School Choice Programs: The Impacts on Housing Values

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This Draft: December 2014

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Abstract

We review both the theoretical and empirical literature relating to the impact of school choice programs, particularly voucher programs, on residential property values. Beginning with the seminal works of Charles Tiebout (1956) and Thomas Nechyba (1999, 2000, 2003), we describe the sorting equilibrium theories that arise in the context of public school assignments based strictly on geographic catchment areas. We then consider the implications of allowing students to attend schools other than those to which they are assigned, particularly in a school voucher context. Finally, we review the empirical tests of these theories to date. The important concepts addressed in this paper are: 1) assigned schools lead to a separating equilibrium that results in segregation on the basis of income, school quality and property values; 2) school choice programs undermine this separating equilibrium by severing the link between place of residence and school assignment.

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1. Introduction

A substantial body of literature examines the relationship between public school quality and residential home prices. This research consistently finds strong evidence that school quality is an important determinant of local housing prices, and families are willing to pay a significant premium for properties in superior school districts.

Surprisingly, relatively little empirical work studies the impact of school choice programs (such as voucher programs, charter schools, magnet schools and inter-district transfer programs) on home values. These non-assigned school choice programs evolved slowly at first, but over time they have come to include a substantial minority of school-aged children. According to the National Center for Education Statistics, by 2007, 27% of children were enrolled in a school other than an assigned school. An additional 3% of students were homeschooled. Among middle-income and upper income families the percentages attending non-assigned schools are even larger. More than 30% of the students above the poverty line attended non-assigned schools, and 38% of children whose parents earned graduate degrees attended non-assigned schools.[1]

The shortage of empirical studies examining the impact of school choice on property values is partially due to the unavailability of data. As a relatively new phenomenon in the United States, researchers are constrained by the availability of data. In general, a choice program must exist before it can be empirically studied. Even as data become readily available, methodological challenges arise. For example, empirical techniques that were devised to examine price impacts near a school catchment boundary are of limited use in studying the impacts of schools that operate without catchment areas.

Theoretical finance has long recognized the value of options, and the application of these theories to the real estate context involves considerable ambiguity and challenges. School choice programs provide parents with an option. The empirical question is whether market participants are willing to pay a premium in locations that offer school choice programs. Theory suggests that school choice programs should unequivocally increase property values in participating locations. However, operationalizing this construct to residential properties brings significant complexities into play. For example, the presence of unconstrained school choice across a geographic catchment area boundary not only reduces the cost of proximity to a "bad" public school, but it also reduces the value of proximity to a "good" school (Reback, 2005). Despite these challenges, several recent empirical studies focus on the effect of school choice on residential property values, local economic growth, and family migration patterns.

In order to best understand the papers that address the impacts of school choice programs on housing values, one must first understand the basic mechanisms that connect property values to school quality in the standard assigned-school framework. Therefore, the remainder of this paper proceeds as follows. In the next section, we review the theoretical predictions of Tiebout (1956), the early tests of Tiebout sorting theory, and the computational general equilibrium models developed in a series of papers, principally by Thomas Nechyba. Section 3 surveys several interesting empirical studies testing

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[1] Institute of Education Sciences, National Center for Education Statistics, Public School Choice Programs.
http://nces.ed.gov/fastfacts/display.asp?id=6

the effect of school choice programs on residential property values. We summarize the analysis in Section 4.

2. Theory

Almost 60 years ago, Charles Tiebout theorized that the local provision of public school services could result in spatial sorting of the population such that areas with high quality schools would have higher home prices than those with poor educational services (Tiebout, 1956). Families would consider the level of school services and of local taxes, and then "vote with their feet," choosing jurisdictions that best met their preferences. Families that placed a low value on good schools (perhaps because they were childless) would choose to live in low-tax jurisdictions with poorer-quality schools. Those who valued the provision of high-quality schools would choose communities that provided them, trading off the cost of higher tax burdens.

An obvious benefit obtained when jurisdictions offer alternative mixes of tax levels and service quality is that economic efficiency is enhanced. In the same way diners benefit from alternative restaurant choices, households can choose communities that optimally cater to their unique tastes for government services and costs. However, household service demand is, in part, determined by ability to pay. Thus, while Tiebout sorting may be economically efficient, it implies that sorting will also lead to spatial segmentation on the basis of household wealth and/or income.

Over the years, extensive empirical support has emerged for the basic Tiebout thesis. In a social-equity sense, the household sorting that results from school districts engaged in Tiebout competition is not unambiguously positive. Equity concerns arise where poor households are locked out of better schools. To the extent that school quality is driven by communities' ability to adequately tax in support of local schools, this inequity can be addressed by efforts to equalize spending across school systems. However, school quality is not exclusively determined by financial inputs. In particular, family income level and race also motivate geographic sorting, and these household characteristics are highly correlated with perceived school quality even when schools' financial resources are equalized. Thus, the economic efficiency gains enjoyed from Tiebout sorting may need to be balanced against the concerns that Tiebout sorting aggravates household segregation on the basis of race and income.

Various school-choice mechanisms (such as charter schools and vouchers) have been offered as potentially moderating the connection between Tiebout sorting, property values, school quality, income segregation and racial segregation. Before turning to this analysis, let us first briefly consider some of the literature that confirmed and expanded upon the original Tiebout thesis.

2.1 The Early Tests of Tiebout Equilibria

Oates (1969) offered an early test of the Tiebout hypothesis. Per Oates, "The obstacles to … consumer mobility (including job commitments and family ties) are obviously great: as a result several economists have expressed reservations as to the likely explanatory power of the Tiebout model. On the other hand, with growing urbanization of society, there is some reason to believe that the Tiebout hypothesis may be relevant to the real world: individuals working in a central city frequently have a wide choice of suburban communities in which to reside, and the quality of public schools, for instance, may be of real importance in the choice of a community of residence (p. 958)." Using a sample of 53 New Jersey municipalities in the New York metropolitan area, Oates found that higher

school quality (as measured by spending levels) and lower taxes were capitalized in home values, as suggested by the Tiebout model.

The empirical literature on capitalization of school quality is vast, and it has become increasingly sophisticated over time. Notably, Black (1999) examined housing prices closest to a school attendance zone boundary, rather than across the full attendance zone. This technique limits the analysis to houses that differ only by the school that the child attends, which effectively removes the variation in neighborhoods, taxes, and school spending. The results show that parents are willing to pay approximately 2.5 percent more for a 5 percent increase in student test scores.

Other studies and methods abound. For a more full review of this literature, we would refer the reader to the survey paper by Black and Machin (2011). For the reader's immediate convenience, we summarize this line of research as follows: although magnitudes vary, the literature finds that school quality is capitalized in home prices across a variety of different research designs.

2.2 Social Equity Concerns Arising from Tiebout Sorting

Equity concerns quickly arose from the implications of Tiebout sorting since some households lack the financial resources to "vote with their feet" and establish residence in communities with better schools. Financial inputs (school spending) are linked to teacher-student ratios, textbook availability, facilities quality, and school quality in general. Thus, an obvious mechanism for addressing the equity issues inherent in Tiebout sorting is through higher-level-government redistribution of financial resources across local districts.

