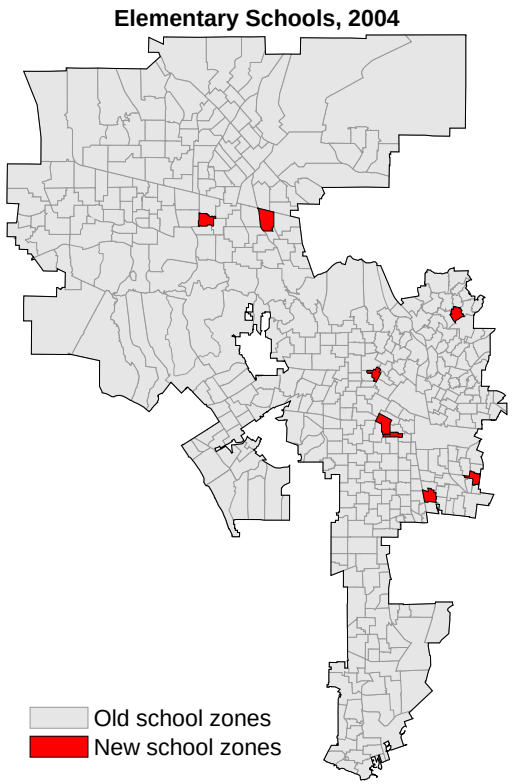
Baseline estimation: examine direct effects using entire sample

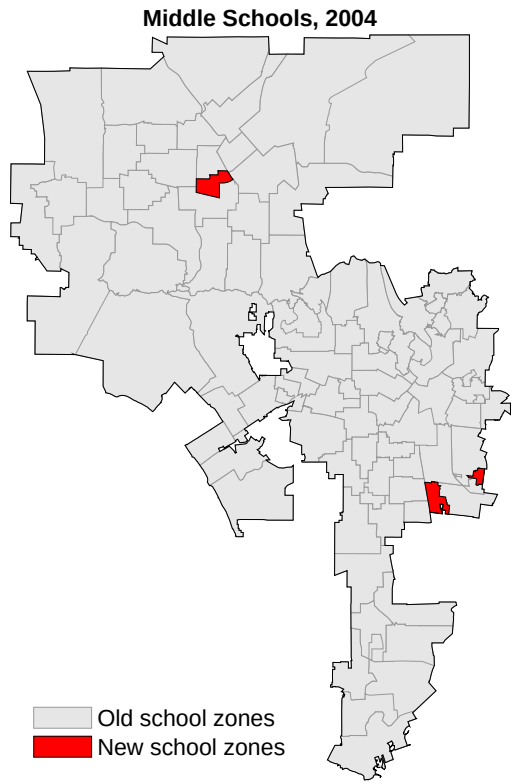
- Results robust to excluding "stayers"
- Later, examine indirect effects on "stayers" (dropping treated students)

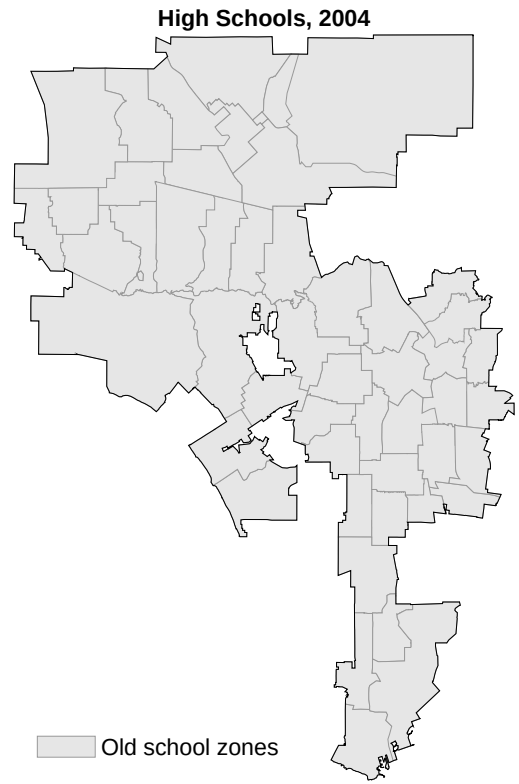
Summary Statistics

	All LAUSD	Never Treated	Always Treated	Switchers	Stayers
Free/reduced-price lunch	0.80	0.78	0.79	0.94	0.89
Hispanic/Latino	0.73	0.71	0.85	0.89	0.82
Black	0.11	0.12	0.05	0.06	0.08
White	0.09	0.10	0.03	0.03	0.05
Asian	0.04	0.04	0.04	0.01	0.03
Parent: any college	0.27	0.28	0.24	0.16	0.20
English spoken at home	0.33	0.35	0.27	0.18	0.22
Predicted test score	-0.25	-0.23	-0.27	-0.38	-0.33
Math score ($t = -1$)				-0.34	-0.16
ELA score ($t = -1$)				-0.52	-0.37
N student-years	7,317,019	6,495,040	122,045	699,934	1,353,762

