Do Low-Income Housing Subsidies Increase Housing Consumption?

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ABSTRACT

A necessary condition for justifying a policy such as publicly provided or subsidized low-income housing is that it has a real effect on recipients' outcomes. In this paper, we examine one aspect of the real effect of public or subsidized housing – does it increase the housing stock? If subsidized housing raises the quantity of occupied housing per capita, either more people are finding housing or they are being housed less densely. On the other hand, if public or subsidized housing merely crowds out equivalent-quality low-income housing that otherwise would have been provided by the private sector, the housing policy may have little real effect on housing consumption. Using Census place-level data from the decennial census and from the Department of Housing and Urban Development, we ask whether places with more public and subsidized housing also have more total housing, after accounting for housing demand. We find that government-financed units raise the total number of units in a Census place, although on average three government-subsidized units displace two units that would otherwise have been provided by the private market. There is less crowd out in more populous markets, and more crowd out in places where there is less excess demand for public housing, as measured by the number of government-financed units per eligible person. Tenant-based housing programs, such as Section 8 Certificates and Vouchers, seem to be more effective than project-based programs at targeting subsidized housing units to people who otherwise would not have their own.

JEL Codes: H42, R21, R31

Through various levels of government, the U.S. spends a considerable sum subsidizing housing, as much as $25 billion in budget outlays on an annualized basis. [Quigley (2000)] These subsidies include both direct provision of housing services through public housing, and voucher programs that aim to shoulder a portion of the cost of privately provided housing, such as Section 8 housing assistance. The implicit rationale underlying both of these programs is that, in the absence of government intervention, poor people would consume inadequate amounts of housing, either because the market would deliver too little that was sufficiently affordable or poor people would choose to consume too much other goods. [Olsen (2001)]

In spite of the large expenditures on these programs, it is far from obvious whether they have any effect on whether families have their own housing units. It is possible, instead, that these programs simply transfer resources to families that would be housed even in the programs' absence. If so, one might regard the programs as wasteful and ineffectual, although such a conclusion would not necessarily follow as subsidies might allow households to occupy better housing units. In this paper we ask whether low-income housing subsidies satisfy a simple sufficient condition for effectuality: do they increase the number of families housed in their own units or do they simply crowd-out privately-provided low-income housing? In particular, if subsidized housing raises the quantity of occupied housing units per capita, either more people are finding housing or they are being housed less densely.

Using cross-sectional data on total housing, subsidized housing, and population (and other demand shifters) in 22,901 Census designated places, we find neither complete crowd out, nor that subsidized housing is all net new. We estimate that an additional subsidized unit raises the total number of units in a place by between 0.25 and 0.375 units. Lending credibility to the estimates, we find that crowd out is smaller in markets with more excess demand for the existing

public and subsidized housing stock, measured as the number of families eligible for subsidized housing per existing unit.

The impact of either public or subsidized housing on the long-run housing stock depends on the way that the housing is allocated to families. If a public unit or a voucher for use toward a privately supplied unit is awarded to a family that would otherwise not have purchased its own housing services, then the unit will be a net addition to housing consumed and no crowd out will occur. Remaining demand for private housing will not decline and in the case of a voucher an additional private unit will be built to replace the one rented by the subsidized family, presuming the long run supply of low income housing is elastic. On the other hand, if the public or subsidized unit is awarded to a family that would have purchased housing services in the absence of the program, then the program may have little effect on the quantity of housing consumed. Indeed, consistent with their reported goals, voucher and certificate-based programs seem to be doing a better job of targeting families who would not otherwise consume their own unit. An additional housing unit provided through this mechanism yields 0.7 units of net new housing while project-based housing generates less than 0.3 units of net new housing. If the goal of low-income housing programs is to house families that would otherwise not have their own units, then resources should be targeted to places with more eligible families relative to the existing stock of government-financed units or distributed through programs with sufficient flexibility to allocate the subsidies to the neediest families.

Our inquiry is related to two strands of existing research. First, this is one of many studies of whether government programs crowd out private activity. To name but a few, other recent studies on this basic topic include Cutler and Gruber (1996), on whether public insurance crowds out private insurance, and Berry and Waldfogel (1999), on whether public radio

broadcasting crowds out commercial broadcasting. Two studies by Murray (1983, 1999) examine how public housing crowd outs housing construction and the private housing stock.[1] Susin (*forthcoming*) finds that rent vouchers lead to substantially higher rents for unsubsidized low-income units. He attributes this result to higher voucher-driven demand in the low-income segment of the housing market combined with a low elasticity of supply of such housing. A low supply elasticity would imply that voucher units would substantially crowd out privately-provided low-income units, although Susin does not test that proposition and does not look at housing quantities. The second strand of research relating to this study is the literature on the value of housing subsidies to their recipients. Studies such as Olsen (2000), Barton and Olsen (1983), Murray (1978), and Currie and Yelowitz (2000) attempt to measure various benefits of subsidized housing at the family level. The focus of our study is instead on market-level equilibrium. Using cross sectional data that we presume describe a long run equilibrium, we ask how the equilibrium in the private housing market responds to the extent of subsidized housing in a market.[2]

This paper proceeds in four sections. First, we review the basic low-income housing subsidies and lay out a simple framework for analyzing their effect. Second, we describe the data used in the study. Third, we present evidence on the impact of public and subsidized housing on overall housing consumption. A brief conclusion follows.

[1] Murray (1999) estimates a vector autoregression on 27 years of the stock of public and private housing units. He concludes that public housing units added to the total housing stock but moderate income subsidies did not. Murray (1983) estimates a time series model on housing starts.

[2] Since it takes some time for the private housing market to fully respond, we believe an equilibrium analysis, rather than a time series analysis, is most appropriate.

I. Background and Mechanisms

1. Program Background

Housing subsidy programs fall into two basic categories: project-based and tenant-based. Project-based programs, such as public housing and Section 236, supply public housing units. Tenant-based programs, such as the Section 8 certificate and voucher program, give recipients a form of assistance to pay for some or all of the rent for a private unit. While in many ways quite different, these programs share the essential feature that program administrators ration access to the program's housing. That is, certain criteria must be met to be eligible for public housing, but not all eligible families receive public housing, and the most poorly housed families do not necessarily receive priority for public housing. The key question for how both programs affect housing market equilibrium is whether the families awarded housing under the programs would have dwelt in their own units in the absence of the programs.