Although the U.S. Supreme Court has ruled that there is no Constitutional right to an education,[2] numerous state court decisions (beginning with the Serrano case in California)[3] found that reliance on local property taxes to fund public schools violates equal protection clauses found in the state constitution. Thus, many states have implemented essentially equal per-pupil spending across districts via inter-district redistribution of resources. Despite these efforts, it is now apparent that there are limits to the degree of success that these interventions produce in mitigating the inequities tied to Tiebout sorting. Financial inputs turn out to be only one of the inputs required for producing high-quality schools, and a number of nonfinancial inputs play an even more important role.

Three non-financial inputs that play important roles are peer effects, teacher quality, and parent inputs. Peer effects refer to the impact that classmates have on the success of an individual student. In the presence of peer effects, student outcomes for all proximate students are jointly determined due to the quality of other proximate students. Peer effects arise when student ability levels are correlated with household income. Tiebout sorting then implies that higher-income communities will benefit from good peer effects, and these peer effects will be capitalized in home prices.

In systems with similar financial resources, teacher pay is also likely to be relatively uniform across districts. When the best teachers cannot be differentially compensated for their performance, they are likely to choose employment in schools that offer the most desirable working conditions. Thus, the best teachers are likely to work in the most desirable school districts. Even within districts, the best teachers will probably receive the preferred assignments simply because they will have options to teach

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[2] *San Antonio Independent School District v. Rodriguez*, 411 U.S. 1 (1973)
[3] *Serrano v. Priest*, 5 Cal.3d 584

in other districts if they become dissatisfied (Loeb and Page, 2001). Again, Tiebout sorting then implies that higher-income communities will benefit from better teacher quality, which will be capitalized into home prices.

Parents themselves are also an important non-financial input. Not only do parents facilitate education at home, with resultant improvement in child ability, but parents can also play a role in monitoring schools. Certainly better educated parents seem more likely and capable of monitoring education production. Once more, Tiebout sorting then implies that higher-income communities will benefit from better parental inputs, which will be capitalized into home prices.

Recognition that Tiebout sorting is driven by both financial and nonfinancial inputs has given rise to empirical simulation models that explicitly consider both school spending levels and nonfinancial inputs. These models generally assume that nonfinancial inputs are correlated with the income distribution of households assigned to public schools. Each school's nonfinancial inputs then arise from Tiebout-style residential sorting. Financial inputs result from traditional political processes that are tied to property taxes (which are driven by home values) or, alternatively, by centralized governmental funding methods.

2.3 Computational General Equilibrium Models and Voucher Alternatives

Given the complexity introduced by the interaction of both financial and nonfinancial inputs in tandem with alternative political structures for school finance and competition, a series of papers beginning with Nechyba (1999), attempt to consider alternative equilibria via computational (rather than closed-form analytical) solutions. Some of these papers further our understanding of the impact of alternative school finance methods, but four papers stand out for the insights they offer regarding property values under various school-choice mechanisms.

Nechyba (1999) introduces a general equilibrium model of public school finance and investigates relevant migration forces induced by school finance reform proposals, in particular the impact of private school vouchers. The study concludes that residential migration patterns influence the impact of vouchers on both poorer and wealthier communities. More specifically, private schools tend to form first in poor districts in part to cater to middle- to high-income families who immigrate from districts with high property values to take advantage of lower house prices. Only if housing of sufficiently high quality is unavailable or large negative neighborhood externalities exist in poor districts would private schools arise elsewhere first. When private schools open either because of high peer quality effects or because of private school vouchers, stratification of income, wealth, and property values across communities is mitigated.

This decrease in residential stratification creates fiscal benefits for public school students in low-income areas, but reduces fiscal benefits for public schools in better districts. This result comes about by bringing school choice into low-income school districts, as private school vouchers sever the relation between school quality and residential location, thereby enhancing the value and attractiveness of living in districts with low home prices (despite poor public schools) and reducing the value of living in districts with high home prices (despite good public schools). Therefore, vouchers tend to benefit lower-income households more than higher-income households who are already able to exercise choice in the current public school system without tuition vouchers. Low-income families

may not be able to afford housing in better-performing public school districts, whereas high-income households already have choice among public schools.

Nechyba (2000) builds on this analysis by exploring the role of family mobility in shaping the Tiebout-sorting effect of different school choice or tuition voucher policies. The simulations are derived from a three-district model of low-, middle-, and high-income school districts and calibrated to New York data. The model demonstrates that vouchers targeted at low-income areas produce similar effects to "universal" vouchers that can be used by residents of all school districts. The intuition is as follows.

For both universal or school-district targeted vouchers, middle- and high-income families can migrate to the most attractive neighborhoods within a district with poor public schools to take advantage of the lower house prices in the district. They can do this because they are allowed to send their children to private schools (through the voucher program).

In contrast, for vouchers targeted to low-income families (rather than location-targeted vouchers), the middle- and high-income households will not move to take advantage of the low house prices. Instead, they continue to reside in the districts with better schools. Thus, no migration to the poor communities occurs provided means-tested vouchers.

To further illustrate the idea, Exhibits 1 through 3 produce figures corresponding to data in Tables 2, Table 3, and Table 5 of Nechyba (2000). These tables contain the paper's main simulation results. The figures produced here are for a moderate level of voucher funding. If vouchers are funded too generously in the model, no public schools will survive. To facilitate a clear comparison without generating unnecessary confusions, we focus on the case of voucher magnitude equal to 0.3 (voucher magnitude ranges from 0 to 0.60 in the paper), which would be valued at $3,000 in 1990's dollars.

The model also assumes that families are concerned with peer quality effects that are a function of both individual student abilities and household income. Theta, θ, weights these peer quality determinants. The figures that we present assume $\theta = 0.5$, but other reasonable weightings produce qualitatively similar results.

Nechyba (2000) runs simulations to compare various equilibria to the benchmark equilibrium (i.e., no voucher) across three districts (District 1-poor district; 2-middle income district; and 3-high income district). The results (by district) include equilibrium per-capita income, property values, and percent of students attending private schools.

[Insert Exhibit #1]

For the case of no vouchers, as Exhibit 1 shows, mean unit home value estimation by district increases monotonically from 0.5859 in the bad school district, to 0.9032 in the mid district and to 1.6950 in the good district. Home values are in tens of thousands of dollars of 1990's dollars and in annualized flows – thus, a value of 0.9032 is equivalent to $9,032 in annual housing value. When universal vouchers are introduced, the average home value across districts remains monotonically increasing. However, what is striking is the comparison between the "no vouchers" case and the "full vouchers" case within districts. When vouchers are introduced, on average home values appreciate in the bad district (from 0.5859 to 0.7595), but depreciate in both other districts.

[Insert Exhibit #2]

Consistent with the decline in home values in the two higher-priced districts, Exhibit 2 shows that once universal vouchers are introduced, the average income in poor district increases. Incomes are shown in tens of thousands of 1990's dollars, and they rise from $32,973 to $47,000 in the poor area. However, income levels in the other two districts decline. Taken together, the evidence suggests that as private schools begin to open in low-income districts, average income increases in the district due to the migration of middle- and high-income families, who move to the district to take advantage of the relatively cheap housing prices (due to the poor quality of their public school system). As a result, home prices in poor districts are bid up. These migrating families move from the better school districts where house values capitalize the public school quality to the poorer school district to make use of the voucher system.

