The Supply of Rental Housing

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The elasticity of the supply of housing services is a critical unknown in our understanding of the housing market. Proposals to substitute housing allowances for some of the present housing subsidy programs cannot be evaluated unless we know the extent to which such demand subsidies would encounter an inelastic supply and serve to drive up rents.[1] The effects of programs such as public housing, which subsidize both demand and supply, also depend in part on the elasticity of supply in the private market.

The present paper is an attempt to use information on rent differences among metropolitan areas to estimate the elasticity of supply of rental housing. The central body of data is the U.S. Bureau of Labor Statistics (*BLS*) 1967 survey of the rental cost of housing units of fixed specifications in thirty-nine metropolitan areas. The *BLS* survey showed (confirming earlier surveys) sizeable differences in rent levels for comparable units in different parts of the United States. The paper relates these rent differences to regional variations in demand influences, such as number of households and average income, and supply influences, such as the costs of capital inputs and operating inputs. By utilizing outside information on demand elasticities, it then draws some inferences about the supply of housing services.

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[1] See The President's Committee on Urban Housing, pp. 71–72, and Edgar Olsen, pp. 619–21.

Studying differences among cities amounts to studying how housing markets behave in the long run, in the sense of having had ample time to adjust to basic market forces. The reason is that differences among cities in size, costs, tax rates, real income, and so on tend to persist for years or even decades. What we observe when we look at rent levels in different cities, therefore, is dominated by the cumulated effects of these long-term differences. The short-term behavior of the supply of housing is also of great interest, but estimating short-term responses requires different bodies of data from the ones used here.

The first part of the paper sets out a general supply-demand framework for analyzing the rent data. An important part of the framework is the distinction between several possible sources of rising supply price for housing services: rising prices of capital and operating inputs, diseconomies of scale in producing new stock, diseconomies of scale in maintaining existing stock, and diseconomies of scale in producing services from a given stock. The second section describes the data and the results of the statistical analysis. The final section draws some inferences about the supply of housing services and its implications for policies to improve housing conditions.

I. The Basic Framework

To understand the behavior of rent levels between cities, we begin with a demand-supply model of the housing market. A central concept in the model is the quantity of housing services. By quantity of housing services is meant a weighted average of space, heat, level of maintenance, nearness to work, and all

other things of value provided by the housing stock. While it is not possible to measure the quantity of housing services directly, it is possible to measure the rental price of units which are identical in many of the characteristics determining the housing services they provide. The *BLS* survey provides such measures. In the model, the price of housing refers to such measures, and the quantity of housing refers to housing expenditures deflated by such measures.

On the demand side there is ample evidence that the quantity of housing services purchased by households in an area depends upon real income and upon the price of housing relative to prices of other goods and services.[2] Our analysis of expenditure and price data for 1960[3] confirms the importance of real income and relative price, and suggests an income elasticity for renter families of 1.0 or a little below, and a price elasticity somewhere in the neighborhood of −1.0.

On the supply side, there is much less to go on in the way of past work. In the short run, a relation between rents and vacancy rates has been discussed and observed,[4] and we have attempted to measure and test the role of vacancy rates in accounting for rent differences between cities; but in the long run new construction and removals tend to limit the variation of vacancy rates.

We assume that in the long run the supply price of housing services bears a positive relation to marginal costs—that is, to the costs to the housing and real estate industry of adding to the supply of housing services. Following this assumption, we would expect rents to be high in cities where land prices, wage rates of construction workers, financing costs, utility prices, wage rates of maintenance labor, or property taxes are high. We have constructed measures of these input prices in different cities, and grouped them into the two variables "average price of capital inputs" and "average price of operating inputs."

Marginal costs may also depend on the amount of housing services provided in an area. Our central interest is in this possible relation of industry costs to the amount of housing services. If housing services are characterized by a rising supply price, then we should expect higher real incomes (other things equal) to lead to higher rents per unit of service. On the other hand, if housing services are not characterized by a rising supply price, then higher incomes should not drive up rents per unit of housing service in the long run. As average income rises, the households in an area should be able to purchase more housing services at the same cost per unit of service.

There are several distinct ways in which a rising supply price for housing services could arise. One of them is inelastic supplies of inputs into the production of housing services. Land is often singled out in this regard; but there are other possibilities as well. Construction labor, maintenance men, security guards, painters, and exterminators—to name a few examples—are specialized inputs in the production of housing services which may command a higher price as the demand for them increases.

The other possible sources of rising supply price all come under the heading of diseconomies of scale. In distinguishing among the varieties of scale considerations involved in housing, it is helpful to factor housing services into the amount of housing services per unit of capital stock times the size of the capital stock, and to separate the capital stock into new stock

[2] See Sherman Maisel and Louis Winnick; Richard Muth (1960); and Margaret Reid.

[3] Described in de Leeuw.

