

ANDREW YOUNG SCHOOL
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Paying for priority in school choice: Capitalization effects of charter school admission zones

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Abstract: We exploit a unique characteristic of some charter schools in the metropolitan Atlanta area to identify property value capitalization of access to charter schools. The charter schools in this study designate small geographic areas within their attendance areas as priority zones. Each of the study charter schools has at least two priority zones: households located in priority one zones have a higher probability of admission than households located in priority two zones. We use this spatial variation in the likelihood of attending a charter school to identify the capitalization effect of increased charter school admission probabilities as the difference-in-differences within priority zone one and two border areas. Our results indicate that prices increased by six to eight percent for priority one zone homes compared to priority two zone homes after the opening of a new charter school. We also find that capitalization is stronger for homes with underperforming traditional public schools.

Keywords: charter schools; property value capitalization; school choice; hedonic difference-in-differences

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1. Introduction

Charter schools represent a special version of public schools that are allowed more novelty in their educational approach, while still being held accountable for student achievement. Similar to traditional public schools, charter schools are open to all students, charge no tuition, and have no particular enrollment requirements. Charter schools were designed to improve the US public school system as well as offer parents more choice in their children's education. The number of charter schools in the United States has been on the rise since the early 1990s. According to the National Alliance for Public Charter Schools, the number of charter schools in the US has increased from 1,500 in the 1999-2000 school year to more than 6,000 in the 2012-2013 school year² This growth in the number of charter schools and enrollees is part of a larger trend in the United States towards more school choice, which also includes inter- and intra-district choice programs, school voucher programs, magnet schools, and private schools.

A significant body of evidence on changes in home values associated with school choice suggests home buyers value it. Yet only a handful of these studies investigate the effect of charters schools on housing values. The charter school findings are largely inconclusive, with some studies finding a positive effect (Shapiro and Hasset 2013, Buerger 2014), and others finding no significant effect (Brehm et al. 2016, Horowitz et al. 2009). As a result, it is unclear how the general public values the school choice option of charter schools.

We address the void in the literature by analyzing charter schools with multiple admission priority zones within their designated attendance areas. Each charter school in this study designates several geographic areas within its attendance area as priority zones. Students

² The metropolitan Atlanta charter schools in this study are located in the state of Georgia, which experienced an increase in the number of charter schools 18 in 1999-2000 to over 100 in 2012-2013. This increase in the number of Georgia charter schools in 2012-2013 does not include schools in a charter system, as they are not comparable to the two types of charter schools included in the count by the National Alliance for Public Charter Schools - conversion and start-up.

applying for admission and residing within a charter school's designated priority zones receive admission offers with different probabilities. Priority one zone applicants have the highest probability of admission, priority two zone applicants the next highest, and so on. These priority zones establish a strong link between geographic location and charter school attendance that contrasts with the decoupling of location and attendance that is characteristic of most school choice programs. We use the discontinuity in admissions probabilities between priority one and priority two zones to estimate the capitalization effects of the increased charter school admission probability conferred by location within priority one zones.

Our empirical strategy compares homes on either side of shared priority one and two zone borders for the metropolitan Atlanta charter schools with priority zones. We present estimates identified by the difference in pre- and post- charter school opening sales prices for priority zone one and two homes within the same border area as well as a repeat sales specification. Our results indicate that prices rose by six to eight percent for priority one zone homes compared to priority two zone homes after the opening of a new charter school. We also find that the priority one zone capitalization is negatively related to the home's traditional public school performance.

Our results indicate that families value school choice in the form of charter schools since they are willing to pay a premium to live in neighborhoods with higher probability of charter schools admission. This study presents the strongest evidence on the importance of charter schools' accessibility to local communities so far, analyzing a longer time period with a more stringent empirical strategy than the handful of existing charter school studies. We also contribute to the broader school choice literature by estimating the capitalization effects of geographically-based increases in admission probabilities. We are aware of only one other study that examines a school choice option of this type – one that strengthens (rather than weakens) the

link between residential location and school attendance. We provide the only evidence (of which we are aware) that relates the capitalization effects of higher probability of admission to the performance of homes' traditional public school.

The remainder of the paper is organized as follows. Section 2 discusses the existing literature on the effects of school choice on residential property values, and describes in detail the sample of charter schools in our analysis. Section 3 lays out the empirical approach, and describes data. Section 4 presents the main results. Section 5 concludes.

2. Background

Charter schools are publicly funded alternatives to traditional public schools in their attendance areas and are a form of school choice. Parents choose whether to enroll their students in their designated traditional public school or to send their student(s) to a charter school if they reside in the schools attendance area. Charter schools are managed by independent operators under a contract with the local authorizing agency, typically the local school board or state educational agency. They are permitted substantially more operational and programmatic flexibility than traditional public schools. For examples, charter schools may require longer school days than customary under traditional public school regulation or deviate from state mandated curriculum. In a sense, charter schools operate similarly to private schools. The differences between charter schools and private schools are two-fold. Charter school attendance is publicly-funded and charter schools exchange their increased flexibility for increased accountability. Charter schools are subject to public oversight and are typically governed by a board of parents and teachers. Charter contracts may be revoked if governing or oversight entities determine the school underperforms with respect to student achievement.

Although there is a substantial literature on charter schools and student outcomes, there is little evidence on the relationship between charter schools and property values. There is a long

history of research documenting the capitalization of school quality, school choice, and public investments into property values (Brunner et al. 2012, Chung 2015, Reback 2005, Schwartz et al. 2014, Brunner and Sonstelie 2003, Nechyba 2000, Fack and Grenet 2010, Cannon et al. 2015, Merrifield et al. 2011, Bonilla et al. 2015, Walden 1990, Brehm et al. 2016, Shapiro and Hasset 2013, Buerger 2014, Horowitz et al. 2009). If households value the charter school option, charter schools' performance exceeds that of traditional public schools, charter schools improve traditional public school performance through competition, or charter schools represent a significant investment in valuable public facilities, then it would be reasonable to expect charter schools to have a positive effect on property values as well. Despite the dearth of evidence on charter schools specifically, the notion that they could influence property values through their option value or through their effect on traditional public schools is supported by a number of studies that find various forms of school choice significantly affect property values in the areas in which they are implemented.

2.1 School Choice and Property Values

School choice comes in a variety of forms, but choice programs generally share the characteristic of weakening the link between residential location and school attendance. Inter- and intra-district programs allow parents to choose an alternative traditional public school from the one servicing the attendance area in which the household resides. Voucher programs are publicly-funded programs that provide students with an opportunity to attend private schools by paying some portion of their tuition (National Conference of State Legislatures). Magnet schools represent type of public school with a concentration in certain curricula, such as STEM, Fine and Performing Arts, International Studies, World Languages, etc. (Magnet Schools of America). Charter schools combine elements of all these forms of school choice. It is therefore reasonable

to expect charter schools to have similar effects on property values as programs with shared characteristics.

Studies evaluating the impact of inter- and intra-district choice establish that property values reflect households' positive valuation of access to better performing schools (Brunner et al. 2012; Schwartz et al. 2014), but also that choice decreases the premium associated with living in the best performing school attendance areas. For example, Chung (2015) discovered that inter- and intra-district school choice in Seoul, Korea led to a decrease in housing values in better-performing school districts of 10-27% relative to housing values in worse-performing school districts, while Reback (2005) documents that inter-district school choice in Minnesota led to an increase in property values in school districts from which students are able to transfer to a different school and decreases in those school districts that accept a lot of transferring students.