[Insert Exhibit #3]

Nechyba (2000) also considers a voucher system that is targeted to the low-income school district. Such geographically targeted vouchers produce virtually the same inference as universal vouchers. Exhibit 3 (produced from Table 5 of Nechyba (2000)) compares the percentage of students attending private schools across the three districts in the case of universal vouchers versus vouchers targeted to low-income districts. Under the universal vouchers program, 56.7 percent of residents in the poor school districts send their children to private schools, 13.3 percent in the middle-income districts, and none in the high-income districts attends private schools. Under the voucher plan targeted to low-income districts, 63 percent of residents in the poor districts attend private schools, whereas none attend private school in the other two districts. In sum, the evidence suggests that strong migration effects are induced by private-school vouchers, which weakens the association between house values and public school quality. Moreover, the voucher plan reduces income and home price inequality across districts.

Nechyba (2003) proposes a general equilibrium model that links school and housing markets. Comparing a purely public school system (without private school alternatives) to a purely private system (without public schools), a purely public school system leads to substantially more spatial income segregation and greater property-value variation by district than a purely private system. Nonetheless, the combination of a public system with a private school market yields the least residential segregation since the housing price distortions from the capitalization of the public system provide incentives for middle- and high-income households whose children go to private school to live with lower-income families whose children attend public school.

The effects of school vouchers on income and property-value across districts are also explored. At high voucher funding levels, both income segregation and the capitalization of public school quality into home prices are reduced, relative to the base case of no vouchers being offered. When vouchers are restricted to students who reside in the poorer school district, the equalization effects on both income and home prices is significantly greater. The implication is that if the goal of a voucher program is to reduce economic segregation, location-targeted vouchers would be the most effective means. Universal vouchers mitigate the spatial differences, but not as effectively as location-targeted vouchers. As a caveat, Nechyba (2003) does not consider the lower facility costs in low-property-value areas that are likely to cause private schools to first arise in those areas anyway, even under a universal voucher program.

Ferreyra (2007) extends the Nechyba analysis to a general equilibrium model of school quality and household residential and school choice with multiple public school districts and private schools (including both religious and nonsectarian schools). The author's simulations use two large-scale private school voucher programs in the Chicago metropolitan area: universal vouchers and vouchers targeted to nonsectarian schools. The findings show that both voucher programs increase private school enrollment and affect household residential choice, with some voucher users migrating to neighborhoods with lower home prices. However, the nonsectarian vouchers have a smaller impact than universal vouchers.

3. Empirical Studies

In this section, we summarize the literature that studies the impact of school choice programs on home values, which limits the scope of our discussion to the geographic regions studied by prior research. Undeniably, we exclude many other quintessential school choice programs throughout the United States (e.g. Milwaukee, WI, and Washington D.C.), and the world because researchers have yet to study their impact on residential property values. The purpose of this section is to discuss the major findings of each study, and to present some unanswered questions that researchers may be able to address with future empirical studies.

Exhibit 4 provides a description of each paper explored in this section. In this table, we provide the author's names, the geographic region used for the empirical analysis, the sample period, and the general findings. The last column in the exhibit reports the approximate premium observed as a result of the school-choice program, where meaningful.

[Insert Exhibit #4]

3.1 Tuition Vouchers

3.1.1 Vermont

Vermont operates one of the longest running tuition voucher programs in the United States. Dating back to 1869, the state legislators passed a bill granting residents living in an area without a public school system a way to provide their children with an education. Using tuition vouchers, parents can send their children to any public school at no cost, or to non-religious private schools for a significant discount, with the subsidy coming from the sending town. In the case of an independent (private) school, the amount of the tuition voucher equals the average tuition for the (public) primary (grades: K-6) or secondary schools (grades: 7-12) within Vermont. Unlike many other state tuition voucher programs, Vermont's system was not established to address a failing inner-city school system. Instead, it was developed to ensure that the residents had access to an education.

The tuition voucher program has several unique characteristics. First, the opportunity set of schools is not constrained to the state. Parents can choose a state school, an out-of-state school, and even a school outside the country (notably in Canada). However, this school choice option only applies to areas (including cities, towns, unincorporated areas and gores) that do not operate traditional public schools. Each district can have either the tuition voucher system or locally operated public schools, but not both. For this reason, the vast majority of towns participating in the voucher system are in rural areas, and subsequently titled "tuition towns." Lastly, the tuition voucher program does not restrict enrollment based on the resident's income. The only requirement is that the family lives in a district without an assigned public school.

The school choice system in Vermont is a relatively old and comprehensive program, whereas school voucher programs across the United States are a relatively new and politically controversial phenomena. The unique characteristics of the voucher system provide an excellent setting to test the cross-sectional relationship between school choice and residential home values, and to evaluate whether the housing market values school vouchers. Using this voucher program as a backdrop, Cannon, Danielsen, and Harrison (2014) collect residential home sales transactions from April 1, 2009 to March 31, 2012 to shed light on this question.

Cannon, Danielsen, and Harrison (2014) find robust evidence that school vouchers increase home values. The results are both economically and statistically meaningful. All else equal, the authors show that the housing market is willing to pay a premium of nearly 5.7% for homes within a "tuition town." For a typical home in the study, this premium is valued at $8,450. The results suggest home buyers value school choice. The authors also examine the effect of having school choice alternatives within a 20 minute commute, as well as whether the presence of better schools within the same driving distance matters. The results indicate that the presence of more schools within the drive time catchment area results in a premium of 6.9% (or $10,879). The premium is even greater when the number of high quality schools (based on exam scores) within a 20 minute commute increases. The authors find that homes in a "tuition town" with "high quality" school choices are able to obtain a substantially higher premium of 16.1% ($24,181).[4] In summary, the study finds strong evidence that parents are willing to pay a premium on the property they buy in order to have the option to choose which school their children attend, and the premium increases when the number of high quality options within a 20 minute commute increases.

3.1.2 Paris, France

The French education system is predominantly administered through public schools, with some private schools. This system is based on a 12 year curriculum where children attend primary school from ages six to ten, middle school from eleven to fourteen, and high school from fifteen to seventeen. At the primary (secondary) level, public schools educate 86% (79%) of the populace, whereas private schools educate 14% (21%) of the students. For public schools, France utilizes school catchment areas, based on the student's home address, to allocate both students and resources efficiently. Municipalities establish the school district boundaries for the primary schools, and the Local Education Authorities (LEAs) determine the boundaries for the secondary schools. For many years, each municipality or LEA would publish a booklet describing the school catchment areas. Beginning in 2000, the information became publicly available online. While public schools adhere to strict zoning restrictions, private schools follow a geographically open enrollment system.

The private schools in France exhibit several interesting characteristics that are not common in the United States. First, the vast majority of the private schools are religious (predominantly Catholic). While religious in nature, admission to the private schools does not necessarily depend on the pupil's faith or that of the attended primary school. Next, private schools can either be state supervised or independent. State supervised private schools deliver the same curriculum as the public schools, whereas the independent schools are permitted to develop their own program of study. Similar to the public schools, the state supervised private schools are publicly funded by the central government,

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[4] Cannon, Danielsen, and Harrison (2014) find similar effects, albeit slightly smaller, when the driving commute is increased to 30 minutes.

whereas the independent private schools are not financed or regulated by the state or local governing bodies. The state also regulates the private school market by limiting the number of new teacher positions offered each year, and by restricting the number of new private schools that open each year. Last, and most important of all, the admission guidelines for public middle schools and private middle schools are significantly different.

