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Do Tenant- and Place-Based Rental Housing Programs Complement Each Other? Evidence from Ohio

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Do Tenant- and Place-Based Rental Housing Programs Complement Each Other? Evidence from Ohio

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We characterize Housing Choice Voucher (HCV) use in Low-Income Housing Tax Credit (LIHTC) units and explore whether the subsidy overlap responds to needs unmet by the HCV program alone. We present a subsidy allocation model allowing for complementarity of tenant-based and place-based subsidies to guide our analysis. Findings for Ohio in 2011 suggest vouchers tied to LIHTC units are more likely allocated to very poor households with special needs. We also find that HCV users who freely choose to redeem their voucher in a LIHTC unit make up a somewhat larger share of LIHTC households in tighter or less affordable markets. There is little evidence that using both programs in concert enables access to better neighborhoods: households across both programs live in neighborhoods that tend to have above 20% poverty rates, with HCVLIHTC users actually living in higher poverty neighborhoods in the most urban Ohio counties when compared to the HCV population as a whole.

Keywords: Affordable Housing, Housing Choice Vouchers, Low-Income Housing Tax Credit, Housing Policy, Neighborhood Quality.

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1 Introduction

The longstanding debate over cost-effectiveness in the provision of rental housing subsidies is influenced by whether the housing goods offered by tenant-based and place-based programs are considered substitute or complement products. Assuming that both programs provide equal access to housing units and environments of similar quality, researchers show that tenant-based programs are less costly than their place-based counterparts (Olsen (2009); GAO (2002)). Thus, under the substitutability assumption, it is possible to house a larger number of eligible households when allocating funds away from place-based and into tenant-based programs. Alternatively, when place-based programs supply housing in a tight rental market, deliver human or educational services, or support neighborhood revitalization efforts, they may reach subpopulations whose needs would be unmet under a tenant-based program alone. Thus, some argue that the programs should be best seen as complementary in the provision of housing for low-income households. These programs can also exhibit complementarity at the individual level. For instance, an elderly, extremely low income individual may need the human services provided through a place-based program, and the deep rental subsidy provided by a housing voucher. Under the complementarity assumption, the goal from a social planner's perspective would be to optimally allocate resources across both programs in order to cover the heterogeneous needs of eligible families.

While, to the extent of our knowledge, there is not an explicit coordination of programs at the federal level, the number of households using vouchers in units produced by place-based programs is not insignificant. By 2011, 34% of Housing Choice Vouchers (HCVs) were being used to subsidize the rent of Low-Income Housing Tax Credit (LIHTC) units in Ohio. Based on a sample from ten states, O'Regan and Horn (2013) report that between 33.7% and 49.6% of low-income qualifying LIHTC tenants received additional rental assistance – HCV or otherwise. Such overlap is not necessarily a recent phenomenon; voucher use in LIHTC started to become more common in the 1990s as a way to ensure a steady stream of tenants and alleviate bankruptcy problems of LIHTC developments. By 1994, GAO (1997) and Buron et al. (2000) reported that 37%-39% of

LIHTC tenants received additional project-based or tenant-based rental assistance.

As a first step in understanding the extent to which these programs complement each other, we lay out a simple allocation model that allows for complementarity of tenant- and place-based subsidies, and we consider potential solutions under alternative optimization criteria. The model guides our subsequent analysis characterizing the subset of users who access subsidies from both types of programs relative to single subsidy users. While it is commonly understood that the overlap between programs evolved primarily to protect tax credit investors and developers, we find evidence in Ohio that tenants also benefit likely due in part to local-level planning across agencies in which vouchers required to be redeemed in a LIHTC unit, on average, are allocated to house the most vulnerable households – relative to LIHTC tenants without vouchers and the HCV population in general. At the same time, it is not clear that voucher households in LIHTC see improvements in neighborhood quality compared to the overall HCV population.

Previous economic and policy research focusing on LIHTC users has documented the incidence of using a voucher in LIHTC but has not looked into whether this subsidy overlap provides housing services unmet by either program alone (Galvez (2002)). For that, a comparison of HCV users in and out of LIHTC would be needed. Lacking the data required for such approach, we resort to a comparison between the entire HCV population in Ohio and its subset of HCV holders living in LIHTC. The time period analyzed spans 2011 and 2012. We use subsidized tenant level data in Ohio for 2011, provided by the Ohio Housing Finance Agency (OHFA) and HUD's Public Use Microdata Sample (PUMS) for the year 2012. Tract level data for HCV users is from HUD's A Picture of Subsidized Households, 2011, and neighborhood quality variables are from the Census Bureau[1], 2010.

In Section 2, we discuss relevant literature on the incidence of voucher use in LIHTC units. Section 3 develops a simple housing subsidy allocation model with program complementarity, and Section 4 presents the comparative analysis of subsidy users. The last

[1] 2010 data in 2000 tract boundaries by Geolytics, Inc.

section provides some concluding thoughts.

2 The Incidence of Voucher Use in LIHTC Units

Of the main affordable housing programs in the US, the Low Income Housing Tax Credit Program is the second largest and the primary source of subsidies for the construction of rent restricted housing units (Table 2). LIHTC is designed so one of the following conditions apply: at least 40% of its units are affordable to households with incomes at 60% of area median income (AMI), or at least 20% of units are affordable to households with incomes at 50% of AMI[2]. However, many states have implemented competitive selection preferences for units that have income restrictions as low as 30% of AMI (NCSHA (2014)). For example, 7% of LIHTC units placed in service in Ohio during 2012 were affordable for households with incomes less than 30% AMI whereas 63% were allocated at the 60% AMI level and 30% at the 50% AMI level.[3]

The Housing Choice Voucher program is the main source of tenant-based subsidies. As conceived, the program relies on the market supply of rental units at the Fair Market Rent (FMR)[4] and requires the voucher holder to pay 30% of their income on housing. The remaining portion of the rent is covered by the voucher, conditional on the unit and tenant meeting certain requirements specified by HUD. By design, housing should be affordable and accessible to all HCV users, provided the market supplies enough units satisfying HUD requirements to meet demand. Local public housing authorities (PHAs) must allocate at least 75% of their vouchers to extremely low-income tenants (households at or below 30% of AMI) with the remainder of vouchers eligible for very low-income tenants (households at or below 50% AMI).[5] It is also important to note that PHAs can alter basic targeting requirements (e.g., based on family size, age, disability status) to reduce wait

[2]In this context, a rental is affordable if it amounts to no more than 30% of household income.

[3]In the US, 10% of all LIHTC units placed in service during 2012 were allocated at the 30% AMI level. Louisiana allocated the largest portion (48%) of LIHTC units at this threshold.

[4]The Fair Market Rent is set at the 40th percentile of gross rent for typical, non-substandard units in a given local housing market.

[5]HUD defines low-income households at or below 80% AMI

times for such applicants and place them in suitable housing. This can extend to coordination with other housing programs, as well. For example, the Columbus Metropolitan Housing Authority (CMHA), in their 5-year plan, commit to continued partnerships with other housing and service providers to serve homeless, family, senior, and special needs populations–which it says are typically served through the use of vouchers in connection with LIHTC projects CMHA (2013).

HCVs may be used in a LIHTC unit via a place-based voucher (PBV) or a tenant-based voucher (TBV). While PBV holders can only use their subsidy in the unit attached to the voucher, TBV users are unrestricted, but choose to redeem their voucher in a LIHTC unit. The allocation of PBVs from a local PHA to a specific project is regulated by HUD, but planned locally. PHAs can use up to 20% of their previously allocated HCV vouchers for this purpose by referring interested HCV applicants to property owners that have project-based voucher units available. These are units for which a housing assistance payments (HAP) contract between the property owner and PHA has already been approved. If these qualifying units also receive additional federal subsidies, they will have also been subject to a subsidy layering review before the establishment of the HAP contract (Federal Register 2014).[6] Importantly, HUD expedites the HAP and subsidy layering review process for LIHTC projects in order to encourage the use of PBVs in LIHTC units Roberts (2008). It is also worth noting that LIHTC landlords cannot refuse to rent to voucher holders solely because of their Section 8 status, which in practicality translates into additional units added to the supply of HUD certified rentals.[7] In effect, these factors serve to expand the market of units available to HCV holders.

[6]In addition to LIHTC, subsidies may include Rural Housing Services (RHS) Section 515, Federal Housing Administration (FHA) insurance, tax-exempt bond financing, FHA risk-sharing, Project-Based Section 8, McKinney-Vento Homeless Assistance, Historic Rehab, Community Development Block Grant (CDBG), HOME investment partnership program, HOPE VI, Native-American Housing Assistance (NAHASDA), and the Neighborhood Stabilization Program (NSP). Any or all of these funds may overlap. In Ohio, according to HUD's National LIHTC Database (1987-2012), the most common federal subsidy programs to be used in concert with LIHTC are tax-exempt bond financing (8.96%), RHS Section 515 (11.3%), and HOME (17.56%)

[7]Internal Revenue Code §42(h)(6)(B)(iv)

Given program design, most LIHTC units will not be affordable to households that qualify for HCVs. Thus, O'Regan and Horn (2013) argue that the HCV program has a significant role in allowing households with extremely low income to access LIHTC developments. Their data consists of 480,000 LIHTC units from fifteen state housing finance agencies (HFAs) for 2009 and 2010, representing approximately 30% of the national LIHTC housing stock. The analysis finds that states with higher rates of HCV use in LIHTC also have higher rates of extremely low-income households served by LIHTC, suggesting more focused resources for the most disadvantaged populations. They also point out that LIHTC households without additional rental assistance experience higher levels of instability (i.e. occupancy turnover) than LIHTC households using a HCV.