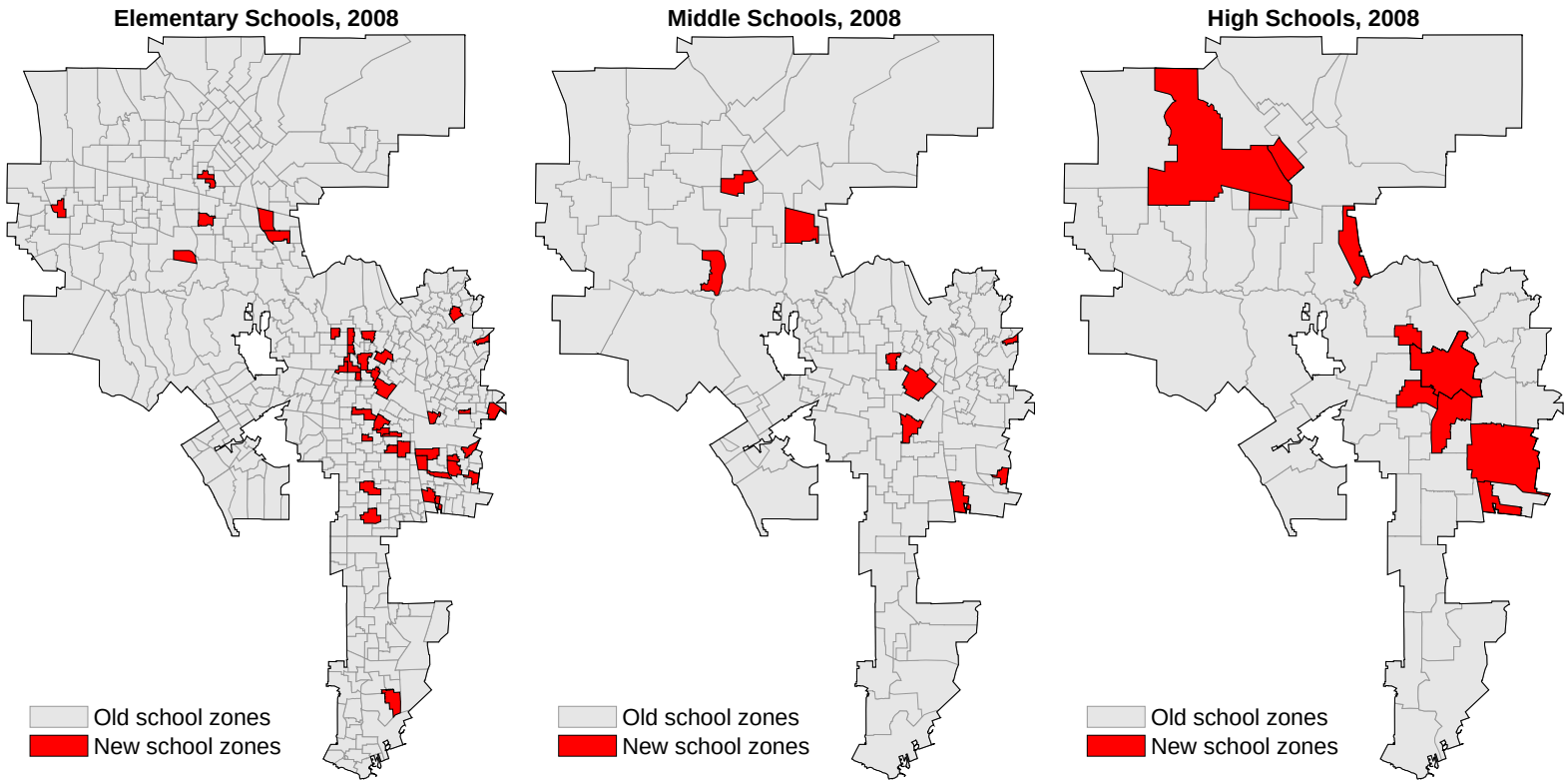
School Attendance Boundaries in 2004



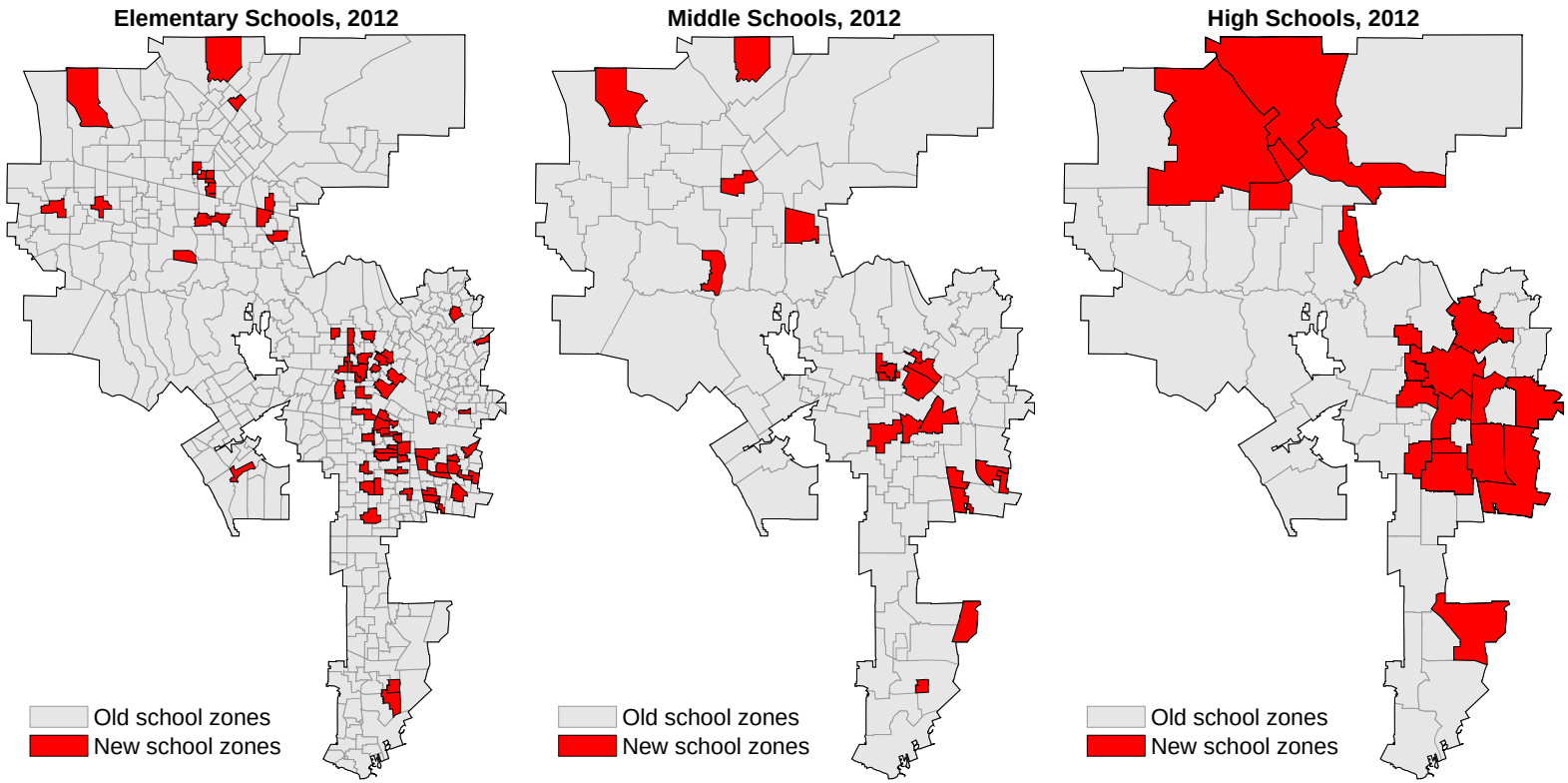




