Impacts of New School Facility Construction: An Analysis of a State-Financed Capital Subsidy Program in Ohio

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PRELIMINARY WORK
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Abstract

We examine the effect of a state-financed capital subsidy program in Ohio on capital expenditures, local tax revenue, student test scores, enrollment, and housing prices. We use an event study approach and find substantial changes to capital expenditures, state revenue, and local tax revenues collected for capital projects in these districts. We find that enrollments decline and test scores rise following acceptance into the program, but these trends appear to reverse once construction slows and new buildings start to become occupied. Housing prices do not change significantly while construction is ongoing, but increase by nearly nine percent during the period in which construction is ending and buildings are becoming occupied.

1. Introduction

Inadequate school district infrastructure has been cited as an issue for policymakers since the 1995 GAO report. In the years since, over $285 billon has been spent to update, renovate, and replace this deteriorating capital stock. However, a 2014 National Center for Education Statistics survey of school facilities found that an additional $200 billion would be required to upgrade all of the nation's public school buildings, which currently have an average age of 44 years, to a "good overall condition." The report also found that these problems are most prevalent in poor school districts, where 60 percent of school buildings need substantial upgrades to reach good condition.

Given how much has been spent to upgrade facilities without much gain in the average condition of facilities as a whole, the question of how best to combat deteriorating school facilities remains. One potential barrier to upgrading school facilities is the unwillingness of local residents to pay for the upgrades through local property or income taxes. Large capital projects in many states are funded by issuing debt through bonds and then paying off the principal and interest through an accompanying property or income tax. Thus, lowering the burden facing local taxpayers through state or federal aid may provide one avenue towards enhancing school facility construction. We analyze one such policy in Ohio, in which the state provides a subsidy (i.e. a percentage of the total project cost) to encourage upgrades to school facilities, particularly in low-wealth districts. Between 1997 and 2013, the Ohio School Facilities Commission disbursed over $10 billion towards the improvement of local school facilities.

Despite the emphasis placed on upgrading school facilities, little empirical evidence is currently known about the effect of school district infrastructure investments. In this paper, we analyze the effect of the state-financed capital subsidy program in Ohio on school district capital investment, student test scores, enrollment, and housing prices. We use an event study approach and find substantial changes to state revenue and capital expenditures in these districts, but negligible effects on housing prices. We find enrollments decline and test scores rise following acceptance into the program, but these trends appear to reverse once construction slows and new buildings start to become occupied.

2. Previous Literature

This paper most directly fits into the literature on the effects of school district infrastructure. A survey of literature by Hanushek (1997) finds mixed evidence on the relationship between school facilities and student performance. Of the 91 studies that Hanushek identifies as examining school facility quality and student performance, 32 percent (nine percent statistically significant) found a positive relationship, 24 percent (five percent statistically significant) found a negative relationship, and 44 percent found relationships of indeterminate sign. Duflo (2001, 2004) examines the effects of a large school construction program in Indonesia on educational attainment and labor market outcomes. She finds that the program increased educational attainment for those who would have been in primary school during the period after the construction program was implemented.

Two recent studies that are most applicable to this study are Cellini, et al. (2010) and Neilson and Zimmerman (2011). Cellini, et al. (2010) examine the effects of bond referenda passage in California on student achievement and housing prices. Using a dynamic regression discontinuity

design they find that marginal homebuyers are willing to pay $1.50 for an additional dollar of capital expenditure, largely due to increases in safety and aesthetics of new and renovated buildings. Neilson and Zimmerman (2011) examine the impact of school construction project in the New Haven Public School District on test scores, enrollment, and housing prices. They find that six years after construction of a new building student reading scores increase by 0.027 standard deviations per $10,000 in per-pupil construction expenditure. They also find that housing prices increase by 1.3 percent and district enrollments increase by 4.4 percent.

This study also contributes to the larger literature on the capitalization of school quality into housing prices.[1] A majority of this literature has focused on the impact of student test scores on housing prices. Numerous studies of United States and international school districts (Bayer et al., 2007; Black, 1999; Clapp et al., 2008; Dougherty et al., 2009; Gibbons and Machin, 2003, 2006; Gibbons, Machin, and Silva, 2009; Fack and Grenet, 2010; Davidoff and Leigh, 2008) find around a three percent increase in home prices resulting from a one standard deviation increase in test score levels. There is little evidence, however, of capitalization of test score gains (Brasingtion and Haurin, 2006; Downes and Zabel, 2002; Kane et al., 2006). Another set of papers has examined the effect of school report card grades, which combine multiple sources of test score and district characteristics into a single rating for each school district. Figlio and Lucas (2004) examine the capitalization effects of school district report card grades in Florida and find that report card grades do provide valuable information about school quality to homebuyers. Studies examining these ratings in other settings find more mixed results (Kane, Staiger, and Samms, 2003; Fiva and Kirkeboen, 2009; Zahirovic-Herbert and Turnbull, 2009).

[1] For a more expansive review of this literature, see the Black and Machin chapter in the ``Handbook of the Economics of Education'' or Nguyen-Hoang and Yinger (2011).

3. Institutional Details

3.1 School Funding in Ohio

The 613 public school districts in Ohio are primarily funded through state aid and local property or income taxation.[2] The state provides districts with the minimum level of per-pupil funding necessary for districts to provide its students with an "adequate" level of educational services. Ohio school districts also have the option to supplement state aid through local property and income taxation, subject to voter approval. Ohio districts generate additional revenue for operating expenditures through either current expense or emergency operating levies.[3] Districts can also issue debt through bonds to fund new capital projects and improvements/renovations to existing classroom facilities. In addition to debt issuances, permanent improvement property tax levies fund short-term, at most five year, capital improvements. Districts can place these taxes on the ballot up to three times per year during either the November general election or during a special election held in February, May, or August.[4] Given that referenda can be voted on multiple times a year, many school districts place previously defeated referenda back on the ballot in the hope that the referenda will pass at a different point in the year.

3.2 The Ohio School Facilities Commission Program

While much of the money provided to districts through the state foundation aid is used to fund operating expenditures, the state also provides subsidies for capital construction through the

[2] For full documentation on the school funding system in Ohio, see the Ohio Legislative Service Commission "School Funding Complete Resource." (http://www.lsc.state.oh.us/schoolfunding/edufeb2011.pdf)

[3] These current expense taxes can either be property or income taxes that raise revenue over a period of five or more years. Emergency operating taxes collect a district-specified amount of revenue for a period of, at most, five years.

[4] In years a presidential primary is held, school districts cannot hold a special election in February or May but instead can hold a special election in March.

