Parental Valuation of School Choice: Evidence from Geographic Boundaries[+]

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Abstract:
School choice in the United States has expanded rapidly over the past two decades, but the degree to which parents value this expanded choice is unclear. Using multiple estimation strategies that exploit discontinuities along administrative boundaries, we estimate the degree to which access to inter-district school choice is capitalized into the housing market. Our estimates indicate a positive home-price premium associated with access to higher-performing school districts, and this premium decreases as distance between residence and district of choice grows and charter school access increases. The school choice premium also increases with the differential in school performance between residential districts and districts of choice, though not enough to overcome the residential school quality home price premium.

Keywords: School Choice, Hedonic Valuation, Housing Prices
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1 Introduction

School choice in the United States has expanded rapidly over the past two decades under the promise that expanding schooling options will provide welfare benefits to parents and their children. In fact, the share of students attending a chosen as opposed to assigned public school rose nearly 50 percent from 11 percent in 1993 to 16 percent in 2007 (NCES). However, given the widespread adoption of school choice policies and their importance, little research seeks to understand the value parents place on school choice options and the limited extant evidence is mixed.

This raw growth in school choice utilization suggests that parents place some value on schooling choice compared to their previous schooling options. Indeed, a voluminous literature focuses on the effects of school choice on the academic achievement of both students who utilize school choice and students who remain in their assigned schools.[1] However, this literature typically focuses on one effect of school choice such as student achievement, and does not attempt to understand the valuation that parents place on these options. Understanding parental valuation is particularly important given that a growing body of work points to parental psychic costs imposed by school choice, which a focus on student outcomes alone would fail to consider.[2] Focusing on parental demand for school choice as reflected in housing prices captures all of these components.[3]

[1] For examples see Cullen (2006); Goldhaber (1996); Hastings & Weinstein (2008); Hoxby (2003); Hsieh (2006); Imberman (2011a, 2011b); Lavy (2010).

[2] For examples see Beal & Hendry (2012); Crozier et al. (2013); Roda & Wells (2013).

[3] Under Rosen's (1974) theory, consumers maximize utility by setting their indifference curves tangent to the continuous hedonic price function, such that their marginal willingness to pay for say school choice quality equals the slope of the hedonic price function. Thus, by estimating the school choice premium we uncover parents' willingness to pay for school choice quality, which is necessary for welfare analysis. Similar strategies have been used to perform welfare analysis associated with the Clean Air Act in Chay & Greenstone (2005) and with superfund cleanup in Greenstone & Gallagher (2008).

In large part, the lack of focus on housing price capitalization of school choice is due to the dearth of convincing identification strategies that make use of exogenous variation in school choice. To overcome this hurdle, we utilize spatial variation in access to inter-district school choice (IDSC) along administrative boundaries in Michigan. We then merge comprehensive home sales data to district boundaries and flows of students between districts. Michigan is an ideal setting for such an analysis for multiple reasons. First, Michigan has a longstanding school choice program that is highly utilized in areas across the state with over 7 percent of students utilizing the program in recent years (Cowen et al. 2015). Second, school districts in Michigan are quite small with around 550 public school districts covering the state, providing housing density along district boundaries that often do not coincide with other administrative boundaries. Last, and most importantly, districts are organized in intermediate school districts (ISDs), which have little direct role in schooling provision, but foster choice between districts within the same ISD. This leads to plausibly exogenous variation in the assignment of school choice between districts.

Borrowing from the literature on the capitalization of school quality in the housing market, we use both boundary discontinuity designs and differences in matched transactions to estimate the value parents place on school choice.[4] Hence, the analysis produces estimates of the housing market's valuation of school choice that are directly comparable to traditional estimates of market capitalization of school quality.[5] In our initial boundary discontinuity design, we relate price differentials between homes on either side of a district boundary to the option to send their children to a third district. We then restrict attention to sales close to the district of choice to account for the mediating effect of transportation costs, and explore a wide variety of

[4] Refer to Black and Machin (2010) for a survey of this literature.
[5] For examples see Black (1999), Gibbons et al. (2013), Bayer et al. (2007), and Kane et al. (2006)

bandwidths. Next, we match home sales across district boundaries and relate the price differential to the differential in school quality, the availability of choice between districts, and the interaction between these two. This analysis provides estimates of the school quality home-price premium as well as the valuation of school choice in proportion to the difference in school quality.

We find a positive home-price premium associated with access to higher-performing school districts. These results are robust across multiple specifications and identification strategies. On average, we find a 3 percent home price premium associated with residential based access to the next-nearest district. However, this premium decreases as distance between residence and district of choice grows, and as residents enjoy additional schooling choice provided by charter schools. Residential access to IDSC raises home prices by 10 percent in homes that are within 0.3 miles of both the nearest and next nearest district. Conversely, each additional charter school within 1 mile of the resident district decreases the IDSC price premium by about 1.5 percent. The home-price IDSC premium also increases with the differential in school performance between residential districts and districts of choice, though not enough to overcome the residential school quality home-price premium. Roughly half of the 30 percent price differential attributed to a 20 percent difference in school quality disappears under inter-district choice. These results indicate that parents value school choice quality, but at a lower level than they value resident school quality.

Our results provide a valuable contribution to an existing literature on parental valuation of school choice that is currently mixed. Whereas Reback (2005) finds that expanding school choice in Minnesota increases home values in sending districts, Imberman et al. (2014) finds no appreciation of homes in Los Angeles with the entrance of charter schools in the neighborhood.

In contrast with these earlier studies, we rely on plausible exogenous spatial variation around otherwise arbitrary administrative boundaries. In doing so, this work avoids potential confounding intertemporal variation in prices with a changing schooling landscape. Furthermore, Rosen's (1974) model of uncovering implicit prices applies to a single equilibria as represented by a single cross-section of home-price data. Interpretation of price changes driven by amenity changes over multiple time equilibria is less straightforward.[6] By providing estimates using within boundary-year variation, we not only provide strong identification, but also estimate the willingness to pay for school choice.

The remainder of the paper is structured as follows. Section 2 provides background on IDSC policies in Michigan and previous literature, and Section 3 discusses the empirical specification used in our analysis. Section 4 then presents the data sources used in our analysis, Section 5 performs a validity check on our empirical strategy, and Section 6 presents the results of our analysis. Section 7 concludes, discussion the implications of our analysis.

2 Background

Parental valuation of school quality is the subject of a longstanding debate in the economics of education. The recent literature that uses more advanced techniques such as boundary discontinuities dates back to Black (1999) and is summarized in a recent review article by Black and Machin (2010).[7] Note that quality of school choice may be valued differently based on the salience of the quality to parents and parental valuation of the transportation costs incurred by transporting their child to the school. Two studies most similar to this work are Imberman et al.

[6] See Banzhaf (2015) for a discussion of the interpretation of difference-in-differences estimates of capitalization.
[7] Recent examples include Gibbons et al. (2013), Bayer et al. (2007), Kane et al. (2006), and Figlio and Lucas (2004).

(2014) and Reback (2005). Imberman et al. (2014) examine how housing prices react to the entrance of charter schools in Los Angeles. Reback (2005) examines changes in property values over time in Minnesota as they relate to the availability of IDSC options. Relative to these previous studies that relied on intertemporal variation, our boundary discontinuity design is robust to differential trends between school district attendance zone housing markets.[8]

In this study, inter-district school choice refers to Michigan's “schools of choice” program, which allows students to attend a school outside of their resident school district.[9] In Michigan, IDSC is voluntary and school districts decide whether to participate in the school choice program. It is important to note that the school districts have multiple dimensions of choice when deciding whether to allow IDSC students. First, the district can set different numbers of slots for each school-grade combination. Most importantly, however, districts also decide whether to allow all students outside of their school district or simply students outside their school district who reside within the boundaries of their Intermediate School District (ISD).[10]

After the number of slots is set, districts get no discretion over which students to admit and must use a lottery to determine admittance if a particular school-grade combination is oversubscribed. Note that some school districts in Michigan also have intra-district choice

[8] Machin and Salvanes (2010) also examine differential access to school choice, but their results are primarily applicable to the debate over parental valuation of school quality. In addition, they study Norway and it is an open question as to whether their results would generalize to school choice programs in other contexts. Fack and Grenet (2010) examine public and private school valuation, but examine private schools in Paris that are almost entirely publicly-funded.

[9] Further information on the interdistrict choice program in Michigan may be found in Section 5-I of the Michigan Pupil Accounting Manual, which includes a discussion of the differences between Section 501 and Section 501c school choice (Michigan Department of Education, 2016a).

[10] Each school district is nested within ISDs, which provide higher-level administrative services for groups of school districts, but typically do not make the same amount of day-to-day financial decisions as school districts. These programs are referred to as “Section 501” (within ISD) and “Section 501c” (outside ISD) inter-district choice, respectively.

programs, which allow students to attend schools within district other the school assigned to them based on residential location. These programs vary across districts in their implementation and are considered outside the scope of the proposed study.

Since the implementation of Proposal A in 1995, school districts in Michigan receive the vast majority of their funding from the state government. School funding is primarily based on a per-pupil “foundation allowance,” which is the amount given to a school for each student attending the school. These amounts vary between districts and are determined in large part by millage rates and pre-1995 school spending levels. If a student participates in inter-district choice, the school receives the minimum of the foundation allowance in the sending district and the foundation allowance in the receiving district. Hence, the marginal revenue gained by the district for enrolling an additional IDSC student is guaranteed to be less than or equal to the marginal revenue gained by enrolling an additional resident student.

3 Empirical Model

We employ three different empirical strategies related to or extending boundary discontinuity designs utilized in previous work on the valuation of neighborhood schools (e.g. Black, 1999; Bogart and Cromwell, 2000; Kane et al., 2005; Davidoff and Leigh, 2006; Fack and Grenet, 2010; Bayer et al, 2007; Ries and Somerville, 2010; Gibbons et al., 2013). Since this earlier work relies on discontinuous changes in school quality across geographical borders, access to choice in schooling beyond neighborhood schools presents a potential threat to validity. Here, we focus on border discontinuities in access to schooling choice to estimate parents’ valuation of additional schooling options.