The literature on school voucher programs documents a similar relationship, with property values reflecting households' positive valuation of choice and a decline in the premium for superior quality schools (Nechyba 2000; Brunner and Sonstelie 2003; Fack and Grenet (2010); Merrifield et al. 2011; Cannon et al. 2015). Nechyba (2000) demonstrates the mechanism through which school choice programs diminish existing positive relationships between public school quality and property values. Nechyba shows that universal vouchers for private schools located in low-income districts lead to an increase in housing prices in those districts due to the migration of high- and middle-income families looking to take advantage of relatively lower housing prices. This sorting of households into relatively less expensive neighborhoods with access to better schools through choice programs also explains the Brunner et al. (2012) finding that districts in close proximity to desirable out-of-district public school options experience a significant increase in residential property values after the introduction of inter-district choice. .

The magnet school alternative to traditional public schools also appears to have a similar effect on property values by providing a valuable choice option and decoupling access from residential location. Echoing Nechyba (2000) and Fack and Grenet (2010), Walden (1990) demonstrates that the presence of a magnet school in Wake County, North Carolina reduced the capitalized value of traditional public schools quality in the school district, especially for elementary schools. Bonilla et al. (2015) show that households' positive valuation of the magnet school choice option is positively capitalized into property values. In the only other study of geographically-based admission probabilities for a school choice option, Bonilla and coauthors find that higher probability of admission to Chicago magnet schools increased housing values in those areas by 5.4%.

Charter schools similarly introduce an alternative choice to traditional public schools. In the few existing studies, researchers estimate property value capitalization of charter schools without catchment areas or with dispersed geographic attendance areas (Brehm et al. 2016, Shapiro and Hasset 2013, Buerger 2014, and Horowitz et al. 2009). Charter school admission is not strongly tied to residential location. Based upon the aforementioned findings for school choice programs that weaken the relationship between geographic location and school quality, one might expect access to a new charter school to increase property values in neighborhoods with underperforming schools and be negatively capitalized in neighborhoods with high quality schools. The latter effect could be offset by positive valuation of the option by all households. However, Brehm et al. (2016) and Horowitz et al. (2009) find no significant relationship between charter schools and housing values. Horitz et al. rely upon variation in the distance within a few miles of Lucas County, Ohio charter schools to identify the property value capitalization effects. The resulting small sample and limited variation in charter school access could explain their “no

effect” result. Brehm et al. (2016) have a larger sample of Los Angeles County, California sales, but identification relies on within Census Block variation in charter school penetration (number of charter schools within close proximity to the home) over a very short time horizon centered on the Great Recession. The Horowitz et al. and Brehm et al. findings indicate household valuation of the charter school option differs from other school choice initiatives discussed above. On the other hand, , Shapiro and Hasset (2013) and Buerger (2014) find that choice is positively capitalized when charter schools are the alternative, similar to the findings for other forms of school choice, but with weaker identification. Shapiro and Hasset estimate that the expansion of charter schools in New York City between 2002 and 2013 Granger-causes a 3.84% increase in the median sale price at the zip code level. Buerger compares housing values in upstate New York school districts with new charter schools to similar districts without charter schools. Using a difference-in-differences estimator, Buerger finds that increases in charter school penetration increase property values within Census Tracts.

We provide stronger evidence on the importance of charter schools' accessibility to local communities by analyzing charter school access over a longer time period with a more stringent empirical strategy than any of the existing studies. We also contribute to the broader school choice literature by estimating the capitalization effects of a school choice option that strengthens (rather than weakens) the link between residential location and school attendance. We focus on charter schools with a unique feature tying residential location with access to the charter school. As discussed in detail below, we examine charter schools with well-defined attendance areas and small, geographic areas designated for priority admissions within those attendance areas. Similar to the aforementioned Bonilla et al (2015) study of Chicago magnet schools, these priority zones are associated with differential probability of gaining admission to

the charter school. We use the discrete change in the probability of admission between zones and focus on homes located within close proximity to the border between priority one and priority two zones, thereby minimizing potentially countervailing effects or confounding unobservables. The next section describes the charter schools and priority zones that we study in more detail.

2.2 Metro Atlanta Charter School Priority Zones

The charter schools in this study operate within metropolitan Atlanta under Georgia guidelines governing charter schools. There are three types of charter schools in Georgia: conversions, start-ups, and schools in a charter system. Charter systems, i.e. school districts operating under a contract between the local board and the state board of education are relatively new and unique to Georgia. Further, conversion to a charter system does not necessarily lead to a substantive change in school operations or governance nor do charter systems provide the same level of choice as the two more common types of charter schools. As such they are not included in our analysis and our results should not be extrapolated to schools in charter systems. Conversion charters are existing traditional public schools that convert to a charter school after a vote by the faculty and parents. Start-up charters, as the name implies, did not exist prior to being authorized and are created by a petition brought forth by individuals, private organizations, or a state or local public entity. Conversion and start-up charter schools operate under contracts with the local school districts that specify the school enrollment cap, attendance zones – the geographic area from which students may be drawn – and enrollment priorities. In Georgia, charters schools may also define priority zones within the charter’s designated attendance zone. The designation of priority zones confers different probabilities of gaining admittance to a charter school to applicants residing in different geographic areas within the school’s attendance area. Priority one status for conversion charters is generally the attendance boundary designated by the local school board, with the entire local school district comprising the attendance zone. Start-up charters have substantial flexibility in setting attendance areas and priority zones. Only a subset of Georgia schools designate priority zones and currently all that do so are located in one of three metropolitan Atlanta local

public school districts – the Atlanta Public Schools District, the Fulton County Schools District, or the DeKalb County Schools district.

Appendix Table A1 details the priority zones, year opened, and grades served by each of the metropolitan Atlanta charter schools with priority zones. Kingsley Charter Elementary and North Springs Charter High School are both conversion charter schools and have two designated priority zones. The remaining schools are start-up schools with at least three priority zones. The Atlanta Neighborhood Charter Schools, Charles Drew Charter School, and The Museum School of Avondale Estates were created through local parent-driven initiatives. KIPP, a nationwide charter school organization, worked with local parents to open its six metro Atlanta charters. The start-up charter school priority zones do not necessarily align with the school attendance boundaries set by the public school system for traditional public schools. For example, the priority one zone for KIPP STRIVE Academy is the 30310 zip code -- a relatively arbitrary boundary in terms of variation in neighborhood and housing attributes.

Figure 1 maps the priority one zone for each of the charter schools listed in Table A1. Figure 1 reveals that priority zone boundaries do not necessarily align with municipal boundaries, with some schools' priority one zones including multiple municipalities and others lying completely within one municipality's boundaries. It should also be clear from Figure 1 that charter schools do not locate at random. The schools vary in their origins as well as their target populations. Location choice and priority attendance areas reflect this variation. The KIPP schools, for example, are clustered near one another, both because of economies of scale in management from the national organization and because target populations are clustered in that area. The non-random nature of charter school location creates a challenge for identifying capitalization of charter schools into property values. Figure 2 depicts the annual mean sales price for priority one

zone single-family residential homes as well as the overall mean for Fulton and DeKalb Counties.³ It reveals that a naive comparison of priority one zone property values would likely suggest negative capitalization attributable to charter school priority zones disproportionately located in lower value areas.

³ The City of Atlanta and all study charter schools are entirely contained within Fulton and DeKalb Counties.