Williamson et al. (2009) analyze 2004 tenant level data from Florida to determine the extent of the HCV-LIHTC overlap in general. They are able to identify HCV holders in LIHTC units but cannot discriminate between PBVs and TBVs. The study finds that a significant portion of HCV-LIHTC users (30%) are housed in LIHTC units located in Qualified Census Tracts (QCTs), usually low-income neighborhoods where developers receive 1.3 times the tax credit that would be allocated outside of QCTs. In a subsequent study, Williamson (2011) finds that LIHTC tenants also receiving HCV assistance are much less likely to be cost burdened than other LIHTC tenants. Her analysis shows that 65% of HCV-LIHTC users do not experience a housing cost burden compared to only 9% of LIHTC households without a voucher.

The aforementioned studies characterize the HCV-LIHTC population in relation to other LIHTC tenants. However, such analyses are unable to inform on whether the subsidy overlap responds to needs unmet by the HCV program alone. The relevant counterfactual analysis for such test would imply comparing the housing conditions of HCV households within a locality, with and without the availability of LIHTC rentals. As Williamson et al. (2009) suggest, it is possible that the use of HCV holders in LIHTC units is a response to the scarcity of HUD-certified affordable housing units in the private rental market. It may also signal household preferences for newer, higher quality units than what are typically available to HCV users – all LIHTC units have been built since 1987 Galvez (2002). HCV

users may also choose LIHTC units in search for better neighborhoods or the provision of special services within the living environment.

Focusing on the potential issue that HCV use in LIHTC may respond to the undersupply of certified FMR units in the local market, Eriksen (2009) suggests that LIHTC developments may actually crowd out unsubsidized rental housing that would have otherwise been built. But the extent of such an effect is not entirely clear. Baum-Snow and Marion (2009) find that LIHTC projects crowd out new rental construction in areas where property values are rising but do not have the same effect in stable or declining areas. One of the largest experiments conducted by HUD in 1973 provides valuable insight on private rental market responses to an expansion of tenant-based housing subsidies (Frieden (1980)). The Experimental Housing Allowance Program (EHAP) consisted of three components: a demand-side experiment (how families would make use of their allowances), a supply-side experiment (local housing market responses to increased demand), and an administrative experiment (to test effectiveness of different administrative arrangements). Despite the fear that discriminatory practices would affect take-up rates, the experiment showed that minority and ''hard to house" families were able to find housing of acceptable quality. Female headed-households and families on welfare assistance were the main participants, but participation by the elderly was low. Still, only about half of families eligible for allowances participated and the program had small effects on mobility and quality of housing. Partly due to the low take-up rate, there was virtually no increase in rents following the open enrollment policy.

While the use of HCV in LIHTC units might be a response to tight low-income rental markets, desirability of better quality, newer units, or need for special services, it could also represent an opportunity for HCV households to access better neighborhoods in close proximity to their social networks. Neighborhood environment influences can have a profound impact on the lives of individuals. The program design of both HCV and LIHTC consider the importance of neighborhood quality. HCVs were originally designed to allow for movement out of public housing units by providing neighborhood choice to poor households. As for LIHTC, many states preference their credits to projects that are part of

a broader community revitalization plan in an effort to improve neighborhoods.

Unfortunately, most studies of neighborhood quality access by housing subsidy users consistently reach disappointing conclusions. Deng (2007) studies HCV and LIHTC programs in six Metropolitan Statistical Areas (MSAs), San Jose, New York, Boston, Cleveland, Atlanta, and Miami. She finds that both HCV and LIHTC units were predominantly located in areas with low school quality. On the other hand, Newman and Schnare (1997) find slightly better prospects for HCV than LIHTC households. Compared to public housing, LIHTC units provide poor households access to better quality neighborhoods; but when compared to HCVs, LIHTC unit dwellers experience lower neighborhood quality.

Lens et al. (2011) investigate whether HCVs assist tenants in moving to neighborhoods with less crime. Their analysis makes use of two datasets, 2000 census tract level crime data for 91 cities and census tract data from 1998-2008 for Austin, Chicago, Cleveland, Denver, Indianapolis, Philadelphia, and Seattle. The authors find that voucher households occupied lower crime neighborhoods compared to tenants occupying LIHTC and public housing units. Residents living in LIHTC and public housing units experienced crime rates comparable to poor renters in general. Richter et al. (2013) consider neighborhood quality of HCV and LIHTC households in 2000 and the 2006-2009 period for Cuyahoga, Franklin, and Hamilton counties in Ohio, as well as Allegheny County in Pennsylvania (quality is a function of poverty, education, and employment indicators). They find that Allegheny County neighborhoods with LIHTC projects placed in service by 2000 improved in quality relative to other poor neighborhoods without LIHTC projects. And the level of quality experienced by LIHTC users in 2006-2009 was comparable to that of HCV users. However, these results did not hold for any of the Ohio counties studied.

3 An Allocation Model of Housing Subsidies

We present a simple model of housing subsidy allocation that comports to the complementarity assumption of housing programs. Assume there is a fixed population of low-income

households H and that subsidies to rent and construction are available via tenant- and place-based programs, respectively. The tenant-based or voucher program subsidizes the rent of certified market units with a subsidy inversely related to the income of the renter. The place-based program subsidizes the construction of project units designed under specific guidelines with the condition that rent be restricted to a certain level in order to be affordable to a targeted low-income population. The housing subsidy cost is denoted by C_v for vouchers and C_p for a project unit, and we assume that $C_v < C_p$.

Let households in H be characterized by two binary variables. Variable y classifies the population into poor ($y = 0$) and very poor ($y = 1$) such that poor–yet not very poor–households can marginally afford to rent in the open market and construction subsidized units with around 30% of their income[8]. Variable z captures non-income factors that classify them as "hard to house,"[9], considerably reducing the value of a certified market unit relative to a planned project subsidized unit. These factors may include the household's own characteristics and those of the housing market she faces. In this stylized model, the threshold that defines z is such that it takes the value of 1 if the household requires a project unit to be housed, either because it provides an additional unit to a tight market or because of the additional housing services it offers.

Thus, households are classified into four types $T(y,z)$ as follows: $T_1 = T(0,0)$, $T_2 = T(1,0)$, $T_3 = T(0,1)$, $T_4 = T(1,1)$, with the last category encompassing the hard to house, very poor households. Given this classification and denoting the number of households in each type by n_j, we can specify $H = \{(i,j)|\ i = 1,\ldots,n_j, \text{ and } j = 1,\ldots,4\}$, where (i,j)

[8]Say a poor household has income at 60% AMI or below and a very poor household has income at 50% AMI or below. For a family of four, respectively, this would equate to approximately $991 and $782 per month in the Cleveland MSA. The 40th percentile or fair market rent for a 2 bedroom unit in the Cleveland MSA is $727 per month.

[9]Cunningham et al. (2005) refer to the "hard to house" as high-need households, such as grandparents caring for grandchildren, persons with disabilities, very large households, and families coping with an array of difficult problems and barriers to housing access. Here, we extend this concept to include market characteristics that, interacted with household conditions, narrow choices in the low-income rental market.

represents the i^{th} household of the j^{th} type. We define subsidy binary variables as

$$v = \mathbb{1}\{\text{voucher assigned}\},$$

$$p = \mathbb{1}\{\text{project unit assigned}\},$$

so $(v(i,j), p(i,j))$ denotes a subsidy assignment to household (i,j) by the social planner, according to some optimization criteria. Subsidy assignments take values $(1,1)$, $(1,0)$, $(0,1)$, or $(0,0)$ if both subsidies, voucher only, project unit only, or no subsidies are accessible to (i,j), respectively.

The housing outcome function $h(v(i,j), p(i,j))$ defined in Table 1 takes the value of 1 if household (i,j) can be housed given the subsidy allocation $(v(i,j), p(i,j))$ and 0 otherwise.

Given Table 1, we can express the housing outcome function for household (i,j) with the help of the logical *and* operator, $\wedge$, as:

$$h(v(i,j), p(i,j)) = \begin{cases} 1, & \text{if } j = 1 \\ v(i,j), & \text{if } j = 2 \\ p(i,j), & \text{if } j = 3 \\ v(i,j) \wedge p(i,j), & \text{if } j = 4 \end{cases} \tag{1}$$

So type T_1 households can be housed without a subsidy and type T_2 households can be housed if assigned a voucher but not a project unit since, by definition, they could not afford it. Type T_3 households are hard to house in the local rental market but can afford and be housed with a project unit. Finally, type T_4 households are hard to house and very poor so they can only be housed in a project unit and with the added rental subsidy of a voucher. We assign weights w_j reflecting the social planner's value of housing type T_j relative to other household types.

