Input Distortions in The Low-Income Housing Tax Credit: Evidence from Building Size[a]

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Abstract

The Low-Income Housing Tax Credit subsidizes the non-land construction costs of low-income housing units. Because land costs are not subsidized, it may incentivize developers to produce buildings with too much capital from the viewpoint of optimal production. Using data on construction in Los Angeles County between 1993 and 2007, this paper estimates how the Low-Income Housing Tax Credit subsidy affects the size of newly constructed apartment buildings. Holding land area constant, I find the average subsidized building includes 25 to 29 percent more square footage than unsubsidized buildings constructed in the same year and zip code. The effect is primarily driven by subsidized buildings including more, instead of larger, housing units. Consistent with theoretical predictions, the effects are strongest in locations with low market rent. This input distortion is one reason that housing subsidies that fund the construction of low-income housing may be less cost-effective than subsidies given directly to tenants.

Keywords: housing; subsidies; construction costs

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1 Introduction

The Low-Income Housing Tax Credit (LIHTC) subsidizes private housing developers with tax credits in exchange for the construction of low-income housing. Currently, LIHTC is the second largest housing subsidy in the United States and the largest of the project-based programs that fund the construction of new apartments. The total funding for LIHTC is quickly approaching the level of the largest program in the country, the tenant-based Section 8 Housing Voucher, which gives households a voucher to supplement rent payments in the housing unit of their choice (Desai et al. 2009).

The growth in the LIHTC program is surprising, given the substantial evidence that tenant-based subsidies provide the same quality of housing services at a lower cost (HUD 1974, Mayo et al. 1980, Olsen and Barton 1981, Olsen 2000, GAO 2001, GAO 2002, Dipasquale et al. 2003, Deng 2005, Olsen 2008). One potential reason for higher average costs in the LIHTC program is that it only subsidizes the non-land costs of construction. This feature could incentivize developers to construct buildings with higher capital-to-land ratios than they would have used without the subsidy (Olsen 2000, Olsen 2009, Eriksen 2009). The intensive capital investment may create subsidized buildings that are taller and have higher average costs than the buildings that would have been built in their place.

Previous research has characterized the nature of this input distortion, but few papers examine it empirically. Using data from Los Angeles County between 1993 and 2007, I estimate that the average LIHTC apartment building is 25 to 29 percent larger per square foot of land than unsubsidized buildings constructed in the same year and zip code. These results provide preliminary evidence that the LIHTC subsidy motivates developers to increase capital inputs relative to land, but it is

not sufficient to conclude that LIHTC is the only incentive motivating this behavior.

Another potential reason that LIHTC buildings may be larger is because of California's Density Bonus Law (California Code 65915-65918). The Bonus Law allows developers of rent-restricted and senior housing to construct buildings with 35 percent higher density than is permitted by local zoning regulations. Nearly all LIHTC buildings are eligible for the density bonus, so the law should affect all LIHTC buildings equally. To differentiate the effect of LIHTC from the density bonus, I theoretically show LIHTC should have the largest effects in locations with low market rent. In these locations, developers receive the subsidy but are less restricted by the LIHTC rent ceiling, which is constant across the county. Construction in higher-rent locations become subject to a more binding rent ceiling, which reduces profitability and decreases optimal building size relative to unsubsidized buildings.

Estimates indicate that the size difference between LIHTC and unsubsidized buildings is isolated to locations in the bottom half of the rent distribution, where subsidized buildings are up to 42 percent larger than unsubsidized buildings. For most building classifications in high-rent locations, there is not a significant size difference between subsidized and unsubsidized buildings.[1] Because this effect varies with market rent, it is stronger evidence that LIHTC may be motivating relatively larger subsidized construction.

Finally, I investigate whether the size difference is driven by the construction of buildings with more or larger housing units. It is important to understand the source of this effect because if the subsidy creates larger housing units than the unsubsidized market, increased costs may be justified

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[1] The exception to this result is LIHTC buildings constructed for seniors, which constitute one-fourth of LIHTC construction in the sample. Senior LIHTC buildings are larger than unsubsidized buildings across the entire rent distribution. I present some evidence that additional incentives from the state and local authorities to build senior housing may contribute to this result.

by higher quality housing for low-income tenants. Subsidized units for families in low-rent locations are approximately 13 percent larger than nearby unsubsidized units, which represents about one-third of the total size effect. This difference in unit size may also result from regulations that require 30 percent of housing units in family-designated LIHTC buildings to include at least three bedrooms. For LIHTC buildings that are not subject to this requirement, the effect is completely driven by buildings that include more housing units.

These results provide new evidence in the debate between the relative merits of project and tenant-based housing subsidies. Estimates indicate that some portion of the higher total and average costs found in previous research for LIHTC may be the result of developers creating taller and more capital-intensive buildings. While this outcome does not negate the benefits of LIHTC housing, it identifies a distortion in the program that may lead to higher costs. Future program evaluation should consider if it is possible to reduce the costs of this distortion or redirect its effects to more effectively improve housing quality.

2   The Low-Income Housing Tax Credit

The United States government has been funding the construction of low-income housing since it created the Public Housing Program in 1937. Since that time, many housing subsidies have been instituted in a variety of formats. The first tenant-based housing program was created in 1965 and in the years that followed, economists provided ample evidence that tenant-based housing assistance was more cost-effective than subsidies that funded the construction of housing. In response to these studies, the government reduced the number of new apartment units built with government funding. That money was reallocated to maintaining existing units and expanding the housing voucher

program. This pattern continued until the Tax Reform Act of 1986, when the Low-Income Housing Tax Credit was instituted into the U.S. tax code.[2] From 1986 to 2006, LIHTC units accounted for approximately one-third of new multi-family rental construction with nearly 1.6 million new housing units (Eriksen 2009, Eriksen and Rosenthal 2010).

The LIHTC program is federally funded, but private developers apply for the subsidy through state housing finance agencies each year.[3] These agencies create a systematic process to determine which proposals receive the subsidy (Gustafson and Walker 2002). If a proposal is selected for funding, the developer is awarded a ten-year stream of tax credits to reduce tax liability. New construction and significant rehabilitation are awarded the "nine percent credit" over ten years, equal to approximately 70 percent of construction costs in present value. Projects with less than $3,000 of development cost per unit or projects with at least 50 percent of financing from tax-exempt bonds are awarded the "four percent credit" over the ten years. The four percent credit is equal to approximately 30 percent of construction costs in present value. New construction projects funded with either the nine or four percent credit are both included in this study, but I control for which subsidy the project receives.[4]

In exchange for the subsidy, the developer must build and manage an apartment complex that will rent for no more than a program-designated rent ceiling for at least 30 years.[5] Because the tax credits are nonrefundable and most developers do not have sufficient tax burden to utilize them, the future credit stream is usually sold to investors to raise the necessary capital for construction.