School Attendance Boundaries in 2008

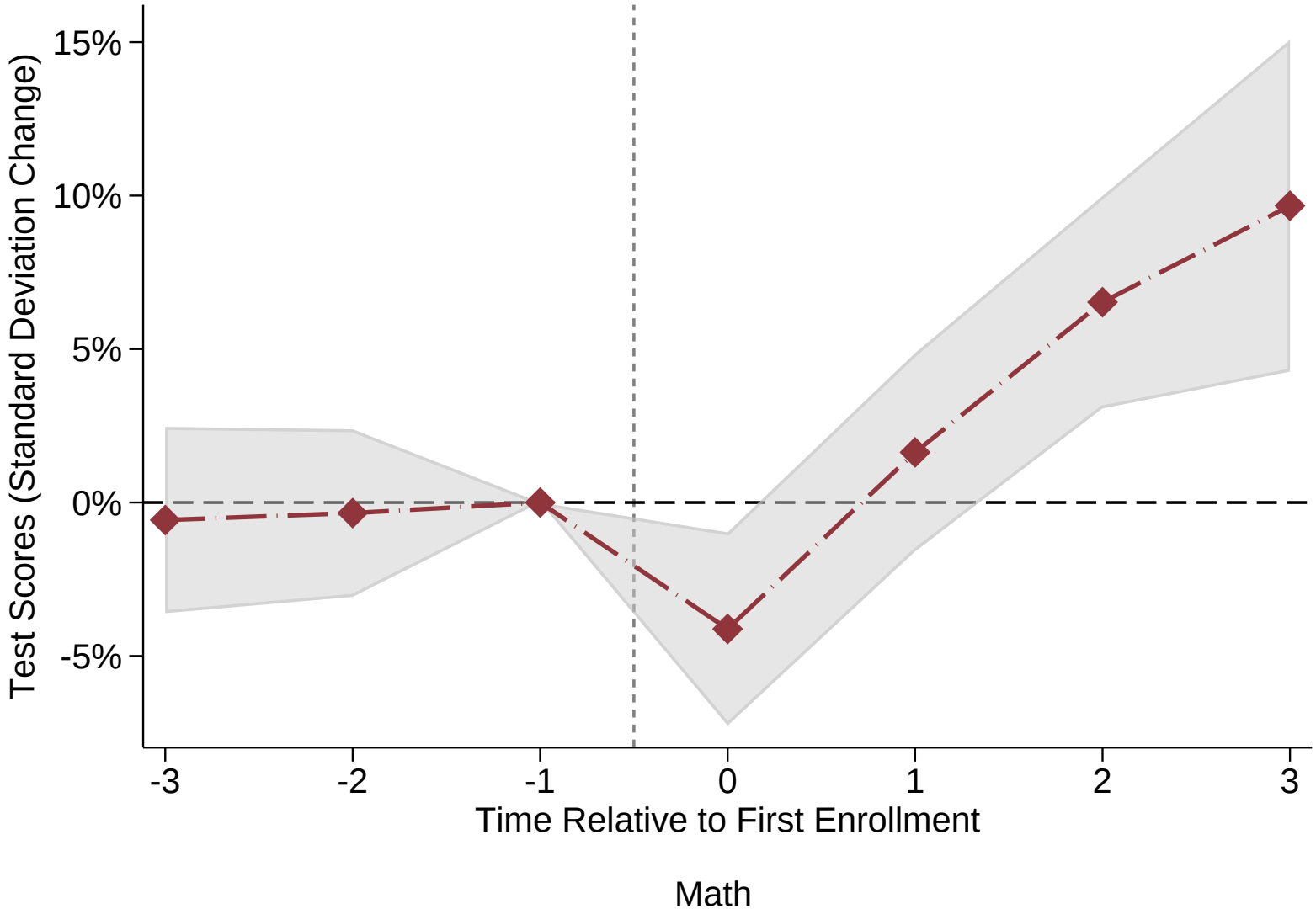


School Attendance