Do Qualified Allocation Plans Influence Developers' LIHTC Siting Decisions: The Case of Access to High-Performing Schools

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ABSTRACT

The study analyzed variation among low income housing tax credit (LIHTC) allocation policies as outlined in state qualified action plans (QAP) and their impacts on the siting patterns of LIHTC properties in proximity to high performing schools. The study was performed nationwide across 37 states and controlled for factors relevant to the development location decision using census-based population characteristics and LIHTC property attributes. The purpose was to determine the effectiveness of LIHTC QAP allocation policies in motivating developers to site their developments near high-performing schools. QAPs typically use points when awarding tax credits competitively, and this study focused on points awarded for (1) access to high quality schools, (2) access to any schools, and (3) location in areas with attributes expected to correlate strongly with high quality schools. Multi-level linear modeling estimated that points for access to any schools had a significant and positive effect on location in a high performing school's catchment area, but other allocation policy variables had no significant effects. The findings inform readers about the ability of current allocation policy to influence developer actions, and discussion centers on policy recommendations and the need for further research.

Public Abstract

Attendance at a high-performing school is critically important in determining short-term academic performance and long-term life outcomes in children. School choice remains limited, especially for lower-income households, and this suggests that housing policy can help children access neighborhoods and quality schools that promote their long-term success. Therefore, supporting the development of affordable housing near quality schools is an imperative social policy goal.

This analysis focuses on housing policy to address the issue of a mismatch between low income students and high quality schools. The low income housing tax credit (LIHTC) program is the largest federal program for the production and preservation of affordable housing and its centrality to the geography of affordable multi-family housing in the country cannot be overstated. As shown in this and other research, LIHTC units are consistently placed in areas with access to under performing schools and a need exists for changes in state LIHTC policy. The study analyzed variation among LIHTC allocation policies as outlined in state qualified action plans (QAP) and their impacts on the siting patterns of LIHTC properties in proximity to high performing schools. This study has highlighted deficiencies in state QAPs, and changes in their allocation systems are warranted to improve LIHTC residents local school quality. The findings inform readers about the ability of current allocation policy to influence developer actions, and discussion centers on policy recommendations and the need for further research

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1. Introduction

Students who attend high performing schools[1] have higher test scores (Hoxby & Weingarth, 2006; Deming et al, 2014; Hastings & Weinstein, 2008), better chances of attending college (Hasting et al 2014; Angrist et al, 2013; Jennings et al 2015), and earn more throughout their lifetime (Chetty & Hendren, 2015). The effects are often strongest for children in low-income households, those who move from a low-performing school to a high-performing one, and those who are young. If low-income households could make housing location decisions based on school quality alone, rather than affordability, they would typically choose to locate elsewhere (Bayer, 2000).

Unfortunately, choice is often constrained. Despite the rise of school choice and charter school programs, most students are assigned to and attend public schools located near their homes (e.g., Burgess & Briggs, 2010; Sohoni & Saporito, 2009; Corwin & Schneider, 2005; Schwartz & Stiefel, 2014). School assignments are especially constraining for students from low-income households. The combination of living in neighborhoods with concentrated poverty, lower household income and wealth, and a greater likelihood of lower-performing schools, coupled with the inability to easily attend another school, means that students in low-income households often attend primary and secondary schools that are below average, as measured by standardized test scores and similar performance indicators (Rothwell, 2012; Pfeiffer, 2009). A recent national study found that low-income students, on average, attend schools that perform at the 42nd percentile on

[1] When discussing school performance, this study refers to "low-performing" and "high-performing" schools on the basis of schools' absolute test scores relative to other schools in the state, without adjusting for student composition. This matches HUD's definitions used in its school performance index. It is recognized that other national and local data, including value-added measures and measures that adjust for student composition, can provide a more complete perspective on school performance when available. In comparison, this report refers to "high-quality" schools more broadly, recognizing that a single performance metric may not fully reflect school's' quality.

state proficiency examinations, whereas middle and high-income students attend schools that perform at the 61st percentile (Rothwell 2012). In a study of distressed neighborhoods with concentrations of poverty in 10 cities, 51% of the children attended schools ranked in the worst performing 20th percentile in the state, and more than four in five children (83 percent) attended schools that were ranked below the 50th percentile (Coulton & Budde, 2014).

Many of these households do not earn enough to cover the monthly costs of rental or home-ownership, and rely on federal subsidies that either provide households a voucher to make up the rent-income gap or incentivize the building of housing affordable to low-income households by private developers. Residential choice, rather than school choice, can be promoted as a way to solve the problem of co-location of low-performing school with students from low-income households through these policies. However, federally assisted affordable housing is persistently located near underperforming schools. Ellen & Horn (2012), in a study of the elementary schools nearest to households receiving four different forms of housing assistance in each of the 50 states as well as in the 100 largest metropolitan areas, found that the median state test score ranking for elementary schools nearest to assisted households was at the 19th percentile, indicating that the school nearest to half of assisted households ranks at or below 19 percent of public schools in their state. In a study of 319 metropolitan areas, Horn, Ellen & Schwartz (2014) expanded the previous study and found that households receiving housing subsidies live near schools with proficiency rates about 5 percent lower than renter households in general.

As important as school quality is, the evidence suggests national housing policy may not be adequately targeting access to high-quality schools as a policy priority. Khadduri (2013) notes that housing policy rarely addresses school quality directly and can even increase the mismatch between high-performing schools and students living in affordable housing.

This study adds to existing research by focusing on the federal low-income housing tax credit program (LIHTC), the dominant supply-side incentive program in the U.S. which has helped finance more than half the units affordable to low-income households developed or rehabilitated in the last 30 years—about 2.8 million units. According to the National Council of State Housing Agencies, approximately 90 percent of all income-restricted affordable rental housing produced annually is financed through the LIHTC program (Lawrence, 2013). Demand side programs are generally ineffective in getting children to attend high performing schools. Choice based housing voucher programs do not have an opportunity to influence where families decide to move. Studies have shown that the Moving to Opportunity (MTO) voucher program has had little to no effect on access to higher quality schools and no effect on actual test scores or educational attainment (Sanbonmatsu et al, 2011; Sanbonmatsu et al. 2006; Kling, Liebman, & Katz, 2007). Further, given the opportunity, many participants did not move to areas with better schools. This trend is persistent in voucher based housing subsidy programs. Analysis of voucher programs show that even for families that move to areas with higher-income households and improved safety, the children continue to attend fairly low-performing schools overall and educational gains are modest (Burdick-Will et al, 2010). Fryer & Katz (2013) noted the hurdles to an effective voucher program: (1) a lack of available units that accept the voucher in high quality school areas, (2) a lack of resident knowledge as to where the high quality schools are located, and (3) an unwillingness to move to high quality school areas due to social incompatibility.

The tax credit program, by working on the supply side, has the potential to drive demand to high-performing schools. LIHTC projects can provide affordable housing in situations where vouchers are difficult to use, in particular in high-opportunity neighborhoods where fewer housing units can be reached within voucher payment standards and where landlords may prefer

unsubsidized tenants (Galvez, 2010; Edin, DeLuca, & Owens, 2012). A supply side program can be more effective in "offering opportunities to live in low-poverty suburban settings" (McClure & Johnson, 2014).

The LIHTC program provides tax credits to state housing finance authorities, which then use qualified allocation plans to determine competitively which projects will be awarded tax credits, a process described in more detail later. With the exception of some federal requirements, the provisions in these allocation plans are controlled by states, and most use a points-based system that rewards developers who propose projects with certain desirable project and neighborhood attributes. Many states use the QAP to at least marginally promote access to schools and at least three even promote access to high-performing schools specifically.

This variation in QAP policies across states that motivates the present research project. The central question is whether QAP policies that directly or indirectly reward access to high-performing schools actually do lead developers to site their projects in locations that provide such access, when controlling for other developer motivations. The expectation is that QAP policies will have a positive effect. In other words, as the share of points awarded for access to high-performing schools—or to other factors that correspond closely with school quality—increases, so too will access of funded projects to such schools.

This research studies more than 500 projects funded with competitive tax credits in 2013 and 2014 nation-wide. The author assembled a project database from national and state sources and linked projects to census block-group data, QAP policy measures, and a block group-level school performance index. Multilevel modeling allowed estimation of effects for projects nested within block groups and within states. Unfortunately, the evidence suggests that QAPs only have

mixed to weak effect on access to quality schools. While the study has limitations, it provides an important first step in revealing a gap in supply-side housing policy.

The next section of this report provides a literature review covering the overall importance and benefits of residing near high performing schools, the performance of schools near LIHTC properties, and the effects of QAP policy on siting of LIHTC units in general. Few studies examine LIHTC project location relative to local school performance, but they all show that the school nearest LIHTC tenants is ranked considerably lower than the school nearest renters as a whole (Ellen & Horn, 2012; Horn, Ellen & Schwartz, 2014; Deng 2007). Very limited research exists regarding the influence of QAPs on a developer's decisions related to location of their LIHTC properties, but majority of experts and practitioners of the LIHTC program do agree that QAPs are very effective and that developers are motivated and affected by their provisions. Section 3 provides detailed background information regarding the LIHTC program in general, the role of state QAPs, a descriptive survey of QAP provisions regarding schools in 2014, and a discussion of developer motivations. The research design and discussion of finding follows in sections 4 and 5, and a concluding section focused on policy recommendations completes the report.

2. Literature Review

2.1 The Importance of School Quality

School quality can have a substantial impact on academic and life outcomes. Studies of charter schools in areas with consistently low performing schools have found that a positive change in school quality can boost academic performance, especially for students from poor families. For example, a study of students in Harlem showed that elementary age children moving from

underperforming schools to high performing charter schools scored significantly higher in math and English language arts after just one year (Dobbie & Fryer, 2011). A study from Massachusetts describes a similar increase and that the improvements are most noticeable in urban area where previous school performance was lower (Angrist, Pathak, & Walters, 2013). Reports from Washington, D.C., Chicago, and New York City charter schools also report positive effects (Curto & Fryer 2011; Hoxby & Rockoff, 2004; Hoxby, Murarka, & Kang, 2009).

College attendance is significantly and positively affected by higher school quality. Deming, Hasting, Kane, and Staiger (2014) found that students who moved from low- to high-performing schools were less likely to be arrested, much more likely to graduate high school, and more likely to attend a four-year college (see also Angrist et al., 2013). Altonji & Mansfield (2011) estimated that attending a high school at the 10th versus the 90th percentile of the school quality distribution increased the predicted probability of high school graduation and four-year college enrollment by about 10 and 20 percentage points, respectively. Similar studies found benefits of increased course progression in higher performing schools and a positive effect on university enrollment (Dobbie & Fryer, 2014). A one standard deviation increase in high school performance added raises students' chances of graduating and attending a four-year college (Jennings et al., 2015). By contrast, students attending low performing schools generally do not have the opportunity for accelerated coursework and are less likely to be college ready or have positive post-secondary outcomes (Burris, Heubert, & Levin, 2006; Clotfelter, Ladd, & Vigdor, 2015).

Other researchers have focused on the potential positive effect of attending school with higher performing peers. For example, a study of student reassignment in North Carolina estimated that a student moving to a school with higher performing peers was associated with a slight but significant increase in an index measure of a student's own achievement (Hoxby & Weingarth,

2006). Peer effects seem to be particularly important for low-income children, as demonstrated in a statewide study of districts in Florida where the lowest performing students experienced the largest positive effect from having high-performing peers (Burke & Sass, 2008). Other studies have provided additional evidence supporting the presence of peer effects (Hanushek et al., 2003; Zimmer & Toma, 2000).

The benefits are not only academic. A recent study by Allensworth and colleagues (2015) found that students moving to higher performing schools also reported experiencing a considerably better school environment with increased feelings of safety, stronger teacher-student trust, a stronger focus on the future, higher attendance, and less likelihood of suspension. The positive effects of attending high performing schools can persist even after graduation. Chetty & Hendren (2015) studied more than five million families who moved, and found that children living in counties with higher quality schools have significant, positive impacts on life outcomes even when controlling for other factors, especially those children from households with below-median income. Those who moved to a county with schools that had a one standard deviation higher average test score, realized an increase in lifetime income of more than three percent, with the gain for lower-income households at four percent.

The evidence of positive effects of attending a high-performing school at a young age is even stronger. Studies of children leaving low-performing elementary schools find that students whom subsequently enroll in schools with higher performance levels show substantial improvements in achievement (De la Torre & Gwynne, 2009; Engberg, Zamarro, & Zimmer, 2012). Further, gains from moving to a higher quality school decrease as the child's age at the time of the move increases, therefore the duration of exposure to a better school environment during childhood is a key determinant of an individual's long-term outcomes (Chetty & Henderson,

2015). Chetty, Hendren, and Katz (2016) found that moving to a lower-poverty neighborhood significantly improved college attendance rates and earnings for children who were young (below age 13) when their families moved. Additionally, the primary school period is critical in cognitive development and life outcomes for children. Behavioral research confirms that the early years are foundational for a full range of human competencies, that quality of early educational environment is a strong predictor of adult productivity and that early enrichment for disadvantaged children increases the probability of later economic success. (Knudsen et al., 2006; Carneiro & Heckman, 2003).

Some researchers, recognizing the difficulty of isolating the effects of change in school quality on child performance and outcomes due to the interactions with neighborhood and household characteristics, take advantage of school lottery systems as a form of natural quasi-experiment (Cullen et al., 2013; Jargowski & Komi, 2011). Cullen, Jacob, and Levitt (2006) found little to no effect of gaining access to a higher-achieving high school on academic outcomes when studying high school lottery recipients in Chicago. Similarly, in a study by Deming, Hasting, Kane, and Staiger (2014) only weak support was found for academic gains from attending a higher performing high school. But, similar experiments in the same district in which treated families enrolled in higher-achieving schools after receiving information about the achievement levels of local schools, found that attending a higher-scoring school increased student test scores (Hastings & Weinstein, 2008).

The Moving to Opportunity (MTO) voucher program provided another opportunity for researchers to isolate the effects of schools, since a majority of the participating families were given the opportunity to move from lower to higher performing schools (Fryer & Katz, 2013). The program, which ran from 1994 to 1998, created an intentional natural experiment by offering

randomly selected families living in high poverty housing projects vouchers to move to lower-poverty neighborhoods. Nearly 5,000 households and 16,000 individuals participated in the experiment. Holding the quality of schools roughly constant, moving to a lower poverty neighborhood did not significantly change the school performance of children (Sanbonmatsu et al. 2006; Kling, Liebman, & Katz, 2007). This result suggests that a better community alone is inadequate. The most recent studies regarding the MTO program, have looked at life success of children in participating families, as more have finished college and entered the labor force. Evidence from Fryer and Katz (2013) suggests that improvements in school quality are more effective than improvements in neighborhood conditions.

This evidence highlights a policy need focused on associating affordable housing policy directly with school quality. Most kids who grow up in subsidized housing do not attend a school where they have access to high-quality education (Ellen & Horn, 2012; Horn, Ellen & Schwartz, 2014). If low-income households could make housing location decisions based on school quality alone, rather than affordability, they would typically choose to locate elsewhere (Bayer, 2000). Concern about neighborhood conditions is still justified since school composition is largely formed as a geographic overlay based on residential composition of the school catchment area. For example, neighborhoods with concentrated poverty typically have schools that are among the worst performing, and communities with a combination of subsidized affordable housing and relatively good public schools are in short supply (Rothwell, 2012; Theodos, Coulton, & Budde, 2014; Pfeiffer, 2009). Therefore, reducing the concentration of poverty and economic segregation generally, may be the easiest way to decrease inequalities that exist between schools.

