CAPITALIZATION OF CHARTER SCHOOLS INTO RESIDENTIAL PROPERTY VALUES

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Abstract

Although prior research has found clear impacts of schools and school quality on property values, little is known about whether charter schools have similar effects. Using sale price data for residential properties in Los Angeles County from 2008 to 2011 we estimate the neighborhood level impact of charter schools on housing prices. Using an identification strategy that relies on census-block fixed effects and variation in charter penetration over time, we find little evidence that the availability of a charter school affects housing prices on average. We do find, however, that when restricting to districts other than Los Angeles Unified and counting only charter schools located in the same school district as the household, housing prices fall in response to an increase in nearby charter penetration.

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1. INTRODUCTION

The charter school movement began about twenty years ago and was driven by the belief that privately run and publicly financed schools could be superior to traditional public schools. Proponents argue that charters can adapt more smoothly in times of financial hardship than traditional schools (e.g., by reducing nonunionized labor force or changing administrative policies). They also argue that charters are leaders in methodological innovations in education. On the other hand, opponents argue that charters are able to restrict admission to make them look better than they are and they divert necessary resources from public schools. Existing research has generally shown charter effectiveness to be mixed (e.g., Bettinger 2005; Bifulco and Ladd 2006; Sass 2006; Hoxby and Murarka 2009; Abdulkadiroğlu et al. 2011; Dobbie and Fryer 2011; Imberman 2011b; Angrist et al. 2012; Angrist, Pathak, and Walters 2013), yet the impacts of these schools on the wider economy is not well known. In this paper, using data from Los Angeles County (LA County), California, we attempt to establish the extent to which charter schools impact residential property markets by examining how charter penetration rates in a community are capitalized into surrounding home prices. Understanding whether housing markets are responsive to charter availability is important given the increasing prevalence of charter schools across the country. Indeed, California has seen significant growth in the number of charter schools since they were authorized in 1992; the overall number of charters has increased from 299 in 2000 to 912 in 2010, with 242 of those in LA County alone. This is the highest number of charter schools in any county in the United States.[1]

There is also a substantial literature relating housing values and school characteristics (e.g., Black 1999; Gibbons and Machin 2003; Figlio and Lucas 2004; Kane, Riegg, and Staiger 2006; Bayer, Ferreira, and McMillan 2007; Gibbons, Machin, and Silva 2013; Imberman and Lovenheim 2016), but only Buerger (2014), in an unpublished working paper, specifically considers homeowners' valuation of charter schools. To identify the impact of charters on housing prices, we use data on single-family home sales from 2008 to 2011, obtained from the LA County Assessor's Office. We estimate the impacts of both the number of charters and the share of public enrollment in charters within various distances of a property, up to 2 miles. To account for endogenous charter locations and changes in the geographic distribution of sales we include census-block[2] fixed effects along with a set of housing and school characteristics to account for the nonrandom location of charter schools. Month-by-year fixed-effects account for any general changes to the education and housing markets over time in LA County.[3] Thus, our identification comes from houses sold in the same census block at different times as charters open, close, expand, and shrink. As a result, we note that our study does not identify how existing charter enrollment affects housing prices but rather how contemporaneous changes in charter enrollment and the number of charters affect housing prices in localized areas, specifically within census blocks.

1. See California Charter Schools Association Web site at www.ccsa.org/.
2. Census blocks are the smallest geographic area used by the U.S. Census Bureau and typically cover a single city block in urban areas.
3. We acknowledge, nonetheless, that because we do not have neighborhood controls that vary over time, our model does not account for changes in neighborhoods independent of changes in local schools that may affect charter penetration. We discuss this issue in more detail in section 6.

Overall, our results suggest that neither the increase in the number of charter schools nor the expansion in charter enrollment relative to public school enrollment—our proxy for the availability of charter school slots to local residents—is capitalized into housing prices on average. This holds both for Los Angeles Unified School District (LAUSD) and other parts of LA County. It also holds for both startup charters (new schools that begin as charters) and conversion charters (public schools that convert to charter status), though we caution that very few schools convert during our sample period. Further, we find no evidence that capitalization varies with income level, minority population, or achievement levels of the local public elementary school.

We do find, however, that when we count charters located only within the household's school district's boundaries and exclude LAUSD there is a significant negative effect of additional nearby charter schools on housing prices. This restriction is reasonable as students who reside within the charter's authorizing school district (which is almost always the district in which they are located) have admissions priority, thus generating a link between these schooling options and local district boundaries. A potential explanation for this finding is that opening a nearby charter school reduces the value of a local community school, thus weakening the link between the availability of local schooling as a public good and house prices.

2. CHARTER SCHOOLS BACKGROUND

Charter schools are public schools that are tuition-free and managed by an independent operator. Typically, they are open to any student wishing to attend, regardless of where they live, though some schools give preference to students who reside nearby. Many schools require an application, and those in high demand will often have a waitlist. Charters are typically governed by parents, teachers, members of the local community, or a private company, and are reviewed for renewal every few years by an authorizer, usually the state or a local school district. In California, charters are funded through a mix of block grants and a state-based funding formula that provides funding at the same per-pupil rate to all charters of a given grade level across the state (see CDE 2016). There is substantial heterogeneity across schools in the way they are managed, their goals, their targeted student population, and level of autonomy from the local school system.

An important distinction to recognize among charter schools is they are either brand new schools (startup charters) or were previously a traditional public school that switched to a charter model (conversion charter). According to the California Charter Schools Association, there are many reasons why traditional schools decide to convert to charter status, but above all is the appeal of increased flexibility and autonomy. Conversion charters must satisfy the same legal requirements and processes as startup charter schools. This involves submitting a charter petition establishing features, such as the school's goals, finances, and governance plan, as well as obtaining signatures of at least 50 percent of the permanent teachers currently employed at the school. California law does require that conversions give priority to students in the school's district, and many districts (including LAUSD), give priority to students in a local catchment area. Typically, startup charters do not have catchment areas, but if they are oversubscribed they are also required to give priority to students who reside in the

authorizing school district and may choose to give priority to those in the local school zone if the neighborhood school has high rates of economic disadvantage.

As of the 2010–11 school year, conversion charters represented 16 percent of California's charter schools, enrolling about 25 percent of all charter school students (CCSA 2012). Charter school facilities vary with type of charter, with some building brand new structures, renting available spaces in churches, community centers, or commercial buildings, or occupying a previously traditionally run public school campus.[4] When a school converts to charter status, it usually remains in the same building and retains teachers, staff, and students. In contrast, startup charters need to recruit a student body because parents have the option to enroll their child in the charter or in the assigned public school.

Another important distinction between types of charter schools that has drawn interest recently is the role of larger charter management organizations (CMOs). CMOs are nonprofits that operate multiple charter schools and charters within an organization and are able to pool management and resources in order to gain economies of scale—a benefit often shared by schools within a traditional public school district. Evidence of the impacts of these types of charters on student outcomes suggests that effectiveness varies substantially across CMOs and students (Angrist et al. 2012; Furgeson et al. 2012). Another heterogeneous distinction between charter schools is whether a charter has a waiting list. Recent work using oversubscription lotteries has indicated that waitlist charters perform better than local public schools but are unable to assess the impacts of non-waitlist charters (Hoxby and Murarka 2009; Abdulkadiroğlu et al. 2011; Dobbie and Fryer 2011; Angrist et al. 2012; Angrist, Pathak, and Walters 2013). Unfortunately, although it would be interesting to see whether housing prices respond differently to these two ways charters vary, we do not have data on whether charters are operated by CMOs or have waitlists.