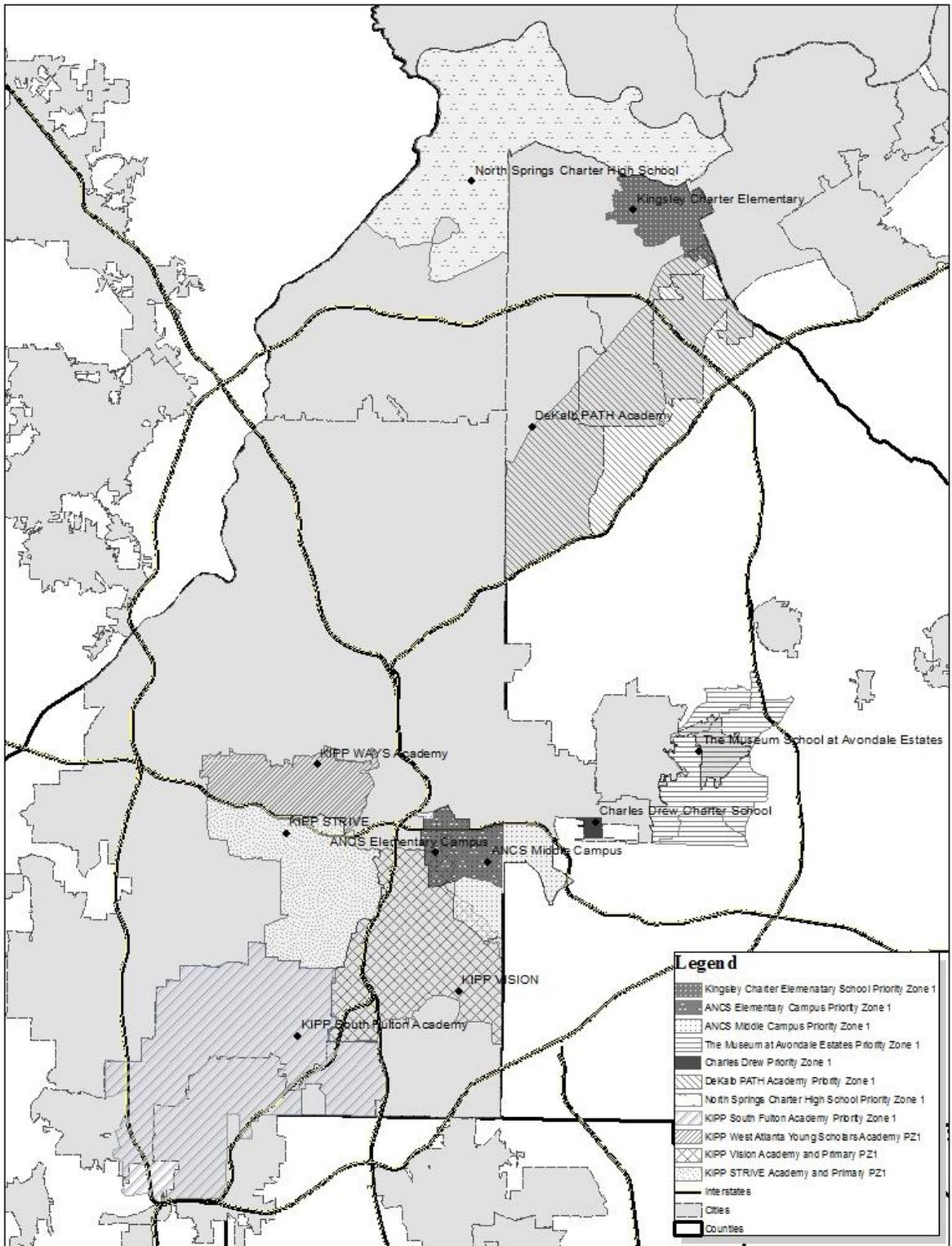


Figure 1: Priority One Zone Map - Atlanta metro area

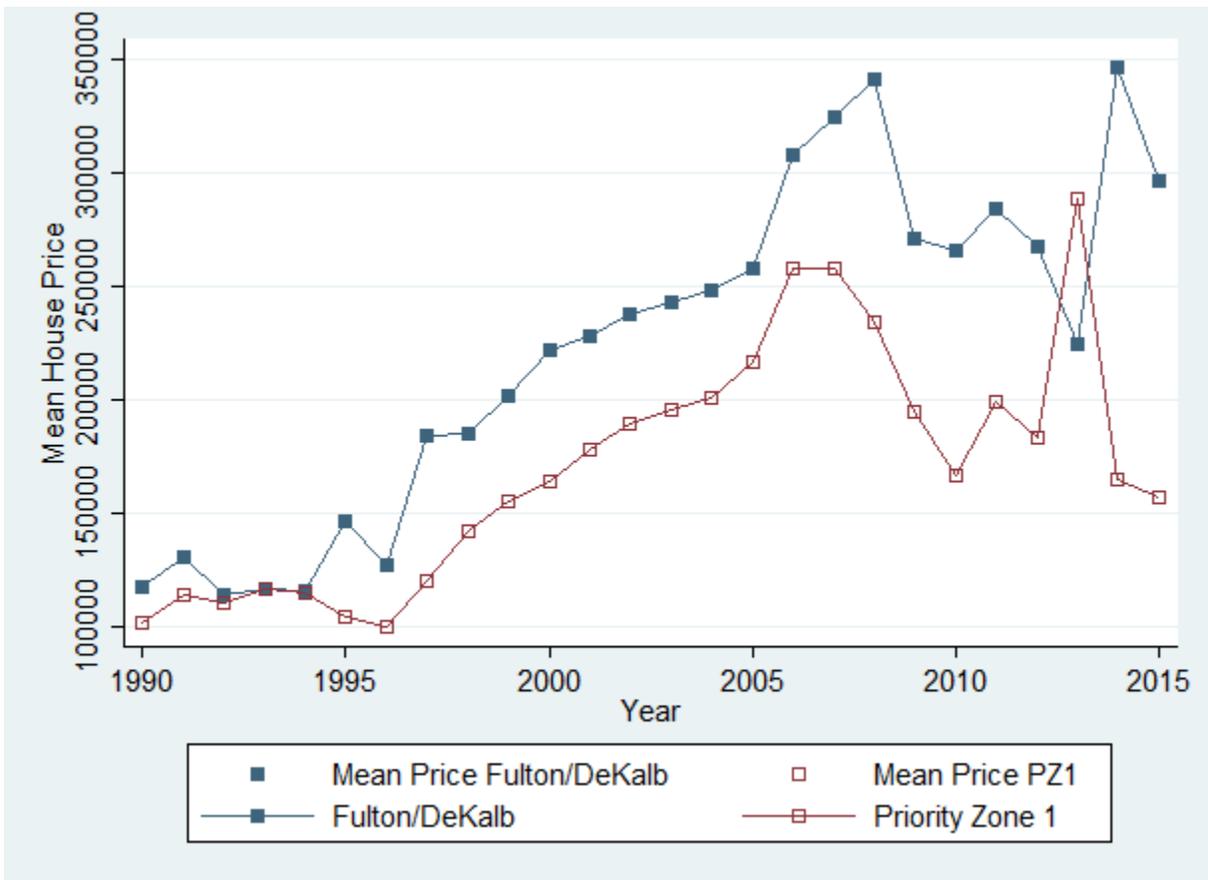


Figure 2: Annual Mean Sales Price Comparison - Priority One Zone, Fulton County and DeKalb County.

It is for this reason that our analysis focuses on properties located close to the border between priority one and priority two zones for each charter school. The priority one and two zones for DeKalb Path Academy are not adjacent, but otherwise priority two zones share a border with the priority one zones. We use that shared border to identify properties treated with priority one status and counterfactual properties as nearby homes with priority two status. DeKalb PATH is not included in our analysis. In some cases, priority one zones for different charter schools overlap. We discuss how we address those areas in more detail in the data section below.