Ohio School Facilities Commission (OSFC). The OSFC was created in 1997 and initially provided $300 million in funding to help rebuild Ohio school facilities. Of this original $300 million, $100 million was earmarked for major renovations and repairs of school facilities in the "Big 8" school districts.[5] In 1999, Governor Taft implemented the "Rebuild Ohio" policy initiative, which called for $23 billion dollars in state and local funding to assure that safe and adequate school facilities were present in every school district. The commission is funded through three main sources of revenue – cash from general revenue funds; cash from the Master Tobacco Settlement Agreement; and State of Ohio General Obligation Bonds. Prior to 2007, a large proportion of the state funding for the program came from bonds and cash in the general fund. Although these sources still make up a large percentage of the revenue, funds from the tobacco settlement have taken on a greater role in helping the continuation of the program. The securitization of Ohio's share of the Tobacco Settlement in an immediate cash payout in 2007 led to an influx of revenue to the OSFC, as a majority of the lump sum payment went towards helping fund the program.

The OSFC funds several different capital initiatives. The largest and oldest OSFC program is the Classroom Facilities Assistance Program (CFAP). Under CFAP, money is earmarked to the lowest wealth districts first and provides sufficient funding to satisfy the entire facilities need of the district. To determine which districts receive funding, an equity list is created that ranks districts based on a formula of taxable value per pupil and an income factor. The least wealthy districts then are the first to be eligible for the funding, with more wealthy districts eligible for

[5] The "Big 8" school districts were the largest eight school districts in the state in 1997: Akron, Canton, Cincinnati, Cleveland, Columbus, Dayton, Toledo, and Youngstown. To be eligible to receive the funds, the districts were required to provide an 100 percent match of the funds set aside for them by the OSFC and submit a capital renovation plan using the available funds.

the funding in subsequent years. Each year a cutoff is established, with districts just below the cutoff offered funding and those just above not offered. The number of districts that are funded each year varies based on the size of the state share of funding and total amount appropriated to the OSFC in that year. With the exception of districts in the 1990 Look Back Program,[6] districts that accept CFAP funding cannot receive another offer of state funding for 20 years.

Districts that are eligible to receive the funding must raise some percentage of the total cost of the project using local funds (i.e. the local funding share). The state then provides a subsidy to the district equal to the difference between the total cost of the project and the local share. The size of the local share largely depends on what percentile of the eligibility list the district resides. For example, a district in the 25th percentile of the ranking would pay 25 percent of the total cost of the project. A district that is unable to secure the local share within a year of the offer of funding then the district becomes a "lapsed" district. This means that the district will not be offered funding in subsequent years unless the district is able to secure the local funds first, at which time the district would have first priority for funding during the next funding cycle.

Districts can raise the local share through cash reserves or contributions from outside sources, but most commonly raise the funds through passage of a new bond and property tax. Districts commonly issue debt through bond referenda to help pay for large construction projects, with an associated property tax collected to help pay off the principle and interest over a 25 to 30 year term. In addition, school districts receiving OSFC funding must raise a one-half mill permanent

[6] Districts in the 1990 Look Back Program are the 44 districts that received state funding in the early 1990s, prior to the creation of the OSFC. These early projects addressed some of the facility needs in these districts, but not all. Thus, the OSFC was given the opportunity to "look back" at these districts to see if CFAP money would be needed to address any facility needs that were unmet during the first project.

improvement tax for the continued maintenance of the new or renovated facilities. Districts with existing permanent improvement taxes, may earmark some of that revenue to satisfy this requirement. In addition to the local share, districts can use local revenue to fund Locally Funded Initiatives (LFI) that lie outside the scope of projects that the OSFC will share the cost. These LFIs include athletic facilities, auditoriums, and extra classroom and gymnasium space.

Districts that are eligible for the program have their facilities evaluated to determine the needs of the district. This facility assessment report provides information on the land acreage, building capacity, number of floors, total building square footage, dates of construction for the original building and any additions, and evaluations of the condition of 23 separate building systems and components. To determine space needs for the new or renovated buildings, the OSFC provides a ten-year enrollment projection based on historical enrollment figures, open enrollment policies, and projections of new developments in the area.

Given the facility assessment and the enrollment projections, a Master Facilities Plan is created. This document details the scope of the work to be completed and the budget for each the district's facilities. The budgets for each facility is determined using the total allowable gross square footage (a function of the school enrollment) multiplied by a cost per square footage measure (a function of school size and the grade configuration of the facility). Information in the Master Facilities Plan include the enrollment projections, grade configurations of the facilities, cost figures for renovation or replacement, and information on whether any additions to existing structures are needed. The OSFC will often recommend replacing a building if the cost of renovating the existing structure exceeds two-thirds the cost of building a new facility.

Districts that are more than two years away from receiving CFAP funds, may apply for the Expedited Local Partnership Program (ELPP). This program allows districts to fully fund a distinct part of the Master Facilities Plan. Just as under CFAP, a facilities assessment is developed and the OSFC develops a Master Facilities Plan for the district. The district then chooses one portion of the Facilities Plan to pursue and raises the funds and administers the construction of the project on its own. Once a district that funded projects under ELPP becomes eligible for CFAP, the money spent through ELPP will be credited as part of the local share of the CFAP project. Districts that spent above the local share through ELPP may receive a reimbursement from the OSFC for the excess local funds.

In addition to the CFAP and ELPP programs, the OSFC funds replacements of buildings that pose a health and safety risk to students through the Exceptional Needs Program. To qualify for this program the district must be more than three years away from becoming eligible for CFAP and either is below the 75th percentile in the distribution of adjusted valuation per pupil or is over 300 square miles in size. Districts submit separate applications for each school building they wish to be considered each year, but to be eligible the building must need replacement as opposed to expansion or renovation. These applications are then scored and ranked based on the degree of severity in terms of the following categories: health, life safety, structure, heating and ventilation, and electrical.

4. Data

We collect data from the OSFC on each of the projects funded through one of the OSFC programs. These data span 1997-2013 and include information on when the project was initially funded, characteristics of the master plans (e.g. number of buildings renovated, built, etc.), the total cost of the project, the portion paid for by the state, and the date of occupancy of the final facility in the project. We also obtained yearly information on the equity list rankings and the cutoffs used to select which districts would receive CFAP funding in a particular year. Thus, we plan to use these data in a regression discontinuity design to model the selection into the CFAP program.