3. THEORY OF CHARTER IMPACTS ON HOUSING PRICES

The theory behind the relationship between housing prices and local school quality predicts that, because of the close link between residential location and the school attended via attendance zones, higher quality schooling will generally lead to an increase in housing prices, though the extent of this increase depends on a number of factors (Rosen 1974; Black and Machin 2011). This relationship has been well established through empirical analyses (Black 1999; Downes and Zabel 2002; Figlio and Lucas 2004; Kane, Riegg, and Staiger 2006; Bayer, Ferreira, and McMillan 2007; Gibbons, Machin, and Silva 2013). Because charter schools do not typically have attendance zones and because typically students may attend a charter regardless of their location of residence, the theoretical link between charter schools and housing prices is ambiguous.

Despite a less obvious link between charter schools and housing prices, economic theory suggests homeowners may respond to charters in a neighborhood for a few reasons. First, charters provide an option value. Even if a child does not attend a charter school, the availability of charters nearby may make a location more attractive for parents. Charters rarely offer busing, therefore travel distance is especially important if transport costs are expensive, as is the case in LA County where there is limited public

4. See California Charter Schools Association's Web site at www.ccsa.org/.

transportation, heavy traffic congestion, and high gas prices. Further, as previously mentioned, in California oversubscribed charters give priority to students who reside in the school district containing the charter, and this could increase the option value to living in the district.

Second, charters may have an indirect effect on housing prices if they affect the performance of local public schools. Evidence on how charters affect local public schools is mixed. Whereas Booker et al. (2008), Bifulco and Ladd (2006), and Sass (2006) find positive effects of charters on nearby public schools, Imberman (2011a) finds negative effects. Thus it is unclear how this mechanism might influence housing prices.

Third, the public may value the direct infrastructure and community improvements charters sometimes provide. Indeed, Cellini, Ferreira, and Rothstein (2010) show that housing prices respond to non-charter public school facility investments. Many charters rent or use donated space, whereas some build their own facilities or convert abandoned properties for use as schools. Even those that rent will often fill up vacant properties in locations like strip malls (Imberman 2011a). Thus, the additional economic activity generated by the charters may influence local housing prices.

Another theory is that charter schools may serve to break the connection between local public schools and housing prices. In so doing we might expect additional charters (and more school choice options more broadly) to lead to increased housing prices where existing schools are low-performing because these locations would have artificially low housing values due to the poor school quality. Alternatively, in high-performing areas, additional charters may actually reduce housing prices as the availability of nearby charters weakens a key benefit of being zoned to a high-performing school if, through attending charters, high-quality schools become available to households outside the attendance zone (Nechyba 2003). Another possibility, however, is that by severing this link, the availability of having a public school option at all, irrespective of school quality, is less valuable. The public good of a local school provides less utility and, thus, without a commensurate reduction in property taxes, lowers the value of residing near that school.

These theories indicate that it is unclear how charter schools may affect housing prices because some economic effects may be positive and some may be negative. As such, understanding the overall effect on local property markets is necessarily an empirical question. We should also note that although it may be tempting to interpret housing price responses as measures of how much people value charters, the complexity of the underlying processes makes it difficult to do this. In fact, the theories described above of how charter schools may sever the link between local public schools and property values highlight that the effects could be showing something entirely different from valuation.

4. PREVIOUS LITERATURE

Most of the existing literature on charter schools focuses on the effect of charters on student achievement. Early research relying on panel data methods found mixed results, with some researchers finding insignificant or significant negative impacts on student test scores of attending a charter school (Bifulco and Ladd 2006; Sass 2006; Zimmer and Buddin 2006; Hanushek et al. 2007; Imberman 2011b), and others

finding positive impacts (Hoxby and Rockoff 2004; Booker et al. 2008). More recent research using random lotteries (Hoxby and Murarka 2009; Abdulkadiroğlu et al. 2011; Dobbie and Fryer 2011; Angrist et al. 2012; Angrist, Pathak, and Walters 2013) and natural experiments (Abdulkadiroğlu et al. 2014) have found large positive effects. Some research has also recognized the distinction between conversion and startup charters and suggests there is a differential impact on performance across the two types (Buddin and Zimmer 2005; Sass 2006; Zimmer and Buddin 2009).

There are two studies in particular that are similar to ours. First, Chakrabarti and Roy (2010) try to use the impact of charter schools on enrollment in private schools as a proxy for how much parents prefer charters to other schooling options. They find modest declines in private school enrollment when charters locate nearby. Second, in an unpublished working paper Buerger (2014) looks at differences in housing prices across school districts in New York due to charter penetration and finds positive effects. His identification relies on differences in charter penetration across school districts and census-tract fixed effects.

Nonetheless, our paper is distinct from Buerger's in a few key ways. First, the focus on differences across districts, although useful in areas with many school districts, is less relevant to areas like Los Angeles that are dominated by a large central core district. Indeed, most charter schools tend to locate in urban core areas dominated by large urban districts. Thus, our analysis allows for identification of charter impacts within these urbanized areas. Second, Buerger looks at the impacts on housing prices from the entry of the first charter school into the district. In our analysis, we look at capitalization of marginal changes in charter penetration using multiple charter penetration measures. Third, our inclusion of census-block fixed effects instead of the geographically larger census-tract fixed effects allows us to account for more potential sources of time-invariant unobserved characteristics.

A separate branch of literature focuses on the relationship between housing prices and school characteristics. There is ample evidence from previous work that housing prices are responsive to test score differences across schools.[5] Both Black (1999) and Bayer, Ferreira, and McMillan (2007) estimate regression discontinuity models across school zone boundaries to identify how school-average test scores are capitalized into housing prices. Figlio and Lucas (2004) examine the effect of the release of "school report card" data in Florida on property values. These report cards rated schools from A to F based on average performance on statewide exams. All three studies find sizable, positive impacts of higher school test scores on home values, suggesting parents place significant value on this school-quality measure. Gibbons, Machin, and Silva (2013) find similar results in England using boundary discontinuities using test score gains. On the other hand, Imberman and Lovenheim (2016) find little impact of the release of teacher and school value-added information on housing prices in Los Angeles.

Several studies have considered the effects of other school characteristics, such as student demographics, per-pupil spending, and pupil-teacher ratio, on housing prices. In the footsteps of Oates' (1969) seminal paper, which uses per-pupil spending and pupil-teacher ratio as measures of school quality, much of this research has found positive relationships between similar measures and housing prices (Bogart and Cromwell

5. For a comprehensive review see Black and Machin (2011).

1997; Bradbury, Mayer, and Case 2001; Weimer and Wolkoff 2001). Clapp, Nanda, and Ross (2008), using panel data from Connecticut, find that an increase in the percentage of Hispanic students has a negative effect on housing prices. Using data from Chicago, Downes and Zabel (2002) find that households do not capitalize per-pupil expenditures.

Bogart and Cromwell (2000) exploit school redistricting in Ohio and find that disruption of neighborhood schools—in terms of student demographics, changes in transportation services, and geographic location within the neighborhood—reduces house values by nearly 10 percent. Reback (2005) analyzes the effect of adoption of a public school choice program in Minnesota to estimate the capitalization effects related to changes in school district revenues, because districts' state revenues depend on enrollment. He finds that a 1 percentage point increase in outgoing transfer rates is associated with an increase in house prices of about 1.7 percent.

Our analysis builds off the approaches of these studies by estimating the impact of charter schools on local housing prices while carefully accounting for selection of charters into neighborhoods. In particular, our baseline specification includes census-block fixed effects to account for unobserved heterogeneity across local neighborhoods in the propensity for charters to open or close nearby.