Table 1: Tabulation of the housing outcome function $h(v(i,j),p(i,j))$

Type (j)	y	z	v	p	$h(v(.,j),p(.,j))$
1	0	0	1	1	1
			1	0	1
			0	1	1
			0	0	1
2	1	0	1	1	1
			1	0	1
			0	1	0
			0	0	0
3	0	1	1	1	1
			1	0	0
			0	1	1
			0	0	0
4	1	1	1	1	1
			1	0	0
			0	1	0
			0	0	0

The total budget allocation to housing programs is B and we assume that B is not large enough to entirely house any of the three types in need of a subsidy.

$$B \leq \min\{n_2 C_v, n_3 C_p, n_4(C_v + C_p)\} \tag{2}$$

We now proceed to consider alternative optimization goals. Suppose the objective is to allocate subsidies $(v(i,j), p(i,j))$ among households in $H - T_1$ in order to house the largest number of households. Then, $w_j = 1/3$ for all $j = 2,3,4$, and we have:

$$\begin{aligned} \underset{q_v, q_p}{\text{maximize}} \quad & \sum_{j=2}^{4} \sum_{i=1}^{n_j} w_j h(v(i,j), p(i,j)) \\ \text{subject to} \quad & q_v C_v + q_p C_p \leq B \\ & q_v = \sum_{j=2}^{4} \sum_{i=1}^{n_j} v(i,j) \\ & q_p = \sum_{j=2}^{4} \sum_{i=1}^{n_j} p(i,j) \end{aligned} \tag{3}$$

Given that $C_v < C_p$ and the restriction imposed in 2, the problem stated in 3 is solved when all resources are devoted to house $\lfloor B/C_v \rfloor$ households of type T_2 with vouchers, the least costly alternative, as illustrated in Figure 1, point A[10]. With this setup, it is best to invest all resources in the type for which the lower cost subsidy delivers the needed housing. This implies taking all resources away from the hard to house groups, which is clearly an undesirable outcome.

If on the other hand, the goal is to house the most disadvantaged (those with both, economic and non-economic barriers to housing), then $w_4 = 1$ and $w_j = 0$ for all $j \neq 4$. In this case, $\lfloor B/(C_v + C_p) \rfloor$ households in T_4 will be housed (see point D in Figure 1). In the figure, F is a solution satisfying this condition, such that subsidies are provided for q_2 households of type T_2, q_3 households of type T_3, and q_4 households of type T_4. Alternatively, the objective could require benefiting households from all types. Each allocation is

[10]The floor function $\lfloor x \rfloor$ gives the largest integer that is smaller than x.

efficient as long as T_2 households use a voucher and not a construction-subsidized unit.

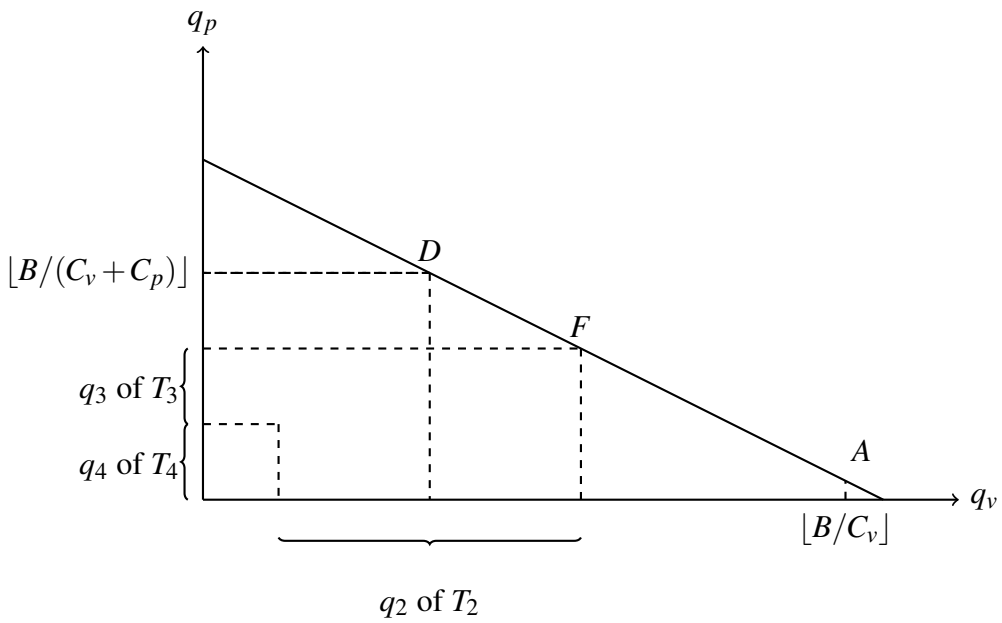

Figure 1: Housing subsidy allocations resulting from various optimization setups

Now, let's step away from the idealized scenario in which the social planner can identify types and assign subsidies accordingly. Much like in actuality, both subsides are available, with income restrictions applying for voucher qualification and rent restrictions for construction subsidies. In this case, T_2 households cannot be prevented from redeeming their vouchers in construction-subsidized units. Likewise, T_1 households may also choose to rent in a construction-subsidized unit, which, according to the above objective, would constitute an inefficient allocation of resources. In reality, however, it is difficult to devise a strict classification of households into types. What we consider T_1 households may be on the margin of becoming T_2 households if their income fluctuates and barely surpasses the affordability threshold. T_1 and T_2 households may also be close to falling into the T_3 and T_4 groups, respectively, if the supply of affordable market units decreases in quantity or quality.

In Section 4 we characterize users of LIHTC by type of subsidy: PBV, TBV, and LIHTC-only. Insofar as housing administrators allocate the larger subsidies to the hardest to house, poorer households, we would expect to see a concentration of T_4 households in PBV units and T_3 households in LIHTC-only units. At the same time, T_2 households may choose to live in PBV or TBV units, while T_1 households may be found in LIHTC-only units. In tight housing markets, assuming that landlords in the open market would be less likely to rent to HCV holders, we would expect to see an increased share of households choosing to redeem their vouchers in LIHTC units. Some of these households would be classified as T_4's even when in less tight markets they could fall into the T_2 group.

4 Characterization of the HCV and LIHTC Populations in Ohio

HCV is the largest subsidized housing program in Ohio, with 33% of all subsidized households falling under this program in 2011. LIHTC comprises the third largest component of subsidized housing in Ohio, at 23% in 2011 (Table 2). While the number of participants across both programs adds to about 154,000, the number of unique households covered is less than 124,000 due to the fact that about 30,000 households use a voucher in a LIHTC unit. In Ohio, during 2011, 34% of HCVs were being used in a LIHTC unit, with 23% of them being PBVs and 11% TBVs (Table 2). Relative to all LIHTC households, PBV holders represented 34% of that pool, while 15% of LIHTC households were TBV users. 51% of LIHTC users were not subsidized under the HCV program.

In order to include local housing market conditions in the analysis, we calculate an index of tightness or unaffordability in the low-income housing market. Counties in Ohio are ranked according to the share of renter households who pay more than 30% of their income in rent[11]. This is similar to a reverse-ranking based on a regional affordability measure(Richter et al., 2013). The larger the share, the 'tighter' the low income market. In tighter markets we would expect TBV use to be more common. To give a sense of

[11]Income and rent data are from the American Community Survey 2009-2013

Table 2: Subsidized Housing in Ohio and the US, 2011

	Ohio	US
LIHTC	63,992	1,832,564
PBV	21,883	–
TBV	9,788	–
HCV	91,313	2,100,000
Public	43,546	1,100,000
Section 8 PB	72,376	1,200,000

the geographic distribution of subsidized housing in Ohio, Figure 2 shows the ratio of program users to poor population by county and by tightness in the low-income rental market. Perhaps not surprisingly, the ratio of HCV users to poor is larger in urban counties, whereas LIHTC is slightly more evenly distributed across both urban and rural areas. In most counties, the HCV population is much larger than the LIHTC population. However, it is interesting to observe that in the tightest markets the added shares of subsidies tend to be larger, which could suggest a greater need for low income and certified units in such markets.

We now compare PBV, TBV, LIHTC-only, and all HCV users (includes PBV, TBV, and HCV only) by the characteristics of individuals they house. HCV data is from PUMS, for the year 2012, while PBV and TBV data is from OHFA for the year 2011.[12]. According to the model, we would expect that the PBV and to some extent, the TBV populations encompass the hard to house, very poor group of eligible households. Our comparisons are limited to those characteristics collected in both data sets. Table 3 shows a higher incidence of elderly (62 and older) among LIHTC users as compared to the entire HCV population. However, non-elderly head of households with a disability are clearly more represented in the HCV program than in any of the LIHTC categories. Comparing TBV

[12]The PUMS for subsidized households is not available in 2011. We do not attempt to calculate the relative size of the overlap at the county level since the data for voucher and LIHTC use are collected at different points in time, which coupled with high levels of mobility of subsidy users makes counts inconsistent at lower aggregate levels.

holders with the entire HCV population, it is possible to say that the elderly are more likely to use their voucher in a LIHTC unit, while the reverse is true for the non-elderly, disabled population of HCV holders.