2.2 School Quality and Household Location

A majority of state school attendance policies dictate catchment areas and districts that determine where an individual attends school based on their housing location. Districts outline the boundaries of entire school systems, while catchment areas dictate which specific school within a district that a student is required to attend based on residence location. Despite the surge of school choice options such as open enrollment and charter schools, research has shown that most students are assigned to schools based on their residence (Burgess & Briggs, 2010; Sohoni & Saporito, 2009) and most students still attend their assigned school (Corwin & Schneider, 2005; Schwartz & Stiefel,2014). According to the U.S. Department of Education (2009), 24.5 percent of parents reported having the opportunity to send a child to a chosen public school. But, the percentage of children attending a "chosen" public school rather than their assigned public school is about 11 percent (Carlson, Lavery, & Witte, 2011). In a study on the New York City school choice program, Nathanson, Corcoran, and Baker-Smith (2013) find that vast majority of students ultimately attend a school close to home. Thus, a neighborhood concentration of high-poverty residents inevitably results in schools with a higher share of students from poor households. In many schools the concentration is magnified because children from higher income families are far more likely to attend private schools (HUD, 2016). Schools' concentration of poverty and disadvantage is a powerful predictor of school performance (Rumberger & Palardy, 2005; Palardy, 2013; HUD, 2016).

2.3 The Role of Affordable Housing Policy

Decreasing the mismatch between high-performing schools and students from low-income households depends either on decreasing the sharp disparities in public education quality or on

using housing policy to promote the co-location of low-income households with high quality schools. In short, without improved residential choice, school choice is unlikely to deliver the same access to quality to students from lower-income households as that enjoyed by their peers from middle- and upper-income households.

Influencing developers to locate their affordable units in higher performing school districts is a promising method to achieve this end goal. In U.S. housing policy, two broad policy paths exist for providing housing to low-income households: a demand-based approach in which households receive vouchers that can be used on participating units in the rental market and a supply-based approach incentivizing developers to create rent-restricted housing. This study aimed to explore the effectiveness of influencing supply-side federally assisted affordable housing by addressing the capacity of the low-income housing tax credit (LIHTC) program to address access to high-quality schools.

Very few studies have analyzed the influence of QAP policy on developers' LIHTC siting decisions and no comprehensive study has examined the link between QAP school policies. This study fills a gap in research by analyzing variation in QAPs across states and locations of LIHTC developments in relation to school performance while (1) utilizing a multilevel regression model and (2) controlling for factors relevant to the development location decision using census-based neighborhood and LIHTC property based variables. In addition, the study utilizes the HUD school performance index, which takes into account school attendance zones rather than strictly residential distance to schools in determining the school quality available to a residence. The results from the descriptive and model statistics in this study could be utilized as an indication of the potential strength of QAPs as policy tools and how they can be improved.

3. Background

3.1 The LIHTC Program and Qualified Allocation Plans

The LIHTC program is enacted through Section 42 of the Internal Revenue Code (IRC), passed by Congress in the Tax Reform act of 1986. The program's goal is to incentivize investment for the construction and rehabilitation of low-income affordable rental housing. LIHTC funding is distributed by the Internal Revenue Service (IRS) to designated state agencies—typically state housing finance agencies. Since 2003, each state has received an annual allocation of $1.75 per resident in LIHTC funding, adjusted annually for inflation; in 2016 the figure rose to $2.35 per capita. Each agency sets its own criteria to allocate tax credits to developers through a competitive application process governed by a Qualified Allocation Plan (QAP). These QAPs are used to further policy objectives by prioritizing the awarding of credits to developers based on a variety of factors that can vary greatly by state. Property owners who receive the tax credits can use them to reduce their federal income tax by $1 for every dollar of tax credit received or, more typically, sell the credits to investors to raise funds for the initial development costs of a project. As long as the property remains in compliance with the LIHTC program requirements, the dollar for dollar credit will be applied to the investor's federal income tax for ten years.

State housing finance agencies provide two types of tax credit rates that determine the amount of financing for each project. The first is set at 70 percent of the present value of the project qualifying costs (initial development costs, excluding the cost of land and certain other expenses), which translate to a yearly tax credit of about 9 percent. The 9 percent credit is allocated each year to projects via a competitive application process governed by each agency's QAP and is the focus of this study. Credits in the amount of 30 percent of qualifying costs, which amounts to a yearly

tax credit of about 4 percent, are distributed outside the competitive allocation system. In most states, any low-income eligible project financed by government bonds are automatically offered the 4 percent credit on an ongoing basis (Kawitzkey et al., 2012).

Federal law requires that all properties receiving credits follow one of two possible low income occupancy requirements where: (1) at least 20 percent of the units within the property are rent restricted and occupied by households with incomes at or below 50 percent of the HUD determined area median income (AMI), or (2) at least 40 percent of the units are rent restricted and occupied by households with incomes at or below 60 percent of the HUD determined AMI. The LIHTC property must operate under these restrictions for 30 years or longer, as defined by a fifteen-year compliance period and a subsequent fifteen-year extended use period. State agencies are required to monitor eligibility requirements during the fifteen-year compliance period by requiring LIHTC property owners to certify on an annual basis that they are renting units to qualified low-income tenants. If properties are found not in compliance, credits can be recaptured or disallowed by the IRS. However, federal regulations do not require agencies to monitor eligibility during the extended use period. States have responded by taking a variety of measures to ensure preservation of low-income units after the fifteenth year. Many states require reporting that is identical to the first fifteen years and some agencies enforce requirements through an honor system or through the risk of litigation on behalf of tenants (Khadurri, 2012). Some states extend or incentivize extended eligibility periods. Forty-one states either require or give preference to projects with affordability periods of longer than 30 years. These periods extend from 40 to 60 years and even to perpetuity in the case of Massachusetts, Michigan, and Vermont (Gustafson & Walker, 2002).

3.2 Developer Motivations

This study focuses on the decision-making process of a developer seeking a location for a low-income, multi-family housing development, and assumes such actors are economically rational and seek to maximize short-term and long-term return on investment through, respectively, rental income and later property sale (Khadurri, 2012). The developer maximizes return on investment by balancing a location's capacity to attract tenants, its development costs, and the political problems associated with gaining planning permission (McClure, 2008). The development of affordable housing naturally limits profits due to a smaller amount of cash flow generated from tenants, making the ability to secure 9 percent low-income housing tax credits critical to raising up-front capital.

This study incorporates and accounts for three vectors of variables that are likely to influence project siting: QAP incentives, neighborhood-level attributes reflective of the housing market and potential resistance to a project (i.e., NIMBY concerns), and project characteristics. These factors are viewed through the lens of specifically how they might influence developers siting their LIHTC properties near high performing schools.

Allocation of LIHTC credits is very competitive as the supply of 9 percent credits available each year is limited, consistently and significantly outnumbering applications (OCC, 2014). Therefore, developers structure their projects to earn the most points possible under the state QAP. According to a QAP analysis by the Urban Institute, there are "substantial relationships between QAPs and the characteristics of LIHTC units developed" (Gustafson & Walker, 2002). Priorities as outlined in state QAPs through set asides, thresholds, and points, will motivate a developer to locate a development in an area that maximizes its chances of being awarded the credits.

LIHTC developments sited in Qualified Census Tracts (QCTs) are eligible for a higher percentage of tax credits across-the-board, a federal policy-based motivator for developers. QCTs are census tracts in which at least half of the households have incomes that are less than 60 percent of the area median income or have a poverty rate of at least 25 percent. The effect of QCT as a motivator is variable across states. It is magnified by states that further incentivize them and reduced by states that select the option to modify which projects in QCTs are incentivized. Since QCTs correspond with higher poverty, lower income areas, this type of motivator interplays with neighborhood characteristics.

The characteristics of a neighborhood would be expected to independently affect a developer's LIHTC location decision, regardless of QAP incentives. Areas with higher housing demand will bring greater profits as vacancy is likely to be low, allowing a developer to minimize economic losses due to shortfalls in occupancy. Additionally, higher demand for housing brings with it higher housing values and prices, which in turn provides a developer with a benefit upon any later resale. But these future benefits may be counteracted by high land costs. Although the opportunity cost is high for building in areas with less demand, a developer may choose to place a project in an area with less demand to take advantage of lower development costs. The motivation to build in lower demand, often lower income communities is intensified if there are additional policy incentives in place to do so. Since LIHTC developers specifically are targeting low-income residents, demand for low-income units may be greater in the lower income neighborhoods.

The physical characteristics of an LIHTC property may also influence a developer's location decision. Research suggests that apartments built in jurisdictions with high performing schools might be designed to be more attractive to families (e.g., by having more bedrooms) (Obrinsky & Stein, 2007). Therefore, a developer placing a LIHTC property near a high

performing school may inherently have a higher proportion of units with three or four bedrooms to attract families. The overall size of LIHTC developments may also influence siting patterns. Larger developments may have difficulty finding available land in constrained areas such as densely settled and populated urban areas. In addition, zoning regulations often legally limit the number of units allowed in a particular area. Both land availability and zoning regulations are expected to interplay with local school performance. For example, land restricted areas are likely to be in urban neighborhoods, where schools tend to be lower performing. Thus, a developer may build a smaller development in these areas. Conversely, areas with strict zoning and low unit density regulations may have higher performing schools, due to exclusionary zoning effects. Affluent residents of major metropolitan areas often live in municipal jurisdictions or zoning districts that discourage or directly prevent the development of inexpensive housing units. Rothwell (2012) estimates that if metropolitan areas eliminated exclusionary zoning, they could lower their test score gaps by four to seven percent as low-income students gain access to higher-quality schools.

The affordability distribution of units within a property is likely to affect siting. A developer with a higher percentage of units that are designated affordable has a lower profit margin, and may decide to locate in a higher poverty area with high rent burden where future likely tenants currently reside. In higher income areas, opportunity costs rise because the market is capable of paying higher rents.

The ability to easily site a LIHTC property could also be hindered by community opposition to higher percentages of affordable units. Unfortunately, residents and individuals in a community have negative perceptions of subsidized housing . Higher-income communities often restrict the construction of affordable housing, effectively excluding low-income families and

blocking their children from attending these communities' higher performing schools (Goyette, 2014). Opposition to low-income housing can come from multiple sources and some common concerns include lowering of surrounding property values, increase in municipal fiscal burden, creation of social issues, and increased crime (Obrinsky & Stein, 2007). This opposition exists despite research that shows the relationships between low-income housing and these outcomes are, at best, tenuous (Baum-Snow & Marion, 2009; Ellen et al., 2009).

Another common objection developers face is the belief that new multifamily housing in general will overburden local schools, despite research showing that rental apartments house fewer school-age children than single-family residences (Obrinsky, 2001). As the LIHTC program has matured, it has gained greater popularity with developers in suburbs, which likely have higher percentages of homeowners and single-family homes (McClure, 2006). Fortunately, since the program assists private developers, it may confront less political opposition than the public project-based programs that preceded it (Freeman, 2004). A hypothesis table summarizing expected variable relationships with school proficiency index is displayed in *Figure 1*.

Figure 1: Hypothesis Table – Expected Relationships to School Proficiency Index

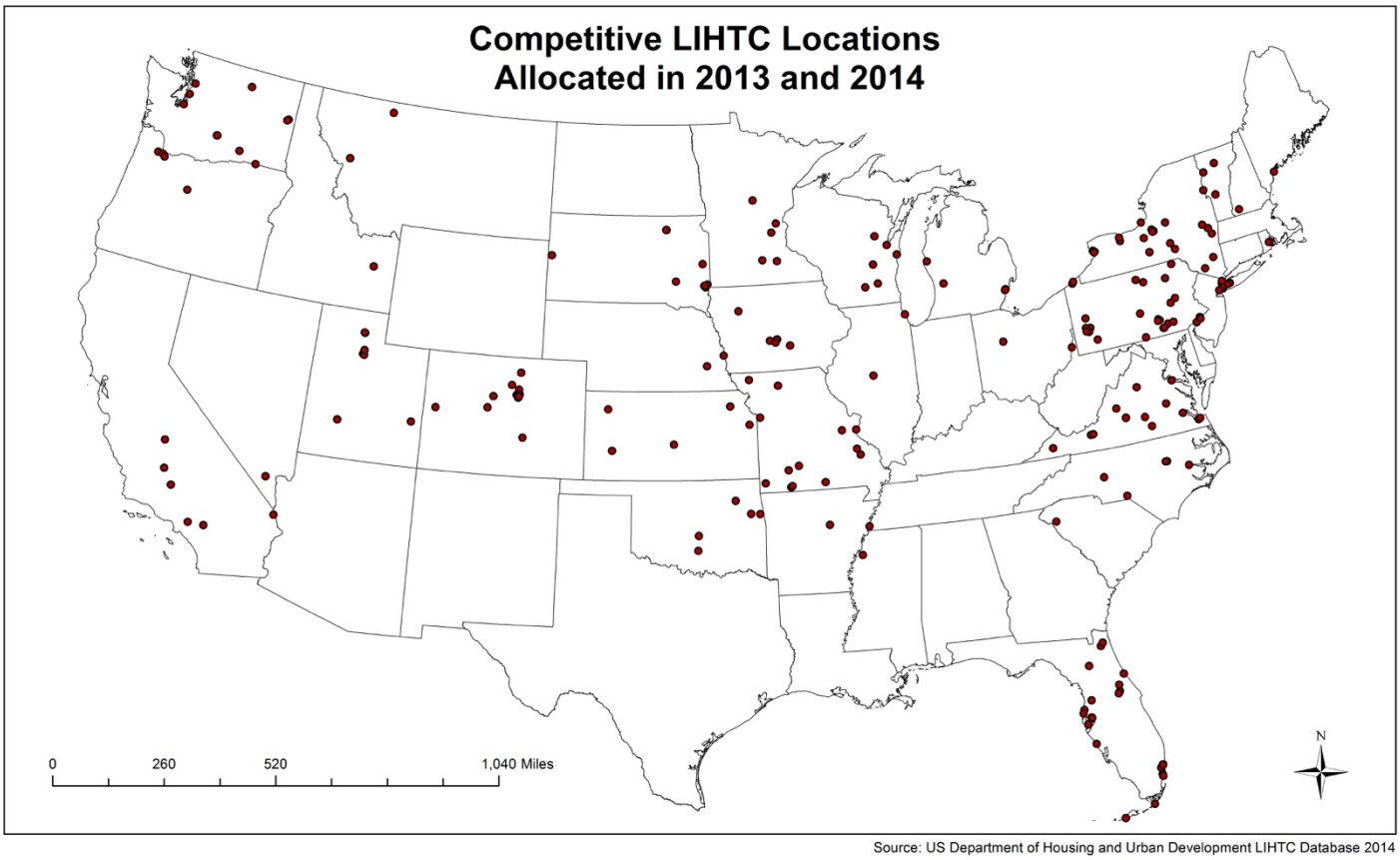
Vector Category	Independent Variable	Expected Sign
Neighborhood Characteristics	Median Household Income	(+)
	Median Property Value	(+)
	Median Gross Rent	(+)
	Percent Single Family	(+)
	Percent Occupied	(+)
	Percent Owner Occupied	(+)
	Percent Built Since 2010	(+)
	Qualified Census Tract	(-)
	Difficult to Develop Area	(-)
Property Characteristics	Number of Units	(-)
	Percent of Units Low Income	(-)
	Percent 3 or 4 Bedroom Units	(+)
	Non-Profit Sponsor	(+)
QAP Policy Scores	QAP School Quality Score	(+)
	QAP School Access Score	(+)
	QAP School Proxy Score	(+)

4. Research Design

This study examines LIHTC properties allocated in 2013 and 2014 across the entire United States, with fifteen states excluded due to unavailability of data or a lack of projects fitting the selection criteria for that time period (*Figure 2*). 2013 and 2014 were the most recent years for which data are available, and a two-year time span was chosen to ensure a large, heterogeneous population of properties. QAPs generally change very slowly over time (Gustafson & Walker,

2002), and the study assumes reasonably that the allocation criteria in 2013—the year for which QAPs were collected and coded—were substantially similar to those in 2014. The final database has 523 properties across 37 states and New York City, which has its own QAP allocation process due to the size of the market there.