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[2]For a more comprehensive history of subsidized housing programs in the United States, see Olsen (2003).

[3]Some states, including California, also supplement the subsidy with state tax credits.

[4]A more detailed explanation of the credit calculation is found in Schwartz (2006).

[5]The federal requirement has been increased since the inception of the program and states can require longer compliance periods. In California, the compliance period was increased to 55 years in 1996 (CTCAC Compliance Manual 2013).

This process is called syndication and research has examined and questioned its efficiency (Eriksen 2009, Case 1991, Stegman 1991).

In California, demand for tax credits has outweighed the supply by a factor of three to one since the year 2000 (CTCAC Annual Report 2012). To determine which proposals receive the subsidy, the California Tax Credit Allocation Committee (CTCAC) has developed a point system based on project attributes. In cases where proposals receive the same number of points, the CTCAC uses a tie-breaker system based on housing goals, location, and the proposal's ability to acquire external funds. In 2012, only 17 of the 236 new construction proposals did not receive the maximum number of points and a total of 102 projects received the subsidy (CTCAC Regulations 2012; CTCAC Applicant List 2012).[6] These statistics indicate that there is substantial demand for these subsidies, which may suggest large potential gains for private developers.

Project attributes may affect the probability of receiving the subsidy through the allocation process, but those attributes may also alter the amount of funding a developer receives. There are two primary attributes that are important for my study. First, the subsidy is reduced by one percent for every one percent of units that do not conform to the rent ceiling. Consequently, most buildings dedicate nearly all units to low-income use. In the empirical analysis, I control for the fraction of units within the building that are rent-restricted.

Second, Second, federal regulations define that projects located in qualified census tracts (QCTs) or difficult to develop areas are eligible for a 30 percent increase in the subsidy. A census tract is designated as a QCT when the poverty rate in the tract is at least 25 percent. Census tracts where at least 50 percent of households in the tract report earning less than 60 percent of the area median

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[6]California has quotas for projects that meet certain requirements, like being partnered with a non-profit or being located in a rural area. Because of this, a project may sometimes receive the subsidy even if its point total is lower than another proposal.

gross income (AMGI) are also designated as QCTs. Difficult to develop areas are MSAs or counties that have high construction, utility or land costs relative to AMGI. Because Los Angeles county is designated as a difficult to develop area over the entire time period, all proposals in this study are eligible for the subsidy boost. I control for the QCT because locating in one of these tracts may increase the probability that the proposal receives the additional 30 percent subsidy.

The LIHTC program in California solicits applications for buildings that are targeted to different populations. Those housing categories are large family, senior, single-room occupancy, at-risk and special needs. I examine the effect of the subsidy on each type of housing construction separately.

Unlike many housing subsidies, LIHTC rents are not determined by an individual tenant's income. Instead, the developer chooses the rent ceiling by designating the income of the tenant that will live in the unit. If the targeted tenant is a household that makes 50 percent of the AMGI, as reported by the Department of Housing and Urban Development, then the LIHTC rent level is determined by multiplying 50 percent of AMGI by 0.3. The goal of this calculation is to ensure that the targeted household pays no more than 30 percent of income on housing. In reality, a household living in a LIHTC unit may earn much less than 50 percent of AMGI, but the rent level is not adjusted to their income. Consequently, up to 45 percent of LIHTC tenants need additional financial assistance to afford the rent in LIHTC units (Williamson 2011, O'Regan and Horn 2013).

In the CTCAC point category meant to minimize the rent charged in subsidized units, developers receive points by proposing different fractions of units and the affordability of those units. For example, a developer can receive the maximum possible points by making 50 percent of units affordable to tenants who earn 50 percent of AMGI and dedicating the other 50 percent to tenants who earn 45 percent of AMGI. The developer can receive the same number of points by dedicating 30 percent of units to tenants who earn 30 percent of the AMGI, 50 percent of units to tenants

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who earn 50 percent of AMGI and placing no rent restriction on 20 percent of units. The CTCAC reports the points awarded to projects between 2003 and 2008 and these documents demonstrate that nearly every proposal receives the maximum points in this category. Within this framework, there is little incentive for developers to reduce the rent in housing units beyond these requirements.

Because Area Median Gross Income is reported on a county and MSA level, the rent ceilings are the same for all units with the same number of bedrooms within a county or MSA. In locations where the market rent is high, the county rent ceiling can be restrictive. In low-rent locations, however, the rent ceiling may not be explicitly binding. This fact is an important part of the theoretical and empirical analysis that follows.

3   Model Specification

Subsidizing the capital inputs of housing construction should lead to taller buildings, relative to unsubsidized buildings. I characterize this relationship and show that the effect varies across the distribution of market rent. The largest effects should be found in low-rent locations, where a less restrictive rent ceiling means LIHTC units are rented near the market rate. As a result, subsidized developers in low-rent locations can use lower input costs to build taller buildings without reductions in future revenue.

In high-rent locations, however, subsidized buildings expect a lower future revenue stream relative to unsubsidized buildings. In these locations, subsidized capital inputs have a positive effect on optimal building size, but there is also negative effect on building size due to reductions in expected revenue. As the rent ceiling becomes more restrictive, the negative effect on building size becomes larger. If the market rent is high enough, the negative effect on building size may entirely cancel

out the positive effect from lower input costs.[7]

To characterize how the LIHTC subsidy affects the relative inputs of capital and land, I characterize a general profit function for housing development. The number of units is determined by a function $f(K, L)$, where K is capital inputs and L is land inputs. I assume that the production function is non-decreasing in K, because it takes more capital to build a taller building when land is fixed. The profit function takes the following form,

$$\pi = R(s) \cdot f(K, L) - p_K(s) \cdot K - p_L \cdot L. \tag{1}$$

In the expression above, the discounted expected market rent stream per unit is $R(s)$, where s represents whether or not the building is subsidized. For simplicity, I assume s is binary and equal to one if the building is subsidized. If $s = 1$, then the price of apartment units must be reduced to the county or MSA rent ceiling, meaning that $\frac{\partial R}{\partial s} < 0$. This is also true in locations where the market rent is less than the program designated rent ceiling, where developers must charge 10 percent less than comparable market rate units (CTCAC Regulations 2012). The unit cost of capital is $p_K(s)$, which also decreases in response to subsidization, or $\frac{\partial p_K}{\partial s} < 0$. The unit cost of land is p_L and is not directly affected by the subsidy.