Boundaries in 2012



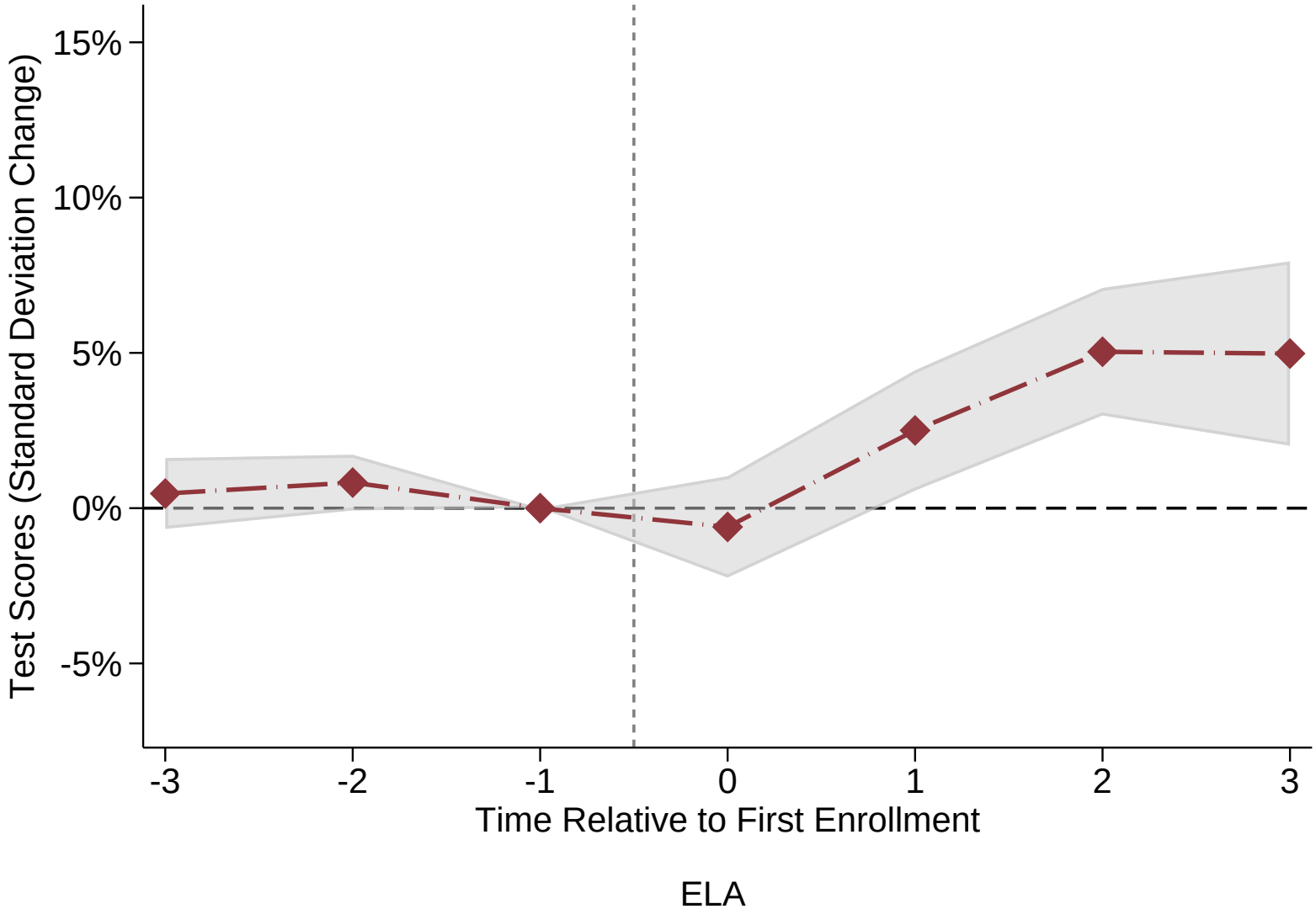
Outline

Results: Math Test Scores (Grades 2-7)