Figure 2: LIHTC Properties Included in the Study Sample



Source: US Department of Housing and Urban Development LIHTC Database 2014

The unit of analysis in this study was a multifamily housing project (two or more units) funded by the LIHTC program with a 9 percent credit allocated in 2013 or 2014. As noted earlier, the higher credits are competitive; projects in each state are scored and ranked under QAP criteria. The LIHTC database kept by HUD has locational and other characteristics (e.g., number of units, number of units of different size by bedroom count, whether the developer was a non-profit

organization) current through 2014 (a map of all current LIHTC locations is displayed in *Appendix C*). A total of 1,802 properties included in the HUD database were allocated in either 2013 or 2014, of which 219 were awarded a 9 percent credit. However, the database is not comprehensive; it is compiled yearly through a survey of data provided by state housing authorities, and many properties were excluded due to missing data regarding the credit type. In order to assemble a more thorough database, and one representing a greater number of states, supplemental LIHTC property information was gathered from multiple housing authorities including those in Indiana, Texas, California, and New York City. A limitation of these databases was the lack of some data on physical characteristics. After excluding developments with missing data on any key variable, the final database contained 523 LIHTC properties.

4.1 Variable Specification and Measurement

As noted in the conceptual framework, neighborhood attributes, project characteristics, and QAP policies are all likely to influence the siting decisions of low-income housing project developers. In this section, these vectors are operationalized as variables. Not all variables described here were included in final models due to multicollinearity or missing data. However, their specification is retained because it may be of use in future research. A complete variable description table is displayed below in *Table 2*.

Figure 3 : Variable Description Table

	Variable	*Variable Label*	*Description*	*Geographic Level*	*Data Year*	*Source*	*Data Type*
Dependent Variable							
	School Proficiency Index	*schl_idx*	A measure of the quality of school available to the residents of an LIHTC unit as approximated by a School Proficiency Index developed by the US department of Housing and Urban Development (HUD).	Block Group	2012-2013	HUD School Proficency Index	Continuous
Independent Variables							
Neighborhood Characteristics	Median Household Income	*medhhinc*	Median annual household income of neighborhood households (dollars).	Block Group	2010-2014 (5 year average)	US Census Bureau American Community Survey 5-Year	Continuous
	Median Property Value	*medval*	Median property value of neighborhood households (dollars).	Block Group	2010-2014 (5 year average)	US Census Bureau American Community Survey 5-Year	Continuous
	Median Gross Rent	*medgrent*	Median monthly gross rent of neighborhood households (dollars).	Block Group	2010-2014 (5 year average)	US Census Bureau American Community Survey 5-Year	Continuous

Figure 3 : Variable Description Table

Percent Single Family	*pctsingfam*	Percent of housing units in the neighborhood that are designated as single family structures	Block Group	2010-2014 (5 year average)	US Census Bureau American Community Survey 5-Year	Continuous, percentage
Percent Occupied	*pctocc*	Percent of housing units in the neighborhood that are occupied	Block Group	2010-2014 (5 year average)	US Census Bureau American Community Survey 5-Year	Continuous, percentage
Percent Owner Occupied	*pctown*	Percent of occupied housing units in the neighborhood that are occupied by the owner.	Block Group	2010-2014 (5 year average)	US Census Bureau American Community Survey 5-Year	Continuous, percentage
Percent Built Since 2010	*pctbuilt2010*	Percent of housing units in the neighborhood that were built in 2010 or later.	Block Group	2010-2014 (5 year average)	US Census Bureau American Community Survey 5-Year	Continuous, percentage
Qualified Census Tract	*qct*	Whether or not the unit is located in a Qualified Census Tract (QCT)	Census Tract	2010-2014 (5 year average)	HUD LIHTC Database	Categorical
Difficult to Develop Area	*dda*	Whether or not the unit is located in a Difficult to Develop Area (DDA)	County	2010-2014 (5 year average)	HUD LIHTC Database	Categorical

Figure 3 : Variable Description Table

Property Characteristics	Number of Units	*n_units*	The total number of housing units within the LIHTC property	Property (point)	2013-2014	HUD LIHTC Database, State PHAs	Continuous
	Percent of Units Low Income	*pctli*	Percent of housing units within the LIHTC property that are designated for low income residents.	Property (point)	2013-2014	HUD LIHTC Database, State PHAs	Continuous, percentage
	Percent 3 or 4 Bedroom Units	*pct34br*	Percent of units within the LIHTC property that have three or four bedrooms	Property (point)	2013-2014	HUD LIHTC Database	Continuous, percentage
	Non-Profit Sponsor	*non_prof*	Whether or not the property was developed, owned, and/or funded by a nonprofit organization	Property (point)	2013-2014	HUD LIHTC Database	Categorical
QAP Policy Scores	QAP School Quality Score	*QAP_pct_SQ*	Percent of total points outlined in the QAP that directly incentivize placement of a development in proximity to a higher quality or higher performing school	State	2013	State QAPs	Continuous, percentage
	QAP School Access Score	*QAP_pct_SA*	Percent of total points outlined in the QAP that incentivize placement of a development in close proximity to a K-12 school	State	2013	State QAPs	Continuous, percentage
	QAP School Proxy Score	*QAP_pct_SP*	Percent of total points outlined in the QAP based on incentives that may proxy or indirectly result in units placed near high quality schools	State	2013	State QAPs	Continuous, percentage

The outcome (dependent) variable in this study is a measure of the quality of school available to the residents of an LIHTC unit as measured by HUD's School Proficiency Index for each census block group. The proficiency index is a function of the percent of 4th grade school students proficient in reading (*r*) and math (*m*) on state test scores and school enrollment (*S*)[2]. Elementary schools are linked to block groups based on a spatial joining of attendance area zones from School Attendance Boundary Information System (SABINS), or an average of up to the three closest schools (as measured using a network analysis) within 1.5 miles. Proficiency data come from the Great Schools Database. School addresses and enrollment from the US Department of Education's Common Core of Data. In cases with multiple school matches, an enrollment-weighted score is calculated following the equation below.

$$School_i = \sum_{n=i}^{3} \left(\frac{s_i}{\sum^n s_i}\right) * \left[\frac{1}{2} * r_i + \frac{1}{2} * m_i\right]$$

The index provides a number between 1 and 100. The creation of this index is recent, and aligns with the goals of the Affirmatively Furthering Fair Housing (AFFH) act in which HUD has asked its program participants to take a more serious look at neighborhood context in order to receive program funding. The agency is taking a more active role by providing data and analytical tools to help grantees quantify and interpret this mandate.

Three vectors of independent variables were used: neighborhood characteristics, project characteristics, and state QAP policies. American Community Survey 5-year data was utilized to characterize the neighborhood in which each LIHTC unit is located. Many variables were initially included, recognizing the possibility of collinearity and complete data availability and reliability.

[2] Further detail on the methodology of the HUD school proficiency index is available at: http://egis.hud.opendata.arcgis.com/datasets/70e2ed8dcb6c47ffa3414c275f62b72b_0

The information was collected at the block group level and matched to each single family LIHTC unit based on the block group FIPS code.

Median household income, median property value, and median gross rent were continuous variables included in the study as neighborhood and market characteristics, and all were drawn from American Community Survey (ACS) five-year estimates. Household income is based on the income of the householder and all other individuals fifteen years old and over in the household over the past twelve months. The median is based on the distribution of the total number of households in the block group, including those with no income. Median property value is the respondent's estimate of how much the property (house and lot, mobile home and lot, or condominium unit) would sell for if it were for sale. The value of a home provides information on neighborhood quality, housing affordability, and wealth. These data provide socioeconomic information not captured by household income and comparative information on the state of local housing markets (US Census Bureau, 2015). Gross rent is the contract rent plus the estimated average monthly cost of utilities (electricity, gas, and water and sewer) and fuels (oil, coal, kerosene, wood, etc.). When gross rent data is used in conjunction with income data, the information offers an excellent measure of housing affordability and excessive shelter costs.

Percent single-family units, percent occupied, percent owner occupied and percent built since 2010 were continuous percentage variables included in the study as neighborhood characteristics. Each variable was constructed based on a proportion of an ACS estimate to the total number of households or the total number of housing units, as appropriate. The proportion of single-family units was based on the number of housing units in the block group that are designated as single-family structures. Single-family structures include fully-detached houses, semi-detached houses, row houses, and townhouses. In the case of attached units, each must be separated from

the adjacent unit by a ground-to-roof wall and must not share heating/air-conditioning systems or utilities. A unit is occupied if it is the current place of residence of the person or group of people at the time of survey, and it cannot be unoccupied for more than two months out of the year. Percent owner-occupied is based on the number of housing units in which the owner of the unit lives, whether mortgaged or fully paid. Homeownership has served as an indicator of the nation's economy for decades and is used to evaluate the overall viability of housing markets and to assess the stability of neighborhoods (US Census Bureau, 2015). The percent built since 2010 may provide a useful indicator of how the housing market in the neighborhood has performed since the housing market collapse in 2009.

Two additional non-census neighborhood characteristics were available in the HUD LIHTC database and coded dichotomously: (1) whether the unit was located in a qualified census tract (QCT) (1 = yes) and (2) whether the unit was located in a difficult to develop area (DDA) (1 = yes). As previously outlined, QCTs can be a factor in concentrating LIHTC developments in high poverty areas typically with low-performing schools. DDAs should increase LIHTC development in better neighborhoods with higher-performing schools, research suggests that despite the incentives offered high land assembly costs can significantly hamper projects, particularly since land costs cannot be included in a developer's calculation of eligible basis (Dawkins, 2011).

In addition to neighborhood (block group) variables, information regarding characteristics of the specific LIHTC properties were considered. The inclusion of many of these variables in the analysis was severely limited by the availability of information. Supplementary property based data was limited and inconsistent among the records obtained from the state agencies, and was often listed as "Not Available" in the HUD LIHTC database. The property based variables

included the total number of units, percent of low income units, percent of units three or four bedroom, and non-profit sponsor.

The total number of housing units within an LIHTC property reflects the size of the development, which may also proxy developer capacity and site availability. The percent of units within the development that are designated for low-income residents (also known as the qualifying ratio) is likely to be a factor in both the awarding of tax credits and the siting of that unit. In order to qualify for tax credits, the development must have either (1) at least 20% of the units rent restricted to be affordable for households with incomes at or below 50% of the HUD determined area median income (AMI), or (2) at least 40% of the units rent restricted to be affordable for households with incomes at or below 60% of the HUD determined AMI. Most QAPs also incentivize projects based on the affordability distribution of the development units but these incentives are inconsistent across states due to differing priorities. Some states push for a higher qualifying ratio in order to serve more individuals, while others prioritize mixed income developments that incorporate numerous levels of affordability. In addition, the percent of units designated for low-income households could have an effect on community acceptance or opposition to a development. Developments with higher percentages of low-income residents may be viewed as more undesirable.

The percent of units within an LIHTC development that have three or four bedrooms is a potential indicator of the targeted residents of the property. Units with three or four bedrooms are likely going to house family tenants. Thus, the higher percentage of units in the development that have three or four bedrooms, the more likely the developer is targeting families. It is speculated that a developer who is geared toward family tenants, may place a higher value on local school performance or access.

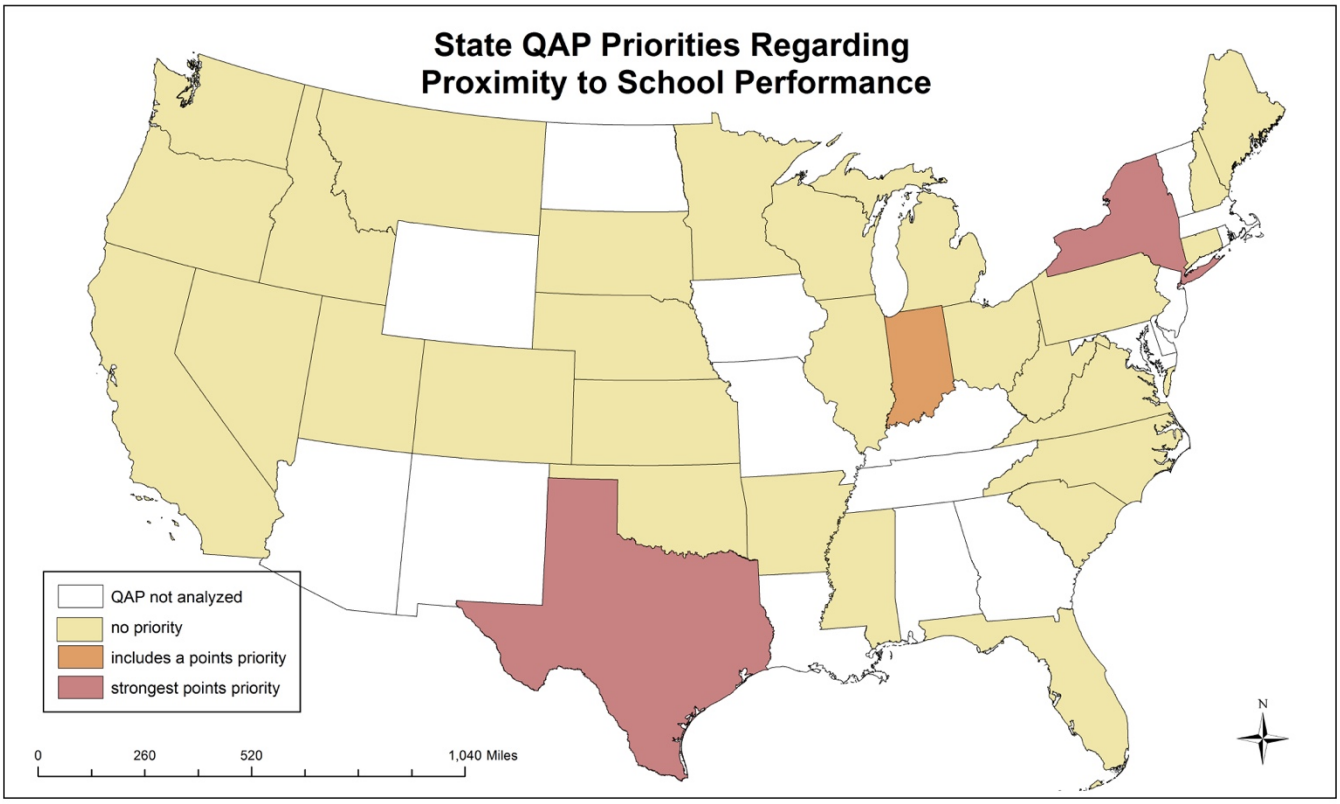
The non-profit sponsor variable is dichotomous (1 = non-profit sponsor) and indicates whether or not the property was developed, owned, and/or funded by a nonprofit organization. Federal statute requires each state to set aside at least ten percent of its credit allocation for projects developed by nonprofits. HUD estimates that between 2013 and 2014 allocation years, 32 to 40 percent of projects were sponsored by non-profits, compared to 26 percent of all LIHTC developments placed in service since the beginning of the program. Research also suggests that some LIHTC equity investors have been socially motivated to fund projects developed by non-profits whose mission is to create and preserve affordable housing in their neighborhoods (Khadurri, 2012). Unfortunately, information regarding the sponsor of the project was severely limited in both the HUD LIHTC database and supplemental data sources.

To assess how different state priorities are shaping the neighborhoods where LIHTC developments are located, the state QAPs for the year 2013 were reviewed. In 2015, Oppenheimer performed a comprehensive review of state QAPs to "analyze requirement and scoring parameters that have the potential to reverse segregated housing patterns, expand housing opportunities for low income families and families of color, and use the Low Income Housing Tax Credit (LIHTC) to deconcentrate poverty and improve civil rights practices." The analysis used the most recent finalized QAP for 49 states plus Chicago and New York City (which have separate QAPs from their state HFAs). The study resulted in publically available QAP summaries detailing 23 indicators, and categorized provisions based on the strength of their fair housing requirements.