Sherwin Rosen's (1974) canonical work proposes that researchers may uncover the value of local amenities for which no direct market exists, by disentangling the price of a bundled good (such as a home) into the implicit prices of its individual components (such as bedrooms, local school quality, or additional schooling options). Within Rosen's framework, consumers maximize their utility by setting their price/amenity indifference curves tangent to the hedonic price function, such that their marginal willingness to pay for a particular amenity equals the slope of the hedonic price function. As a starting point, consider the following general hedonic price function:[11]

$$p = s(b)\eta + c(b)\beta + x(b)\gamma + g(b) + u$$

Here, *p* represents the housing price, *s(b)* is the expected school "quality" attained in the resident school district for residence *b*, *c(b)* captures the availability of additional schooling options to households living in residence *b*. Naturally, β serves as the relevant slope which reflects consumer's valuation of the additional schooling options. *x(b)* is a vector of housing characteristics, and *u* is an error term that is assumed to be independent of *x*, *r*, and *s*. *g(b)* represents the unobserved determinants of housing prices that may be correlated across nearby houses and with resident or choice schooling quality.

The intuition of the boundary discontinuity strategy is to compare sufficiently nearby residences such that $E[g(b) - g(b')|x, c, s] = 0$. This implies that the strategy requires finding instances where $E[g(b) - g(b')|x, c, s] = 0$, but there is still variation in $\Delta s(b, b')$ and $\Delta c(b, b')$.

4.1 Boundary and Boundary Corner Discontinuity

[11] This equation reflects a standard starting point in the literature (e.g., Black and Machin 2010, Gibbons et al. 2013), extended to incorporate the valuation of school choice quality.

Our first proposed analysis makes use of administrative boundaries in Michigan to find cases where $\Delta c(b, b')$ and $\Delta s(b, b')$ vary, while in principle being able to realistically maintain the assumption that $E[g(i) - g(j)|x, c, s] = 0$. In practice, we vary the distance to the border from one to one-tenth of a mile with the thought that closer to the border, properties will be more similar though smaller in number. With a sufficiently tight bandwidth around the border, while sacrificing efficiency, the border and time fixed effects more plausibly capture differences in *g(b)*. As with prior work, we assume that with tight geographic bandwidths the physical landscape does not differ substantially on either side of the border (e.g., Black and Machin 2010, Gibbons et al. 2013). We construct our measure of choice, c_{bjt}, as an indicator for whether the nearest district to the border area (as opposed to the comparison district across the border) is of higher quality than the resident district and accepts students from the resident school district. In this way we further divorce our measure of choice from differences in school quality between districts on either side of the administrative boundary. In practice, we estimate the following specification:

$$p_{bjt} = \eta \, s_{bjt} + \beta \, c_{bjt} + \mathrm{X}_{\mathrm{bjt}}\gamma + f\left(BorderDist_{bj}\right) + \theta_{jt} + u_{ijt}$$

Where p_{bjt} is the log sales price of house in residence *b* on boundary *j* in year *t*. The primary variable of interest is c_{bjt}, which represents an indicator for whether the nearest district to the border area is of higher quality than the resident district and accepts students from the resident school district. s_{bjt} represents the quality of resident district schools and $\mathrm{X}_{\mathrm{bjt}}$ is a vector of house-level controls including number of bedrooms, number of bathrooms, square footage, lot size, month of sale, and age of the home. $f\left(BorderDist_{bj}\right)$ is a parametric function of distance to the border. θ_{jt} represents a border-by-year fixed effect, which absorbs any yearly unobserved border heterogeneity. [12] Finally, u_{ijt} represents an error term that is assumed to evolve continuously at the border so that it is conditionally uncorrelated with the explanatory variables within a given bandwidth of the border.

We may expect the degree to which IDSC is capitalized into home prices to vary with proximity to the higher-quality, accepting district. As transportation costs presumably increase with distance, the value of choice becomes less capitalized into homes further from the district of choice. Indeed, a long line of previous research shows the capitalization of public amenities in home-prices decreases in distance from the amenity (for examples see Gibbons and Machin, 2005; Anderson and West, 2006; Greenstone and Gallagher, 2008).

Our subsequent boundary corners approach is motivated by this basic intuition. In practice, this is accomplished by estimating the following specification:

$$p_{bjt} = \eta\, s_{bjt} + \beta\, c_{bjt} + \mathrm{X}_{\mathrm{bjt}}\gamma + f\left(BorderDist_{bj}\right) + h\left(ChoiceDist_{bj}\right) + \theta_{jt} + u_{ijt}$$

Here, we keep much of the structure as before with $f\left(BorderDist_{bj}\right)$ and $h\left(ChoiceDist_{bj}\right)$ serving as parametric functions of distance to the border and the nearest district to the border area. Rather than vary distance to the border j, in this specification we tighten the radius around a corner of three districts. As the bandwidth around the corner tightens, the fact that the district sharing the boundary is closer in proximity becomes less relevant.

The key assumption underlying both of these approaches is that conditional on covariates, there are no unobserved characteristics on either side of the border that are correlated with the explanatory variables and the difference in prices between houses. If this holds, this

[12] In robustness specifications, we include border and month-by-year fixed effects that sacrifice some robustness to time variability of the unobserved border characteristics for modest efficiency gains.

analysis isolates the part of housing price changes that are due to changes in residential schooling and school choice options.

In both prior specifications, we focus on nearest districts to the border area so that our results will be less sensitive to unobserved differences in local amenities across district boundaries. However, the school district just across the border maybe the closest school district that accepts resident students. In such cases, these bordering districts may be the most relevant district of choice, and thus most likely to influence home prices in the resident district. This fact motivates our matched transactions analysis below.

4.2 Differences in Matched Transactions

Our final specification is designed to uncover the valuation parents on one side of the border place on the option of sending their children to higher-performing schools on the other side of the border. While the critique that district boundaries create discrete unobserved changes in local amenities is still present, this approach uses multiple strategies to mitigate these concerns. First, we match home sales across administrative district borders within each year of sale based on the minimum distance between properties as does Gibbons et al., 2013.[13] We then take the first difference of price and covariates to remove unobserved local year effect. We then use a type of difference-in-differences specification to capture the capitalization of the difference in school quality Δs_{bjt}, an indicator for the higher-performing district accepting students from the lower-performing district a_j, and the interaction of the two $\Delta s_{bjt} \times a_j$. Lastly, we vary the bandwidth around the border to again focus our attention to areas in which unobserved differences in geography are minimal.

[13] I practice we, match on distance between census blocks. In the event that there are more than one property sale in a given year, the matching property is drawn at random.

$$\Delta p_{bjt} = \eta \, \Delta s_{bjt} + \beta a_j + \gamma \, \Delta s_{bjt} \times a_j + \Delta \mathrm{X}_{\mathrm{bjt}} \gamma + f\left(\Delta Dist_{bj}\right) + \Delta u_{bjt},$$

where Δp_{mjt} is the difference in log sale price between home b and its closest propensity score matched home across boundary *j* in year *t*. The sample is constructed such that Δs_{bjt} in non-negative; that is each home-sale in the lower-performing district is matched to the closest home-sale in the higher-performing district. The primary variable of interest is the interaction, $\Delta s_{bjt} \times a_j$, where a_j indicates whether the higher-performing district on boundary *j* accepts students from the lower-performing school district across the boundary. This interaction term is key to providing an estimate of the valuation that parents place on school choice quality as opposed to pure value of having a choice. $\Delta \mathrm{X}_{\mathrm{bjt}}$ is a vector of differences in the same house-level controls used is previous specifications, and $f\left(\Delta Dist_{bj}\right)$ is a parametric function of distance between the properties.[14] Finally, Δu_{ijt} represents the difference in error terms that we assume to be conditionally uncorrelated with the differences in explanatory variables.

4 Data

The analysis draws on data from three disparate sources. We use housing sales data from 2007-2009 data provided by Corelogic as the source of the most recent home prices. See Figure 1 for a map of covered counties. These data contain 134,372 home sales across 557 border-years. The data set covers the majority of major cities and towns in the state of Michigan, and the covered counties contained over 68 percent of the state's resident population in 2010. In addition to home prices, these data also contain property acreage, building size and age, and number of bedrooms and baths.

[14] In practice, distance is measured using census block centroids.

These home characteristics are summarized at the top of Table 1. In these data, the average home sold for $122,977 with a standard deviation (SD) of $142,886. We also show summary statistics at bandwidths of 1, 0.5, 0.25, and 0.125 miles to reflect the changing composition of our sample as we restrict attention to properties close to administrative boundaries in our RD approaches. In general, the homes are more modest closer to the boundary with the average home selling for $103,517 within an eighth-of-a-mile from the district border.

Administrative school district boundaries are publicly available and published by the U.S. Census Bureau, as are the boundaries of census blocks and charter school locations.[15] From these data we calculated distances between district boundaries and census blocks in which home sales transpired. The same was done for charter schools. The average home sale is a mile from the district boundary with a SD of 0.96 miles.

Information on school and district quality as well as flows of IDSC students is made publicly available by the Center for Educational Performance and Information (CEPI) and provides a description of how many students transfer between any given pair of school districts. As our primary measure of district quality we use an average of school scores, where the school score is an average of grade-level-standardized scale scores. We present the raw scaled scores both disaggregated by grade and averaged in the middle of Table 1. The standardized measures of school quality appear immediately below. As noted in Kane et al. (2003), it is important to note the magnitude of SD when using standardizations. Here, when averaging across schools, the SD grows substantially. Whereas according to Black (1999) a 1 SD increase in test scores translates to roughly 5 percent of the mean, in our context 1 SD increase in scores is roughly 20 percent of the mean.