Table 3: Share of Household Heads by Assistance Type 2011-2012

	HCV	LIHTC-Only	PBV	TBV
62 or Older	13.44	29.69	28.03	22.56
Persons w/ disabilities, under 62	31.10	3.01	14.12	7.92
Black	61.41	41.59	54.60	61.37
White	36.99	54.5	44.34	37.16
Hispanic	1.53	41.59	54.6	61.37

The income distribution of subsidized households across programs shows that TBV holders are very similar to the overall population of HCV users with a median income of about $10,000 (Figure 3). On the other hand, PBV holders tend to be on the lower end of the distribution, with a median income under $8,000 and about 10% of its population receiving no income at all. Other characteristics of the PBV population suggest this group may lack family support. Over fifty percent of PBV users have a household size of 1, compared to a larger household size, on average, for all HCV users. Accordingly, PBV users also tend to live in much smaller units–nearly fifty percent are one or zero bedroom apartments. As expected, LIHTC dwellers with no additional housing subsidies are less needy. In Ohio, the median income for this group was about $20,000 in 2011.

We also look at the distribution of households by race under each subsidy combination (Table 3). Issues such as discrimination in the private rental market could lead to a higher share of African-American households using their HCVs in LIHTC units when compared to the HCV holder population as a whole. However, the data only tells us that the shares of African-American head of households in the HCV population and the population of TBV holders is comparable, at about 60%.

4.1 Characterizing voucher use within LIHTC

While we are limited in our comparison of HCV users in and out of LIHTC units, data does allow for a richer comparison of HCV users within LIHTC. Based on the stylized model described in Section 3, we would expect to see a concentration of T_4 households in PBV and TBV units, within the constraints given by the number of HCVs available. Given that only about a quarter of all income-eligible households receive rental housing assistance, we expect there will be T_4 households in LIHTC-only units as well. According to our model, T_3 households would occupy LIHTC-only units, and the low-income rental market would accommodate the needs of T_2 voucher users and T_1 households. However, T_2 households may decide to use their vouchers in LIHTC units and T_1 households may also freely rent in a LIHTC-only unit. Given the higher degree of coordination involved in allocating PBVs, we expect to see a higher proportion of T_4's among PBVs than among TBVs. In addition, more TBVs are likely to be present in tight markets compared to markets where affordable rental housing is more accessible.

We approximate the model classification of household types with the data of LIHTC tenants which includes income, age, household size, number of children, and indicators for disability and having previously been homeless. Tenants are classified by income into 'poor' and 'very poor' if their incomes, adjusted for household size, are above and below 50% AMI in their county of residence, respectively. They are classified as 'hard to house' if they meet any of the following criteria: are 62 year of age and older; are disabled; were previously homeless; are in the top tercile relative to the number of children in the household. Table 4 provides a cross tabulation of households by type and subsidy use in LIHTC. We see that Type 1's constitute only 5% of the population and most of these households (92%) are not PBV or TBV users. Type 3 households, those that are hard to house but are not very poor, make up 13% of the population and most of this group (93%) is not housed with a voucher. Technically, Type 1 and Type 3 households should not receive vouchers according to program rules, as their household income is greater than 50% of AMI. The fact that some show up as voucher users in the data could be due to a change in income status since receiving the voucher. Type 2's and Type 4's constitute the

other 30% and 52% of the population, respectively and their distribution in LIHTC is quite similar, with a little under half of them being in units with a PBV attached.

Table 4: Cross Tabulation of Households by Type and Subsidy use in LIHTC, Ohio 2011. Top number is row percentage, bottom number is column percentage.

Typology	LIHTC-only	PBV	TBV	Total
Type 1	92.40	3.56	4.04	100
	10.51	0.49	1.33	5.24
Type 2	36.43	45.17	18.40	100
	23.41	35.12	34.38	29.61
Type 3	92.70	3.84	3.46	100
	26.71	1.34	2.90	13.28
Type 4	34.97	46.28	18.75	100
	39.37	63.05	61.38	51.87
Total	46.07	38.08	15.85	100
	100	100	100	100

Table 5 reports households paying greater than 30% (rent burdened) and 50% (severe rent burden) of their monthly household income in rent. The voucher program by definition only requires households to pay 30% of their adjusted gross income in rent, but a voucher user still may be rent burdened if the cost of the selected unit exceeds the payment standard set by HUD, generally the 40th percentile market rent. Focusing on Type 2 and Type 4 households, we observe that over 80% of LIHTC-only subsidy users in each sub-sample are either rent burdened or severely rent burdened. While a lower portion of PBV and TBV users are rent burdened, still as many as 40% of Type 2 PBV users and over 50% of Type 2 TBV users experience either rent burden or severe rent burden. Type 4 PBV users experience among the lowest rates of rent burden. This could be due to more 30% AMI units being allocated for PBV use; 43% of 6,133 extremely low-income units are occupied by PBV users while only 10% are occupied by TBV users. For sake of com-

Table 5: Percent of income paid to rent inclusive of utilities by Type and Subsidy use in LIHTC, Ohio 2011. Tenants who did not report income are excluded. Top number is count of households in each category, bottom number is percentage.

	Type 1				Type 2			
	LIHTC-only	PBV	TBV	Total	LIHTC-only	PBV	TBV	Total
$\leq 30\%$	1,847	50	102	1,999	939	3,446	1,410	5,795
	67.9	90.91	91.07	69.24	15.64	57.96	49.51	39.16
$> 30\%$	871	5	10	886	3,434	1,347	1,045	5,826
	32.02	9.09	8.93	30.69	57.2	22.66	36.69	39.37
$> 50\%$	2			2	1,631	1,152	393	3,176
	0.07			0.07	27.17	19.38	13.8	21.46
Total	2,720	55	112	2,887	6,004	5,945	2,848	14,797
	100	100	100	100	100	100	100	100
	Type 3				Type 4			
	LIHTC-only	PBV	TBV	Total	LIHTC-only	PBV	TBV	Total
$\leq 30\%$	1,967	145	121	2,233	1,627	9,176	2,930	13,733
	65.05	96.03	93.8	67.58	17.01	81.83	56.38	52.87
$> 30\%$	1,056	6	8	1,070	5,509	1,157	1,699	8,365
	34.92	3.97	6.2	32.38	57.6	10.32	32.69	32.2
$> 50\%$	1			1	2,429	880	568	3,877
	0.03			0.03	25.39	7.85	10.93	14.93
Total	3,024	151	129	3,304	9,565	11,213	5,197	25,975
	100	100	100	100	100	100	100	100
	All Types							
	LIHTC-only	PBV	TBV	Total				
$\leq 30\%$	6,380	12,817	4,563	23,760				
	29.93	73.81	55.07	50.59				
$> 30\%$	10,870	2,515	2,762	16,147				
	51	14.48	33.33	34.38				
$> 50\%$	4,063	2,032	961	7,056				
	19.06	11.7	11.6	15.02				
Total	21,313	17,364	8,286	46,963				
	100	100	100	100				

parison, McClure (2005) found that 38% of all HCV users were rent burdened in 2002. Similarly, as mentioned in Section 2, Williamson (2011) found that approximately 35% of HCV users in LIHTC units were rent burdened.

In order to further characterize the set of households in Ohio who use HCV within LIHTC, we specify a multinomial logit model for the probability that LIHTC households belong to one of the three categories of users in question: PBV holders, TBV holders and other LIHTC users.

$$P(y_i = j) = \frac{\exp(x'_{ij}\beta_j)}{1 + \exp(x'_{i2}\beta_2) + \exp(x'_{i3}\beta_3)},\ j = 1,2,3 \tag{4}$$

The multinomial logit is derived from the underlying assumption that to each LIHTC household corresponds a random variable taking one of three possible user-category values, and these random variables are independent from each other. That is, each individual i has probabilities $P(y_i = 1)$, $P(y_i = 2)$, $P(y_i = 3)$ of belonging to one of the three user categories: PBV, TBV, LIHTC-only, respectively. The three categories are mutually exclusive and exhaustive. The log odds ratio for category j relative to the baseline category (LIHTC-only) is set to be a linear function of households characteristics (x_{ij} vector), and this relation leads to equation4[13].

We provide two specifications. Model 1 estimates user category probabilities given the following household characteristics: age, race, gender of household head, number of children, homelessness status, disability status, and an income from employment dummy. Finally, a dummy for living in a county above the 80th percentile of the low income housing tightness index is also included. Results are presented in the form of marginal effects. For each covariate and category combination, the marginal effect estimates the change in probability of belonging to the specific category due to a unit change in the covariate.

The second model estimates user category probabilities given previously derived indi-

[13]Note that the purpose of this model is to describe user categorization based on household covariates. We are not estimating a conditional logit model of consumer choice.