Oppenheimer's QAP summaries were used in this study to acquire information on QAP point allocation related to schools. Three school quality variables were developed from the QAP information. First, and most directly, a QAP can award points to projects that are near high performing schools, with each allocation authority defining for itself the regulatory meaning of

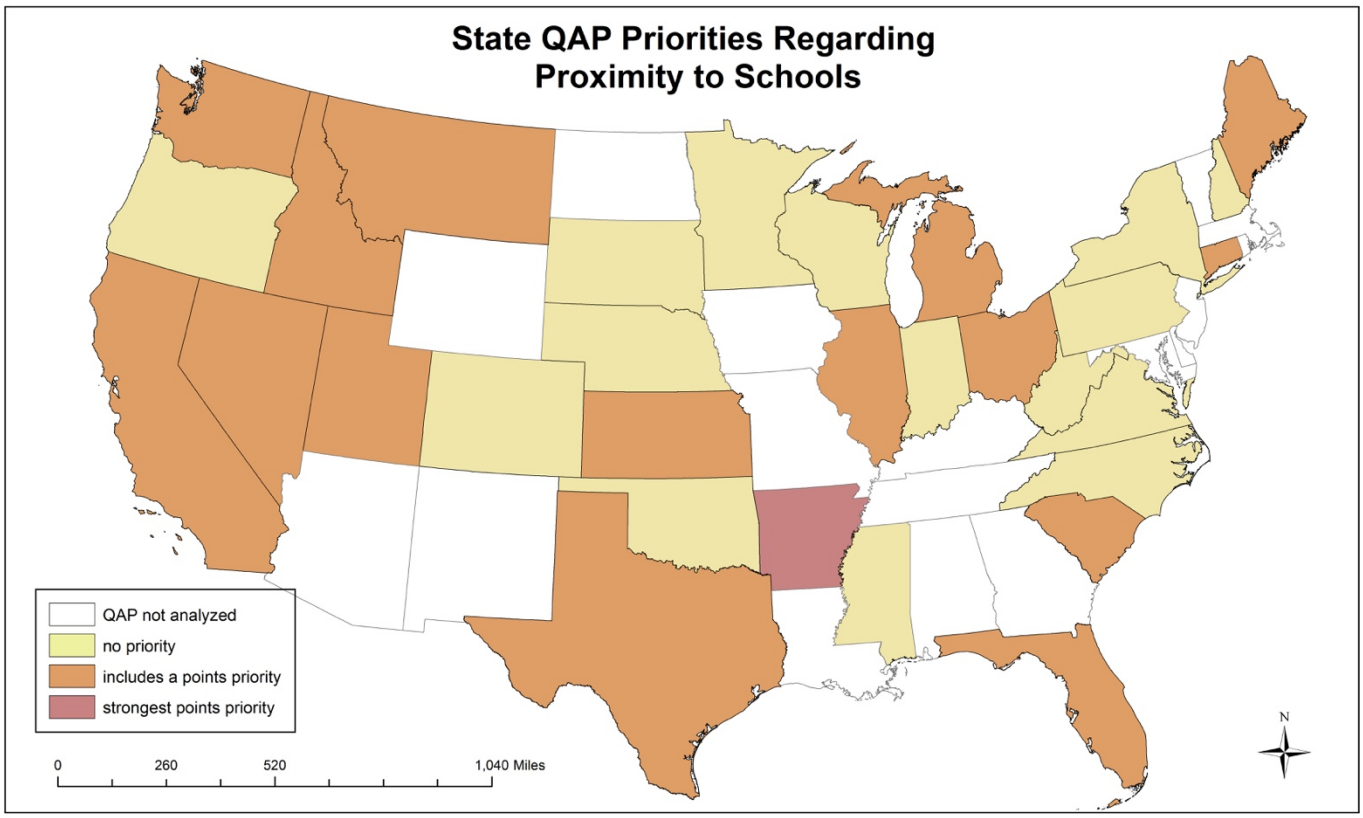
"high performing" and "near." (*Figure 4*) For example, Texas awards up to three (3) out of 185 points for a property located within the attendance zones of public schools that have achieved a 77 or greater on the Texas Education Agency's student achievement performance index.

Figure 4: Map of State QAP Priorities Regarding Proximity to School Performance



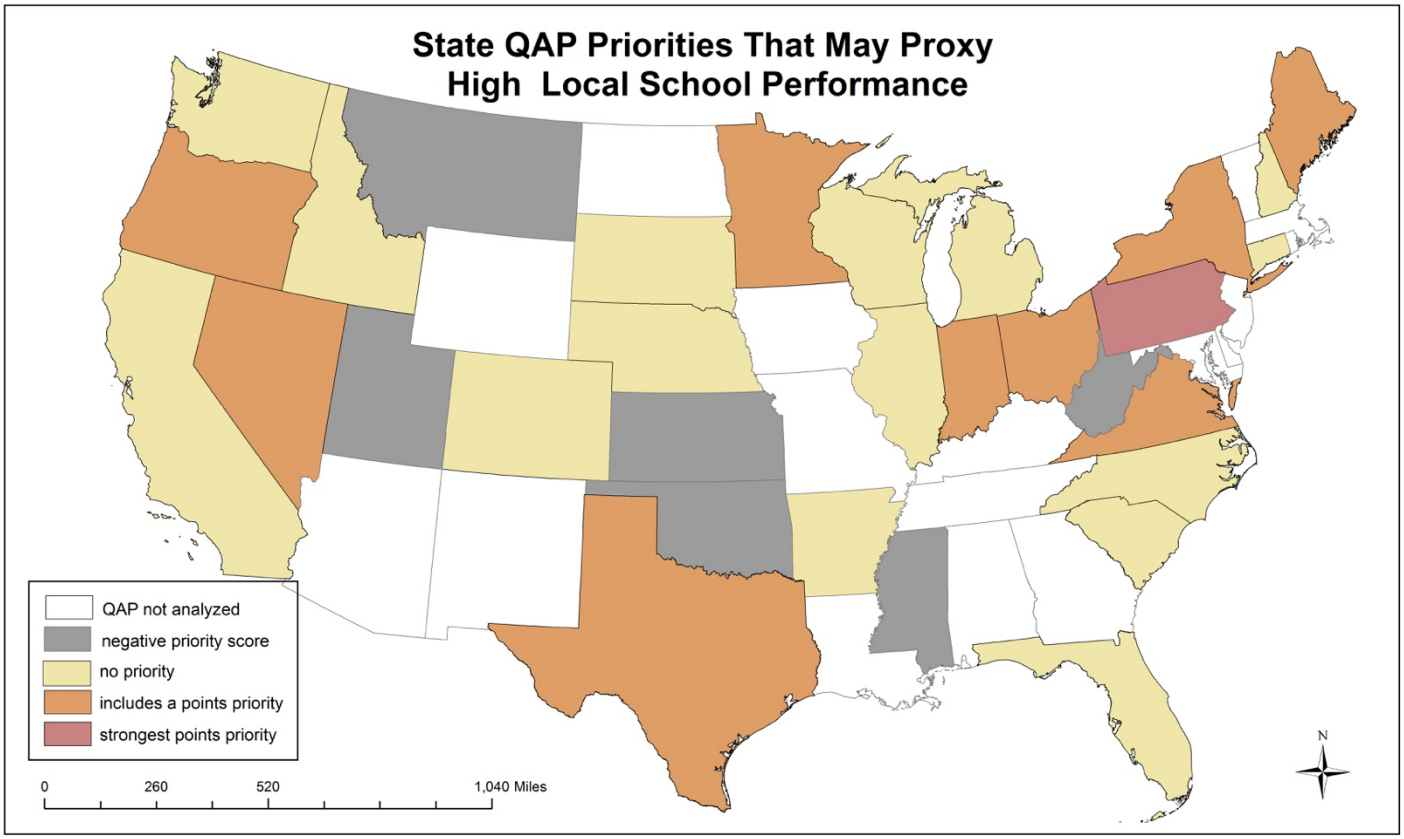
Second, a QAP can award points to projects that have access to any schools, with "access" again being defined differently. Often, these points were part of a bundle of points awarded for general access to amenities. In cases where a school was one of several amenities that could garner points, the highest number of points that could be obtained specifically for schools were recorded. (*Figure 5*) For example, California awards a maximum of fifteen (15) out of 155 points for developments located near amenities including public parks, libraries, public schools, and grocery stores, with a maximum of three (3) points given for each amenity.

Figure 5: Map of State QAP Priorities Regarding Proximity to School Performance



Third, a QAP can award points to projects for attributes that may proxy access to high-performing schools (*Figure 6*). Such schools, as described at length earlier, tend to exist in areas with high median income, high home value, high median rent, high percentage of owner-occupied households, and a low poverty rate. Many QAPs award points for projects proposed in areas with such characteristics, and some simultaneously reward projects in areas with opposing attributes, including those in qualified census tracts. For example, West Virginia awards 50 points (out of 1055 total) for projects in block groups where median family income falls into the lowest category, but also gives 40 points for projects located in counties where the tax credit rent restriction as a percent of average monthly wage falls is very high.

Figure 6: Map of State QAP Priorities That May Proxy High Local School Performance



To create the final variables on these dimensions, the percent proportion of points for each dimension was calculated. Thus, Texas on the first dimension—allocation priority for access to a high-performing school—would be measured as 1.6 (3 / 185). California on the second dimension—allocation priority for access to any school—was measured as 1.9 (3 / 155). West Virginia on the proxy access variable was scored at -1 ((30-40) / 1055). If the QAP is viewed from the developer's perspective, it is logical that the proportion of points would be more meaningful for maximizing the award of credits. A lower score on a dimension means that a developer has other more effective options for gaining points for a proposed project than locating it near a high-performing school. In the three examples given here—Texas, California, and West Virginia—it is

clear that a developer interested in providing access to high-performing schools will receive little reward, either directly or indirectly.

Each project had a block group level FIPS code from which the state FIPS code could also be parsed. The school proficiency index values, recorded by catchment area, had block group FIPS codes. Similarly, neighborhood attributes—all of which were at the block group level and available through American Community Survey datasets—could be joined with the block group FIPS code. The QAP scores for the key explanatory variables—school quality, school access, and school proxy—were linked to the projects within a state using the state FIPS code. In the final database, each row had an LIHTC project with FIPS identifying characteristics, project attributes, block group (neighborhood) attributes, and state-level QAP characteristics.

The data, therefore, occurred at multiple nested levels, violating the usual assumptions of independence. All projects in Texas would share not only the same QAP, but would be located in block groups that might have attributes biased by their location within that state for reasons not measured by the model. Similarly, multiple LIHTC projects could be located in a single block group, and this might lead to them having similar project-level characteristics for reasons not accounted for directly. In short, each project has attributes that vary at multiple levels, and the variation across levels may be linked. Multilevel linear models (also known as hierarchical linear models) allow a representation of nesting in a statistical modeling framework (Ojeda, Sahai, & Juarez-Cerrillo, 1999). This study utilized one-level multilevel regression in order to estimate the variation in school quality (as measured by a school performance index) available to LIHTC developments attributable to differing state QAP policies. Using a multilevel model allows for different regression coefficients for each variable in each state. Essentially, this structure allows the assumption that LIHTC properties in a given state have correlated school performance index

numbers generated by single set of regression coefficients, which is expected due to the QAP policy measures that are homogeneous at the state level.

To analyze the data, separate regression equations are set up in each state to estimate the school performance index (schl_idx) as a function of QAP school variables (used separately; QAP_pct_SQ;), median property value (medval), median household income (medhhinc), percent of households that are occupied (pctocc), numer of units (n_units), and percent of units that are low income (pctli). The three models, each with a different QAP school variable, follow the general structure below

$$schl\_idx_{ij} = \beta_{0j} + \beta_{1j} QAP\_pct\_SQ_{1ij} + \beta_{2j} medval_{2ij} + \beta_{3j} medhhinc_{3ij} + \beta_{4j} pctocc_{4ij} + \beta_{5j} n\_units_{5ij} + \beta_{6j} pctli_{6ij} + \varepsilon_{ij}$$

where β_{0j} is the intercept, β_{1j} through β_{6j} are the estimated effects of the explanatory variables, and e_{ij} is the residual error term. The subscript j is for the state (j = 1...J) and the subscript i is for individual LIHTC developments (i = 1...nj). We assume that each state has a different intercept coefficient β_{0j} and different slope coefficients (β_{1j}, β_{2j}, …), an important difference from a usual regression model.

Not all of the collected explanatory variables of interest were included in the final model due to multicollinearity, data availability, and data reliability. A correlation matrix of all variables is displayed in *Figure 7.* Large correlation coefficients in the correlation matrix of predictor variables indicate multicollinearity and, according to Tabachnick and Fidell (1996), the explanatory variables with a correlation more than 0.70 should not be included in multiple regression analysis.

Figure 7: Correlation Matrix

	pctsin~m	*medhhinc*	*medval*	*pctocc*	*pctown*	*built2010*	*medgrent*	*qct*	*dda*	*n_units*	*pctli*
pctsingfam	1										
medhhinc	0.5177	1									
medval	-0.0286	0.4969	1								
pctocc	0.1026	0.248	0.2588	1							
pctown	0.8019	0.6803	0.1393	0.1516	1						
built2010	-0.0063	0.1436	0.1341	0.1282	0.0479	1					
medgrent	0.3432	0.7202	0.4318	0.1689	0.3865	0.256	1				
qct	0.3735	0.4483	0.1857	0.1744	0.5234	0.0965	0.2726	1			
dda	0.0025	0.0364	0.1174	-0.3046	0.0782	-0.0909	0.0204	0.0926	1		
n_units	-0.2783	-0.1629	0.0611	0.0827	-0.2446	0.1563	-0.0333	-0.2819	-0.1012	1	
pctli	0.0039	0.0644	0.0097	0.0191	0.0238	0.0697	0.017	-0.0945	-0.0644	0.0345	1
pct34br	0.1495	-0.0331	-0.1924	0.0462	0.0204	-0.0724	-0.1403	-0.1553	-0.0785	-0.0304	0.0855
non_prof	-0.0774	0.0067	0.0319	0.0105	0.0328	0.0931	-0.0039	-0.0398	0.0677	0.1142	0.0357

Among the census based neighborhood variables, median household income was strongly correlated with median gross rent (0.72), as well as percent of owner-occupied households (0.68), as would be expected,. Literature suggests that areas with higher household incomes bring with them higher rents (Joint Center for Housing Studies, 2013). Additionally, households that rent their homes have comparably lower incomes than those that own their homes, as lower income households are unable to afford the equity required to purchase a home. Median gross rent and percent of households that are owner occupied were excluded from analysis and median household income was retained. The percent of units that were built in 2010 and later was removed due to unreliable data at the block group level. Location in a qualified census tract or difficult to develop area were both excluded due to lack of complete data available for the entire sample.

Among the project level variables, the percent of units in the LIHTC property that are three or four bedrooms and the non-profit status of the developer were both excluded from the model due to lack of complete data. The property data obtained from the HUD database had missing data regarding non-profit status and the supplemental property data did not include this specification. Most of the supplemental state housing agency data did not include the bedroom of unit size composition of its projects. These variables were omitted in order to maximize the study sample size.

5. Findings

5.1 Descriptive Statistics

The study began with a total of 523 LIHTC properties across 37 states allocated in 2013 or 2014 and awarded a 9 percent competitive credit. The number of LIHTC properties with information for median property value was the least among all variables included in the model at 461. Median property value being the limiting variable, the final sample size of the study was restricted to 461 properties. Roughly half (45 percent) of the properties were allocated in 2013 with the remaining allocated in 2014. Summary statistics of the data are presented in *Figure 8*.