To isolate the decision of the developer to invest in capital, I assume that the land input is fixed, or the parcel of construction has already been chosen. This assumption simplifies the characterization and requires capital investment to be the primary determinant of building size once a parcel of land is identified or purchased. Assuming land is fixed, maximize expression (1) with respect to

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[7]It is also possible that subsidized developers construct buildings in high-rent locations that look similar to unsubsidized buildings so they will be attractive to high-income residents once the building is converted. I cannot separate this possibility from the effects that would result from developers responding to differences in marginal revenue.

capital. Solving for K^* yields a function that determines optimal capital investment,

$$K^* = g(R(s), p_K(s), \bar{L}, p_L). \tag{2}$$

The function $g()$ calculates the optimal capital investment, where developers use more capital inputs as rent increases, $\frac{\partial g}{\partial R} > 0$ and rental revenue is reduced when a building is subsidized, $\frac{\partial R}{\partial s} < 0$. Additionally, developers use fewer capital inputs in response to increases in capital input cost, $\frac{\partial g}{\partial p_K} < 0$, and the subsidy reduces the cost of capital, $\frac{\partial p_K}{\partial s} < 0$. Developers may use more capital inputs on larger parcels of land because it is less expensive to build out instead of up, $\frac{\partial g}{\partial L} > 0$. When the price of land increases relative to the price of capital, a substitution effect may increase capital usage and an income effect may decrease it. Therefore, the partial derivative of $g()$ with respect to p_L is ambiguous, although previous estimates of the elasticity of substitution of land for capital fall between 0.4 and unity (Ahlfeldt and McMillen 2014). When a building is subsidized, the effect on capital investment is determined by taking the derivative of (2) with respect to the subsidy, s.

$$\frac{\partial K^*}{\partial s} = \left[\frac{\partial g}{\partial R} \cdot \frac{\partial R}{\partial s} \right] + \left[\frac{\partial g}{\partial p_K} \cdot \frac{\partial p_K}{\partial s} \right] \tag{3}$$

The first bracketed term in (3) is negative. The first term in the first bracket, $\frac{\partial g}{\partial R}$, indicates that the optimal capital investment is positively related to the price at which the constructed units can be rented. The second term, $\frac{\partial R}{\partial s}$, indicates that subsidization decreases the price at which units are rented.

The first term in the second bracket, $\frac{\partial g}{\partial p_K}$, represents the negative relationship between the price of capital and the optimal capital investment. The second term, $\frac{\partial p_K}{\partial s}$, represents the reduction in the price of capital that is associated with the subsidy. Both of these terms are negative and the second bracket is positive.

The two bracketed terms in (3) characterize the trade-off created by the LIHTC subsidy. The first bracketed term is negative because relative to an unsubsidized building, subsidization decreases expected marginal revenue. That reduction should decrease optimal capital investment holding land area constant, which results in smaller buildings. The magnitude of the negative effect, however, depends on the difference between the subsidized and market rent. Because the rent ceiling is constant across a county, subsidized buildings in low-rent locations experience small reductions in rent and small negative effects on capital investment. The required rent reductions are larger in high-rent locations, so the negative effect on optimal capital investment should also be larger. By this reasoning, the first bracketed term in (3) represents a negative effect on capital investment and its magnitude increases as market rent increases.

The second bracketed term indicates that the subsidy decreases the marginal cost of capital, which should incentivize the construction of larger buildings. If I assume that the cost of capital is constant across locations, the magnitude of this effect should also be constant across the rent distribution. Looking at both effects together, the first bracketed term becomes more negative as market rent increases and the second bracketed term is positive and constant across all locations. As a result, the largest positive effects on building size should occur in low-rent locations. As construction moves to locations with higher market rent, subsidized buildings should become relatively smaller because the negative effect of the first bracketed term cancels out a larger portion of the positive effect represented by the second bracketed term. I test this hypothesis in the empirical analysis.[8]

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[8]The welfare effects from subsidization also depend on the level of market rent. In low-rent locations, where the welfare losses should be the largest, there are two sources of inefficiency: overproduction of the housing and an inefficient capital to land input ratio. While there should be less overproduction in high-rent locations, subsidized developers may still use input ratios that are overly capital intensive if they can vary both land and capital inputs.

An empirical model that estimates the effect of the subsidy on building size uses expression (2) as its foundation, with buildings as the unit of observation. Because I cannot measure the price of capital, I include zip code and year fixed effects to capture that effect. This assumes that within the same zip code and year, the capital costs of construction will be equal. These fixed effects, along with a fixed effect for zoning classification also control for other market conditions in the location and year of construction. The resulting log-linear specification is,[9]

$$\ln K^*_{itzc} = \beta_0 + \beta_1 \ln R_{itzc} + \sum_{h=\{f,s,m\}} \beta_{2,h} LIHTC_{itzc,h} + \sum_{h=\{f,s,m\}} \beta_{3,h} \ln R_{itzc} \cdot LIHTC_{itzc,h} +$$

$$\beta_4 \ln L_{itzc} + \beta_5 \ln p_{L,itzc} + \tau_t + \zeta_z + \lambda_c + \gamma_i + u_{itzc}. \quad (4)$$

In specification (4), the dependent variable is square feet of building space in building i. The coefficient β_1 estimates how square footage increases in response to increases in market rent. The coefficient $\beta_{2,h}$ is the effect of the subsidy on square footage, which is expected to be positive. This coefficient and the variable $LIHTC_{itzc,h}$ are both indexed by h, which differentiates the subsidy's effect based on the population that the housing units are built to serve: families, seniors, or a category that combines single-room occupancy, at-risk, special needs and non-targeted housing.

The term associated with $\beta_{3,h}$ is an interaction between market rent and the binary LIHTC variables. For subsidized buildings, increases in market rent should not affect building size because the rent charged in subsidized units is assumed to remain equal to the rent ceiling. Therefore, $\beta_{3,h}$ should be negative, cancelling out some portion of the effect of β_1. The effect of land area and the cost of land per square foot is measured by β_4 and β_5. The fixed effects τ_t, ζ_z and λ_c represent the year of construction, zip code and zoning, respectively.

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[9]I use a log-linear specification because taking the natural log of equation (2) is necessary to separate the effects.

Specification (4) assumes that a unit of capital investment always results in the same amount of housing production that can be rented at $R(s)$. In reality, developers may alter the size or quality of housing units in response to the subsidy. It is not possible to measure the quality of materials used in construction, but I can measure housing unit size. The effect of the subsidy on unit size is difficult to predict. When an unsubsidized developer reduces the size or quality of an apartment unit, he faces a possible reduction in the price at which he can rent the unit. In the subsidized market, the rental price of smaller housing units does not decrease unless the number of bedrooms also decreases. Assuming vacancy rates of subsidized units are not sensitive to marginal changes in size, the subsidy may create an incentive to reduce the number of square feet per apartment unit.

