# Public School Open Enrollment and Housing Capitalization

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# Public School Open Enrollment and Housing Capitalization

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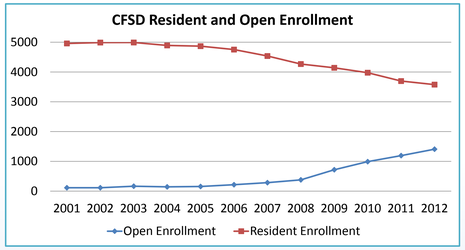
## Introduction

• House prices are higher in better school districts, all else equal. Homebuyers pay premium for better schools along with other public amenities.

• With changes in government and state policies on open enrollment in public schools, it is important to evaluate the impact of schools on housing prices.

• In 1994, the state of Arizona approved open enrollment in all school districts which was contingent upon availability of classroom space.




*Open Enrollment and within district enrollment of Catalina Foothills School District (CFSD), Pima County, Arizona*

## Objectives

• The effect of open enrollment (OE) in public school districts on house prices at a district level is evaluated here.

• Unobserved heterogeneity for the fixed effects is removed using a difference in sales model. In addition to estimating the means effects, the effects on median houses are also evaluated using quantile regressions.

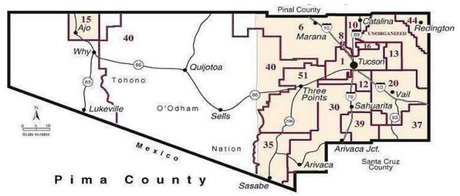
• We identify the houses on boundaries of a school district to observe how the impact is different for these houses as compared to houses closer to the center of a district.

## Data

• The dataset used is from six school districts in and around Tucson Metropolitan area in Pima County, Arizona for 2001-2012.

• CFSD is considered the best district in this study area. The immediate bordering districts are TUSD and AUSD..

• We consider all single-family houses sold in this period with 131,232 observations. Houses sold multiple times in this time period are used for difference in sales model.




*Pima County District Map: Study region considered 6 school districts viz. 1(TUSD), 6(MUSD), 8(FWUD), 10(AUSD), 13(TVUD), 16(CFSD)*

## Empirical Models and Methodology

• A hedonic house price equation describes its sales price as a function of its characteristics, that include its location, house characteristics and other neighborhood characteristics.

$$\log(price_{it}) = \alpha + X_t'\beta + W_i'\gamma + D_k'\nu + D_t'\eta + (D_k' * OE_t)\theta + \epsilon_{it}$$

where $price_{it}$ is the sales price of house $i$ at time $t$; $X_t$ is the time-varying characteristics; $W_i$ includes time invariant observed house characteristics; $D_k$ is the set of district and boundary dummies; $D_t$ is the yearly dummy in which the house was sold; $OE_t$ is the open-enrollment numbers in CFSD; $\epsilon_{it}$ is the error term.

• The difference in sales model that we estimate is a differenced model of the above equation:

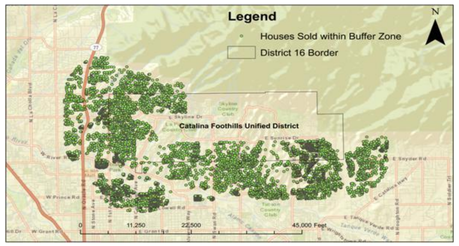
$$\log\left(\frac{price_{it}}{price_{i,t-q_i}}\right) = \left(X_t' - X_{i,t-q_i}'\right)\beta + D_k'\left(OE_t - OE_{i,t-q_i}\right)\theta + \left(D_t - D_{t-q_i}\right)'\eta + \epsilon_{it} - \epsilon_{i,t-q_i}$$

where subscript $q_i$ is used to distinguish the difference in the year of sale for each house.

## Methods cont.

• This difference approach helps in controlling for any unobserved fixed effects. By differencing, we also remove all the time invariant characteristics.

• By using boundary discontinuity approach we evaluate the effect on houses in either side of CFSD boundary which were otherwise similar.