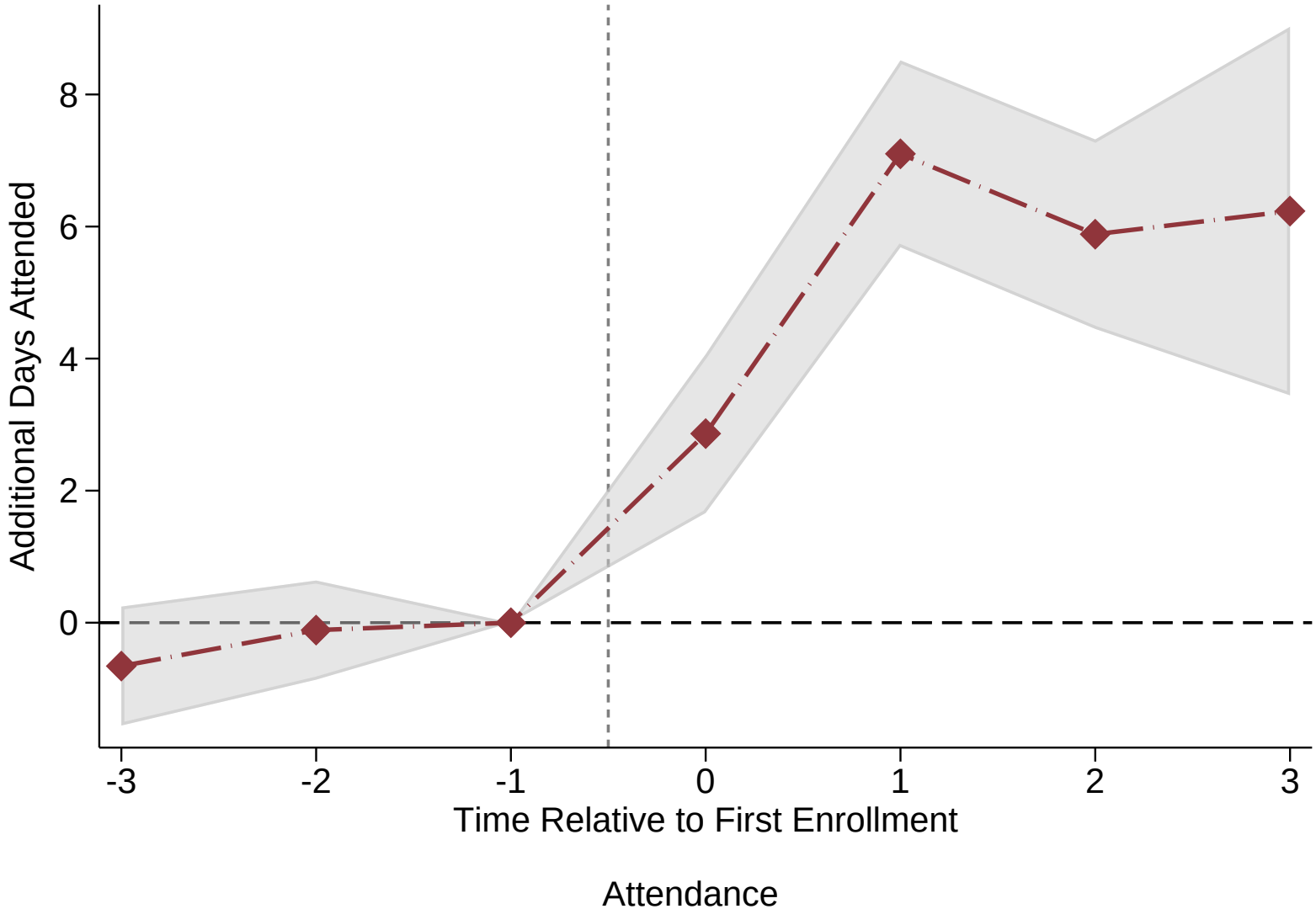
Parametric overlay | Parametric table | 2SLS table

Results: ELA Test Scores (Grades 2-11)