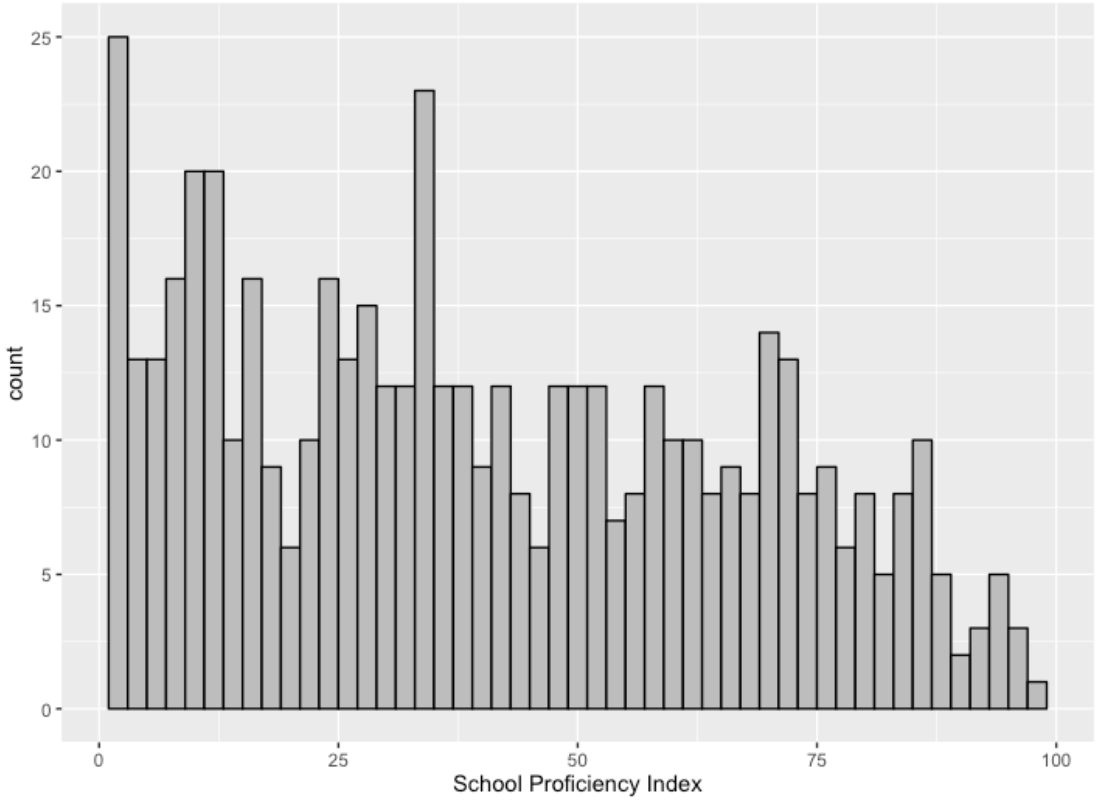
Figure 8: Summary Statistics

Variable	*N*	*Mean*	*St. Dev.*	*Min*	*Median*	*Max*
schl_idx	516	40.921	26.397	1	37	98
n_units	507	62.935	46.368	0	49	312
pctLI	496	90.323	24.392	0	98.658	100
medval	461	210,351.60	171,712.60	19,700	156,800	1,000,001
pctocc	522	88.041	10.113	38.997	89.784	100
medhhinc	522	41,478.67	22,807.58	2,499	35,930.50	152,083
QAP_pct_SQ	498	0.381	0.802	0	0	2.913
QAP_pct_SA	498	1.208	1.243	0	1.622	8.696
QAP_pct_SP	498	1.802	4.318	-8.696	0	16.964

The LIHTC properties in the sample were located in block groups with proficiency levels below the national average and median. The median school performance index accessible to LIHTC units in the sample was 37 (compared to a national median of 49) and the mean was 40.9 (compared to a national average of 49.1). However, the distribution of school proficiency scores

in the dataset was from 12 to 98, showing that at least some projects are located near high-performing schools. The distribution of LIHTC properties by their school proficiency index for the entire sample is displayed in *Figure 9*.

Figure 9: School Proficiency Index Distribution



Only twelve states in the sample had more than ten LIHTC properties allocated in the sampling years of 2013 or 2014. Of those states, Texas (55 properties) and Missouri (13 properties) had the highest median school proficiency scores of 61 and 58 respectively. New York state and New York City had the lowest median school proficiency scores of 20 and 25. *Figure 10* displays the complete distribution of school index scores across all states included in the study.

Figure 10: Summary Statistics of School Performance Index Across Study States

State	Count	Mean	std_dev	Median	pct_sq	pct_sa	pct_sp
ALASKA	2.00	74.00	21.21	74.00	0.00	0.00	16.96
ARKANSAS	2.00	69.50	7.78	69.50	0.00	8.70	0.00
CALIFORNIA	176.00	37.74	23.54	35.00	0.00	1.94	0.00
COLORADO	12.00	39.58	32.86	39.50	0.00	0.00	0.00
FLORIDA	25.00	34.33	27.18	28.00	0.00	3.45	0.00
IDAHO	1.00	41.00	NA	41.00	0.00	0.60	0.00
ILLINOIS	2.00	84.00	16.97	84.00	0.00	1.00	0.00
INDIANA	38.00	35.34	25.39	30.50	0.50	0.00	1.00
IOWA	7.00	36.71	32.11	25.00	0.00	0.96	0.00
KANSAS	5.00	57.60	28.92	56.00	0.00	1.61	-6.45
MAINE	1.00	62.00	NA	62.00	0.00	8.22	5.48
MICHIGAN	5.00	30.60	27.95	23.00	0.00	3.98	0.00
MINNESOTA	5.00	57.60	27.23	66.00	0.00	0.00	6.02
MISSISSIPPI	1.00	12.00	NA	12.00	0.00	0.00	-2.39
MISSOURI	13.00	56.77	18.68	58.00			
MONTANA	2.00	80.00	11.31	80.00	0.00	0.96	-0.96
NEBRASKA	2.00	55.00	7.07	55.00	0.00	0.00	0.00
NEVADA	1.00	64.00	NA	64.00	0.00	1.34	0.67
NEW HAMPSHIRE	1.00	98.00	NA	98.00	0.00	0.00	0.00
NEW YORK	28.00	28.64	26.28	20.00	2.91	0.00	7.77
NORTH CAROLINA	5.00	52.40	37.82	56.00	0.00	0.00	0.00
NYC	41.00	28.22	24.13	25.00	0.00	0.00	0.00
OHIO	1.00	65.00	NA	65.00	0.00	8.00	12.00
OKLAHOMA	5.00	45.20	23.82	37.00	0.00	0.00	-8.70
OREGON	5.00	63.40	32.72	72.00	0.00	0.00	6.00
PENNSYLVANIA	27.00	39.69	26.40	40.00	0.00	0.00	15.38
RHODE ISLAND	1.00	69.00	NA	69.00			
SOUTH CAROLINA	1.00	63.00	NA	63.00	0.00	0.66	0.00
SOUTH DAKOTA	10.00	50.50	20.23	59.50	0.00	0.45	0.00
TEXAS	55.00	55.85	25.22	61.00	1.62	1.62	3.78
UTAH	8.00	47.00	29.84	38.00	0.00	0.51	-5.05
VERMONT	4.00	53.75	33.92	61.50			
VIRGINIA	14.00	38.36	25.32	34.00	0.00	0.00	2.10
WASHINGTON	10.00	34.50	23.71	28.50	0.00	0.90	0.00
WEST VIRGINIA	1.00	34.00	NA	34.00	0.00	0.00	-2.84
WISCONSIN	6.00	36.00	12.44	38.00	0.00	0.00	0.00

Nearly one fourth of the sample (121 LIHTC properties across three states) had a QAP school quality score greater than zero. The state of New York received the highest QAP school quality score (2.9 percent) yet has the lowest state average and median school proficiency index accessible to LIHTC properties in the sample. However, among the states with QAP school quality provisions the median and mean school index was slightly higher than the sample average with a median of 40 and mean of 43.1. LIHTC properties located in states without a school quality provision had a mean school index of 39.5 and median of 35, both lower than the sample average. The distribution of LIHTC projects by their school proficiency index among states with and without a QAP school quality provision is displayed in *Figures 11 & 12*.

Figure 11: School Proficiency Index in States with a School Quality Provision

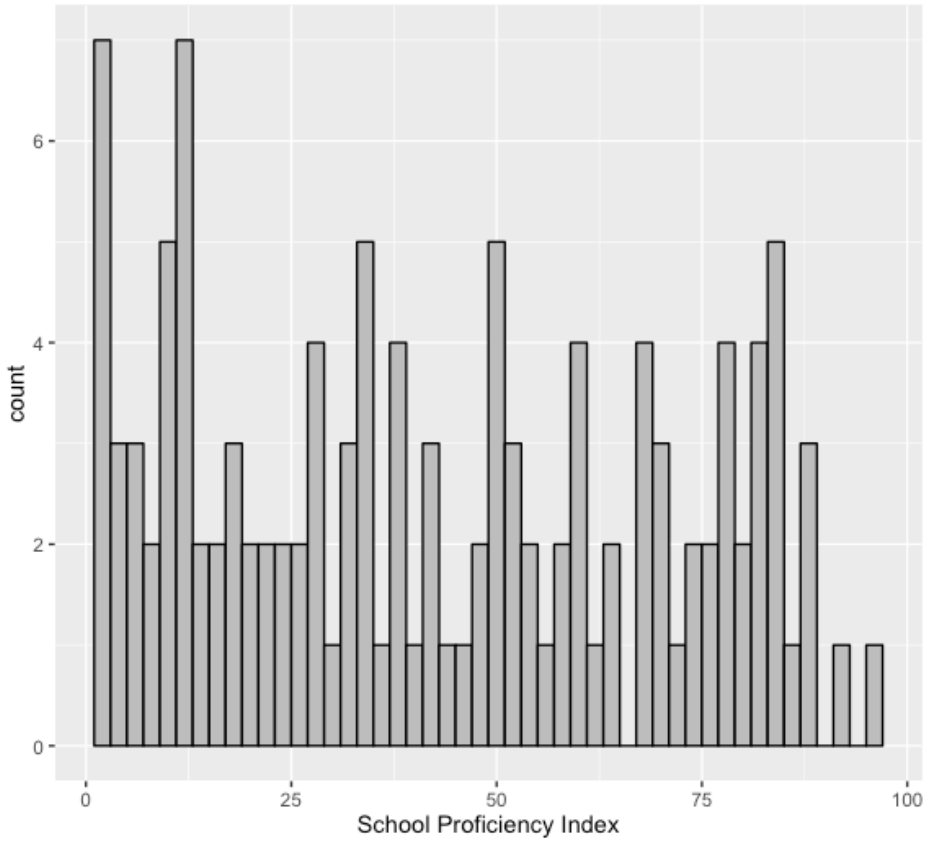
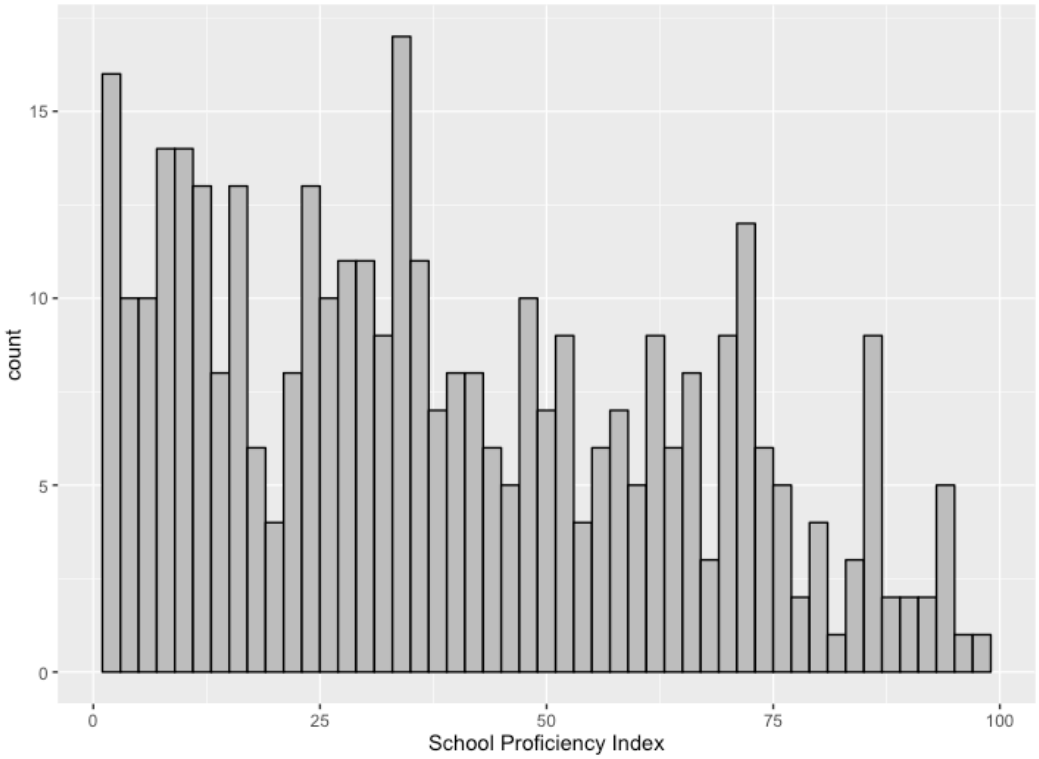


Figure 12: School Proficiency Index in States with No School Quality Provision



Almost three fourths of the sample or 299 properties across 15 states had a QAP school access score greater than zero. Texas, with 55 projects, was the only state with both school quality and school access QAP provisions, and as previously mentioned the state exhibited the highest median school performance index (61). Florida and Michigan both had relatively high QAP school access scores, but had relatively low median school performance index scores of 28 and 23, respectively. Similar to school quality, among the states with QAP school access provisions the median and mean school index was slightly higher than the sample average, with a median of 41 and mean of 42.7. LIHTC properties located in states without a school access provision had a mean school index of 36.8 and median of 33, both lower than the figures for projects in states without school quality provisions. The frequency distribution of LIHTC projects by school proficiency

index among states with and without a QAP school access provision is displayed in *Figures 13 & 14*.