5. DATA

Our home price data come from the Los Angeles County Assessor's Office (LACAO). The data contain the most recent sale price of every home in LA County as of October 2011. In addition to LAUSD, the second largest district in the country, the data encompass 75 other school districts. Because our data are based on most recent sales, to avoid endogenous selection into the sample and small sample sizes in early years, we restrict our data to include only residential sales that occurred between 1 September 2008 and 30 September 2011. From LACAO, we also obtained parcel-specific property maps, which we overlay with school zone maps from 2002 (the most recent year such data are available for the whole county).[6] The data also include home and property characteristics, such as the number of bedrooms, the number of bathrooms, units on the property, square footage, and the year the structure was built.

We drop all properties with sale prices above $1.5 million in order to avoid results being driven by home-price outliers. Further, about 25 percent of the residential properties in the dataset do not have a sale price listed. Usually, these are property transfers between relatives or inheritances. Hence, we limit our sample to those sales that have "document reason codes" of "A," which denotes that it is a "good transfer" of property. We also drop all properties with more than either eight bedrooms or eight bathrooms.

The charter school data are from the California Department of Education. We rely on two measures of charter school penetration: the counts of the number of charter schools within a specified distance from a home and the percentage of total enrollment in the public sector attributable to charter schools within a specified distance from a home. For the former measure, we calculate the distance between each charter and

6. The 2002 LA County maps come from the Los Angeles County GIS portal at http://egis3.lacounty.gov/dataportal/. The maps were created using a variety of sources and thus may not match precisely to actual school zones.

Table 1. Schools in LA County

Panel A. Schools by Grade Level				
	Elementary	Middle	High	Multiple Levels
Non-charter public schools	1,196	243	390	68
Total charter schools	113	48	88	35
% charter schools	8.6	16.5	18.4	34.0
Conversion charters	21	1	10	3
Startup charters	92	47	78	32

Panel B. Schools by Years of Operation				
	Non-charter Public	Conversion	Startup	% Charter Schools
2008	1,743	19	127	7.7
2009	1,758	23	147	8.8
2010	1,777	24	181	10.3
2011	1,809	26	213	11.7

Notes: Schools included in panel A are those open and active at any point September 2008 through September 2011. Data obtained from California Department of Education.

the home, and count the number of charters falling within a specified distance. For the latter measure, we use enrollment figures for all public schools in LA County from the Common Core of Data, managed by the Institute of Education Sciences at the U.S. Department of Education. An explanation for why we choose these variables and our specified distances is provided in section 6.

We combine these data with school-by-academic year data on Academic Performance Index (API) scores, API rank, school average racial composition, percent on free- and reduced-price lunch, percent disabled, percent gifted and talented, average parental education levels, and enrollment. The API score is California's summary index of school test score performance. These covariates, which are available through the California Department of Education, control for the differences in charter school penetration that are correlated with underlying demographic trends in each school.

Our main analytic sample consists of 158,211 house sales occurring from September 2008 through September 2011. Of these, 65,170 are sales of homes zoned to an elementary school in LAUSD and 93,041 are sales of homes zoned to an elementary school in another school district in LA County. Table 1 provides information on the types of charter and public schools that operate in LA County over our sample period. Panel A provides schools by grade level. Charters are more common for middle and high schools but still account for a substantial portion of elementary schools, at 9 percent. Conversion charters in particular are common for elementary schools but not middle and high schools. Panel B shows that over the time period of our study, the percent of schools that are charters grows from 7.7 percent in 2008 to 11.7 percent in 2011. Tables 2 and 3 provide sample means and standard deviations at the property level for several of the variables we include in our regressions. In table 2 we see that properties in LA County have an average sale price of $383,546 and tend to be of modest size, averaging around three bedrooms, two bathrooms, and 1600 square feet. We also have a ranking of the quality of the structures on the property, which will be useful for conducting validity tests. The property is given a rating on a scale of 1 to 12.5 by LACAO assessors,

Table 2. Summary Statistics of Properties with Sale Prices

Property characteristics	
Sale price, $	383,546 (247,685)
Number of bedrooms	2.98 (1.05)
Number of bathrooms	2.11 (0.92)
Square footage	1,573 (718)
Quality	6.45 (1.25)
Number of charters	
0–0.5 miles	0.16 (0.54)
0.5–1 mile	0.47 (1.11)
1–1.5 miles	0.78 (1.59)
1.5–2 miles	1.06 (2.04)
Charters as percentage of enrollment	
0–0.5 miles	0.05 (0.18)
0.5–1 mile	0.06 (0.15)
1–1.5 miles	0.06 (0.13)
1.5–2 miles	0.06 (0.12)
Observations	158,211

Notes: Summary statistics are means for sales from September 2008 through September 2011. Property sample excludes homes with a sale price exceeding $1.5 million, and a bedroom or bathroom count in excess of eight. Homes are divided into the "LAUSD" or "Rest of LA County" samples via the location of the elementary school to which the property is zoned. Standard deviations in parentheses.

where a rating of 12.5 is the highest assessed quality. Not surprisingly, the average quality of a property in LA County is close to the midway point on this scale, at 6.45. For charter penetration, the number of charters in each distance ring increases as we go further out, primarily because of the larger amount of land area in larger distance rings. When we look at charters as a percentage of total public school enrollments, the rates are relatively constant across distance rings at 5 to 6 percent.

We note that our data cover some periods of abnormal rigidity in the Los Angeles housing market due to the housing collapse of 2008 and the Great Recession. Figure 1 shows the Case-Shiller House Price Index for the Greater Los Angeles area from 2008 through 2011.[7] Even though housing prices in Los Angeles fell dramatically until May

7. Acquired from http://us.spindices.com/indices/real-estate/sp-case-shiller-ca-los-angeles-home-price-index.

Table 3. Summary Statistics: Schools Near Properties with Sale Prices

	Panel A: Characteristics of Zoned School			Panel B: Characteristics of Charters Within 1 Mile (Enrollment Weighted)		
	Elementary	Middle	High	Elementary	Middle	High
Enrollment	440.5 (165.6)	1,197.4 (488.0)	2,002.6 (680.6)	443.0 (138.0)	1,121.3 (435.7)	1,140.5 (814.3)
API score	805.6 (73.6)	746.1 (90.3)	707.0 (88.2)	800.1 (64.5)	744.7 (93.0)	663.7 (112.4)
% Black	10.9 (14.4)	10.1 (11.9)	11.2 (13.3)	10.6 (13.2)	10.3 (11.6)	11.1 (12.6)
% Hispanic	58.2 (28.5)	62.9 (24.7)	60.1 (24.8)	62.0 (25.7)	63.6 (25.2)	65.2 (23.9)
% Asian	7.1 (12.6)	7.0 (12.0)	7.6 (12.3)	7.2 (12.0)	7.7 (13.2)	5.9 (11.5)
% Disabled	11.4 (4.5)	11.4 (2.8)	10.3 (3.1)	11.8 (4.1)	11.1 (2.7)	10.6 (12.2)
% Gifted	8.4 (7.3)	13.8 (9.7)	11.4 (8.8)	7.5 (5.4)	12.6 (8.6)	7.3 (7.0)
% Free or reduced price lunch	64.7 (30.0)	66.9 (25.7)	55.9 (26.9)	68.7 (26.6)	67.5 (26.6)	61.2 (24.1)
% English language learner	28.1 (17.2)	19.8 (11.5)	18.0 (10.5)	30.3 (15.2)	20.2 (11.7)	20.8 (12.2)
Observations	158,211	127,558	141,212	136,546	81,204	83,079
for API score:	158,211	127,174	140,866	136,536	80,686	80,979

Notes: Summary statistics are means for sales from September 2008 through September 2011. Sample excludes homes with a sale price exceeding $1.5 million, and a bedroom or bathroom count in excess of eight. School zones are based on 2002 zoning. See text for details on how to access school zone maps. Standard deviations in parentheses.