Middle school may be one of the important periods in a student's educational development, especially, in France. At the end of the third year of middle school, students that underperform are directed toward vocational studies, while the remaining pupils continue on the path toward graduation.[5] More importantly, in Paris, France the admission to a specific high school can depend on the specific middle school the student attended, as well as their academic performance. Paris has slightly different admission rules for entering high school. While middle schools have strict catchment areas, parents have more options when it comes to sending their children to high school. The LEA allows parents to submit applications to a broad set of high schools within a much wider catchment area. Ultimately the admittance into a "good" high school depends on the pupil's academic performance, as well as the quality of the middle school. Thus, the choice of a middle school is extremely important because the quality of middle school may improve the chances of admission into a "good" high school.

Parents have two outlets for getting around the strict middle school zoning restrictions. First, they can ask the LEA for an exemption to attend a school located outside the current zone. This workaround has a high rejection rate, and only about 8% of the requests are granted each year. A more viable alternative would be to exercise the option to send the pupil to a subsidized private middle school. In France, the subsidies work very similarly to U.S. tuition vouchers. The vast majority of the expenses are paid by the government, and parents will only incur negligible costs. Because private schools are not constrained geographically, the option to send the child to an outside private school offers parents a relatively cheaper alternative compared to having to relocate to a better school district. Not surprisingly, the number of students attending private middle schools is higher than the number of students attending private primary schools and private high schools.

Paris presents a unique backdrop for studying the effect of school quality on residential property values. More importantly, the combination of a catchment-based school assignment system and a well-developed subsidized private school system allows researchers to explore the impact of school choice on the relationship between school performance and housing prices. Interestingly, the set of private schools is not evenly distributed across the city, which may substantially increase commute times for some families.

Fack and Grenet (2010) study the influence of catchment-based public middle schools on residential property values, and they examine this effect in the presence of publicly-funded private middle schools. The authors use an extensive dataset provided by the LEA in Paris to test for these effects from 1997 to 2004. The results indicate that there exists a positive relationship between the performance of the public middle school and the surrounding home prices. School zones with a better performing (public) middle school have significantly higher property values, approximately 5%, than the adjacent school zones. Next, the authors test the effect of having a good network of private middle schools near the residence's existing catchment area. The results are consistent with the theory,

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[5] Students that significantly underperform may be transferred to vocational studies at the beginning of the third year.

and as expected, the closer the private middle school the lower the impact of the public school quality on surrounding property values. In fact, for the residence in the highest quartile (the group with the closest private middle schools) the relationship between school performance and home values becomes both economically and statistically insignificant.

3.1.3 San Antonio, Texas

In April 1998, a private sponsor, the CEO Foundation, donated $52.4 million to the Edgewood Independent School District (EISD) to start a tuition voucher program. The purpose of this program was to provide an education option to low income families living within the EISD; a relatively small school district in the western portion of San Antonio, Texas. While the Edgewood voucher program (EVP) was privately funded, the program gave students an option to attend a different public school or private school. The average voucher covered up to $4,700 per year in tuition. If tuition expenses exceed the voucher amount, then families could cover the remaining costs. Interestingly, a larger percentage of the tuition voucher users elected to attend the only private school within the EISD area – Holy Cross High. The cost of tuition at the private school exceeded the average tuition voucher amount by $900 suggesting that families were willing to make up the difference in expenses.

The EVP is similar to the voucher program in Paris except for a few key differences. First, the EVP was temporary and had a finite life of 10 years. The program started at the beginning of the 1998-1999 school year and concluded with the 2007-2008 school year. Second, the EVP could only support 12% of the students attending schools within the EISD. Lastly, the voucher program in Edgewood was privately funded.

The Edgewood Voucher Program provides researchers with an excellent framework to explore the effect of tuition vouchers on surrounding property values. Merrifield, King-Adzima, Nesbit, and Gunasekara (2011) obtain Multiple Listing Service (MLS) home sales data for the EISD area and three nearby school districts from 2002 to 2008. The authors explore the impact of the temporary tuition voucher program on the property values within the EISD. They hypothesize that tuition vouchers that subsidize private schools should increase the attractiveness of the school district, which in turn should increase the demand for residential properties in that area. All else equal, the increase in demand should cause home values to rise. The results support this hypothesis.

Given the temporary nature of the voucher program, the authors divide the sample into different sub-periods. Early on in the voucher program, Merrifield, King-Adzima, Nesbit, and Gunasekara find evidence that homes sell for a significant premium. The results indicate that homes sold for 9.87% ($5,800) more during the early stages of the EVP. Interestingly, the size of the premium is slightly greater than the average voucher amount. The authors also find that during the period with tighter voucher availability restrictions, and towards the end of the life of the program, the effect falls to 1.1% ($600). In an additional model specification, the authors show that property values are positively associated with the actual usage level in the program (not just the program's availability for use). The premium ranges from 1.9% to 6.17% depending on voucher program usage levels. The results can be considered as a worst case scenario because the program was only temporary. More importantly, these findings suggest that parents value school choice, and tuition vouchers that can be used on either private or public schools can attract residents and increase property values.

3.2 School Choice via Magnet Programs, Charter Schools, and Inter-district Transfers

3.2.1 North Carolina

The public school system in North Carolina mirrors other states in that it assigns each pupil to a school based on his/her home address. In this setting, the local education agency (LEA) within each county establishes geographic catchment areas to assign students to schools. Parents wanting to send their children to a high performing school need to "vote with their feet" by moving to an appropriate district or catchment area within a district. Consistent with the vast literature on the capitalization of school quality in home prices, homes sell for a premium in the areas with the best-performing schools.

In the 1970s, school districts in North Carolina were among the first to utilize magnet school programs to promote desegregation and offer parents a choice of schools. Parents can either send their children to the designated public school or to a magnet school within the public school system. Magnet schools offer a variety of specialized courses and curriculums from STEM programs (Science, Technology, Engineering, and Mathematics) to leadership programs. Some magnet schools provide curriculum for gifted and talented students, whereas other magnet schools have an international focus. While students often are required to apply to enroll in magnet schools, students are also assigned to magnet schools as their "base" schools.

Magnet schools increase the degree of choice available to families, but students are still constrained to attend a magnet school within the district school system. Moreover, the availability of popular magnet schools can be restricted so that students are prioritized for admission. The policies that govern student prioritization are not always straight-forward. For example, in the Wake County Public School System (Raleigh), high priority is given to "Students residing in an area designated as "high-performing" whose first-choice school is a magnet school." The rationale for giving preference to students who would be assigned to a "high-performing" school anyway is that the magnet school program is used as a desegregation tool. High-income students are offered access to magnet programs in low-income areas as an inducement to attract good students into the low-income area. Since the district cannot observe income levels, home residence in a high-performing area is used as a proxy for high-income. In essence, the district is making use of Tiebout sorting to offer additional alternatives to families that live in high-property value areas with good schools, because the offered alternatives are deemed to be socially desirable.