Perhaps in response to this possibility, the LIHTC program enforces regulations that place minimum size requirements on housing units, based on number of bedrooms. For example, LIHTC three-bedroom units are required to include at least 1,000 square feet of living space (CTCAC Regulations 2012). Requirements like these limit the amount that developers can decrease the size of housing units and may actually lead to the construction of larger units. To examine this possibility, I use a specification similar to (4) to also estimate if the size effect of the subsidy is the result of higher square footage per housing unit or more housing units within the building.

4   Data and Results

Assessment data from the Los Angeles County Tax Assessor for the 2013 tax year identifies each apartment building in Los Angeles County that includes at least five housing units. The data also report square footage, the number of housing units, land value, the year the building was constructed, the size of the parcel in square feet and the county zoning classification.

The Department of Housing and Urban Development (HUD) publishes a LIHTC database that describes every LIHTC project placed in operation since the beginning of the program until 2007. Each LIHTC new construction project is linked to a parcel within the tax assessor data. Data for rehabilitation projects are not used because building size may be restricted by the existing structure.

In the data, I identify every subsidized and unsubsidized multi-family residential building constructed between 1993 and 2007.[10] To measure land value per square foot, I divide the land value reported in the 2013 assessor roll by the size of the parcel in square feet. It would be ideal to measure land value the year before construction, but parcel-level land value is not available each year before 2013. As a robustness check, I also collect the 1990 median owner-occupied property value for census tracts in 1990. The Lincoln Institute's Land and Property Value in the United States Database (Morris and Palumbo 2007) indicates that 73.3 percent of total property value is attributed to land in the Los Angeles MSA in 1990. Multiplying this fraction by the median property value reported in the 1990 Census, I create an alternative measure of land value. The results using this measure of land value are not qualitatively different than the results estimated using the 2013 land value measure.

I also collect the average rent by census tract for Los Angeles County, as reported by the 1990 Decennial Census. While 1990 average rent is not equal to the market rent in the year of construction, using the 1990 rent reduces the concern of reverse causality between building size and market rent levels. For the 1990 average rent to provide a proper measure of the lifetime revenue that developers can expect from housing units of various types and sizes, I make two assumptions. The first assumption is that the order of the 1990 average rent variable correctly ranks census tracts

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[10]Much of the assessor data for construction before 1993 are incorrect or do not report square footage. After 1993, there are 80 parcels that are not properly reported and those observations are dropped from the analysis.

by the rent that a unit would expect to collect, regardless of the number of bedrooms within that unit. Second, I assume that the rent level ranking of average rent in 1990 is representative of the ranking in the year of construction.

The final data set includes 1,086 buildings, of which 244 are subsidized by the tax credit. These buildings house 31,538 unsubsidized and 15,890 subsidized housing units. Table 1 reports the descriptive statistics, dividing observations into subsidized and unsubsidized buildings. The statistics in Table 1 show that the average LIHTC building is twice as large as an unsubsidized building and includes twice as many housing units. Subsidized buildings are also constructed on larger and less expensive parcels. For every variable in Table 1, the mean for subsidized buildings is statistically different from unsubsidized buildings at the one percent level.

I control for some of the attributes of LIHTC projects that may affect the level of subsidization. Among LIHTC buildings, about half are located in a qualified census tract (QCT), which may have a higher probability of receiving a 30 percent subsidy increase. Because QCTs are defined as high-poverty census tracts, their designation is likely correlated with lower market rents. Controlling for the QCT separates the effect of a potential subsidy boost from the effects related to differences in rent.

Approximately 25 percent of the new construction LIHTC sample is funded with the four percent credit, which are projects with less than \$3,000 of development cost per unit or at least 50 percent of financing from tax-exempt bonds. Also, a small portion of the LIHTC units face subsidy reductions because they include over 10 percent of units that will be rented at the market rate.

The LIHTC database also reports the population that the LIHTC building is built to serve. In this sample, more than 60 percent of buildings are created for families. Other types include senior, special needs, single room and projects that did not identify a targeted population. This sample

does not include all of the possible designations because many of those populations are targeted in rehabilitation projects instead of new construction. I estimate effects for each type of LIHTC housing, but I combine special needs, single room and non-targeted housing into one category named "Miscellaneous LIHTC Housing".

Table 1
Descriptive Statistics

| Variable	Unsubsidized	LIHTC
Building Square Footage	41,450	60,121
Number of Housing Units	37	65
Square Footage Per Unit	1,110	1,023
Parcel Square Footage	35,884	57,288
Land Value per Square Foot Land (2013 $s)	76	34
Mean Year Built	2001	2000
1990 Census Tract Average Rent (1990 $s)	686	571
Qualified Census Tract	–	0.52
Four Percent Credit	–	0.25
More than 10 Percent Not Rent Restricted	–	0.08
Family Housing	–	0.63
Senior Housing	–	0.25
Miscellaneous LIHTC Housing		
Special Needs Housing	–	0.07
Single Room Housing	–	0.02
Non-targeted Housing	–	0.03
Building Observations	842	244

All means between subsidized and unsubsidized sample are significantly different from each other at the one percent level.

To compare the size of subsidized and unsubsidized buildings, it would be ideal to construct each type of building on the same piece of land. Because this is impossible, I compare parcels that are similar and near each other but house the two different construction types. Because I use this strategy, it is necessary to accurately control for the market conditions at the time and location of construction.

To capture local market conditions, I include a zip code fixed effect. The observations are located in 188 unique zip codes and 85 zip codes include both subsidized and non-subsidized buildings. Of

the 244 LIHTC buildings, 216 are in a zip code with at least one unsubsidized apartment building

for comparison.[11] Figure 1 is a map of the zip code boundaries in Los Angeles County that shows the

locations of subsidized and unsubsidized buildings. The figure illustrates that subsidized housing

construction is often located near unsubsidized construction.

