# The Impact of Charter Schools on Housing Values.

CHRISTIAN BUERGER[a]
1555 Poydras Street
7th Floor, Room # 701
New Orleans, LA 70112
Email: cbuerger@tulane.edu

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**Abstract**

The dynamics between school quality and housing markets contribute to the isolation of disadvantaged students in low performing school districts. Charter schools reduce the link between residential location and school services, and hence potentially affect both property values and residential sorting. This paper examines if charter schools influence the differences in housing prices between school districts and neighborhoods. I begin by developing a theoretical model identifying how charter schools influence school quality and how these changes potentially affect housing prices. Utilizing housing sale data for Upstate New York between 2000 and 2010, I estimate models comparing changes in housing price differences between school districts and neighborhoods. I find that charter schools do not influence the gap in housing prices between districts but decrease the differences in housing values between high and low income neighborhoods in districts with charter schools.

**Keywords**: Charter schools, School quality capitalization, Property value hedonic

[a] Tulane University, New Orleans, LA

# 1. The Impact of Charter Schools on Housing Values

## 2. Introduction

Starting with Oates (1969), an extensive body of literature has examined the link between school quality and residential location documenting that school quality is capitalized into housing values (Ross and Yinger 1999; Nguyen-Hoang and Yinger 2011). No matter if the studies focus on educational inputs such as spending per pupil or school outputs such as test scores, researchers have consistently found that households are willing to pay more for an incremental increase in education (Black 1999; Kane et al. 2006; Brasington and Haurin 2006). Further, studies found that heterogeneous preferences for school quality lead to residential sorting. Households with greater preferences for school quality and higher income sort into different neighborhoods than families with lower preferences for school quality and lower income (Bayer, Ferreira, and McMillan 2007; Yinger 2009). Ultimately, the dynamics between school quality and housing markets have strongly contributed to the isolation of disadvantaged students in low performing school districts (Barrow 2002). This is particularly true for urban areas where the poor are isolated in low performing city school districts and high degrees of segregation are prevalent between city and suburban school districts (Eberts and Gronberg 2005; Urquiola 2005; Bayoh, Irwin, and Haab 2006).

School choice programs reduce the link between residential location and school services, and hence potentially affect both property values and residential sorting. Theoretical papers predict

large effects of voucher programs on housing markets, reducing income and housing value disparities across school districts (Nechyba 2000, 2003; Ferreyra 2007; Epple and Romano 2003). Brunner, Cho, and Reback (2012) find that, in states that adopted inter-district choice programs, school districts with desirable nearby, out of district schooling options experience a relatively large increase in housing values, residential income, and population density. Hence, the authors corroborate the theoretical hypotheses substantiating that school choice programs are a potential instrument for overcoming the isolation of disadvantaged students and student segregation.

This essay focuses on charter schools, a rapidly growing form of school choice, and their impact on housing price disparities between neighborhoods with different income. Charter schools are nonsectarian, publicly funded schools, operating under a contract with a public agency. The contract, or charter, exempts the school from selected state or local rules and regulations. In return for funding and autonomy, the school must meet student performance standards specified in the law and its charter. The contract usually lasts for a set number of years and must be renewed to continue receiving public funding. Typically, students are not enrolled unless parents apply for admission. Charter schools are open to anyone who applies and they do not charge tuition. Oversubscribed charter schools are normally required to select students by lottery (Nelson et al. 2000; Bifulco and Bulkley 2008).

This chapter adds to the small literature on the impact of charter schools on housing values. More specifically, I evaluate whether or not the appearance of charter schools lowers the difference in housing prices between adjacent high and low performing jurisdictions. Prior

research by Imberman, Rourke and Naretta (2014) analyzes the impact of charter schools on housing values in Los Angeles County. The authors use the number of charters and the share of public enrollment in charters within various distances from a parcel as measurements of charter school penetration. Including census block fixed effects to account for endogenous charter locations and changes in the geographic distribution of sales, Imberman and colleagues do not find an impact of charter schools on housing values. Schwartz, Voicu, and Horn (2014) use housing sales in New York City to estimate the effect of choice school on housing values. The authors use the border approach popularized by Black (1999) and find that the opening of a choice school reduces the capitalization of test scores from zoned schools into housing values by approximately one third. They also find that the opening of the choice school is positively capitalized into housing values, suggesting that choice schools in New York City are viewed as neighborhood amenities.

The chapter contributes to the existing literature in two ways. *First*, I develop a theoretical framework to analyze the impact of charter schools on housing values. My theory describes three ideal cases of how charter schools influence school quality and thereafter the difference in housing prices between jurisdictions (either school districts or neighborhoods). The first case describes a positive effect of charter schools on school quality. The charter school is perceived as valuable schooling option or introduces competition among schools. However, the increase in school quality is not large enough to create an incentive for households to move between jurisdictions. The difference in housing prices can either go up or down depending on the relative changes in school quality between jurisdictions. The second case illustrates an increase in school quality that is large enough to create resorting between jurisdictions. In this case, housing price

differences between jurisdictions will decrease. The third case describes how charter school decrease school quality. Cream skimming of educationally advantaged students or a decrease in district resources can degrade school quality. Housing values in jurisdictions with lower school quality will drop leading to an increase in the housing price gap between high and low performing school districts.

*Second*, this chapter is the first study on the impact of charter schools on housing values outside the two largest cities in the United States, New York and Los Angeles. To analyze changes in housing price differences, I utilize housing sales for New York State between 2000 and 2010. My final sample consist of the city school districts of Syracuse, Niagara Falls, Ithaca and of their adjacent districts as well as a group of comparison districts. Thus, this study sheds light into the impact of charter schools on housing prices for a set of school districts located in metropolitan areas with fewer than 500,000 inhabitants.

To analyze the change in housing price differences across districts, I estimate models comparing housing prices between districts with charter schools and their adjacent districts. Further, I compare changes in housing prices between neighborhoods with similar income in the district with charter school and its adjacent districts. Also, I run regressions using a control group of districts similar to Syracuse, Niagara Falls, and Ithaca.

I do not find statistically significant changes in housing price differences between school districts. However, I do find an effect of charter schools on housing price differences between neighborhoods. In Syracuse, charter schools raise the price of housing by almost 6 percent in

neighborhoods having an income below the district's median relative to similar neighborhoods in the adjacent school districts. In contrast, housing prices decrease by 5 percent in neighborhoods with an income above the median compared to similar neighborhoods in the adjacent school district. As a consequence, the difference in housing prices between poorer and richer neighborhoods in Syracuse decreases. The results probably indicate resorting between Syracuse's richer and poorer neighborhoods. Households living in Syracuse's richer neighborhoods, who get their child enrolled into one of the high performing charter schools, move out of their neighborhood into somewhat poorer neighborhoods in Syracuse. As demand decreases in the richer neighborhoods, housing prices in the richer neighborhoods fall. As demand increases in poorer neighborhoods, housing prices in the poorer neighborhoods grow.

After charter school entry, housing prices in Niagara Fall's poorer neighborhoods decrease relative to neighborhoods with similar income levels located in the adjacent school districts. Likewise, after charter school entry, Ithaca's poorer neighborhoods experience declining housing prices relative to similar neighborhoods in the adjacent school districts. In both districts housing prices in richer neighborhoods are not influenced by charter school entry. Consequently, in Niagara Falls and Ithaca, the difference in housing prices between richer and poorer neighborhoods increases after charter school opening.

The empirical results suggest that the impact of charter schools on housing price gaps between jurisdictions is more complex and context specific than described in theoretical models on inter-district choice and voucher programs. More specifically, the effect of charter schools on housing values depend on how charter schools affect expected school quality in jurisdictions. Also, the

empirical findings suggest that the effect of charter schools on housing values varies substantially between neighborhoods within the same district. Thus, to detect housing price changes it is necessary to analyze housing prices at the neighborhood level.

The remainder of the chapter is structured as follows. Section 2 describes the charter school program in New York State. Section 3 states the theoretical framework and Section 4 applies the theoretical framework to New York State. Sections 5 and 6 explain estimation strategies and comparison groups respectively. Section 7 makes conclusions on the estimation strategies and comparison groups. Section 8 describes the data used for the analysis and provides Summary statistics. Section 9 presents the results and Section 10 states the conclusions.

## 3. Charter School Program in New York State and Sample of School Districts

The New York Charter School Law was established in 1998. According to the law, charter school students are allowed to attend charter schools outside their school district and attendance zone boundaries. However, if charter schools are oversubscribed, they have to select students by lottery. In this lottery process, preference is given to students residing in the school district, where the charter school is locating (NYS Charter School Law Subsection 2854 (2b)). Thus, oversubscribed schools may almost exclusively serve students from the district where they are located.

Charter schools receive per pupil payments from the districts in which their students reside, and these payments are the charter school's primary source of funding. The amount a district pays per student is linked to the approved operating expenses of the district where the student resides.

The charter application, approval, and evaluation process is closely regulated by the charter school authorizers[1]. The accountability standards set by authorizers can be considered relatively high compared to other states. Charter schools authorized by the Board of Regents have to perform higher than traditional schools in their district. School authorized by the New York State University are expected to have 75 percent of their students to score "proficient" or higher on state assessments. In a multistate comparison of charter school accountability laws and practices, the Center for Education Reform (CER) rated New York as a state that holds charter schools strictly accountable, pointing out that New York is one of the few states that have closed charter schools for performance reasons (CER 2007). The National Alliance of Public Charter Schools identifies New York as being amongst the few states using performance-based charter contracts, comprehensive school monitoring, and a systematic data collection processes (NAPCS 2012). Further, the charter school law of New York State requires districts to provide transportation to students enrolled in charter schools (NYS Charter School Law Subsection 2853 (4b)).

In 2010, 177 charter schools were operating in New York State. The majority of charter schools are located in NYC. I focus on charter schools outside NYC as I do not have housing sale data available for NYC. Table 1 shows the 14 school districts outside NYC that have charter schools. The first column indicates the year the first charter school was established. The second column shows the number of charter schools in each school district and the third column the share of students enrolled in charter schools. The highest counts of charter schools are in Albany, Buffalo, and Rochester. The share varies widely between 1 percent in Yonkers and 74 percent in

[1] Almost all charter schools are authorized by the State University of New York and the Board of Regents. Only two charter schools are authorized by a local school district.

Wainscott[2]. Further, there are several districts where the share is between 11 and 24 percent including Albany, Buffalo, Lackawanna, Roosevelt, and Kenmore-Tonawanda.

The following columns present the performance of charter schools, regular public schools in the district, and the performance of adjacent districts. Performance is measured using state wide tests for grades 4 and 8 in English Language, as well as grades 4 and 8 in mathematics. After calculating the state average, I standardize the result with regard to the state mean. The resulting performance measurement is zero at the state mean and equals one (and negative one) at one standard deviation above (below) the mean. Charter schools outperform the average public school in the district where they are located except in the Niagara Falls school district. Most of the charter schools locate in school districts that perform below the state average. The exceptions are Ithaca and Kenmore Tonawanda where traditional public schools perform above the state average. The surrounding suburban districts perform in most cases better than the city school districts except in Ithaca, Kenmore-Tonawanda, and Troy, where the performance in the charter school district is greater than in its neighboring districts.

To be included in the analysis, districts have to fulfill two criteria. *First*, there has to be a sufficient number of housing sales observed before and after charter school entry. In Albany, the first charter school opened in 1999. As I do not have housing sales prior 2000, I excluded Albany from the sample. In Buffalo, Rochester, Roosevelt, and Wainscott charter schools started operating in 2000. With only 8 months of housing sales before charter school entry, I am unable to estimate the effect of charter schools on housing values in these school districts, and hence

[2] The Wainscott School District has only two schools including the charter school. The traditional public school has only elementary grades and had an enrollment of 21 students.

excluded them from my analysis. For some districts, particularly those located on Long Island, I have sales information only for parts of the district. These districts have to be excluded as well.

*Second*, some school districts had a charter school moving into one of their adjacent school district at an earlier point in time. These charter schools may already affected housing values. Therefore, I excluded the school districts Kenmore-Tonawanda, Lackawanna, Troy, and Yonkers. Applying these two criteria leaves Syracuse, Niagara Falls, and Ithaca for the analysis.

## 4. General Theoretical Framework

The theoretical framework is based on the standard model of school quality capitalization as expressed in Ross and Yinger (1999), and Nguyen-Hoang and Yinger (2011). The standard model assumes that households maximize their utility over school quality, housing, and a composite good. Households make bids on housing based on school quality and local property tax rates. Households sort into different districts and attendance zones according to their income and preferences. The model assumes that households are mobile, and hence a key equilibrium condition is that all households in an income taste class achieve the same utility level. Households locate in a metropolitan area with many local governments financed by a property tax. All people who live in the same district are assumed to receive the same level of public services, and the only way to gain access to the public services in a district is to live there. Further, all households are considered homeowners.

A household's budget constraint requires income to equal spending.

$$Y = Z + PH + tV = Z + PH + t\frac{PH}{r} = Z + PH + t^{*}PH = Z + PH(1 + t^{*}) \quad (1)$$

where *Y* is the household's income; *Z* is a composite good; *H* is units of housing services, which are sold at price *P*; *t* is the effective property tax rate[3]; *V* is the market value of a house and equal to *PH/r*, where *r* is the appropriate discount rate; and *t* = t/r*.

The household's problem is to determine how much to pay for *H* given the quality of local public services, *S*, and the effective tax rate, *t*. This problem can be specified by determining the maximum price a household will pay for housing associated with a given *S*, holding their utility constant. More technically, the household problem is defined by solving Equation (1) for *P* and maximizing the result with respect to *H* and *Z* subject to a utility constraint. Thus, a household maximizes

$$P = \frac{Y - Z}{H(1 + t^{*})} \quad (2)$$

subject to

$$U(Z, H, S) = U^{0}(Y) \quad (3)$$

where $U^0$ is the utility achieved by households with income *Y*.

[3] The effective property tax rate equals the nominal tax rate times the assessed value divided by the market value.

Using the envelope theorem, the following equation can be derived

$$\frac{\partial P}{\partial S} = \frac{U_S/U_Z}{H(1+t)} = \frac{MB_S}{H(1+t^*)} \quad (4)$$

In this equation, $\partial P/\partial S$ is the slope of the households bid function with respect to the quality of local schools. The slope indicates a household's willingness to pay for an additional unit of school quality. According to the standard model, households sort into jurisdictions based upon the slope of their bid functions. Further, $U_S/U_Z$ is the marginal rate of substitution between *S* and the composite good and is also called the marginal benefit from *S* in dollar terms or $MB_S$.