The OSFC projects data are augmented with data on school district finances, tax rates, taxable values, election outcomes, test scores, and residential home sales from 2000-2012.[7] Detailed information on expenditures and revenues is obtained from the NCES Common Core of Data. In addition to information on total capital expenditures, this data set also provides disaggregated information on the amount of money spent on school district infrastructure, including the specific amounts spent on new construction, instructional equipment, or land and existing structures. To get a sense of how much revenue for capital is changing in these districts we collect data from the Ohio Department of Taxation on all tax rates levied by school districts. These data include the specific purpose of each tax and the yearly tax rate. These tax data are supplemented with yearly taxable values for real property, tangible personal property, and tangible public utility property for each school district. Combining these two data sets allows us to calculate the tax revenue that is earmarked for capital expenditures.

[7] The year used in this paper refers to the school year, so this data spans the 1999-2000 school year to the 2011-2012 school year.

In Ohio, districts increase revenue for capital projects through debt issuances and local property taxation that are subject to voter-approved referenda. Therefore, we obtain data on these school tax elections for all property and income tax referenda from 2004-2012 from the Ohio Secretary of State. The information collected includes the proposed tax rate, the proposed dollar amount of the debt issuance (if a bond referenda), the number of yes and no votes, the duration of the proposed tax, and the purpose of the tax.

Student test score proficiency levels, school report card grades, and district accountability status are collected from the Ohio Department of Education. School district demographic data are obtained from the NCES Common Core of Data and the Small Area Income and Poverty Estimates. These data include the number of free and reduced priced lunch students, enrollments broken down by race, number of schools in the district, and the number of school-aged children in poverty.

Finally, housing sales data are collected from individual Ohio county auditors.[8] These data include the location of the property, the date of sale, the sale price, numerous characteristics of the home, and the tax district in which the property resides.[9] The data from these various sources are linked to each parcel using the associated tax district. To ease the constraints in collecting the housing transaction data, the sample is restricted to include only single-family homes with

[8] The 63 counties included in the analytic sample (for the housing price regressions) are quite representative of the entire state. The districts in the analytic sample have slightly larger enrollments and spend slightly more per student, but are nearly identical on all of the other covariates of interest to the state as a whole (88 counties).

[9] A tax district corresponds to a unique county-township-city-school combination. Within a school district there may be a number of different tax districts. This means that the taxes faced by residents within a given school district may vary depending on which tax district the resident resides.

sale prices that exceed $10,000. The analytic sample contains 1,011,726 parcel sales with all the relevant parcel characteristics.

5. Descriptive Analysis

Table 1 displays the number of districts that have conducted capital projects with the help of the OSFC and is broken down by the type of assistance program used. Of the 613 districts in Ohio, 440 have participated in at least one of the OSFC programs. The most widely used program is the CFAP, which has updated school facilities in 245 districts. Districts still two or more years away from eligibility for the CFAP program upgraded some school facilities through the ELPP (205 districts) or ENP (51 districts) programs. Some districts also participated in multiple programs, with 77 participating in both ELPP and CFAP, 11 in ELPP and ENP, and four participating in all three programs. An additional 31 districts received subsidies to maintain capital that had been built using state funds prior to 1997 and the six large urban school districts received state money under the OSFC's Urban program.

Table 1: Number of OSFC Districts, by Program Type

	Total OSFC Districts	CFAP	ELPP	ENP	Look Back	Urban
# of Districts	440	245	205	51	31	6

Note: 77 districts participated in ELPP and CFAP; 11 in ELPP and ENP; and 4 in CFAP, ELPP, and ENP

Table 2 provides descriptive statistics about the size and scope of the capital projects under these various programs.[10] Projects conducted under CFAP average $42.5 million in total cost, with 68.9 of that amount paid for by the state subsidy. ENP projects focus much more heavily on new construction than renovations, which is not that surprising given that buildings eligible for ENP

[10] Currently, we do not have detailed information on the size and scope of projects conducted in conjunction with the ELPP program and therefore is not included in Table 2.

are health hazards. Projects conducted by Look Back districts, those that received state money for capital prior to 1997, are primarily renovations and maintenance of buildings not served using the previous state money. Given that the Urban program only applies to the six largest school districts in the state, the average project is much higher ($550 million) than the other programs, but the state subsidy in these districts is only 53 percent of the total cost. Consolidation of school buildings seems to be a major goal of the master plans in these districts, as the average number of demolitions is greater than the average number of new buildings for each of these programs.

Table 2: Descriptive Statistics of OSFC Funded Projects

	CFAP	ENP	Lookback	Urban
State Share	0.689	0.565	0.734	0.53
	(0.19)	(0.16)	(0.27)	(0.22)
Total Project Cost ($ Millions)	42.5	33.8	27.1	551.0
	(35.4)	(21.3)	(27.8)	(125.0)
Renovated Sq. Ft.	85,250	46,769	170,815	710,103
	(119,778)	(80,576)	(96,575)	(538,759)
New Sq. Ft.	160,996	145,455	52,613	2,043,148
	(170,735)	(100,454)	(86,320)	(541,952)
Number of Demolitions	2.97	2.63	0.77	41.50
	(3.29)	(1.97)	(1.38)	(13.59)
Number of New Buildings	1.72	1.47	0.65	29.33
	(2.10)	(1.30)	(1.05)	(8.29)
Number of Renovations	1.72	0.39	1.90	6.33
	(2.10)	(0.70)	(1.27)	(5.16)
Number of Districts	245	51	31	6

Figure 1 depicts the number of districts receiving a CFAP subsidy (left axis) and the proportion of the total cost of the capital project that is paid for by the state funds (right axis) from 1997-2013. The number of districts receiving CFAP each year has varied widely over the time frame, largely due to available funding. We see a large spike in the number of funded projects in 1999

and 2008 that coincide with two influxes in funding that were discussed in section 3.2. The 1999 spike, in which 41 districts received CFAP, coincided with the introduction of Governor Taft's "Rebuild Ohio" plan. The 2008 spike, in which 27 districts received CFAP, coincided with the securitization of Ohio's share of the Tobacco Settlement in an immediate cash payout at the end of 2007. Since 2010, however, the number of projects per year has been quite small, averaging five funded projects per year. This may be a result of the recession and stress on the state budget, resulting in less money being used to fund the OSFC projects. Alternatively, since the state subsidy has been falling over time, the subsidy may not be large enough for some districts to undertake the local share of the capital projects.