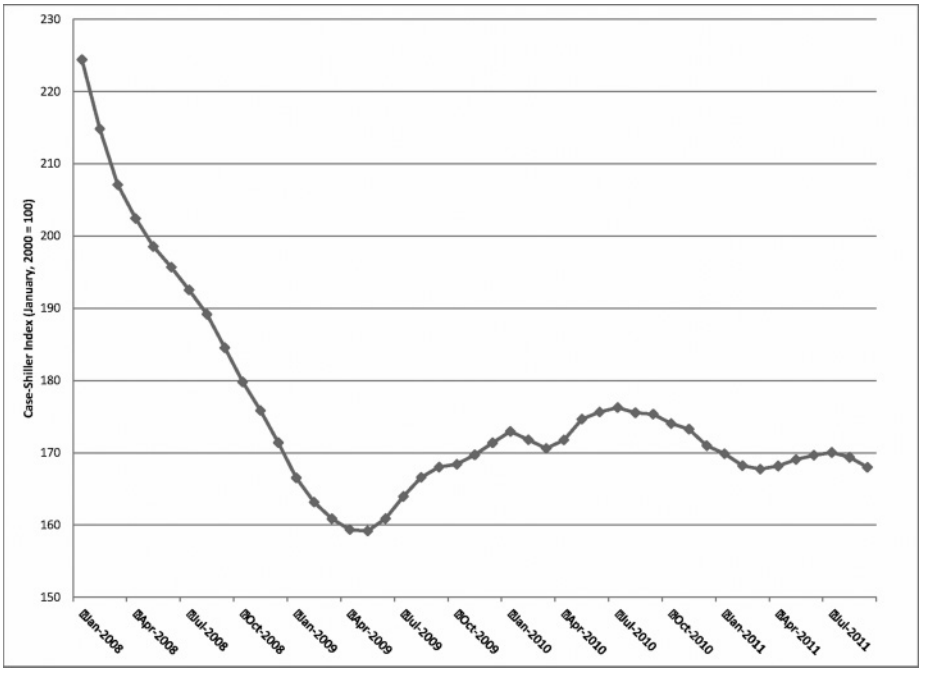

Figure 1. Case-Shiller House Price Index for Greater Los Angeles.

2009, afterwards they had begun to rebound, increasing by 11 percent through July 2010. The prices fell slightly thereafter until the end of our data in September 2011. Thus, the housing market had been in recovery for most of our sample period. Even so, we may be worried that market rigidities would continue to limit capitalization. To address this we provide results in a separate online appendix (accessible on *Education Finance and Policy*'s Web site at www.mitpressjournals.org/doi/suppl/10.1162/EDFP_a_00192) that vary by year of sale and show that our estimates are similar to baseline in later years of the sample when the market had more fully recovered.

In panel A of table 3 we provide information on the characteristics for the elementary, middle, and high schools to which each property is zoned. Panel B provides a comparison with charters at each grade level within one mile of the property. For elementary and middle schools, the characteristics of charters are pretty similar to those of the zoned school in terms of enrollment, API score, and demographics. For high schools, however, there are some differences. Charter high schools tend to be substantially smaller (1,140 students versus 2,002) but lower-performing as measured by API score. Zoned and charter high schools are demographically similar, though high school charters tend to have fewer gifted students.

6. EMPIRICAL STRATEGY

Our identification strategy relies on variation across households and over time within a census block in the number of charters within various distance radii. To achieve this, in addition to controls for characteristics of the local elementary school and property characteristics, we include census-block fixed effects along with month-of-sale fixed effects. Including census-block fixed effects allows us to compare the sale prices of properties that are geographically very close; the mean land area for census blocks in LA County is 108,322 square feet with a median of 19,283 square feet. Although it may be preferable to use repeated sales on the same property, this is not possible with our data because we only have sale price information for the most recent sale. Even if we did have repeated sales, given the short timeframe, restricting to those types of households would create a selected sample since a disproportionate number of those properties may be distressed, in fast changing neighborhoods, or houses that are often "flipped."

We believe that multiple sales within census blocks provide a reasonably small geographic area to closely mimic repeated sales for specific properties while avoiding the potential selection issues generated by using repeated sales. For example, in our final estimation sample the median census block in LA County has three sales during the study period with a mean of 3.9. Figure 2 provides a histogram of the distribution of sales within census blocks, conditional on having any sales, over the study period. While our econometric strategy identifies the effect of charter penetration only from blocks with more than one sale, a substantial number of census blocks provide this identification. There are 29,512 blocks with at least two sales and of those, 14,494 blocks have at least four sales and 7,387 blocks have at least six sales. Further, of all blocks with at least one sale, 73 percent have multiple sales, providing wide geographic variation in blocks that contribute to identification. Finally, we conduct an analysis of variance of property characteristics to assess the within- and between-census-block variance. In

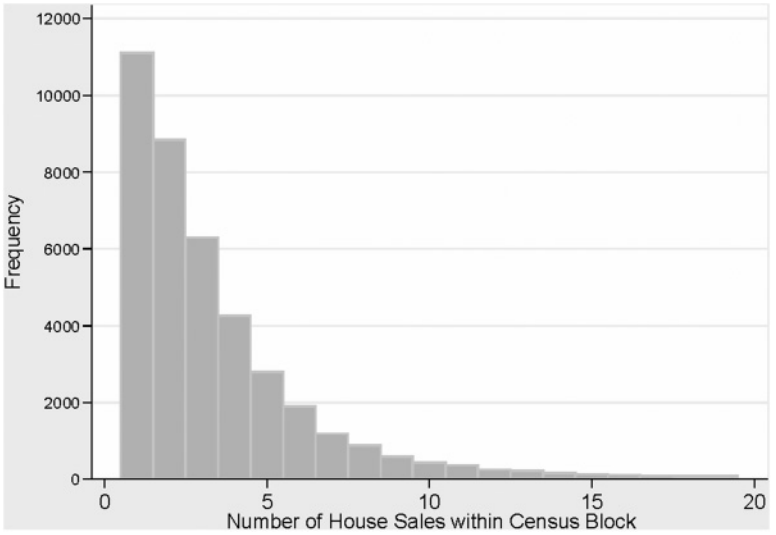

Figure 2. Distribution of House Sales by Census Block During Sample Period Conditional on Census Block Having any Sales.

our estimation sample, only 39 percent of the variance in house size and 20 percent of the variance in housing quality are within a census block, along with less than half of the variation in bedrooms and bathrooms.[8] These results suggest that different houses within a block have largely similar characteristics.

By including census-block fixed effects, our identification strategy assumes there are no changes in neighborhood conditions over time that are correlated both with housing prices and charter penetration. Of course, housing prices are increasing in general in Los Angeles during our analysis period, as is the number of charter schools. Hence, to account for general changes in house prices related to overall market conditions, we include year-by-month indicators in all of our regression models.