As discussed above, priority zones confer different probabilities of gaining admission to the charter school. Charter schools set enrollment caps that dictate the maximum number of students

per grade level. Returning students, siblings of returning students, children of full-time employees, and children of governing board members typically receive first priority in allocating available slots in each grade. Although there is some variation across schools, the remaining available slots are filled by priority one zone applicants, priority two zone applicants, priority three zone applicants, and so on. If there are more applicants than available slots, then a random lottery of applicants determines which applicants receive offers of admission. The following summarizes this process for priority one and priority two zones (Patrick 2015):

i) If applications for students residing within the priority one zone exceed available slots, then a random lottery selects applicants from priority one zone applicants only. All applicants living within the priority two zone are waitlisted, with waitlist order determined by random lottery.

ii) If applications from students residing within the priority one zone do not exceed available slots but the combined number of priority one and two applicants does, then either

a. Priority one applicants receive offers of admission and a lottery determines admission offers and waitlist order for priority two applicants; or,

b. Priority one and two applicants are pooled in the lottery to determine admission offers and waitlist order.

iii) If priority one and two applicants do not exceed available slots but the total number of applicants from the designated attendance area exceeds available slots, then priority one and two applicants receive offers of admission. A random lottery determines admission offers and waitlist priorities for remaining applicants.

The admission probability conferred by living in the priority zones varies by school, grade, and year. Kingsley Charter Elementary School and North Springs Charter High School are

outliers in this process because they are conversion charters. Priority one zone students are guaranteed admission. If school capacity has not been reached, zone two applicants will receive admission offers by lottery until the enrollment cap.⁴ The admission probability associated with living in the priority one zone is therefore one, and less than one for priority two zone residents.

Similarly, Figure 1 reveals that the start-up charter school Charles Drew priority one zone covers a very small geographic area. There are, consequently, a small number of households in the Charles Drew Charter School priority one zone relative to the average number of available slots below the enrollment cap. The Charles Drew admission process implies a probability of one for zone one applicants. The probability for Drew priority two zone two residents varies from year to year, with Drew reporting no lottery for the 2009-2010 school year (implying a probability of one) and lotteries in subsequent years (implying a probability of less than one).⁵ Thus, at least in expectation, there is a discrete change in probability for households in Drew priority zones one and two.

Atlanta Neighborhood Charter Schools (ANCS), on the other hand, report regularly receiving more applicants from priority one zone students than available slots in some grade-years. As noted above, a lottery determines which zone one applicants receive admission offers when there are more applicants from zone one than available slots. In this case, the zone one admissions probability is less than one (for oversubscribed grade-years) and zero for priority two zone applicants. In other grade-years, ANCS did not receive more applicants from zone one than available slots. In this case, all zone one and two applicants are pooled in the lottery, with equal

⁴ According to information provided by the school, Kingsley has not had available lottery slots for zone two applicants in recent years. The conversion of North Springs Charter High School to a school in a charter system (from a conversion charter school) that began in 2014 eliminates zone two effective probabilities of admission outside the magnet programs.

⁵ For example, the 2014-2015 Pre-K lottery admitted 108 applicants and waitlisted 168, implying an acceptance probability of 0.39.

probability of being chosen. Parents cannot know a priori whether there will be more applicants for their student's grade level from zone one than available slots. The expected probability of admission for ANCS zone one applicants therefore is higher than the expected probability for zone two applicants, but still less than one.

3. Empirical Implementation

3.1 Empirical Strategy

As noted above, charter school priority zones are not randomly located across space and thus the potential for biased estimates arise to the extent that unobservable attributes of the homes or neighborhoods determining treatment (charter school priority zone designation) also influences sale price. Our empirical strategy minimizes this risk by comparing the change in sale prices for homes located within close proximity to the border between priority zones one and two. Homes located near the shared border should be similar with respect to unobservable attributes such as access to employment opportunities, transportation networks, parks, and shopping and dining, the neighbors with whom residents interact, etc. It is reasonable to expect that homes become more similar as they become closer in space. Defining "close" as a very small distance from the border therefore has the advantage of comparing similar homes, but at the cost of decreased sample sizes and loss of information from other home sales in the area. Our primary results define "close" as being within 0.3 miles of the shared border, which we believe balances the trade-off between minimizing unobserved heterogeneity and sample size. We also present estimates for "close" defined as 0.1 miles and 0.5 miles, although we interpret the 0.1 mile results with caution.

We are interested in the "causal" or "capitalization" effect of the increased probability of gaining admission to the charter school conferred by being located in a priority one zone. We

therefore adopt a standard strategy in the literature and estimate the following hedonic difference-in-differences for the change in the log of sales price y for single-family house i border area j at time t :

$$(1) \quad y_{ijt} = \beta' X_{it} + \delta 1(PZ1)_{ij} + \kappa 1(\tau > 0)_{jt} + \theta [1(PZ1)_{ij} \times 1(\tau > 0)_{jt}] + \alpha_j + \mu_t + \varepsilon_{ijt}$$

where X_{it} is a vector of observable characteristics of house i , α_j is a vector of border area indicator variables, μ_t is a vector of quarter-year fixed effects, $1(PZ1)_{ij}$ is an indicator variable equal to one for homes located on the priority zone one side of shared border j , $1(\tau > 0)_{jt}$ is an indicator equal to one for t being after the charter school opened, and τ is year normalized such that $\tau = 0$ in the charter school opening year for each school.⁶

Our parameter of interest is θ , the average change in sale prices for priority one zone homes due to the charter school opening, which we refer to as the capitalization effect. This effect is identified by comparing the difference in pre- and post- charter school opening sales prices for priority zone one and two homes within the same border area while controlling for observable characteristics and common quarter-year shocks to sale prices.

Threats to identification arise to the extent that the specification does not account for unobservables correlated with sales price and treatment (priority one zone status and charter school openings). Our vector of observable characteristics includes measures of house size, lot size, bathrooms, bedrooms, age, condition of the home, fireplaces, garages, and recent renovation (see Table 1 for descriptions for how these variables are measured). It also includes measures of the number of nearby distressed transactions within the last six months. The border area fixed effects control for other unobservable characteristics such as access to employment opportunities, transportation networks, parks, and shopping and dining, the neighbors with whom

⁶ We use an indicator for the discrete change in probability at the border rather than the actual probabilities for admission in priority one and priority two zones, which are ex post outcomes of the residential sorting process.

residents interact, etc. The priority one zone indicator absorbs unobservables common across areas designated as priority one zones (as opposed to priority two). Unobservables may still pose a threat, though, through at least three channels.

The first channel is through unobservable differences in house characteristics. In particular, the concern is that the sample of sales in the post-treatment areas (or, equivalently, in the counterfactual areas or pre-treatment period) is composed of homes with unusually high or low values of these unobservable characteristics. This “sample selection” problem, as it is commonly referred to in the literature, introduces the potential for omitted variable bias that is typically addressed by using repeat sales (McMillen 2012). We follow the literature and our primary results use a repeat sales version of Equation (1). We present the repeat sales estimates alongside estimates from Equation (1) to allay any concerns that homes selling multiple times during the sample period may not be representative of typical homes in the area.

Recent critiques of the hedonic difference-in-differences estimation identify a second channel through which unobservables may threaten identification of θ as the capitalization effect of treatment—changing hedonic price functions over time or as a result of treatment (Klaiber and Smith 2013; Kuminoff and Pope 2014). Hedonic equilibria occur across space within a single time period. Hedonic difference-in-differences therefore compare prices from two (or more) equilibria in which treatment or changes in the underlying economic environment may have altered the hedonic price function (Banzhaf 2015). Critiques of hedonic difference-in-differences suggest the resulting estimates do not identify the capitalization effect because they mix information from two (or more) equilibria and information on treatment. More recently, Banzhaf (2015) provides fairly weak conditions under which difference-in-differences hedonic estimates identify the direct (unmediated) effect of treatment. It is this effect that we will refer to

as the capitalization effect of priority one zone increases in the probability of charter school admission.

We estimate capitalization using a pooled cross-section of single-family, residential homes as well as repeated sales of single-family, residential homes. Our data do not provide detailed characteristics on the home buyers. Bayer et al. (2007) poignantly demonstrate that households sort across borders in response to changes in school quality and that estimates of willingness-to-pay for school quality include the value of school quality as well as the value of changes in resident characteristics. If neighborhood composition changes in response to priority one zone status after charter school openings, then our capitalization estimates also include changes in price associated with and increase in the number of neighbors who value increased admission probability.