*Boundary Houses in and around CFSD. Bordering South and SE by TUSD and on west , SW and NW by AUSD*

## Results

• The first column gives results using outer boundary houses that are within 2 miles and inner boundary houses within 1 mile of CFSD boundary. Column 2 gives the marginal effects. Similarly for columns 3 and 4:

| Dependent Variable: log(price) | Outside 2 mile & Inside 1 mile | Marginal Effects | Outside 1 mile & Inside 1/2 mile | Marginal Effects |
|---|---|---|---|---|
| d_outer * OE | 2.54 E-04*** | 61.5 | 3.23 E-04*** | 61.4 |
| d_inner * OE | -1.48 E-04*** | -35.8 | -1.02 E-04*** | -35.8 |
| d_CFSD * OE | 2.9 E-04*** | 70.2 | 2.13 E-04*** | 70.1 |
| d_TUSD * OE | -6.52 E-05*** | -15.8 | -5.6 E-05*** | -15.7 |
| d_AUSD * OE | 7.81 E-05*** | 18.9 | 9.74 E-05*** | 18.9 |
| District and Yearly Dummies | Yes | | Yes | |
| House characteristics | Yes | | Yes | |
| Observations | 131232 | | 131232 | |
| R-squared | 0.737 | | 0.736 | |

*Regression results from semi-log hedonic model.*
**** Parameter estimates significant at 1% . Results are heteroskedasticity robust.*

## Results cont.

• The following table shows the results from quantile regressions where the effects of OE are evaluated on median houses and first quartile houses.

• The first two columns consider boundary zones (2 mile outside and 1 mile inside) and last two columns show for (1 mile outside and ½ mile inside):

| Dependent Variable: log(price) | Out: 2 mile & In:1 mile (Quartile = 0.5) | Out: 2 mile & In: 1 mile (Quartile = 0.25) | Out: 1 mile & In: 1/2 mile (Quartile = 0.5) | Out: 1 mile & In: 1/2 mile (Quartile = 0.25) |
|---|---|---|---|---|
| d_outer * OE | 2.80 E-04*** | 2.78 E-04*** | 3.32 E-04*** | 3.54 E-04*** |
| d_inner * OE | -1.57 E-04*** | -1.45 E-04*** | -8.80 E-05*** | -6.54 E-05*** |
| d_CFSD * OE | 2.89 E-04*** | 3.06 E-04*** | 2.06 E-04*** | 2.10 E-04*** |
| d_TUSD * OE | -4.99 E-05*** | -1.47 E-04*** | -4.15 E-05*** | -1.44 E-04*** |
| d_AUSD * OE | 9.52 E-05*** | 8.06 E-05*** | 1.09 E-04*** | 9.94 E-05*** |
| District and Yearly Dummies | Yes | Yes | Yes | Yes |
| House characteristics | Yes | Yes | Yes | Yes |
| Observations | 131232 | 131232 | 131232 | 131232 |

*Quantile Regression results from semi-log hedonic model.*
**** Parameter estimates significant at 1% . Results are heteroskedasticity robust.*

• This table presents the regression results from difference in sales models.

• The first and third column evaluates the mean effects while third and fourth evaluates the median effects respectively:

| Dependent Variable: Difference in log(price) | Out: 2 mile & In: 1 mile | Out: 2 mile & In: 1 mile (Quartile = 0.5) | Out:1 mile & In: 1/2 mile | Out: 1 mile & In: 1/2 mile (Quartile = 0.25) |
|---|---|---|---|---|
| d_outer * (Diff in OE) | 1.39 E-04*** | 1.45 E-04*** | 1.72 E-04*** | 1.64 E-04*** |
| d_inner * (Diff in OE) | -1.98 E-05 | -6.70 E-05* | 1.14 E-05 | -3.48 E-05 |
| d_CFSD * (Diff in OE) | 2.50 E-04*** | 2.68 E-04*** | 2.33 E-04*** | 2.35 E-04*** |
| d_TUSD * (Diff in OE) | -5.33 E-05*** | -5.50 E-05*** | -4.83 E-05*** | -4.82 E-05*** |
| d_AUSD * (Diff in OE) | 6.36 E-05*** | 7.30 E-05*** | 7.28 E-05*** | 7.95 E-05*** |
| District and Yearly Dummies | No | No | No | No |
| House characteristics | No | No | No | No |
| Observations | 31759 | 31759 | 31759 | 31759 |
| R-squared | 0.547 | | 0.546 | |

*Regression results from difference in sales model.*
**** Parameter estimates significant at 1%. Results are heteroskedasticity robust.*

## Conclusion

• Prices significantly increase in houses outside the boundary of CFSD. This effect is quite robust across specifications. We find similar results using the "better" difference models.

• This effect is quite similar for houses in first or second quartile. Thus OE has doesn't have varying effects within the median price.

• The effect of OE is different for houses in the boundary than those closer to the center of the district. However, it is not much different in both the boundary zones that we considered.

• While the semi-log models exhibit a significant decrease in prices of houses inside the boundary, we don't find significance in the difference models. This might be due to capacity constraint of enrollment in any school district.

• For every 1000 open enrolled students, the premium for a house in the outer boundary is $61,500.

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