Households sort according to their bid-functions for educational quality at two jurisdictional levels: school districts and attendance zones. To illustrate how school quality and residential location are linked for both types of jurisdictions consider the case depicted in Figure 1. There are two jurisdictions and two income-taste classes. Jurisdiction 1 has a low school quality and Jurisdiction 2 has a high school quality[4]. Further, there are two income taste classes A and B. Income taste class A has a high marginal willingness to pay for education. Income taste class B has a low marginal willingness to pay for education. Households in income taste class A have a steep bid function for school quality, and they win the bidding competition for housing in Jurisdiction 2. Households in income taste class B have a flatter bid function for school quality,

[4] "School quality is a complex and multidimensional concept" (Cullen and Jacob 2007: 6). Measures of school quality can be financial resources, the quality of the match between students and teachers, test scores, etc. In this study, I will use standardized test scores from the NYS report cards as they make comparisons between school districts possible. Further, report cards are well known to parents and potentially guide schooling decisions.

and they win the bid in Jurisdiction 1. Over time, households will perfectly sort into both school jurisdictions resulting in income and housing prices disparities.

Assume now that a charter school opens in Jurisdiction 1 (similar to Syracuse and Niagara Falls). The appearance of a charter school in Jurisdiction 1 can influence perceived school quality in four different ways. *First*, parents might value the option of sending their child to a low-cost educational alternative. When the existence of that possibility gives rise to a higher level of expected school quality than without it, the option has a value. This value is irrespective of whether the option is exercised or not. Option values are frequently encountered in financial markets, for example when the right to sell or buy in the future at a given price is bargained. The concept is also frequently associated with the valuation of environmental goods (Cameron and Englin 1997; Adamowitz et al. 1998) and transportation options (TCRP 2002), which may or may not be enjoyed in the future. If parents see charter schools as an option value because of their high performance, a particular school theme, or the racial composition of the school, school quality in Jurisdiction 1 and 2 will increase. This effect is likely to be larger in Jurisdiction 1 as the existing school quality is low and potential alternatives will add more value.

*Second*, charter schools introduce competition to regular public schools. Charter school proponents argue that regular public schools operate in a monopolistic market and are overburdened by the institutions of democratic governance that leave them vulnerable to conflicting demands of multiple interest groups. Thus, they have weak incentives to improve school quality as perceived by parents or to use resources more efficiently (Brennan and Buchanan 1980; Chubb and Moe 1990). Charter schools introduce competition to the public

school system creating market incentives that induce regular public schools to become more efficient and increase their performance (Friedman 1955, 1962). Competitive mechanisms are likely to increase school quality in Jurisdiction 1. In Jurisdiction 2, school quality changes only if the charter school performs at the same or a higher level than the traditional schools in Jurisdiction 2. In that case, the charter schools is able to compete with traditional schools potentially influencing their quality. Generally, the effect of competition is likely to be larger in Jurisdiction 1 as school quality is relatively low and competitive mechanisms will create greater pressure to improve school quality.

*Third*, charter schools can give rise to "cream skimming". Cream skimming refers to the worry that charter schools will primarily serve the most advantaged students, leaving the disadvantaged to languish in underperforming schools. Cream skimming might arise for two main reasons. There is variation in availability of information about charter schools, and if information is costly to obtain, economically and educationally advantaged families are better able to exercise choice (Hastings and Weinstein 2008). Further, advantaged students are less costly to educate and charter schools might choose a location in the district where students with relatively high socio-economic status live or take other steps to recruit relatively high performing students (Henig and McDonald 2002). Cream skimming is likely to result in high quality charter schools potentially leading to an increased option value. At the same time, traditional public schools will decrease in school quality.

*Fourth*, charter schools can potentially decrease district resources. Charter schools might have a negative impact on school districts resources in two ways. First, operating two systems of public

schools under separate governance arrangements can create excess costs. Excess costs can be a result of increased personnel, facility, transportation, special education, health services, and maintenance costs. Second, charter school financing policies can distribute resources away from districts if state aid payments to districts decrease and local charter school contributions increase (Bifulco and Reback 2012). Decreasing district resources are likely to have a negative impact on the quality of traditional public schools. Charter school quality is unlikely to be influenced by decreasing district resources.

These mechanisms may appear simultaneously, and may offset or complement each other. For instance, it is possible that charter schools introduce "cream skimming" and at the same time competition to the regular district school. Whether overall school quality increases or decreases depends on the relative strength of these effects. The mechanisms can empirically lead to three different cases that I explain in the following sections. In the first case, school quality increases but the change is insufficient to generate resorting. In the second case, the increase in school quality leads to resorting. In the third case, school quality decreases.

*Case 1: Increase in School Quality Insufficient to Generate Resorting*

In the first case, illustrated in Figure 2, growth in perceived school quality is not large enough to generate resorting. For Type B households the savings in housing generated by a move into District 1 would not be outweighed by the loss in amenities. Case 1 is more likely, if there is a large difference in school quality and other amenities between Jurisdiction 1 and 2 prior to the charter school opening. Both income taste classes stay in their jurisdiction and compete with families of the same type for housing. However, as school quality has increased households are

willing to pay a higher price for a unit of housing holding their utility constant. Population density and average income in both districts stay the same. Depending on the change in school quality for both jurisdictions housing prices will remain the same or go up. Thus, if the school quality in Jurisdiction 2 is greater than in Jurisdiction 1 prior to the appearance of the charter school and no resorting takes place, then

$$\Delta N_1 = 0, \quad \Delta N_2 = 0, \quad \Delta P_1 \geq 0, \quad \Delta P_2 \geq 0, \quad \Delta \overline{Y}_1 = 0, \text{ and } \Delta \overline{Y}_2 = 0.$$

The change in relative housing prices between Jurisdictions 1 and 2 is difficult to predict. However, even if the incremental increase in school quality is smaller in Jurisdiction 2 than in Jurisdiction 1, the effect on housing prices could be larger in Jurisdiction 2 as households have a greater willingness to pay for marginal increases in school quality.

*Case 2: Increase in School Quality Leading to Resorting*

In the second case, growth in perceived school quality is large enough to generate resorting. This case is illustrated in Figure 3. Increases in Jurisdiction 1's school quality will create an incentive for Type B households living in Jurisdiction 2, to move into Jurisdiction 1 to take advantage of lower housing prices while sending their child to the charter school. Note that Type B households will only move into Jurisdiction 1 if the loss in amenities, they face by leaving Jurisdiction 2, is outweighed by savings in housing. Generally, resorting is more likely if Jurisdictions 1 and 2 are relatively close in the quality of education and other amenities before the appearance of the charter school. The resorting of households leads to an increase in population density in Jurisdiction 1 and a decline in population density in Jurisdiction 2. As a result housing prices in Jurisdiction 1 will go up and housing prices in Jurisdiction 2 will go

down. Since the households choosing to move into Jurisdiction 1 have a greater income than the households already living in Jurisdiction 1, the average income in Jurisdiction 1 will increase. As all households in Jurisdiction 2 belong to the same income taste class there will be no change in average income. Thus, if school quality is greater in Jurisdiction 2 than in Jurisdiction 1 prior to the appearance of the charter school and resorting takes place, then it follows that:

$$\Delta N_1 > 0, \quad \Delta N_2 < 0, \quad \Delta P_1 > 0, \quad \Delta P_2 < 0, \quad \Delta \overline{Y}_1 > 0, \text{ and } \Delta \overline{Y}_2 = 0.$$

where $N_1$ and $N_2$ are population densities, and $\overline{Y}_1$ and $\overline{Y}_2$ are the average incomes in Jurisdiction 1 and 2. The difference in housing prices between Jurisdiction 1 and 2 will be reduced as housing prices in Jurisdiction 1 increase and Jurisdiction 2 decrease. Also, the gap in income disparities is reduced as average income increases in Jurisdiction 1.

*Case 3: Decrease in School Quality*

In the third case, the charter school decreases overall school quality in Jurisdiction 1. This case is depicted in Figure 4. As school quality has decreased, Type B households will pay less for a unit of housing holding their utility constant. Type A households will not be attracted by the low performing schools in Jurisdiction 1. Thus, housing prices in Jurisdiction 2 will not change. Under this scenario, the same income taste classes continue living in Jurisdiction 1 and Jurisdiction 2. Also, population density and average income in both Jurisdictions stay the same. Depending on the decrease in school quality for Jurisdiction 1 housing prices will go down. Thus, if the school quality in Jurisdiction 2 stays the same and school quality in Jurisdiction 1 decreases, then

$$\Delta N_1 = 0, \quad \Delta N_2 = 0, \quad \Delta P_1 \leq 0, \quad \Delta P_2 = 0, \quad \Delta \overline{Y}_1 = 0, \text{ and } \Delta \overline{Y}_2 = 0.$$

The difference in housing prices between Jurisdiction 1 and 2 will increase as housing prices in Jurisdiction 1 decrease and Jurisdiction 2 stay the same. Population density and average income stay the same in both Jurisdictions.

*Differential Effect of Charter Schools on Housing Values with Distance*

The effects described in the above cases are likely to differ by households' distance to the charter school. Epple and Romano (2003) describe how with increasing distance from the charter school transportation costs increase. Increasing transportation costs will decrease households' option values of sending a child to a charter school. Thus, it is likely that the effect of charter schools on housing values is also declining with distance.

## 5. Application of Theoretical Framework

The theoretical framework can be applied to school districts and neighborhoods. I start with an application to housing prices changes between districts and then explain implications for housing price changes between neighborhoods. For each jurisdiction, I state how changes in housing price gaps are likely to occur.

The New York State charter school program and the location of the three school districts in the sample have two important implications for applying the above described theory. *First*, oversubscribed schools in New York have to give enrollment preference to students living in the school district the charter school is located. Thus, for oversubscribed schools, the option value of

the charter school is very small for families living outside the district. *Second*, charter schools in Niagara Falls and particularly Syracuse have lower levels of performance relative to the traditional public schools in their adjacent districts (see Table 1). In these areas, it is unlikely that parents will send their children to a charter school which has lower levels of performance than the traditional public school the family can access.

These assumptions are supported by the charter school enrollment figures in 2010[5]. In Syracuse and Niagara Falls, 95 percent of the students enrolled in charter schools reside in the district where the charter school is located. In Ithaca, the share of students enrolled from outside the district is greater. Still about 60 percent of the students in the Ithaca charter school are from Ithaca. Consequently, the gap in housing prices between districts with charter schools and their adjacent districts is most likely driven by changes in housing prices in districts with charter school particularly in Syracuse and Niagara Falls.

In sum, for the Syracuse and Niagara Falls metro areas, I expect changes in housing price differences between districts to be driven by housing price changes in districts with charter school. The gap in housing prices between districts will converge if housing prices in the district with charter school increase. The housing price gap will diverge if housing prices in the district with charter school decrease. In Ithaca, the change in housing price differences is likely to be driven by housing price changes in Ithaca and its adjacent school districts. If housing prices decrease or decrease more in Ithaca than in its adjacent districts, housing prices will converge. If

[5] Enrollment is taken from the New York State report cards.

housing prices increase or increase more in Ithaca than in its adjacent school districts, housing prices will diverge.

Changes in housing price differences between neighborhoods are expected to follow a different pattern. *First*, it is important to note that changes in housing price differences between neighborhoods can occur in two ways. On one hand, the difference in housing prices between neighborhoods located in the same districts can change. On the other hand, the difference in housing prices between neighborhoods in different districts can change. *Second*, resorting between neighborhoods is more likely, as gaps in amenities are smaller compared to gaps in amenities between districts. *Third*, neighborhoods within a school district are often very heterogeneous. Usually, the socio-economic status of residents and the quality of schooling available differ between neighborhoods. Thus, charter school may impact housing prices in varying neighborhoods differently.

If households move between neighborhoods or bid up housing prices in some neighborhoods but not in others, the housing price difference between districts is probably influenced as well. However, the changing housing prices may not show up in an across district analysis for the following reasons. *First*, the effect of charter schools may strongly differ between neighborhoods even if the effect goes in the same direction. In an across district analysis, a heterogeneous charter school effect would lead to imprecisely measured results leaving the researcher in uncertainty if there is an effect of charter schools on housing values. *Second*, the effects of charter school may be positive in some neighborhoods while being negative in other

neighborhoods. In an across district analysis these effect would cancel each other out leading the researcher believe that there is no effect of charter schools on housing values.

Altogether, I expect the gap in housing prices between neighborhoods to converge if households resort between neighborhoods. In this case, housing prices in the neighborhood with formerly low school quality increase and housing prices in the neighborhood with formerly high school quality decrease. Further, housing prices between neighborhoods will converge if housing price changes in the neighborhood with formerly low school quality are greater than in the neighborhood with formerly high school quality. I anticipate housing prices to diverge if school quality decreases in the neighborhood with low school quality leading to lower housing values while housing prices in the neighborhood with formerly high school quality stay the same. Also, charter schools may lead to an increase in housing prices in formerly low and high performing neighborhoods but more so in the neighborhood with high school quality. This case is likely as households in the neighborhood with high school quality have a steeper bid function and housing prices are likely to react more to an incremental increase in school quality.

## 6. Empirical Methods: Estimation Strategy

The section on empirical methods consist of three parts. The first part explains the estimation strategies used in the chapter. The second part describes in more detail the comparison groups utilized in the empirical methods. The third part compares advantages and disadvantages of the empirical strategies used.