Magnet schools increase the opportunity set of potential schools, and they do not require the family to relocate to a different catchment area to exercise choice. The empirical question that needs to be answered is whether magnet schools affect the positive relationship that we observe between public school quality and residential home values. Walden (1990) uses data from Wake County, North Carolina to test the aforementioned empirical question. Based on the prior literature, he posits that the presence of magnet schools should reduce the likelihood that public school quality is capitalized in residential home values. Using data from home values in the county in 1987, Walden regresses the natural log of home values on home, subdivision, and neighborhood characteristics plus quality metrics (test scores) for the assigned elementary, middle and high schools. While middle school quality is priced into the home values, elementary school quality is not. Since the magnet program was more extensively implemented in elementary schools, this result could be driven by the magnet program serving to disconnect school quality from home values, over the range of grades where the magnet school was most fully utilized. High schools' average SAT scores were not found to be priced, but only 70% of the students in the system took the SAT test.

In 1996, North Carolina passed the Charter School Act to provide parents with an expanded school choice set and to help at-risk and gifted pupils get the attention and resources they need to be successful. Charter schools are publicly funded. Many charter schools are privately managed and subject to limited oversight by local school districts. Charter schools are granted a higher degree of freedom to develop and deliver curriculum, and employ an open enrollment policy. As public schools, charter schools cannot discriminate or charge tuition, and they have no religious affiliation. More importantly, in North Carolina, charter schools are open to everyone without regard to school district boundaries. The original act limited the number of charter schools to 100, and this cap was reached in 2001. The cap was removed in 2011. In some regards, charter schools in North Carolina are similar to the publicly funded private schools found in Paris, France. They provide parents with additional school choices, and they can enroll students from all over the state, not just from the local catchment area.

Danielsen, Harrison and Zhao (2014) examine the effect of a charter school on the surrounding area. The authors collect student data from a charter school in the Raleigh-Durham, North Carolina area. The school level data consists of 662 families with at least one student attending the charter school. The nature of the data permits the authors to identify the mailing address of each student prior to admission to the charter school (from the application), and the student's mailing address changes over time. Using ArcGIS 9.2 and Google Maps API service, the authors calculate the linear distance, as well as driving time for 658 of the 662 families. Prior to admission to the charter school, the average applicant lived 5.77 miles from the school. The authors find that 176 of the families moved (changed mailing addresses) after their child was admitted to the school, and on average the families moved 1.48 miles closer to the school. The authors also find that families with greater home-to-school commutes, number of years at the current school, and families with younger students were more likely to move closer to the charter school.

We highlight the key finding from Danielsen, Harrison and Zhao (2014) in Exhibit 5 and Exhibit 6. These exhibits show the distance from the school's location, the black dot, to the student's home represented by the other dots clustered around the school's location. Exhibit 5 shows the scatter plot of family addresses, the grey dots, prior to admission to the school (ex-ante view), whereas Exhibit 6 shows the scatter plot of family addresses after several years of attending the school (ex-post view). The lighter grey dots in Exhibit 6 represent the 176 families that moved after a child enrolled in the school. The scale for each graph is kilometers. By comparison, the results shown in the exhibits indicate that families are likely to move closer to the charter school, on average. Put differently, the charter school creates an attraction for families, and the statistical results indicate that this attraction is stronger than the parents' work location. These findings may have important policy implications for addressing urban sprawl and urban blight.

[Insert Exhibit #5 and Exhibit #6]

North Carolina provides researchers with an interesting testing ground for examining the impact of school choice on the relationship between school quality and residential property values. The examination of the magnet program by Walden (1990) fills an important hole in the literature. However, several empirical questions remain unanswered. First, do the mitigating effects of magnet schools on school quality and home prices hold across different county school systems? Answering this question may be more complicated now given the introduction of charter schools in competition

with magnet schools in the public school system. While Danielsen, Harrison and Zhao (2014) examine the relocation effects of charter schools, they do not examine the effect of charter schools on home prices directly. Do parents consider a charter school an amenity and pay premiums for homes closer to the charter school? Are charter schools similar to magnet schools in that they lessen the importance of local public school quality and residential home values?

North Carolina also has two interesting structural events that may offer fruitful research paths in the near future. First, the number of charter schools operating in the state was initially capped at 100. The state reached capacity in 2001, but it took another 10 years to remove this cap. By the beginning of the 2014-2015 school year almost 50 additional charter schools had opened, and over 70 applications had been made to open additional charters. Future studies are needed to examine the implications on the capitalization of school quality in home prices after eliminating the cap. Another major change occurred on September 4, 2014, when the state agreed to allow "virtual" charter schools. These virtual schools are set to open in 2015, and they will operate in an online environment. In theory, these additional "choices" should reduce the effect of public school quality on residential home values. However, the magnitude of the reduction in Tiebout sorting as a result of additional "choices" is an open question that can be settled only through future empirical research.

3.2.2 New York, New York

Prior to 2002, New York City (NYC) operated a public school system with an array of strict catchment areas, magnet schools, and charter schools. The NYC public school system presents many challenges. For example, the school system is the largest in the country, the student population is extremely diverse, and many students live in homes where English is a second language. A major reform of the school system occurred in 2002, when Michael Bloomberg became the Mayor. The objective of the 2002 reform was to increase accountability, graduation rates, and student performance. To achieve these objectives, Mayor Bloomberg requested that legislators disband the NYC school board and grant the mayor absolute oversight of the public school system, which was granted. Under his guidance, the reform resulted in the closing of 160 underperforming schools, and the opening of 660 new schools. The reform also resulted in the expansion of the charter school system at the elementary and middle school level. The total number of charter schools and the number of students attending these schools increased from 16 schools with 1,800 pupils in 2002 to 180 schools with 60,000 students in 2013. In summary, the Bloomberg reform resulted in an increase in "school choice" for many students in NYC.

In an effort to estimate the economic benefits associated with the increase in school choice, Shapiro and Hasset (2013) study the impact of the reform on student achievement, and property values from 2002 to 2013. The authors report that the expansion of charter schools increases residential housing prices. Specifically, adding a charter school to a zip code results in a 3.84% increase in the values of the properties within the zip code. The study also demonstrates that the academic performance of NYC public school students improved substantially as a result of the reform. In turn, the improvements in student outcomes generate significant economic benefits by increasing residential property values. The findings indicate that a 1% increase in the graduation rates can lead to a 0.54% increase in the surrounding property values within the zip code for which the rates improved. By examining early 2013 home prices, the authors estimate that the expansion of charter schools added $22.45 billion to NYC residential property values.

Schwartz, Voicu, and Horn (2014) examine the impact that choice schools have on the positive relationship that exists between school quality and residential property values. This paper studies the effect prior to the major Bloomberg reform. The "choice schools" covered by this study include public schools that offer a wide range of programs and structures, including schools designed specifically to serve low performing students. Choice schools also include system-wide gifted and talented schools, alternative schools, magnet schools, schools that offer bilingual programs, and unzoned special education programs, but only two charter schools.

The authors explore the fifteen year period from 1988 to 2002. This article is different from Shapiro and Hasset (2013) because it does not restrict its inquiry to charter schools, and the empirical analysis focuses on elementary schools. Schwartz, Voicu, and Horn argue that there exists a stronger relationship between residential location and choice of elementary school in NYC. This stems from the fact that there are fewer choices at the middle school and high school level, and average commute times are much higher for the secondary schools. As the theory predicts, the results suggest that school choice dampens the positive relationship between the quality of the elementary school and surrounding housing prices. The authors find that the inclusion of choice reduces the capitalization of the school's performance into housing values by a third. Opening a choice school results in higher surrounding property values (2.2% higher). The findings also suggest that the performance of the choice school is capitalized into home values, but to a lesser degree. The overall effect of introducing choice schools also depends upon the ex-ante quality of the assigned school. The authors find a decrease in property values of approximately 0.4% for homes that are previously in catchment areas that already had higher performing schools. This finding is consistent with the idea that choice schools decouple the link between assigned-school quality and home values.

