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Housing Prices and School Choice

Evidence from the Chicago magnet schools proximity lottery

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Submitted in partial fulfillment of the requirements for the degree of the Master of Science in Applied and Agricultural Economics

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Motivation

Context   Capitalization of school quality into house prices
- Closed enrollment: Higher school quality, high house prices
- Open enrollment (School Choice): Prices increase in low school quality neighborhoods

Issue   Incentives to buy a house in areas with higher chances of access to better schools
- How would an increase in the probability of admission affect housing prices?
- Having the right to apply for admission is not guarantee of a seat

Lit. Gap   There is very little information about this issue.

Research Question

Do school choice (open enrollment) affect housing prices?
Empirical challenge: Potential endogeneity of school
location/quality.

Previous literature:

- School boundaries discontinuity (Black, 1999; Gibbons et al., 2009)
- School openings (Fack & Grenet, 2000; Schwartz et al., 2014)
- School Redistricting (Bogart & Cromwell, 2000)

**This paper uses two reforms of the Chicago Magnet schools
admission policies as natural experiments.**

Reforms to the Chicago Magnet School System

New *distance-based* admission rules introduced in December 1997 and modified in December 2009.

1980-1997	1997 Reform	2009 Reform
Citywide lottery Minority quotas	Siblings (up to 45%)	Siblings (all)
	Proximity lottery* Minority quotas (30% of remaining seats)	***Proximity lottery**** (40% of remaining seats)
	Citywide lottery Minority quotas (remaining seats)	Citywide lottery 4 tier system (remaining seats)

* Proximity lottery: Preferential lottery for applicants living in a 1.5 miles radius around elementary magnet schools.

Outline

- Is the change in the probability of admission capitalized into house prices?
- **Two reforms:** December 1997 and December 2009.
  - Clear treatment area: within 1.5 miles.
- **Data:** 1993-2012 Monthly sales of class 2 properties, all within 3 miles of a magnet school.
  - Vary bands around 1.5mi contours. Also consider number of nearby magnet schools.
- **Results:** 1997 reform increased price by 5.4% ; the 2009 reform about 15%.
- **Placebo tests:** different reform dates and locations
  - Variation in effects by house size and census tract socioeconomic status.
  - Quantile estimates.

Data Sources

- Housing Sales and attributes
  - 1993-1997: Illinois Department of Revenue - Prof. McMillen
  - 1997-2012: DataQuick - UIUC Library Spatial Data Purchase Program
  - Monthly Sales, but aggregated to quarterly sales
  - Geocoded to match it's respective parcel centroid
  - Distance to amenities & schools

- Schools
  - Information from CPS & Chicago Data Portal
  - Selected schools based on historical files (schools existing before 1997)
  - Set-aside 1.5mi rule based in policy manuals

Magnet schools

Selected Magnet Schools

Legend

○ Magnet Schools with 1.5mi Rule

☐ Community Areas

0   1.5   3   4.5   6 Miles
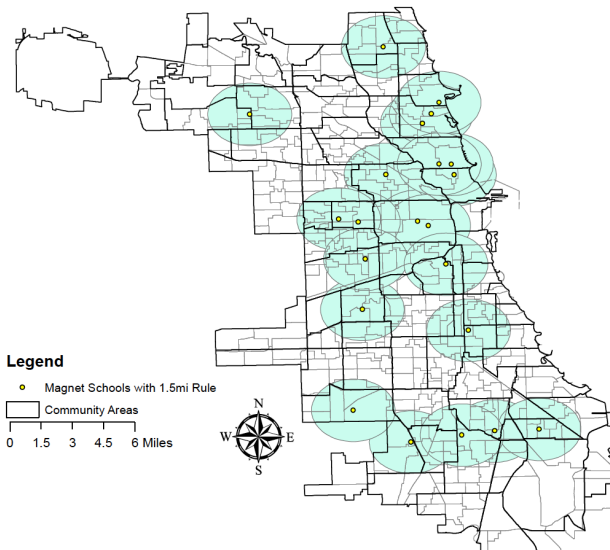
Treatment and Control Groups

Spatial discontinuity at 1.5 miles (around each magnet school):
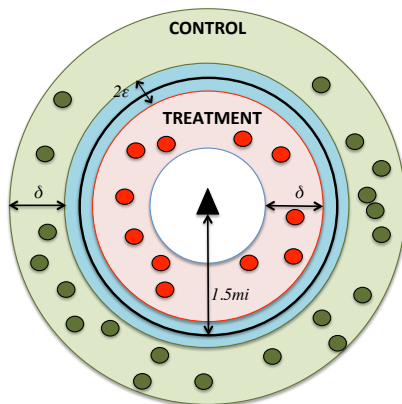
- Treatment:
  $([1.5 - \epsilon] - \delta) - [1.5 - \epsilon]$
  miles area.
- Control:
  $([1.5 + \epsilon] + \delta) - [1.5 + \epsilon]$
  miles area.