Table 6: Marginal Effects of Select Characteristics on User Type Probabilities. Standard errors in parentheses.

	PBV	TBV
Model 1		
Elderly	-0.118***	-0.050***
	(0.005)	(0.005)
Female household head	0.058***	0.066***
	(0.005)	(0.004)
Household with children	0.021***	0.075***
	(0.005)	(0.005)
Head or spouse w/ disability	0.144***	-0.025***
	(0.007)	(0.005)
No income from employment	0.314***	0.065***
	(0.005)	(0.004)
Homeless	0.099***	-0.004
	(0.012)	(0.010)
Tighter market	0.034***	0.034***
	(0.005)	(0.004)
Model 2		
Very poor	0.421**	0.150**
	(0.003)	(0.003)
Hard to house	0.010**	0.001
	(0.004)	(0.003)
Tighter market	-0.005	0.037**
	(0.004)	(0.004)
Tighter market	-0.001	0.050**
at 'very poor'=1	(0.005)	(0.004)
Hard to house	0.011**	0.003
at 'very poor'=1	(0.005)	(0.004)

cator variables for 'very poor' and 'hard-to-house' that define household types, as well as the indicator for tighter rental market. The model includes interactions among these three variables as these interactions define the household types. Note that, unlike with linear models, marginal effects in nonlinear models are non-constant even in the absence of interaction terms(Karaca-Mandic et al., 2012). However, our inclusion of interaction terms in the model allows for a more flexible form of marginal effects.

Table 6 presents the average marginal effects (AME) estimates derived from the multinomial logit of equation 1, with LIHTC-only as the base outcome. The AME is the average change in probability of being a PBV or TBV user -given LIHTC residence- due to a one unit increase in the explanatory variable. Estimates from Model 1 confirm that PBV holders are clearly a more vulnerable population relative to other LIHTC dwellers. All else equal, having no income from employment increases the probability of being a PBV user by 31 percentage points, and having a disability increases this probability by 14 percentage points. The extent of the latter effect is limited in that less than 20% of LIHTC projects in Ohio provide supportive services for the elderly and less than 10% for persons with disabilities (Table 7). If supportive services in LIHTC were expanded, we might see this effect increase.

Being elderly decreases the likelihood that the LIHTC user is a PBV or TBV holder. However, a few caveats should be kept in mind. The marginal effects calculation reflects that the largest share of elderly LIHTC users are LIHTC-only users (in line with what we would consider Type 3s and possibly Type 1s). However, relative to the entire HCV population, the share of elderly tenants is much higher among PBVs and TBVs (Table 3). It is also worth noting that there is a higher share of elderly and persons with disabilities in the most recently built LIHTC projects; this is especially true among PBV users (Figure 4 and 5). Distinct from the provision of supportive services, the fact that newer buildings house a higher share of elderly and persons with disabilities seems to suggest a growing trend to match the hardest to house HCV applicants with units most suitable to their needs. Since 2007, OHFA has required all new construction units to meet certain Universal Design elements, including a no-step entrance into the unit, a width of 32 inches for all doors, and a

Table 7: LIHTC Projects Providing Supportive Services. Top row is count, bottom row is percentage.

	Ohio	US	Ohio	US
	One or more services		Services for families	
Yes	477	16,308	52	10,250
	27.93	43.4	3.00	27.28
No	1,231	21,271	1,656	27,329
	72.00	56.60	96.96	72.72
Total	1,708	37,579	1,708	37,579
	100	100	100	100
	Services for the elderly		Services for persons with disabilities	
Yes	313	5,055	57	3,028
	18.33	13.45	3.00	8.06%
No	1,395	32,524	1,651	34,551
	82.00	86.55	96.66	91.94
Total	1,708	37,579	1,708	37,579
	100	100	100	100
	Services for the homeless			
Yes	15	1,000		
	0.88	2.66		
No	1,693	36,579		
	99.12	97.34		
Total	1,708	37,579		
	100	100		

bathroom on the main floor with clear floor space of 30 inches by 48 inches OHFA (2006).

It is also observed that the probability of voucher use in LIHTC units increases by about three and one-half percent if tenants are located in tight housing markets. This result is only indicative of housing market conditions in Ohio in 2011. Focusing on Model 2, we see that when the market becomes tighter, 'very poor' households have 5% higher chances of being TBV holders and lower chances of being LIHTC-only users. If a 'very poor' household becomes 'hard to house,' their probability of being in LIHTC as a PBV holder slightly increases.

Altogether, data suggests a pattern of allocation somewhat consistent with our stylized model presented in Section 3. PHAs appear most likely to refer households for PBV placement in LIHTC so as to house those with the lowest incomes or with disabilities. And in tighter markets, the use of vouchers in LIHTC seems to respond to a lower supply of units that meet FMR standards in the private rental market. Access to HCV tenant-level data would allow a more robust analysis and provide an opportunity to confirm these results.

4.2 Neighborhood Quality for HCV users in LIHTC units relative to all HCV users

Previous work comparing neighborhood quality under place- and tenant-based programs has not identified neighborhood quality for the group of households subsidized under both programs. There is no way of uncovering the complex decision making process by which individuals decide where to locate with a voucher. However, we can see whether those selecting into a LIHTC unit – via a TBV or PBV – experience better neighborhood quality as compared to the entire population of HCV users. We know that the HCV population is made of individuals living in and out of LIHTC units and that those in LIHTC units represented about 34% of the HCV population in Ohio, 2011.

$$HCV_{pop} = TBV_{pop} + PBV_{pop} + HCVnonLIHTC_{pop}.$$

Unable to identify HCV users not living in LIHTC units ($HCVnonLIHTC_{pop}$), we compare average neighborhood quality for the voucher population in LIHTC ($TBV_{pop} + PBV_{pop}$) with that of the HCV population as a whole (HCV_{pop}).

Figure 6 shows the average neighborhood quality for voucher users in select Ohio counties versus that for the subset of TBV and PBV holders, jointly. Figure 7 compares neighborhood quality for TBV and PBV holders. Neighborhood quality is measured at the census tract level and it is relative to all tracts in the United States in 2010. We use quantiles of the first principal component estimated from the following variables: percent poverty, percent in the labor force, percent with a high school diploma, percent with a bachelor's degree, and percent employed.[14] Thus, the highest quality neighborhood in the US would have an index of 100 and the median quality neighborhood according to our measure would have an index of 50. The average neighborhood quality is calculated for all tracts within a county, weighted by the number of HCV, TBV or PBV holders per tract, accordingly. Counts of HCV holders within each tract are from the Picture of Subsidized Households, 2011 and counts for TBV and PBV holders are from 2011 LIHTC data provided by OHFA.[15] Similarly, average poverty rates experienced by HCV, TBV and PBV users at the county level are presented in Figures 8 and 9. The size of the bubble in these graphs reflects the relative share of TBV and PBV users in the HCV populations. The larger the bubble, the more TBV and PBV holders there are in the county relative to the total number of HCV holders.

By focusing on the bottom left quadrant of Figure 6, we see that on average, HCV holders in Ohio counties live in neighborhoods of below median quality; and for those voucher holders living in a LIHTC unit (TBV+PBV holders), neighborhood quality tends

[14]The first component explains 67% of the variation in the 2010 data.

[15]Because these two data sets are collected at different points in time, and low-income populations are highly mobile, we cannot expect alignment of counts at the census tract level. However, the data does give us a snapshot of the distribution of voucher holders across neighborhoods and thus, we can compare neighborhood quality for all three groups (HCV, PBV, TBV) aggregated to the county level. Counties included in our study had a population greater than 50,000 to primarily capture urban areas, per US Census Bureau definition, and greater than 50 PBV & 50 TBV holders to ensure low voucher populations aren't given undue weight.

to remain below the median. Figure 7 shows that in some counties PBV holders experience higher average neighborhood quality than TBV holders, yet in these counties, both groups remain below the median of quality (bottom left quadrant). There are, however, a few counties in which subsidized households experience above the median neighborhood quality (right side quadrants). In these counties, it is most likely that TBV holders are located in better neighborhoods than their PBV counterparts.

To complement the rank-based analysis of neighborhood quality we provide graphs using actual neighborhood poverty rate averages experienced by the subsidized populations within counties. Here, we divide the plots into four quadrants to mark average poverty rates below and above 0.2 or 20%. It is worth noting that the average neighborhood poverty rate for the HCV population is above 10% for all counties studied and HCV-LIHTC households do not benefit from living in less poor neighborhoods relative to the overall HCV population (Figure 8). Figure 9 shows that compared to PBV users, TBV users – those who chose to live in LIHTC unit – tend to live in less poor neighborhoods, but only in a handful of counties the average neighborhood poverty for TBV users is below 20%.