*Estimation Strategy 1*

The baseline specification is based on a difference in difference framework. I estimate the shift in neighborhood housing price trends comparing housing values before and after the charter school entry in the district where the charter school enters to the shift in housing values in its adjacent districts. I use census tract fixed effects to control for time invariant neighborhood characteristics. I also include quarter by year fixed effects to control for seasonality and specific year characteristics. The baseline estimating equation is written as follows:

$$\log P_{indqy} = \beta_0 + \beta_1 Post_{qy} + \beta_2 \left(Post_{qy} \times Inside_d\right) + \varphi X_{indqy} + \delta_n + \theta_n T_y + \mu_{qy} + \varepsilon_{indqy} \quad (5)$$

where ***P*** is the price of a house ***i***, in neighborhood ***n***, in district ***d***, during a quarter of the year ***q***, and year ***y***. $Post_{qy}$ indicates the time after charter school entry[6]. $Inside_d$ indicates the district with the charter school. The vector *X* stands for housing characteristics including the overall condition of the house, the availability of a fireplace, the construction grade, the availability of central air conditioning, the number of bathrooms, the number of bedrooms, the living area, the living area squared, the age of the house, and the age of the house squared. The term $\delta_n$ stands for neighborhood fixed effects at the census tract level. The term $\theta_n T_y$ indicates the slope of the neighborhood specific trend and $\mu_{qy}$ indicates month by year fixed effects. The last term $\varepsilon_{indqy}$ is a randomly distributed error term.

The coefficient of interest in the above equation is $\beta_2$. The coefficient compares housing price trends in districts with charter schools to housing price trends in their adjacent districts before

[6] I set the start of the post period equal to the opening of the first charter school in the area.

and after charter school entry. The coefficient measures the average treatment effect of charter schools on housing values in the district in which they are located under the provision that the adjacent districts act as an appropriate counterfactual for the change in housing prices in absence of the charter school. I expect the coefficient to be positive, if charter schools raise housing prices in the district they locate. I expect a negative sign, if charter schools decrease housing prices in the district they locate.

There are three potentially useful modifications of the baseline model. In the *first* modification, I will reduce the sample to housing sales taking place half a mile away from the district border. By reducing the sample to housing sales close to the district border, I can effectively control for amenities relevant to residents on either side of the border.

In the *second* modification, I control for distance between charter school and parcel. As stated in the theoretical section, with distance grow transportation costs. Increased transportation costs are likely to decrease the option value of the charter school. Thus, the effect of charter schools on housing values probably decreases with distance.

To control for distance in the baseline specification, I measure the distance between each house sold and the charter school. I add a distance term to Equation 5. Further, I interact distance with *Post* and *Inside*. The coefficient I am after is attached to the triple interaction between distance and *Post X Inside*. The coefficient tells me how the effect of the charter school is changing if the distance to the charter school increases by one mile.

*Third*, theoretical models on the relationship of school quality and housing values have stressed the importance of household income on the willingness to pay for education (Nguyen-Hoang and Yinger 2011; Epple and Romano 2003; Epple, Romer, and Sieg 2001). These models emphasize that high-income households are willing to pay more for increases in their child's educational achievement and hence are willing to pay more for increases in the quality of their child's school. Therefore, a charter school may be highly valued by families living in a high income neighborhood. On the other hand, households living in high income neighborhoods are likely to have already access to relatively high performing public or private schools. Thus, charter schools may not add additional value for them. Households living in low income neighborhoods are likely to have only access to low performing schools, and a potential alternative will be highly valued. However, poor households are unlikely to be able to pay relatively large amounts of money for increases in the quality of their child's school.

As the effect of charter schools on housing values is likely to differ between neighborhoods with varying income, I estimate the baseline specification separately for neighborhoods with different income. In the first of these models, I reduce the sample to housing sales in neighborhoods with an income below the median in the district with charter school. In the second model, I reduce the sample to housing sales in neighborhoods above the median in the district with charter school. In both models, I include only neighborhoods in the charter school district that have a similar income compared the neighborhoods in the adjacent districts and vice versa. With limiting the sample to similar neighborhoods in the district with charter school and its adjacent districts, I avoid bias resulting from comparisons that are not supported on either side of the border.

*Estimation Strategy 2*

The next empirical specification is based on a triple difference framework. I estimate the shift in neighborhood housing price trends comparing housing values before and after charter school entry, between the metropolitan areas in the sample and their matched metropolitan areas, and between the focal districts in these areas with their adjacent districts. Similar to the previous equation, I include a several fixed effects to control for time-invariant neighborhood characteristics, neighborhood housing price trends, seasonality, and year effects. The empirical model can be expressed as follows:

$$\log P_{indqy} = \beta_0 + \beta_1 Post_{qy} + \beta_2 \left(Post_{qy} \times Inside_d\right) + \beta_3 \left(Post_{qy} \times Treat_d\right) + \beta_4 \left(Post_{qy} \times Inside_d \times Treat_d\right) + \varphi X_{indqy} + \delta_n + \theta_n T_y + \mu_{qy} + \varepsilon_{indqy} \quad (6)$$

In this model, $Inside_d$ indicates the district with charter and its direct comparison district in a matched metropolitan area. $Treat_d$ is a dummy variable being one in the district with charter school and its adjacent districts. The dummy equals zero for all districts in the control group.

The coefficient of interest is $\beta_4$. The coefficient compares metropolitan areas with each other, compares the district with charter school and its direct comparison district with their adjacent school districts, and compares the time before and after charter school entry. The coefficient will be positive if charter schools impact properties more positively (or less negatively) in districts with charter schools compared to its adjacent districts and a set of similar school districts in another metropolitan area. Therefore, a positive coefficient can indicate two effects. If the charter

school moved into a district with lower housing values than its adjacent district, the housing price gap will decrease. If the charter moved into a district with greater housing prices than its adjacent districts, the housing price gap will increase. The coefficient will be negative if the impact of charter school entry is more negative (or less positive) in the district with the charter school compared to its adjacent districts and a set of school districts in another metropolitan area. Thus, a negative coefficient can imply two effects. If the charter school moved into a district with lower housing values than its adjacent districts, the housing price gap will increase. If the charter school moved into a district with greater housing prices than its adjacent districts, the housing price gap will decrease.

It is important to note that the empirical strategy stated above does not rely on similarity in district characteristics. If districts with charter schools and without charter schools are not becoming more or less dissimilar prior charter school opening, the estimated effect should identify the causal impact of charter schools on housing values. More specifically, identification of the causal effect requires that housing prices follow parallel trends conditional on the observable covariates in the absence of any intervention. If that is the case, any difference in housing prices in the period after charter school entry can be attributed to charter schools. Importantly, this assumption cannot be explicitly tested as we do not observe the true counterfactual. In the next section, I will analyze the parallel trend assumption using graphical evidence.

## 7 Empirical Methods: Comparison Groups

The goal of the empirical strategy is to estimate changes in housing price differences between districts with and without charter schools. For causal inference, however, it is not sufficient to

compare housing prices in school districts before and after charter school opening. An appropriate comparison group is required to estimate what would have happened to housing prices in the absence of the charter school. To help estimate the counterfactual, I select different control groups. How I select control groups is explained in more detail below.

*Comparison Group 1: Adjacent School Districts*

The *first* control group consists of all housing sales in the adjacent school districts. I define adjacent districts as all districts that border the district with the charter school. This is illustrated in Figure 5, which shows Syracuse and its adjacent districts. The Syracuse City School District is located in the center and the two charter schools are highlighted. Adjacent school districts are all districts touching the border of the Syracuse City School District. The focus of my analyses is changes in housing price gaps between school districts after charter school entry. Thus, the adjacent school districts are a natural comparison group. Further, as the adjacent school districts are in the same metropolitan area, they are likely to be affected by the same housing market shocks as the district with charter school.

As stated earlier, for my empirical strategy it is important that housing price trends between districts with charter school and their adjacent districts are not becoming more or less dissimilar prior charter school opening. As this so called parallel trends assumption cannot be explicitly tested, I graphically analyze housing price trends prior charter school opening.

To analyze if districts with charter schools have similar trend compared to their adjacent districts, I regress the log of housing prices on a full set of quarter by year fixed effects for the time period prior to charter school entry. Then, I plot the monthly average residual for the charter

school district and the adjacent school districts. The time fixed effects in the regression control for potential shocks over time. The residuals show how monthly housing sales in districts with charter schools and in their adjacent districts differ from the respective trends. In Figures 6 to 8, I plot the monthly residuals with a local linear fit[7] to make the trend line more visible.

Figure 6 shows housing price trends for Syracuse. Panel 1 compares trends between all housing sales in Syracuse and its adjacent districts. The trends are parallel. At the end of the observed time period the trends start to slightly diverge probably because of an anticipation effect of the charter school on housing values. Panel 2 reduces the sample to sales half a mile away from the district border. As expected, the trends are closer to each other. Further, the trends are relatively parallel and do not show a potential anticipation effect for the time period prior charter school entry.

Figure 7 shows housing price trends for Niagara Falls and its adjacent school districts. Using all housing sales, the trends are parallel (see Panel 1). Limiting the sample to housing sales close to the district border, trends are still parallel but the distance between them is less (see Panel 2).

Figure 8 shows housing price trends for Ithaca and its adjacent school districts. Using all housing sales, the trends are less parallel compared to Syracuse and Niagara Falls (see Panel 1). It is difficult to say why these differences in trends occur. A potential explanation is that the more rural districts surrounding Ithaca have somewhat different housing markets compared to Ithaca.

[7] I use Stata's lpoly command to produce the local line fit line. The command performs a kernel-weighted local polynomial regression of the residual and time in months. Displayed is a graph of the smoothed values with confidence bands

Also, the housing markets in the adjacent school districts could be less homogenous than in the other two districts. Reducing the sample to sales at the district border, trends seem to be even less parallel. The space between both graphs varies considerably.

*Comparison Group 2: Similar Metropolitan Areas*

The second comparisons group consist of districts located in metropolitan areas other than Syracuse, Niagara Falls, and Ithaca. Searching for metropolitan areas that match the districts in the sample and their adjacent districts, I face the following dilemma. I have plenty of information on school district characteristics but only a small number of metropolitan areas in New York State. To overcome this dilemma, I use a judgmental approach with the following formal procedure. All three districts in the study sample with charter schools are city school districts, thus I start with a list of all city school districts in New York State. Next, I limited the sample to districts that, like Syracuse, Niagara Falls, and Ithaca, are located in western or central New York. Finally, I select the districts and their adjacent districts that are the closest match to Syracuse, Niagara Falls, Ithaca, and their adjacent districts on variables drawn from school district tabulations of the 2000 U.S. Census. Specifically, I find the closest match, on mean performance, enrollment, share of black students, and share of students in poverty. The four variables are good determinants of factors influencing housing prices making them a good approximation for differences in housing price trends between districts. The results of this matching process are presented in Table 2. A graphical comparison between housing price trends is shown in Panels 3 and 4 in Figures 6 to 8.

Compared to other school districts in western and central New York, Syracuse stands out as a school district having a relatively high enrollment, low performance, high rates of poverty, and a large share of black students. Syracuse is surrounded by school districts having a much lower enrollment, higher levels of student performance, a lower share of students in poverty, and a lower share of black students as depicted in Table 2. These figures suggest that there is a high degree of socio-economic segregation between Syracuse and its adjacent districts. The unique characteristics of the area will strongly influence the difference in housing prices between Syracuse and its adjacent districts making it difficult to find comparison districts. However, I can exploit the variation in the timing of charter school entrance between districts and can compare Syracuse with Niagara Falls. Niagara Falls is the closest match for Syracuse among districts that did not contain charter schools earlier than Syracuse (see Table 2). Its enrollment and share of black students is somewhat smaller than Syracuse, but in all other categories Niagara Falls and its adjacent districts show great similarities with Syracuse and its neighboring districts. The first charter school moved into Syracuse in 2002, while Niagara Falls had its first charter school in 2006. Thus, I can use Niagara Falls as the control district for Syracuse during the pre-2006 period. Therefore, the pre-period for Syracuse are the 2 years before charter school entry. The post period are the years following the charter school entrance up to the point when Niagara Falls had its charter school[8].

Figure 9 shows the pre trends for Syracuse and Niagara Falls. The first panel shows housing price trends for Niagara Falls and its adjacent school districts. The trends are parallel. Panel 2 compares the difference in housing price trends between Syracuse and its adjacent school

[8] As families might anticipate the opening of the charter school in Niagara Falls, I exclude the 6 months before charter school opening in Niagara Falls from the analysis.

districts with the difference in housing price trends between Niagara Falls and its adjacent school districts. The residuals in Panel 2 are calculated in the following way. In a first step, I subtract the residuals in Syracuse from the residuals in its adjacent districts. I do the same for Niagara Falls. Then I plot the difference separately for both metro areas. The trend lines are again based on a local linear fit. The trends are parallel in the beginning of the time period but converge at the end. The result suggests that Syracuse's adjacent school districts are a better comparisons group.

In the next step, I have to find comparison districts for Niagara Falls. The Niagara Falls school district is characterized by schools that perform about one standard deviation below the state average, have an enrollment that is smaller than in the big upstate cities but substantially larger than in rural school districts, and a relatively high share of students in poverty (see Table 2). Niagara Fall's adjacent districts perform better and have a smaller enrollment. Their shares of black and poor students are less than the state average. School districts that serve as a good comparison are Binghamton and Dunkirk. They are somewhat smaller than Niagara Falls but have performance below the state mean and enrollment of black and poor students above the state mean. Their adjacent districts are suburban and comparable to Niagara's adjacent districts.

Figure 10 shows the pre trends for Niagara Falls and Binghamton and Dunkirk. As previously shown, trends between Niagara Falls and its adjacent school districts are parallel (see Figure 7). Trends in Binghamton, Dunkirk, and their adjacent districts are the same in the beginning of the observed time period. Then, the trend in Dunkirk and Binghamton drops a bit. Again, I plot the differences in residuals between Niagara Falls and its adjacent districts and Binghamton and

Dunkirk and their adjacent districts. The trends are parallel for most of the observed time period. However, similar to the Syracuse case, trends converge at the end of the observed time period. Thus, the adjacent school districts seem to be a better comparisons group for Niagara Falls.

Ithaca is located in a small metropolitan area and is strongly influenced by its higher education industry. Ithaca enrolls fewer students than the other districts in the sample and has much higher student performance compared to its adjacent school districts. The share of black and poor students is much lower compared to other districts with a charter school. The surrounding districts are rural, have lower student achievement than Ithaca, smaller enrollment, a similar share of black students, but fewer students in poverty (see Table 2). Saratoga Springs and Oneonta are districts that share these characteristics. They have institutions of higher education in the district and they are surrounded by rural districts. Their performance is above the state mean and their enrollment is relatively small. The share of black students in Saratoga Springs is less than in Ithaca and the share of poor students is higher in Oneonta. Saratoga Springs and Oneonta have adjacent school districts with lower performance and smaller enrollment. These characteristics make Saratoga Springs and Oneonta good comparison districts for Ithaca.