Public housing is not necessarily free housing. A family that meets the eligibility criteria still needs to pay some rent, with an amount typically defined as a percent of family income. The primary programs through which HUD provides public or subsidized housing all require such a tenant contribution.[3] The first program is Public and Indian Housing. Beginning in 1937, HUD has paid the construction costs, and more recently the operating costs not covered by tenant rents, of public housing projects run by Public Housing Authorities (PHAs) or Indian Housing Authorities (IHAs). Tenants currently are required to pay 30 percent of their incomes as rent.

Section 8 new construction and rehabilitation, in place from 1974 to 1983, subsidized private developers to build new public housing or convert existing buildings into public housing. In addition, tenants' rent was subsidized by HUD with HUD covering the differential in rents

[3] See Olsen (2001) and Quigley (2000) for excellent descriptions of the institutional details and history of public

between what the tenant is required to pay and the fair market rent in the area.[4] As of 1983, no additional units were funded under this program, though funding was continued for existing obligations.[5]

Over the last two decades, low income housing policy has shifted from public provision of housing (public housing) toward a reliance on tenant-based assistance, such as vouchers.[6] Public housing in the US was constructed mainly in the 1960s and 1970s. As Poterba (1994) documents, new public housing starts slowed from 24,000 units in 1980 to a trickle in the late 1980s (2,000 to 3,000 per year during 1985-1987). Project based assistance continues to comprise the majority of public housing units, but the growth in tenant-based assistance is much more rapid.

The Section 8 Housing Assistance Program is HUD's current tenant-based assistance program. Eligible participants receive either certificates or vouchers good for the difference between HUD's assessment of fair market rent and 30 percent of their income. Under the certificate program, the tenants must locate a unit that meets minimum quality standards and does not rent for more than the fair market rent. They pay their share and the HUD certificate covers the remainder. The voucher program does not place a cap on the market rent of the unit. The tenants simply receive a voucher for the difference between the fair market rent and the tenant's contribution; if the tenant chooses to rent a more expensive unit they can pay the difference out of pocket. If they choose a less expensive unit, their contribution is reduced.

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housing.

[4] "Fair market rent" is defined by HUD for each geographical area.

[5] Olsen (2001) reports that prior funded construction continued for more than a decade.

[6] There is one big exception to this statement: the Low-Income Housing Tax Credit provides a tax subsidy to private developers if they make their units available to a sufficient number of low-income families. This form of assistance is expected to grow. [Olsen (2001)]

Table 1 provides a summary of the size of various programs targeted at low-income families in 1996. A total of eight basic programs provided 4.81 million housing units, or 4.2 percent of the nearly 116 million housing units in the U.S.[7] By far the largest programs are Section 8 Certificates & Vouchers (1.34 million units) and Public Housing (1.33 million units). The Section 8 New & Substantial Rehabilitation program provides 0.88 million units. Other public housing programs include Section 236 (0.45 million units), the low income housing tax credit (0.33 million units), Section 8 Moderate Rehabilitation (0.11 million units), Indian Housing (0.07 million units) and miscellaneous other programs providing a total of 0.29 million units.

To receive a public or subsidized unit, one must satisfy a fairly complicated set of eligibility criteria and also be selected from within the pool of eligible applicants. The primary restriction on eligibility is income. A family of four can earn no more than 80 percent of their area's median income to be eligible.[8] In recent years, Congress has enacted preferences for "very low income" families: to be so classified, a family of four must have an income less than 50 percent of the median.[9] Choosing which families from the large pool of eligibles would receive public housing is up to each of the approximately 3400 local public housing authorities though preference is typically given to the elderly, people living in "substandard" housing, and those paying more than 50 percent of their income as rent. [Olsen (2001)]

[7] Source: "Census 2000 Quickfacts," http://quickfacts.census.gov/hunits.
[8] This cap varies with family size.
[9] In addition there are now some preferences for families with incomes below 30 percent of the median, though these rules were not in effect during the time period covered by our data.

2. Policy Mechanism

At face the programs that operate through increasing the supply of housing (such as public and Indian housing, as well as some parts of Section 8) would appear to affect the housing market differently than the programs such as Section 8 Certificates and Vouchers, that operate on the demand side. Yet, all of these programs share an important feature: administrators choose how to allocate housing to eligibles, leaving the remainder of the (private) market to equilibrate.[10] The process of allocating housing units (or vouchers, as we shall see below) provides the demand management that determines the equilibrium impact of the program.

It is instructive to consider the effects of the two basic kinds of housing programs using simple supply and demand analysis. We first consider publicly provided housing. Publicly provided units are public supply. When they are built they shift aggregate housing supply out. If prices adjust so that markets clear, then the number of units consumed will initially rise by the number of public units made available. How the public units are allocated, however, determines whether in the long run they raise housing consumption. Suppose that each new public housing unit is allocated to a family that was formerly unable to purchase housing and was sharing a unit with another family. Then the public housing policy provides new demand and supply. The unit occupied by the recipient family represents a transaction that would otherwise not have occurred. This transaction, however, has no effect on the private market. Because the family would not have purchased housing in the private market, private demand is not reduced. Because the new supply is rationed only to families with no private demand, the public supply has no effect on the

[10] For the purpose of this exposition, it is easiest to view privately owned units that are rented using section 8 certificates or vouchers as public housing. One can view the future stream of section 8 payments that the landlord will receive as the means by which the housing is purchased for the virtual public stock.

private market. Put another way, the public unit would raise the total housing stock by one unit. No crowd out would occur.

Had the public unit been allocated to an inframarginal family – one purchasing private housing without the program, the program would reduce demand for private housing. With such a rationing scheme, the equilibrium impact of the public housing unit would be a reduction by one in the number of private units. Put another way, the public housing unit would not raise the number of units in the housing stock. Crowd out would be complete.[11]

While voucher programs do not provide public supply, their potential effect on demand is the same. A certificate or voucher can be awarded to a family that would have purchased private housing in the absence of the program, or it can be awarded to a family that would not have purchased such housing. In the former case, demand for housing where landlords do not accept vouchers falls by the number of voucher units allocated. Vouchers do not raise the number of units in the stock, and crowd out is complete. In the latter case, demand for non-voucher housing is unaffected. In the long run vouchers provide new demand, and the private market responds with additional private units.