5 Conclusions

Evidence from Ohio suggests that HCV and LIHTC programs exhibit some degree of complementarity, particularly, when serving very poor households and those considered hard to house. The overlap of programs is not at all insignificant: In Ohio, during 2011, 34% of LIHTC households received place-based voucher assistance and another 15% of LIHTC dwellers were using their tenant-based voucher to live in a tax-credit unit. We develop a subsidy allocation model to guide our analysis of voucher use in LIHTC. Though coordination between the two rental housing programs is limited at the state and federal levels, more intentional planning among housing administrators seems to occur at the local level in order to allocate vouchers for use in LIHTC to the most vulnerable households. This is important in that the deep subsidy of the HCV provides access to LIHTC units that otherwise might not be affordable and which could convey certain benefits – e.g.

supportive services, newer housing that incorporates universal design principles, etc. – compared to the rest of the affordable rental housing stock. We also find that the population of TBV users, who freely choose to live in LIHTC units, is somewhat larger in tighter rental markets, which we interpret as a response to a lower supply of private market rental units that meet FMR standards. Otherwise, TBV users are similar to the overall HCV population in terms of incomes and ethnicity, but older on average.

While our analysis of HCV users in LIHTC points to benefits of the overlap for certain populations under certain market conditions, there is very little evidence to support that PBV or TBV usage enables access to better quality neighborhoods relative to other HCV users. In the Ohio counties studied, the average HCV user and the average voucher holder living in LIHTC units, occupy neighborhoods which are below the 50% median neighborhood quality index, with poverty rates of above 20%. There are only a few Ohio counties – Clermont (Cincinnati MSA) and Delaware (Columbus MSA) – where PBV or TBV users, on average, reside in better neighborhoods than the HCV population as a whole, and at the same time, experience above median neighborhood quality. Unfortunately, households across both programs live in neighborhoods that tend to have above 20% poverty rates, with PBV and TBV users actually living in higher poverty neighborhoods in the most urban counties (e.g., Cuyahoga, Hamilton, Summit, and Franklin) when compared to the HCV population as a whole.

Voucher use in LIHTC units can be perceived as beneficial insofar as the lowest income and hardest to house population are provided access to quality rental units that would otherwise not be available. However, it is important for housing administrators and policy makers to address the low neighborhood quality that prevails for users of both programs. A further exploration of the county-level variation in neighborhood quality and poverty illustrated by our analysis may shed some light into how to better coordinate the provision of rental housing subsidies to improve the living conditions and opportunities of low-income families.

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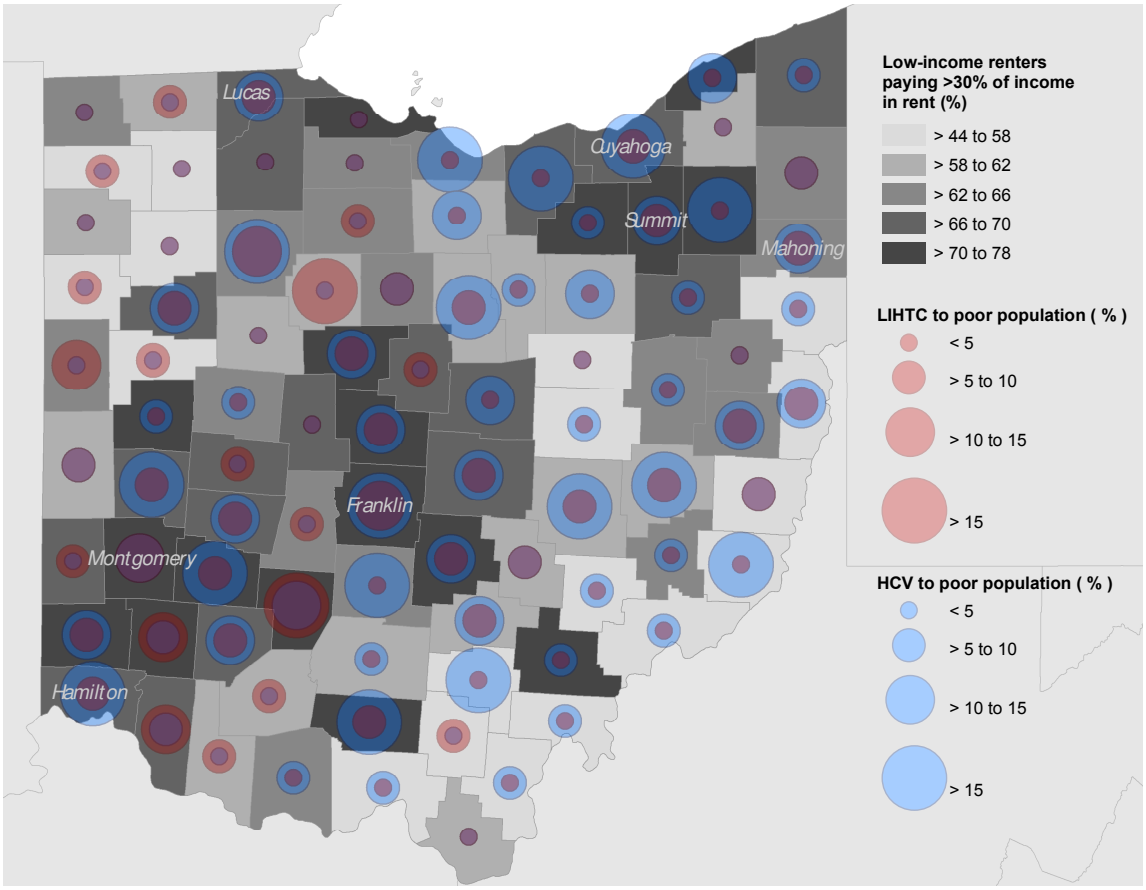

Figure 2: Distribution of LIHTC and HCV tenants in Ohio as a percentage of the county population in poverty. 2011 LIHTC data is from OHFA, HCV data is from A Picture of Subsidized Housing, income and rent data from 2009-2013 American Community Survey.

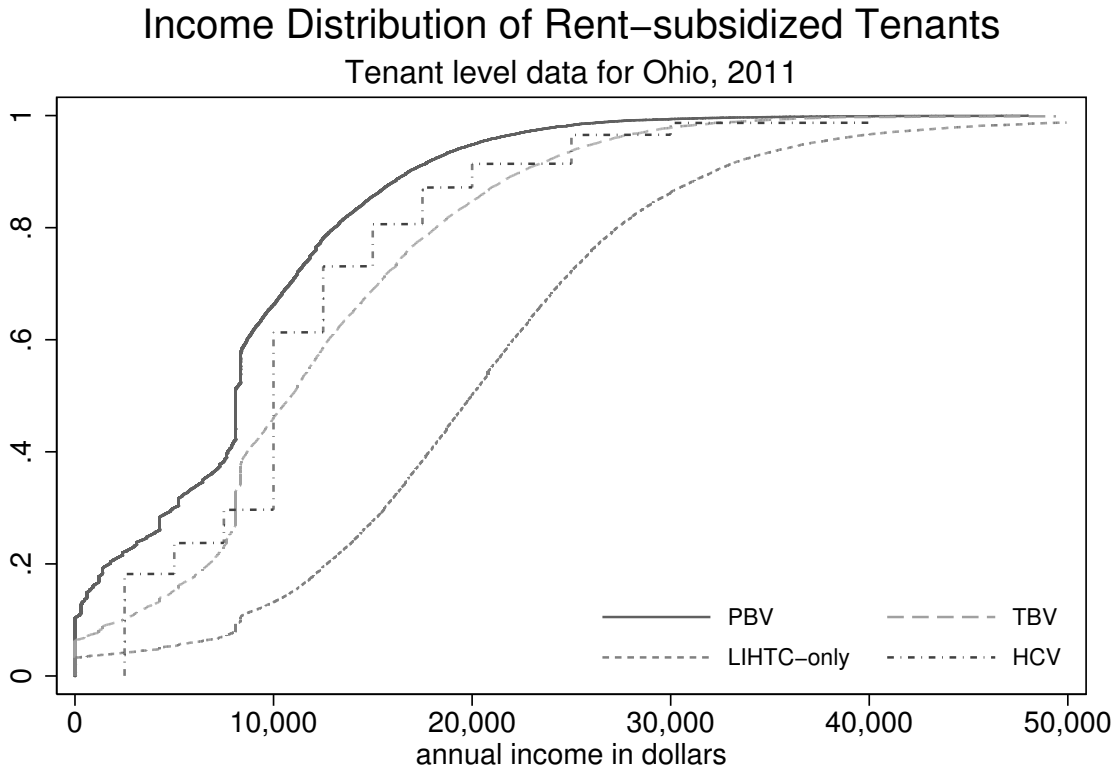

Figure 3: Income Distribution of Rent-subsidized Tenants. 2011 LIHTC data is from the Ohio Housing Finance Agency. 2012 interval income data of HCV users is from the Public Use Microdata Sample.