Even with census-block fixed effect and year-by-month fixed effects, it is possible that there are factors changing locally that could bias our estimates. Of primary concern is the possibility that charters select into neighborhoods where the local public school is under-performing and the poor quality of the school is reflected in lower housing prices. Ideally, we would be able to at least control for changes in neighborhood characteristics as we do for school characteristics and housing supply. Unfortunately, the data available to us are very limited. To our knowledge, only the American Communities Survey (ACS) provides neighborhood data at a small enough geographic level (e.g., census tract) to be relevant for this analysis. The ACS only provides five-year estimates at the census-tract level, however, because estimates based on smaller periods of time are too imprecise. As a result, the ACS data do not provide temporal variation in neighborhood characteristics over our three-year time period and any data on neighborhood characteristics would be absorbed by the census-block fixed effects. Thus, we assume that selection of charter location is unrelated to time-varying neighborhood characteristics that are themselves not captured in our housing and school characteristics controls. We cannot test this

8. An analysis of variance using the residuals from regressions of the characteristics on month-by-year indicators provides similar results.

assumption directly, but we do attempt to address it indirectly by testing whether our observable measures of housing characteristics change when more charters move in, and by testing whether charter penetration can be explained by prior changes in house prices. If time-varying neighborhood characteristics are correlated with prior house prices and the types of houses put on the market then we should expect to see some impact on these observables, and indeed we do not find evidence for this. Nonetheless, although we do not have temporal variation in neighborhood variables, we do have such variation for local elementary school characteristics. Thus in table A.1 of the online appendix, we look at how charter entry relates to public school characteristics when we condition on school fixed effects. Without school fixed effects, the estimates show that charters tend to locate in the zones of elementary schools with fewer minorities, more gifted students, more English language learners, and more disabled students. When school fixed effects are added some characteristics are statistically significant, but importantly they are all economically small. The largest statistically significant coefficient is on percent of black residents in the public school zone, but this coefficient is still rather small. For a one charter increase in the school zone, there would need to be a percent black student increase of 84 percentage points. Given this pattern and the general shift in the coefficients toward zero as the school fixed effects are added, these results suggest that lower levels of geographic fixed effects, specifically census-block effects, should reduce these correlations further to the point where they are negligible.

Another difficulty in this analysis is deciding how to measure charter penetration. There are two key factors here. First, there is the question of whether the important factor is the existence of a charter school as a whole or the relative size of a charter school. Arguably, whereas the former is the most visible aspect of the school to the wider public (people in the neighborhood know that a school exists but may be uncertain as to how large it is), the latter is a potentially better indicator of the supply constraints on a family that wishes to send a child to the charter. The second issue is that it is unclear how far from the charter a household must be before we can be confident the household should not care about the charter's existence. To deal with both of these issues we follow the prior literature on the effects of charter schools on public schools (Bifulco and Ladd 2006; Sass 2006; Booker et al. 2008; Imberman 2011a). The analyses in these studies estimate the effects of charter schools on traditional public schools within concentric rings of various distances. Because it is not obvious whether what matters is relative enrollment in charters or the number of charters, they estimate the effects of both charter counts and enrollment in the charters as a share of total enrollment.

We use measures of charter penetration equal to (1) the number of charters and (2) the share of all public school enrollments in charters in concentric rings between 0 and 0.5 miles, 0.5 and 1 mile, 1 and 1.5 miles, and 1.5 and 2 miles from a property. We focus our attention on charters within relatively short distances of properties because of the urbanicity and size of school zones in LA County. The mean elementary school zone in LA County has an area of 3.2 square miles. With this area, if school zones were circular, the radius of the average zone would be 1.0 mile. The median school zone has an area of 0.8 square miles, translating into a radius of 0.5 miles. Hence, given the size of school zones in LA County, these are reasonable distances within which to measure the effect of charters. Indeed, in a large southwestern city that is less densely populated than Los Angeles, Imberman (2011a) shows charters only impact enrollment of public

schools within 2 miles of the charter. Further, in an analysis of charter applicants in Boston, Walters (2014) finds that 40 percent of applicants apply to the closest charter school and a further 22 percent apply to the second closest. Although we do not have data on who actually applies to or attends charters, we note that in LA County the median property is 1.35 miles from the nearest charter and the second closest charter is 2.18 miles away. Because these measures include all properties, it is likely that the average distances for charter attendees are substantially smaller. Based on these factors, we believe 2 miles is a reasonable maximum distance, though we also report distances between 2 and 5 miles in the online appendix.

Our baseline model estimates the impact of charter penetration on the log of the sales price of property i in census block s at time t as

$$\text{Ln}(\text{SalePrice}_{ist}) = \alpha + \mathbf{Charter_{it}}\boldsymbol{\beta} + \mathbf{X_{it}}\boldsymbol{\Gamma} + \mathbf{H_i}\boldsymbol{\Phi} + \lambda_t + \gamma_s + \varepsilon_{it}, \quad (1)$$

where *Charter* is a vector of charter penetration variables calculated as the number of charters or the share of public school enrollment in charters between 0 and 0.5 miles, 0.5 and 1 mile, 1 and 1.5 miles, and 1.5 and 2 miles from the property. The $\boldsymbol{\beta}$ coefficients can be interpreted as jointly identifying a house price gradient that captures the differential valuation of charter penetration by homeowners over distance. $\mathbf{X}$ is a vector of school-by-year observables, where the school is the elementary school to which the property is zoned. $\mathbf{H}$ is a vector of house-specific characteristics, such as the number of bedrooms, the number of bathrooms, age, quality, and square footage. The model also includes month-by-year fixed effects (λ_t) to control for common time trends and census-block fixed effects (γ_s) to control for time-invariant neighborhood quality and quality of the locally zoned school.[9] We cluster standard errors at the school-zone level to account for correlation between prices of properties in the same census block. An adjustment to this model also restricts to charter schools within school-district boundaries. This is relevant because, as previously mentioned, California requires oversubscribed charters to give admissions priority to within-district students.

We expand the baseline model to account for heterogeneous effects on housing price by disaggregating our charter penetration variables by type of charter: conversion or startup. In this model, the charter penetration vector is split into two:

$$\begin{aligned}\text{Ln}(P_{ist}) = \alpha &+ \boldsymbol{StartupCharter_{it}}\boldsymbol{\beta_1} + \boldsymbol{ConversionCharter_{it}}\boldsymbol{\beta_2} \\ &+ \mathbf{X_{it}}\boldsymbol{\Gamma} + \mathbf{H_i}\boldsymbol{\Phi} + \lambda_t + \gamma_s + \varepsilon_{it}. \quad (2)\end{aligned}$$

In this setup, the $\boldsymbol{\beta_1}$ coefficients will provide a gradient for startup charters and the $\boldsymbol{\beta_2}$ coefficients will provide a gradient for conversion charters. We include the same controls as in equation 1. As mentioned earlier, we would expect to find differing valuation of these two types of charters if homeowners place different weights on the inputs of each type—conversion charters often remain in the same building, with the same student body and staff, and adopting new operating styles, whereas startup charters are often in rental spaces, tend to be smaller than conversions and traditional

9. The baseline model excludes school-zone fixed effects because most census blocks do not straddle school zones. Nonetheless, inclusion of school-zone fixed effects has a negligible impact on the results.

Table 4. Effect of Charters on Log Sale Prices for Los Angeles County

	Los Angeles County					
	Number of Charters			Charter Seats as Percentage of Enrollment		
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
A. Distance Gradient						
0–0.5 miles	−0.00725	−0.0353***	−0.00543	0.0741*	0.00648	−0.00134
	(0.0131)	(0.00800)	(0.00827)	(0.0438)	(0.0249)	(0.0194)
0.5–1 mile	0.00858	−0.0253***	0.000950	0.117**	−0.0166	−0.0128
	(0.00748)	(0.00609)	(0.00476)	(0.0564)	(0.0270)	(0.0195)
1–1.5 miles	0.0252***	−0.0149***	0.00223	0.140**	−0.0442*	−0.0123
	(0.00578)	(0.00387)	(0.00313)	(0.0616)	(0.0268)	(0.0239)
1.5–2 miles	0.0239***	−0.00460	−0.00110	0.120	−0.0217	−0.00470
	(0.00494)	(0.00309)	(0.00279)	(0.0770)	(0.0340)	(0.0255)
B. Condensed 0–2 Miles						
0–2 miles	0.0193***	−0.0101***	−0.00010	0.328***	−0.0301	−0.00750
	(0.00321)	(0.00255)	(0.00207)	(0.112)	(0.0609)	(0.0544)
Observations	158,211	158,211	158,211	158,211	158,211	158,211
Housing characteristics	Y	Y	Y	Y	Y	Y
School characteristics	Y	Y	Y	Y	Y	Y
School fixed effects	N	Y	N	N	Y	N
Census-block fixed effects	N	N	Y	N	N	Y

Notes: Sample includes property sales from April 2009 through September 2011. The independent variable denotes either the number of charters in operation or the share of enrollment in operating charters as of the sale date in various distance rings from the property. Housing characteristics include number of bedrooms, bathrooms, square footage, and quality. School characteristics include API levels overall, lags and second lags of overall API scores, percent of students of each race, percent free lunch, percent gifted, percent English language learners, percent disabled, and parent education levels for elementary school zoned to the property in 2002. All regressions include month-by-year fixed effects. Robust standard errors clustered by elementary school zone in 2002 in parentheses.

*Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

public schools, and need to recruit students and staff in addition to operating under a new management style.[10]

7. RESULTS

Effect of Charter Penetration on Housing Prices

Table 4 provides the baseline results of our analysis using variations of equation 1 and the sample of homes sold across all of LA County. The table includes two panels, one for each charter measure, overall numbers of charters, and percentage of total enrollment attributed to charters. Each specification in the table includes month-by-year time dummies, housing controls (square footage, number of bedrooms, number of bathrooms, and quality) and controls for the locally zoned elementary school (enrollment, API score, school demographics, percentage disabled, gifted, free- or reduced-price lunch eligible, and English language learners). All standard errors are clustered at the school-zone level, where the school is the elementary school to which a property was zoned in 2002.

10. The fact that conversions usually maintain the same attendance zone after converting suggests the potential for using a difference-in-differences approach to assessing the impacts of these schools on housing prices. Unfortunately, only five schools in LA County convert to charter status during our study period, making the estimates from this type of analysis too imprecise.

In columns (i) and (iv), respectively, of table 4, we regress the log of the house price on charter counts and the share of public school enrollment in charters within half-mile diameter rings without geographic fixed effects. The estimates suggest there is a positive relationship that strengthens as the distance from the property increases. In columns (ii) and (v), we include elementary school-zone fixed effects to account for characteristics of the locally zoned school. In these models the patterns differ depending on how we measure charter penetration. When using charter counts, the results indicate charters negatively impact housing prices, becoming more negative the closer charters are to the property. The coefficient on the zero to half-mile radius charter measure indicates that an additional charter is associated with a statistically significant 3.5 log point decrease in the sale price. When using enrollment share, however, only 1 to 1.5 miles is significant.

We may still be concerned that there are endogenous differences within school zones, but across neighborhoods, that affect both housing prices and charter penetration. Thus, in columns (iii) and (vi) we provide our preferred estimates that replace school-zone fixed effects with census-block fixed effects. In this model, estimates are all statistically insignificant and small. The largest estimate in column (iii) suggests, when taken at face value, an additional charter school increases housing prices between 1 and 1.5 miles away by 0.2 percent, with smaller values for other distances. For the enrollment share measure, all of the values are negative, insignificant, and economically small with a 10 percentage point (pp) increase in charter share reducing housing prices by less than 0.2 percent at all distance levels. To provide additional context, if we focus on charter penetration within 0.5 miles of the property, the 95 percent confidence interval for the impact of an additional charter is [–2%, 1%] and for a 10 pp increase in charter enrollment share it is [0.4%, –0.4%].

One potentially important issue in interpreting the estimated effect of charter penetration is that as the distance increases, the area in which the charter could locate increases. This is not a substantial concern when focusing on share of enrollment but it does indicate there may be more variation in the number of charters in farther rings, making comparison of the estimated effects of charter penetration at different distances difficult. To address this we also provide estimates using charter penetration within the full 2-mile radius around the property in panel B. The results are similar to those in panel A and show no impact of charters on housing prices when we include census-block fixed effects. It is also interesting to note that the standard errors decrease when we add census-block (or school) fixed effects. This is another indicator that there is substantial identifying power within blocks and that including between-block variation adds uninformative noise to the analysis.

Table 5 provides results for our preferred model that includes census-block fixed effects when we split the sample by whether the properties are within the boundaries of LAUSD, which is the largest district in LA County, or all other school districts in the county. We may suspect that there are different property effects for the two samples because LAUSD covers the main urban core of the county, and recent evidence suggests urban charters are more effective than suburban charters (Angrist, Pathak, and Walters 2013). Our results, however, provide little evidence that house price effects vary via this location difference. Only one estimate—for charter counts in LAUSD from 1 to 1.5 miles—is statistically significant.

Table 5. Effect of Charters on Log Sale Prices for Los Angeles County by School District

	LAUSD		Rest of LA County	
	Number of Charters	Charter Seats as Percentage of Enrollment	Number of Charters	Charter Seats as Percentage of Enrollment
0–0.5 miles	0.000504	0.00923	−0.0143	−0.0220
	(0.00970)	(0.0236)	(0.0169)	(0.0373)
0.5–1 mile	0.00591	−0.00620	−0.00447	−0.0114
	(0.00559)	(0.0278)	(0.00869)	(0.0241)
1–1.5 miles	0.00712**	−0.00607	−0.00225	0.000579
	(0.00349)	(0.0314)	(0.00632)	(0.0351)
1.5–2 miles	0.00233	−0.0130	−0.00375	0.0259
	(0.00342)	(0.0408)	(0.00470)	(0.0206)
Observations	65,170	65,170	93,041	93,041
R^2	0.83	0.83	0.91	0.91
Housing characteristics	Y	Y	Y	Y
School characteristics	Y	Y	Y	Y
School fixed-effects	N	N	N	N
Census-block fixed effects	Y	Y	Y	Y

Notes: See table 4 for a description of baseline sample and controls. Robust standard errors clustered by elementary school zone in 2002 in parentheses.

**Significant at the 5% level.

Table 6 provides the results for equation 2, splitting the charter penetration variable by charter type (conversion and startup) for homes in all of LA County. As in our regression split by school district, we focus on our preferred model with census-block fixed effects, zoned elementary school controls, and housing controls. As in the pooled model, none of the coefficients is statistically significant and the magnitudes and signs of the estimates do not reveal a consistent relationship between charter counts or charter enrollment rates and sale price for either charter type.

In table 7 we provide estimates that look at how charters affect house prices when we restrict the charters included in the count and enrollment share variables to those located in the same school district as the household. In California, within-district students get priority for charter enrollment and so there may be a stronger link with housing prices for these charters than those outside the district. Because LAUSD is especially large with most properties located far from district boundaries, when we estimate this model for LAUSD the estimates are little changed from baseline. Hence, in table 7 we only provide estimates using the districts in LA County outside LAUSD. These estimates are the only ones in this paper that provide a consistent indicator of a charter impact on housing prices. Intriguingly, this estimated effect is negative. An additional charter school within 2 miles reduces house prices by 1.9 percent and a 10 pp increase in charter share of enrollment within 0.5 miles reduces prices by 1.2 percent. This analysis provides some evidence that charters weaken the link between public schools and housing prices.