[4] See David Blank, Chester Rapkin, and Louis Winnick.

and existing stock. Diseconomies of scale could arise in the production of services from capital stock and operating inputs, they could arise in the production of new capital stock, or they could arise in the maintenance of existing capital stock. An example of scale effects in the production of services is the additional output in relation to the additional resources associated with obtaining repairs promptly rather than after a long or unpredictable delay. An example of scale effects in maintenance is the additional output in relation to the additional resources associated with overhauling the plumbing, heating, or electrical systems of an old unit in order to keep it from falling below the standards demanded by most middle-income households.

Muth's discussion of the supply of housing (1968) focuses primarily on the production of new housing units and the prices of inputs into new housing. The evidence which leads him to conclude that the long-run supply is highly elastic is consequently incomplete. It does not cover prices of operating inputs, the production of housing services from capital stock and operating inputs, or the maintenance of existing stock.

The present study is mainly concerned with the possible existence of an inelastic supply, or rising supply price, for housing services, not with its precise source. Nevertheless, available data permit some differentiation among possible sources of inelastic supply. If the supply of housing services is inelastic primarily because of inelastic supplies of inputs, then rent differences among metropolitan areas (for comparable units) ought to be related to demand factors only through the influence of input prices. That is, if there are no diseconomies of scale, rents should be significantly related to incomes and price levels when input prices are not included in the analysis; but rents should not be significantly related to demand factors if input prices are included.[5] Consequently, it will be of interest to test the relation of rents to demand variables both including and excluding variables measuring prices of inputs.

With respect to diseconomies of scale, all that available data permit is separate estimates of the relation of rents to services per household and of rents to number of households. The factoring of total services into services per household and number of households does not correspond very closely to the concepts discussed above of services per unit of capital stock and new and existing capital stock. However, it is likely that diseconomies of scale in the production of services would affect primarily the relation of rents to services per household, while diseconomies of scale in producing new stock or maintaining existting stock could affect either the relation

[5] In mathematical terms suppose we have the following reduced form relations. Equation (a) is derived from the equality of the supply and demand for housing services.

(a) $$R = b_1C + b_2D + u$$

where R is rental price, C is an index of input prices, D is a demand influence such as income. Equation (b) is a reduced form relation derived from the equality of the demand and supply for inputs into the production of housing services.

(b) $$C = b_3D + b_4Z + v$$

where Z is an influence on the supply of inputs, and u and v are disturbances uncorrelated with the independent variables in their respective equations. Let us assume there are no diseconomies of scale so that the supply schedule with respect to output price is perfectly elastic for given input prices. This implies that b_2 is equal to zero. The footnoted statement asserts that if b_2 is equal to zero but b_1 and b_3 are not equal to zero, then (i) a simple regression of R on D should yield a significant coefficient of D, and (ii) a multiple regression of R on C and D should yield an insignificant coefficient of D. The expected value of the ordinary least squares estimator of the coefficient of D is of course b_2 in case (ii), the multiple regression. In case (i), the expected value of the ordinary least squares estimator is

$$b_2 + b_1b_3 + b_1b_4\, m_{ZD}/m_{DD}$$

where m_{ZD} and m_{DD} are product-moments.

of rents to services per household or the relation of rents to number of households.

Two equations summarize the relationships of the present study: a demand equation for the average household and a supply equation in which it is convenient to express rental price as the dependent variable.

$$(1) \qquad S/H = g(Y, R/P)$$

$$(2) \qquad R = f(C, O, H, S/H, V)$$

where S/H represents the quantity of housing services per household, Y represents real income per household, R represents rent per unit of housing service, P represents the price of goods other than housing, C represents the price of capital inputs, O represents the price of operating inputs, H represents the number of households, and V represents the rental vacancy rate, an indicator of disequilibrium in a housing market.

The data available measure all of the variables in the two equations except services per household, S/H. It is therefore necessary to combine the two equations to eliminate S/H. We are left with a reduced-form relationship between rents per unit of service on the one hand and the following supply and demand influences on the other.

C = the price of capital inputs
O = the price of operating inputs
H = the number of households
Y = real income per household
P = the general price level in an area
V = the vacancy rate

For the first two variables, prices of capital and operating inputs, we expect a positive relationship with rents, while for the last, vacancies, we expect a negative relationship with rents. For the remaining variables—households, income, and the general price level—we expect a zero or positive relationship, with a positive relationship indicating a less-than-perfectly elastic supply.

The estimation of the reduced-form equation is itself of some interest, and has the advantage of avoiding the problems of simultaneous-equations bias. Furthermore, it is a relatively simple matter to combine the results of the reduced-form estimation with information from other studies on the parameters of the demand equation (equation (1)) and draw conclusions as to the behavior of the supply of housing services.