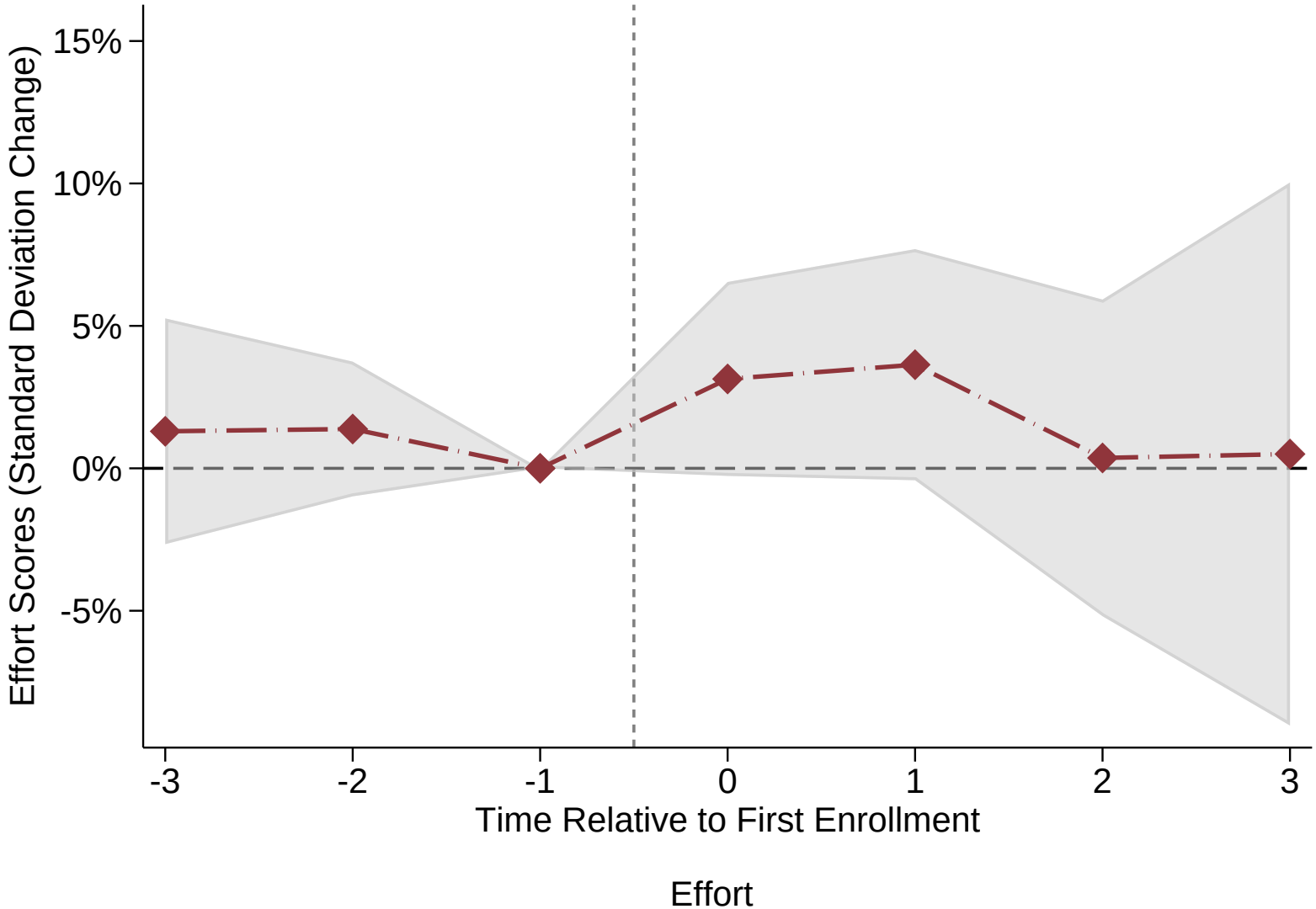
Parametric overlay | Parametric table | 2SLS table

Results: Attendance (Grades K-12)



Parametric table | 2SLS table

Results: Student Effort (Grades K-5)



Course Marks | Parametric table | 2SLS table

Indirect Treatment at Existing Schools

- Also effects on students who "stay behind" at old schools:
  - *Stayer*: student for whom $\geq 10\%$ of cohort switch to new
  - Estimate analogous event-study design

  $\Rightarrow$ Informs role of overcrowding on directly treated students

- School-level changes for stayers: School-level changes table
  1. Overcrowding $\downarrow$
  2. Calendar: convert back to 9-month ($\uparrow$)
  3. Peer effects $\uparrow$ (small)
  4. Class size $\downarrow$ (small)

- Findings:
  - We find robust effects for English and attendance
  - Weak evidence for math and no effort effects

Mechanisms

- Key question: What drives student gains at new schools?
- Main mechanisms for switchers: School-level changes table
  1. Calendar change / overcrowding: $\downarrow$
     - Effects small for stayers: $\Rightarrow$ not primary mechanism
  2. Class size: $\uparrow$ (small)
  3. Peer effects: $\downarrow$ (small)
  4. Teacher quality: $\downarrow$ (small)
     - Younger, less experienced teachers
     - Lower value added
  5. Direct facility effects: $\uparrow$

Mechanisms: Facility Quality

	Math	ELA	Attendance	Effort
Pooled (switchers only)	0.035***	0.014***	3.692***	0.031*
	(0.012)	(0.005)	(0.765)	(0.019)
By share permanent classrooms:				
Low share permanent	0.037***	0.015***	4.505***	0.059***
	(0.013)	(0.005)	(0.799)	(0.018)
High share permanent	0.020	0.006	4.434***	-0.045
	(0.017)	(0.007)	(0.835)	(0.029)
p-value	0.34	0.22	0.93	0.00
By prior building age:				
Below median age	0.025**	0.012**	4.754***	-0.000
	(0.012)	(0.005)	(0.804)	(0.020)
Above median age	0.047***	0.015**	5.296***	0.056**
	(0.017)	(0.006)	(0.811)	(0.025)
p-value	0.19	0.62	0.50	0.03