We build on this analysis further by testing whether we see larger effects in areas with higher quality schools. Tables A.2 and A.3 in the online appendix provide estimates, respectively, that are allowed to differ by terciles of income and school API score counting all charters, and counting only within-district charters. Although there are

Table 6. Effect of Charters on Log Sale Prices by Charter Type

	Los Angeles County	
	Number of Charters	Charter Seats as Percentage of Enrollment
Startup charters		
0–0.5 miles	−0.00450	0.00389
	(0.00952)	(0.0226)
0.5–1 mile	0.00253	0.000917
	(0.00537)	(0.0241)
1–1.5 miles	0.00341	0.00269
	(0.00357)	(0.0240)
1.5–2 miles	−0.00110	0.0273
	(0.00299)	(0.0234)
Conversion charters		
0–0.5 miles	−0.0137	−0.0226
	(0.0133)	(0.0362)
0.5–1 mile	−0.0110	−0.0432
	(0.0103)	(0.0311)
1–1.5 miles	−0.00664	−0.0397
	(0.00854)	(0.0456)
1.5–2 miles	−0.00225	−0.0506
	(0.00788)	(0.0513)
Observations	158,211	158,211
R^2	0.881	0.881
Housing characteristics	Y	Y
School characteristics	Y	Y
School fixed effects	N	N
Census-block fixed effects	Y	Y

Notes: See table 4 for a description of baseline sample and controls. Robust standard errors clustered by elementary school zone in 2002 in parentheses.

some marginally significant estimates in the low income schools in table A.3, overall the evidence for a pattern across school types is weak. One possibility is that the district quality is what matters. In table A.4 in the online appendix we investigate this by extending the model in table 7 to allow for different estimates by tercile of district API score. Here a clearer pattern emerges. In fact, the estimates suggest that there is a small increase in property values for high-performing districts but a reduction for low-performing districts. The relationship remains weak, however, with only one estimate for bottom tercile schools significant at the 5 percent level. It is unclear why such a pattern emerges but one possibility is that the low-achieving districts competing with LAUSD, which is also low-performing (12th percentile API), benefit from a premium over LAUSD that is weakened by charters. Or it could be the relationship between housing prices and school quality is more sensitive to charters in low-performing districts. Nonetheless, it is unclear to what extent this restriction to within-district charters should matter. Although district students get priority, this is only relevant if charters are oversubscribed. Hence, given the null results when we do not make this restriction we think it is best to consider these estimates to be a bound on the potential negative effect of charters.

Table 7. Effect of Charters Within the Home's School District on Log Sale Prices for Los Angeles County, Excluding LAUSD

	Number of Charters	Charter Seats as Percentage of Enrollment
Panel A. Half-mile Increments		
0–0.5 miles	−0.0387	−0.118***
	(0.0284)	(0.0431)
0.5–1 mile	−0.0123	−0.0786*
	(0.0149)	(0.0409)
1–1.5 miles	−0.0178*	−0.0758*
	(0.0098)	(0.0433)
1.5–2 miles	−0.0186	−0.0670
	(0.0156)	(0.0541)
Panel B. Condensed 0–2 Miles		
0–2 miles	−0.0192**	−0.0292
	(0.0090)	(0.1540)
Observations	93,041	93,041
Housing characteristics	Y	Y
School characteristics	Y	Y
School fixed effects	N	N
Census-block fixed effects	Y	Y

Notes: Sample includes property sales from April 2009 through September 2011. The independent variable denotes either the number of charters within the home's zoned school district in operation or the share of enrollment in operating charters as of the sale date in various distance rings from the property. Housing characteristics include number of bedrooms, bathrooms, square footage, and quality. School characteristics include API levels overall, lags and second lags of overall API scores, percent of students of each race, percent free lunch, percent gifted, percent English language learners, percent disabled, and parent education levels for elementary school zoned to the property in 2002. All regressions include month-by-year fixed effects. Robust standard errors clustered by elementary school zone in 2002 in parentheses.

*Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

Testing for Endogenous Charter Location

A consistent estimate of the relationship between charter penetration and housing prices rests on the assumption that the variation in charter penetration is exogenous, conditional on the included controls and, most importantly, the census-block fixed effects. As a test of this, we regress our limited set of housing characteristics on charter penetration variables and census-block fixed effects. Ideally, we would like to test the relationship between charter penetration and local neighborhood characteristics. Including census-block fixed effects precludes such an analysis, however, as we do not have access to time-varying neighborhood characteristics. Thus, we must rely on characteristics of the specific households that can be acquired from the property sales data.

Table 8 presents results that estimate whether charter penetration is related to square footage, the number of bedrooms, the number of bathrooms, and the quality of the structures on the property, as measured by the county assessor. We find no statistically significant relationship between the numbers of charters in any radius ring and square footage, the number of bedrooms, or the number of bathrooms. For quality,

Table 8. Impacts of Charters on Exogenous Observables

	Los Angeles County			
Number of Charters	**Square Footage**	**No. of Beds**	**No. of Baths**	**Quality**
0–0.5 miles	3.899	0.0147	0.0186	0.0124
	(14.0)	(0.0247)	(0.0192)	(0.0172)
0.5–1 mile	−6.593	−0.0112	−0.0183	−0.0096
	(7.4)	(0.0147)	(0.0112)	(0.0098)
1–1.5 miles	4.954	0.0116	0.0045	−0.0086
	(5.0)	(0.0098)	(0.0074)	(0.0066)
1.5–2 miles	−2.357	−0.0015	0.0001	−0.0120*
	(4.8)	(0.0097)	(0.007)	(0.0065)
Observations	158,211	158,211	158,211	158,211
Charter seats as percentage of enrollment				
0–0.5 miles	−22.710	−0.005	0.023	0.025
	(37.3)	(0.048)	(0.040)	(0.046)
0.5–1 mile	25.590	0.011	0.023	−0.037
	(40.6)	(0.062)	(0.050)	(0.05)
1–1.5 miles	28.490	0.011	−0.009	−0.021
	(39.5)	(0.057)	(0.051)	(0.050)
1.5–2 miles	−23.360	−0.044	−0.046	0.000
	(43.2)	(0.052)	(0.052)	(0.049)
Observations	158,211	158,211	158,211	158,211
R^2	0.67	0.55	0.59	0.80
School fixed effects	N	N	N	N
Census-block fixed effects	Y	Y	Y	Y

Notes: See table 4 for a description of baseline sample. Robust standard errors clustered by elementary school zone in 2002 in parentheses.

*Significant at the 10% level.

only the estimate for charters between 1.5 and 2 miles is statistically significant and only at the 10 percent level. For charter seats as a percentage of all public education seats, no estimate is statistically significant.

In a second analysis, we regress the log of house price on charter penetration within a half-mile of the home in 12-month lag and lead intervals up to 3 years before the home was sold and 3 years after the home was sold. For example, the 12-month lag measure corresponds to charters within a half-mile of the property that were in operation 12 months prior to the home's sale. The purpose of this analysis is to test for pre-existing trends and to see if there are any anticipatory or delayed impacts of charter openings. Thus, a clear pattern of higher prices from charters in operation after the house sale would be evidence of either anticipatory effects or pre-existing trends in housing prices, the latter of which would invalidate the identification strategy. A pattern of higher prices from charters in operation prior to the home sale would indicate that housing prices are affected by charters but with a delay, potentially due to short-term price stickiness.

Table 9 provides the impacts of lags and leads, which show little evidence of responses to charter penetration. Of the two significant coefficients, one is for the 12-month lead in charter enrollment percentage. This estimate suggests that an increase in enrollment rates of 10 pp within a half-mile of a home 2 months following its sale increases the sale price by 0.3 percent. This could be indicative of a pre-existing

Table 9. Effect of Lags and Leads of Charter Penetration

	Los Angeles County	
	Number of Charters	Charter Seats as Percentage of Enrollment
36 months prior to sale	−0.0005	−0.001
	(0.0100)	(0.027)
24 months prior to sale	−0.0039	−0.017
	(0.0093)	(0.031)
12 months prior to sale	−0.0055	−0.008
	(0.0089)	(0.030)
Time of sale	−0.0010	0.006
	(0.0088)	(0.031)
12 months after sale	0.0038	0.033**
	(0.0054)	(0.015)
24 months after sale	−0.0082	−0.019
	(0.0080)	(0.025)
36 months after sale	0.0190*	0.013
	(0.0102)	(0.037)
Observations	158,211	158,211
R^2	0.88	0.88

Notes: See table 4 for a description of baseline sample and controls. Robust standard errors clustered by elementary school zone in 2002 in parentheses.