Intensity of treatment

Some residential areas have preferential access to more than one magnet school:

Differences in Treatment Intensity: Access to more than 1 magnet school
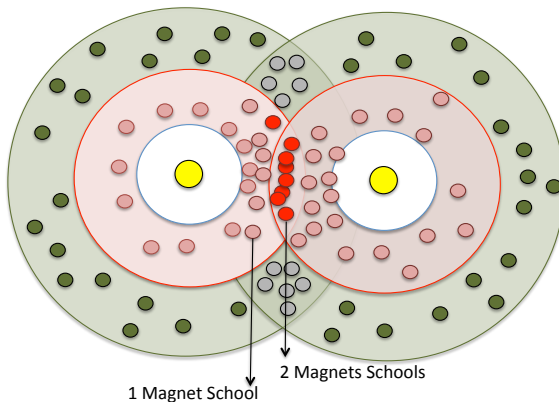
2 Magnets Schools

1 Magnet School

Treatment and Control Houses

Treatment and Control Definitions: $\delta = 1$
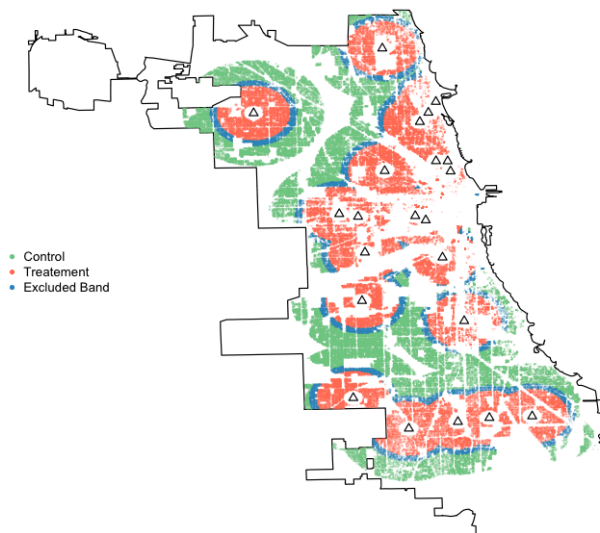
- Control
- Treatement
- Excluded Band

Treatment and Control Houses

Treatment and Control Definitions: $\delta = 0.5$

- Control
- Treatment
- Excluded Band

Treatment and Control Houses

Treatment and Control Definitions: $\delta = 0.25$
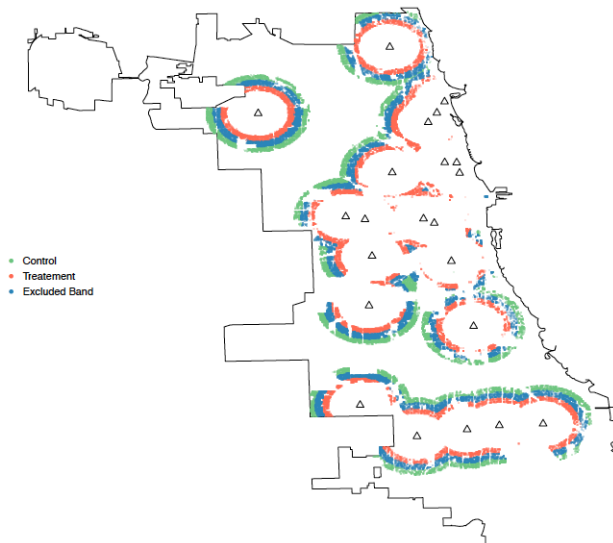
Treatment and Control Houses