Figure 13: School Proficiency Index in States with School Access provision

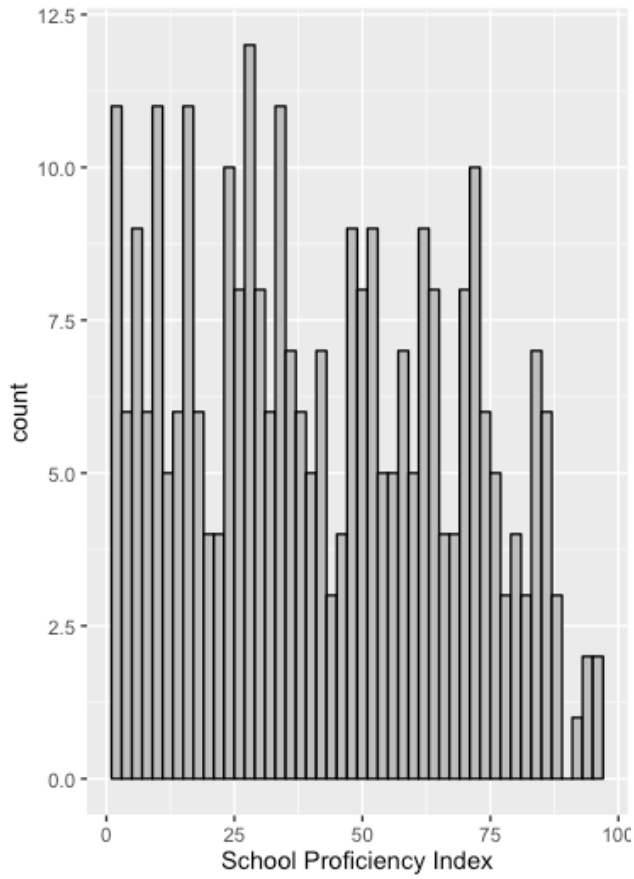
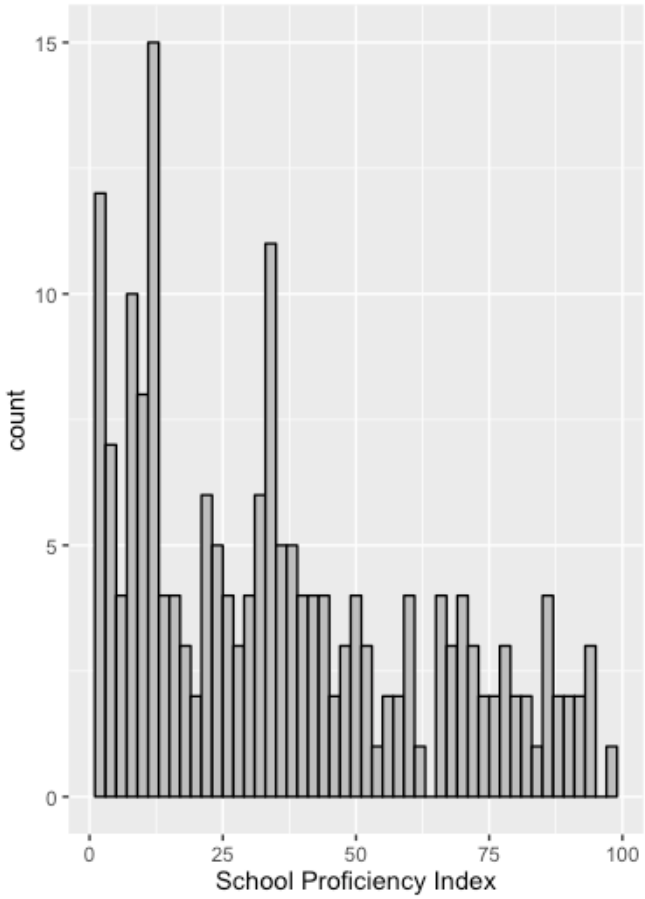


Figure 14: School Proficiency Index in States without School Access provision



5.1.2 Neighborhoods of LIHTC Properties

The census-based neighborhood variables collected allow a general characterization of the areas in which the sample LIHTC projects are located. Compared to national averages and medians, LIHTC properties in the sample are generally located in block groups with lower household incomes, lower property values, and higher occupancy rates. The average median

household income across the sample of LIHTC locations was $41,478 with a median of $35,930. The lowest median household income was $2,499 and the highest was $152,082. By comparison, the national median household income was $53,482. The median property value was $156,800, lower than the national median property value of $188,900. The median occupancy rate across the sample was 89.8 percent, which is slightly higher than for the U.S. overall (86.2 percent) and ranged from 39.0 percent to 100 percent. A higher median occupancy rate near LIHTC properties could be indicative of a more competitive market and higher demand for housing in these neighborhoods. The median rate of homeownership among the sample areas was 40.6 percent compared to the national rate of 64.4 percent, and the median share of single-family housing units was 52.0 percent compared to the national median rate of 64.2 percent. These figures are not surprising, since we would expect neighborhoods with higher homeownership and a predominantly single-family detached building stock to have residents and potentially a land use approval process that is more resistant to multi-family and low-income housing.

5.1.3 Property Characteristics

Compared to all 43,092 LIHTC projects placed in service between 1987 and 2014 available in the HUD database, properties in the study sample are generally smaller and have a lower proportion of low-income units. The mean number of units per LIHTC development is 63 compared to the national average of 76 among all multifamily units in the U.S. The number of units has a much lower median of 49 and a high standard deviation of 46, indicating a high degree of variability and a small number of very large developments. The mean qualifying ratio of LIHTC projects in the study sample is 90.3 percent compared to a national average of 95.7 percent. The qualifying ratio among the sample has a higher median of 98.7 percent with a standard deviation of 24.4 percent, indicating that the bulk of these projects provide housing nearly exclusively for

low-income tenants. The average percent of units with three or four bedrooms is nearly identical to the rate among all projects in the LIHTC database.

5.1.4 QAP Policies

Of the 37 QAPs examined, Virginia had the most total points available for a developer's LIHTC application (1192) and Nebraska had the fewest at (61). The average QAP had about 200 points available. Three states in the sample had QAP provisions related to school quality, twelve states had provisions related to school access, and fourteen states had provisions identified as being school proxies. In this latter group, six of the states had negative incentives overall—they had on balance more provisions that would afford points to projects in neighborhoods with characteristics more associated with low-performing schools. Seven states had no QAP provisions in any of the three areas considered, and Texas was the only state with scores in all three categories. The QAPs of three states could not be properly scored because they did not incorporate a points scoring system into their QAP design.

The highest QAP school quality score belonged to New York with 2.91 percent of total available points. Texas received a score of 1.62 and Indiana a score of 0.50. Regarding QAP school access scores, Arkansas scored the highest with 8.7 percent of its points awarded for access to any school regardless of quality. The average across the 37 states was 1.21. The QAP school proxy scores could be negative or positive, as already described. The QAP school proxy scores ranged from -8.69 for Oklahoma to 16.96 in Alaska, with a mean across all states of 1.8.

The median property value among areas with units in states that have a school access score is $172,850, higher than both the median of the entire sample and the national median. This relatively high median is likely indicative of the impact of local schools and amenities on housing

and property prices. Interestingly, this phenomenon does not occur for the median property value for properties in the three states with QAP school quality points, where median property value is $91,850, likely indicative of the low sample size in such states. Additionally, the average rate of 3 or 4 bedroom units among sample LIHTC projects in states with school access QAP provisions is nearly four percentage points higher than both the mean of the entire sample and the national mean. This relatively high rate of 3- and 4-bedroom units is likely indicative of the market naturally locating family units near schools in order to target demand from families with children. However, this phenomenon does not occur in the states with school quality provisions in their QAP, which is again likely due to the low sample size in such states.

5.1.5 School Performance

Just over one third of the LIHTC projects had a school performance index of less than 25 and tended to be larger and located in block groups with relatively low median property value, low median household income, and low occupancy rate compared to projects in higher performing school areas, as displayed in *Figure 15*.

Figure 15: School Performance Index by Selected Dependent Variables

schl_idx	*medval*				
	<$100,0000	**$100,000-$150,000**	**$150001-$250000**	**>$250,000**	**Total**
<25	40.14%	17.61%	17.61%	24.65%	100.00%
25-50	31.34%	20.15%	20.90%	27.61%	100.00%
51-75	23.93%	17.09%	25.64%	33.33%	100.00%
>75	17.74%	14.52%	30.65%	37.10%	100.00%

schl_idx	*medhhinc*				
	<$25,000	**$25,000-$35,000**	**$35,001-$50,000**	**>$50,000**	**Total**
<25	36.78%	29.89%	22.41%	10.92%	100.00%
25-50	26.32%	23.03%	31.58%	19.08%	100.00%
51-75	13.60%	16.00%	28.00%	42.40%	100.00%
>75	4.62%	12.31%	24.62%	58.46%	100.00%

schl_idxCA	*pctocc*				
	<80%	**80-90%**	**91-95%**	**>95%**	**Total**
<25	24.14%	36.78%	19.54%	19.54%	100.00%
25-50	13.16%	35.53%	23.68%	27.63%	100.00%
51-75	12.80%	30.40%	24.00%	32.80%	100.00%
>75	7.69%	33.85%	21.54%	36.92%	100.00%

schl_idxCA	*n_units*				
	<30	**30-50**	**51-75**	**>75**	**Total**
<25	12.80%	37.20%	21.34%	28.66%	100.00%
25-50	16.22%	39.86%	18.92%	25.00%	100.00%
51-75	17.74%	45.16%	14.52%	22.58%	100.00%
>75	21.88%	37.50%	20.31%	20.31%	100.00%

About half of projects with a school performance index less than 25 have more than 50 units, and that frequency decreases as the index increases (44 percent for a school performance index from 25 to 50, 38 percent for 50 to 75, and 40 percent for greater than 75). Of the projects with a school performance index less than 25, a majority are located in block groups with median property values less than 150,000 and two fifths have median property values less than $100,000. About two thirds of projects with a school index less than 25 are located in block groups with a median annual household income less than $35,000, with about half of these having household income less than $25,000. For these same projects, one fourth are located in a block group with less than 80 percent occupancy and the frequency of location in the lower occupancy block groups decreases as the school performance index increases. (thirteen percent for 25 to 50, thirteen percent for 51 to 75, and seven percent for greater than 75).

Complete cross tabulations between the school proficiency index and each independent variable are displayed in *Appendix B*.

5.2 Estimated Effects Based on Regression Analysis

Results from the multilevel regression models are displayed in the sections below, with each section outlining relationships to the school proficiency index with one of the three key explanatory QAP variables (school quality, school access, school proxy). The regressions are displayed in stepwise coefficient tables progressively adding the QAP, neighborhood, and property variable vectors. The Akaike information criterion (AIC), Bayesian information criterion (BIC), and Wald Chi Square are reported for each model as measures of goodness-of-fit. AIC and BIC consist of a goodness-of-fit term plus a penalty to control overfitting, and provide a standardized way to balance sensitivity and specificity. A lower AIC means a model is considered to be closer

to the truth, while a lower BIC means that a model is considered more likely to be the true model. BIC differences above ten provide very strong evidence favoring the lower BIC model (Dziak, Coffman, Lanza, & Li, 2012). Wald chi squared is a measure of whether the variance for each random intercept or slope (and their covariances) are significantly different from zero.

5.2.1 School Quality

Figure 16: Multilevel Regression Coefficients: School Quality QAP Score

	EMPTY	CENSUS VARIABLES	CENSUS & PROPERTY VARIABLES
SCHOOL INDEX			
QAP ACCESS SCORE	-3.074732	-3.272272	-3.356503
	(-3.24)	(-3.59)	(-3.81)
MEDINA HOUSEHOLD INCOME		0.000357***	0.000321***
		(0)	(0)
MEDIAN PROPERTY VALUE		0.000032***	0.000038***
		(0)	(0)
OCCUPANCY RATE		0.253706*	0.263160*
		(-0.11)	(-0.12)
PERCENT LOW INCOME UNITS			-0.099956
			(-0.06)
NUMBER OF UNITS			-0.046477
			(-0.03)
CONSTANT	45.535804***	4.478378	15.056834
	(-2.67)	(-10.08)	(-11.79)
AIC	4588.346	3933.783	3718.605
BIC	4605.132	3962.246	3754.707
WALD CHI2 ($P > X^2$)	0.90 (0.3424)	131.59 (0.0000)	137.41 (0.0000)

β Coefficient is displayed with the standard error in parenthesis underneath
Significance testing: * for p<.10, ** for p<.05, and *** for p<.01

The key explanatory variable of school quality QAP score displayed a negative association with school proficiency index that was not statistically significant ($p <= .10$). Coefficients for median household income and median property value were both positive and significant ($p <= .01$). The model coefficient for median household income estimates that an increase area median household income of $10,000 would result in an increase in school index of 3.21 holding all other variables constant. The coefficient for median property value indicates that an increase in area median property value of $10,000 would result in a 0.38 increase in school index holding all other variables constant. The coefficient for occupancy rate was positive and significant ($p <= .10$), and indicates that an increase of one percent in area occupancy would result in a 0.25 increase in the school performance index, holding all other variables constant. The two property variables—percent low income and number of units—were not significant. The insignificance of the constant term in the final model was expected as values of zero for the census and property variables would be illogical.

The empty model with only the school quality QAP score and our outcome variable is not sufficient, with high values for AIC and BIC, and a chi squared that is insignificant. Progressively adding in the census and property control variables lowered the AIC and BIC, and made the chi squared highly significant. This chnage suggests the final model has some explanatory purchase, in line with expectations about developer behavior.

The association between school quality QAP priorities and school performance level of schools available to LIHTC units was the fundamental inquiry of this study. Given that only three states have school quality QAP scores, it is suspected that there is not sufficient variation in school quality QAP scores to generate statistical estimates. This insufficient variation is due to both the

low number of QAP incentive points allocated for school quality, as well as the low number of states that implement these incentives.

The significant positive association between the census variables and school performance index is consistent with literature and expectations. Holding all else constant, areas with higher median household income and higher property values tend to have higher performing schools. This relationship is likely due to the capitalization of school quality into housing values (Goyette (2014), the funding of schools from property taxes, and the cognitive and social support advantages associated with living in a higher-income household and community (HUD, 2016). The positive association between the school performance index and the block group occupancy rate is likely capturing demand or housing quality in an area. A block group with a lower occupancy rate and more vacant housing units is possibly in an undesirable area or an area with undesirable housing.

The lower AIC and BIC for the final model with census and property variables indicates that it is preferable and more accurate. When adding additional variables that are somewhat collinear with those in the model (such as percent single family homes or percent owner occupied), the BIC rose slightly. The rise in BIC indicated that the chosen set of census and property control variables are likely the most parsimonious available.

The primary research design limitation in relation to the school quality QAP score model is the lack of data on LIHTC developments from states with QAP priorities for location near high performing schools. There are at least six states—in addition to the three included in the sample—that provide some points for locating developments near high performing schools. Lack of complete data available from the HUD LIHTC database in the limited years of the study did not allow inclusion of units from additional states with QAP school quality priorities. Supplementary data collected from Texas and Indiana provided the study with more properties in the sample, but

these properties did not improve variation. Collection of supplementary data from PHAs in the six additional states with QAP school quality priorities was not publicly accessible online and, therefore, was not included.

Another limitation was in the coding of school quality QAP scores due to the variation among definitions of high quality schools between state QAPs. Texas uses its own school performance index and scoring system to rank schools and gives points to projects that locate in the attendance zone of a school with an index of 77 or greater. By contrast, Indiana awards points for proximity to at least one assigned public K-12 school with a rating of "A" or "exemplary" or equivalent according to the most recent accounting from the state's department of education, and specifies proximity as being within a half mile.

5.2.2 School Access

Figure 17: Multilevel Regression Coefficients: School Access QAP Score

	EMPTY	CENSUS VARIABLES	CENSUS & PROPERTY VARIABLES
SCHOOL INDEX			
QAP ACCESS SCORE	1.458195	2.052367	2.536322*
	(-1.41)	(-1.37)	(-1.38)
MEDINA HOUSEHOLD INCOME		0.000356***	0.000320***
		(0)	(0)
MEDIAN PROPERTY VALUE		0.000032***	0.000038***
		(0)	(0)
OCCUPANCY RATE		0.263380**	0.275985**
		(-0.11)	(-0.12)
PERCENT LOW INCOME UNITS			-0.09099
			(-0.06)
NUMBER OF UNITS			-0.047245*
			(-0.03)
CONSTANT	43.041721***	0.461514	9.55082
	(-2.82)	(-10.17)	(-11.61)
AIC	4588.181	3932.403	3716.098
BIC	4604.967	3960.866	3752.2
WALD CHI2 ($P > X^2$)	1.07 (0.003)	132.89 (0.0000)	139.52 (0.0000)

β Coefficient is displayed with the standard error in parenthesis underneath
Significance testing: * for p<.10, ** for p<.05, and *** for p<.01

The key explanatory variable of school access QAP score displayed a positive association with school proficiency index that was statistically significant at the 10 percent level. Coefficients for median household income and median property value were both positive and significant at the 1 percent level. The model coefficient of 0.00032 for median household income indicates that an

increase in area median household income of $10,000 would result in a school index increase of 3.2 holding all other variables constant. The coefficient of 0.000038 for median property value indicates that an increase in area median property value of $10,000 would result in a 0.38 increase in school index of holding all other variables constant. The coefficient for occupancy rate was positive and significant at the 5 percent level. The model indicates that an increase of 1% in area occupancy would result in a 0.28 increase in school index, holding all other variables constant. The coefficient on the number of units in a project is now statistically significant at the 10 percent level when taking into account school access QAP score and holding it constant. The model indicates that a ten-unit increase in an LIHTC development's size results in a 0.5 decrease in school proficiency index.