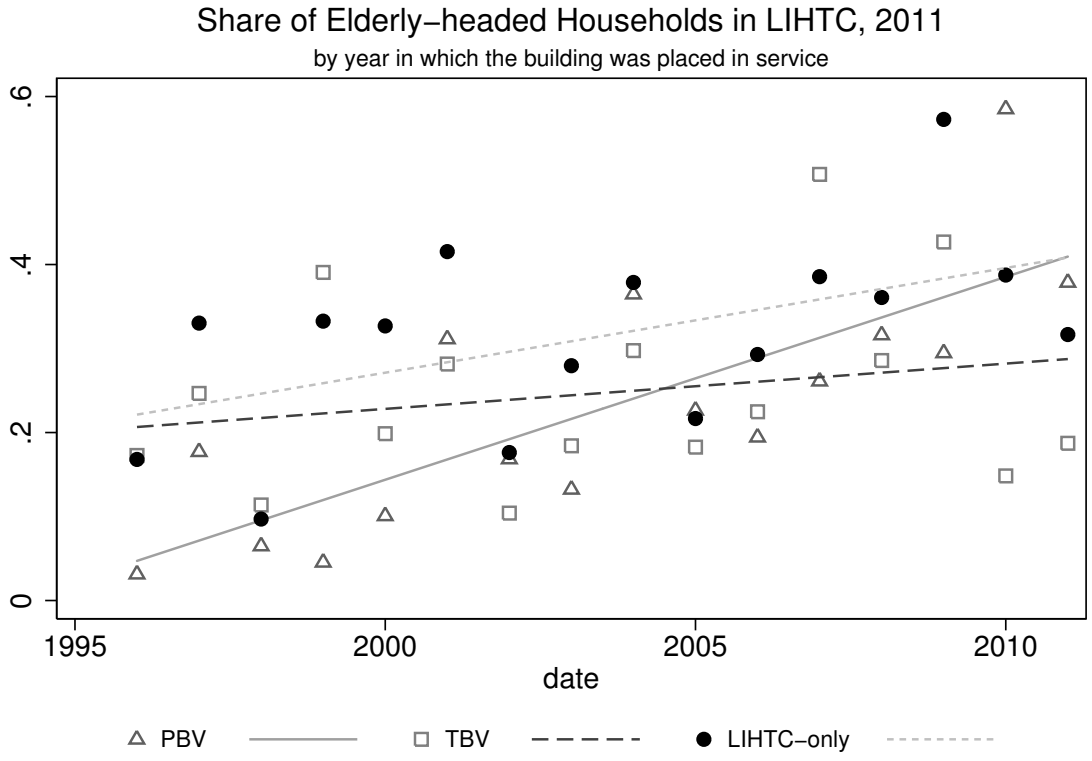

Figure 4: Share of Elderly-headed Households in LIHTC by year placed in service. 2011 LIHTC data is from the Ohio Housing Finance Agency.

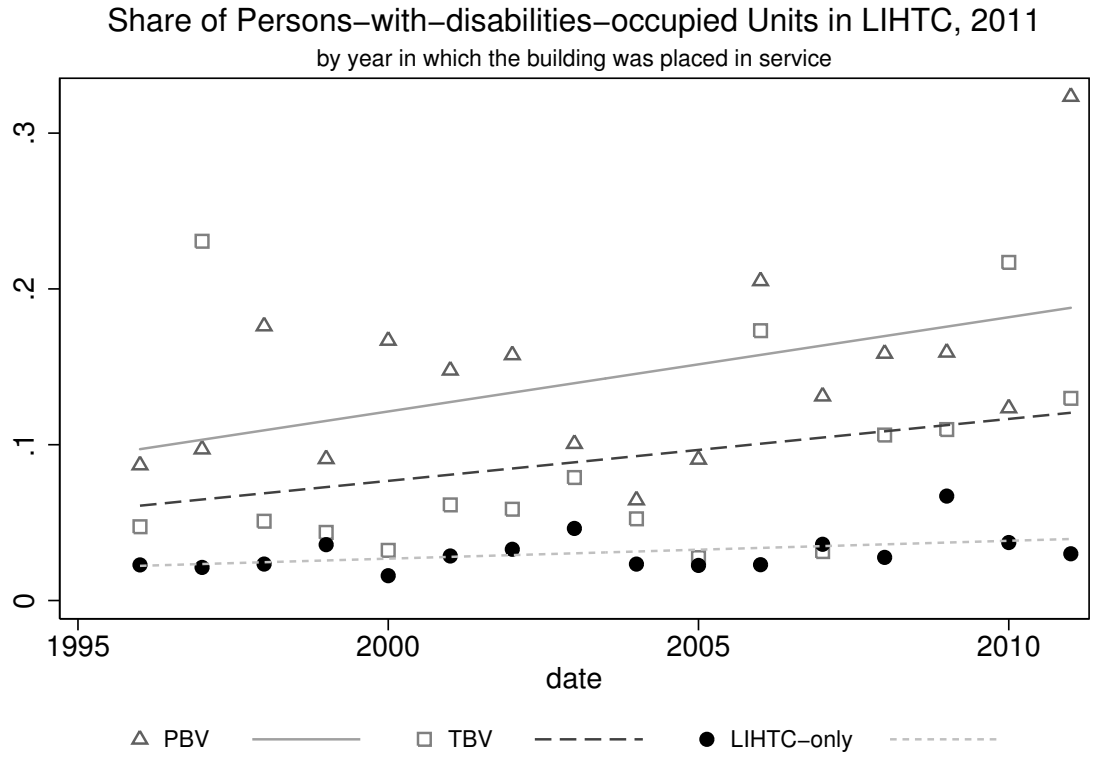

Figure 5: Share of Persons-with-disabilities-occupied Units in LIHTC by year placed in service. 2011 LIHTC data is from the Ohio Housing Finance Agency.

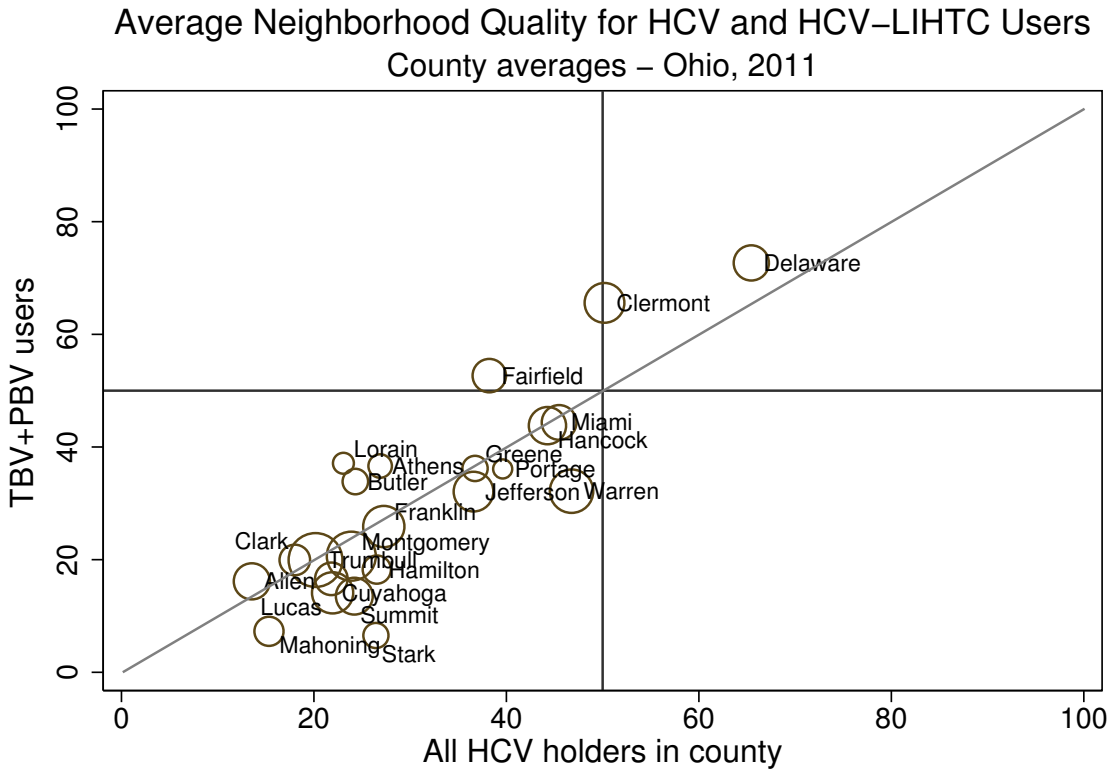

Figure 6: Average Neighborhodd Quality for HCV (x-axis) and HCV-LIHTC Users (y-axis). Neighborhood quality measured as quantiles of first principal component of census tract level variables from Census 2010. We include %poor, %employed, %in labor force, %high school, %bachelors. Bubble size represents relative share of HCV use in LIHTC units across counties. 2011 LIHTC data is from Ohio Housing Finance Agency. 2011 HCV data is from A Picture of Subsidized Housing.