Treatment and Control Houses

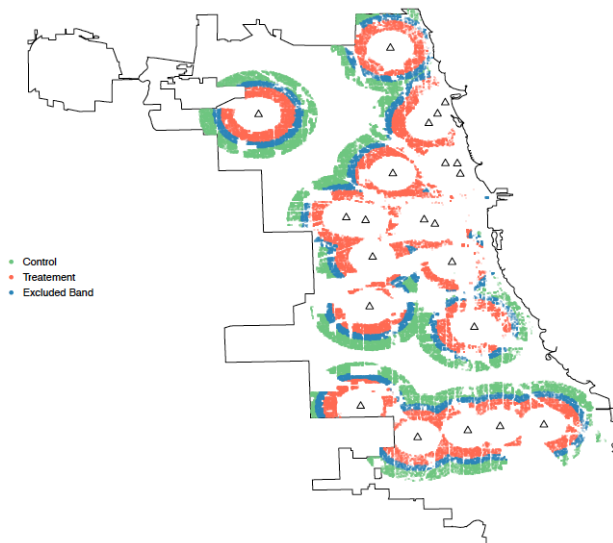|	1993-1998	1998-2009	2010-2012	Total
$\delta = 1.5$				
Control	35,053	129,447	18,021	182,521
Treatment	32,598	116,857	16,588	166,043
Total	67,651	246,304	34,609	348,564
$\delta = 1$				
Control	25,741	97,887	13,560	137,188
Treatment	26,310	96,509	13,753	136,572
Total	52,051	194,396	27,313	273,760
$\delta = 0.5$				
Control	13,600	52,713	7,349	73,662
Treatment	14,159	52,388	7,424	73,971
Total	27,759	105,101	14,773	147,633

Treatment and Control Houses

Treatment and Control Houses by Treatment Intensity

	1993-1998	1998-2009	2010-2012	Total
$\delta = 1.5$				
Control	35,053	129,447	18,021	182,521
1 Magnet	25,434	83,684	11,739	120,857
2 Magnets	4,178	21,718	3,156	29,052
3 Magnets	2,696	10,351	1,532	14,579
4 Magnets	290	1,104	161	1,555
Total	67,651	246,304	34,609	348,564
$\delta = 1$				
Control	25,741	97,887	13,560	137,188
1 Magnet	21,274	72,399	10,175	103,848
2 Magnets	3,340	16,714	2,462	22,516
3 Magnets	1,406	6,292	955	8,653
4 Magnets	290	1,104	161	1,555
Total	52,051	194,396	27,313	273,760
$\delta = 0.5$				
Control	13,600	52,713	7,349	73,662
1 Magnet	12,318	43,995	6,148	62,461
2 Magnets	1,332	5,878	907	8,117
3 Magnets	440	2,161	326	2,927
4 Magnets	69	354	43	466
Total	27,759	105,101	14,773	147,633

Identification Strategy: Diff-in-Diff Model

$$Y_{hct} = \gamma_1 Treat_{ht}^{\delta} + \gamma_2 Ref_t + \gamma_3 Treat_{ht} \times Ref_t + \beta_k X_{hc} + \mu_c + \rho_t + u_{hct}$$

where,

- Outcome:
  - Y_{hct}: Log of Sale Price of house h in census tract c at time t
- Variables of Interest:
  - $Treat_{ht}$: 4 definitions exploiting spatial discontinuity
  - Ref_t: One or two reforms
  - $Treat_{ht} \times Ref_t$: **Causal effect of school choice**
- Controls:
  - X_{hc}: SQFT, Lot Size, Bathrooms, Garage, Fireplace, Year Built, Distance to amenities
  - $\mu_c + \rho_t$ School district and quarter fixed effects

Housing Prices

Median housing prices: $\delta = 1.5$ (1993-2012)
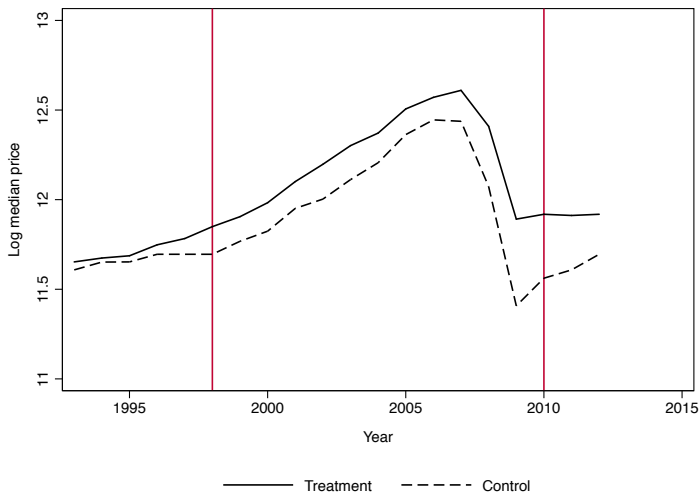
Housing Prices