Figure 1: Size and Number of CFAP Subsidies, 1997-2013

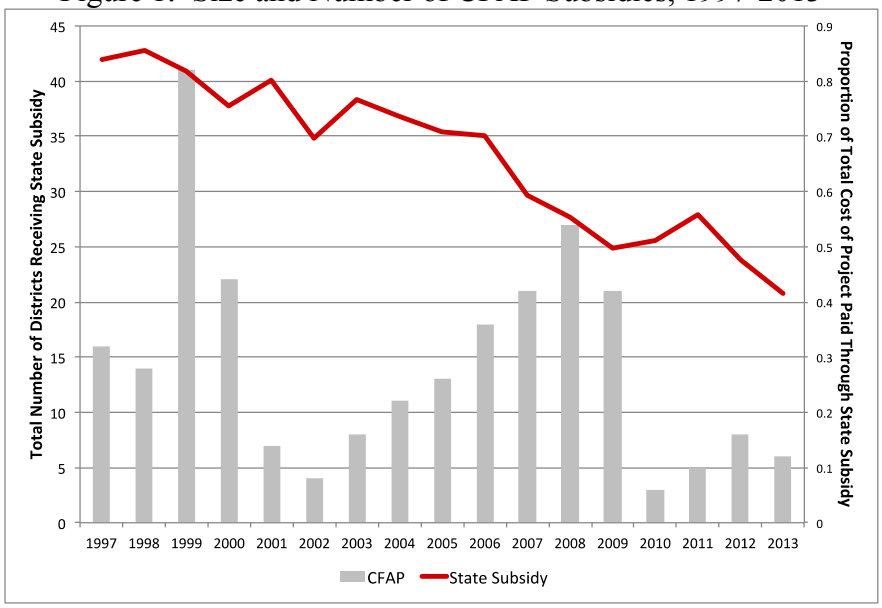
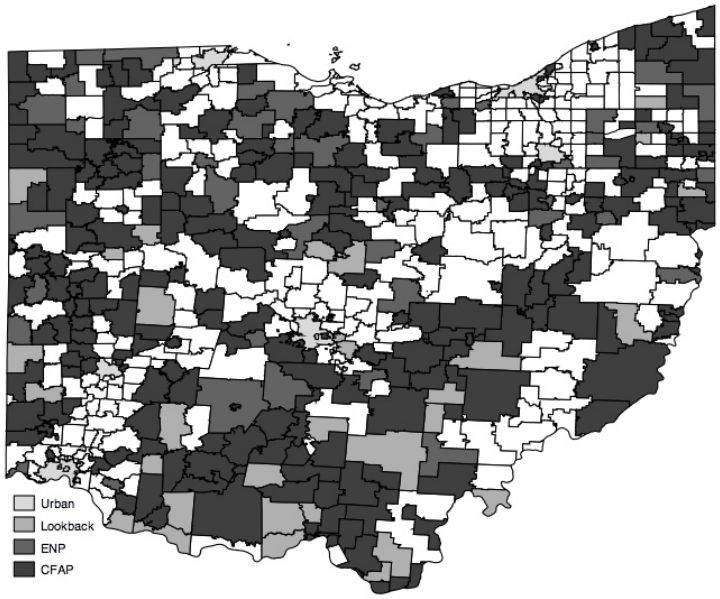


Figure 2 depicts the geographic location of districts undertaking capital projects in conjunction with one of the OSFC programs. Panel A depicts the location of the CFAP, ENP, Look Back, or Urban project districts. We see that a majority of the districts in the state have received funding through one of these programs. Given that these projects, especially CFAP, were targeted at the least wealthy districts first, it is not surprising that many of the wealthy suburban districts outside

of Cincinnati, Cleveland, and Columbus have not yet received funding through these programs. As observed in Panel B, however, many of these suburban districts have taken advantage of the ELPP program to update at least one school facility while waiting to become eligible for CFAP.

Figure 2: Geographic Distribution of OSFC Districts Across Ohio
Panel A: CFAP, ENP, Lookback, and Urban Districts



Panel B: ELPP Districts

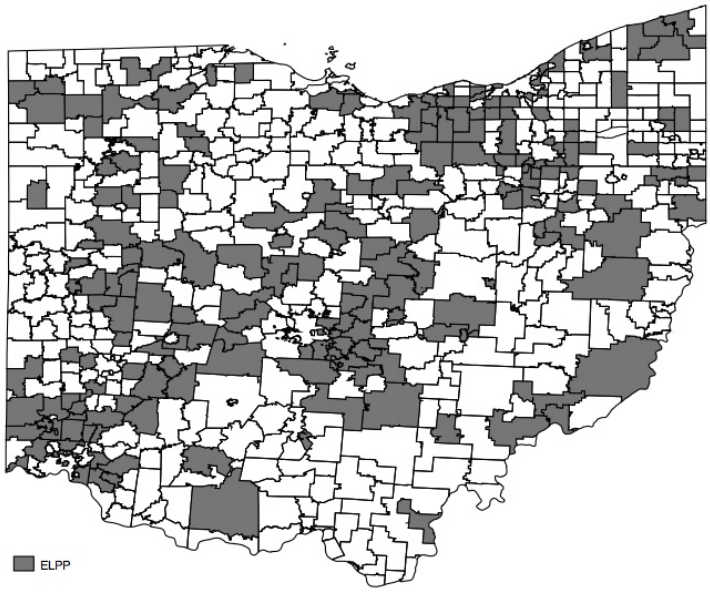


Table 3 presents means and standard deviations for the school district financial and demographic characteristics, broken down by CFAP time period. Panel A provides descriptive statistics for the 368 districts that never participate in the CFAP program during the time period examined in this study. Panel B provides descriptive statistics for the 239 districts that are observed both before (Pre-CFAP) and after (Post-CFAP) receiving aid through CFAP.

Table 3: Table of Means – School District Characteristics

	Panel A	Panel B	
	No CFAP	Pre-CFAP	Post-CFAP
Total Expend PP	10,476	7,907	11,893
	(3,655)	(1,101)	(1,891)
Total Oper Expend PP	8,945	7,099	8,725
	(2,906)	(866)	(981)
Total Capital Expend PP	1,077	729	2,613
	(906)	(567)	(1,449)
Total Revenue PP	10,633	8,045	12,416
	(3,938)	(1,016)	(2,016)
Total State Revenue PP	4,085	4,273	7,408
	(2,874)	(425)	(1,465)
Total Local Capital Tax Rev	588	326	598
	(487)	(267)	(291)
Total Local Oper Tax Rev	5,135	2,738	2,418
	(3,339)	(860)	(2,033)
Total Enrollment	3,375	2,275	2,064
	(5,987)	(2,282)	(2,033)
FTE Teachers	202	138	116
	(365)	(135)	(101)
Number of Schools	6.59	5.15	4.57
	(11.34)	(4.10)	(3.54)
Urban	0.14	0.27	0.27
	(0.35)	(0.44)	(0.44)
Math Proficiency	76.83	68.28	75.96
	(8.80)	(10.50)	(10.13)
Reading Proficiency	83.44	77.65	82.04
	(6.51)	(7.26)	(7.45)
Number of Districts	368	239	239

Comparing Panel A with the Pre-CFAP column in Panel B, we see that districts that have received CFAP have worse observables than districts that never receive CFAP money. This is not surprising given the setup of the program, which offered CFAP money to the poorest districts first. Thus, in the time panel of this study we only observe the bottom half of the wealth distribution receiving CFAP. Prior to receiving CFAP, these districts spend nearly $1,850 less per pupil on operating and $350 less per pupil on capital than districts that never receive CFAP. Districts that receive CFAP are also substantially smaller, more likely to reside in urban areas, and have lower performing students than districts that never receive CFAP.