Figure 11 shows pre trends for Ithaca as well as for Saratoga Springs and Oneonta. As already mentioned, trends between Ithaca and its adjacent school districts are less parallel compared to Syracuse, Niagara Falls and their adjacent school districts. Oneonta and Saratoga show similar trends except five years prior charter school entry. Again, I plot the difference in residuals between Ithaca and its adjacent districts and Ithaca’s direct comparison districts and their adjacent districts. Trends converge and diverge at different points in time periods and do not

seem to be parallel for most of the observed time. Ithaca's adjacent school districts seem to be a better comparisons group than Saratoga Springs and Oneonta.

## 8 Empirical Methods: Concluding Remarks

While both specifications estimate the change in housing price gaps between school districts, the underlying assumptions and identification strategies are different. Equation 5 assumes that housing price trends between districts with charter schools and their adjacent districts are parallel prior charter school opening. Equation 6 assumes that the trend of housing price difference between districts in the metropolitan area with charter school are similar to trends in housing price differences between districts in a matched control area. As the graphical analysis of pre trends showed, the parallel trends assumption is meet best by districts adjacent to the district with charter school. Thus, Equation 5 is the preferred specification.

Equation 5 estimates the effect of charter schools on the housing price gap between districts by using a difference in difference estimator. Using this strategy, I can effectively control for common shocks to housing prices in the metropolitan area. Equation 6 uses a triple difference strategy. Using this strategy, I can effectively control for housing price shocks in the metropolitan area and for common shock between city school districts and their adjacent districts. While the triple difference has the advantage of a more robust analysis, the housing price trends prior charter school opening were less parallel. Thus, generally, I will give more weight to the results of Equation 5.

## 9 Data

The data for these analyses are drawn from several sources. Property sales information and housing characteristics were obtained from the New York Office of Real Property Services (ORPS). The database includes information on property location, class, sales date, and sales price. Information from the sales database was merged with detailed parcel-level data from the New York State Real Property System (RPS) database. The Real Property System collects information from local assessors on a number of parcel characteristics such as construction grade of the house (which refers to the quality of the material and workmanship used to construct the house and is graded from A to E), size (for living space measured in square feet, number of bathrooms, number of bedrooms, etc.), and special features (for example full basement, central air conditioninging, fireplace, etc.). In most cases, housing characteristics were only available for the first time a house was sold. Thus, the data does not provide information on parcel traits that varies over time. Combining both datasets, I constructed a pooled cross-sectional dataset that spans from January 2, 2000 to August 6, 2010[9]. It is important to note that neither of the combined datasets includes information on housing sales in NYC, and hence I have to exclude NYC from my analysis. Information on charter school entry and location was drawn from the New York Charter School Institute web page hosted by the State University of New York[10]. Tables 3 to 6 show Summary statistics for housing sales in Syracuse, Niagara Falls, and Ithaca. In each table Columns 1 and 2 compare the housing characteristics in the district with charter schools to housing characteristics in the adjacent school districts. In Columns 3 and 4, I compare

[9] The New York Office of Real Property Services puts a flag on all housing sales that are not arm's length. I do not include these sales in my data set as they are unlikely to reflect the market price of a parcel.
[10] Housing sales and charter schools were geo coded and placed into the census tracts and districts using ArcGis.

the housing characteristics for the same district but for houses located ½ mile away from the district border. Finally, Columns 5 and 6 contrast housing characteristics for the direct comparison of the charter school district and its adjacent school districts.

Table 3 compares housing characteristics for Syracuse. Columns 1 and 2 show that houses in Syracuse cost $37,598 less than in the adjacent districts (about 27 percent). Further, houses in Syracuse are of somewhat inferior quality, are less likely to have air conditioning, and are on average 32 years older compared to houses in the adjacent school districts. Therefore, housing characteristics in Syracuse and its adjacent school district mirror to some extent the socio-economic segregation between the school districts. Comparing houses characteristics for sales ½ mile away from the district border, the gap in housing prices is somewhat greater averaging $38,504 (a difference of about 26 percent). The housing quality in Syracuse is still inferior to its neighbors. Also, the share of houses with central air conditioning is higher in the adjacent school districts and the age gap is less compared to the previous sample.

Contrasting houses in Niagara Falls and its adjacent school districts, houses in Niagara Falls have lower sales prices and are of lower quality than in the adjacent school districts. The difference in housing prices is on average $83,734 (about percent 51 percent). Houses in Niagara Falls are more likely to have central air conditioning and they are older.

Comparing Syracuse and its adjacent school districts with Niagara Falls and its adjacent school districts, it is apparent that the housing price gap between Niagara Falls and its adjacent districts is somewhat greater. Further, the gap in housing size is greater while the gap in housing age is

smaller between Niagara Falls and its adjacent districts. All other housing characteristics look similar.

Table 4 presents summary statistics for Niagara Falls. As already described earlier, houses in Niagara Falls are of less value and of somewhat less quality compared to houses in the adjacent school district. Using the reduced sample around the district border for Niagara Falls, the gap in housing prices is much smaller averaging $20,782 (about 18 percent). Houses in Niagara Falls are of somewhat better quality, more likely to have air central air conditioning, and to be older.

Dunkirk and Binghamton have less valuable and lower quality houses than their adjacent districts. The difference in housing prices is $41,484 (about 32 percent). Further, houses in the Dunkirk and Binghamton are less likely to have central air conditioning. Comparing the differences in housing stock between Niagara Falls and its adjacent districts with Dunkirk and Binghamton and their adjacent school districts the following points are evident. The housing price difference between Niagara Falls and its adjacent districts is greater. Also, the differences in housing size and age are greater in Niagara Falls. All other housing characteristics look relatively similar.

Table 5 presents summary statistics for Ithaca. Columns 1 and 2 compare housing characteristics in Ithaca and its surrounding districts. It is notable that housing prices and the quality of housing in Ithaca are greater than in its adjacent school districts. The difference in housing prices is $62,003 (about 43 percent). Also, houses in Ithaca are more likely to have central air conditioning. The reduced sample shows for Ithaca a decline in the housing price difference. The

difference in housing prices is reduced to $29,492 (about 13 percent). Overall, the gap in housing quality, share of houses with air conditioning, and age is reduced.

In Oneonta and Saratoga, housing prices and housing quality are greater than in their adjacent school districts. The difference is $54,223 (about 21 percent). Further, houses are more likely to have central air conditioning. Comparing the differences in housing characteristics between Ithaca and its adjacent districts with differences between Oneonta and Saratoga and its adjacent districts, it is evident that there is a greater difference in the housing prices and quality between Ithaca and its adjacent districts. All other housing characteristics look relatively similar.

## 10 Results

The results are presented separately for Syracuse, Niagara Falls, and Ithaca in Tables 6 to 8 respectively. Models 1 and 2 estimate Equation 5 using the adjacent school districts as control group. In Model 2, the sample is reduced to housing sales ½ mile away from the district border. The main focus in the first two models is the coefficient on the interaction between post and inside. The effect captures the change in housing prices differences between school districts with charter schools and their adjacent districts after charter school entry.

Model 3 estimates Equation 6 using the matched metropolitan areas. The main effect is captured by the triple interaction between post, inside, and treatment. The coefficient compares the change in housing price differences between the districts with charter school and its comparison district and between the control districts and their adjacent school districts after charter school entry.

Models 4 to 6 estimate Equation 5 but differentiate by distance and neighborhood income. Model 4 interacts the coefficient of interest with distance in miles. In Model 5, the sample consist only of sales in neighborhoods having a neighborhood income below the median in the district with charter school. Model 6 presents the same model for housing sales taking place in neighborhoods with an income above the median. In Models 5 and 6, I include only neighborhoods in the charter school district that have a similar income compared the neighborhoods in the adjacent districts and vice versa. With limiting the sample to similar neighborhoods on each side of the border, I avoid bias resulting from comparisons that are not supported on either side of the border.

*Results Syracuse*

Table 6 presents the results for Syracuse. In Models 1 and 2, the coefficients on the interaction between post and inside are negative and imply an increase in the housing price gap between Syracuse and its adjacent school districts. However, the estimated coefficient are imprecisely estimated and not statistically significant. Model 3 shows no effect of the charter school indicating that the difference in housing prices between Syracuse and its adjacent district relative to the difference in housing prices between Niagara Falls and its adjacent districts is not changing after charter school entry. Model 4 shows a main effect being close to zero and statistically insignificant. The coefficient on the triple interaction including distance suggests that with increasing distance, the effect of the charter school is reduced. Being a mile further away reduces the impact of the charter school in housing prices by 1.4 percent. As the coefficient is imprecisely estimated, this cannot said with certainty.

Model 5 shows a positive and statistically significant coefficient on the interaction between post and inside. Housing prices in Syracuse's poor neighborhoods increase by about 6 percent after charter school entry compared to similar neighborhoods in the adjacent school districts. Model 6 shows a negative and statistically significant coefficient on the interaction between post and inside. Housing prices in Syracuse's richer neighborhoods decreased by 5 percent after charter school entry compared to similar neighborhoods located in the adjacent school districts.

The results for Models 5 and 6 probably indicate resorting between Syracuse's richer and poorer neighborhoods. Households living in Syracuse's richer neighborhoods, who get their child enrolled into one of the high performing charter schools, move out of their neighborhood into somewhat poorer neighborhoods in Syracuse. As demand decreases in the richer neighborhoods, housing prices fall. As demand increases in poorer neighborhoods, housing prices grow. Thus, the result for neighborhoods in Syracuse is similar to Case 2 in the theoretical section.

*Results Niagara Falls*

Table 7 shows the results for Niagara Falls. In Model 1, the coefficient on the interaction between post and inside is close to zero implying no change in the housing price gap between Niagara Falls and its neighboring districts. Reducing the sample to housing sales close to the district border the coefficient becomes positive indicating a decrease the housing price gap. The coefficients in both models are not statistically significant. In Model 3, the coefficient on the triple interaction is close to zero. The coefficient indicates that the difference in housing prices between Niagara Falls and its adjacent districts is not changing differently compared to districts in the matched metro area. In Model 4, the main effect is close to zero and not statistically

significant. The coefficient on the triple interaction is positive indicating a greater impact on housing values for parcels that are further away from the charter school. However, the coefficient is imprecisely estimated and not statistically significant.

Model 5 shows a statistically significant negative coefficient on the interaction between post and inside. Housing prices in Niagara Falls poor neighborhood decreased by 2.9 percent compared to similar neighborhoods in the adjacent school districts. Model 6 shows a positive but not statistically significant coefficient on the interaction between post and inside. The results indicate an increasing gap between housing prices in Niagara Falls neighborhoods. Housing prices in poorer neighborhoods decrease while they remain unchanged in richer neighborhoods. The result is potentially explained by declining school quality in Niagara Fall's poorer neighborhoods. As the charter school is low performing compared to other schools in the district, a reduction in school quality is unlikely based on cream skimming. It is more likely that resources or services declined in schools located in low income neighborhoods. As school quality decreases, households have to be compensated by lower housing prices. The situation in Niagara Falls is best explained by theoretical case number three.

*Results Ithaca*

Table 8 presents the results for Ithaca. In Model 1, the coefficient on the interaction between post and inside is negative and indicates a decline in the housing prices gap between Ithaca and its neighboring districts. Reducing the sample to housing sales at the district border, the coefficient becomes positive. Both coefficients are imprecisely estimated and they are not statistically significant. In Model 3, the coefficient on the triple interaction is close to zero. The coefficient

indicates that the difference in housing prices between Ithaca and its adjacent districts is not changing differently compared to districts in the matched metro area. Differentiating the effect by distance, the main effect in Model 4 is close to zero. The coefficient on the triple interaction is close to zero suggesting no relationship between distances and housing price changes. Both coefficients are not statistically significant.

Model 5 shows a negative and statistically significant negative coefficient on the interaction between post and inside. Housing prices in Ithaca's poor neighborhood decrease by 1.9 percent compared to similar neighborhoods in the adjacent school districts. Model 6 shows a positive but not statistically significant coefficient on the interaction between post and inside. The results indicate an increasing gap between housing prices in Ithaca's neighborhoods. Housing prices in poorer neighborhoods decrease while they stay the same in richer neighborhoods. Similar to Niagara Falls, the result is potentially explained by declining school quality in the poorer neighborhoods in Ithaca. As performance measurement in the charter school's 2012 and 2013 report cards reveal, the Ithaca charter school is lower performing compared to its traditional counterparts. Thus, a reduction in school quality is unlikely to be based on cream skimming.

It is more likely that resources or services declined in schools located in low income neighborhoods. As school quality decreases, households have to be compensated by lower housing prices. The situation in Niagara Falls is best explained by theoretical case number three. More likely is that resources or services declined in schools located in low income neighborhoods. As school quality decreases, households have to be compensated by lower

housing prices. Similar to Niagara Falls, the situation in Ithaca is best explained by theoretical case number three.

In conclusion, there are no statistically significant results on the coefficients of interest for Models 1 to 4. Most of the results are imprecisely measured and do not allow any further conclusions about and whether the gap in housing prices changes. The models 5 and 6 show statistically significant coefficients indicating changes in housing prices for neighborhoods within Syracuse, Niagara Falls, and Ithaca. The heterogeneity of the charter school effect amongst neighborhoods with different income is most likely the reason why models focusing on overall effects at the district level show either imprecise or no results. In Syracuse, households living in neighborhoods with higher median income move into neighborhoods with lower median income located in Syracuse. The difference in housing prices between neighborhoods in Syracuse is decreasing. In Niagara Falls and Ithaca low income neighborhoods experience declining housing prices. As housing prices in higher income neighborhoods do not change, the gap in housing prices between neighborhoods is increasing.

## 11 Conclusions

Theoretical models of bidding and sorting suggest that charter schools can have a significant effect on housing markets and residential sorting. In this chapter, I provide an direct empirical test of whether those predicted effects occur. My theory describes three cases how charter schools influence school quality and housing prices. The first case describes a positive effect of charter schools on school quality. However, the increase in school quality is not large enough to generate resorting. The difference in housing prices between high and low performing

jurisdictions can either go up or down depending on the relative changes in school quality between jurisdictions. The second case illustrates an increase in school quality that is large enough to create resorting. In this case, housing price differences between high and low performing jurisdictions decrease. The third case describes how charter school decrease school quality leading to a decline in housing prices in the lower performing jurisdiction. In this case, the gap in housing prices between districts increases.