3.2.3 Ohio

In 1997, Ohio decided to institute a pilot program to test the efficacy of charter schools. The purpose of the program was to determine whether charter schools helped overcome the problems associated with failing (or low performing) school districts. The first county to receive approval was Lucas County where many of the schools in the city of Toledo were under-achieving their peer schools.

The charter school system in Ohio is relatively flexible compared to other states, and it exhibits many common charter-school characteristics. For example, the schools are publicly funded, and the state pays for each student attending the charter school. Ohio authorizes multiple agencies to grant charters, but charters cannot be granted to for-profit organizations; however, the school can be managed by a for-profit. Additionally, Ohio charter schools have no boundaries or catchment areas and use an open enrollment policy. The only exception is for schools that are specifically designed to serve disadvantaged pupils. Some public schools have been converted into charter schools, but other charter schools have opened in commercial buildings or built new school buildings. Recently, some charters began operating as virtual schools online.

Horowitz, Keil, and Spector (2009) obtain residential deed transfers from the Lucas County (OH) Auditor's office. This data contains property characteristics, assessed property values, and transaction information such as the sale date and the amount for each deed transfer from 1987 to 2006. Using this sample, the authors examine the impact of charter schools on surrounding property values for elementary and secondary schools. The findings indicate that elementary charter schools do not affect

surrounding property values. The coefficient estimates are not significantly positive or negative. However, when the authors construct a sample of two non-overlapping neighborhoods to see if a secondary (7 through 12 grade) charter school has a different effect on surrounding property values than a traditional public high school, their results indicate that as the distance from either school (charter or public high school) increases the property value also increases. This finding suggests that property owners view both types to be a locally undesirable land use (LULUs). Moreover, the authors do not find any statistical difference between the secondary charter school and the secondary public school when comparing property value growth rates and a sales price-to-assessed value ratio for the two non-overlapping neighborhoods. In summary, elementary charter schools do not appear to affect surrounding property values, and secondary charter schools are viewed as LULUs similar to their public school counterpart.

Horowitz, Keil, and Spector (2009) indirectly identify several interesting unanswered questions that future research may consider addressing. First, they argue that the impact charter schools have on the surrounding properties may influence the long-run acceptability of the charter school. In other words, do successful long standing charter schools impact surrounding property values differently than charter schools that are closed? To test this hypothesis, researchers will need a sample of charters that close, and a sample that educate students for some period of time. The authors also suggest that the charter school impact may depend on the specific mission of the school. Do certain charter school missions exert a different impact on property values than other missions? Another way to state this question would be, do property owners capitalize different charter school missions in home prices? Clearly there is no reason to believe that charter schools exert identical impacts, regardless of their characteristics. Thus, further research is needed to improve the understanding of the impact that differing charter school types might have on the surrounding environment.

3.2.4 Minnesota

The Minnesota Enrollment Options Program (MEOP) is one of the oldest "school choice" programs in the country that allows pupils to attend public schools outside of their catchment area. In 1987, when the program began, the system allowed voluntary participation from the individual school districts, which meant that each school district, rather than each family, had a choice. Optional participation was removed beginning in the 1990-1991 school year, at which time all school districts were required to partake in the school choice program. Under this modification, school districts can no longer prevent students from attending a school outside of their catchment area, and they can only restrict new enrollments if the number of applicants exceeds their operating capacity. More importantly, the MEOP does not allow enrollment discrimination against minorities. However, the state education agency has the authority to block Caucasian pupils from leaving a school district comprised of a high percentage of minorities.

Under the program, each school district did not, and could not, provide transportation beyond its designated catchment area. However, school districts gaining a large number of students could provide transportation starting at the boundary of their assigned zone. Thus, students wanting to attend a school outside of their designated attendance zone are required to provide their own transportation, at least to the point just beyond the school district boundary. In recent years, the state has mitigated this drawback, and in some cases will allow school districts to provide transportation services beyond their area or the state may provide families with transportation subsidies.

If a student attends a school different from his assigned school, then the assigned school district loses state aid for the pupil, and the school district gaining the student receives state aid. Moreover, the amount lost by one school district may not equal the amount gained by the other district because the state calculates funding by the specific district's non-compensatory state aid per pupil. Until the district option was removed in 1990, only about 1.5% of all public school students exercised their school choice option to transfer. Not surprisingly, once all districts were compelled to participate, the percentage of students transferring increased. By the beginning of the 1997-1998 school year approximately 4.6% of all students had participated. Of course, the distribution of participation was not uniform across the many school districts.

Reback (2005) utilizes Minnesota's school choice program to provide evidence consistent with the theoretical predictions of Nechyba (1999, 2000, 2003) that school choice programs reduce the positive relation between local school quality and housing values. The results suggest that properties in areas with a greater fraction of students transferring out (generally lower performing catchment areas) experienced an increase in value between 1991 and 1998 relative to the typical district, whereas properties located in catchment areas with a higher number of incoming transfer students decreased in value. For instance, a one standard deviation increase in initial outgoing (incoming) transfer rates is associated with an increase (decrease) in house prices of more than 3%. These findings indicate that families value school choice. Moreover, with unconstrained school choice, the importance of public school district boundaries and the capitalization effects of school quality on housing prices appear to diminish, leading to equalizing home values across districts with differing public schools.

It may be worth emphasizing that the home values around the "good schools" fell, relatively, while the home values near the "bad schools" rose. This result happened because the families near the bad schools could now attend the "good schools" anyway.

3.2.5 Oslo, Norway

Similar to many other countries, the public education system in Norway makes use of strict catchment areas to assign students to a school. Within each municipality each pupil (ages: 6 to 13) is assigned to an elementary school based on a catchment area. Several elementary schools funnel into each middle school (ages: 13 to 16), which serves a larger catchment area. High school enrollment depends on the county. In some counties, students are granted a "choice" and can apply to high schools, whereas in other counties, students are assigned by strict catchment areas. Prior to the 1997-1998 school year, Oslo County (the largest county in Norway) restricted student high school choice to the schools within its zone; on average, each zone consisted of approximately 3 high schools. While there was some degree of choice, students were not permitted to attend schools outside of their assigned high school zone. At the time, Oslo maintained six distinct high school zones.

In February 1997, Oslo put into practice a less restrictive form of "school choice" for high school admission. Under the new system, middle school students in their last year were able to apply to any high school in the county, not just the few within their designated area. The application process required each student to rank order their top 6 high school choices, and the central authority matched the students according to their grades. In the event that a particular school was oversubscribed, the authority attempted to enroll the student in his/her second choice school. This process continued for each student until a match was found. A key difference between this school choice program and those

in the United States is that the admission decision does not involve the individual high school's administrators. In sum, the Oslo school choice reform improved the allocation of students across the county, and increased pupil choice of high school. Like many other school districts, the distribution of high performing schools was not uniform.