Figure 1
Multifamily Housing Construction in Los Angeles County: 1993-2007
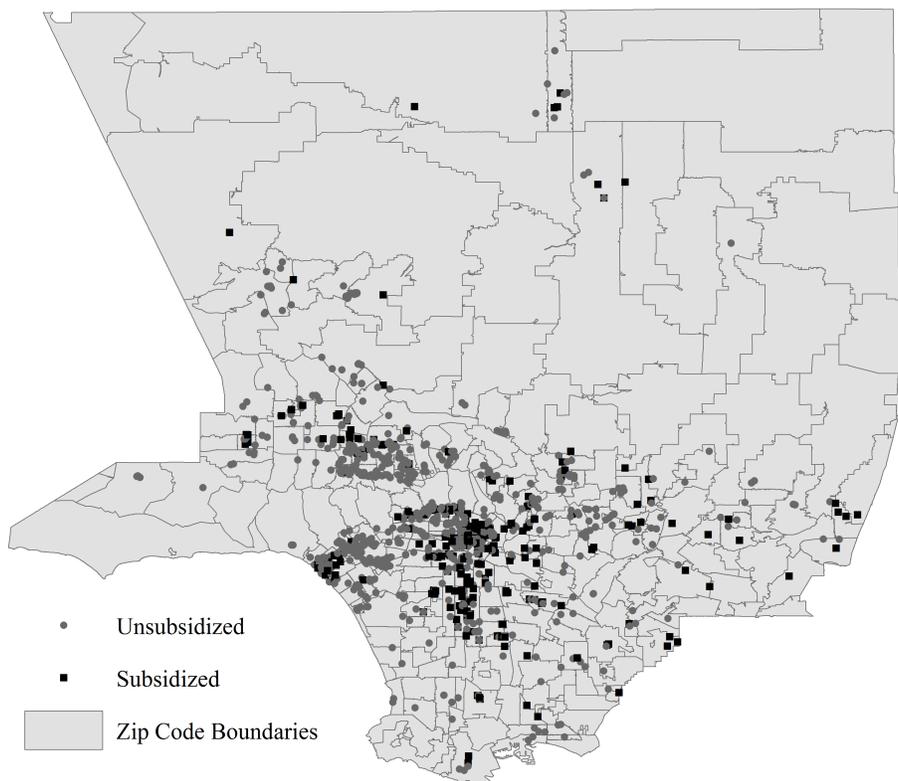
I also include a zoning "use code", developed by the Los Angeles County Assessor, which de-

scribes the size of building that is allowed on the parcel. A use code fixed effect controls for local

restrictions on development. All but 43 observations fall into one of two categories: five residential

units or more in a building with four or fewer stories and five residential units or more in a building

with five or more stories. Categories for the other observations are designated as condos, senior

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[11]Zip code fixed effects may not capture differences in zip codes over time. In an unreported regression, I create a fixed effect that interacts zip code with decade of construction. A regression that includes the interacted fixed effect and a yearly fixed effect yields very similar results to those that use a year and zip code fixed effect separately.

housing and group quarters. A year fixed effect is included to control for market conditions at the time of construction. Table 2 reports the observations by year of construction, demonstrating that LIHTC construction is evenly distributed over the time period.

Table 2
Building Construction by Year

Variable	Unsubsidized Buildings	LIHTC Subsidized Buildings	Total
1993	64	13	77
1994	27	18	45
1995	36	22	58
1996	32	18	50
1997	26	15	41
1998	33	16	49
1999	61	15	76
2000	38	19	57
2001	73	18	91
2002	80	15	95
2003	95	18	113
2004	97	19	116
2005	78	18	96
2006	67	12	79
2007	35	8	43

Even with these control variables, other issues may confound the estimation of how the subsidy affects building size. Unobserved differences between developers that do and do not receive the subsidy may exist. If developers who receive the subsidy use less expensive production methods and materials, it will result in larger buildings and the empirical analysis may assign that effect to the subsidy itself. While the LIHTC program monitors the quality of materials used, this and other cases of unobserved differences may occur. I discuss some of these possibilities with the results.

The average effect of the LIHTC subsidy on building size across the entire rent distribution is presented in Table 3. To obtain the average effect, I estimate specification (4), but do not interact the LIHTC variable with market rent. The first column of Table 3 reports regression estimates where the dependent variable is the natural log of building square footage. The effect of the subsidy

is estimated for each LIHTC housing type: family, senior and miscellaneous housing.

Based on the results in Table 3, LIHTC buildings built for families and the miscellaneous category are 29 percent and senior buildings are 25 percent larger than unsubsidized buildings. All three coefficients are at least significant at the five percent level. The coefficients on market rent and the QCT are positive and the coefficients on the four percent credit and 10 percent of units being rented at the market-rate are negative, but all are statistically insignificant. Coefficients for parcel size and land value are positive and significant. The positive coefficient on land value is consistent with developers substituting away from land and toward capital investment when land prices increase. Because land value is likely correlated with market rent, the coefficient may also be positive because developers are more likely to invest more capital in locations with more revenue potential.

The next two columns of Table 3 examine if larger buildings are a result of additional housing units or more space within those units. If units are larger, it may represent higher quality housing for low-income tenants that would not be available without the subsidy. The estimates in the second column, where the dependent variable is the natural log of square feet per unit, indicate that LIHTC units for families are not significantly larger than unsubsidized units. Senior and miscellaneous LIHTC units are 35 and 17 percent smaller than unsubsidized units, respectively.

Other estimates are similar to those found in column (1). One difference is that the QCT variable is now significant at the 10 percent level. This means that subsidized housing units built in QCTs are significantly larger than LIHTC units not located in QCTs. Because the QCT is likely correlated with low-market rent, additional specifications that interact the LIHTC variable with market rent can better separate these two effects.

In the third column, the dependent variable is the natural log of housing units. The number of units in LIHTC buildings is larger than unsubsidized buildings for all three populations. The

largest effect on number of units is for senior developments at 61 percent and the smallest effect is for family developments at 25 percent.

The estimates in Table 3 illustrate three points. First, subsidized buildings are larger in terms of square footage than unsubsidized buildings on average. Second, increased square footage appears to be the result of additional units within those buildings. Finally, housing unit size is no different from unsubsidized units for families but senior and miscellaneous housing units are significantly smaller than unsubsidized units.

California LIHTC Regulations are likely driving variation in unit size between the different types of LIHTC building designations. Regulations require that 30 percent of buildings meant for families include at least three bedrooms, with square footage minimums for units. Senior buildings also enforce minimum unit square footage rules but the regulations state that no more than 20 percent of housing units in a senior development can be larger than one bedroom. Two of the categories in the miscellaneous designation are also restricted by unit regulations that are similar to senior housing (CTCAC 2012).

The results in Table 3 indicate that LIHTC buildings are larger than unsubsidized buildings, but more evidence is needed to indicate if this difference is driven by the subsidy or some other effect. For instance, California has a Density Bonus Law (California Code 65915-65918) that allows developers to disregard local zoning laws and construct buildings with up to 35 percent more than the maximum allowed units if the project meets certain affordability requirements or is designated for seniors. However, the density bonus applies to all low-income designated buildings, regardless of the market rent in that location. As I outlined in the previous section, an effect caused by the LIHTC subsidy should be largest in low-rent locations and dissipate in high-rent locations.