After receiving CFAP districts receive a large subsidy from the state, with state revenue increasing by $3,135 per pupil following receipt of CFAP. Given that the local share of these projects must be raised through local property taxes, we also observe local tax revenue for capital increasing by $272 per pupil after CFAP is granted. This increased revenue is used to increase both capital and operating expenditures. After CFAP funding, capital expenditures increase by $1,884 per pupil and operating expenditures increase by $1,626 per pupil. Despite the increase in per-pupil expenditures, these districts are consolidating facilities as a result of the CFAP master plans. The average number of operational schools in these districts falls from 5.15 to 4.57 and may be a result of declining enrollments in these districts. However, proficiency levels in these districts rise following the introduction of the CFAP projects

Similarly, Table 4 presents means and standard deviations for housing characteristics. Homes sold in districts that receive CFAP are smaller and sell for less than homes that have never received CFAP. Prior to receiving CFAP, homes sell for an average of $123,723. This falls to

$102,809 after the CFAP project is approved. Given that the average characteristics of sold homes are nearly identical between the two periods, the reduction in sale prices is likely not attributable to changes in the composition of sold homes.

Table 4: Table of Means – Housing Characteristics

	Panel A	Panel B	
	No CFAP	Pre-CFAP	Post-CFAP
Sale Price (2012 $)	158,615	123,723	102,809
	(66,844)	(35,150)	(31,063)
Rooms	6.42	6.14	6.14
	(0.64)	(0.49)	(0.43)
Bedrooms	3.11	2.99	3.01
	(0.26)	(0.21)	(0.22)
Total Baths	1.75	1.56	1.54
	(0.40)	(0.29)	(0.26)
Living Area (Sq. Ft.)	1,752	1,595	1,577
	(345)	(248)	(223)
Year Home Built	1963	1955	1956
	(17)	(15)	(15)
Number of Districts	307	122	122

Finally, Table 5 compares school tax referenda proposal and passage rates for referenda proposed under CFAP and ELPP to those proposed without any OSFC funding. As expected, CFAP and ELPP districts are much more likely to propose bonds for capital projects. In the year that CFAP funding is offered, 60 percent of districts propose a bond referenda and 22 percent propose a permanent improvement levy. These numbers are much higher than districts that are not participating in an OSFC program, of which only six percent propose bonds and 11 percent propose permanent improvement referenda. Only 20 percent of districts participating ELPP propose new bonds and 12 percent propose new permanent improvements, numbers that are small given the fact that ELPP requires that local funds be used to pay for these projects. It may be possible that many of the districts using ELPP are using reserve funds or revenue from

existing permanent improvement levies to pay for these projects. Passage rates are also higher under CFAP, especially for new bond referenda. While 72 percent of bonds from CFAP districts pass, only 34 percent of non-OSFC bonds pass. These numbers suggest that residents are cognizant of the state subsidy and the lowered tax burden they face because of the subsidy, making them more willing to approve CFAP projects than those not part of that program. Voters seem to be less knowledgeable about ELPP program, as the passage rates of ELPP referenda are much more similar to those of non-OSFC districts.

Table 5: School Tax Referenda Proposal and Passage Rates, by OSFC Program Participation

	CFAP	ELPP	No OSFC
	Proportion of Districts Proposing Referenda		
Bond	0.60	0.20	0.06
	(0.49)	(0.40)	(0.24)
Permanent	0.22	0.12	0.11
Improvement	(0.41)	(0.33)	(0.31)
Operating	0.20	0.25	0.35
	(0.40)	(0.43)	(0.48)
	Proportion of Referenda that Pass		
Bond	0.72	0.27	0.34
	(0.45)	(0.45)	(0.47)
Permanent	0.71	0.69	0.68
Improvement	(0.46)	(0.47)	(0.47)
Operating	0.68	0.60	0.52
	(0.47)	(0.49)	(0.50)
District-year Obs	225	191	4,928

6. Empirical Specification and Results

Given that many of these construction projects are implemented over many years, the impact of the CFAP subsidy on capital expenditures, enrollment, test scores and housing prices may vary over time. Thus, we analyze the effect of the CFAP program using the following event study specification:

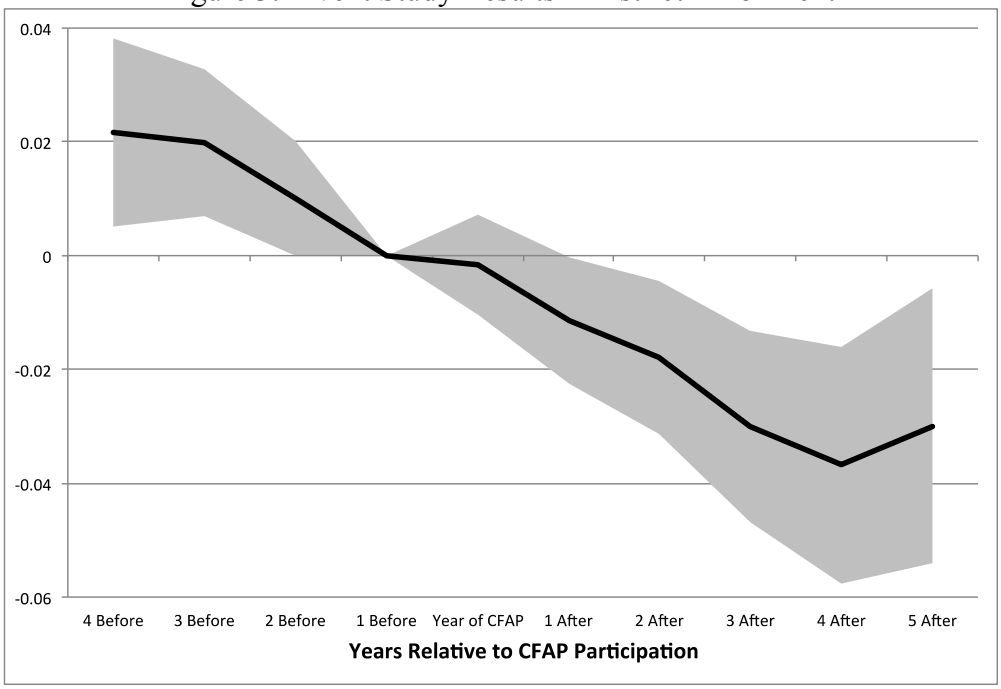
$$\boldsymbol{ln(y_{dt}) = \alpha + \sum_{k=-4}^{5} \beta_k CFAP_{dtk} + \gamma X_{dt} + \lambda_d + \theta_t + \varepsilon_{dt}} \qquad (\mathbf{1})$$