Empirically, I do not find statistically significant changes in housing price differences between school districts. However, I do find an effect of charter schools on housing price differences between neighborhoods. In Syracuse, charter school raise the price of housing by almost 6 percent in neighborhoods having an income below the district's median relative to similar neighborhoods in the adjacent school districts. In contrast, housing prices decrease by 5 percent in neighborhoods with an income above the median compared to similar neighborhoods in the adjacent school district. As a consequence, the difference in housing prices between poorer and richer neighborhoods in Syracuse is decreasing. The results probably indicate resorting between Syracuse's richer and poorer neighborhoods. Households living in Syracuse's richer neighborhoods, who get their child enrolled into one of the high performing charter schools, move out of their neighborhood into somewhat poorer neighborhoods in Syracuse. As demand decreases in the richer neighborhoods, housing prices fall. As demand increases in poorer neighborhoods, housing prices grow.

Syracuse is exemplary for the effect of high performing charter schools on housing values in districts with much lower performing traditional public schools. The charter schools are an

amenity that is valued by some families who willing to move out of their neighborhood into a poorer neighborhood.

In Niagara Falls poorer neighborhoods, housing prices decrease relative to neighborhoods with similar income levels located in the adjacent school districts. Likewise, Ithaca's poorer neighborhoods experience declining housing prices relative to similar neighborhoods in the adjacent school districts after charter school entry. In both districts housing prices in richer neighborhoods are not influenced by charter school entry. Consequently, in Niagara Falls and Ithaca, the difference in housing prices between richer and poorer neighborhoods increased after charter school opening.

Niagara Falls and Ithaca are exemplary for the effect of charter schools on housing values that performing lower than the traditional public schools in the district. The charter schools takes students and money away from traditional schools. Their low performance is likely to be acknowledge by residents and seen as a disamenity.

The empirical results suggest that the impact of charter schools on housing price gaps between jurisdictions is more complex and context specific compared to inter-district choice and voucher programs. More specifically, the effect of charter schools on housing values depend on how charter schools impact expected school quality in jurisdictions. Also, the empirical findings suggest that the effect of charter schools on housing values varies tremendously between neighborhoods within the same district. Thus, to detect housing price changes it is necessary to analyze housing prices at the neighborhood level.

Additional research has to be conducted to explore the relationship between charter schools and housing prices further. Particularly, my analysis is limited by the availability of housing sales before 2000 and only focuses on areas with small charter school enrollment. Using different samples may lead to somewhat different results. Further, I did not have attendance zones for school districts to explore within district changes on housing prices further. Future research could address these deficiencies to create a better understanding how charter school influence housing prices.