Outline

Capitalization of School Quality

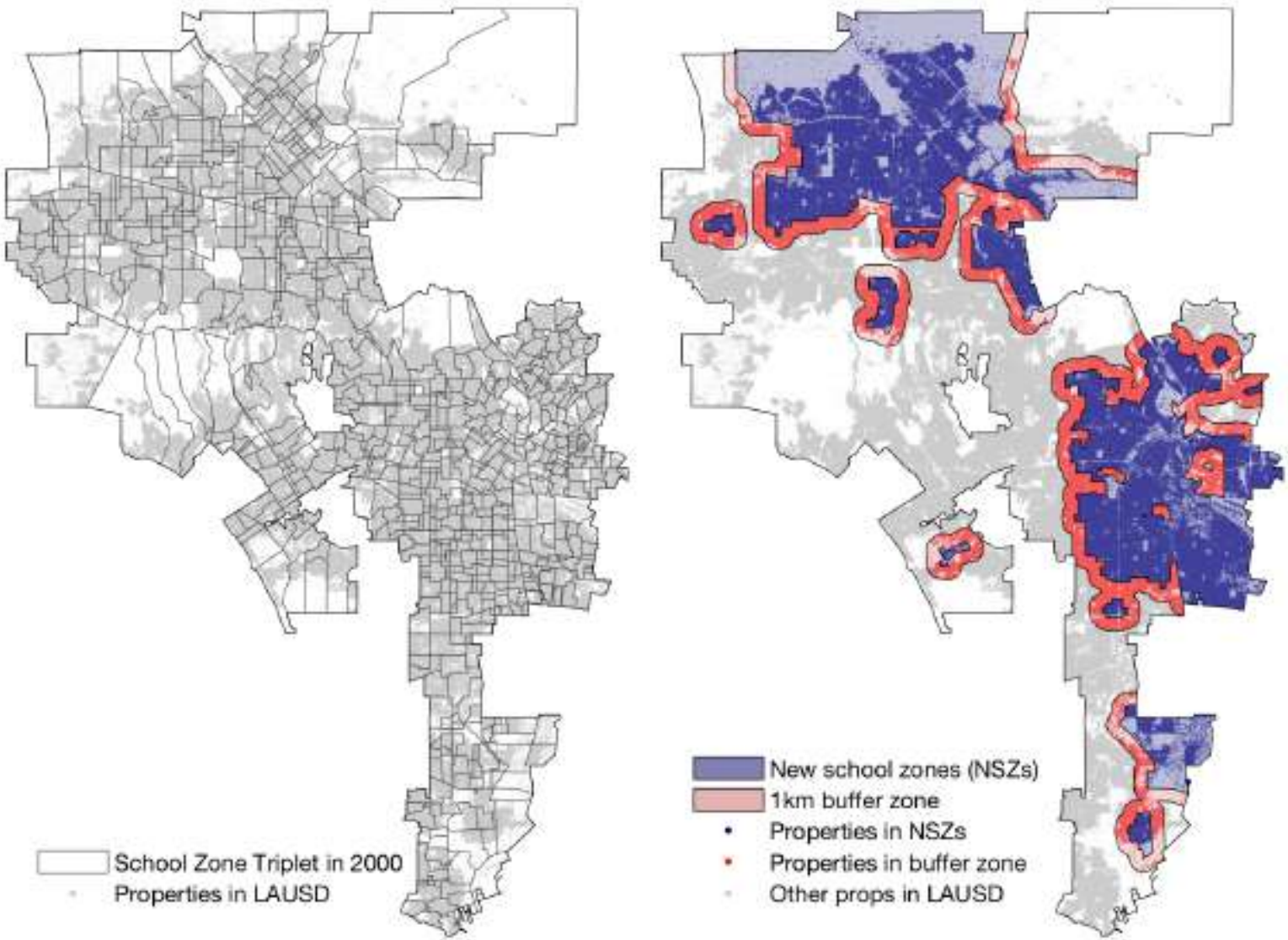
Large improvements in school **physical** and **educational** quality, *but at great cost*

How are improvements capitalized into housing market?

- How do residents value school quality? More general amenities?
- Use analogous design to examine house price effects
  - $\Rightarrow$ Compare within-neighborhood changes in prices, relative to timing of new school construction