Table 3

Average LIHTC Subsidy Effect on Building Size

Dependent Variables	(1) ln(Square Footage)	(2) ln(Sqft. per Unit)	(3) ln(Housing Units)
β_1: ln(1990 Tract Average Rent)	0.084	0.070	0.014
	(0.19)	(0.10)	(0.19)
$\beta_{2,family}$: Family LIHTC Indicator	0.29***	0.040	0.25**
	(0.090)	(0.078)	(0.11)
$\beta_{2,senior}$: Senior LIHTC Indicator	0.25**	-0.35***	0.61***
	(0.12)	(0.051)	(0.12)
$\beta_{2,misc.}$: Misc. LIHTC Indicator	0.29**	-0.17**	0.47***
	(0.14)	(0.070)	(0.15)
β_4: ln(Parcel Square Footage)	0.94***	0.039*	0.90***
	(0.036)	(0.020)	(0.037)
β_5: ln(Land Value per Sqft. Land)	0.12***	0.0042	0.12***
	(0.025)	(0.010)	(0.025)
Qualified Census Tract	0.14	0.10*	0.037
	(0.098)	(0.061)	(0.10)
Four Percent Credit	-0.012	0.047	-0.059
	(0.11)	(0.058)	(0.097)
>10 Percent Not Rent Restricted	-0.077	0.023	-0.10
	(0.14)	(0.072)	(0.15)
Constant	-0.62	5.96***	-6.59***
	(1.39)	(0.67)	(1.35)
R^2	0.853	0.457	0.852

***p<0.01, **p<0.05, *p<0.1. Standard errors clustered on zip code in parentheses. All regressions include 1,086 building observations with zip code, construction year and county use code fixed effects.

Table 4 reports the results for specification (4), which includes the interaction between LIHTC and market rent. Like Table 3, each column reports a regression with a different dependent variable related to building size. Although the same control variables are included in the regressions, I only report the coefficients for the QCT variable in the interest of space.

Table 4 is divided into two panels, Panel A and Panel B. Panel A reports the regression coefficients. Panel B reports linear combinations of the coefficients at the 25th and 75th percentiles of census tract average rent in the dataset. The reported numbers in Panel B represent the estimated size difference between subsidized and unsubsidized buildings at those rent levels.

The first column of Panel A reports the estimates for the coefficients when the dependent variable is the log of building square footage. The family LIHTC subsidy coefficient is 4.87 and significantly different from zero at the five percent level. This point estimate is much larger than the coefficient in Table 3 because it measures the size difference between subsidized and unsubsidized buildings when the market rent hypothetically equals zero.

When market rent increases by one percent, there is no significant increase in square footage for unsubsidized buildings. For subsidized buildings, however, the effect of changes in rent on building size is the sum of the coefficients β_1 and $\beta_{3.family}$. Based on these coefficients, subsidized building square footage decreases as market rent increases. Consequently, the difference between the size of unsubsidized and LIHTC buildings for families also decreases with market rent.

Panel B of the first column reports that at the 25th percentile, or \$536, a subsidized building for families has 35 percent more square footage than an unsubsidized building. At the 75th percentile of rent, \$779, the point estimate is 0.08 but not statistically different from zero. The estimates are consistent with theoretical expectations. The results for senior and miscellaneous buildings are less clear. Buildings designated for seniors are always estimated to be larger than unsubsidized buildings. Miscellaneous buildings are larger than unsubsidized buildings at the 25th rent percentile. The point estimate is approximately equal at the 75th rent percentile, but it is no longer statistically significant. This estimate may be imprecise because there are no miscellaneous building observations with market rent greater than \$718.

Like Table 3, The second and third columns of Table 4 investigate if differences in square footage are driven by more or larger housing units. The coefficients for a regression where the dependent variable is the log of square feet per housing unit is reported in Panel A of column (2).

Table 4
Linear LIHTC Subsidy Effect on Building Size

Panel A: Regression Estimates	(1)	(2)	(3)
Dependent Variables	ln(Square Footage)	ln(Sqft. per Unit)	ln(Housing Units)
β_1: ln(1990 Tract Rent)	0.22	0.17	0.052
	(0.22)	(0.11)	(0.21)
$\beta_{2,family}$: Family LIHTC Indicator	4.87**	3.59**	1.28
	(2.07)	(1.61)	(2.16)
$\beta_{3,family}$: ln(1990 Tract Rent)·LIHTC$_{family}$	-0.72**	-0.56**	-0.16
	(0.32)	(0.26)	(0.34)
$\beta_{2,senior}$: Senior LIHTC Indicator	0.40	-0.43	0.83
	(2.69)	(2.16)	(2.82)
$\beta_{3,senior}$: ln(1990 Tract Rent)·LIHTC$_{senior}$	-0.021	0.014	-0.035
	(0.42)	(0.34)	(0.44)
$\beta_{2,misc.}$: Misc. LIHTC Indicator	0.071	-1.83	1.90
	(4.42)	(1.83)	(4.17)
$\beta_{3,misc.}$: ln(1990 Tract Rent)·LIHTC$_{misc.}$	0.043	0.27	-0.22
	(0.70)	(0.29)	(0.66)
Qualified Census Tract	0.036	0.027	0.0090
	(0.094)	(0.055)	(0.10)
Panel B: Linear Combinations of Estimates			
Size Difference Between Subsidized and Unsubsidized Buildings			
At 25th Percentile of Average Rent ($536)			
Family LIHTC	0.35***	0.08	0.26***
Senior LIHTC	0.27**	-0.34***	0.61***
Miscellaneous LIHTC	0.34**	-0.15**	0.49***
At 75th Percentile of Average Rent ($779)			
Family LIHTC	0.08	-0.12	0.20
Senior LIHTC	0.27*	-0.34***	0.60***
Miscellaneous LIHTC	0.35	-0.05	0.40

***p<0.01, **p<0.05, *p<0.1. Standard errors clustered on zip code in parentheses.
Although not reported, all regressions include 1,086 building observations,the control
variables in Table 3 and zip code, year of construction and county use code fixed effects.

Using the coefficients in Panel A, the estimates in Panel B of the second column indicate that

family LIHTC units are not significantly larger than unsubsidized units at any point on the rent

distribution. Senior LIHTC units are significantly smaller than unsubsidized housing units across

the entire rent distribution. For the miscellaneous LIHTC buildings, units are smaller than unsub-

sidized at low levels of rent and become relatively larger at higher levels of rent. Again, because

there are few miscellaneous LIHTC buildings in tracts with higher rent, it is difficult to make an inference from the miscellaneous estimates.

The log of number of units is the dependent variable in column (3). The estimates in Panel B show that family LIHTC buildings include 26 percent more housing units than unsubsidized buildings at the 25th percentile of rent. The magnitude of the estimate decreases to 0.20 and is no longer statistically significant at the 75th rent percentile. The results for miscellaneous buildings are similar to family buildings, but senior LIHTC buildings include significantly more units than unsubsidized buildings across the entire rent distribution.