where $\ln(y_{dt})$ is the natural log of a per-pupil expenditure or revenue variable, district enrollment, or percentage of students testing proficient in math for school district d in year t; $CFAP_{dtk}$ is an indicator for k years before or after initial label receipt, with k = 0 signifying the year of $CFAP_{dtk}$ eligibility; $\mathbf{X_{dt}}$ is a vector of time-varying district characteristics; λ_d is a vector of school district fixed effects and θ_t is a vector of year fixed effects; and ε_{dt} is an idiosyncratic error.

Figures 3 - 6 depict the estimates of β_k from equation (1) for enrollment, state revenue per pupil, total capital expenditures per pupil, and total local property tax revenue per pupil collected for capital, and the percentage of students testing proficient in math. In each figure the black line represents the point estimates of the β_k coefficients for each year relative to label receipt dummy variable and the grey shaded region represents the 95% confidence interval from the standard errors clustered at the school district level.[11]

[11] To ease interpretation of the coefficients, we drop the fiscal stress indicator for k = -1 (i.e. year prior to CFAP eligibility). Thus the β coefficients identify treatment effects relative to the effect for the year prior to label receipt. The figures signify that this zero is imposed, by including a zero point estimate without an associated confidence interval. It should also be noted that in each regression, the treated group is restricted to only districts we observe in all of the years before and after label receipt to eliminate issues of compositional changes in the treated group.

Figure 3: Event Study Results – District Enrollment



Since we examine per-pupil revenues and expenditures, changes in enrollment in these labeled districts as a response to these labels may influence the changes observed in per-pupil revenues and expenditures. Therefore, I first estimate equation (1) using district enrollment as the dependent variable, with the results presented graphically in Figure 3. Enrollment in these districts is falling both before and after receipt of CFAP, although there is a break in trend during the year that CFAP is received. The continued down trend after the initial announcement may suggest that some parents are taking students out of the district to avoid disruption while the construction and renovations are taking place or due to uncertainty about how consolidation of school buildings will impact their student's education (e.g. combining middle school and high school grades into one building). However, enrollment begins to increase again five years after the beginning of CFAP, coinciding with the period in which major construction begins to taper off (see Figure 5). This may suggest that the opening of the new school buildings is attracting students back into these districts.

Figure 4: Event Study Results – State Revenue Per Pupil

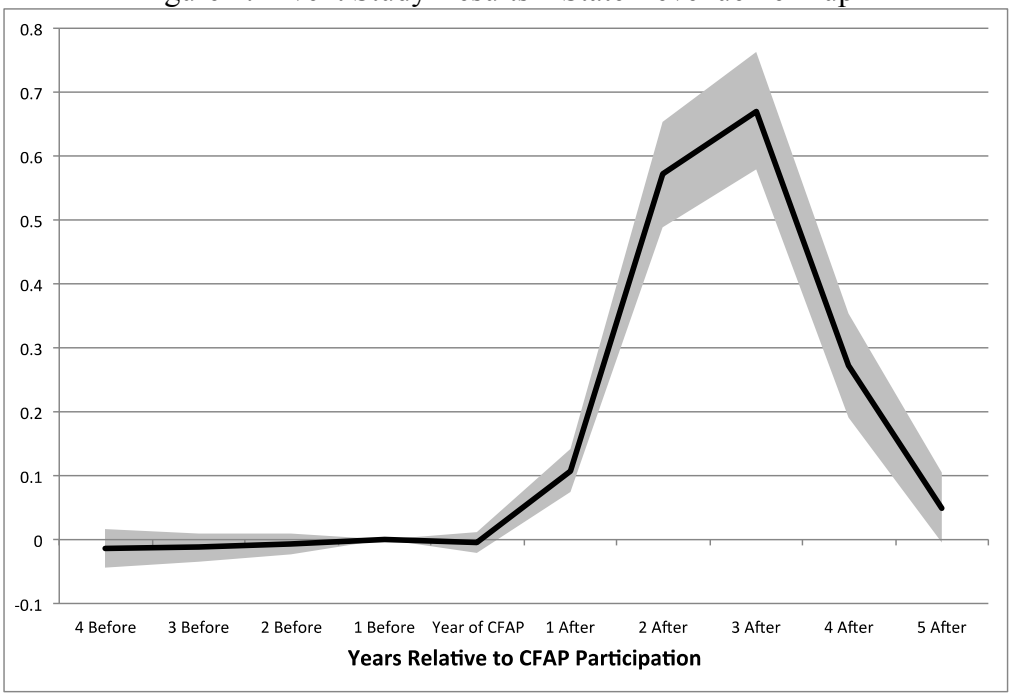
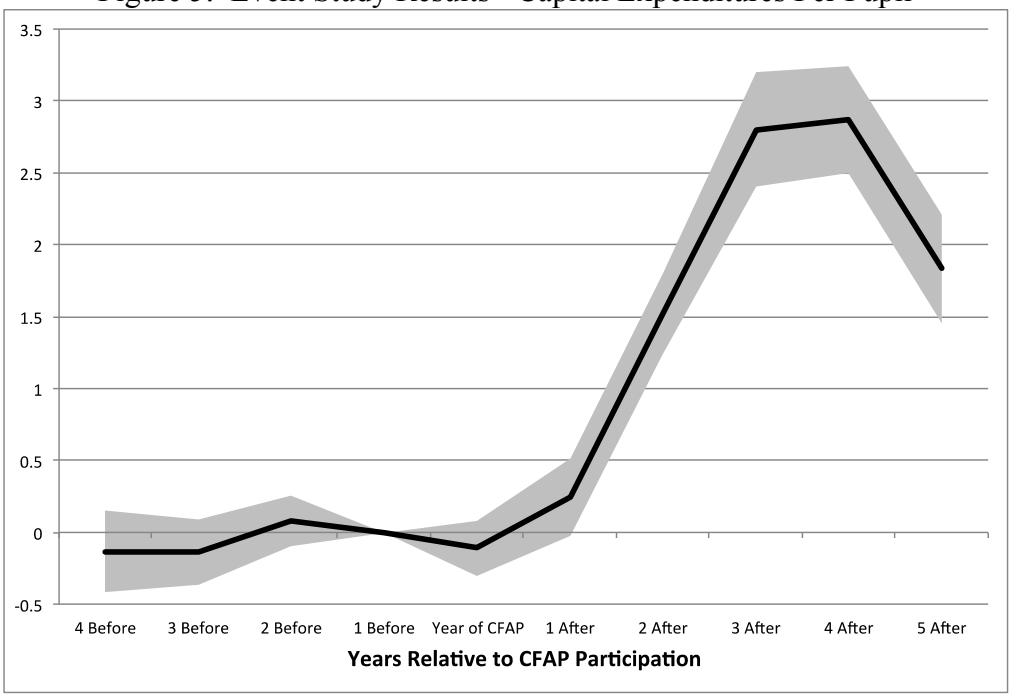