Figure 1: Perfect Sorting without Charter Schools

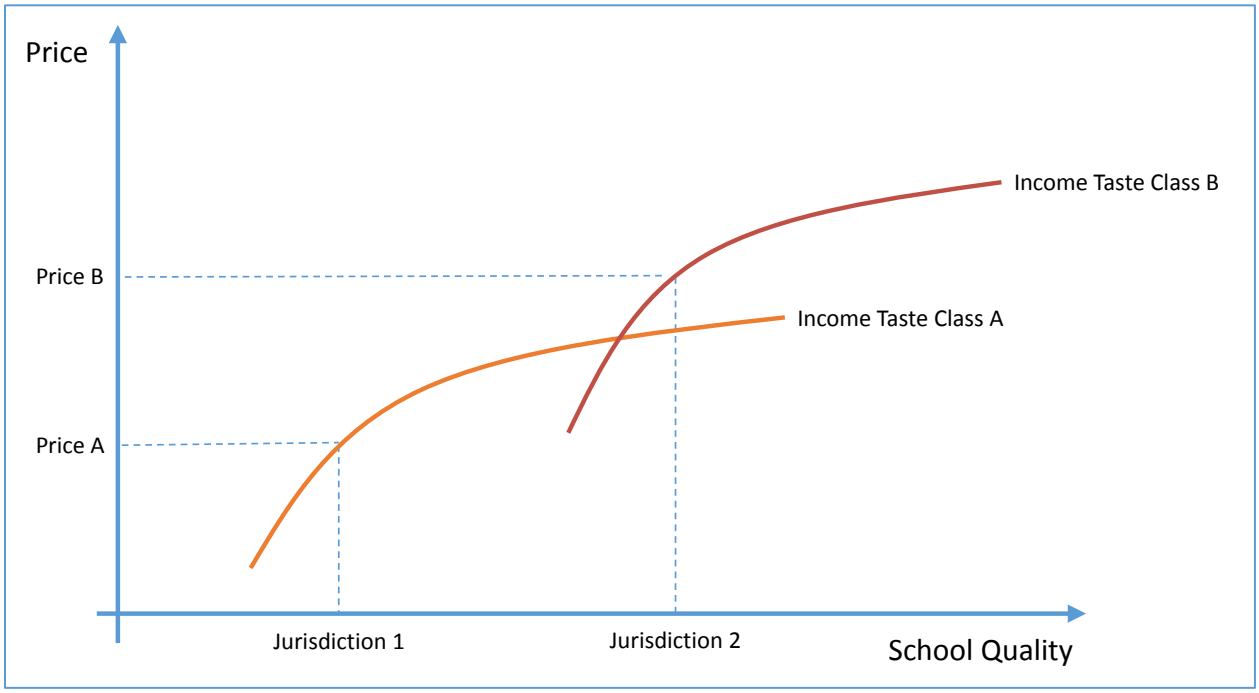



Figure 2: School Quality Increase Without Resorting

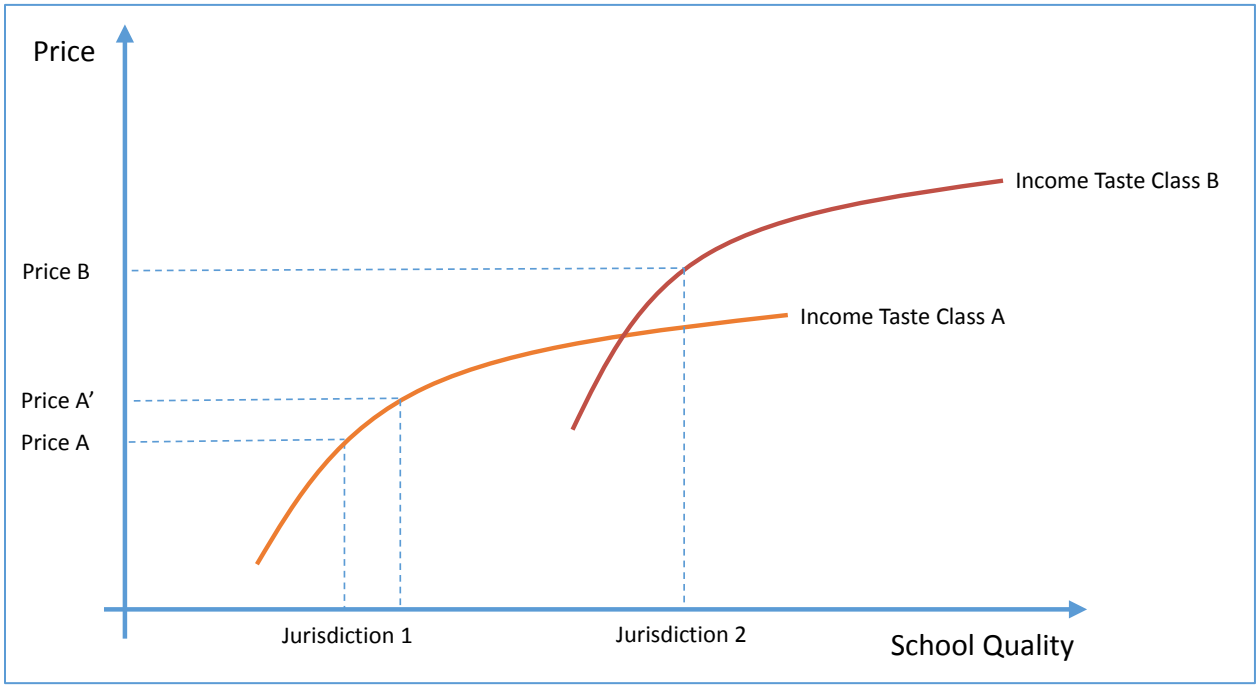


Figure 3: School Quality Increase With Resorting

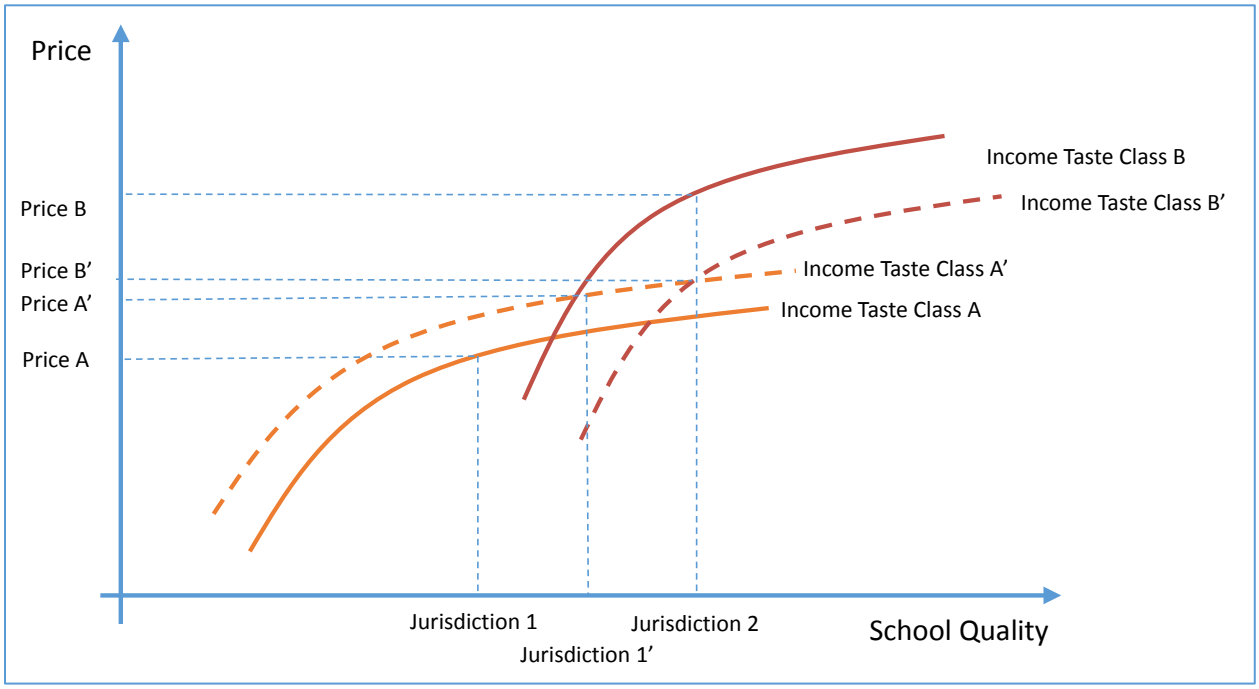



Figure 4: School Quality Decrease

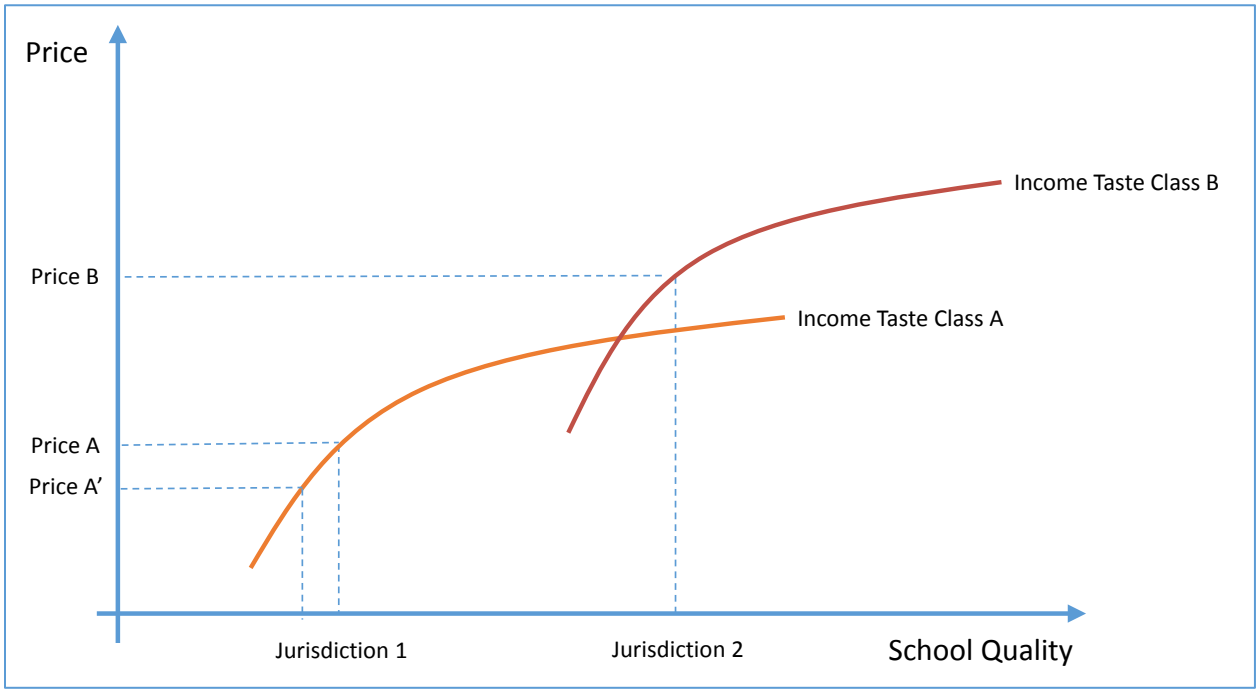


Figure 5: Syracuse City School School District and Its Adjacent School Districts

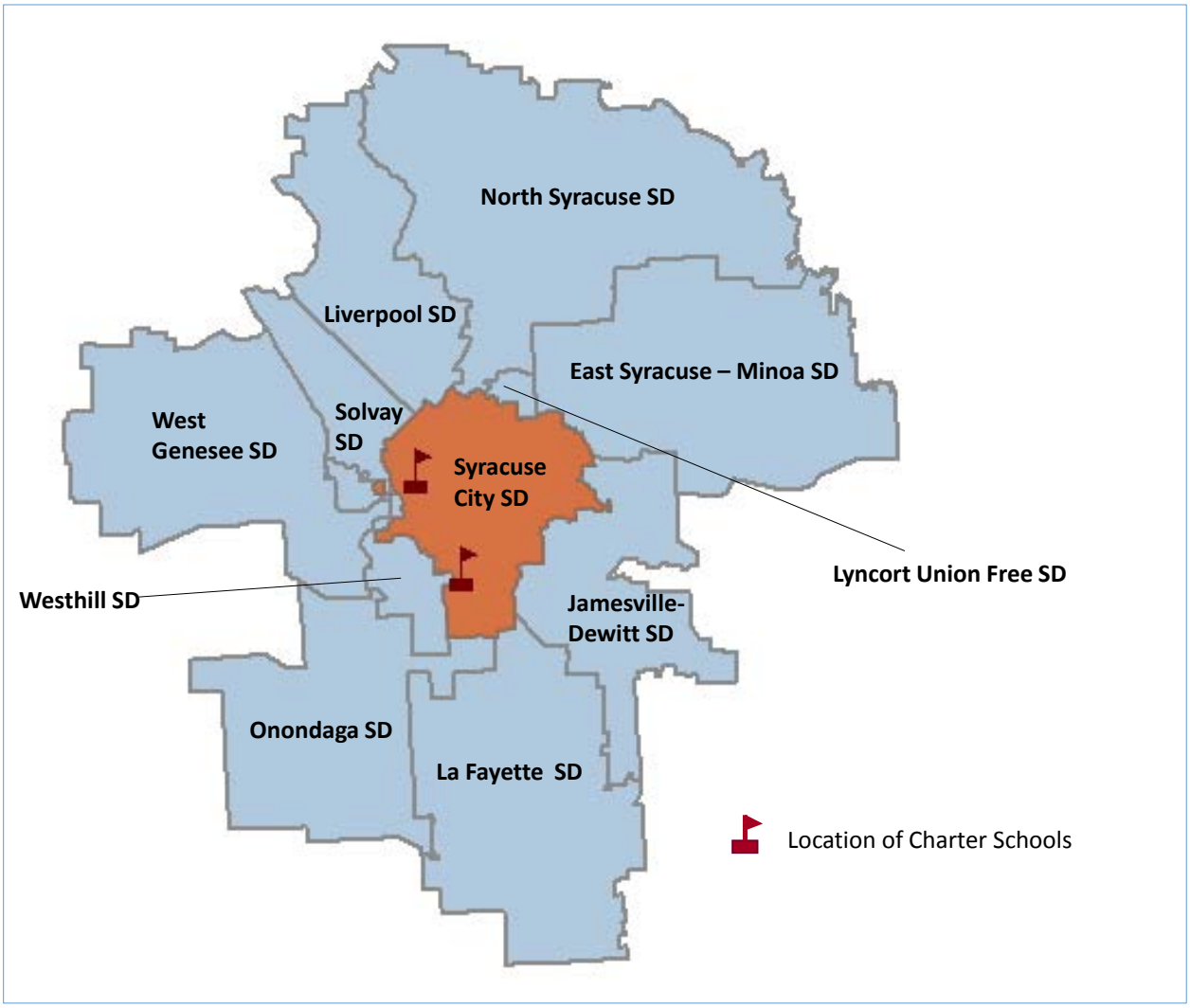
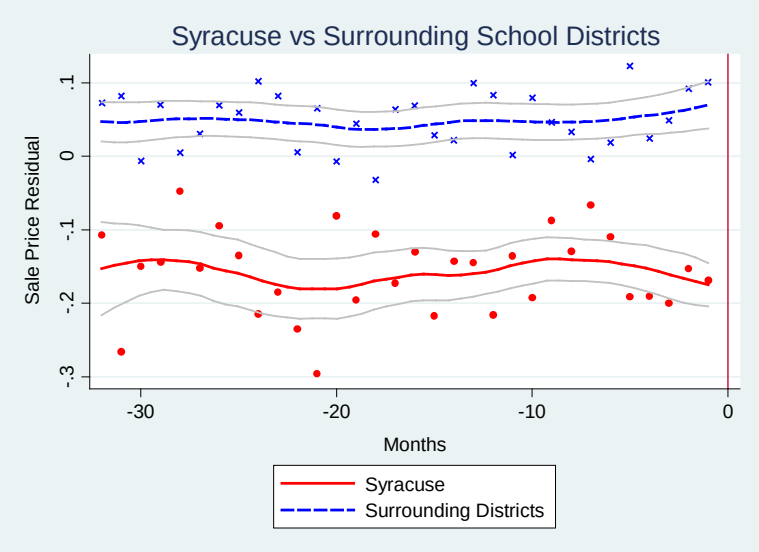


Figure 6: Sale Price Residuals by Month for Syracuse

1)




2)

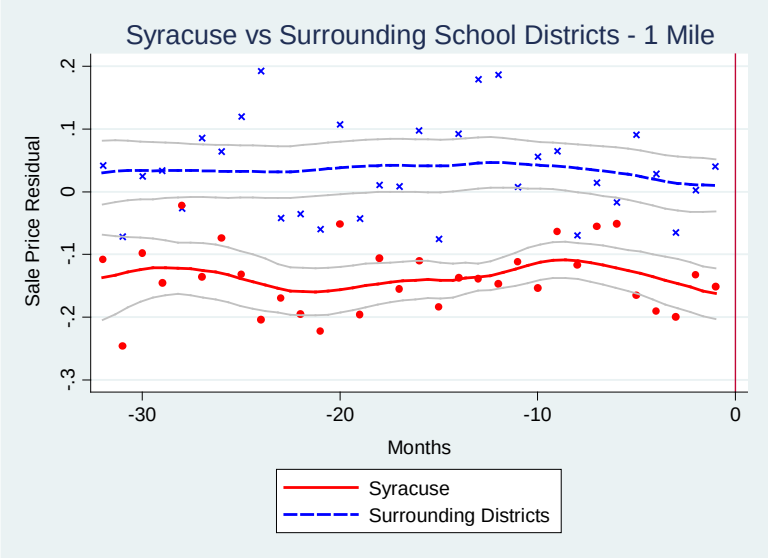
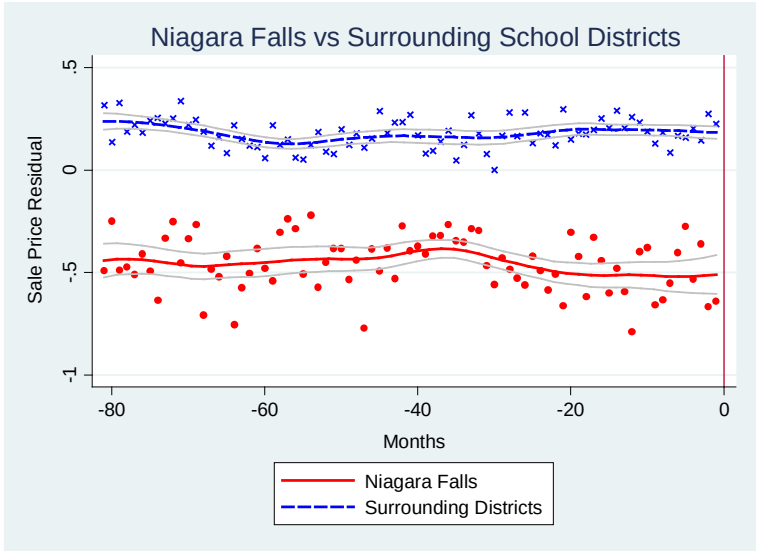


Figure 7: Sale Price Residuals by Month for Niagara Falls

1)




2)

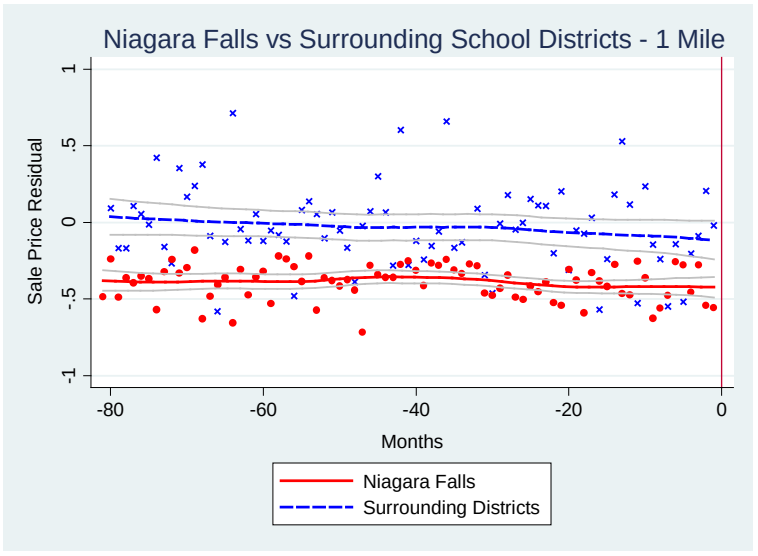
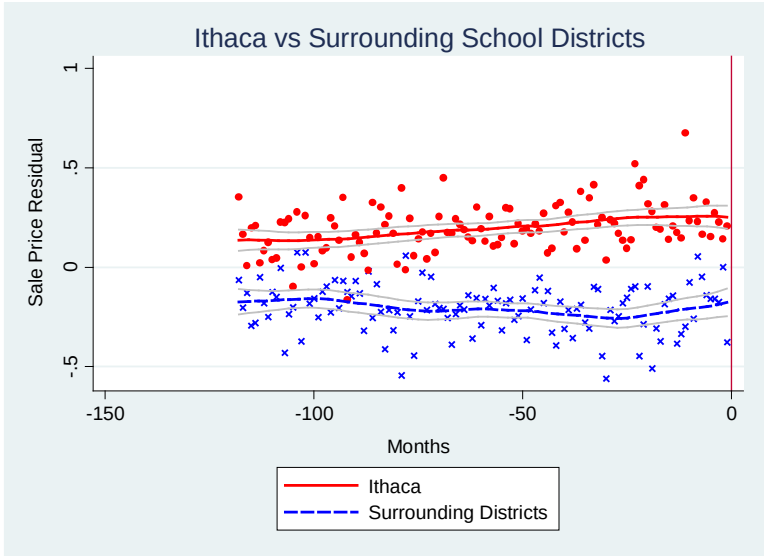


Figure 8: Sale Price Residuals by Month for Ithaca

1)




2)

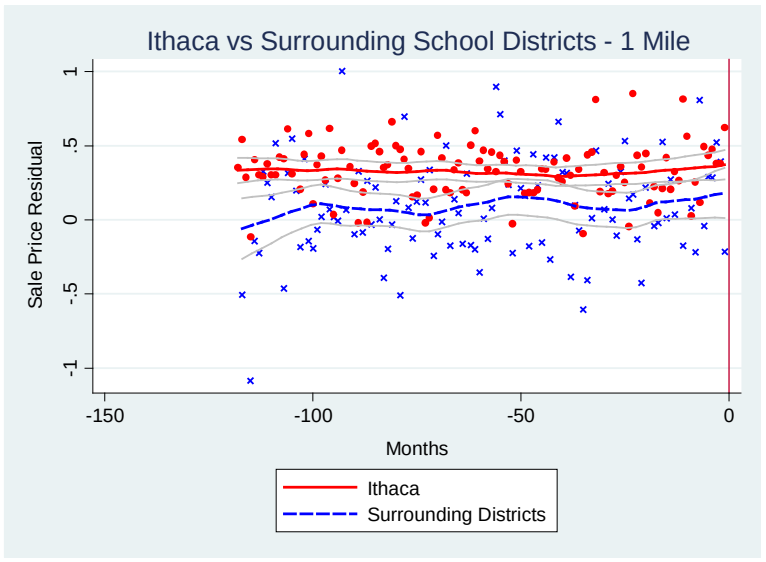
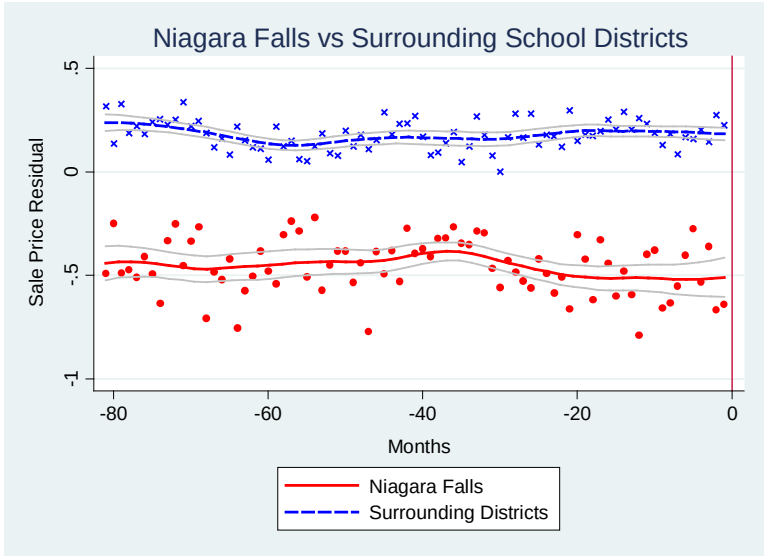


Figure 9: Sale Price Residuals by Date for Syracuse and Metro Comparison

1)




2)