3.2 Data

The housing price data cover all transactions from 1990 to 2015 for Fulton and DeKalb counties in Georgia, all parts of Atlanta metro area. We assign a precise geographic location to all properties in our sample by mapping them into GIS parcel data for Fulton and DeKalb counties. As discussed above, we chose Georgia as our study sample because some of its charter schools have designated priority attendance zones, a characteristic that sets our sample of charter schools apart from samples used in previous studies. We use charter schools serving elementary, middle and high schools.

Figure 1 represents part of the Atlanta metro area used in our analysis. Using Fulton and DeKalb counties' parcel data, which include geographic coordinates, we matched housing transactions to charter schools' priority zones.

The charter schools for the analysis were selected based on whether they had at least two priority attendance zones. The priority zones were determined from the approved school charters provided by the Georgia Department of Education. The maps were obtained as either JPEG or PDF files directly from schools' websites, or provided as GIS shapefiles by the Atlanta Regional Commission.

We generated buffer areas on each side of the border between priority zones 1 and 2 of each charter school in the sample. We created 0.1, 0.3, and 0.5 mile buffers for each set of priority zones. We intersect the buffer zones, priority zones, and parcels to create our samples of border area transactions. Figure 3 represent an example of charter schools' priority zones and corresponding buffers in our sample.

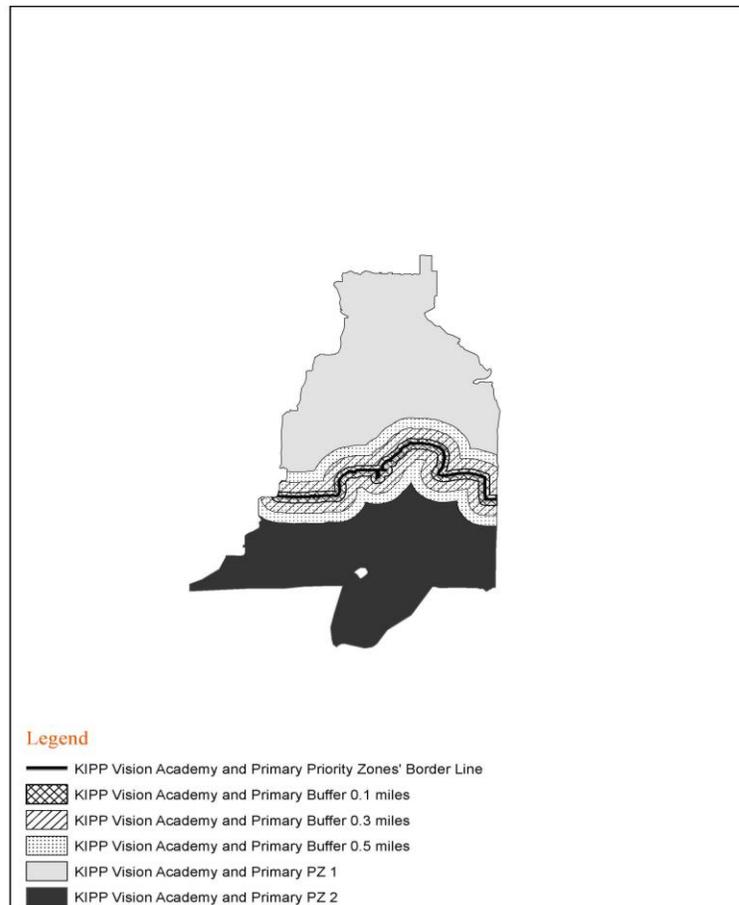


Figure 3: Example of Charter School Priority Zones and Corresponding Buffers

We exclude all single-family residences located in more than one charter school priority one zone as they are not immediately comparable to the rest of the houses in the sample. For example, in Figure 4 part of the Atlanta Neighborhood Charter School middle campus priority one zone overlaps with the KIPP Vision Academy priority one zone. As a result, families residing in properties located at the intersection of two priority zones, indicated by black dots, are eligible for acceptance into either Atlanta Neighborhood Charter School (ANCS) middle school, or KIPP Vision Academy, which is also a middle school. Not only are homes in these areas treated with multiple charter school priority one zones, the counterfactuals in the border areas are also treated with priority one zone admission probabilities from another charter school. We exclude 3,327 single-family, residential fair market sales that occur from 1990-2015 in the overlapping priority one zone 0.3 mile border areas.

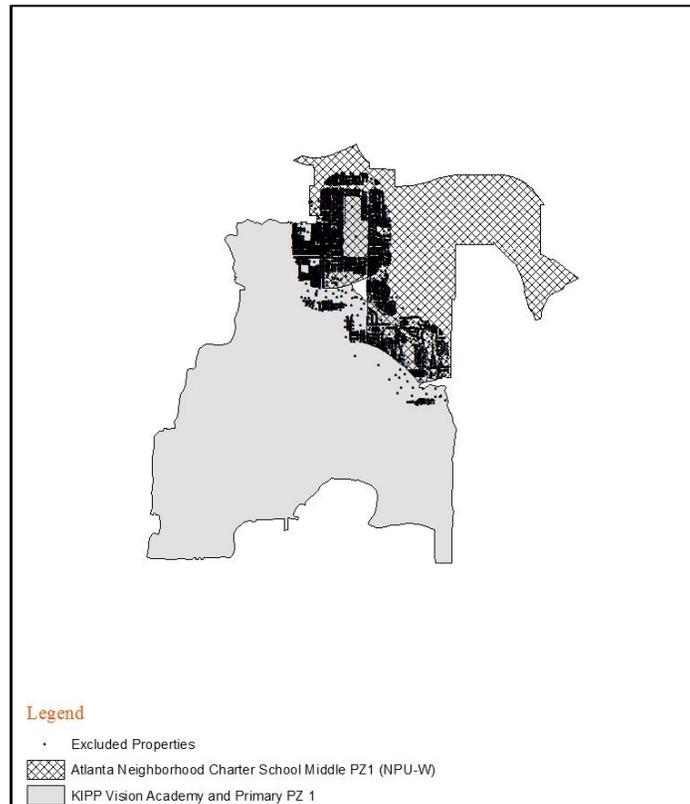


Figure 4: Atlanta Neighborhood Charter School Priority Zone 1 and KIPP Vision Academy Priority Zone 1

The housing price data comes from DataQuick. The sample within 0.3 miles of the priority one and two zone borders consists of 28,654 single-family residential sales within the charter schools' attendance boundaries. The sample of repeated sales consists of 22,860 single-family residences within the attendance boundaries of the same charter schools.

Our data include controls for other housing characteristics such as number of bedrooms and bathrooms, house and lot square footage, age of the building, presence of fireplace and garage, presence of recent renovations, number of distress transactions in close proximity, and dummy variables for whether the house is in below, at, or above the average condition as determined by the county assessor. Table 1 presents the pretreatment means for sale price and control variables for the sample of transactions within the 0.3-mile border areas and 0.5-mile border areas for the charter schools priority zone boundaries. Table 1 also contains the p-values for t-tests of the difference in treatment and control means for each characteristic. We fail to reject the null hypothesis of equal means for all characteristics, including sales price. This suggests that our border area strategy achieves the goal of minimizing differences between treated and control groups.