Figure 4 depicts the increase in state revenue per pupil as a result of the CFAP subsidy. Prior to receiving CFAP money we observe some increase in state aid, likely attributed to modifications to the state aid formula to provide poor districts with disproportionately more funding. In the first three years after the introduction of CFAP, however, these districts experience large incremental increases in state funding. The CFAP disbursements are largely on a year-to-year basis depending on how much of the construction project is completed in that year.

The incremental increase in state aid mirrors the incremental increase observed in capital expenditures per pupil in Figure 5. Capital expenditures per pupil are 10 percent higher two years before CFAP compared to the year before, which is likely attributable to districts taking advantage of ELPP before they become ineligible for that program. Districts that receive CFAP appear to hold off on capital expenditures in the year of CFAP receipt, likely as they wait for voter approval of the local share of the project. Substantial increases in capital expenditures per

pupil are not observed until two years after initial approval of the CFAP project suggesting that the time needed to secure the local funds and to develop the master plans for these projects can be lengthy. Capital expenditures per pupil increase by 100 percent two years after CFAP receipt and by 275 percent three and four years after compared to the year before CFAP receipt, following which construction begins to taper off.

Figure 5: Event Study Results - Capital Expenditures Per Pupil



In addition to the state funds, the CFAP program requires districts to raise some portion of the total project cost through local taxes. Figure 6 depicts results of equation (1) using local capital property tax revenue per pupil as the dependent variable. Prior to receiving CFAP, tax revenue collected for capital projects is largely unchanged, but these districts substantially increase property tax revenue for capital in the years after being approved for the CFAP funds. In the first couple years after CFAP, local property tax revenue for capital increases by nearly 80 percent relative to a year before CFAP approval and stays constant at this level as far out as five years after CFAP.

Figure 6: Event Study Results – Local Capital Property Tax Revenue Per Pupil

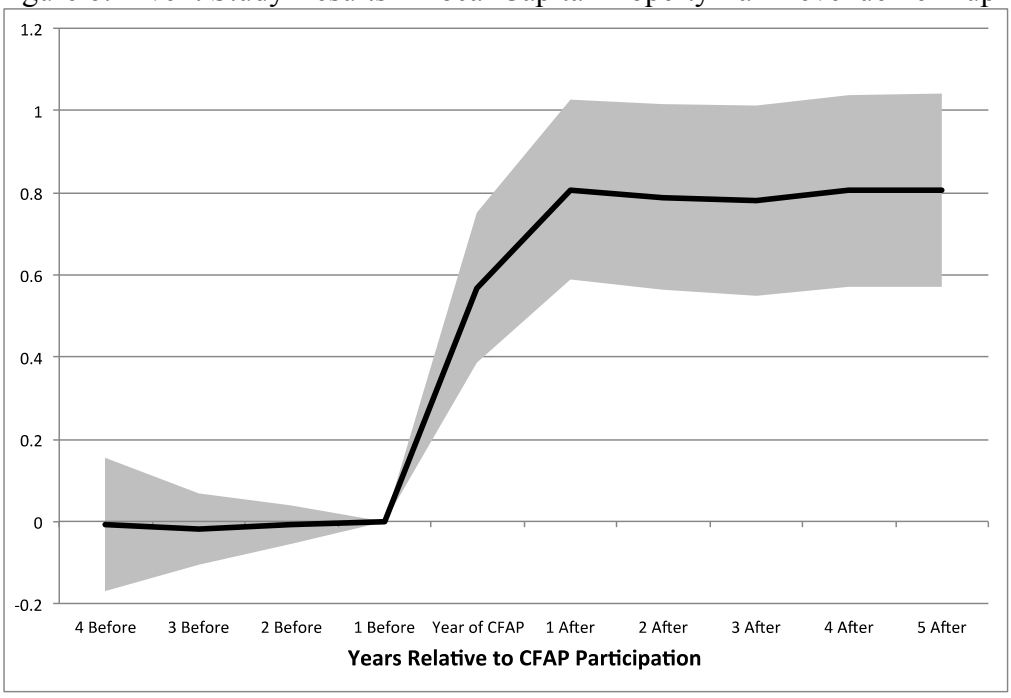
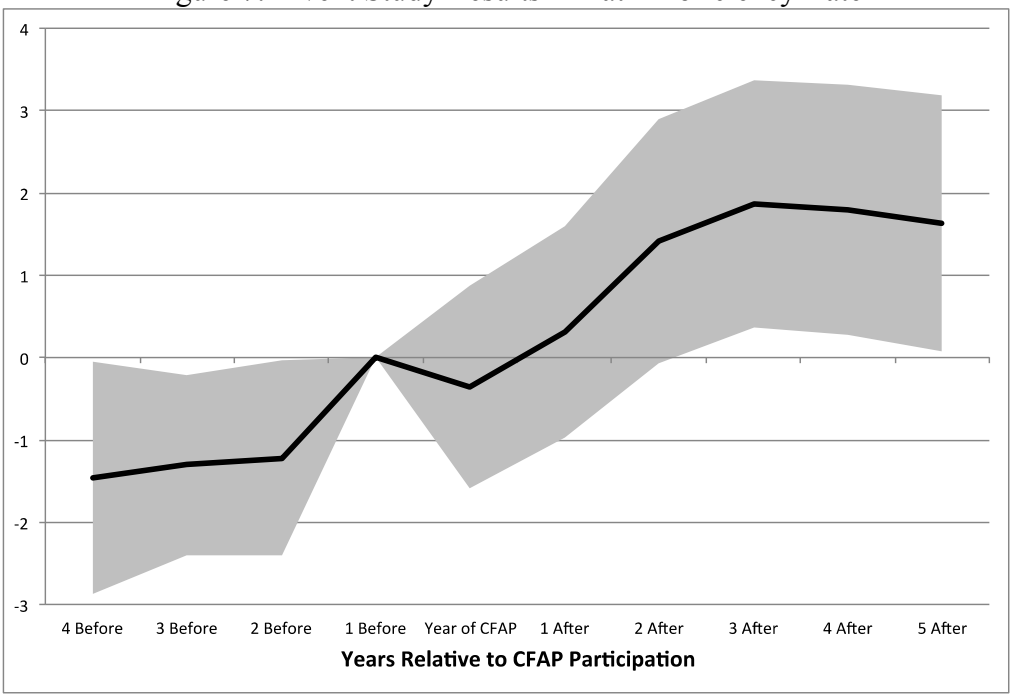