Median housing prices: $\delta = 1$ (1993-2012)

Treatment   – – – – Control
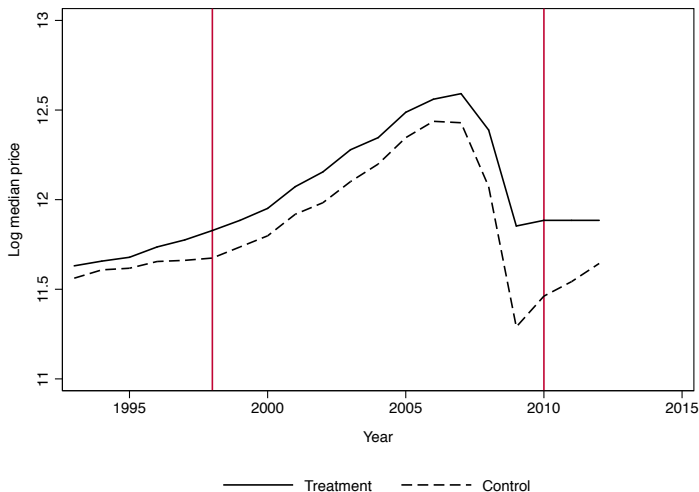
Housing Prices

Median housing prices: $\delta = 0.5$ (1993-2012)
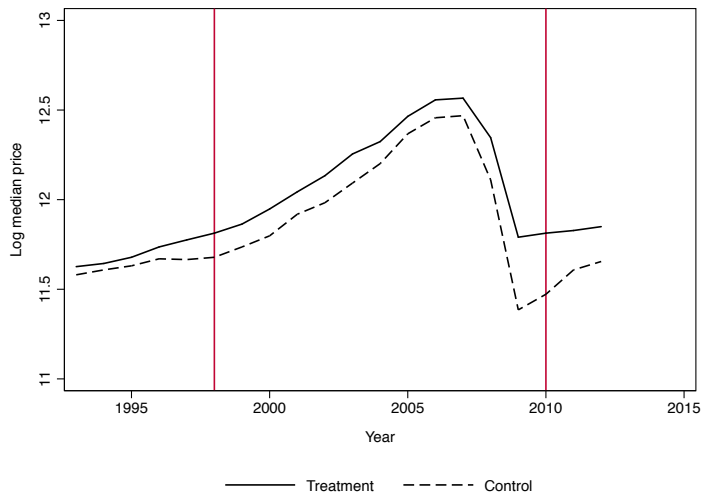
Diff-in-Diff Estimates

Average Effect on Housing Prices: $\delta = 1.5$, $\epsilon = 0.125$

	(1)	(2)	(3)
	1995-2000	2007-2012	1995-2012
Treated	0.020	-0.025	-0.020
	(0.032)	(0.037)	(0.017)
Treat X Ref. 1997	0.054***		0.028**
	(0.010)		(0.013)
Treat X Ref. 2009		0.147***	0.198***
		(0.024)	(0.032)
Observations	90100	65783	321447
r2	0.728	0.749	0.727

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Notes: Standard errors in parentheses.

Diff-in-Diff Estimates by Year

Average Effect on Housing Prices by Year: $\delta = 1.5$, $\epsilon = 0.125$
(1993-2012)
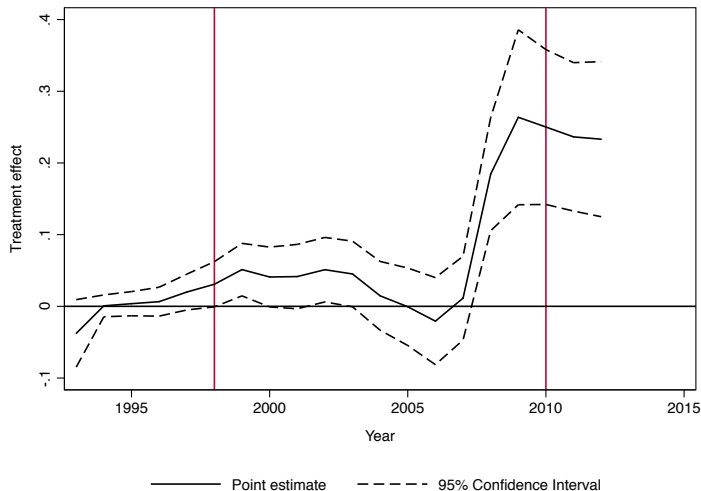
Diff-in-Diff: Intensity of Treatment