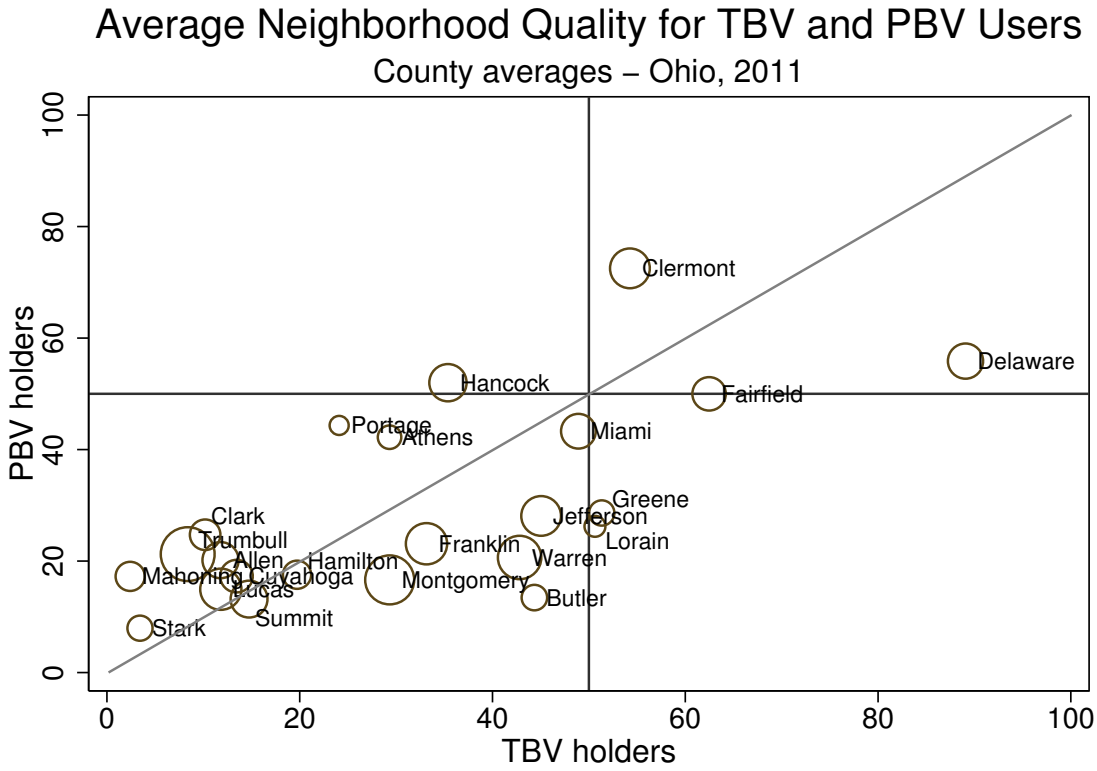

Figure 7: Average Neighborhodd Quality for TBV and PBV Users. Neighborhood quality measured as quantiles of first principal component of census tract level variables from Census 2010. We include %poor, %employed, %in labor force, %high school, %bachelors. Bubble size represents relative share of HCV use in LIHTC units across counties. 2011 LIHTC data is from Ohio Housing Finance Agency.

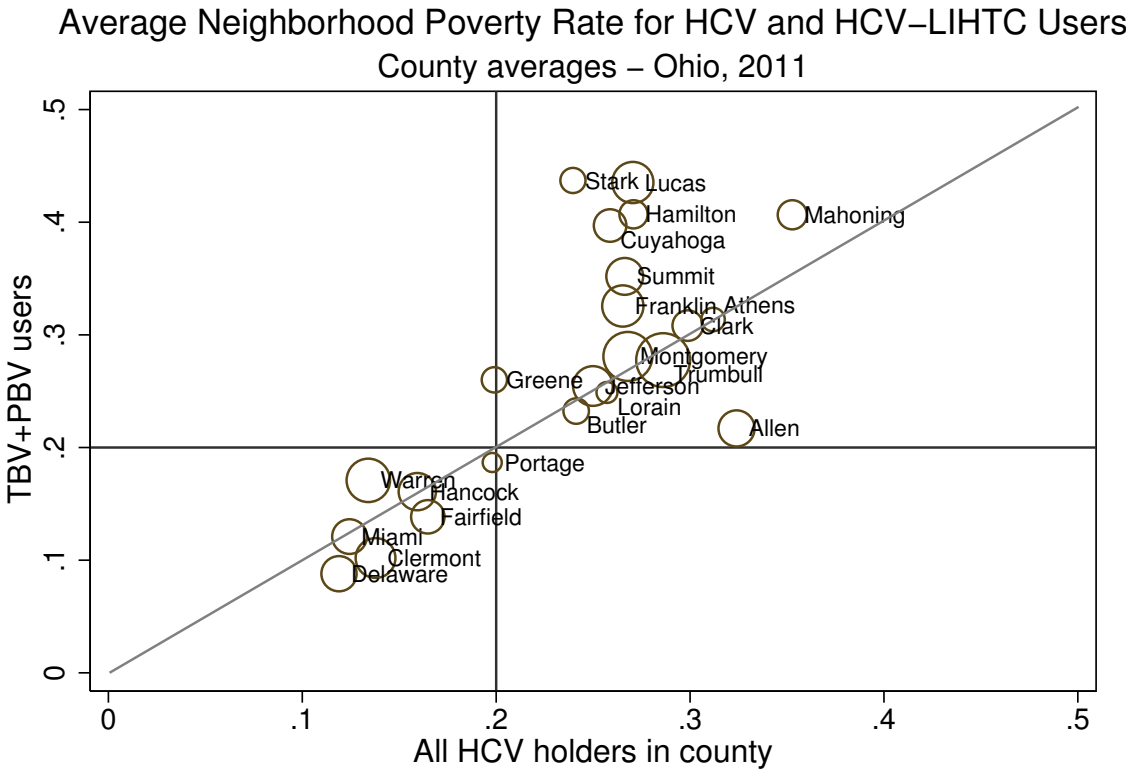

Figure 8: Average Neighborhood Poverty Rate for HCV and HCV-LIHTC Users. Census tract neighborhood poverty rates are from the Census 2010. Bubble size represents relative share of HCV use in LIHTC units across counties. 2011 LIHTC data is from Ohio Housing Finance Agency. 2011 HCV data is from A Picture of Subsidized Housing.

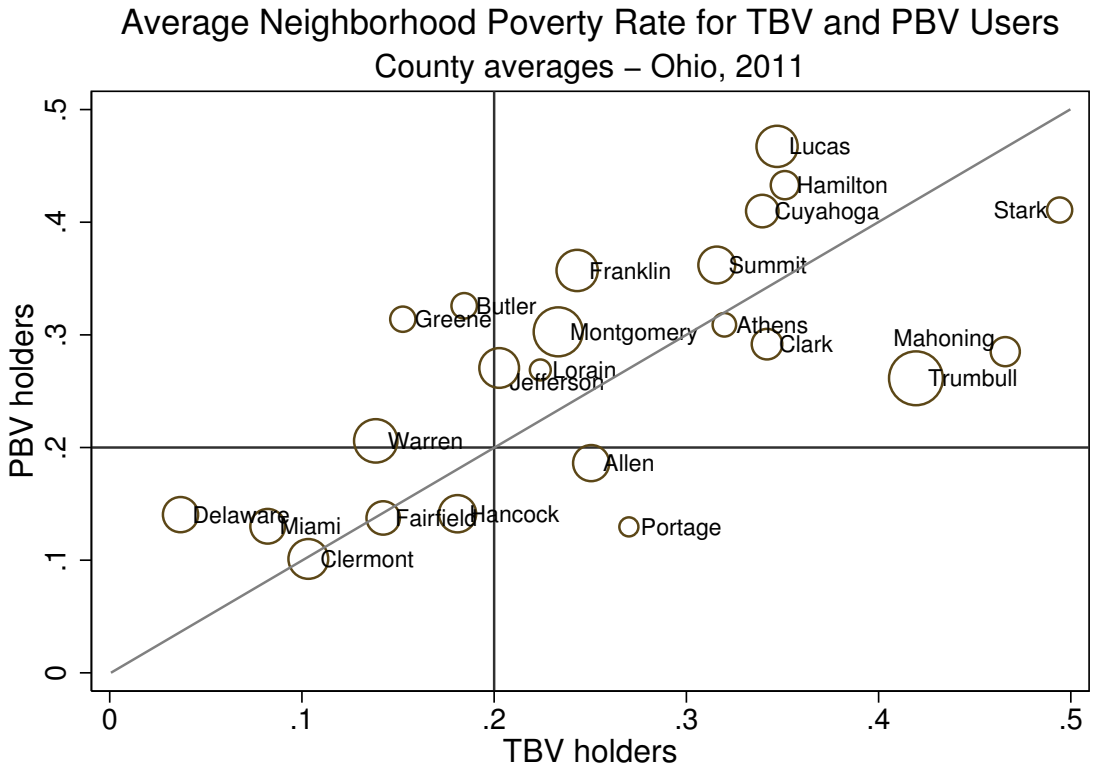

Figure 9: Average Neighborhood Poverty Rate for TBV and PBV Users. Census tract neighborhood poverty rates are from the Census 2010. Bubble size represents relative share of HCV use in LIHTC units across counties. 2011 LIHTC data is from Ohio Housing Finance Agency