Thus far, our exposition has assumed that the long run supply of privately-provided low income housing is perfectly elastic and thus the quantity of low-income housing adjusts to public subsidies but not the price. If the housing supply curve is upward-sloping in the long run, the degree of crowd out, when measured in terms of units, would be smaller. A new public unit allocated to a family not already consuming a unit would still lead to one unit net addition to the housing stock, and no effect on private demand. But suppose the public unit were instead

[11] In the short run, constructing public housing units would increase the aggregate housing supply in a market. However, the resulting lower house prices would lead to fewer additional units being constructed than otherwise would have. If the public housing units were of a higher quality than the private housing they displaced, the overall

allocated to a family that already had a private unit. This would reduce the private demand for units by one, and the supply of private housing would ultimately fall, but not by a full unit; and the new equilibrium would also entail lower rents. Similarly, a voucher given to an already-housed family would have no net effect on the aggregate number of housing units. A voucher allocated to an unhoused family would lead to a partial, but not one-for-one, increase in the number of units, along with a new equilibrium with higher rents.

Recent research [Susin (*forthcoming*)] presents evidence that the long-run housing supply elasticity is low. While we cannot resolve the housing supply elasticity question in this paper, two points are in order. First, the possibility of inelastic supply shrinks the possible effect of subsidies on housing consumption and thus makes any effect more difficult to identify. Second, a low supply elasticity implies that housing consumption should respond differentially to vouchers vs. public housing. If supply is inelastic, then voucher policies which directly stimulate only demand should have smaller effects on quantity than public housing programs which (unless they are accompanied by demolition) stimulate both supply and demand. As we will see in the empirical section, vouchers have bigger effects on consumption than public housing, consistent with relatively elastic long run supply.

Our schematic description leaves out a few important features of the housing market. First, we are focusing on units. Even if a public housing program has no effect on the number of units in the stock, it may affect the quality of units consumed. Second, a public housing program may affect where recipients choose to live in potentially beneficial ways. [Katz *et al* (2001)] Finally, we are abstracting from the income transfer portion of the program. Rent subsidies, even to people who would have rented their own unit in the absence of the program, is one way of

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quality of low income housing could increase without any apparent change in the number of units.

transferring income to the needy. Public or subsidized housing may provide a way for families with high rent burdens to reduce the proportion of their incomes they devote to housing, even if they are already housed. In addition, if public housing is suitably stigmatized it may be an optimal way of identifying valid recipients of public assistance. [Nichols and Zeckhauser (1982)]

II. Data

The ideal unit of observation for our study would be a market area. That is, we are trying to ascertain the impact of public housing on total housing. A narrow geographic unit, for example a census tract, would be inappropriate as a unit of observation for our study because the private housing built in the adjustment to the new equilibrium following the introduction of subsidized housing would likely be outside the tract. The data we employ for this study is a cross section of 22,901 Census designated places. Places are political units such as cities and towns.[12] By using places, we are implicitly assuming that the private market adjustment to the low-income housing programs occurs inside of the political jurisdictions where the subsidized housing is located. As we document below, much of the public and subsidized housing is located in large, urban places, suggesting that our treatment of places as markets is reasonable.

Our basic cross section matches data on total housing stock, population, and other demand determinants in each Census place from the 1990 decennial Census with data on the number of public and subsidized housing units, also by Census place, for 1996 from HUD's "A Picture of Subsidized Households – 1996." The HUD data set reports project- and housing authority-level data that we aggregated up to the Census place level. While the timing of the

[12] We exclude places with a ratio of public and subsidized units per capita greater or equal to 0.5, as well as places with 1.1 or more total housing units per capita. These restrictions keep places such as resort communities, with many housing units but few permanent residents, out of the sample.

matches between the public housing and the Census data is imperfect, it is the best we could obtain.[13] In addition, we have earlier 1977 HUD data, as well as 1980 Census data which we use to create instruments, as we outline below.

Table 2 reports the means and standard deviations of some of the data we use most frequently, weighted by the population of the Census place. On average, about 2.7 people live in each housing unit (1/0.376). There is less than one public or subsidized housing unit for every 50 people in the U.S. (a ratio of 0.018), of which 72 percent (0.013/0.018) is project-based housing and 28 percent is tenant-based. The "pressure" variable indicates that, on average, there are three times as many "eligible" recipients of public or subsidized housing than there are units. About 13 percent of the population in all these Census places are over 65 years of age and approximately 14 percent are Black.

Public housing is disproportionately concentrated in large places. As table 3 shows, 93.5 percent of public and subsidized housing is located in the top 25 percent of markets, while these markets contain 88.1 percent of total housing and 88.6 percent of the population. The top percentile of places contains just over half the public and subsidized housing in the U.S. The same places contain just over a third of the population and total housing units. Indeed, the top 20 markets, listed in table 4, together include 22 percent of public and subsidized housing. New York City alone has a quarter of a million public or subsidized units, about 7.5 percent of the national total.

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[13] Although HUD maintains a data set on public housing in 1993 (See http://www.huduser.org/data/data.html for information on Family Data on Public and Indian Housing (1993)), that data source contains information only on projects, not certificate and voucher programs. According to HUD employees, it appears that historic public and subsidized housing data was not archived. Thus it is impossible to go back and construct data on the quantities of public and subsidized housing in, say, 1990.

III. Empirical Strategy and Results

Our empirical approach is to ask whether markets with more public housing have more total housing units, after accounting for other potential determinants of the number of housing units. If places with more public housing units do not have more total housing units than they would have in the absence of public housing, we can conclude that public housing does not increase the housing stock and must have crowded out private provision of low-income housing. If places with more public housing units have a greater number of total housing units, all else equal, some public housing must be net new. We recognize the possibility that public and subsidizing housing units may be endogenous, so we also employ an instrumental variables strategy that we describe below.