The school access QAP score was an indicator of state QAP incentives aimed at locating LIHTC housing near schools, regardless of their quality. The positive and significant association between school access QAP scores and school index suggests that incentives to site LIHTC developments near schools also increases the likelihood that the developments are placed near high performing schools. It is suspected that the association between incentives to simply site developments near a school and near a school that is high performing is a factor of both developer motivations and the relative neighborhood location of schools. It is possible that if a developer is proposing to place their development near a school (in order to get the point incentive), they will intuitively place it near a school of higher quality in order to be of greater appeal to families. This assumption is based on the tendency of multifamily real estate developers to locate their units in order to maximize profit through locating in high demand areas. Research suggests that, if given the appropriate information and opportunities, more low-income families would move to better schools when their children reach school age (Ellen, Horn, & Schwartz, 2016). In addition, a

developer proposing a project with a lower qualifying ratio of low income to market rate units may strategically located near high quality schools, in order to attract residents to fill their market rate units. Further, the type of developer that takes advantage of school access QAP points, may be socially and intrinsically motivated to place their LIHTC development near a school that is high performing. Khadurri (2012) suggests that some developers are motivated by community issues, as well as by financial returns. These socially motivated sponsors are often non-profits whose mission is to create and preserve affordable housing in their neighborhoods.

This model that included school access QAP score as the primary explanatory variable was the lone regression model in the study that displayed a significant QAP policy coefficient. Its significance is expected to be due to the wide range of variability in both percentage of points awarded for school access as well as the larger number of state QAPs that list school access as a priority. The higher variability allowed a stronger model and thus more statistically significant conclusions.

The model estimates that just a one percent increase in points allocated to school access provisions results in a 2.6 point increase in the school performance index. Since the average number of total QAP points available across all states in the sample is 267, a one percent increase in points translates to an increase of about 2.7 points. Therefore, on average, an increase of 2.7 QAP points awarded for school access could potentially encourage developers to site their LIHTC units near a school that is 2.6 points higher in school performance index.

As with the school quality QAP model, the significant positive association between the census variables and school proficiency index is consistent with literature and expectations. The coefficients for these variables in the school access QAP model are nearly identical, echoing the

tendency for areas with wealthier residents (as measured by median household income) and higher property values to have higher performing schools.

Compared to the school quality QAP score model, the coefficient for number of units in an LIHTC development is now statistically significant. As an indicator of development size, number of units' negative association with school index aligns with the expectation that larger developments locate near lower performing schools perhaps because of their tendency to engender community opposition or encounter local regulatory limitations in suburban areas.

Although less relevant than the school quality QAP model, a research design limitation in relation to the school access QAP score model is the lack of data on LIHTC developments from states with QAP priorities for location near schools. Twelve states in the sample had school access QAP scores with a wide range in percent of total points allocated. Inclusion of more projects in states outside of the sample that were within the study years could have improved the significance and reliability of the model.

A more important research design limitation was in the coding of the school access QAP score related to the specificity of policies about development proximity with a school. While some states outline in their QAPs points awarded specifically for locating near a school, many outlined proximity to schools as one of a bundle of choices available to gain points. For example, Iowa allocates five points to projects within one mile to a school, while California allocates up to fifteen points for proximity to "amenities" of which three are awarded for proximity to schools. Therefore, in some states developers can choose to gain their "amenities" or "opportunity" points through routes other than locating near schools.

5.2.3 School Proxy

Figure 18: Multilevel Regression Coefficients: School Proxy QAP Score

	EMPTY	CENSUS VARIABLES	CENSUS & PROPERTY VARIABLES
SCHOOL INDEX			
QAP ACCESS SCORE	0.137283	-0.00929	0.138366
	-0.47	-0.49	-0.5
MEDINA HOUSEHOLD INCOME		0.000355***	0.000317***
		(0)	(0)
MEDIAN PROPERTY VALUE		0.000032***	0.000038***
		(0)	(0)
OCCUPANCY RATE		0.255364**	0.267253**
		(-0.11)	(-0.12)
PERCENT LOW INCOME UNITS			-0.08978
			(-0.06)
NUMBER OF UNITS			-0.047641*
			(-0.03)
CONSTANT	44.369382***	3.530985	12.89378
	(-2.63)	(-10.07)	(-11.61)
AIC	4589.163	3934.61	3719.303
BIC	4605.949	3963.073	3755.404
WALD CHI2 ($P > X^2$)	0.08 (0.7719)	130.61 (0.0000)	136.43 (0.0000)

β Coefficient is displayed with the standard error in parenthesis underneath
Significance testing: * for p<.10, ** for p<.05, and *** for p<.01

The key explanatory variable of school proxy QAP score displayed a positive association with school proficiency index that was not statistically significant at any traditional level. The school proxy QAP score coefficient of 0.14 was not significant and was considerably weaker in

magnitude than the school quality and access QAP score models. Coefficients for median household income and median property value were both positive and significant ($p <= .01$) and consistent with the school quality and access QAP score models. The coefficient on median household income indicates that an increase in area median household income of $10,000 would result in a school index increase of 3.2 holding all other variables constant, while a an increase in median property value of $10,000 is estimated to result in a rise in school index of 0.38 holding all other variables constant. The coefficient for occupancy rate was positive and significant ($p <= .05$). The model indicates that an increase of one percent in area occupancy would result in a 0.27 increase in the school performance index, holding all other variables constant. A ten-unit increase in the number of units in a project corresponds to a 0.5 decrease in school proficiency index, consistent with the other models.

The school proxy QAP score allowed the study to consider other QAP policy routes to site LIHTC units in areas with high performing schools. The proxy QAP score combined QAP incentives that may proxy or indirectly result in units placed near high quality schools such as high-income levels, low poverty rates, or high property values. The results suggest that these school proxy measures are not what drive developers to think about schools, due to the small and insignificant association between school proxy QAP measures and school index available to LIHTC properties. Placement of an LIHTC development in an area with higher school performance may occur with incentives for these school QAP proxies, but the resulting success of the incentives is inconsistent.

Strong positive associations between both median household income and median property value and school index persisted in the school proxy QAP model. These statistically significant

correlations continued to display that neighborhood characteristics of wealth and economic status are better predictors of the school performance available to residents of that neighborhood.

There were multiple research design limitations involved in the coding of the school proxy QAP score. In order to gain a comprehensive view, points outlined in the QAP were recorded that incentivize placement in areas with high median income, high home value, high median rent, high percentage of owner occupied households, or low poverty rate. Points were subtracted in cases where a provision incentivized lower opportunity areas (low income, low home value, high poverty rate, low percent owner occupied) or further incentivized project placement in a QCT. The coding scheme of QAP school proxy score produced multiple states with negative school proxy score value, due to the vast difference in overall priority of states to incentivize placement of LIHTC properties outside disadvantaged areas. Flaws in the coding scheme due to the combination of multiple priorities considered as school quality proxies and vastly differing provisions regarding these school quality proxies may have contributed to inaccurate results.

6. Discussion

Based on the analysis presented in this study, with awareness of the limitations in the data and in the method of analysis, the current system of QAP point allocation for school quality appears ineffective at consistently placing tax credit properties in areas with access to high-performing schools. The positive and significant correlation of school performance with school access QAP provisions is promising but difficult to interpret, and the insignificance of the QAP school quality and school proxy policies was surprising. It is suspected that the inconclusiveness of the study is due to the lack of variability in QAP provisions that directly incentivize school quality or are related to schools. The percentage of total points awarded in QAPs for school quality

or school access are miniscule, ranging from 0.45 percent to a max of 8.70 percent, which leaves a significant amount of points available for a developer to chose in creating their LIHTC proposal. A developer would logically select a project specification category that would gain more points and make an application more competitive, while maximizing potential return on investment. The number of states that are implementing school related QAP policy priorities is increasing but remains relatively small, with less than half of the states included in the study mentioning schools at all. Further, multiple state QAPs have siting priorities that act as effective disincentives to placing units near high quality schools, as indicated by the multiple states with negative school proxy QAP scores. These disincentives further complicate any analysis of developer motivations behind siting decisions. Existing research has shown that implementation of increased QAP points for broad goals such as "access to community" measures may be impactful (Ellen et al., 2015), but in respect to specific goals such as proximity to high quality schools the success in motivating developers to locate in such areas may be more limited.

As expected, area median household income and median property value were significantly and positively associated with school performance in each of the study models. The model results consistently indicated that a rise in $10,000 in area median household income results in a rise of about 3.2 in school proficiency available to those households. A rise in $10,000 in median property value results in a rise of about 0.38 in school proficiency available to residents of that neighborhood. For example, holding property value constant, if a household living in a block group in southeast Washington, D.C. with a median household income of about $25,000 were to move across the Potomac River into a block group in Arlington, Virginia with a median household income of $115,000, the estimated school performance index would rise by nearly 29 points. These associations between area wealth and school quality reinforce existing literature on the topic.

Evaluating the effectiveness of policy in motivating developers to site units near high performing schools proved difficult, with many limitations. Overall limitations of the study regarded quantifying of QAP policy, accounting for all developer decision factors, obtaining complete LIHTC unit data, and measuring school quality. The classification and coding of state QAPs provided a challenge due to the large differences in organization, allocation systems, and provision definitions. In order to standardize and take into account the impact of points awarded for QAP priorities in respect to the other options a developer may have to gain points, the study calculated points scores as a percentage of total points available in the specific QAP. The coding strategy here eliminated some of the uncertainty, but created a few additional problems. Three states did not utilize points systems at all, instead allowing more discretion to state housing authorities. Therefore, these three states and their LIHTC developments were eliminated from the study sample. In addition, the points scoring system did not account for set asides, thresholds, or listed priorities that a state may outline related to a QAP policy incentive. For example, Florida gives priority to developments located in qualified census tracts, but does not score them and uses proximity to amenities (i.e. schools) as a tiebreaker. Additionally, Massachusetts' QAP outlines a threshold requirement that all applications must describe how their LIHTC development location will expand housing opportunities and "grow social and/or educational opportunities".

Several variables were not included in the study due to data availability and ease of accessibility. These omissions included the QCT and DDA status of the LIHTC locations. Further, the available indicators of QCT and DDA status indicates whether a LIHTC property is located in one of these two areas, but does not identify whether the property actually received a basis boost from being located in one of these areas. QCTs and DDAs both receive a 30 percent basis boost across all states—a large incentive to locate an LIHTC project in such areas. However, as of 2008

HUD implemented a rule giving state housing authorities the power to select specific buildings not already in DDAs or QCTs to receive the 30 percent basis boost. This discretion provided to the states increasingly brings into question the magnitude of incentives that QCTs and DDAs actually provide for developers, considering most states now have other routes in their QAPs for developers to gain a boost. The final models rely on median household income and median property values to account for the underlying QCT and DDA motivations, but including data regarding DDAs and QCTs could have been beneficial.

Data was also limited in the HUD database regarding the specification of whether the properties were eligible for 9 percent competitive credits. Fifteen percent of the HUD LIHTC property databases records for projects allocated in 2013 or 2014 did not specify the credit type, requiring their omission from the study. Similarly, thirteen percent of the HUD records and none of the supplementary state LIHTC records used included data on non-profit status. As previously mentioned, non-profit sponsors of projects tend to have different motivations than for-profit sponsors.

The study was cross-sectional, creating possible research design limitations regarding the slight mismatch of the data source years. The most recent LIHTC unit data available was for 2014, but the sample size of projects with complete data allocated in 2014 was small. Therefore, the study was expanded to include LIHTC projects allocated in 2013 as well as 2014. QAPs were analyzed for 2014 assuming that there were limited changes between 2013 and 2014 QAPs across states. The most recent HUD school performance index was based on school data and catchment boundaries from the 2012 to 2013 school year. The utilization of the index relied on the assumption that school performance generally remained constant between 2012 and 2014. Research does show

that school quality as measured by performance and achievement levels is generally constant from year to year (HUD, 2016).

The HUD LIHTC database is not a comprehensive database of all LIHTC properties awarded, and submission to HUD from the state PHAs is voluntary. Therefore, several states were omitted from the study due to the fact that they did not report their developments, did not yet report their developments, or incompletely reported all the details of their LIHTC developments awarded. The selective omission could have created a sampling error as these states that were not included could be similar on some characteristic.

Finally, the variety of school choice options available may have limited the study. The study relies on the assumption that students attend a school based upon the location of their residents. School choice programs, which allow for children to choose schools other than those to which they are assigned based on their neighborhood, have emerged over the past few decades. School choice can refer to a range of strategies, including the availability of charter schools, magnet schools, school vouchers, or private schools and also programs that allow for students to voluntarily transfer to other traditional public schools (HUD, 2016). School choice decisions were not implemented into the study due to difficulty in obtaining personal student level residence data in order to specifically match student residence location to their school attended. Literature generally agrees most children still attend their assigned neighborhood school and that whether children can attend a high quality school is largely determined by where they live (HUD, 2016; Schwartz & Stiefel, 2014). However, the increasing prevalence of school choice options could have affected the results.

7. Conclusion

Attendance at a high-performing school is critically important in determining short-term academic performance and long-term life outcomes such as college attendance (Angrist et al., 2013), poverty (Clotfelter, Ladd, & Vigdor, 2015), lifetime earnings (Chetty & Hendren, 2015), and health (Zimmerman, Woolf, & Haley, 2015). School choice remains limited, especially for lower-income households, and this suggests that housing policy can help children access neighborhoods and quality schools that promote their long-term success. Therefore, supporting the development of affordable housing near quality schools is an imperative social policy goal.

The LIHTC program is largest federal program for the production and preservation of affordable housing, and annually helps finance over half of all multifamily complexes in the U.S. (Enterprise Community, 2012). Its centrality to the geography of affordable multi-family housing in the country cannot be overstated. As shown in this and other research, LIHTC units are consistently placed in areas with access to under performing schools and a need exists for changes in state LIHTC policy. This study has highlighted deficiencies in state QAPs, and changes in their allocation systems are warranted to improve LIHTC residents local school quality. State QAPs should award a greater percentage of points available to be earned by an LIHTC proposal that are related to the quality of nearby schools.

Considering that the QAPs have such a small percentage of total points available that relate to school quality (and access to opportunity in general), it is no surprise that developers are choosing other point categories to gain advantage. For example, the Virginia QAP awards 10% of its available points for gaining zoning approval, 5% for LEED certification, 9% for easy maintenance building specifications, up to 5% for developer experience, and up to 25% for cost efficient building practices. All of these priorities are important in their own respect but are large

when compared to the percentage of points allocated towards school related priorities. The mean percent of points allocated towards project location relative to school quality is 0.3%, 1.2% towards locating near a school in general, and 1.8% of points for and incentive that may proxy nearby high performing schools. If states were to weight school location related incentives comparable to some of the other QAP categories, we would likely see a greater impact on LIHTC siting near higher performing schools and in higher income areas.

Ellen et al (2015) confirmed that that when states increase priorities toward higher opportunity areas, those states exhibited increases in the share of LIHTC properties in low poverty areas and decreases the share of properties in high poverty areas. Since good schools generally follow lower poverty areas, the results of the study by Ellen et al (2015) suggests that QAP changes have the potential to increase access to high performing schools. While this study could not confirm that specific incentives toward high quality schools were effective in increasing LIHTC properties' access to high performing schools, our study does suggest that priorities for locating near a school can improve this access. School access priorities are likely serving as a proxy for "areas of opportunity" in our study, confirming the results of Ellen et al (2015). Since school quality is potentially a stronger indicator of "areas of opportunity", it is likely that if more states were to introduce or increase their point percentages that incentivize school performance, we would see results similar or stronger than the school access effects.