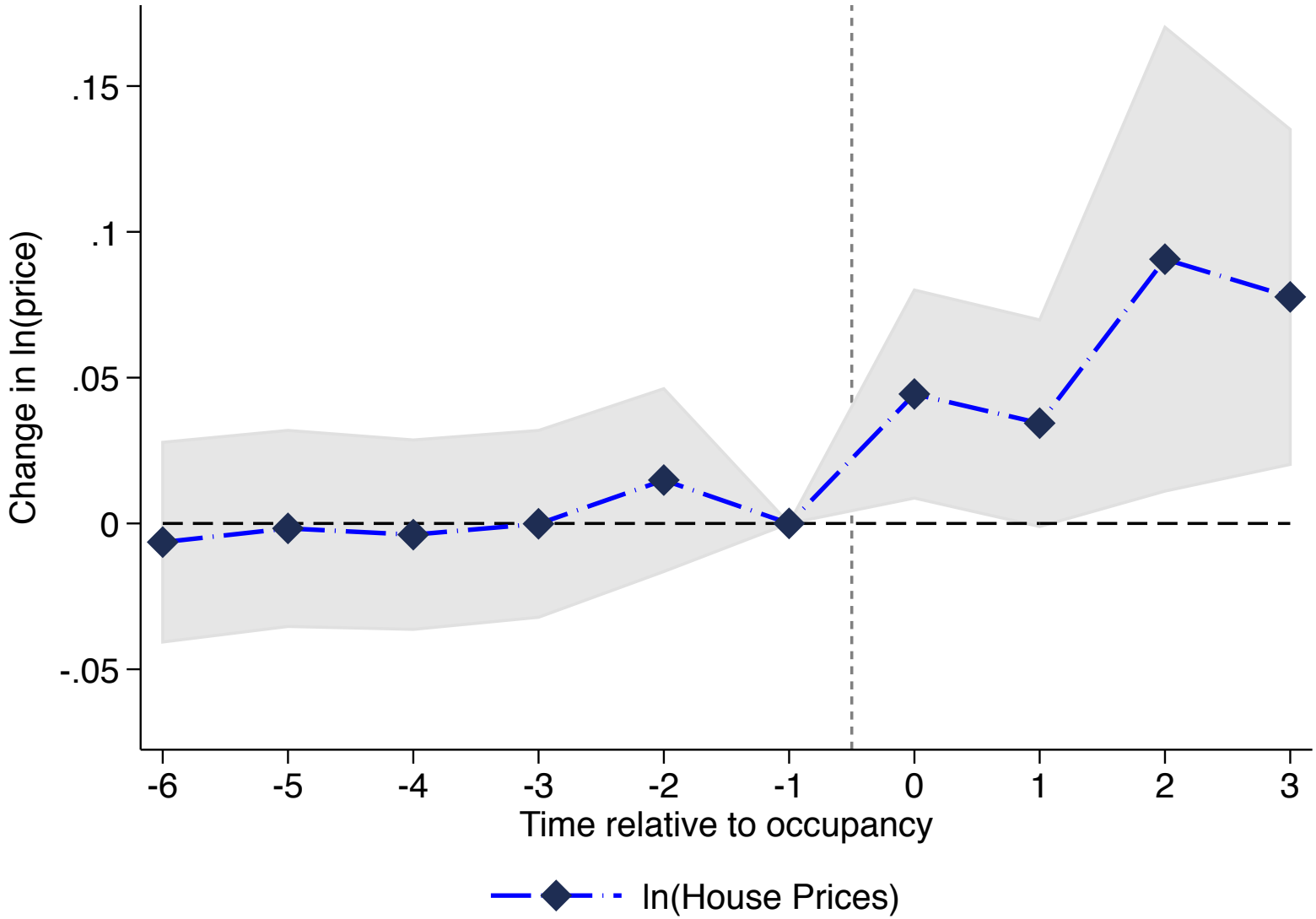
$\Rightarrow$ Use extent of capitalization to assess valuation and provision

Neighborhood boundaries



Outline

Results: House Prices (1 km buffer)



No buffer | 1km buffer; Incl. -1 | All LAUSD

Results: House Prices

Table: DiD estimates: Ln(House Price)

	Neighborhood Fixed Effects				Repeat Sales	
	(1)	(2)	(3)	(4)	(5)	(6)
New School	0.060***	0.059***	0.044***	0.055***	0.045***	0.059***
	(0.018)	(0.016)	(0.011)	(0.015)	(0.013)	(0.016)
Yr FEs				X		X
Yr-HSZ FEs	X	X	X		X	
Month FEs	X	X	X	X	X	X
Sch Zone FEs	X	X	X	X		
Prop Controls	X	X	X	X		
Prop FEs					X	X
New Sch Zones	X	X	X	X	X	X
w/in 1km		X				
All LAUSD	X					
Number of sales	505,781	255,481	161,775	161,782	87,523	87,551
R2	.82	.79	.78	.75	.91	.9

Note: Standard errors clustered by neighborhood.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Stayers | School level | Distance to school | Prior neighborhood prices

Outline

Interpreting Household Valuation

Two common approaches to compare costs and benefits:

1. Real estate capitalization approach
   - e.g. Barrow and Rouse (2004), Cellini et al. (2010)
   - ⊕ Pro: Captures benefits beyond academic achievement
     - → safety, health, non-test score outcomes, etc
   - ⊖ Con: Revealed preferences may not fully capture benefits
     - → Parental valuation of effectiveness may be limited
     - → e.g. Rothstein (2006), Abdulkadiroglu et al. (2017)
2. Later life earnings approach
   - e.g. Chetty et al. (2011), Kline and Walters (2016)
   - ⊕ Pro: Direct estimation of earnings impacts
     - → sidesteps issues of limited parental valuation
   - ⊖ Con: Only considers academic (test score) benefits

Joint Evaluation of Welfare Effects

Program component	Value
Program cost	
Households in LAUSD	1.52 million
Share treated households	0.328
Per treated household cost	$18,430
Total program cost	**$9.17 billion**
Program benefit	
1. Housing capitalization approach	
Estimated house price in treated areas	$28,201
Total real estate valuation	**$14.06 billion**
Marginal value of public funds (capitalization)	**1.53**
2. Later life earnings approach	
Implied later life earnings per treated household	$7,782
Total earnings valuation	**$3.88 billion**
Marginal value of public funds (earnings)	**0.42**
3. Hybrid approach	
Share housing valuation due to academic achievement	0.22
Share future earnings captured in academic valuation	0.76
Program benefit per treated household	$29,786
Total benefits	**$14.85 billion**
Marginal value of public funds	**1.62**

Effects regression Student gains estimation

Conclusions

1. Public expenditures in school infrastructure are productive:
   - Modest test score effects; large attendance improvements
   - Overcrowding / calendar changes generated indirect gains
   - *External validity*: many large urban or low-income districts
2. School infrastructure likely underprovided in many schools:
   - Robust real estate capitalization equals or surpasses costs
   - LAUSD breakthrough after CA local bond threshold eased
3. Future earnings approach underestimates valuation
   - But HH lack preferences/information to value effectiveness
   - Housing capitalization may capture only part of value