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[15] GIS software was used to calculate distances between census block, school districts, and charter schools.

While this latter data set does not provide documentation of whether school districts accept students from outside of their school district, it can be inferred that, conditional on distance and district characteristics, if a school district enrolls no school-of-choice students, there are likely no IDSC opportunities available to residents of the sending school district. We define a district as open to the resident district if it enrolls more than 10 school-of-choice students from the resident districts. Approximately half our sample has access to attending school in the next-nearest district.

5 Validity

As noted in Black and Machin (2010) and Brasington (2002), one important assumption in hedonic analysis is that the housing supply elasticity is close to zero. This concern may be particularly relevant in our setting using boundary fixed effects to study IDSC. Here we are helped by the generally small district sizes in Michigan, particularly in the most populous counties which comprise our sample. For example, 15 other districts lie within 15 miles of the borders of Detroit Public Schools.

Further, to illustrate the comparability of our school district analysis to analyses using school catchment areas, we estimate the capitalization of school district quality along school district boundaries, similar to Black's (1999) analysis of school quality. Table 2 reports the results of this analysis with Figure 2 showing the evolution of point estimates as we restrict the bandwidth. Moving left to right, we begin with the full sample before tightening the bandwidth to the district boundary from one mile on either side down to one-fifth mile on the furthest right. Black (1999) finds a 20 percent gain in school test scores associated with a 7.5-20 percent increase in home prices. Our point estimates are remarkably close implying that a 20 percent increase in test scores result in a 10-26 percent increase in home prices with all results significant at 95 percent confidence level.

One key assumption underlying these analyses is that amenities do not vary discontinuously around administrative boundaries. Though we include covariates in our RD estimates, discontinuous changes in those covariates may be symptomatic of potential bias-inducing discontinuous changes in unobservable characteristics. To determine whether such discontinuities are present in the data, we estimate the following for each home characteristic, again varying bandwidths as with the initial boundary discontinuity approach:

$$X_{bjt} = \eta\, s_{bjt} + \beta\, c_{bjt} + f\left(BorderDist_{bj}\right) + \tau_m + \theta_{jt} + u_{ijt}.$$

Here, X_{bjt} represents each home characteristic, s_{bjt} and c_{bjt} represent school quality and school choice, $f\left(BorderDist_{bj}\right)$ is again a flexible function of distance from the border, and τ_m and θ_{jt} represent month and district-by-year fixed effects respectively.

We report the results of the boundary discontinuity regressions in Table 3, such that each cell of the table is taken from a separate regression. We also depict the relationship between point estimates on IDSC and bandwidths in Figure 3. Only one covariate is unbalanced around the border in the data—building square footage. Naturally, with multiple hypothesis testing, some imbalance is likely to occur. Further, it is important to note that there is significant missing data with this covariate allowing us to use under 15 percent of the available data for testing unbalance in building size even before we restrict bandwidths. We perform similar tests using the boundary corners approach, and report the results in Table 4. While at larger bandwidths we find more evidence of unbalance than with the basic boundary discontinuity design, as we restrict attention to properties close to the borders, with the exception of building size, these coefficients drop in magnitude and lose statistical significance.

6 Results

6.1 Boundary and Boundary Corners Discontinuity Designs

Table 5 presents coefficient estimates and standard errors for our basic boundary discontinuity approach. Moving left to right we begin with the most parsimonious specification including only resident district school quality and the choice indicator in addition to month and boundary-by-year fixed effects. We then add our control variables followed by reducing the bandwidth to the district boundary from first the full sample to one mile on either side, then gradually down to 0.1 mile on the furthest right.

We find that access to higher-performing schools in the nearest district to the border area, increases home prices by around 3 percent. Across all bandwidths, our point estimates are quite stable and range from 2.1 to 5.2 percent. Unsurprisingly, the standard errors rise as the bandwidth gets tighter, and the coefficients lose statistical significance moving between bandwidths of 0.75 and 0.50 miles. It is important to note that here the choice refers to access to the next-nearest district rather than the district across the border—the latter potentially being the more relevant in the determination of home values.

Our estimates of the price premium for resident school quality are less stable using this basic boundary discontinuity approach. A one SD increase in our composite measure of school quality is comparable to a 20 percent increase in student test scores. We find that the same one SD increase in school quality translates to a 13-28 percent increase in price. These estimated effects are within, but are on the higher end of those summarized in Black and Machin (2010). For context, the preferred point estimates from Black (1999) would predict a 10 percent increase in price for the same increase in test scores. We should note that much of that earlier work focuses on school catchment areas rather than districts, and thus misses the price effects of intra-district choice. Further, the point estimates of the capitalization of school quality decrease in magnitude as bandwidths tighten. This initially monotonic fall in the point estimates associated with higher resident school quality suggests that away from the border unobservable neighborhood characteristics may be biasing the estimates. The stability of the estimated premiums on choice suggests omitted variable bias is less of a concern on the parameter of primary interest. Lot size, home square footage, number of bedrooms and bathrooms, and recency of build each add to the home's value. However, the option of attending school in the nearest district to the border may not be the most relevant schooling option to parents living along the border. Whether the district across the border accepts students from the resident district may be a more salient determinant of home values. The regressions reported in Table 6 address these concerns by explicitly controlling for distance to the next-nearest (as well as distance to the nearest district border), and tightens the bandwidth in regard to both districts, such that we focus around a corner. Thus, Columns 1 and 2 of Table 6, which includes the full sample, is very similar to the results we report in Columns 1 and 2 of Table 5. However, as the bandwidth tightens, we restrict attention to home sales close to both districts. Since the sample restriction is in two dimensions in this specification, each reduction of bandwidth sacrifices a substantial number of observations. Accordingly, Table 5 presents bandwidths that range from 1 mile to 0.20 miles.

Table 6 shows the premiums associated with having access to higher-performing schools in the next nearest district. In the full sample, the estimated effect of access to the next-nearest higher-performing district is near the 3 percent increase shown in Table 4. As predicted, these effects largely increase up to 12.7 percent as bandwidths tighten around these district corners.

Since with tighter bandwidths we restrict attention to homes with low transportation costs to the schools of choice, this inverse relationship between bandwidths and the capitalization of school choice in home values shows that the value of choice likely depends upon the cost at which homeowners may access it.

These point estimates are largely statistically significant with *p*-values in Columns 3-8 ranging from 0.079 to 0.009. However, the standard errors rise as the sample size shrinks with tighter bandwidths. With bandwidths of 0.2 miles, the point estimate is similar in magnitude but loses statistical significance (*p*-value of 0.138).

6.2 Differences in Matched Transactions

Table 7 reports results from our matched transactions approach. Here we estimate the value parents place on access to higher-performing schools directly across an administrative boundary using matched property sales.[16] Here we control both for differences in school quality between matched property sales and for whether the higher-performing district accepts students from the lower-performing district. Our primary variable of interest is the interaction between the two. As with Table 5 we begin with the most parsimonious specification including only our main effects and their interaction. We then add covariates before restricting the bandwidth from 1 mile on either side to one-tenth-mile on either side of the border.

In this specification across all bandwidths, we find that a 20 percent difference in school quality corresponds to a 27-38 percent difference in home prices, but that price difference is nearly entirely erased by the option to attend school in the higher preforming district (point

[16] Table 7 reports results from matching home sales in lower-performing districts to the nearest home-sales in the higher-performing district. Table A.1 of Appendix A shows the symmetric results when home-sales in the higher-performing district are used as the basis for matching. The results are very similar between the two.

estimates ranging from 22-32 percent). These point estimates largely fall as we tighten the bandwidths, causing us to prefer these smaller estimates. With larger bandwidths, we also find that choice even with a negligible difference in school quality corresponds to an increase in the price differential. However, these point estimates drop more dramatically than the other two with tightening bandwidths, and lose statistical significance with a bandwidth of 0.15 miles.

6.3 Charters Schools as Other School Choice

Another major source of school choice in Michigan comes from the charter sector, which serves roughly 10 percent of the state's public school students.[17] For parents interested in sending their children to schools other than those in the resident district, charters and IDSC may serve as substitutes. Given that there are no residential constraints on who may attend a given charter school, such additional choice may alter the demand of inter-district schooling choices. Consequently, we expect that increases in the number of charter schools would erode the capitalization of IDSC within the housing market.

We explore this possibility explicitly by including both a measure of charter school's penetration into the local schooling market and an interaction between charter presence and access to inter-district choice. We perform analysis using multiple measures of charter school presence. Initially we use an indicator for whether at least one charter school is present in the district. We subsequently use a count of charter schools within given radii of the district.

We present the results of this analysis in Table 8 with Panel A using the indicator for charters within the districts and counts of charter schools within radii of one, three, and five miles of the district borders in Panels B, C, and D respectively. Taken in entirety, the results

[17] Sources: Michigan Department of Education (2016b) and Michigan Association of Public Schools (2016).

presented in Table 4 remain largely unchanged. There are two exceptions. First, the capitalization of school quality falls in Panels C and D, estimating that 1SD increase in school-performance increases home prices by only 6.5-7 percent at the smallest 0.1-mile bandwidth. Second, in Panels A, B, and C, the point estimates of IDSC increase to 4-8.3 percent with statistical significance extending to a half-mile bandwidth. In general these results suggest that our prior estimates ignoring charter options are reasonable, but if anything slightly understate the role of IDSC in the next-nearest district in determining home prices.

In contrast, the number of charter schools seems to negatively affect home values. Note that this finding is sensitive to the measurement of charter penetration, as we estimate having a charter option within district to have an imprecisely measured positive effect on prices (shown in Panel A), whereas we find a 2-4 percent price reduction associated with each additional charter school with radii of 3 and 5 miles (shown in Panels C and D). In addition, it is possible that this association is not causal. As noted in Imberman et al. (2014), charter schools may choose to locate in areas with low property values, or move from areas where rental prices rise.