Different approaches to allocating points related to property location near quality schools could potentially increase their effectiveness. States could award points for a proposing development in the attendance zone of a school with above-average scores for the grade level, rather than simply setting an arbitrary and universal cutoff for a "good" performance level. Extra points could be awarded if all grade levels were performing above average and points deducted

for proposing a development in the attendance zone of a failing school. Value added measures of school quality could also be considered as indicators, especially those value added measures that consider growth among low-income students. Using absolute test scores can underestimate the impact of effective higher-poverty schools while overrating schools with fewer disadvantaged students (Downey et al, 2008). Growth indicators could enable communities to instead target schools that have enabled students to improve, as opposed to indicators that are proxies for student poverty. Additionally, when ta developer does propose to build in an area with low performing schools. state QAPs could prioritize proposed projects that are located where improved housing quality is already a stated goal or recognized barrier in an *existing* school community revitalization plan.

There are understandable difficulties in increasing the weight of points awarded toward one policy goal, due to the tension inherent in a points system; if one priority is weighted with a greater percentage, others get relatively less prioritization. However, increasing evidence of the importance of education quality not only on life outcomes, but as a primary overall indicator of an "area of opportunity", supports the value of prioritizing school performance levels.

Some additional changes to the overall LIHTC program are warranted including adding mandatory set asides for proximity to quality schools, changes to the QCT preference, and an overall standardization of QAPs.

The IRS code governing the LIHTC program mandates that at least 10% of the state's allocable credit must be set-aside for a nonprofit pool. Given the current HUD goals of affirmatively furthering fair housing, the recent supreme court standard, and inconsistency in states implementing priorities for equal opportunity, a similar set aside for such incentives is reasonable. Research discussed in this report has displayed the importance of education in future opportunity,

thus a federal mandated set aside specifically for proximity to high quality schools would effectively increase the future prospects for low income children.

The preference granted to QCTs is often cited as the driver of poverty concentration among LIHTC properties today (Khadduri, 2013). As previously mentioned, neighborhoods with concentrated poverty (i.e. QCTs) are routinely co-located with poor performing schools. Therefore, an incentive to build in a QCT intuitively results in more LIHTC developments sited in the catchment areas of low performing schools. The purpose of focusing development in QCTs is rooted in developing and revitalizing high poverty communities by investing in new affordable housing, but this intension is rarely realized. QCT incentives were designed to give the preference to developers "with a concerted community revitalization plan", but most QAPs simply ignore this qualifier (Khadduri, 2013). Due to the ambiguity involved in requiring a revitalization plan and the considerable discretion provided to the states on this matter, federally mandated QCT preferences should be decreased. Further, the “community revitalization plan” definition could be detailed further by HUD and possibly strengthened to require that the development be a part of an existing community revitalization plan, rather than one created by the developer.

In the course of this study, a large scale analysis of QAP incentives proved to be difficult due to the wide variation in the organization of credit allocation systems among states. Most QAPs utilize point systems, but the value of each point differs between states due to the large variation between maximum points available. In addition, multiple states do not have detailed and transparent allocation systems, enabling a large amount of discretion by state housing agency officials. A federal rule outlining a standard QAP model or template would be effective in promoting transparency as well as enabling effective research and evaluation.

This study highlights the difficulty of tackling the school quality and affordable housing issue simply through QAPs. Other aspects of US housing policy could be altered to potentially increase access to high quality schools for affordable housing residents. Although demand side voucher programs leave much discretion to households on residence location, there are opportunities to influence their spatial choices. School quality could be more readily emphasized in a voucher system where its implementation would potentially show faster, widespread results in an area that is already built out. Major impediments faced by housing choice voucher recipients are a lack of education regarding where high quality schools are located (Horn et al, 2014), constraint of units accepting vouchers in high opportunity areas, and fears of social exclusion or discrimination (McClure & Johnson, 2014). Incentives for voucher recipients to locate their residence where their child will go to a high quality school could be effective. Alternatively, HUD could directly incentivize public housing agencies (PHAs) that have a high percentage of its voucher recipients locating in high performing school catchment areas. Such PHA incentives would potentially motivate them to implement education programs for voucher recipients on the performance of areas schools as well as how to gain entry into high opportunity neighborhoods.

This analysis focuses on housing policy to address the issue of a mismatch between low income students and high quality schools, but a more fundamental problem underlying the issue is in education policy. Even in a perfectly functioning LIHTC program that locates units near high performing schools, new construction is being encouraged and their affordability will eventually expire. Therefore, investment continues to flow to "nicer" neighborhoods, and away from places already underperforming. The current system in place sets up a geography of better and worse public schools (and a geography of opportunity in many areas broken down by race and class). Housing policy changes that influence mixing of incomes and race by subsidizing housing costs

in higher opportunity areas may assist in incremental changes, but in order to achieve a more sustainable outcome fundamental changes to educational funding and districting must be made.

It is imperative that as HUD and state housing authorities make changes to QAPs, create and modify programs, establish goals, and regularly evaluate outcomes. As highlighted in this study, incomplete and unconsolidated data on LIHTC units provided at the national level facilitates a difficultly in producing accurate and effective research. Better data organization, availability and transparency would allow HUD, state housing authorities, and other independent entities like academic institutions to evaluate outcomes. These evaluations will establish the effectiveness of pilots and modifications over time and inform future adjustments and initiatives. Agencies should disseminate the results of their efforts to expand the knowledge base across the other state housing agencies and the affordable housing community.

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Appendices

Appendix A: Detailed State Qualified Allocation Plan QAP (Policy) Scoring

State	Total QAP Points Available	School Quality Points	School Access Points	School Proxy Points	% School Quality	% School Access	% School Proxy
ALASKA	224	0	0	38	0.00%	0.00%	16.96%
ARKANSAS	115	0	10	0	0.00%	8.70%	0.00%
CALIFORNIA	155	0	3	0	0.00%	1.94%	0.00%
COLORADO	202	0	0	0	0.00%	0.00%	0.00%
FLORIDA	116	0	4	0	0.00%	3.45%	0.00%
IDAHO	168	0	1	0	0.00%	0.60%	0.00%
ILLINOIS	100	0	1	0	0.00%	1.00%	0.00%
INDIANA	200	1	0	2	0.50%	0.00%	1.00%
IOWA	522	0	5	0	0.00%	0.96%	0.00%
KANSAS	310	0	5	-20	0.00%	1.61%	-6.45%
MAINE	73	0	6	4	0.00%	8.22%	5.48%
MICHIGAN	251	0	10	0	0.00%	3.98%	0.00%
MINNESOTA	166	0	0	10	0.00%	0.00%	6.02%
MISSISSIPPI	209	0	0	-5	0.00%	0.00%	-2.39%
MISSOURI*							
MONTANA	104	0	1	-1	0.00%	0.96%	-0.96%
NEBRASKA	61	0	0	0	0.00%	0.00%	0.00%
NEVADA	149	0	2	1	0.00%	1.34%	0.67%
NEW HAMPSHIRE	185	0	0	0	0.00%	0.00%	0.00%
NEW YORK	103	3	0	8	2.91%	0.00%	7.77%
NYC	100	0	0	0	0.00%	0.00%	0.00%
NORTH CAROLINA	102	0	0	0	0.00%	0.00%	0.00%
OHIO	125	0	10	15	0.00%	8.00%	12.00%
OKLAHOMA	115	0	0	-10	0.00%	0.00%	-8.70%
OREGON	100	0	0	6	0.00%	0.00%	6.00%
PENNSYLVANIA	130	0	0	20	0.00%	0.00%	15.38%
RHODE ISLAND*							
SOUTH CAROLINA	301	0	2	0	0.00%	0.66%	0.00%
SOUTH DAKOTA	1100	0	5	0	0.00%	0.45%	0.00%
TEXAS	185	3	3	7	1.62%	1.62%	3.78%
UTAH	198	0	1	-10	0.00%	0.51%	-5.05%
VERMONT*							
VIRGINIA	1192	0	0	25	0.00%	0.00%	2.10%
WASHINGTON	222	0	2	0	0.00%	0.90%	0.00%
WEST VIRGINIA	1055	0	0	-30	0.00%	0.00%	-2.84%
WISCONSIN	465	0	0	0	0.00%	0.00%	0.00%

*These states do not utilize points systems in their QAPs

Appendix B: Complete Cross-tabulations

Figure B.1: School Index by QAP School Quality Score

schl_idx	QAP_pct_SQ				
	0%	0.50%	1.62%	2.90%	Total
<25	26.27%	3.46%	1.63%	3.05%	34.42%
25-50	23.83%	2.44%	2.24%	1.43%	29.94%
51-75	17.72%	0.81%	4.28%	0.61%	23.42%
>75	7.54%	1.02%	3.05%	0.61%	12.22%
Total	75.36%	7.74%	11.20%	5.70%	100.00%

Figure B.2: School Index by QAP School Access Score

schl_idx	QAP_pct_SA				
	0%	0.1-1.0%	1.1-2.0%	>2.0%	Total
<25	16.29%	1.83%	13.65%	2.65%	34.42%
25-50	11.61%	1.63%	14.87%	1.83%	29.94%
51-75	6.31%	2.65%	12.83%	1.63%	23.42%
>75	4.89%	0.81%	5.91%	0.61%	12.22%
Total	39.10%	6.92%	47.25%	6.72%	100.00%

Figure B.3: School Index by QAP School Proxy Score

schl_idx	QAP_pct_SP				
	<0%	0%	0.1-7.0%	>7.0%	Total
<25	1.22%	21.59%	6.52%	5.09%	34.42%
25-50	1.43%	19.96%	5.91%	2.65%	29.94%
51-75	0.61%	13.44%	6.72%	2.65%	23.42%
>75	1.22%	4.68%	5.09%	1.22%	12.22%
Total	4.48%	59.67%	24.24%	11.61%	100.00%

Figure B.4: School Index by Median Property Value

schl_idx	medval				
	<$100,0000	$100,000-$150,000	$150001-$250000	>$250,000	Total
<25	12.53%	5.49%	5.49%	7.69%	31.21%
25-50	9.23%	5.93%	6.15%	8.13%	29.45%
51-75	6.15%	4.40%	6.59%	8.57%	25.71%
>75	2.42%	1.98%	4.18%	5.05%	13.63%
Total	30.33%	17.80%	22.42%	29.45%	100.00%

Figure B.5: School Index by Median Household Income

schl_idx	medhhinc				
	<$25,000	$25,000-$35,000	$35,001-$50,000	>$50,000	Total
<25	12.40%	10.08%	7.56%	3.68%	33.72%
25-50	7.75%	6.78%	9.30%	5.62%	29.46%
51-75	3.29%	3.88%	6.78%	10.27%	24.22%
>75	0.58%	1.55%	3.10%	7.36%	12.60%
Total	24.03%	22.29%	26.74%	26.94%	100.00%

Figure B.6: School Index by Occupancy Rate

schl_idx	pctocc				
	<80%	80-90%	91-95%	>95%	Total
<25	8.14%	12.40%	6.59%	6.59%	33.72%
25-50	3.88%	10.47%	6.98%	8.14%	29.46%
51-75	3.10%	7.36%	5.81%	7.95%	24.22%
>75	0.97%	4.26%	2.71%	4.65%	12.60%
Total	16.09%	34.50%	22.09%	27.33%	100.00%

Figure B.7: School Index by Number of Units in Property

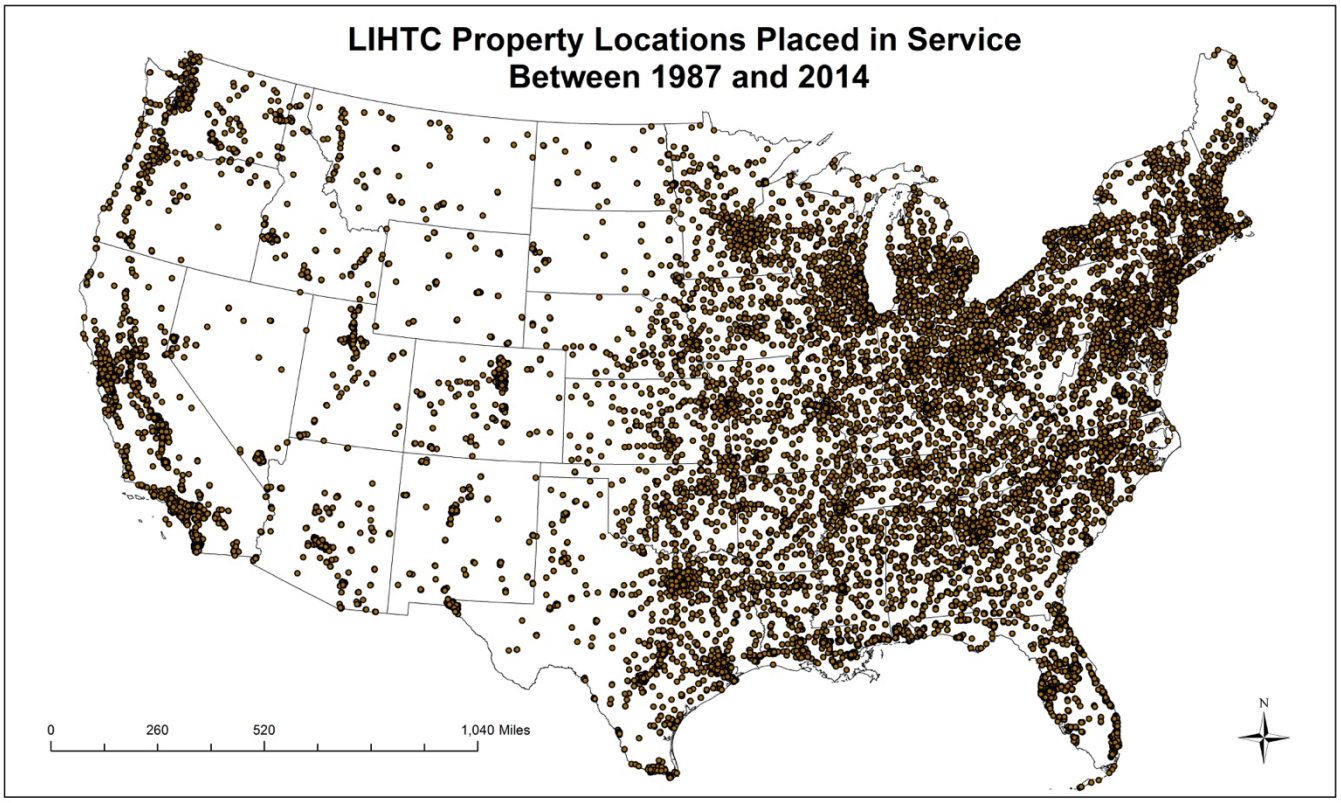
schl_idx	n_units				
	<30	30-50	51-75	>75	Total
<25	4.20%	12.20%	7.00%	9.40%	32.80%
25-50	4.80%	11.80%	5.60%	7.40%	29.60%
51-75	4.40%	11.20%	3.60%	5.60%	24.80%
>75	2.80%	4.80%	2.60%	2.60%	12.80%
Total	16.20%	40.00%	18.80%	25.00%	100.00%

Figure B.8: School Index by Percent of Units Low Income

schl_idx	pctLI					
	<20%	20-50%	51-80%	81-99%	100%	Total
<25	1.84%	0.00%	2.04%	14.72%	14.52%	33.13%
25-50	2.25%	0.41%	1.23%	13.91%	12.27%	30.06%
51-75	0.82%	0.00%	2.25%	9.20%	12.27%	24.54%
>75	1.43%	0.00%	0.61%	3.89%	6.34%	12.27%
Total	6.34%	0.41%	6.13%	41.72%	45.40%	100.00%

Appendix C: Additional Maps

Figure C.1: Locations of all LIHTC Properties in the HUD Database



Source: US Department of Housing and Urban Development LIHTC Database 2014