*Significant at the 10% level; **significant at the 5% level.

trend, although the other estimates suggest this is not likely to be the case. First, estimates for charter penetration 24 and 36 months after the sale show no impact. Second, there is no similar impact when measuring penetration using the number of charters. The other significant coefficient is for the 36-month lead in number of charters, suggesting an additional charter school within a half-mile of the property 36 months following the sale of the home increases the sale price by 1.9 percent. If this were indicative of an anticipatory response or pre-existing trend, however, we would expect to find significant impacts from charter penetration 24 months and 12 months after the sale, as well. Thus, although there are a couple of estimates that suggest anticipatory responses or pre-trends, the bulk of the evidence in table 7 argues against such a pattern. Further, we note that the results in the table also provide little evidence of a delayed response since there is no significant impact from the number of charters open or the charter enrollment rates 12, 24, or 36 months prior to the sale.

Finally, in table 10, we test the concern that the addition (or closure) of charter schools may generate sample selection by inducing some people to enter or stay out of the housing market. To do this we regress the number of annual sales in a census block on charter penetration near the block centroid. Further, even though we only have price data for the most recent sale of a property, we can see the dates for the three most recent sales. Thus, in the second column we repeat the analysis using the three most recent sales of properties in the sales counts. The results show little impact of charter share of enrollment on housing sales. There is also no significant relationship between charter counts and sale counts within one mile of the centroid. Nonetheless, there is a statistically significant but economically small relationship between sales counts and

Table 10. Relationship Between Charter Penetration and the Number of Annual House Sales in Census Block

	Quantity of House Sales within Census Block			
	Counting Most Recent House Sale		Counting Three Most Recent House Sales	
	Number of Charters	Charter Seats as Percentage of Enrollment	Number of Charters	Charter Seats as Percentage of Enrollment
0–0.5 miles	0.0828 (0.168)	0.354 (0.414)	0.0901 (0.174)	0.346 (0.417)
0.5–1 mile	0.119 (0.110)	0.346 (0.533)	0.130 (0.110)	0.391 (0.537)
1–1.5 miles	0.139* (0.0776)	0.581 (0.647)	0.171** (0.0794)	0.801 (0.721)
1.5–2 miles	0.0972* (0.0547)	−0.0104 (0.607)	0.121** (0.0554)	0.120 (0.659)
Observations	87,683	87,683	87,683	87,683
Census-tract fixed effects	N	N	N	N
Census-block fixed effects	Y	Y	Y	Y

Notes: Sample includes property sales from September 2008 through September 2011. The independent variable denotes either the number of charters in operation or the share of enrollment in operating charters as of the sale date in various distance rings from the property. Robust standard errors clustered by elementary school zone in 2002 in parentheses.

*Significant at the 10% level; **significant at the 5% level.

the number of charters 1 to 2 miles from the centroid. The estimates suggest, after conditioning on census-block fixed effects, that a new charter opening 1 to 2 miles from the block centroid is related to an increase of 0.1 to 0.2 sales in a year. To put this in perspective, it would take five to ten new charter openings in a year to generate an additional sale. Given that the average number of charters in that distance range from properties is 1.9, we believe this impact is too small to substantially affect our estimates.

Effect of Charter Penetration on Housing Prices: Heterogeneity and Specification Checks

In the online appendix we provide a series of analyses to look at impacts of charters when we allow the characteristics of the charters, local neighborhoods, and local public schools to vary. First, in table A.5 we provide different estimates by the grade level of the charter. We split charter penetration measures into four categories—elementary, middle, high, and multi-level schools. We see little evidence of differential impacts on housing prices by the level of the charter school at any distance up to 2 miles from the property. Only one estimate out of thirty-two is statistically significant at the 5 percent level. Three more are significant at the 10 percent level, but show no clear pattern and differ in sign.

In table A.6 we interact the charter penetration measures with the year of the property sale. Because the housing market in Los Angeles had undergone substantial declines just prior to our study, we may be concerned that the lack of capitalization is due to abnormal rigidities in the market, although we note the significant effects when we restrict to within-district charters suggest this is not the case. Nonetheless, to address this, we focus on the estimates for 2010 and 2011, well after the market had

started its recovery. As with our main results, we find no statistically significant impacts of charter penetration at any distance within 2 miles of a property in 2010 or 2011. In fact only one estimate out of the thirty-two shown is statistically significant—that is, 1 to 1.5 miles in 2008.

In table A.7 we provide evidence on whether the overall mean charter impacts may be hiding heterogeneous effects between neighborhoods with high-performing and low-performing schools by interacting the charter penetration variables with both the distance from the property and quartiles of household income (across all properties in the data) in the census tract, the zoned elementary school's API score, percent minority enrollment in the zoned elementary school, and minority enrollment in the census tract. Only 5 estimates out of 128 are statistically significant at the 10 percent level (one estimate at the 1 percent level) and do not show a clear pattern. Thus we see little indication of our pooled estimates hiding heterogeneous impacts among these characteristics. This further indicates that the overall null results are not due to differential impacts from weak and strong schools canceling each other out.

Finally, in table A.8 we provide estimates under different specifications and sample restrictions. Through all of these specification and sample checks, no estimates are statistically significant. These checks include using sale price levels rather than log sale prices, splitting the sample by the number of bedrooms, keeping properties with more than eight bedrooms in the regression, dropping large (5,000 square feet or larger) properties, dropping multi-unit properties, and limiting to the summer months of June, July, and August as families with children are more likely to move during this period between school years. Further, we show that adding a fifth distance ring of 2 to 5 miles does not change the estimates, nor is the estimate on the added ring significant, and adding in school fixed effects (in addition to census-block fixed effects) has little impact on the baseline estimates.

8. CONCLUSIONS

Research has previously shown close links between school quality and property prices. This has been explained as a capitalization of both the quality and capital stock of schooling into local property values, given that students typically are required to attend a specific local public school. Hence, properties zoned to schools and districts with higher performance and more resources have seen higher values, all else equal. Charter schools have the potential to weaken this relationship. Students can typically attend a charter regardless of where they reside, thus making the local school potentially less important to residency decisions. Given that enrollment in charter schools has been increasing across the country over the past twenty years and, if present trends continue, is likely to increase further, the breaking of the link between housing prices and school quality can have implications for local public finance as well as socioeconomic diversity across schools.

In this study we directly estimate how charter schools affect local property values in Los Angeles County. We also expand our analysis to separate our measures of charter penetration by urbanicity, charter type, and grade level of the school, along with wealth of the local neighborhood and the achievement levels of the local elementary school. Our approach follows the work of other researchers relating school characteristics to housing prices, and carefully accounts for the correlation between neighborhood characteristics

and housing prices, by including census-block fixed effects. This method allows us to estimate the impacts of charters net of any time-invariant differences between local neighborhoods and, by extension, local public schools.

Using data from the Los Angeles County Assessor's Office on property sale prices from 2008 through 2011, our estimates show there is very little impact of charters on home prices on average. The results are not sensitive to sample selection or model specification, nor do we find differential impacts by whether a charter is a startup or conversion, whether the property is in the primary urban school district in the area, Los Angeles Unified School District, by the grade level of the charter, by the income level of the neighborhood, or by test scores in the zoned elementary school. However, given that in California oversubscribed charters must provide priority enrollment to students within the local school district, we also estimate a model that restricts to charters located in the same school district as the property. In this case, which we consider a negative lower-bound impact as it is not clear whether such a restriction is appropriate, we find some evidence that housing prices actually fall by 2 percent for each additional charter within 2 miles. Because evidence of differential impacts by school quality is weak and, at best, negatively related to income and performance, this suggests that perhaps charter schools weaken the capitalization of schooling as a public good into property values rather than the capitalization of school quality in particular.

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