Lastly, as predicted we largely find that the presence of charter schools erodes the price premium parents place on residential access to additional schooling options. While imprecisely measured (and largely not statistically significant), taken literally the point estimates in Panel A imply that the presence of a charter school within the district may halve or nearly eliminate the capitalization of inter-district choice. Panels B, C, & D provide more convincing evidence that charter schooling option undermine the housing premium associated with inter-district choice. The point estimates on the interaction between inter-district and charter school choice in Panel B suggest that in the presence of inter-district choice, each additional charter school within 1 mile of the district lowers home prices by 0.9-1.7 percent. This is roughly 20-35 percent of the inter-district price premium, and these point estimates are statistically significant for 0.15-1.0 mile bandwidths. As the count of charter schools extends to five miles from the district border, the point estimates fall in magnitude by about half. Panel C shows that each additional charter school lowers the IDSC premium 0.6-1.0 (12-19 percent). Moving to Panel D the pattern continues. When using a five-mile radius to construct the count of schools, the point estimate on the interaction between IDSC and number of charter schools falls again in half to 0.1-0.5 percent per additional charter.

While non-random charter location warrants use of caution when interpreting these results, the consistently negative coefficient estimates on the interaction between charter and IDSC suggest that the availability of charter schools erodes parents' willingness to pay for the opportunity to send their children to higher-performing public schools. Additionally, falling point estimates on this interaction term as charter schools further from the district are included in the measure suggests that parents value these charter schooling options only so far as transportation costs are sufficiently low.

7 Conclusion

While numerous studies investigate the extent to which school quality is capitalized into housing prices, relatively few studies examine whether housing markets value access to school choice. We use administrative boundary discontinuities related to local home prices to examine whether parents value additional schooling options. Using both boundary and matched property transactions approaches, we find consistent evidence that parents value access to improved school choice, but at lower levels than they value resident school quality. These results are robust across various specifications and bandwidth choices.

Further, we consider several forms of mediating factors, such as distance from districts of choice, school quality differentials, and additional local schooling choices provided by the charter sector. In each case, these mediating factors have the predicted effects on the IDSC home price premium. As expected, the capitalization of schooling choice is higher near to district borders, consistent with transportation costs mitigating the net benefit of the local amenity. We also find that the price differential between matched home sales on either side of a district boundary grows with the differential in school performance between the two districts. Lastly, we find that both the presence of charter schools within the resident district as well as the number of charters in close proximity undermine the capitalization of IDSC into home prices. This is consistent with parents' demand for IDSC being sensitive to the supply of close substitutes. The finding that this sensitivity diminishes with distance to charter schools further evidences the role of transportation costs in determining the demand of local amenities.

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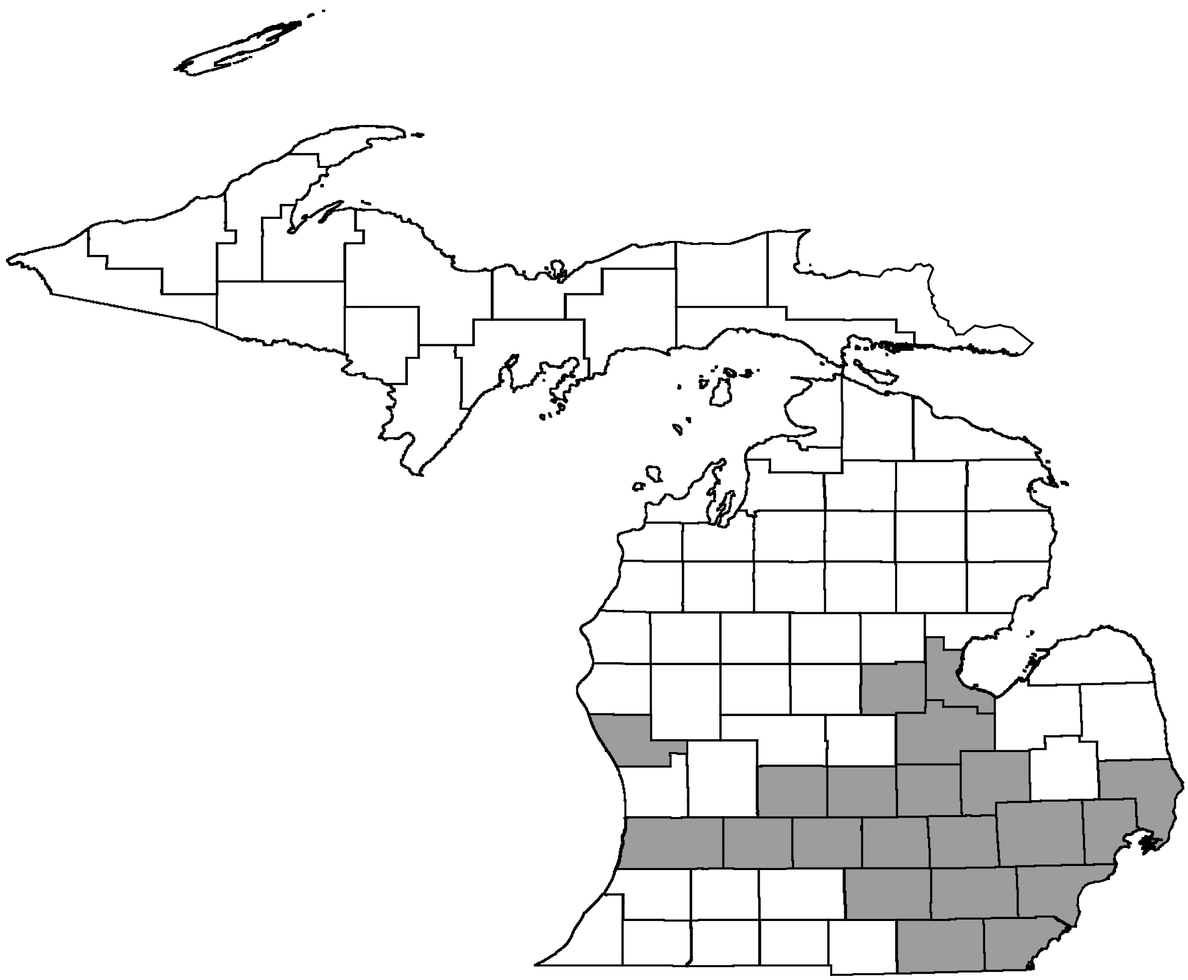
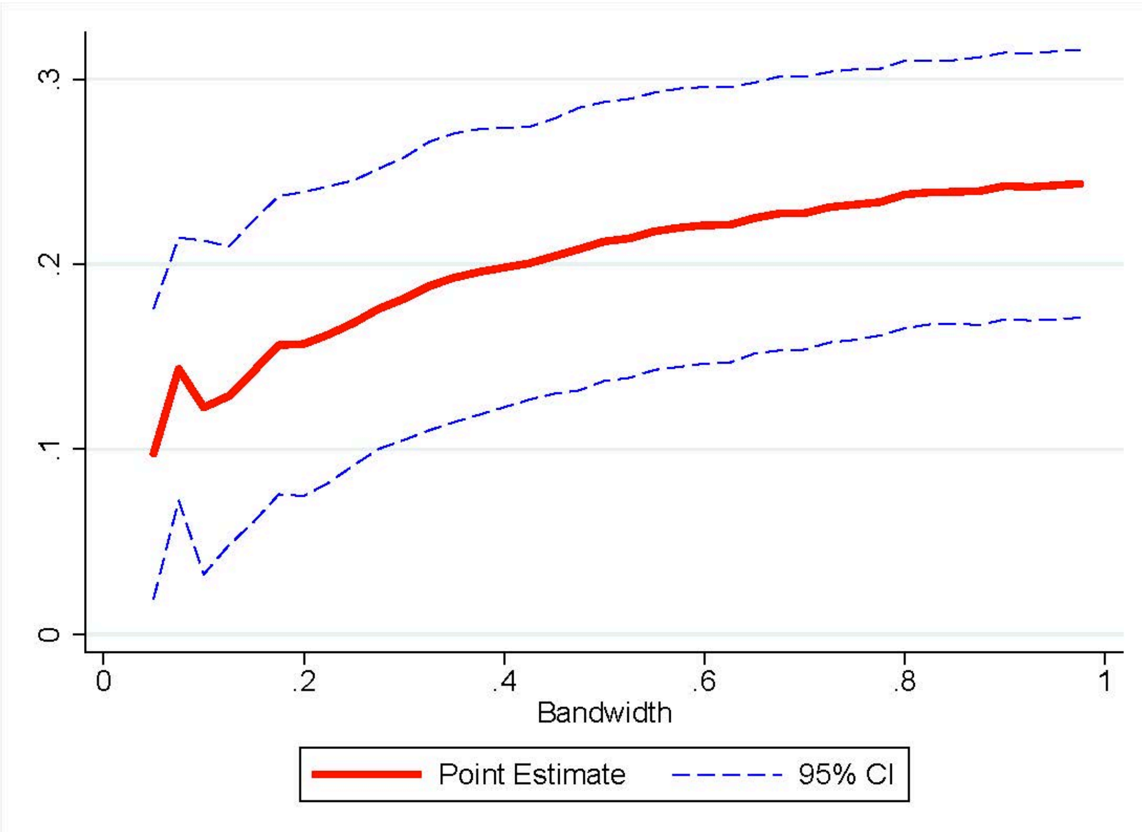
Figure 1: Geographic Distribution of Analysis Data Set



Source: Linked CoreLogic property tax data and publicly available MEAP results. Shading indicates data availability in a given county.