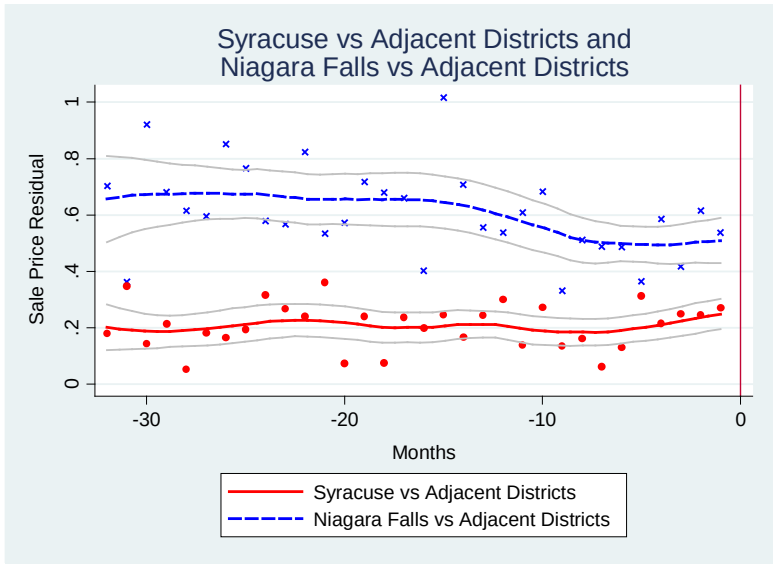
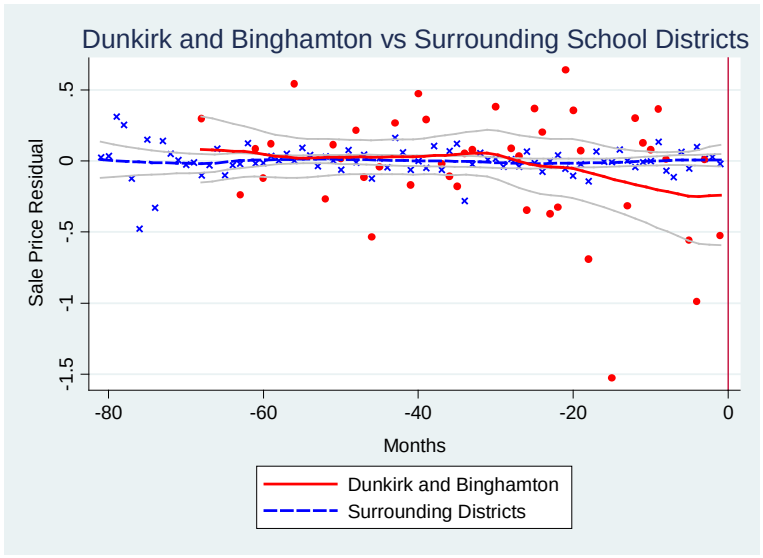


Figure 10: Sale Price Residuals by Date for Niagara Falls and Metro Comparison

3)




4)

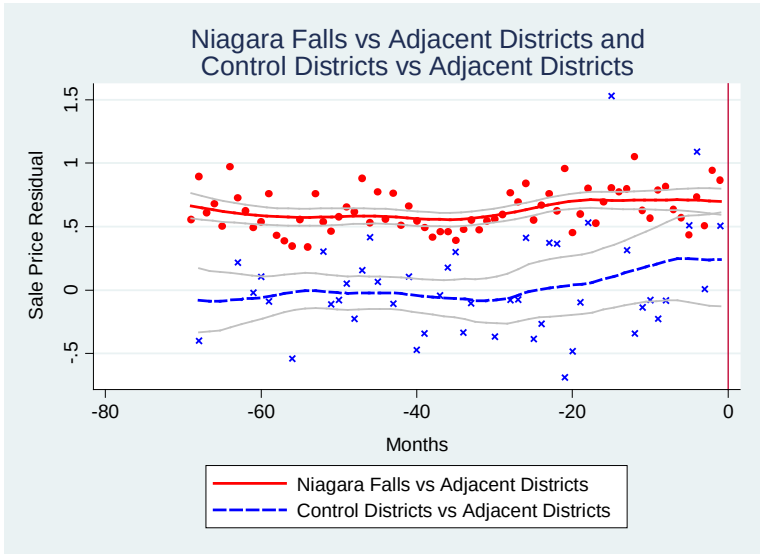
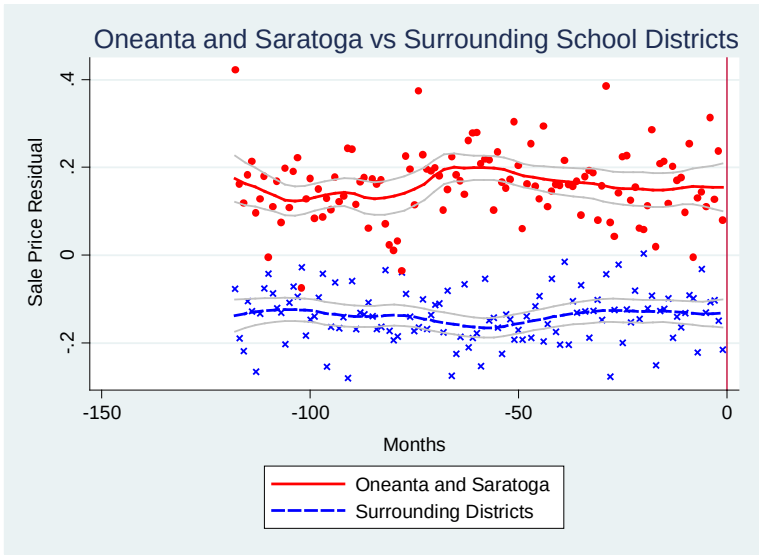
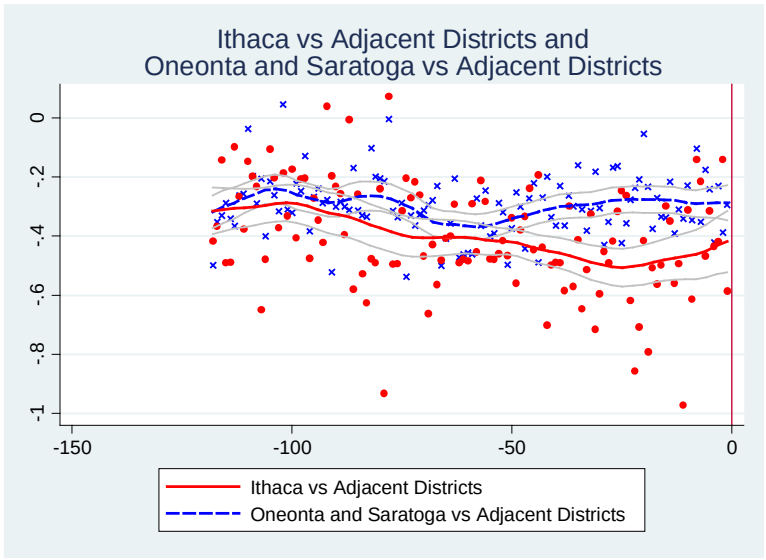


Figure 11: Sale Price Residuals by Date for Ithaca and Metro Comparison

3)




4)



| District | First Charter Established | Number of Charter Schools | Share of District Enrollment | Sufficient Pre Period | Housing Sales Avialable | Charter School in Adjacent District | Average Performance Charter Schools | Average Performance District Schools | Average Performance Surrounding Districts | Included in Final Sample |
|---|---|---|---|---|---|---|---|---|---|---|
| Albany | 1999 | 12 | 24% | No | Yes | No | -0.18 | -0.97 | 0.63 | No |
| Buffalo | 2000 | 15 | 19% | No | Yes | No | -0.44 | -1.58 | 0.18 | No |
| Rochester | 2000 | 6 | 4% | No | Yes | No | N/A | -0.90 | 0.74 | No |
| Roosevelt | 2000 | 1 | 8% | No | Yes | No | N/A | 0.15 | -0.53 | No |
| Wainscott | 2000 | 1 | 74% | No | Yes | No | -0.25 | -1.17 | -1.14 | No |
| Riverhead | 2001 | 1 | 2% | Yes | No | No | -0.59 | -0.22 | 0.34 | No |
| Kenmore-Tonawanda | 2001 | 1 | 2% | Yes | Yes | Yes | 0.91 | -0.07 | 0.60 | No |
| Troy | 2001 | 2 | 11% | Yes | Yes | Yes | -0.84 | -1.71 | 0.48 | No |
| Lackawanna | 2002 | 1 | 19% | Yes | Yes | Yes | -0.60 | -0.84 | 0.30 | No |
| Syracuse | 2002 | 2 | 5% | Yes | Yes | No | -0.89 | -2.20 | 0.22 | Yes |
| Yonkers | 2005 | 1 | 1% | Yes | Yes | Yes | N/A | 0.42 | 0.14 | No |
| Niagara Falls | 2006 | 1 | 5% | Yes | Yes | No | -0.49 | -1.29 | -0.17 | Yes |
| Hempstead | 2009 | 2 | 7% | Yes | No | No | -0.19 | N/A | 0.56 | No |
| Ithaca | 2009 | 1 | 2% | Yes | Yes | No | 1.13 | -1.04 | 0.83 | Yes |
| Source: Number of charter schools and year of establishment are taken from the SUNY Charter School Institute web page (http://www.newyorkcharters.org). Enrollment figures are taken from the Common Core of Data 2010 Public Elementary/Secondary School Universe Survey. Performance measures are taken from the 2010 New York State report cards | | | | | | | | | | |
| Performance is computed by averaging the standard scores for grade 4 ELA, grade 4 math, grade 8 ELA and grade 8 math for each school in New York State. Then, the measurement is converted into standard scores with a mean of zero and standard deviation of one. | | | | | | | | | | |

| District | First Charter Established | Number of Charter Schools | Share of District Enrollment | Sufficient Pre Period | Housing Sales Avialable | Charter School in Adjacent District | Average Performance Charter Schools | Average Performance District Schools | Average Performance Surrounding Districts | Included in Final Sample |
|---|---|---|---|---|---|---|---|---|---|---|
| Albany | 1999 | 12 | 24% | No | Yes | No | -0.18 | -0.97 | 0.63 | No |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buffalo | 2000 | 15 | 19% | No | Yes | No | -0.44 | -1.58 | 0.18 | No |
| Rochester | 2000 | 6 | 4% | No | Yes | No | N/A | -0.90 | 0.74 | No |
| Roosevelt | 2000 | 1 | 8% | No | Yes | No | N/A | 0.15 | -0.53 | No |
| Wainscott | 2000 | 1 | 74% | No | Yes | No | -0.25 | -1.17 | -1.14 | No |
| Riverhead | 2001 | 1 | 2% | Yes | No | No | -0.59 | -0.22 | 0.34 | No |
| Kenmore-Tonawanda | 2001 | 1 | 2% | Yes | Yes | Yes | 0.91 | -0.07 | 0.60 | No |
| Troy | 2001 | 2 | 11% | Yes | Yes | Yes | -0.84 | -1.71 | 0.48 | No |
| Lackawanna | 2002 | 1 | 19% | Yes | Yes | Yes | -0.60 | -0.84 | 0.30 | No |
| Syracuse | 2002 | 2 | 5% | Yes | Yes | No | -0.89 | -2.20 | 0.22 | Yes |
| Yonkers | 2005 | 1 | 1% | Yes | Yes | Yes | N/A | 0.42 | 0.14 | No |
| Niagara Falls | 2006 | 1 | 5% | Yes | Yes | No | -0.49 | -1.29 | -0.17 | Yes |
| Hempstead | 2009 | 2 | 7% | Yes | No | No | -0.19 | N/A | 0.56 | No |
| Ithaca | 2009 | 1 | 2% | Yes | Yes | No | 1.13 | -1.04 | 0.83 | Yes |

Source: Number of charter schools and year of establishment are taken from the SUNY Charter School Institute web page (http://www.newyorkcharters.org). Enrollment figures are taken from the Common Core of Data 2010 Public Elementary/Secondary School Universe Survey. Performance measures are taken from the 2010 New York State report cards

Performance is computed by averaging the standard scores for grade 4 ELA, grade 4 math, grade 8 ELA and grade 8 math for each school in New York State. Then, the measurement is converted into standard scores with a mean of zero and standard deviation of one.

Table 1: Charter Districts and Matched Control Districts

| | District | | | | Adjacent Districts Averages | | | |
|---|---|---|---|---|---|---|---|---|
| | **Mean Performance** | **Enrollment** | **Black Population in %** | **Population in Poverty in %** | **Mean Performance** | **Enrollment** | **Black Population in %** | **Population in Poverty in %** |
| **Measurement** | | | | | | | | |
| state mean | 0.00 | 3082.23 | 4.09 | 8.38 | 0.14 | 3487.26 | 4.21 | 8.47 |
| state standard deviation | 1.00 | 4198.70 | 9.29 | 5.22 | 0.46 | 3261.23 | 5.75 | 3.65 |
| **District** | | | | | | | | |
| **ITHACA** | 1.02 | 7620.00 | 7.33 | 7.61 | -0.03 | 1501.25 | 2.17 | 7.88 |
| Control: Saratoga Springs | 0.58 | 7915.00 | 1.48 | 5.68 | 0.06 | 2107.50 | 1.02 | 7.30 |
| Control: Oneonta | 0.65 | 2705.00 | 7.33 | 14.99 | -0.22 | 691.67 | 0.31 | 11.72 |
| **NIAGARA FALLS** | -0.96 | 11075.00 | 28.65 | 19.64 | 0.24 | 4162.86 | 1.13 | 4.40 |
| Control: Binghamton | -0.23 | 8135.00 | 14.47 | 18.34 | 0.41 | 3020.00 | 2.57 | 7.86 |
| Control: Dunkirk | -1.36 | 2610.00 | 5.07 | 24.70 | 0.14 | 1657.50 | 1.11 | 9.72 |
| **SYRACUSE** | -2.17 | 28575.00 | 40.45 | 22.54 | 0.25 | 4193.33 | 2.49 | 5.97 |
| Control: Niagara Falls | -0.96 | 11075.00 | 28.65 | 19.64 | 0.24 | 4162.86 | 1.13 | 4.40 |

All variables are used for the school year 1999

Performance computed by converting mean score of each district in the state into a standard scores with a mean of zero and standard deviation of one using statewide test specific means and standard deviations, and then averaging the standard scores for grade 4 ELA, grade 4 math, grade 8 ELA and grade 8 math.