For family and miscellaneous LIHTC buildings, Table 4 provides some evidence that subsidization leads to significantly more square footage than unsubsidized buildings in the lower part of the rent distribution. The size difference decreases and becomes statistically insignificant as construction moves to higher rent locations. Senior buildings, however, appear to always be larger than unsubsidized buildings. The results confirm the implications from Table 3 that size differences appear to be driven by differences in the number of units within a building.

The estimates in Table 4 provide evidence that the LIHTC subsidy alters construction decisions, but the specifications assume that rent will have a log-linear effect on the dependent variables. Because there are not multiple observations of LIHTC buildings at every market rent value, this may not be the best way to precisely estimate the effect. To explore an alternate possibility, I estimate a non-linear relationship between the subsidy, market rent and building size. To do this, I split the sample into two groups, based on whether a census tract's average rent falls above or below the sample median rent of $645. The results are not sensitive to decreasing this threshold by $50 and become stronger in favor of the theoretical predictions as the threshold is increased.

There are 551 buildings in census tracts with average rent less than the median, 192 of which

are subsidized. There are 57 LIHTC buildings in census tracts with average rent greater than the median. Of the 57 LIHTC buildings in the top half of the rent distribution, 22 are for families, 27 are for seniors and eight are defined as miscellaneous. Specification (4) is altered to allow for a non-linear relationship between building size and rent,

$$\ln K^*_{itzc} = \phi_0 + \phi_1 HIGH_{itzc} + \sum_{h=\{f,s,m\}} \phi_{2,h} LIHTC_{itzc,h} + \sum_{h=\{f,s,m\}} \phi_{3,h} HIGH_{itzc} \cdot LIHTC_{itzc,h} +$$

$$\phi_4 \ln L_{itzc} + \phi_5 \ln p_{L,itzc} + \tau_t + \zeta_z + \lambda_c + \varepsilon_{itzc},$$

where $HIGH_{itzc}$ is an binary indicator that equals one if the market rent in the census tract of building i is above the sample median of \$645. In low-rent locations, the difference in square footage between subsidized and unsubsidized buildings is estimated by $\phi_{2,h}$. In high-rent locations, the square footage difference is estimated by the sum of $\phi_{2,h}$ and $\phi_{3,h}$. Like the previous tables, each column of Table 5 reports a regression that uses a different dependent variable. In the first column, the dependent variable is the natural log of building square footage and the effect for each type of LIHTC buildings is separately reported.

The estimates in the first column of Table 5 indicate that unsubsidized buildings in high-rent locations are 15 percent larger than unsubsidized buildings in low-rent locations. Within low-rent locations, LIHTC buildings for families have 42 percent more square footage than unsubsidized buildings. In high-rent locations, however, the effect is the sum of 0.42 and -0.43. For family LIHTC buildings, the positive effect of the subsidy on square footage appears to be offset by the requirement to conform to the rent ceiling. The estimated effects for miscellaneous buildings are similar to family buildings. For senior buildings, there is no significant size difference in low-rent locations, but there is a significant size difference in high-rent locations. I mark the coefficient on $\phi_{3,h}$ with a dagger to indicate that an F-test with the null hypothesis of $\phi_{2,h} + \phi_{3,h} = 0$ yields a

p-value less than 0.05.

The next two columns of Table 5 estimate differences in unit size and number of units within a building. Family LIHTC units are 13 percent larger than unsubsidized units in low-rent locations, but not significantly different in high-rent locations. For senior and miscellaneous buildings, subsidized units are smaller than unsubsidized units across the entire rent distribution.

Table 5
Nonlinear LIHTC Subsidy Effect on Building Size

Dependent Variables	(1) ln(Square Footage)	(2) ln(Sqft. per Unit)	(3) ln(Housing Units)
ϕ_1: High Rent Indicator	0.15**	0.054	0.092
	(0.064)	(0.041)	(0.072)
$\phi_{2,family}$: Family LIHTC Indicator	0.42***	0.13**	0.30**
	(0.092)	(0.062)	(0.12)
$\phi_{3,family}$: High Rent·LIHTC$_{family}$	-0.43***	-0.29	-0.14
	(0.15)	(0.19)	(0.24)
$\phi_{2,senior}$: Senior LIHTC Indicator	0.19	-0.32***	0.51***
	(0.14)	(0.051)	(0.14)
$\phi_{3,senior}$: High Rent·LIHTC$_{senior}$	0.16†	-0.058†	0.22†
	(0.19)	(0.10)	(0.20)
$\phi_{2,misc.}$: Misc. LIHTC Indicator	0.50***	-0.11	0.61***
	(0.17)	(0.080)	(0.19)
$\phi_{3,misc.}$: High Rent·LIHTC$_{misc.}$	-0.58***	-0.11†	-0.47**
	(0.21)	(0.12)	(0.21)
Qualified Census Tract	0.027	0.031	-0.0041
	(0.11)	(0.057)	(0.11)

*** p<0.01, ** p<0.05, * p<0.1. † p<0.05 for F-test H_0: $\phi_{2,h} + \phi_{3,h} = 0$. Standard errors clustered on zip code in parentheses. Omitted LIHTC housing category is housing for families. All regressions include 1,086 building observations, yearly, county use code and zip code fixed effects. High rent indicator equals one if 1990 average census tract rent > \$645.

For the regression reported in the third column, the dependent variable is the natural log of the number of units. Subsidized LIHTC buildings for families house 30 percent more units than unsubsidized buildings in low-rent locations but like the previous two columns, that difference decreases and becomes insignificant in high-rent locations. Like previous results, miscellaneous buildings mir-

ror the results for family buildings. Senior buildings house more units than unsubsidized buildings across the entire rent distribution.

The estimates in Table 5 reinforce the result that was presented in Table 4. Subsidized buildings for families and in the miscellaneous designation are larger than unsubsidized buildings in low-rent locations. In high-rent locations, the size difference between these types of subsidized buildings and unsubsidized buildings decreases and becomes statistically insignificant. Senior buildings are larger than unsubsidized buildings, with some evidence that even larger buildings are constructed in high-rent locations.

Family LIHTC buildings have relatively more and larger units in low-rent areas. As rent increases, the differences in number of units and unit size decrease relative to unsubsidized buildings. For miscellaneous buildings, units are smaller across the entire distribution, and the relative number of units decreases as market rent increases. Contrary to the theory that predicts the effect of LIHTC on construction, senior buildings tend to have more units than unsubsidized buildings across the entire rent distribution, however, the size of senior units is significantly smaller than unsubsidized units. I discuss these results further in the next section.