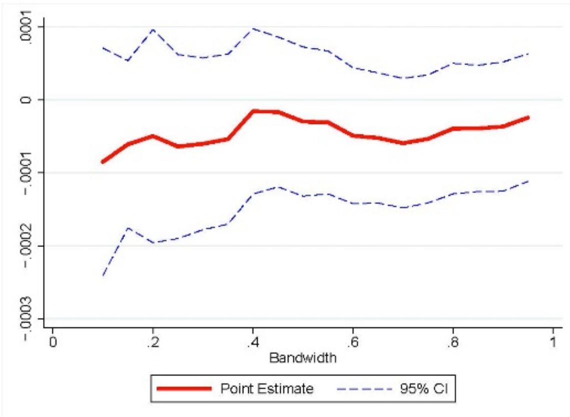
Figure 2: School Quality Point Estimates by Bandwidth



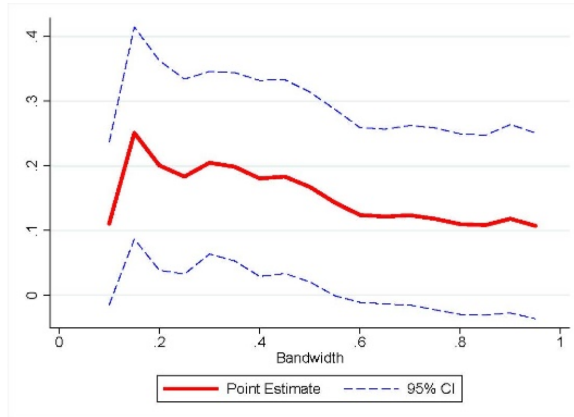
Source: Linked CoreLogic property tax data and publicly available MEAP results**.**

Figure 3: Balance of Covariates by Bandwidth

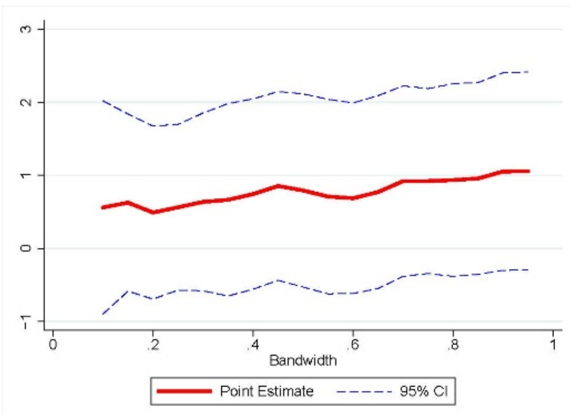
Panel A: Acres



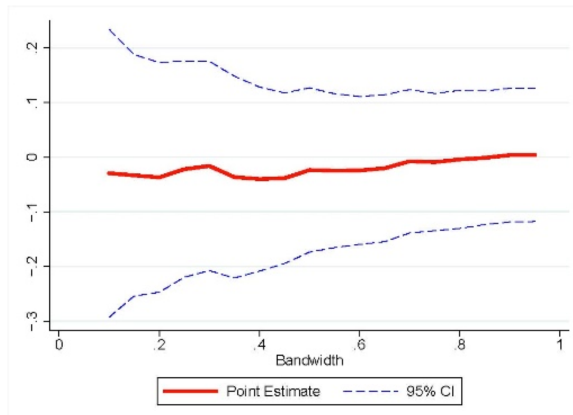
Panel B: Square-footage



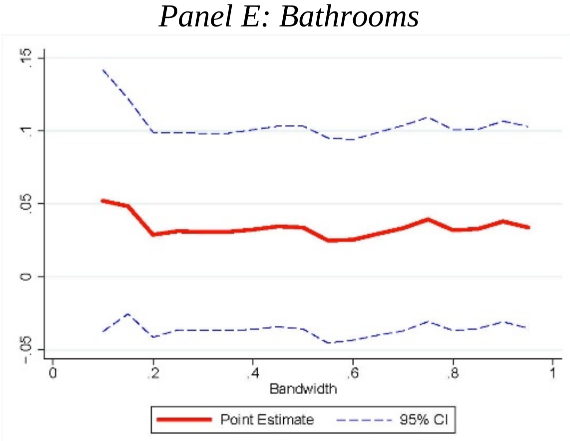
Panel C: Year Built



Panel D: Bedrooms

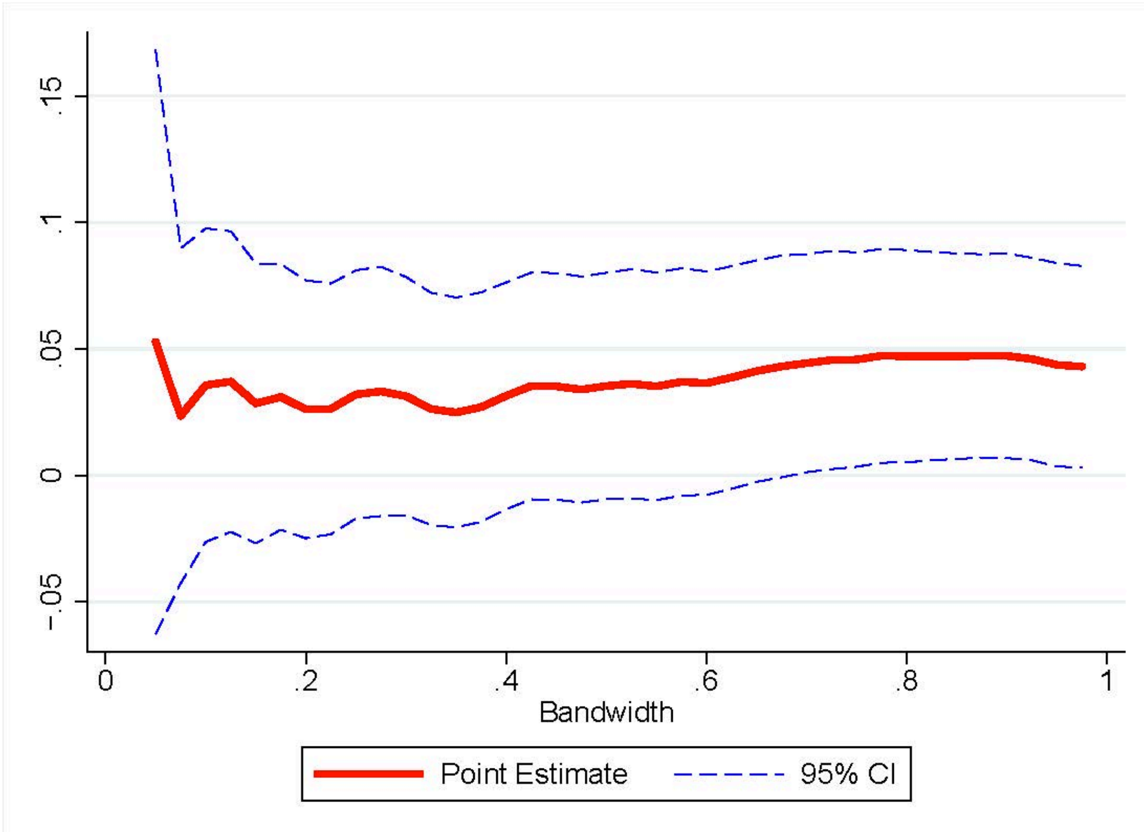


Panel E: Bathrooms



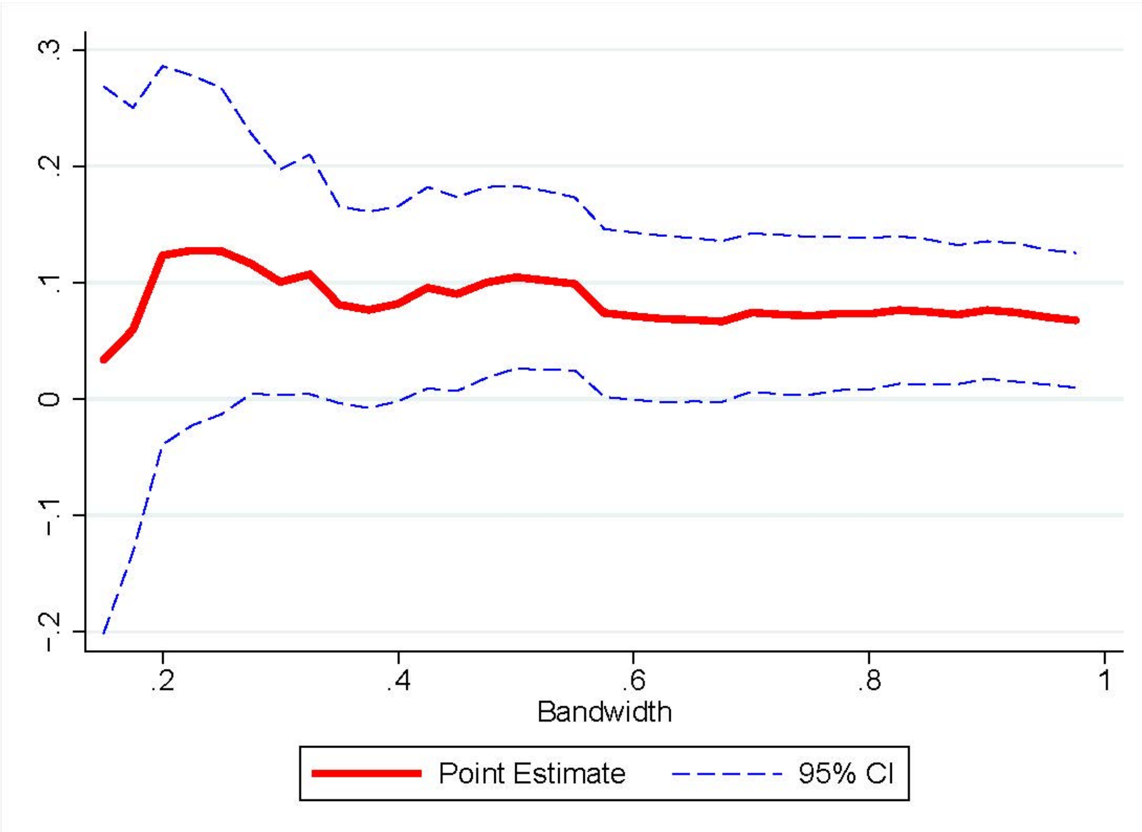
Source: Linked CoreLogic property tax data and publicly available MEAP results**.**