To measure the impact of low-income housing policy on the private housing market equilibrium, we first regress the quantity of public and subsidized housing in a place on the total quantity of housing in the place. Because the places differ enormously in size, we run the regressions in per capita terms, weighting using population. This cross sectional strategy assumes private housing markets are in equilibrium. That is, the private housing stock must have fully adjusted to the presence of public housing. If public housing has been constructed or vouchers funded recently, the private market may not have had time to respond, biasing our results.[14] For example, in the short run, building a public unit *must* increase the housing stock by one unit since no private units have been removed from the housing stock. Similarly, allocating a new voucher would have no effect on total housing in the short run since private developers would not yet have had the opportunity or time to build anew. These outcomes would make

[14] The private market response may be fairly rapid. If public housing is constructed, private housing units do not have to fall down for the market to reach equilibrium. If there is population growth, developers simply can construct less new supply than otherwise would have been the case.

public housing look very efficient and vouchers look like they had no effect on housing consumption, even if in the long run the private housing market would have fully responded.[15]

To surmount this potential problem, we use the total *occupied* housing stock per capita as our left-hand-side variable. If a new public housing unit is allocated to someone who would have consumed a housing unit anyway, it will have no effect on the aggregate occupied housing stock. However, if it induces someone to move away from sharing a unit to living on their own, it will increase the number of occupied units. Similarly, we use occupied public and subsidized housing units per capita as our independent variable.[16] Using the total housing stock, rather than just occupied, yields very similar results.[17]

The results are reported in table 5. Specification one includes the distribution of race, the distribution of age across 12 categories, the distribution of family income across 25 categories, and the median family income as controls. The second specification adds state fixed effects to control for possible unobserved heterogeneity. The crowd-out effects are then identified from differences in public housing in places within the same state. The coefficient on total public and subsidized housing per capita varies from around 0.27 to about 0.37, and is large relative to its standard error. We can clearly reject both that the coefficient is zero and that it is one. Thus, the full sample estimates are inconsistent with both full and zero crowd out, suggesting instead that three additional public or subsidized units add one unit to the aggregate stock, crowding out about two private units. The controls explain a significant fraction of the cross-sectional variance in occupied housing units per capita, almost 80 percent.

[15] In fact, Murray (1999) finds the aforementioned pattern, suggesting that his time series analysis may be picking up a short-run effect.

[16] HUD reports occupancy rates only for public housing. HUD points out that the other forms of housing assistance are more-or-less fully occupied and reports the data accordingly. Whether we use occupied or total public housing is inconsequential.

Because public housing is skewed toward large places, we re-estimate the equations for each quartile of places, ranked by population. Columns one and two of table 6 replicate the specifications in table 5 and report just the coefficient on occupied public and subsidized housing for several size categories of Census places. A pattern that emerges in the table is that crowding out is less in larger places. In the bottom quartile, each public or subsidized unit adds only 0.06 of a unit to the long-run housing stock. But for places with an above the median population, crowd out is between 0.8 and 0.6 private units for each public unit. Since population is skewed, with many people in the top few percent of Census places, the largest cities may drive the results in columns 1 and 2. Specification 3, rather than weighting each place by population, weights each Census place equally. This emphasizes where in the population distribution the results are coming from. The results are very similar to the weighted regression suggesting that our model is well-specified.[18]

1. Crowd Out and the Pressure on Public and Subsidized Housing

Since public housing crowds out privately provided low income housing only to the degree that the recipients of the subsidy did not really need it to obtain a unit, one might expect that public housing will be more efficient in places where there is more excess demand for it. That is, we expect the extent of crowd-out that our approach measures to be smaller in markets with greater pressure on the public and subsidized housing supply. (Finding this pattern will also lend additional credence to our estimation approach).

[17] The standard errors are comparable and the point estimates on the public housing variable varies by about 0.10.
[18] Since we have data on public housing in 1977 – tenant-based programs did not yet exist – we could run an analogous set of regressions for crowd out in 1980. When we do so, the results are economically and statistically similar.

We proxy for the level of demand pressure for public housing with the number of eligible recipients relative to the existing public housing supply.[19] According to public and subsidized housing eligibility rules, a family of four is eligible only if its income falls short of 50 percent of the local family median income.[20] Using Census data on the number of families in each of the 25 income cells, we compute rough numbers of eligible families per Census place. We then calculate an index which is the number of total public and subsidized units per eligible family. For markets where this index is small, the pressure on public housing is greater. We allow the extent of crowd out to differ across places according to the amount of pressure on public housing by adding an interaction of public and subsidized housing per capita with the index.[21] A higher value of the index indicates less pressure on public and subsidized housing. Because we expect more crowding out where there is less pressure on the government-supported low-income housing stock, we expect a negative coefficient on the interaction term.

Table 7 reports the estimated coefficients on public and subsidized housing per capita, demand "pressure" on public housing, and the interaction of the two. The specifications mirror those in table 5. The coefficients on public housing per capita vary between about 0.38 and 0.51, and the coefficients on the interaction term are uniformly negative. All are very precisely estimated.[22] The middle three rows of the table report estimates of the effect adding one more unit of public and subsidized housing would have on total housing, evaluated at the 25th, 50th,

[19] One could imagine using the length of the waiting list or the local eligibility rules for this purpose. However, waiting lists are poorly measured and are capped and eligibility rules vary by public housing authority and are difficult to obtain. [Olsen (2001)]

[20] As our discussion of the rules above indicates, some families with up to 80 percent of local median income may also be eligible, although spots for such families are limited.

[21] Among the 10,049 places with public housing, the values of the index at various points of the distribution are .0081301 (5th percentile), .0931011 (25th percentile), .2822478 (median), 0.5106383 (75th percentile), 0.7647059 (90th percentile), and 0.9714286 (95th percentile). The mean value of the index is 0.3715442.

[22] We also estimated the regressions underlying table 7 using only places with public housing, and results were virtually identical.

and 75th percentiles of the distribution of the pressure index (among the 10,049 places with public housing). Focusing on specification (2), we see that in places with little public housing per eligible family (high pressure), an additional public or subsidized unit raises total housing by 0.49 units. At a place with the median value of the index, the effect falls to 0.47. In places with relatively plentiful public housing relative to the eligible population, the effect drops to 0.44. These estimates show that public housing has a greater effect on total housing - and therefore whether families occupy their own housing units - in places with relatively little public housing. We interpret this to mean that in places with relatively more public housing, the marginal recipient family would have been more likely to occupy a (private) unit in the absence of the housing policy.

2. Project-based versus tenant-based assistance

While to this point we have treated project-based and tenant-based assistance as having similar effects on the private housing stock, that need not be the case. Since U.S. policy is moving away from project-based public housing towards more tenant-based assistance [Quigley (2000)], it would be worthwhile to determine whether vouchers and certificates lead to more or less net new housing than do project-based public housing programs.