5 Discussion

This paper provides evidence that LIHTC buildings constructed in low-rent locations are larger than the unsubsidized buildings that may have been built in their place. In high-rent locations, there is no significant size difference between unsubsidized and most subsidized buildings. This result holds for family LIHTC buildings and buildings in the miscellaneous designation, but not for senior housing. Subsidized buildings for seniors are larger than unsubsidized buildings across the

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entire rent distribution.

Senior buildings, which make up 25 percent of LIHTC construction in this sample, may be larger across the entire rent distribution because there are factors this study has not considered. One possible factor is that developers can use California's Density Bonus Law to reduce the amount of required parking spaces for tenants. Developers can claim larger reductions for buildings that include more one-bedroom units. Because senior housing primarily includes only one-bedroom units, the reductions in parking requirements could significantly reduce costs of construction. If those cost reductions are invested into the construction of additional building space, housing for seniors may be larger as a result. In a 2012 published guide for housing developers from Kronick, Moskovitz, Tiedemann and Girard, it states, "In jurisdictions where the local ordinances do not reduce the parking requirements for senior housing developments, the reduced parking requirements alone may justify applying for a density bonus" (Goetz and Sakai 2012, pg. 6).

In addition to the Density Bonus Law, local officials may provide special resources for senior developments at a higher rate than other types of subsidized housing. Many city general plans include strategies to increase the availability of senior housing, either through additional funding or donated land. For example, Los Angeles County passed an ordinance in 2006 that allowed for up to a 50 percent density bonus for senior housing that is also income restricted (Los Angeles Civil Ordinance 22.52.1870). While this ordinance passed at the end of the study period, it is evidence that local governments may create additional incentives to construct larger apartment buildings for seniors.

Turning to the results on the size of housing units constructed, this paper shows that family LIHTC buildings are more likely to construct larger units in low-rent locations. This outcome is consistent with California LIHTC policy that requires that 30 percent of units in family-designated

buildings include at least three bedrooms. Units in family buildings also have square footage minimums based on the number of bedrooms within that unit (CTCAC Regulations 2012). It appears that because of this requirement, LIHTC is building relatively larger subsidized housing units in low-rent locations. Of the 42 percent differential in total square footage between family LIHTC and unsubsidized buildings in low-rent locations, 13 percent is driven by larger housing units. The other 29 percent of the difference is due to additional units within the building. In high-rent locations, the difference in square footage, unit size and number of units in the building is not statistically significant relative to unsubsidized construction.

For senior and miscellaneous buildings, housing units are generally smaller than unsubsidized units. The results are also consistent with California LIHTC regulations, which state that no more than 20 percent of housing units in a senior development can be larger than one bedroom, There are similar requirements for the housing built for the populations defined in the miscellaneous category (CTCAC Regulations 2012).

Taken as a whole, the results point to an input distortion that has been identified in previous research as a potential source of program inefficiency (Olsen 2000, Olsen 2009). Eriksen (2009) specifically finds with a sample of buildings in California that the average construction cost of the median LIHTC building is 21 percent higher than a medium-quality unsubsidized building. Significantly taller buildings with higher capital-to-land ratios could drive at least some portion of that difference.

But higher costs alone do not mean the costs are not justified. The LIHTC program could provide benefits to tenants that would not be available without the subsidy. One of the primary objectives of project-based housing subsidies is to increase the supply of affordable housing. Although my paper finds that LIHTC may incentivize the construction of larger buildings, a substantial literature

suggests that LIHTC does not increase housing supply. Those studies find that the majority of LIHTC housing units would have been constructed in absence of the subsidy (Malpezzi and Vandell 2002, Sinai and Waldfogel 2005, Baum-Snow and Marion 2009, Eriksen and Rosenthal 2010).[12] In spite of failing to meet the objective of increasing housing supply, other research has found evidence that LIHTC construction increases property values (Schwartz et al. 2006, Baum-Snow and Marion 2009), reduces poverty concentration (McClure 2006, Ellen et al. 2009, Horn and O'Regan 2011, Freedman and McGavock 2014), provides access to better schools (Horn et al. 2014, Di and Murdoch 2013) and decreases local crime rates (Freedman and Owens 2011). These benefits combined with evidence that family LIHTC units in low-rent locations are larger than unsubsidized units and it is certainly possible that higher costs of production are justified.

A final program characteristic to consider is the fraction of the total subsidy cost that is eventually transferred to tenants in the form of lower rents. Burge (2011) estimates that less than half of the government cost of the LIHTC program is captured by tenants in the form of rent savings. Developers receive the remainder of the subsidy's value. The results in my paper support this finding, as increased profit expectations may lead to the construction of larger buildings (Dipasquale and Wheaton 1995). In this case, the size discrepancy in low-rent locations could suggest higher profits and potential oversubsidization in these locations. Even if the benefits are considered enough to justify the additional costs of the program, focusing on transferring a larger fraction of the LIHTC subsidy to tenants should be a focus for policy-makers going forward.

This research implies some ways to potentially improve the cost-effectiveness of the LIHTC pro-

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[12]Note that crowd out will be small in areas that exhibit elastic demand for rental housing or inelastic supply for rental housing. Empirical research suggests that neither of these conditions hold in most housing markets in the United States. See Eriksen and Rosenthal (2010) for a theoretical treatment of crowd out in subsidized housing and a discussion of empirical elasticity estimates.

gram. The results indicate that regulations, like those that require housing unit size minimums, may effectively improve the quality of housing. The program could also become more cost effective by allocating tax credits through a process where developers compete by bidding down the subsidization rate. Another potential solution is to make rent ceilings dependent on local rental markets, instead of county or MSA markets. This would eliminate the opportunity to receive subsidization in exchange for only minimal reductions in revenue streams. Some economists argue for a more extreme solution, which is to phase out all project-based subsidies in favor of housing vouchers, which most research suggests is more cost effective (Olsen 2008).

6   Conclusion

As research on LIHTC progresses, attention to what causes the outcomes observed in previous research will determine how to improve the program. This paper provides evidence that a developer responds to the subsidy by altering the size of the building he constructs. In low-rent locations, most LIHTC buildings are larger in number and size of housing units. There is no significant difference between most subsidized and unsubsidized buildings in high-rent areas.

The building size effect may signal potential inefficiencies in the LIHTC program, through construction input distortions or oversubsidization of private developers. If developers are subsidized to build in low-rent locations, but the rent ceiling is not restrictive, developers may receive the bulk of the subsidy in the form of profit. Excess demand for the subsidy in California provides some evidence of this possibility.

The LIHTC program allocates billions of dollars annually to fund the construction of low-income housing (Eriksen and Rosenthal 2010). Any program that uses such large scale funding should be

critically examined for ways to improve cost-effectiveness. Subsidized buildings that are significantly

larger than the surrounding unsubsidized buildings may indicate that the LIHTC program is paying

developers too much or that low-income tenants are receiving too little of the subsidy.

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