Figure 4: IDSC home price premium across bandwidths under BDD



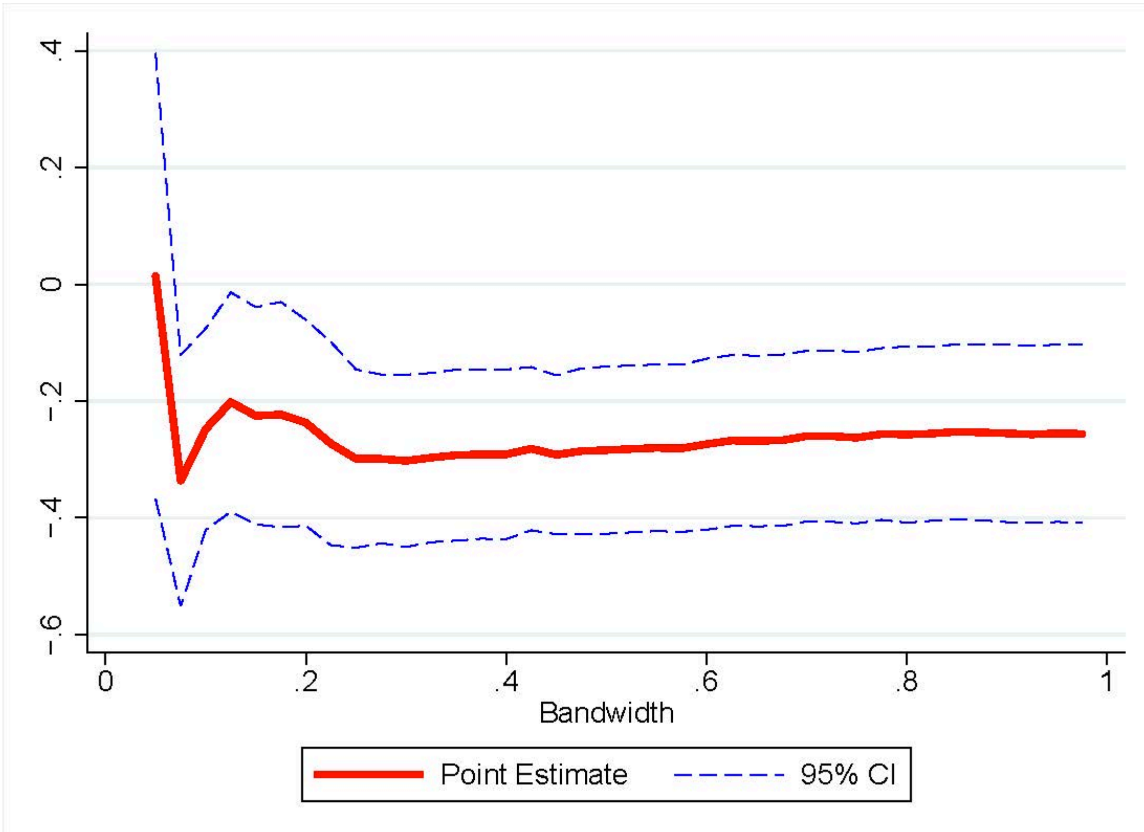
Source: Linked CoreLogic property tax data and publicly available MEAP results**.**

Figure 5: IDSC home price premium across bandwidths under corner BDD



Source: Linked CoreLogic property tax data and publicly available MEAP results.

Figure 6: Effect of IDSC × Δ School Quality on home price differential across bandwidths in matched transaction approach



Source: Linked CoreLogic property tax data and publicly available MEAP results**.**

Table 1: Descriptive Statistics of Sample by Bandwidth

Variable	Total Mean	Total SD	>1.0 miles	>0.5 miles	>0.25 miles	>0.125 miles
Housing Characteristics:						
Sale amount	122977	142886.3	116739	112233.2	110160.4	103516.7
Year built	1961.10	24.04	1961.54	1961.56	1961.74	1960.62
Square footage	2509.17	33049.70	2206.42	2231.80	2224.15	2238.69
Acres	1.49	103.22	1.60	0.88	0.46	0.36
Total rooms	6.26	2.04	6.08	5.97	5.93	5.83
Bedrooms	2.20	1.56	2.03	1.91	1.84	1.75
Bathrooms	1.83	0.93	1.78	1.74	1.73	1.67
Distance to nearest border	1.02	0.96	0.44	0.25	0.14	0.08
Inter-district choice	0.50	0.50	0.51	0.51	0.50	0.51
Average resident district math scaled scores:						
Grade 3	329.84	10.33	329.38	329.21	329.26	328.82
Grade 4	429.11	10.32	428.40	428.09	428.06	427.66
Grade 5	525.53	15.17	524.50	524.06	524.04	523.41
Grade 6	623.82	13.88	622.88	622.48	622.39	621.82
Grade 7	723.16	13.45	722.45	722.03	721.95	721.40
Grade 8	817.09	13.63	816.12	815.71	815.63	815.05
Across grades 3-8	456.30	89.85	457.77	459.21	460.06	460.13
Standardized school quality:						
Resident district	0.09	0.98	0.03	0.01	0.01	-0.03
Nearest district	0.15	0.90	0.09	0.06	0.05	0.03
Next nearest district	0.17	0.91	0.13	0.11	0.12	0.10
N school-of-choice students in next nearest district	323.01	396.81	336.41	339.86	348.10	363.54
Charter penetration						
Charter within district	0.597	0.491	0.583	0.570	0.568	0.582
N Charters within 1 mile						
N Charters within 3 miles						
N Charters within 5 miles						
N	134875		85068	50808	26377	11511

Source: Linked CoreLogic property tax data and publicly available MEAP results.

Table 2: School quality capitalization using school district boundaries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bandwidths in miles:		1	0.5	0.3	0.2	0.15	0.1	0.05
School Quality	0.264***	0.245***	0.212***	0.181***	0.157***	0.142***	0.123***	0.098**
	(0.036)	(0.037)	(0.038)	(0.039)	(0.042)	(0.042)	(0.046)	(0.040)
Acres (in 1K)	3.007	-1.373	-2.909	-7.437	-12.895	-14.184	0.008	13.463
	(5.013)	(5.695)	(6.295)	(7.827)	(9.922)	(10.113)	(10.179)	(15.375)
Bathrooms	0.262***	0.260***	0.255***	0.243***	0.244***	0.239***	0.237***	0.214***
	(0.009)	(0.010)	(0.011)	(0.011)	(0.013)	(0.016)	(0.020)	(0.031)
Bedrooms	0.037***	0.040***	0.041***	0.047***	0.045***	0.045***	0.040***	0.082***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.011)	(0.013)	(0.017)
Year built	0.005***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Square-feet	0.000*	0.021	0.012	0.024	0.034*	0.027*	0.015	0.157***
(in 1K)	(0.000)	(0.015)	(0.009)	(0.019)	(0.019)	(0.016)	(0.015)	(0.049)
Distance	0.024	0.168***	0.361***	0.570**	-0.347	-0.374	3.729**	-12.105
	(0.018)	(0.057)	(0.122)	(0.288)	(0.560)	(0.729)	(1.836)	(9.170)
Distance^2	-0.007	-0.102*	-0.503**	-1.143	3.257	4.208	-29.776*	213.703
	(0.004)	(0.053)	(0.220)	(0.860)	(2.415)	(4.333)	(16.182)	(144.674)
Observations	134,819	85,016	50,779	31,933	20,747	14,651	8,429	2,639
R-squared	0.5866	0.5952	0.6051	0.6166	0.6230	0.6264	0.6197	0.6727
Clusters	558	530	498	449	412	381	316	215
		1	0.500	0.300	0.200	0.150	0.100	0.0500

Source: Linked CoreLogic property tax data and publicly available MEAP results**.** Border-clustered standard errors in parentheses. All regressions include border-by-year fixed effects as well month fixed effects. Regressions with covariates also include indicators for missing data. ***/**/* denote p-values that represent <0.01/<0.05/<0.1 respectively.

Table 3: Balance test under boundary discontinuity design—IDSC estimates with housing characteristics as dependent variables

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bandwidths in miles:			1	0.75	0.5	0.25	0.2	0.15	0.1
Dependent Variables									
Acres									
Coefficient		-0.102**	-0.032	-0.053	-0.030	-0.064	-0.050	-0.061	-0.085
	(SE)	(0.044)	(0.046)	(0.045)	(0.052)	(0.064)	(0.075)	(0.058)	(0.079)
	N	134372	84758	69932	50672	26325	20711	14637	8420
Bathrooms		0.040	0.033	0.039	0.034	0.031	0.029	0.048	0.052
		(0.033)	(0.035)	(0.036)	(0.035)	(0.035)	(0.036)	(0.038)	(0.046)
		131519	83923	69235	50156	26064	20499	14515	8355
Bedrooms		0.008	0.009	-0.009	-0.023	-0.022	-0.037	-0.033	-0.029
		(0.055)	(0.061)	(0.064)	(0.077)	(0.101)	(0.107)	(0.113)	(0.134)
		66524	45437	38051	28115	14812	11778	8415	4818
Year built		1.168	1.065	0.921	0.793	0.562	0.490	0.625	0.560
		(0.738)	(0.692)	(0.647)	(0.675)	(0.580)	(0.605)	(0.619)	(0.746)
		129677	82515	68189	49565	25829	20347	14392	8282
Square-feet		0.519	0.099	0.118	0.167**	0.183**	0.200**	0.251***	0.111*
(in 1K)		(0.443)	(0.074)	(0.072)	(0.075)	(0.077)	(0.083)	(0.084)	(0.064)
		19858	14035	11819	8673	4608	3698	2753	1385

Source: Linked CoreLogic property tax data and publicly available MEAP results**.** Each coefficient, standard error (SE), and observation N triplet comes from a separate regression. Border-clustered standard errors in parentheses. All regressions additionally include month and year-by-boundary fixed effects, a quadratic in distance from the boundary, and school ***/**/* denote p-values that represent <0.01/<0.05/<0.1 respectively.