Machin and Salvanes (2010) study the impact of the school choice reform on residential housing values. Using house price data from 1995 to 2002 and the school district zones, the authors find evidence that increased school choice affects attendance patterns, and this result is capitalized into the housing market. Before the reform, approximately 85 to 95% of the students attended a high school within their assigned catchment area, whereas only 36 to 57% of the pupils remained within their zone after the reform. In the 2.5 years before the reform, the authors find a strong relationship between school quality and the probability a resident moves. With school choice, families no longer needed to move between catchment areas for their children to attend a preferred school. The authors find that prior to the reform, a one standard deviation increase in school quality was worth 7-10% higher property values. After the reform, capitalization of school quality in home values fell by more than 50%. In short, the policy change substantially equalized home values across the city.

Overall, these findings suggest that an open school choice program may help prevent family migration from poor performing school districts to more preferred ones, with a potential to alleviate urban decline associated with low quality inner-city schools.

3.2.6 Multiple States

In a recent comprehensive study, Brunner, Cho, and Reback (2012) investigate the impact of inter-district choice programs on property values and family migration patterns from a sample consisting of 12 different states and 1,700 different school districts.[6] The central findings of the paper are similar in nature to the empirical results reported by Reback (2005). They find that a one-percentage point increase in the number of net out-transferring students from a district increases mean house values by $1,955 in a two-stage-least-squares model. A one percentage point increase in net out-transfers also increases the district's mean residential household income by $745. Moreover, net out-transferring districts attract new residents such that the population density of the out-transferring district increases, relative to in-transferring districts.

The Brunner, Cho, and Reback (2012) findings support the hypothesis that wealthier families will relocate to underperforming school districts to take advantage of lowering housing costs when they have the option to send their children to a school outside of the district. The authors show that inter-district public choice programs result in less desirable school districts realizing higher property values and population growth rates, whereas families migrate out of higher preforming school districts.

4. Conclusion

In summary, depending upon the nature of available education choice arrangements, a variety of residential sorting equilibria and resulting home price patterns may emerge. We find a common result from the few empirical studies on school choice programs and tuition vouchers. School choice programs, especially those that are not means-tested, appear to enhance the attractiveness of

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[6] The authors collect data from the following states for their study: Arizona, Arkansas, Colorado, Delaware, Iowa, Minnesota, Nebraska, Oklahoma, South Dakota, Utah, Washington, and Wisconsin.

residential properties. This increased level of attraction raises home values within an area that was previously served by poorly performing schools. However, areas that had "good schools" prior to the introduction of a choice program may see a decline in their school-quality price premium, thereby equalizing home values across district boundaries. Consistent with the theoretical predictions in studies such as Nechyba (1999, 2000, 2003) and Ferreyra (2007), the empirical research further suggests that the expansion of school choice arrangements and tuition vouchers may increase (reduce) the trend of family migration into poor-performing (better performing) school districts as families now have access to better quality education without having to "vote with their feet" and move to a preferred geographic catchment area. As such, open school enrollment and choice may result in less economic and social segregation, as well as real estate property value equalization.

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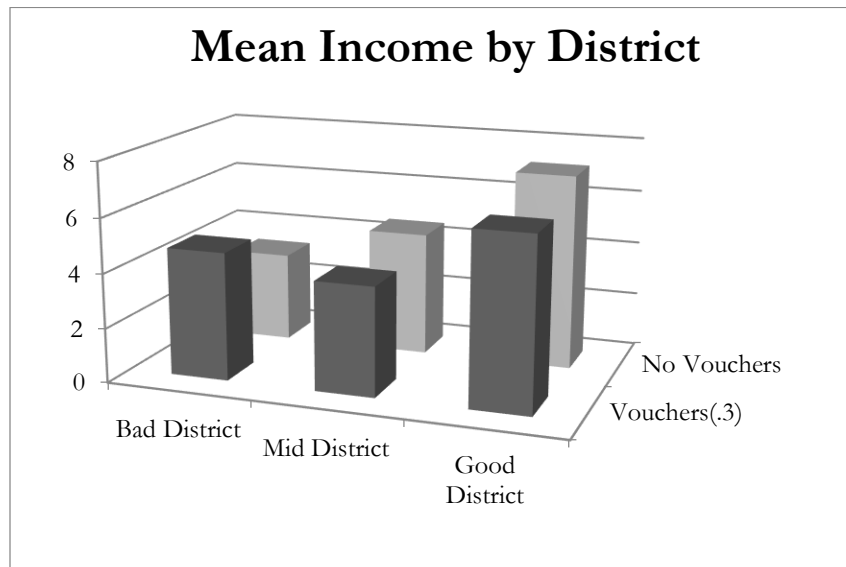
Exhibit 1
Mean Home Value by District

	Mean Property Value ($\theta = 0.5$)	
	Vouchers(.3)	No Vouchers
Bad District	0.7292	0.5859
Mid District	0.8532	0.9032
Good District	1.4538	1.6950
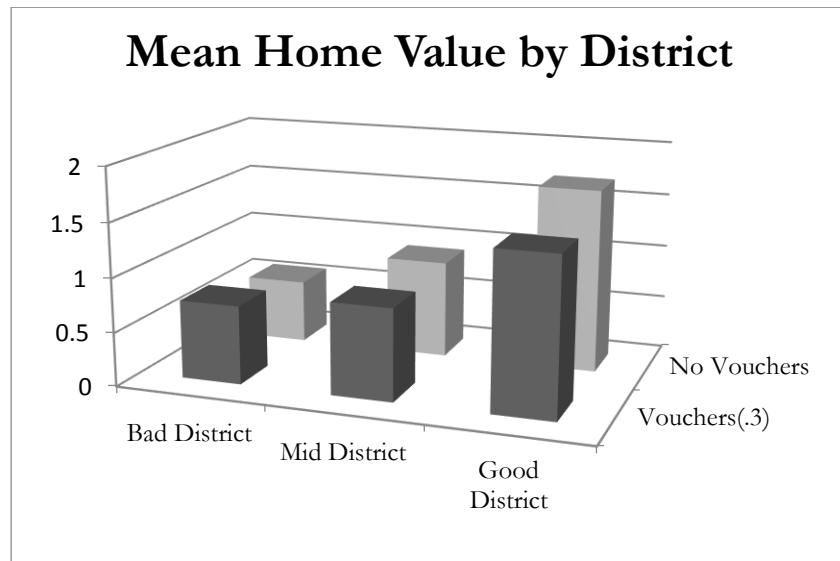
Source: Tables 2 and 3 in Nechyba (2000) "Mobility, Targeting and Private School Vouchers".
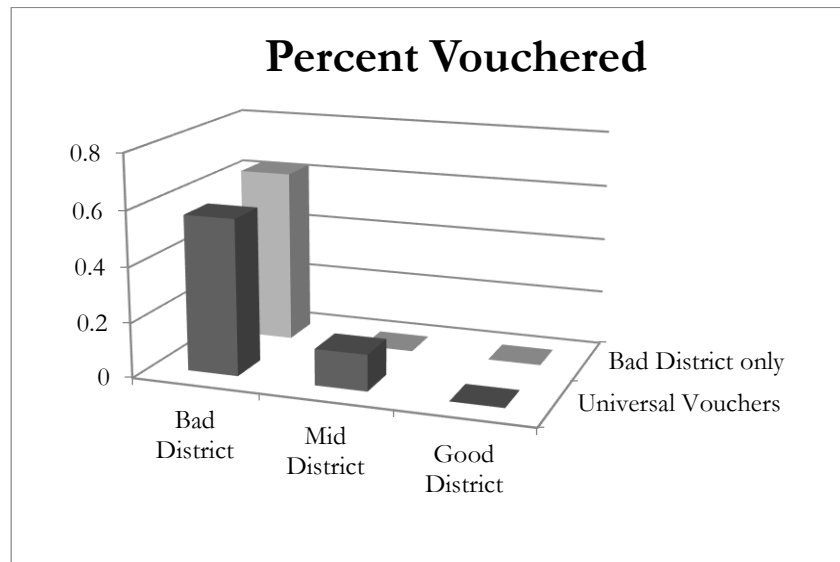
Exhibit 2
Mean Income by District