Average Effect on Housing Prices by Intensity of Treatment: $\delta = 1.5$, $\epsilon = 0.125$

	(1)	(2)	(3)
	1995-2000	2007-2012	1995-2012
Treated 1	0.032	-0.021	-0.005
	(0.032)	(0.037)	(0.017)
Treated 2	0.006	0.069	-0.018
	(0.037)	(0.043)	(0.035)
Treated 3-4	-0.056	-0.051	-0.105***
	(0.046)	(0.057)	(0.031)
Treat 1 X Ref. 1997	0.033**		0.012
	(0.011)		(0.013)
Treat 2 X Ref. 1997	0.109***		0.072**
	(0.020)		(0.028)
Treat 3-4 X Ref. 1997	0.131***		0.095***
	(0.013)		(0.018)
Treat 1 X Ref. 2009		0.129***	0.175***
		(0.024)	(0.032)
Treat 2 X Ref. 2009		0.084**	0.129**
		(0.039)	(0.055)
Treat 3-4 X Ref. 2009		0.372***	0.488***
		(0.048)	(0.059)
Observations	90100	65783	321447
r2	0.749	0.750	0.728

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Notes: Standard errors in parentheses.

Diff-in-Diff: Variation in Distance Bands

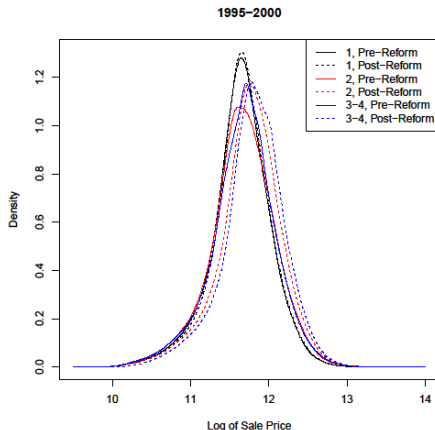**Average Effect on Housing Prices by Intensity of Treatment and Distance Bands, $\epsilon = 0.125$**

	(1)	(2)	(3)	(4)
	$\delta = 3/2$	$\delta = 1$	$\delta = 1/2$	$\delta = 1/4$
Treat X Ref. 1997	0.054***	0.051***	0.046***	0.031**
	(0.010)	(0.011)	(0.014)	(0.019)
Observations	90100	67611	31097	10429
Treat X Ref. 2009	0.147***	0.145***	0.109***	0.085**
	(0.024)	(0.026)	(0.036)	(0.047)
Observations	65783	50377	23572	7559
Treat 1 X Ref. 1997	0.012	0.018	0.019	0.008
	(0.013)	(0.015)	(0.017)	(0.020)
Treat 2 X Ref. 1997	0.072**	0.066**	0.079**	0.075
	(0.028)	(0.031)	(0.038)	(0.049)
Treat 3-4 X Ref. 1997	0.095***	0.118***	0.128***	0.154***
	(0.018)	(0.023)	(0.032)	(0.056)
Treat 1 X Ref. 2009	0.175***	0.213***	0.189***	0.127**
	(0.032)	(0.036)	(0.046)	(0.056)
Treat 2 X Ref. 2009	0.129**	0.165***	0.250***	0.184*
	(0.055)	(0.060)	(0.079)	(0.095)
Treat 3-4 X Ref. 2009	0.488***	0.455***	0.358***	0.330***
	(0.059)	(0.074)	(0.117)	(0.123)
Observations	321447	241619	134800	69002

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors in parentheses.