Table 4: Balance test under boundary corner discontinuity—IDSC estimates with housing characteristics as dependent variables

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bandwidths in miles:			1	0.75	0.5	0.4	0.3	0.25	0.2
Acres									
Coefficient		-0.103**	-0.022	0.005	0.011	-0.067	-0.092	-0.161	0.002
	(SE)	(0.044)	(0.056)	(0.061)	(0.094)	(0.103)	(0.149)	(0.207)	(0.036)
	N	134,372	36,115	21,313	9,625	6,005	3,148	2,029	1,165
Bathrooms		0.041	0.062*	0.081**	0.089**	0.089*	0.041	0.038	-0.058
		(0.033)	(0.036)	(0.037)	(0.045)	(0.051)	(0.058)	(0.083)	(0.094)
		131,519	35,862	21,175	9,560	5,967	3,127	2,012	1,156
Bedrooms		0.008	0.053	0.000	-0.026	0.016	-0.061	0.039	0.003
		(0.054)	(0.058)	(0.044)	(0.066)	(0.090)	(0.104)	(0.168)	(0.245)
		66,524	22,304	13,210	5,901	3,669	1,859	1,192	735
Year built		1.158	1.034*	1.479**	1.627	2.041*	1.646	1.064	-0.666
		(0.736)	(0.529)	(0.675)	(1.006)	(1.091)	(1.361)	(1.851)	(2.385)
		129,677	35,629	21,079	9,534	5,960	3,123	2,014	1,156
Square-feet		0.504	0.189***	0.189**	0.139	0.193*	0.210*	0.312***	0.183
(in 1K)		(0.426)	(0.066)	(0.092)	(0.109)	(0.099)	(0.117)	(0.114)	(0.151)
		19,858	7,714	4,478	2,168	1,504	767	540	312

Source: Linked CoreLogic property tax data and publicly available MEAP results. Each coefficient, standard error (SE), and observation N triplet comes from a separate regression. . Border-clustered standard errors in parentheses. All regressions additionally include month and year-by-boundary fixed effects, a quadratic in distance from the boundary, and school ***/**/* denote p-values that represent <0.01/<0.05/<0.1 respectively.

Table 5: Capitalization of school choice using boundary discontinuity design

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bandwidths in miles:			1	0.75	0.5	0.25	0.2	0.15	0.1
School Quality	0.375***	0.276***	0.261***	0.248***	0.225***	0.180***	0.167***	0.152***	0.142***
	(0.042)	(0.036)	(0.038)	(0.038)	(0.039)	(0.040)	(0.043)	(0.043)	(0.043)
IDSC	0.052**	0.034**	0.044**	0.046**	0.035	0.032	0.026	0.028	0.037
	(0.022)	(0.016)	(0.020)	(0.022)	(0.023)	(0.025)	(0.026)	(0.028)	(0.030)
Acres (in 1K)		2.926	-1.338	-1.295	-2.645	-9.948	-12.743	-14.228	-8.920
		(5.033)	(5.734)	(5.983)	(6.330)	(8.541)	(9.971)	(10.131)	(10.408)
Bathrooms		0.262***	0.260***	0.256***	0.255***	0.243***	0.244***	0.239***	0.245***
		(0.009)	(0.010)	(0.010)	(0.011)	(0.012)	(0.013)	(0.016)	(0.017)
Bedrooms		0.036***	0.039***	0.042***	0.041***	0.046***	0.045***	0.045***	0.042***
		(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.010)	(0.011)
Year built		0.005***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Square-feet		0.000*	0.021	0.017	0.011	0.021	0.033*	0.027*	0.016
(in 1K)		(0.000)	(0.015)	(0.012)	(0.009)	(0.017)	(0.019)	(0.016)	(0.012)
Distance		0.025	0.168***	0.212***	0.357***	0.418	-0.356	-0.382	0.990
		(0.018)	(0.057)	(0.066)	(0.122)	(0.364)	(0.561)	(0.733)	(1.068)
$Distance^2$		-0.007*	-0.101*	-0.179**	-0.493**	-0.495	3.326	4.245	-5.621
		(0.004)	(0.053)	(0.078)	(0.219)	(1.269)	(2.412)	(4.350)	(7.849)
Observations	134,372	134,372	84,758	69,932	50,672	26,325	20,711	14,637	11,492
R-squared	0.5066	0.5890	0.5977	0.6029	0.6078	0.6238	0.6254	0.6290	0.6292
Clusters	557	557	528	518	496	436	411	379	346

Source: Linked CoreLogic property tax data and publicly available MEAP results**.** Linked CoreLogic property tax data and publicly available MEAP results**.** Dependent variable is log of sale price. Border-clustered standard errors in parentheses. All regressions include border-by-year fixed effects as well as month fixed effects. Regressions with covariates also include indicators for missing data. ***/**/* denote p-values that represent <0.01/<0.05/<0.1 respectively.

Table 6: Capitalization of school choice using boundary corner discontinuity design

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bandwidths in miles:			1	0.75	0.5	0.4	0.3	0.25	0.2
School Quality	0.375***	0.276***	0.238***	0.228***	0.209***	0.181***	0.195***	0.191**	0.147
	(0.042)	(0.036)	(0.027)	(0.031)	(0.042)	(0.046)	(0.061)	(0.086)	(0.091)
IDSC	0.052**	0.034**	0.065**	0.072**	0.105***	0.082*	0.101**	0.127*	0.123
	(0.022)	(0.016)	(0.030)	(0.035)	(0.040)	(0.043)	(0.049)	(0.071)	(0.083)
Acres (in 1K)		2.902	-20.29***	-12.785	-8.369	-8.785	-18.953	-46.532*	-26.480
		(5.026)	(6.531)	(8.429)	(11.008)	(14.477)	(19.135)	(25.400)	(22.564)
Bathrooms		0.262***	0.239***	0.226***	0.240***	0.216***	0.226***	0.207***	0.170***
		(0.009)	(0.010)	(0.014)	(0.020)	(0.025)	(0.032)	(0.042)	(0.048)
Bedrooms		0.036***	0.045***	0.047***	0.036***	0.047***	0.029	0.036	0.047
		(0.008)	(0.009)	(0.011)	(0.013)	(0.015)	(0.019)	(0.026)	(0.031)
Year built		0.005***	0.006***	0.006***	0.006***	0.007***	0.007***	0.006***	0.003
		(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Square-feet		0.000*	0.020	0.182***	0.175***	0.185***	0.197***	0.220***	0.259***
(in 1K)		(0.000)	(0.017)	(0.025)	(0.031)	(0.040)	(0.050)	(0.059)	(0.059)
Distance to		0.016	0.162*	0.224	0.670**	0.710	0.892	1.308	3.481
border		(0.022)	(0.093)	(0.149)	(0.263)	(0.482)	(1.012)	(1.557)	(2.841)
Distance to		-0.006	-0.092	-0.190	-1.395**	-1.388	-2.341	-6.042	-17.252
border^2		(0.005)	(0.098)	(0.206)	(0.563)	(1.299)	(3.803)	(6.766)	(15.805)
Distance to next		0.020	0.223*	0.065	-0.321	-1.053	0.103	0.874	-7.696*
nearest district		(0.021)	(0.120)	(0.189)	(0.422)	(0.656)	(1.594)	(2.554)	(4.486)
Distance to next		-0.002	-0.150	0.020	0.817	2.471*	-0.701	-2.760	30.265*
nearest district^2		(0.003)	(0.094)	(0.192)	(0.669)	(1.324)	(4.323)	(8.344)	(17.169)
Observations	134,372	134,372	36,115	21,313	9,625	6,005	3,148	2,029	1,165
R-squared	0.5066	0.5890	0.5872	0.5917	0.6015	0.6243	0.6501	0.6719	0.7065
Clusters	557	557	436	370	289	252	207	176	148

Source: Linked CoreLogic property tax data and publicly available MEAP results**.** Linked CoreLogic property tax data and publicly available MEAP results**.** Dependent variable is log of sale price. Border-clustered standard errors in parentheses. All regressions include border-by-year fixed effects as well as month fixed effects. Regressions with covariates also include indicators for missing data. ***/**/* denote p-values that represent <0.01/<0.05/<0.1 respectively.