Table 1: Difference in border area pretreatment means

Variable	<u>0.3 mile area</u>			<u>0.5 mile area</u>		
	Treated	Control	p>t	Treated	Control	p>t
(log) Sale Price	11.59	11.46	0.634	11.67	11.50	0.495
Square feet	1,659	1,637	0.943	1,710	1,644	0.823
Lot size (sq. ft.)	16,335	12,523	0.307	15,157	12,998	0.486
Bathrooms	1.89	1.91	0.953	1.98	1.94	0.91
Bedrooms	2.97	2.94	0.902	3.01	2.99	0.929
Age	45.71	42.57	0.685	42.70	41.61	0.896
Fireplace	0.33	0.46	0.511	0.34	0.50	0.374
Garage	0.06	0.05	0.719	0.07	0.09	0.663
Recent Renovation	0.05	0.04	0.529	0.06	0.04	0.311
Below Avg. Condition	0.03	0.03	0.864	0.03	0.03	0.897
Above Avg. Condition	0.08	0.17	0.246	0.09	0.18	0.235

Distress Sales within 0.1 m	26.62	25.69	0.943	27.92	26.64	0.918
Distress Sales within 0.25 m	2.55	2.30	0.855	2.66	2.51	0.903
Distress Sales within 0.5 m	8.18	7.97	0.961	8.51	8.32	0.964

It is plausible that homebuyers will value eligibility for charter school enrollment even more if they reside in the attendance zone of a relatively underperforming traditional public school. To test this notion, we add an interaction between $[1(PZ1)_{ij} \times 1(\tau > 0)_{jt}]$ and a measure for the quality of homes' traditional public schools⁷ to our empirical specification. We spatially match each housing transaction to its designated public elementary, middle, and high schools. School attendance boundaries change over time and we obtained data on the boundary changes directly from the local school districts. Our proxies for school quality are Criterion-Referenced Competency Tests (CRCT) in English, Reading, and Math for elementary and middle schools, and End of Course Tests (EOCT) in Algebra and English Composition for high schools from 2004 to 2013.⁸ CRCT was a state-wide assessment performed every year on students in grades 1 through 8. EOCT was largely used for high school accountability assessment. We acquired CRCT and EOCT results from the Georgia Governor's Office of Student Achievement for every public school in Fulton and DeKalb counties. Specifically, the data show the mean percent of students who did not meet state standards, mean percent of students who met the state standards, and mean percent of students who exceeded the state standards in a particular subject. CRCT means were calculated across grades in elementary and middle schools, grades 3 through 5 and 6 through 8, respectively. EOCT means were calculated across grades in high schools (grades 9 through 12). In addition, the data delineate CRCT and EOCT results by race and income. All performance means were calculated at the school level. The school performance measure is

⁷ I.e. the public schools students would have to attend if they did not get accepted in the charter school.

⁸ Both CRCT and EOCT programs were discontinued at the end of the 2013-2014 school year, and replaced with Georgia Milestones Assessment System (Georgia Department of Education). CRCT program did not exist prior to 2004.

assigned to housing transactions for the traditional public school servicing the same grade level as the charter school for the transaction. For example, the performance measure for a home within the KIPP Vision Academy boundary area is the performance for the middle school that students in that home would otherwise attend. In practice, we present results for performance separately measured as the percentage of all, black, or economically disadvantaged students failing to meet math standards. Results using measures for reading and literature were quantitatively and qualitatively similar.

Do charter schools in our sample perform better relative to the traditional public schools located in the same attendance zone? Figures A1 and A2 in Appendix illustrate the relative performance of charter schools and corresponding traditional public schools in 2004-2013. Figure A1 depicts the annual mean percentage of all students failing to meet math standards as measured by CRCT and EOCT scores for charter schools and traditional public schools. Figure A2 shows annual similar mean percentages for a subsample of black students. Both figures reveal that a naive comparison of test scores suggests fewer students failed math CRCT and EOCT in charter schools than in surrounding traditional public schools.

4. Results

Table 2 presents the estimated change in single-family, residential home sale price in priority one zones after the corresponding charter school opening as compared to the change in price for homes in priority two zones within the same 0.3 mile border area. Column (1) reports the hedonic difference-in-differences estimator θ from Equation (1). Column (2) adds additional city and county fixed effects to Equation (1). Column (3) contains the results from the repeat sales specification. The Table 2 estimates indicate sales prices increased for homes with the greater probability of charter school admission conferred by priority one zone status. The repeat sales

estimated increase of 8.86% (Column 3) is slightly larger than the 7.26% increase from estimating Equation (1). This suggests that homes with slightly lower valued unobservables may comprise a larger share of post-period sales; however, the values are statistically similar and indicates that our sample of repeat sales resemble the typical homes in the area. As noted above, the repeat sales estimator removes “sample selection” concerns and is therefore our preferred estimate.

Table 2: Estimated priority one zone capitalization within 0.3 mile border areas

	(1)	(2)	(3)
PZ1 Capitalization	0.0726*** (0.0180)	0.0535*** (0.0182)	0.0886*** (0.0221)
Housing Characteristics	Y	Y	N
Distress Measures	Y	Y	Y
Border Area FE	Y	Y	N
Quarter-Year FE	Y	Y	Y
City/County FE	N	Y	N
Observations	27,319	27,319	21,767
R-squared	0.593	0.598	0.783

Notes: The table presents results from three separate regressions. Column (1) is the hedonic difference-in-difference for priority one zone sales prices after charter school opening compared to priority two zone home sales in the same 0.3 mile border area. Column (2) adds additional city and county fixed effects to the Column (1) specification. Column (3) contains the results from the repeat sales difference-in-differences specification. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Given the mean pretreatment sales price for priority one zone homes within 0.3 miles of the border, Table 2 suggests priority one zone prices increased by \$8,845-\$13,470 in the period following charter school openings. If homebuyers spend more for priority one zone homes, it implies that households value the choice, flexibility, and accountability that characterize charter schools. In this context, it is important to note that the change in priority one zone sale prices is being compared to the change in priority two zone prices. Households in priority two zones lie within the charter school attendance areas and therefore also have access to the charter school. The difference in access is the difference in the probability of charter school admission associated with the change in priority zones. As we discussed in the Section 3.1, it is possible

that households differentially sort along the priority zone border after the charter school opening. It is therefore possible that Table 2 estimates the increase for increased charter school admission probabilities and the type of neighbors that value them.

Table 3 reports the variation in estimated capitalization effects across border areas of 0.1 (Panel A), 0.3 (Panel B), and 0.5 miles (Panel C), respectively. Columns (1) and (2) in each Panel contain the within border area difference-in-differences hedonic and repeat sales estimates, respectively. Table 3 indicates property values significantly increased between 5 and 9.5 percent in priority one zones after charter school openings, which is consistent with the Table 2 results. It should be noted that statistically significant capitalization effects disappear in the 0.1 mile border area for repeat sales (Panel A, Column 2); however, this could be attributable to small sample size. Otherwise the capitalization effect is similar across specifications and border area sizes.

Table 3: Estimated priority one zone capitalization within 0.1, 0.3, 0.5 mile border areas

	Panel A: 0.1 miles		Panel B: 0.3 miles		Panel C: 0.5 miles	
	(1)	(2)	(1)	(2)	(1)	(2)
PZ1 Capitalization	0.0699** (0.0343)	0.0081 (0.0429)	0.0726*** (0.0180)	0.0886*** (0.0221)	0.0472*** (0.0140)	0.0953*** (0.0174)
Housing Characteristics	Y	N	Y	N	Y	N
Distress Measures	Y	Y	Y	Y	Y	Y
Border Area FE	Y	N	Y	N	Y	N
Quarter-Year FE	Y	Y	Y	Y	Y	Y
Observations	8,054	6,454	27,319	21,767	44,598	35,031
R-squared	0.578	0.768	0.593	0.783	0.592	0.783

Notes: The table presents results from six separate regressions. Panels A, B, and C correspond to different 0.1, 0.3, and 0.5 mile border areas, respectively. Panel A, B, and C Columns (1) report the hedonic difference-in-difference for priority one zone sales prices after charter school opening compared to priority two zone home sales in the same 0.3 mile border area. Column (2) contains the results from the repeat sales difference-in-differences specification. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Tables 2 and 3 employ data from all available years, 1990-2015. As discussed in Section 3.2, the sales are limited to single-family, residential fair market value transactions whenever possible, but early sales in some jurisdictions without sale type information have been retained.