Any additional measure from the district tabulations of the 2000 U.S. Census

Table 2: Summary Statistics Syracuse

| | Syracuse | | Syracuse | | Niagara Falls | |
|---|---|---|---|---|---|---|
| | All housing sales Syracuse | All housing sales adjacent districts | 1 Mile around the border Syracuse | 1 Mile around the border adjacent school districts | All housing sales Niagara Falls | All housing sales adjacent districts |
| Number of sales | 5,053 | 13,470 | 2,943.00 | 1,481.00 | 2,314.00 | 5,464.00 |
| Sales price in $ | 100,362 | 137,959 | 105530.6 | 144035 | 80,677.15 | 164,411.50 |
| | (52,368) | (73,248) | (44,553) | (78,981) | (39,099) | (78,217) |
| Share condition fair or poor | 0.04 | 0.03 | 0.03 | 0.02 | 0.04 | 0.02 |
| | (0.19) | (0.17) | (0.17) | (0.14) | (0.18) | (0.14) |
| Share condition good or excellent | 0.04 | 0.10 | 0.03 | 0.08 | 0.05 | 0.09 |
| | (0.20) | (0.29) | (0.18) | (0.27) | (0.23) | (0.28) |
| Share no fire place | 0.50 | 0.53 | 0.45 | 0.43 | 0.69 | 0.38 |
| | (0.50) | (0.50) | (0.50) | C(0.49) | (0.46) | (0.49) |
| Share construction grade A or B | 0.05 | 0.06 | 0.04 | 0.09 | 0.06 | 0.16 |
| | (0.22) | (0.24) | (0.19) | (0.29) | (0.24) | (0.37) |
| Share construction grade D or E | 0.16 | 0.13 | 0.12 | 0.11 | 0.00 | 0.01 |
| | (0.36) | (0.34) | (0.33) | (0.32) | (0.02) | (0.08) |
| Share central air condition | 0.15 | 0.27 | 0.19 | 0.34 | 0.37 | 0.24 |
| | (0.36) | (0.44) | 0.39) | (0.47) | (0.48) | (0.43) |
| Average number of full baths | 1.23 | 1.40 | 1.23 | 1.46 | 1.25 | 1.51 |
| | (0.51) | (0.58) | (0.51) | (0.62) | (0.48) | (0.60) |
| Average number of bedrooms | 3.10 | 3.11 | 3.03 | 3.06 | 3.08 | 3.20 |
| | (0.73) | (0.70) | (0.65) | (0.72) | (0.76) | (0.72) |
| Average number square feet living area | 1533.96 | 1580.09 | 1,501.17 | 1,633.74 | 1,367.62 | 1,766.08 |
| | (531.02) | (582.57) | (471.83) | (660.78) | (440.47) | (619.31) |
| Average age | 66.84 | 34.74 | 64.59 | 48.50 | 61.61 | 36.06 |
| | (15.66) | (20.91) | (15.38) | (20.37) | (16.02) | (20.97) |

*Notes:* Prices were deflated to January 2000 dollars using the "CPI Inflation Calculator" from the Bureau of Labor Statistics.

Table 3: Summary Statistics Niagara Falls

| | Niagara Falls | | Niagara Falls | | Dunkirk and Binghamton | |
|---|---|---|---|---|---|---|
| | All housing sales Niagara Falls | All housing sales adjacent districts | 1 Mile around the border Niagara Falls | 1 Mile around the border adjacent school districts | All housing sales Dunkirk and Binghamton | All housing sales adjacent districts |
| Number of sales | 2,314 | 5,464 | 790.00 | 212.00 | 966.00 | 15,966.00 |
| Sales price in $ | 80,677 | 164,412 | 97441.94 | 118223.5 | 89,351.64 | 130,835.90 |
| | (39,099) | (78,217) | (41,239) | (100,389) | (52,203) | (80,980) |
| Share condition fair or poor | 0.04 | 0.02 | 0.01 | 0.03 | 0.12 | 0.07 |
| | (0.18) | (0.14) | (0.11) | (0.17) | (0.33) | (0.26) |
| Share condition good or excellent | 0.05 | 0.09 | 0.10 | 0.01 | 0.07 | 0.07 |
| | (0.23) | (0.28) | (0.30) | (0.10) | (0.26) | (0.26) |
| Share no fire place | 0.69 | 0.38 | 0.63 | 0.58 | 0.70 | 0.54 |
| | (0.46) | (0.49) | (0.48) | (0.49) | (0.46) | (0.50) |
| Share construction grade A or B | 0.06 | 0.16 | 0.11 | 0.24 | 0.06 | 0.10 |
| | (0.24) | (0.37) | (0.31) | (0.43) | (0.23) | (0.30) |
| Share construction grade D or E | 0.00 | 0.01 | 0.00 | 0.00 | 0.08 | 0.06 |
| | (0.02) | (0.08) | (0) | (0) | (0.28) | (0.23) |
| Share central air condition | 0.37 | 0.24 | 0.43 | 0.12 | 0.07 | 0.21 |
| | (0.48) | (0.43) | (0.50) | (0.33) | (0.25) | (0.41) |
| Average number of full baths | 1.25 | 1.51 | 1.26 | 1.33 | 1.24 | 1.40 |
| | (0.48) | (0.60) | (0.49) | (0.54) | (0.48) | (0.58) |
| Average number of bedrooms | 3.08 | 3.20 | 3.04 | 2.92 | 3.11 | 3.11 |
| | (0.76) | (0.72) | (0.62) | (0.72) | (0.87) | 0.7629268 |
| Average number square feet living area | 1367.62 | 1766.08 | 1,350.82 | 1,451.51 | 1,509.62 | 1,607.15 |
| | (440.47) | (619.36) | (411.61) | (609.22) | (476.92) | (594.69) |
| Average age | 61.61 | 36.06 | 53.87 | 46.05 | 67.29 | 47.70 |
| | (16.02) | (20.97) | (17.36) | (19.61) | (16.72) | (22.37) |

*Notes:* Prices were deflated to January 2000 dollars using the "CPI Inflation Calculator" from the Bureau of Labor Statistics.

Table 4: Summary Statistics Ithaca

| | Ithaca | | Ithaca | | Oneanta and Saratoga | |
|---|---|---|---|---|---|---|
| | All housing sales Ithaca | All housing sales adjacent districts | 1 Mile around the border Syracuse | 1 Mile around the border adjacent school districts | All housing sales Oneanta and Saratoga | All housing sales adjacent districts |
| Number of sales | 3,777 | 3,112 | 539.00 | 228.00 | 6,435.00 | 20,833.00 |
| Sales price in $ | 207,012 | 145,009 | 227882.8 | 198390.4 | 257,702.90 | 203,479.60 |
| | (122,708) | (108,677) | (122,426) | (112,922) | (173,751) | (135,591) |
| Share condition fair or poor | 0.03 | 0.06 | 0.02 | 0.01 | 0.05 | 0.04 |
| | (0.16) | (0.25) | (0.13) | (0.11) | (0.21) | (0.20) |
| Share condition good or excellent | 0.43 | 0.28 | 0.43 | 0.49 | 0.12 | 0.18 |
| | (0.50) | (0.45) | (0.50) | (0.50) | (0.32) | (0.38) |
| Share no fire place | 0.48 | 0.71 | 0.40 | 0.51 | 0.48 | 0.56 |
| | (0.50) | (0.46) | (0.49) | (0.50) | (0.50) | (0.50) |
| Share construction grade A or B | 0.15 | 0.08 | 0.13 | 0.20 | 0.18 | 0.11 |
| | (0.36) | (0.28) | (0.34) | (0.40) | (0.39) | (0.31) |
| Share construction grade D or E | 0.11 | 0.17 | 0.10 | 0.20 | 0.05 | 0.08 |
| | (0.32) | (0.38) | (0.30) | (0.40) | (0.22) | (0.26) |
| Share central air condition | 0.16 | 0.05 | 0.19 | 0.13 | 0.43 | 0.26 |
| | (0.36) | (0.22) | (0.39) | (0.34) | (0.50) | (0.44) |
| Average number of full baths | 1.67 | 1.51 | 1.88 | 1.74 | 1.63 | 1.56 |
| | (0.71) | (0.63) | (0.67) | (0.68) | (0.67) | (0.64) |
| Average number of bedrooms | 3.16 | 3.10 | 3.42 | 3.29 | 3.19 | 3.10 |
| | (0.86) | (0.78) | (0.80) | (0.78) | 0.8216371 | 0.8013503 |
| Average number square feet living area | 1681.48 | 1654.07 | 1,897.15 | 1,807.02 | 1,800.00 | 1,662.80 |
| | (659.52) | (607.48) | (650.88) | (640.79) | (693.98) | (627.25) |
| Average age | 48.05 | 44.47 | 36.51 | 36.16 | 35.45 | 37.88 |
| | (26.07) | (26.73) | (20.35) | (24.90) | (27.77) | (27.46) |

*Notes:* Prices were deflated to January 2000 dollars using the "CPI Inflation Calculator" from the Bureau of Labor Statistics.

Table 5: Analysis for Syracuse

| | Syracuse and Adjacent Districts | Syracuse and Adjacent Districts - 1/2 Mile | Syracuse and Control Districts - inl. Adjacent Districts | Syracuse and Adjacent Districts - with Distance Interaction | Syracuse and Adjacent Districts - Income below Median | Syracuse and Adjacent Districts - Income above Median |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Post | 0.0544** | 0.0892* | 0.0114 | 0.0637* | -0.0757 | 0.0748*** |
| | (0.0222) | (0.0457) | (0.0204) | (0.0337) | (0.0550) | (0.0228) |
| Distance | | | | -0.0113 | | |
| | | | | (0.0111) | | |
| Post X Inside | -0.0243 | -0.0351 | -0.0336 | 0.00998 | 0.0597** | -0.0503** |
| | (0.0171) | (0.0231) | (0.0256) | (0.0364) | (0.0274) | (0.0231) |
| Post X Treatment | | | 0.0466*** | | | |
| | | | (0.0146) | | | |
| Post X Distance | | | | -0.00109 | | |
| | | | | (0.00355) | | |
| Inside X Distance | | | | 0.0530 | | |
| | | | | (0.0712) | | |
| Post X Inside X Distance | | | | -0.0139 | | |
| | | | | (0.00871) | | |
| Post X Inside X Treatment | | | 0.00829 | | | |
| | | | (0.0307) | | | |
| Neighborhood Fixed Effects | YES | YES | YES | YES | YES | YES |
| Neighborhood Trend | YES | YES | YES | YES | YES | YES |
| Quarter/Year Fixed Effects | YES | YES | YES | YES | YES | YES |
| Number of observations | 18,517 | 4,423 | 23,379 | 18,517 | 3,451 | 4,429 |
| $R^2$ | 0.605 | 0.571 | 0.606 | 0.606 | 0.440 | 0.629 |

*Notes*: Regressions are estimated with OLS. The post period starts on September 1st of the school year the first charter school opens.

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 6: Analysis for Niagara Falls

| | Niagara Falls and Adjacent Districts | Niagara Falls and Adjacent Districts - 1/2 Mile | Niagara Falls and Control Districts - inl. Adjacent Districts | Niagara Falls and Adjacent Districts - with Distance Interaction | Niagara Falls and Adjacent Districts - Income below Median | Niagara Falls and Adjacent Districts - Income above Median |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Post | 0.126** | 0.133** | 0.151*** | 0.121* | 0.033*** | 0.118** |
| | (0.0460) | (0.0555) | (0.0469) | (0.0665) | (0.0054) | (0.0469) |
| Distance | | | | 0.00359 | | |
| | | | | (0.00966) | | |
| Post X Inside | 0.00987 | 0.0325 | 0.0784 | -0.0109 | -0.0291*** | 0.0139 |
| | (0.0211) | (0.0391) | (0.0568) | (0.0776) | (0.0016) | (0.0105) |
| Post X Treatment | | | -0.0401* | | | |
| | | | (0.0232) | | | |
| Post X Distance | | | | 0.000684 | | |
| | | | | (0.00518) | | |
| Inside X Distance | | | | -0.190** | | |
| | | | | (0.0749) | | |
| Post X Inside X Distance | | | | 0.0282 | | |
| | | | | (0.0194) | | |
| Post X Inside X Treatment | | | -0.0511 | | | |
| | | | (0.0614) | | | |
| Neighborhood Fixed Effects | YES | YES | YES | YES | YES | YES |
| Neighborhood Trend | YES | YES | YES | YES | YES | YES |
| Quarter/Year Fixed Effects | YES | YES | YES | YES | YES | YES |
| Number of observations | 7,772 | 1,001 | 15,953 | 5,507 | 1,294 | 1,792 |
| $R^2$ | 0.618 | 0.688 | 0.565 | 0.642 | 0.548 | 0.644 |

*Notes:* Regressions are estimated with OLS. The post period starts on September 1st of the school year the first charter school opens.

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7: Analysis for Ithaca

| | Ithaca and Adjacent Districts | Ithaca and Adjacent Districts - 1/2 Mile | Ithaca and Control Districts - inl. Adjacent Districts | Ithaca and Adjacent Districts - with Distance Interaction | Ithaca and Adjacent Districts - Income below Median | Ithaca and Adjacent Districts - Income above Median |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Post | 0.0344 | 0.0328 | -0.0311 | 0.747** | 0.0211*** | 0.0164 |
| | (0.0664) | (0.122) | (0.0345) | (0.334) | (0.0041) | (0.0802) |
| Distance | | | | -0.0153** | | |
| | | | | (0.00628) | | |
| Post X Inside | -0.0504 | 0.0421 | -0.0245 | -0.01297 | -0.0191*** | 0.0199 |
| | (0.0417) | (0.0854) | (0.0229) | (0.0292) | (0.0033) | (0.0408) |
| Post X Treatment | | | 0.0476* | | | |
| | | | (0.0286) | | | |
| Post X Distance | | | | -0.00534** | | |
| | | | | (0.00231) | | |
| Inside X Distance | | | | -0.00601 | | |
| | | | | (0.0124) | | |
| Post X Inside X Distance | | | | 0.00560 | | |
| | | | | (0.0138) | | |
| Post X Inside X Treatment | | | 0.0468 | | | |
| | | | (0.0453) | | | |
| Neighborhood Fixed Effects | YES | YES | YES | YES | YES | YES |
| Neighborhood Trend | YES | YES | YES | YES | YES | YES |
| Quarter/Year Fixed Effects | YES | YES | YES | YES | YES | YES |
| Number of observations | 6,876 | 767 | 20,782 | 4,763 | 1,351 | 4,686 |
| $R^2$ | 0.627 | 0.715 | 0.627 | 0.587 | 0.709 | 0.594 |

*Notes:* Regressions are estimated with OLS. The post period starts on September 1st of the school year the first charter school opens.

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1