Figure 7 examines the effect of CFAP on the percentage of students testing proficient in math. There is a slight upward trend in test score proficiency throughout the panel, but a noticeable, albeit statistically insignificant, dip in the year of CFAP approval. By three years after CFAP, district proficiency rates in math have increased by nearly two percentage points, but begin to slightly decline in the years thereafter. So what might be causing these changes in test scores? One explanation might be changes in teacher motivation and effort. Given that CFAP districts are consolidating school buildings, they are likely also consolidating the teaching force. Thus, teachers may work harder to be retained while the construction projects are going on, causing test scores to rise. Once the new buildings are occupied, however, the decision of who to retain has already been made and thus the incentive to work hard is not as high. This may partly explain the stagnation and slight decrease in proficiency rates 4+ years after OSFC approval.

Figure 7: Event Study Results – Math Proficiency Rate

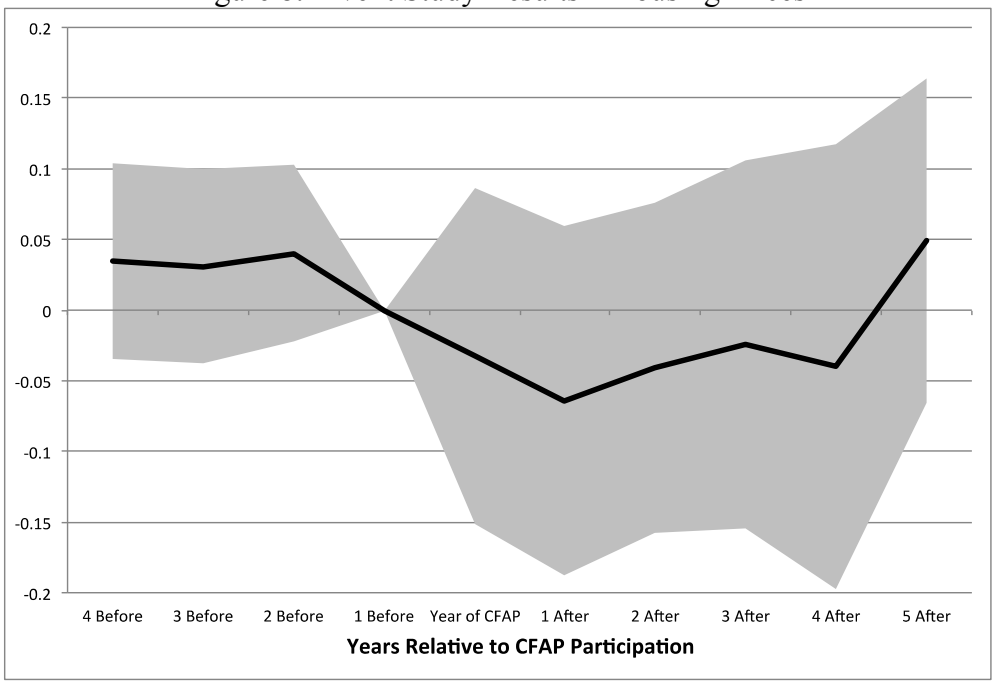


We might expect homebuyers to react to these construction projects and the increase in the quality of the capital stock and so we also analyze the effect of the CFAP program on housing prices. To assess how quickly housing prices respond to these CFAP projects, we estimate the following equation:

$$\boldsymbol{ln(P_{idjt}) = \alpha + \sum_{k=-4}^{5} \beta_k CFAP_{dtk} + \gamma Z_{idjt} + \gamma X_{dt} + \lambda_d + \varphi_j + \theta_t + \varepsilon_{dt}} \qquad (2)$$

where $\ln(P_{idjt})$ represents the natural log of the sale price of parcel i in school district d and municipality/township j at month-year t; Z_{idjt} is a vector of observable housing and parcel characteristics (e.g. number of rooms, number of bedrooms, number of bathrooms, indicators for the amount of acreage, and the square footage of the home's living area); X_{dt} is a vector of observable district-level financial characteristics; λ_d is a vector of school district fixed effects; φ_j is a set of county-by-year fixed effects; θ_t is a set of month-by-year fixed effects; and ε_{idjt} is an idiosyncratic error.

Figure 8: Event Study Results – Housing Prices



Although the results of estimating equation (2) yield largely insignificant results, the point estimates fit with what we might expect. While the construction projects are being completed (i.e. one year after to four years after) housing prices are lowered due to the disruption caused by the construction projects, the increase in the tax burden without any realized benefit, and uncertainty about the long-term impacts of the projects. Once the construction is complete and students begin occupying the new buildings, the benefits of the projects become more tangible and it appears homebuyers are responding accordingly. As construction begins to taper off and new schools begin to become occupied (i.e. between four and five years after CFAP) housing prices increase by nearly 9 percent.

7. Conclusion

In this paper, we analyze the effect of the state-financed capital subsidy program in Ohio on school district capital investment, student test scores, enrollment, and housing prices. We use an event study approach and find substantial changes to state revenue and capital expenditures in these districts. We find that enrollments decline and test scores rise following acceptance into the program, but these trends appear to reverse once construction slows and new buildings start to become occupied. Housing prices, while exhibiting largely insignificant changes while construction is ongoing, increase by nearly nine percent during the period in which construction is slowing and buildings are becoming occupied (i.e. between four and five years after CFAP begins).

Future work will delve further into the selection into the program, taking advantage of yearly data on the equity list rankings and knowledge of the cutoffs. This will allow for a regression discontinuity design to be developed to compare district outcomes for those just above and below the threshold. In addition, we plan to use the bond referenda data, similar to Cellini, et al., to obtain a better estimate of the return to capital investment in these districts. One unique variation we hope to exploit is the variation in the marginal cost of the project, as districts that receive CFAP money only pay X percent of every dollar of capital expenditures. Thus, by comparing bonds from CFAP districts to those proposed without CFAP money, we could examine whether residents are capitalizing this reduced marginal cost into housing prices. We also hope to collect additional data on the dates of building occupancy to examine more closely the housing price and enrollment responses to the opening of new school buildings.

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