Separately identifying the crowd-out effects of project- and tenant-based programs could also shed additional light on the believability of our results. *A priori*, one would not necessarily expect any differential crowd-out effect between the two types of programs. If there are differences in eligibility, however, the program that is more targeted towards families that otherwise would not be housed should exhibit less crowd-out. Olsen (2001) claims that vouchers and certificates are given to *more* needy recipients than project-based housing since

administrators want to avoid concentrations of poverty in housing projects.[23] If this claim is true, we should see tenant-based programs generating more net new housing than public housing. On the other hand, if the housing markets were not truly in equilibrium or long-run supply were not fully elastic, we would expect to find that public housing creates more net new housing since it actually constructs new units. Certificates and vouchers would have little-to-no effect on the total housing stock since they are merely reallocating an existing unit.

Table 8 tests these hypotheses and finds support for the first one, that tenant-based housing is more likely to go to people who would not otherwise have had their own housing units. The specifications are the same as in table 5, with even-numbered columns including state fixed effects. In the first panel, we estimate the effect of project-based public housing on the total stock of housing units.[24] An additional unit of occupied public housing is estimated to increase the total occupied housing stock by only 0.21 to 0.33 units, crowding out 0.7 to 0.8 private units. In the second panel, an additional unit of tenant-based assistance increases the occupied housing stock by more than 0.7 units, crowding out less than one-third of a private housing unit.

The third panel of table 8 includes both project-based public housing per capita and tenant-based housing per capita as explanatory variables in case the quantities of project- and tenant-based units in a Census place are related. Once again, we find evidence that tenant-based housing crowds out less private housing than project-based public housing does. An additional unit of project-based housing is estimated to increase the total occupied housing stock by just

[23] In addition, the Low-Income Housing Tax Credit program allows landlords to charge 30 percent of the maximum eligible income – 50 percent of the local median – as rent, pricing out all but the highest income eligible families.
[24] Project-based housing is defined as Public and Indian housing, Section 236, Section 8 new construction and substantial rehabilitation, and the low-income housing tax credit. Tenant-based housing is Section 8 certificates and vouchers and "other."

0.16 to 0.29 units, while one more unit of tenant-based housing would increase the occupied housing stock by approximately 0.65 units.[25]

3. Instrumental Variables

Our empirical strategy thus far allows inference about the effect of public and subsidized housing on total housing if the variation in total public housing were exogenous. If public and subsidized housing is located in markets for reasons related to unobserved determinants of total housing, then ordinary least squares (and other such approaches) will yield biased estimates of the effect of public and subsidized housing on the private housing market equilibrium.[26]

As we pointed out earlier, almost all public housing in the US was built prior to the late 1980s. It seems likely that public housing, when first erected, was placed in its locations for reasons related to the demand for housing. However, if the reasons for locating public housing change over time (i.e. so that if public housing were built today from scratch, its distribution across markets would be different), then it will be reasonable to view the quantities of public housing as exogenous.

The quantity of section 8 certificates and vouchers is another matter, since it did not exist in the late 1970s. However, the budget rules that determine the funding for each locality, and thus the number of public housing units or vouchers it can provide, is set by statute. The current

[25] One should resist the temptation to extrapolate from these results that all housing programs should be tenant-based. If the differences between them are simply due to program administrators giving the vouchers to the most needy recipients, moving the public housing recipients into the voucher program will merely increase the amount of crowd-out due to the voucher program. It could also be that since tenant-based housing assistance is not as historically determined, it is allocated more to the places with the greatest need and thus is more efficient. That would argue for moving away from the existing project-based housing and turning towards the more flexible voucher system.

[26] Another potential source of bias is that people may move to where there is more public housing. Painter (1997) finds little within-metro area moving in response to local disparities in the length of waiting lists. However, he does not provide evidence on moving across metropolitan areas to obtain public housing. Such mobility would imply that

budgeting rules start with the level of appropriations allocated by Congress for a given year. From that, anything previously agreed to or that needs ongoing spending must be paid. Second, HUD pays for anything Congress specially asks for. Finally, the remainder is divided among allocation areas according a score that is determined by the area's proportion of the national total of: (a) the renter population (20 percent), (b) renters in poverty (20 percent), (c) rental occupancy that is more than 1.01 persons/room (10 percent), (d) the number of rental units needed to raise market vacancy rate to normal levels (10 percent), (e) number of rental units built before 1940 occupied by impoverished (20 percent), (f) other measurable conditions (20 percent). That division is constrained by rules that HUD cannot spend less than 0.5 percent on any single state and cannot spend less than 25 percent in nonmetropolitan areas.

Of these rules, we deem a portion of rule (e) to be reasonably exogenous. Accordingly, we will instrument with the number of rental units in the Census place built before 1940. Presumably the number of impoverished may be endogenous so we leave that portion of the budget rule out of our instrument set.

We reestimate our base specifications, first employing both instruments: the number of public housing units per capita in 1977-1980 and the number of housing units per capita built prior to 1940. Then we try instrumenting with each separately. The results are reported in table 9, with the first stage regressions shown in appendix table A. Once again, the specifications mirror those in table 5.

Instrumenting seems to increase the measured crowd-out relative to table 5. The estimated coefficient on the total occupied public and subsidized units drops by 75 percent (from its value in table 5) to 0.067 (0.024). This implies that an additional public unit has almost no

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we underestimate the effect of subsidized housing on net new housing units.

effect on the total housing stock. When we add state fixed effects, the coefficient increases from its table 5 value of 0.37 to 0.48, implying less crowd-out. The next two panels, which include each instrument separately, suggest why state fixed effects change the estimates so much. Columns 3 and 4 show that instrumenting with the 1977 public housing units per capita leads to a finding of complete or almost-complete crowd out (0.026 net new units when we estimate without state dummies and 0.211 net new units when the state controls are included.) Column 5, where we instrument with the number of housing units per capita built before 1940, finds the same effect: one new public unit leads to 0.18 (0.04) net new units overall. The results obtained in column 6, including state dummies, show an implausibly large effect of public and subsidized housing on total housing. We surmise that this arises because the pre-1940 housing stock, while it varies across states reflecting historical state-by-state settlement patterns, does not vary substantially within states. This curious result explains which the column 2 coefficient exceeds its analogue in table 5.