Table 7: Capitalization of school quality and choice from differencing matched transactions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bandwidths in miles:			1	0.75	0.5	0.25	0.2	0.15	0.1
IDSC ×	-0.341***	-0.317***	-0.289***	-0.286***	-0.298***	-0.290***	-0.271***	-0.244**	-0.235*
ΔSchool Quality	(0.093)	(0.088)	(0.088)	(0.090)	(0.097)	(0.103)	(0.104)	(0.111)	(0.123)
IDSC	0.303**	0.304***	0.260***	0.241**	0.250**	0.225*	0.250**	0.198	0.060
	(0.121)	(0.104)	(0.098)	(0.099)	(0.107)	(0.119)	(0.127)	(0.141)	(0.130)
ΔSchool Quality	0.458***	0.379***	0.354***	0.341***	0.339***	0.285***	0.292***	0.264**	0.273***
	(0.083)	(0.079)	(0.079)	(0.082)	(0.087)	(0.092)	(0.093)	(0.102)	(0.094)
ΔAcres (in 1K)		5.990	6.361	4.455	1.080	-7.441	-7.244	-4.869	20.123
		(8.277)	(8.898)	(9.616)	(10.271)	(11.772)	(13.273)	(15.590)	(14.601)
ΔBathrooms		0.279***	0.273***	0.264***	0.256***	0.227***	0.225***	0.214***	0.243***
		(0.016)	(0.016)	(0.015)	(0.016)	(0.017)	(0.019)	(0.020)	(0.029)
ΔBedrooms		0.030*	0.032*	0.037**	0.035*	0.036**	0.037**	0.031	0.045**
		(0.018)	(0.018)	(0.018)	(0.019)	(0.016)	(0.016)	(0.022)	(0.022)
ΔYear built		0.007***	0.007***	0.007***	0.007***	0.008***	0.008***	0.008***	0.006***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ΔSquare-feet		0.116***	0.106***	0.105***	0.093***	0.100***	0.092***	0.086***	0.122***
(in 1K)		(0.026)	(0.026)	(0.025)	(0.026)	(0.026)	(0.026)	(0.030)	(0.046)
Distance between	0.026	-0.001	0.011	0.007	0.020	0.046	0.048	0.028	0.079
properties	(0.052)	(0.035)	(0.032)	(0.033)	(0.040)	(0.058)	(0.065)	(0.072)	(0.120)
Distance between	0.001	0.002	0.004	0.006	0.003	0.000	-0.008	-0.000	-0.012
properties^2	(0.005)	(0.004)	(0.004)	(0.004)	(0.006)	(0.009)	(0.010)	(0.011)	(0.020)
Observations	40,894	40,894	40,168	32,888	23,253	11,327	8,594	5,433	2,534
R-squared	0.0539	0.2252	0.2136	0.2049	0.1969	0.1653	0.1553	0.1458	0.1661
Clusters	388	388	372	353	323	250	221	193	150

Source: Linked CoreLogic property tax data and publicly available MEAP results. Dependent variable is the difference in log of sale price between matched transactions. Border-clustered standard errors in parentheses. Regressions with covariates also include indicators for missing data. ***/**/* denote p-values that represent <0.01/<0.05/<0.1 respectively.

Table 8: Impact of charter schools on the inter-district-choice price premium

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bandwidths in miles:		1	0.75	0.5	0.25	0.2	0.15	0.1
Panel A: Charter is defined by as an indicator for a charter school within resident district								
School Quality	0.374***	0.262***	0.249***	0.225***	0.179***	0.165***	0.150***	0.137***
	(0.042)	(0.038)	(0.038)	(0.039)	(0.040)	(0.042)	(0.043)	(0.046)
IDSC	0.083***	0.078***	0.081***	0.068**	0.053	0.051	0.040	0.043
	(0.030)	(0.028)	(0.028)	(0.030)	(0.032)	(0.032)	(0.034)	(0.040)
Charter	0.035	0.060	0.059	0.050	0.029	0.035	0.006	0.042
	(0.057)	(0.046)	(0.046)	(0.044)	(0.047)	(0.048)	(0.050)	(0.067)
Charter × IDSC	-0.056	-0.062	-0.065	-0.062	-0.039	-0.046	-0.022	-0.013
	(0.047)	(0.042)	(0.042)	(0.043)	(0.046)	(0.047)	(0.050)	(0.058)
Panel B: Charter is defined by number of charter school within 1 mile radius of resident district								
School Quality	0.374***	0.260***	0.248***	0.225***	0.180***	0.166***	0.152***	0.137***
	(0.040)	(0.036)	(0.036)	(0.038)	(0.040)	(0.042)	(0.042)	(0.047)
IDSC	0.063**	0.055**	0.059**	0.050**	0.046	0.043	0.044	0.047
	(0.025)	(0.022)	(0.023)	(0.025)	(0.028)	(0.030)	(0.032)	(0.037)
Charter	-0.022	-0.018	-0.015	-0.008	-0.002	0.002	0.003	-0.011
	(0.028)	(0.023)	(0.023)	(0.024)	(0.028)	(0.029)	(0.028)	(0.031)
Charter × IDSC	-0.015	-0.015*	-0.017*	-0.017*	-0.014*	-0.017*	-0.015*	-0.009
	(0.011)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)	(0.014)
Panel C: Charter is defined by number of charter school within 3 mile radius of resident district								
School Quality	0.311***	0.207***	0.195***	0.169***	0.120***	0.106***	0.089***	0.071**
	(0.029)	(0.023)	(0.024)	(0.024)	(0.024)	(0.026)	(0.026)	(0.032)
IDSC	0.060**	0.055**	0.060***	0.049**	0.043	0.040	0.041	0.047
	(0.024)	(0.021)	(0.023)	(0.024)	(0.027)	(0.028)	(0.030)	(0.034)
Charter	-0.040***	-0.037***	-0.035***	-0.038***	-0.040***	-0.039***	-0.041***	-0.042***
	(0.012)	(0.012)	(0.012)	(0.013)	(0.014)	(0.015)	(0.015)	(0.015)
Charter × IDSC	-0.008***	-0.008*	-0.010**	-0.009**	-0.008	-0.009*	-0.007	-0.006
	(0.003)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Panel D: Charter is defined by number of charter school within 5 mile radius of resident district								
School Quality	0.325***	0.215***	0.202***	0.174***	0.124***	0.107***	0.089***	0.066*
	(0.034)	(0.028)	(0.028)	(0.028)	(0.027)	(0.029)	(0.029)	(0.036)
IDSC	0.057**	0.050**	0.054**	0.041*	0.036	0.032	0.032	0.036
	(0.025)	(0.022)	(0.023)	(0.025)	(0.027)	(0.028)	(0.031)	(0.035)
Charter	-0.020**	-0.020**	-0.020**	-0.023***	-0.026***	-0.026**	-0.028**	-0.030**
	(0.008)	(0.008)	(0.008)	(0.009)	(0.010)	(0.010)	(0.011)	(0.012)
Charter × IDSC	-0.005*	-0.004	-0.005*	-0.004	-0.003	-0.004	-0.002	-0.001
	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.006)	(0.006)

Source: Linked CoreLogic property tax data and publicly available MEAP results**.** Dependent variable is log of sale price. Border-clustered standard errors in parentheses. All regressions include border-by-year fixed effects as well as month fixed effects. Regressions with covariates also include indicators for missing data. ***/**/* denote p-values that represent <0.01/<0.05/<0.1 respectively.

Appendix A: Supplemental Results

Table A.1: Results from differencing matched transactions using higher-performing district as the basis for matches.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bandwidths in miles:			1	0.75	0.5	0.25	0.2	0.15	0.1
IDSC ×	-0.248***	-0.251***	-0.259***	-0.263***	-0.284***	-0.299***	-0.237***	-0.225**	-0.248***
ΔSchool Quality	(0.089)	(0.077)	(0.078)	(0.075)	(0.073)	(0.078)	(0.090)	(0.095)	(0.088)
IDSC	0.159*	0.208***	0.216***	0.217***	0.261***	0.274***	0.194**	0.222**	0.100
	(0.089)	(0.077)	(0.077)	(0.079)	(0.081)	(0.090)	(0.092)	(0.099)	(0.094)
ΔSchool Quality	0.425***	0.358***	0.361***	0.356***	0.372***	0.376***	0.300***	0.283***	0.221***
	(0.077)	(0.069)	(0.070)	(0.067)	(0.066)	(0.072)	(0.085)	(0.086)	(0.069)
ΔAcres (in 1K)		10.791**	10.275**	6.991	5.241	10.138	13.131	1.337	23.797
		(5.058)	(5.186)	(5.643)	(6.411)	(9.140)	(10.869)	(14.581)	(20.773)
ΔBathrooms		0.259***	0.257***	0.253***	0.245***	0.219***	0.203***	0.201***	0.211***
		(0.015)	(0.015)	(0.015)	(0.016)	(0.019)	(0.021)	(0.026)	(0.029)
ΔBedrooms		0.065***	0.064***	0.070***	0.075***	0.054***	0.057***	0.064***	0.062***
		(0.013)	(0.013)	(0.013)	(0.014)	(0.017)	(0.017)	(0.020)	(0.022)
ΔYear built		0.005***	0.005***	0.005***	0.005***	0.006***	0.006***	0.006***	0.006***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ΔSquare-feet		0.195***	0.195***	0.189***	0.182***	0.184***	0.188***	0.191***	0.181***
(in 1K)		(0.034)	(0.034)	(0.034)	(0.033)	(0.035)	(0.039)	(0.042)	(0.055)
Distance between		(0.055)	(0.055)	(0.052)	(0.046)	(0.045)	(0.047)	(0.056)	(0.075)
properties	-0.032	-0.027	-0.029	-0.050	-0.062	-0.035	0.034	0.002	-0.029
Distance between	(0.032)	(0.025)	(0.029)	(0.035)	(0.048)	(0.101)	(0.099)	(0.128)	(0.168)
properties^2	0.002	-0.000	0.002	0.006	0.001	0.012	-0.017	-0.012	-0.009
	(0.004)	(0.003)	(0.006)	(0.007)	(0.008)	(0.026)	(0.029)	(0.035)	(0.042)
Observations									
R-squared	38,278	38,278	37,918	31,207	22,240	10,645	7,915	5,241	2,547
Clusters	0.0713	0.2335	0.2311	0.2222	0.2112	0.1729	0.1447	0.1237	0.1136

Source: Linked CoreLogic property tax data and publicly available MEAP results. Dependent variable is the difference in log of sale price between matched transactions. Border-clustered standard errors in parentheses. Regressions with covariates also include indicators for missing data. ***/**/* denote p-values that represent <0.01/<0.05/<0.1 respectively.