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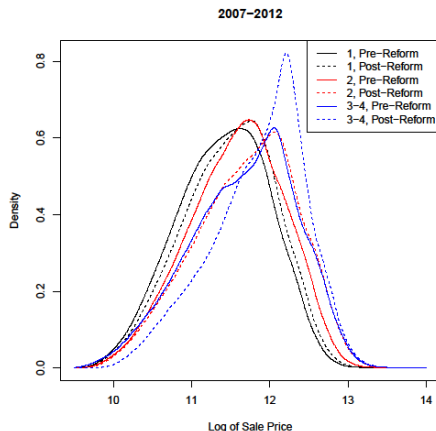ROBUSTNESS
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Quantile: 1995-2000

Quantile Estimates of Log Sale Price Distributions within 1.5 Miles of a
Magnet School by Number of Nearby Schools

Quantile: 2007-2012

Quantile Estimates of Log Sale Price Distributions within 1.5 Miles of a Magnet School by Number of Nearby Schools

Diff-in-Diff: Variation in House Size

Average Effect on Housing Prices by House Size and Distance Bands, $\epsilon = 0.125$

	(1) $\delta = 3/2$	(2) $\delta = 1$	(3) $\delta = 1/2$	(4) $\delta = 1/4$
Smaller Homes (<1100 sqf) 1995-2000				
Treat X Ref. 1997	-0.005	-0.002	0.001	0.022
	(0.010)	(0.011)	(0.014)	(0.024)
Observations	23910	17955	7991	2796
Smaller Homes (<1100 sqf) 2007-2012				
Treat X Ref. 2009	0.102**	0.094**	0.088**	0.048
	(0.031)	(0.033)	(0.044)	(0.060)
Observations	16339	12279	5579	1861
Larger Homes (>2250 sqf) 1995-2000				
Treat X Ref. 1997	0.131***	0.127***	0.098**	0.046
	(0.016)	(0.018)	(0.027)	(0.039)
Observations	22808	17335	8004	2698
Larger Homes (>2250 sqf) 2007-2012				
Treat X Ref. 2009	0.208***	0.223***	0.177***	0.133**
	(0.039)	(0.044)	(0.064)	(0.083)
Observations	17668	13699	6492	2053

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Notes: Standard errors in parentheses.

Robustness checks

Three types of Placebo regressions:

1. Different spatial threshold:
   - Suppose proximity lottery limit is 0.5 miles

2. Different reform year:
   - Suppose reform happens in 1994

3. Different schools:
   - Suppose Selective schools (7 existing before 1997) have a proximity lottery

Placebo 1: Different spatial threshold

Average Effect on Housing Prices if Threshold is 0.5 Miles: $\delta = 0.5$ **(1995-2012)**

	(1)	(2)	(3)
	1995-2000	2007-2012	1995-2012
Treated	0.000	-0.022	0.010
	(0.016)	(0.023)	(0.023)
Treat X Ref. 1997	0.006		-0.019
	(0.018)		(0.023)
Treat X Ref. 2009		0.046	0.020
		(0.037)	(0.045)
Observations	27531	19537	84721
r2	0.769	0.771	0.764

Standard errors in parentheses

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

Placebo 2: Different Reform Time

Average Effect on Housing Prices if Reform is in 1994: $\delta = 1.5$ (1995-2012)

	(1)	(2)	(3)
	$\delta = 1.5$	$\delta = 1$	$\delta = 0.5$
Treated	0.012	0.013	0.017
	(0.013)	(0.013)	(0.013)
Treat X Ref. 1994	0.010	0.008	-0.004
	(0.006)	(0.006)	(0.008)
Observations	51121	39382	20974
r2	0.768	0.759	0.758

Standard errors in parentheses

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

Placebo 3: Different Schools

Average Effect on Housing Prices for Selective Schools (1995-2012)

	(1)	(2)	(3)
	$\delta = 1.5$	$\delta = 1$	$\delta = 0.5$
Treat	0.042	0.024	0.025
	(0.025)	(0.026)	(0.027)
Treat X Ref. 1997	-0.050***	-0.027	-0.032
	(0.015)	(0.016)	(0.017)
Treat X Ref. 2009	0.055	0.027	0.057
	(0.040)	(0.043)	(0.047)
Observations	202384	145369	163419
r2	0.714	0.711	0.721

Standard errors in parentheses

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

Conclusion

- School choice capitalization on housing prices:
    - 5.4% (1997) and about 15% (2009)
    - This might have contributed with less price segregation between neighborhoods
    - Heterogeneous intensity depending of the access level (More magnets $\hookrightarrow$ higher price)
    - In 2009 this seemed to have helped homes to avoid (in part) the drop due to the Housing Crisis

- House price increases in middle quantiles:
    - Middle-to-upper priced homes lead the price increase effect

- Housing Size and Socio-Economic Tiers matter:
    - Larger homes seem to capture the higher likelihood of children presence
    - Lower socio-economic stratus areas ($<$42K) have higher appreciation rates

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