While our instruments are not enormously successful, our IV results provide support for our basic OLS and fixed effects estimates showing that low-income housing subsidies increase housing consumption. For two reasons, we believe that the IV results provide a lower-bound on the true net effect of housing subsidies on aggregate housing units. First, especially in columns (3) and (4), our instrument mainly reflects the amount of public housing in an area. Because vouchers may not be allocated in the same manner as public housing is distributed, the IV estimates are best compared to the estimates of the effect of project-level assistance on total housing, which we document in table 8 to be much smaller than the effect of tenant-level assistance. Viewed that way, the IV estimates are not so different from the OLS results, although they are still smaller. Second, a plausible kind of possible endogeneity in our 1980 public

housing unit instrument will tend to drive our IV results toward zero. Suppose that public housing units were allocated in greater amounts where they were most necessary, for example in places where there are too few units per capita. If the need for public housing were persistent enough that the 1977 distribution were not completely exogenous in the 1990s, there would be more public housing in places with less private-market housing, which would appear in these estimates as larger crowd-out, or little net program effect on total housing units.

IV. Conclusion

A simple but natural test for public housing programs is whether they allow families that would otherwise not have, to occupy their own housing units. Given equilibrium housing market responses to government programs, it is by no means obvious that programs that place families into their own housing units will raise the total number of families occupying units. The effect of such programs depends crucially on whether recipient families would have occupied their own units in the absence of the programs.

We provide a simple evaluation of this question. We ask whether places with more public and subsidized housing also have more total housing, after accounting for housing demand. We find that government-financed units raise the total number of units, although on average three government-subsidized units displace two units that would otherwise have been provided by the private market. There is less crowd out in more populous markets, and less crowd out in places where excess demand for public housing is higher because there are fewer government-financed units per eligible person. Tenant-based housing programs seem to be more efficient at providing housing units to people who otherwise would not have their own. These results remain even with sensible instruments.

We take these results to be an indication of a positive real effect of low-income housing subsidies. Because we observe an aggregate increase in the number of units, the programs do not merely redistribute the same housing among the population. These results are also sufficient (though not necessary) for the program to have a real economic impact. Alternative effects of public and subsidized housing programs would make our results more difficult to find – such as subsidies affecting equilibrium rents rather than quantities of housing consumed – and often further support our conclusion of a real benefit. For example, subsidized housing may also improve the quality of housing consumed and, since it is also an income transfer, it may raise non-housing consumption.

However, much work remains. Public provision of housing is typically quite costly. [Olsen (2000)] In addition, Susin (*forthcoming*) points out that if vouchers lead to higher market rents, on net the programs might transfer income from tenants to landlords. The rudimentary measure of housing consumption we examine here, the number of units consumed, is insufficient to determine whether public housing programs are the most efficient way of subsidizing low income housing or targeting low-income families for financial assistance. All of the factors mentioned above would need to be weighed when determining whether the government should provide a private good, such as housing.

References

Berry, Steven T. and Joel Waldfogel. "Public Radio in the United States: Does it Correct Market Failure or Cannibalize Commercial Stations?" *Journal of Public Economics* 71 (1999), 189-211.

Currie, Janet, and Aaron Yelowitz. "Are Public Housing Projects Good for Kids?" *Journal of Public Economics* 75 (2000), 99-124.

Cutler, David M. and Jonathan Gruber. "Does Public Insurance Crowd Out Private Insurance?" *Quarterly Journal of Economics* 111 (1996): 391-430.

Katz, Lawrence, Jeffrey Kling and Jeffrey Liebman. "Moving to Opportunity in Boston: Early Results of a Randomized Mobility Experiment." *Quarterly Journal of Economics* 116 (May 2001), 607-654.

Murray, Michael P. "Methodologies for Estimating Housing Subsidy Benefits." *Public Finance Quarterly* 6 (1978): 161-192

----------. "A Potential Hazard of Housing Allowances for Public Housing." *Journal of Urban Economics*. Vol. 4 (2). p 119-34. April 1977.

----------. "Subsidized and Unsubsidized Housing Starts: 1961-1977." *Review of Economics and Statistics* 65 (1983):590-597.

----------. "Subsidized and Unsubsidized Housing Stocks 1935 to 1987: Crowding Out and Cointegration," *Journal of Real Estate Finance and Economics* 18 (1999): 107-124.

----------. "Tenant Benefits in Alternative Federal Housing Programmes." *Urban Studies* 17 (1980): 25-34.

Nichols, Albert and Richard Zeckhauser. "Targeting Transfers through Restrictions on Recipients." *American Economic Review* 72 (May 1982), 372-377.

Olsen, Edgar O. "The Cost-Effectiveness of Alternative Methods of Delivering Housing Subsidies." *Mimeo, University of Virginia*, December 2000.

Olsen, Edgar O. "Housing Programs for Low-Income Households," *NBER Working Paper #8208,* April 2001.

Olsen, Edgar O. and David M. Barton. "The Benefits and Costs of Public Housing in New York City." *Journal of Public Economics* 20 (1983): 299-332.

Painter, Gary. "Does Variation in Public Housing Waiting Lists Induce Intra-Urban Mobility?" *Journal of Housing Economics* 6 (1997), 248-276.

Poterba, James M. “Public Policy and Housing in the United States.” *Housing markets in the United States and Japan*. Noguchi, Yukio Poterba, James M., *eds*., National Bureau of Economic Research Conference Report. Chicago and London: University of Chicago Press. p 239-56. 1994.

Reeder, William. “The Benefits and Costs of the Section 8 Existing Housing Program.” *Journal of Public Economics* 26 (1985), 349-377.

Quigley, John. “A Decent Home: Housing Policy in Perspective.” *Brookings-Wharton Papers on Urban Affairs*, 2000, pp. 53-88.

Susin, Scott. “Rent Vouchers and the Price of Low-Income Housing,” *Journal of Public Economics*, forthcoming.