	Mean Income ($\theta = 0.5$)	
	Vouchers(.3)	No Vouchers
Bad District	4.7000	3.2973
Mid District	4.0000	4.5527
Good District	6.3000	7.1500

Source: Tables 2 and 3 in Nechyba (2000) "Mobility, Targeting and Private School Vouchers".

Exhibit 3
Percent Attending Private School

	Percent Attending Private School	
	Universal Vouchers	Bad District only
Bad District	0.5667	0.6300
Mid District	0.1333	0.0000
Good District	0.0000	0.0000

Source: Tables 5 in Nechyba (2000) "Mobility, Targeting and Private School Vouchers".

Exhibit 4
Recent Articles

Author(s)	Geographic Location	Period	Findings	Approx. Premium
Cannon, Danielsen, and Harrison (2014)	Vermont	2009-2012	Residential property values are significantly higher in areas offering tuition vouchers.	3-16%
Fack and Grenet (2010)	Paris, France	1997-2004	Home prices are significantly related to the test scores of public schools when the availability of private schools is relatively low.	1.5-2.5%
Merrifield, King-Adzima, Nesbit, and Gunasekara (2011)	San Antonio	1998-2008	The Edgewood School District voucher program led to an increase in property values in the early years of the program; however, the effect diminished when the eligibility requirements were tightened.	1.1-9.7%
Walden (1990)	North Carolina	1987	Elementary magnet schools reduce the relationship between school quality and home values.	Not Determined
Danielsen, Harrison, Zhao (2014)	North Carolina	2009	Families are more likely to relocate towards their child's charter school.	N/A
Shapiro and Hasset (2013)	New York City	2006-2012	The demand for housing increases in neighborhoods where new charter schools are opened.	3.69%
Schwartz, Ellen, Voicu, and Horn (2014)	New York City	1988-2003	The positive relation between school quality and home values diminishes as the proximity of alternative school choices increases.	2.2%
Horowitz, Keil and Spector (2009)	Ohio	1987-2005	Elementary charter schools do not significantly affect surrounding property values. Both public and charter high schools are viewed as Locally Undesirable Land Use.	0%
Reback (2005)	Minnesota	1989-1990 1997-1998	The adoption of a statewide open enrollment plan had a significant impact on residential property values. An increase in outgoing (incoming) transfer rates positively (negatively) effects home values.	3% per one standard deviation change in out-transfer rates
Machin and Salvanes (2010)	Oslo, Norway	1995-2002	Parents are willing to pay a premium for school quality when constrained to a specific school based on location. This premium diminishes when the catchment area restrictions are removed.	2 - 10%
Brunner, Cho, and Reback (2012)	Various	1995-2002	Inter-district transfers policies lead to home value increases where students transfer out to better districts. Average income levels and population density in the out-transferring district also rise.	$1,853 or $1,955 per one percentage point increase in net out-transfers

Exhibit 5
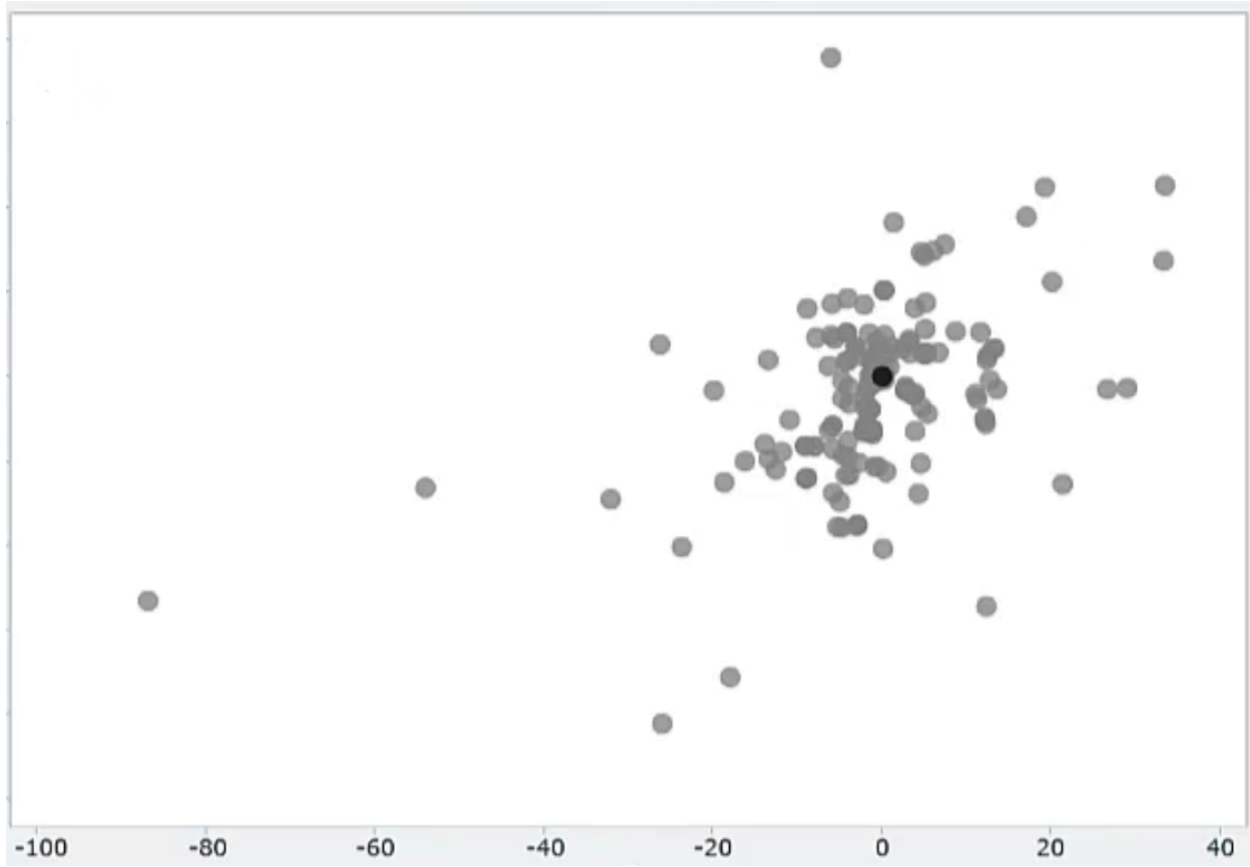**Ex-Ante View of Home Proximity to the Charter School**

Exhibit 6
Ex-Post View of Home Proximity to the Charter School