Table 4 presents results for repeat sales after removing any transactions for which sale type could

not be verified. Column (1) contains estimates using all available years analogous to those in Tables 2 and 3. Column (2) limits the pre- and post-period window to four years. Column (3) employs repeat sales within six years before and up to six years after the charter school opening. Panels A and B present results for the 0.3 and 0.5 mile border areas, respectively. The estimated capitalization effect is again similar across samples, with point estimates ranging from 6-10% in Table 4.

Table 4: Restricted sample, repeat sales estimated capitalization by time window

	Panel A: 0.3 mile			Panel B: 0.5 mile		
	(1)	(2)	(3)	(1)	(2)	(3)
	All Years	4 Years	6 Years	All Years	4 Years	6 Years
PZ1 Capitalization	0.0739** (0.0313)	0.0981* (0.0547)	0.0672 (0.0425)	0.0617*** (0.0235)	0.0788* (0.0406)	0.0630** (0.0321)
Observations	16,154	7,995	10,838	26,214	12,837	17,482
R-squared	0.801	0.862	0.821	0.802	0.867	0.826

Notes: The table presents results from six separate repeat sales regressions with quarter-year fixed effects and distress measures for the restricted sample of early sales. Panels A and B correspond to different the 0.3 and 0.5 mile border areas, respectively. Panel A and B Columns (1) uses all periods of available restricted data. Column (2) contains the results from repeat sales occurring within four years before or after the charter school opening. Column (3) expands the time window to six years before or after the charter school opening. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

The effect of removing the unverified early sales from the sample can be gleaned by comparing Table 4 with the analogous estimates in Table 3. It has little effect on the 0.3 mile estimates, decreasing the point estimates from 8.86 percent (Table 3 Panel B Column 2) to 7.39 percent (Table 4 Panel A Column 1). The decrease is a bit more pronounced for the 0.5 mile border area estimates, decreasing the capitalization effect from 9.5 percent (Table 3 Panel C Column 2) to 6.17 percent (Table 4 Panel B Column 1).

Looking across the columns within each panel in Table 4 reveals some variation in capitalization effects across time. Price increases are larger when the sample is limited to repeat sales within four years before and after the charter school opening (Columns 2) than when the sample contains repeat sales within longer time windows. The six-year window estimates

(Column 3), however, closely resemble the estimates using all periods, suggesting the initial boost in property values levels out to a sustained priority one zone capitalization effect of approximately 6-7 percent compared to priority two zone homes.

Recall that our estimates compare home sales on either side of the priority one and two zone border. The homes have access to the charter schools with different probabilities, but both treated and control groups are within the charter school attendance boundaries. While estimated positive capitalization effect suggest households value the choice associated with charter schools, our results are identified from the discrete change in admission probability at the border. Taken together, the estimates in Tables 2-4 suggest that households value the increased probability of admission to charter schools associated with being located in priority one zones and, perhaps, the change in neighborhood resident composition associated with priority one zone status. Since our sample of residential properties is located near the shared border, and in close geographic proximity, the houses on each side of that border should be relatively similar with respect to unobservable neighborhood characteristics. As a result, we can argue that housing premiums associated with zone one are predominantly driven by the increased probability of charter school enrollment.

Table 5 presents results relating the capitalization to the performance of the homes' traditional public school using repeat sales within 0.3 mile border areas. The specification includes the priority one zone capitalization estimated above as well an interaction term between the priority one zone post-opening indicator and a measure of the traditional school's quality. We exclude charter schools with opening dates prior to 2003 because performance data was unavailable prior to the 2003-2004 school year. School quality is measured by the percentage of all, black, or economically disadvantaged students failing to meet math standards, in Columns

(1) – (3), respectively. As noted in the data section, results using reading and literature were similar.

Table 5 indicates that capitalization is stronger for homes associated with underperforming traditional public schools. A percent increase in the number of students failing to meet math standards increases priority one zone sales prices by 0.4 percent after the charter school opens (Table 5, Column 1). Consistent with previous studies of school choice capitalization, charter schools appear to increase demand and/or change the type of residents buying homes in areas with struggling traditional public schools. Measuring performance by the percentage of black or economically disadvantaged students failing to meet math standards, Column 2 and 3, respectively, produces similar estimated effects.

Table 5: Change in capitalization associated with traditional school performance for repeat sales within 0.3 mile border areas

	(1) All Students	(2) Black Students	(3) Disadvantaged Students
PZ1 Capitalization	0.125** (0.0546)	0.136*** (0.0527)	0.120** (0.0541)
PZ1-School Quality Interaction	0.0038*** (0.0013)	0.0034*** (0.0012)	0.0039*** (0.0012)
Observations	16,476	16,476	16,476
R-squared	0.778	0.778	0.778

Notes: The table presents results from three separate repeat sales regressions with quarter-year fixed effects and distress measures for the sample of single-family residential sales within 0.3 miles of shared priority one and two zone borders. School quality is measured by the percentage of all, black, and economically disadvantaged students failing to meet math standards, in Columns (1) – (3), respectively. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

5. Conclusion

Do families value charter schools? Our results suggest that they do. Our findings indicate households value geographically-based increases in the probability of admission to a charter school, and that they value the increased probability of admission more in areas with underperforming traditional public schools. We use a unique characteristic of ten charter schools in the Atlanta metro area to study whether households are willing to pay a premium for a house

located in priority one zone as opposed to priority two zone. Even though students residing in either priority zone are eligible to attend corresponding charter school, the probability of enrollment is substantially larger for the residents of priority zone one. Our identification strategy is based on the differences in sales prices for homes in priority one and two zones before and after the opening of a charter school. We find that parents are willing to pay about 6%-8% or \$8,845-\$13,470 – more for houses located in priority zone one within 0.3 miles from the border, following the charter school opening. These results are robust to different border areas, and sample sizes. We also find that the effect is stronger for houses with underperforming traditional public schools.

Our findings have several important implications. Even though our sample of Atlanta area families might not necessarily reflect the preferences of others, the study demonstrates that charter schools represent an important component of school choice. They not only have value to parents, but also to property owners and policy makers by making surrounding neighborhoods more attractive.

We have concentrated on the small part of the relationship between property values and charter schools. The political economy of charter schools has many other aspects, most of which remain largely unstudied. For example, this paper ignores the issue of charter schools formation, which is not random and depends on many observable and unobservable neighborhood characteristics. On the one hand, charter schools may be created in lower-income neighborhoods as a way to improve residents' access to better-quality education. On the other hand, residents in higher-income areas might form a charter school to ensure that their children will be surrounded by peers from similar socio-economic background. Pursuing this line of research will shed light on which neighborhoods benefit the most from charter schools penetration.