Table 1: Number of Public or Subsidized Housing Units, By Program

Program	Number of housing units
Public	1,326,224
Indian	67,744
Section 8 Certificates and Vouchers	1,346,306
Section 8 Moderate Rehabilitation	105,845
Section 8 New Construction and Substantial Rehabilitation	897,160
Section 236	447,382
Other Subsidy	292,237
Low-Income Housing Tax Credit	332,085
Total	4,814,983

Source: A Picture of Subsidized Households, December 1996; www.huduser.org

Table 2: Summary Statistics

Variable	Mean	Standard Deviation	Number of Observations
Total occupied housing units per capita	0.376	0.045	22,875
Total occupied public and subsidized housing units per capita	0.018	0.016	22,875
Total occupied project-based housing units per capita	0.013	0.013	22,875
Total occupied tenant-based housing units per capita	0.005	0.005	22,875
Public housing “Pressure”	0.322	0.270	22,630
Public units * Pressure	0.010	0.021	22,630
Percent 65+	0.130	0.060	22,875
Percent Black	0.140	0.175	22,875
Percent American Indian	0.007	0.035	22,875
Percent Asian	0.037	0.067	22,875
Percent other race	0.049	0.076	22,875

Notes: Summary statistics are weighted by population.

Table 3: Census Place Distributions

Percent of Census Places, ranked by population	Percent of public and subsidized housing units in sample	Percent of total housing units	Percent of population	Number of public and subsidized housing units per capita	Average Population	Number of Census-Designated Places
Full sample	100.0	100.0	100.0	0.010	7,808	22,901
Top 50 percent	98.6	96.5	96.7	0.013	15,098	11,448
Top 25 percent	93.5	88.1	88.6	0.015	27,632	5,725
Top 10 percent	82.0	72.8	73.1	0.016	57,059	2,290
Top 5 percent	72.2	60.6	60.6	0.018	94,522	1,145

Table 4: Population, Public (and Subsidized) and Total Housing, and Eligibles for Places with Large Amounts of Public (and Subsidized) Housing

Rank by public and subs'd housing	Place	Population	Public Housing	Total Housing	Eligible
1	New York city	7,322,564	249,924	2,992,169	455,108
2	Chicago city	2,783,726	83,344	1,133,039	181,758
3	Los Angeles city	3,485,398	54,272	1,299,963	192,818
4	Baltimore city	736,014	38,298	303,706	44,852
5	Philadelphia city	1,585,577	36,831	674,899	108,167
6	Boston city	574,283	30,923	250,863	29,793
7	Dallas city	1,006,877	30,700	465,579	60,720
8	Atlanta city	394,017	25,923	182,754	29,430
9	Detroit city	1,027,974	24,857	410,027	80,457
10	Houston city	1,630,553	22,319	726,402	112,197
11	Newark city	275,221	21,906	102,473	18,926
12	Columbus city	632,910	21,889	278,102	34,692
13	Cleveland city	505,616	21,660	224,311	36,979
14	San Antonio city	935,933	20,363	365,400	61,220
15	Pittsburgh city	369,879	19,955	170,159	22,830
16	San Francisco city	723,959	19,749	328,471	36,163
17	New Orleans city	496,938	19,605	225,573	37,719
18	St. Louis city	396,685	18,678	194,919	23,590
19	Milwaukee city	628,088	18,322	254,204	39,120
20	Nashville-Davidson (remainder)	488,374	17,838	219,521	27,298
21	Memphis city	610,337	16,728	248,573	41,727
22	Seattle city	516,259	16,344	249,032	22,026
23	Cincinnati city	364,040	15,732	169,088	24,317
24	Kansas City city	435,146	15,332	201,773	25,480
25	Denver city	467,610	14,784	239,636	27,871
26	Oakland city	372,242	14,398	154,737	23,714
27	Louisville city	269,063	13,775	124,062	19,523
28	Minneapolis city	368,383	13,671	172,666	18,947
29	Birmingham city	265,968	13,254	117,636	17,501
30	San Diego city	1,110,549	12,263	431,722	54,311
31	Buffalo city	328,123	12,125	151,971	21,446
32	St. Paul city	272,235	12,011	117,583	14,113
33	El Paso city	515,342	11,334	168,625	36,701
34	Portland city	437,319	11,331	198,319	22,575
35	Akron city	223,019	10,936	96,372	13,942
36	Phoenix city	983,403	10,640	422,036	52,688

37	Tulsa city	367,302	10,466	176,232	23,051
38	Richmond city	203,056	10,214	94,141	12,502
	Total in above places	34,100,000	1,032,694	14,300,000	2,106,272

Sources: Population, total housing, and public-housing eligibles: 1990 Census. Public and subsidized housing data are derived from HUD's Picture of Subsidized Housing, 1996.

Table 5: The Effect of Public and Subsidized Housing on Total Occupied Housing Units

	(1)	(2)
Total public and subsidized housing units per capita	0.268 (0.012)	0.369 (0.012)
Percent Black	-0.033 (0.001)	-0.020 (0.001)
Percent American Indian	-0.036 (0.004)	-0.051 (0.004)
Percent Asian	-0.079 (0.002)	-0.080 (0.004)
Percent other race	-0.126 (0.002)	-0.117 (0.003)
Constant	0.333 (0.023)	0.349 (0.023)
State dummies	No	Yes
Other covariates	Yes	Yes
Adjusted R^2	0.76	0.80

Notes: Left-hand-side variable is total occupied housing per capita. Standard errors are in parentheses. Regressions are OLS, weighted by population. There are 22,870; each is a Census-designated place. The omitted race category is "white." The "other" covariates that are included but not reported are: the income distribution across 24 categories, the age distribution across 12 categories, and the median family income.

Table 6: The Effect of Public and Subsidized Housing on Total Occupied Housing Units, by population of the Census-designated place

Percent of Census Places, ranked by population	(1)	(2)	(3)
Bottom quartile	0.065 (0.021)	0.064 (0.021)	0.060 (0.025)
Second quartile	0.160 (0.021)	0.154 (0.021)	0.145 (0.021)
Third quartile	0.245 (0.023)	0.221 (0.024)	0.205 (0.023)
Top quartile	0.197 (0.025)	0.375 (0.026)	0.360 (0.027)
State dummies	No	Yes	Yes

Notes: Left-hand-side variable is total occupied housing per capita. The reported coefficients are the estimates for "total occupied public and subsidized housing units per capita." Standard errors are in parentheses. Each observation is a Census-designated place. Specifications (1) and (2) are weighted by population, specification (3) is not. All regressions include controls for the age, racial, and income distributions, and the median family income. Specifications (2) and (3) add state dummies.

Table 7: Crowd-Out is Lower in Places Where There is Less Public Housing Relative to the Needy Population

	(1)	(2)
Total public and subsidized housing units per capita	0.377 (0.041)	0.506 (0.040)
Public housing "Pressure"	0.003 (0.002)	0.001 (0.002)
Public units * Pressure	-0.143 (0.011)	-0.135 (0.010)
∂ Public / ∂ Pressure, evaluated at:		
25^{th} percentile of Pressure (0.511)	0.304 (0.041)	0.437 (0.039)
50^{th} percentile of Pressure (0.282)	0.336 (0.041)	0.468 (0.039)
75^{th} percentile of Pressure (0.093)	0.363 (0.041)	0.493 (0.040)
State dummies	No	Yes
Adjusted R^2	0.7664	0.7966

Notes: Left-hand-side variable is total occupied housing per capita. Standard errors are in parentheses. There are 22,630 observations, each is a Census-designated place. Regressions are weighted by population. Public housing "Pressure" is the number of public housing units divided by the number of people that have less than 50 percent of the median family income. All regressions include controls for the age, racial, and income distributions, and the median family income. Specification (2) adds state dummies.

Table 8: Do Project-based and Tenant-based Assistance Have Different Rates of Crowd-Out?

	Project-based assistance		Tenant-based assistance		Project and Tenant-based Assistance	
	(1)	(2)	(3)	(4)	(5)	(6)
Occupied project-based housing per capita	0.209 (0.014)	0.334 (0.015)			0.156 (0.014)	0.287 (0.015)
Occupied tenant-based housing per capita			0.715 (0.030)	0.729 (0.029)	0.660 (0.030)	0.644 (0.029)
Percent Black	-0.032 (0.001)	-0.018 (0.001)	-0.031 (0.001)	-0.019 (0.001)	-0.032 (0.001)	-0.021 (0.001)
Percent American Indian	-0.039 (0.004)	-0.054 (0.004)	-0.040 (0.004)	-0.055 (0.004)	-0.037 (0.004)	-0.051 (0.004)
Percent Asian	-0.079 (0.002)	-0.078 (0.004)	-0.079 (0.002)	-0.074 (0.004)	-0.080 (0.002)	-0.079 (0.004)
Percent other race	-0.127 (0.002)	-0.119 (0.003)	-0.129 (0.002)	-0.117 (0.003)	-0.127 (0.002)	-0.117 (0.003)
Constant	0.336 (0.024)	0.353 (0.023)	0.339 (0.023)	0.335 (0.023)	0.335 (0.023)	0.343 (0.023)
State dummies	No	Yes	No	Yes	No	Yes
Adjusted R-squared	0.76	0.79	0.77	0.79	0.77	0.80

Notes: Left-hand-side variable is total occupied housing per capita. Standard errors are in parentheses. There are 22,870 observations, each is a Census-designated place. Regressions are weighted by population. All regressions also include controls for the age and income distributions, and the median family income. The omitted race category is "white."

Table 9: The Effect of Public and Subsidized Housing on Total Housing Units, Instrumental Variables Estimates

	Instruments: Public housing units per capita (1980) and Number of housing units per capita built before 1940		Instrument: Public housing units per capita (1980)		Instrument: Number of housing units per capita built before 1940	
Total public and subsidized housing units per capita	0.067 (0.024)	0.476 (0.028)	0.026 (0.027)	0.211 (0.030)	0.177 (0.037)	1.579 (0.061)
Percent Black	-0.032 (0.001)	-0.021 (0.001)	-0.031 (0.001)	-0.018 (0.001)	-0.032 (0.001)	-0.034 (0.002)
Percent American Indian	-0.026 (0.005)	-0.045 (0.006)	-0.027 (0.005)	-0.050 (0.006)	-0.039 (0.004)	-0.021 (0.005)
Percent Asian	-0.080 (0.002)	-0.088 (0.004)	-0.080 (0.002)	-0.083 (0.004)	-0.079 (0.002)	-0.103 (0.005)
Percent other race	-0.131 (0.002)	-0.120 (0.003)	-0.132 (0.002)	-0.121 (0.003)	-0.127 (0.002)	-0.112 (0.003)
Constant	0.343 (0.025)	0.421 (0.024)	0.345 (0.025)	0.423 (0.024)	0.336 (0.023)	0.410 (0.027)
State dummies	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.76	0.79	0.76	0.71	0.76	0.79

Notes: Left-hand-side variable is total occupied housing per capita. Standard errors are in parentheses. There are There are 21,235 observations in columns (1), (2), (5) and (6), and 22,870 in colums (3) and (4). Each is a Census-designated place. Regressions are weighted by population. All regressions also include controls for the age and income distributions, and the median family income. The omitted race category is "white." Total public and subsidized housing units per capita is an endogenous variable in these regressions and the variables at the top of the columns are added to the instrument set.

Appendix Table A: First-Stage Regressions
The Relationship Between Preexisting Public Housing or
Old Rental Stock and Current Public Housing

	Instrument: Public housing units per capita (1980)		Instrument: Number of Housing units per capita built before 1940	
Public units in 1977 per 1990 capita	0.721	0.645		
	(0.010)	(0.010)		
# of rental units per capita built pre-1940			0.136	0.137
			(0.003)	(0.004)
Percent Black	0.007	0.008	0.008	0.009
	(0.001)	(0.001)	(0.001)	(0.001)
Percent American Indian	-0.018	-0.022	-0.020	-0.023
	(0.003)	(0.003)	(0.002)	(0.002)
Percent Asian	0.000	0.012	0.001	0.006
	(0.001)	(0.002)	(0.001)	(0.002)
Percent other race	-0.013	-0.005	-0.022	-0.008
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.032	0.008	0.009	0.021
	(0.012)	(0.012)	(0.012)	(0.012)
State dummies	No	Yes	No	Yes
Adjusted R^2	0.54	0.59	0.47	0.53

Notes: Left-hand-side variable is total public and subsidized housing units per capita. Standard errors are in parentheses. There are 21,235 observations in columns (1) and (2) and 22,870 in colums (3) and (4), each is a Census-designated place. Regressions are weighted by population. All regressions also include controls for the age and income distributions, and the median family income. The omitted race category is "white."