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Appendix

Table A1: Metropolitan Atlanta Charter Schools with Priority Zones

Charter School Name	Year Opened	Grades	Priority zone 1	Priority zone 2	Priority zone 3
Atlanta Neighborhood Charter School – Elementary Campus	2001	K-5	Grant Park and Ormewood Park neighborhoods	Other NPU-W ¹ neighborhoods	Other APS district neighborhoods
Atlanta Neighborhood Charter School – Middle Campus	2005	6-8	NPU-W ¹	APS district outside of NPU-W	
Charles R. Drew Charter School	2000	PK-12	Villages of East Lake	East Lake and Kirkwood neighborhoods	APS district attendance zones outside priority zones 1 and 2
DeKalb PATH Academy	2002	5-8	Buford Highway corridor ²	Clarkston, Stone Mountain, Lithonia zip codes - 30021, 30032, 30034, 30035, 30083, 30088	DeKalb county school system outside priority zones 1 and 2
Kingsley Charter Elementary School ³	1998 (1970)	PK-5	Kingsley Attendance Zone	DeKalb County School District attendance zones outside of priority zone 1	

KIPP South Fulton Academy	2003	5-8	Conley Hills, Holmes, Hapeville, Mt. Olive, Oak Knoll, Park Lane, Harriet Tubman, and Brookview elementary school attendance zones	Seaborn Lee, Heritage, Feldwood, Bethune, Gullatt, Love Nolan, and St. Lewis elementary school attendance zones	Fulton County Schools attendance zone
KIPP STRIVE Academy	2009	5-8	30310 zip code	30311 zip code	APS attendance zone outside priority zones 1 and 2
KIPP STRIVE Primary	2012	K-3 ⁴	30310 zip code	30311 zip code	APS attendance zone outside priority zones 1 and 2
KIPP VISION Academy	2010	5-8	30315 zip code	30354 zip code	APS attendance zone outside priority zones 1 and 2
KIPP VISION Primary	2013	K-2 ⁵	30315 zip code	30354 zip code	APS attendance zone outside priority zones 1 and 2
KIPP West Atlanta Young Scholars (WAYS) Academy	2003	5-8	30314 zip code	30318 zip code	APS attendance zone outside priority zones 1 and 2
North Springs Charter High School ⁶	2007 (1963)	9-12	FCS designated North Springs attendance zone	FCS district	outside the Fulton County School district

The Museum School of Avondale Estates	2010	K-8	Avondale, Knollwood and Midway Elementary School attendance zones	DeKalb County School District attendance zones outside of priority zone 1
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Notes: Data compiled directly from charters on file with the Georgia Department of Education, with supplemental information provided by Georgia Department of Education annual reports, school websites and contacts (Patrick 2015).

1. Neighborhood Planning Unit W (NPU-W) includes the neighborhoods of Benteen, Boulevard Heights, Custer/McDonough/Guice, East Atlanta, Grant Park, Ormewood Park, North Ormewood Park, and Woodland Hills.
2. The Buford Highway Corridor is defined by I-85 as the southeast boundary, the Fulton-DeKalb county line as the west boundary, the Gwinnett-DeKalb county line as the north boundary, and a line one-half mile to the northwest and parallel to Peachtree Street/Peachtree Industrial Boulevard as the northwest boundary.
3. Kingsley Elementary Charter School is a conversion charter. The conversion occurred in August 1998.
4. KIPP STRIVE Primary opened in July 2012 with 100 kindergarten students, and will grow a grade per year until serving grades K-4. The school serves grades K-3 for 2015-2016 school year.
5. KIPP Vision Primary opened in July 2013 with a 100 kindergarten students, and will add one grade annually to reach full elementary school capacity in July of 2017. KIPP Vision Primary will serve students in grades K-2 during the 2015-16 school year. Additional grades will be added each year until the school serves grades K-4.
6. North Springs Charter High School is a conversion charter school, with conversion occurring in 2007. Fulton County became a Charter System in 2012. North Springs Charter High School began transitioning into the Fulton County Charter System in the 2014-2015 school year as part of Cohort 3. The charter sunsets June 2015, at which time governance transitions to the School Governance Council and the Fulton County Charter System. North Springs will continue to operate its two magnet programs, accepting students from outside the designated attendance zone based upon admissions criteria

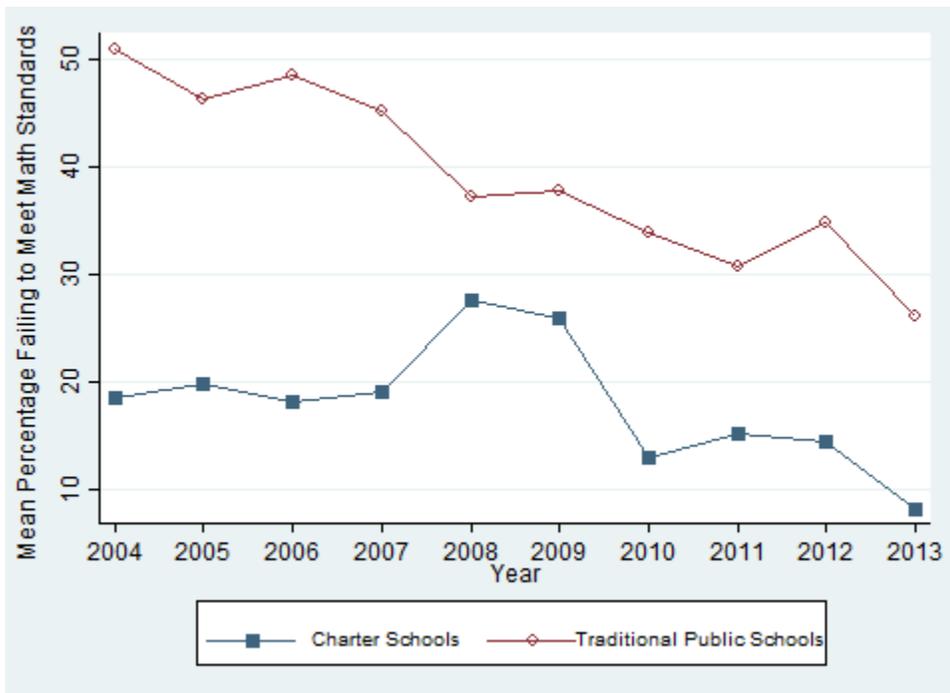


Figure A1: Mean Percentage Failing to Meet Math Standards (All Students)

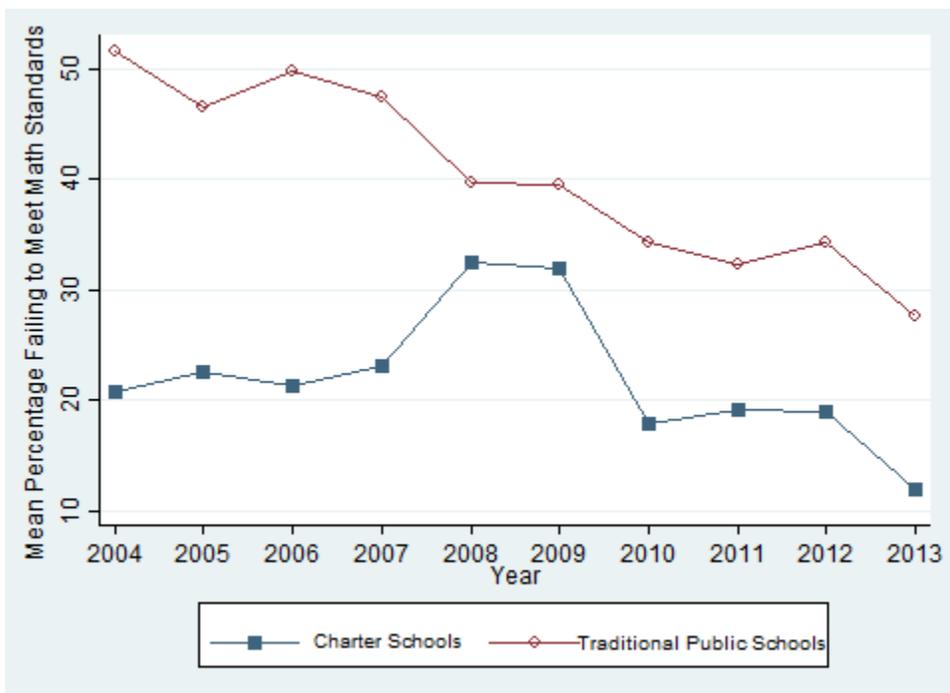


Figure A2: Mean Percentage Failing to Meet Math Standards (Black Students)