II. The Data and Results

Description and Evaluation of Data

The rental price measure and a number of other variables used in the analysis were taken from the *BLS* survey of the cost of "Three Standards of Living for an Urban Family of Four Persons" in the spring of 1967. The rental units priced in each metropolitan area for this survey met the following specifications:

> An unfurnished five-room unit (house or apartment) in sound condition; a completely private bath; a fully equipped kitchen; hot and cold running water; electricity, central or other standard heating; access to public transportation, schools, grocery stores and play space for children; and location in residential neighborhoods free from hazards or nuisances. [p. 42]

Units meeting these specifications had a wide distribution of rents within each area, and the *BLS* divided this distribution into thirds. The rent for the lowest of the three standards of living is an average of the lower third of the distribution of rents for these units. The rent for the moderate standard is the average of the middle third of the distribution, and the rent for the higher standard is the average of the upper third of the distribution. For the higher standard, some units were included in the distribution which had more than one private bath and extras

such as "a central switchboard, secretarial, swimming or special facilities." The simple average of the low rents for thirty-eight metropolitan areas[6] was $1,048 per year or $87 per month. The average moderate rent was $108 per month, and the average high rent was $156 per month. The statistical work below deals with each of the three rental levels separately.

The wide distribution of sample rents within most metropolitan areas implies that either price varies greatly among the neighborhoods and individual units within an area, or that the units in the *BLS* sample vary greatly in the quantity of housing services they provide. The former explanation—price variation within rental areas—could arise if neighborhoods are imperfect substitutes for one another or if lags and imperfections in the rental market lead to large discrepancies between the actual and the equilibrium rent for a unit. The latter explanation—quantity variations among sample units—could arise if the *BLS* specifications of number of rooms, baths, access to schools, and so on, are not sufficiently detailed to define a narrow range of housing services.

A critical question in evaluating the results of the present paper is whether there are important errors of measurement in the *BLS* rental data considered as a measure of price. The discussion in the previous paragraph suggests that for individual units, the *BLS* measure might be in part a measure of quantity rather than a measure of price. If it is true that rents for sample units measure quantity as well as price, *and* if quantity variations do not cancel out in striking averages for metropolitan areas, then there are systematic errors in the rental price variable.

Errors of this kind, if they exist, seem likely to be correlated with real income per household in an area. The reason is that the units in the *BLS* sample are not controlled for "neighborhood quality"—crowding, quality of schools, local public services, and so on—and that variations among areas in these factors are probably related to variations in real income. Needless to add, these factors are important influences on the rent a household is willing to pay for its dwelling unit. It is possible, then, that a positive partial relation between the rental measure used in this study and real income is due to errors of measurement rather than to a less-than-perfectly elastic supply of housing services.

It seems much less likely that measurement errors in the rental price measure are correlated with the general price level than that they are correlated with real income. Crowding, quality of schools, and other elements of neighborhood quality may well vary with real income, but there is little reason to expect them to vary with the general price level. A positive partial relation between the rental measure used in this study and the price level therefore is probably a reliable indicator of a less-than-perfectly elastic supply.

A number of other variables were also drawn from the *BLS* study. The price of capital inputs was represented by the annual payments (not including insurance, taxes, or other operating costs) on a typical 1960–61, 25 percent-down mortgage for a "standard home" defined as a "five- or six-room house with one or one and one-half baths, a fully equipped kitchen, hot and cold running water, electricity, central or other heating," and neighborhood specifications the same as for rental units. This figure reflects differences in construction costs, financing charges, and land prices among metropolitan areas.

The prices of operating inputs were also taken from the *BLS* study. Operating costs included prices of fuel and other utilities,

[6] The *BLS* study covered thirty-nine metropolitan areas, but we have not used data for New York because of the presence of rent controls.

property taxes, insurance, repair and replacement costs, and certain other items as specified and priced for the "moderate" homeowner budget. Because there is some question as to the incidence of property taxes, two operating cost variables were tested, one including all of the property tax and the other including only half. The results below are for the second of these measures; but results using the first measure were very similar and would lead to the same conclusions as the second measure.

The general price level in each metropolitan area is represented by the total cost of the moderate standard for renter families in the *BLS* study, but excluding the rental component of that cost. The rental component was excluded in order to avoid biased statistical results which might arise from having an imperfectly measured rental cost as both a dependent variable and as an important part of one of the explanatory variables.

The remaining variables were drawn from a variety of sources. Personal income estimates by metropolitan area are made by the U.S. Office of Business Economics. Rental vacancy rates were calculated by interpolating estimates in the periodic *Housing Market Analyses* of the Department of Housing and Urban Development, Federal Housing Administration. These were not available for all of the thirty-eight sample cities; for the missing areas, there was no way of estimating vacancies. Finally, estimates of the number of households in each metropolitan area were taken from *Sales Management.*

Statistical Results

In the discussion of the basic framework, it was argued that the existence of diseconomies of scale in producing housing services can be tested by comparing the relation of rents to demand factors (income and the general price level) excluding input price variables with the relation including input price variables. The following equations indicate that if we exclude input price variables, there is a clear positive relationship of rents to both income and the price level.

$$(3)\quad \underset{}{R_1} = \underset{}{2.58} + \underset{(2.2)}{1.80P} + \underset{(4.3)}{.54Y} \quad (R^2 = .52) \qquad (3.7)$$

$$(4)\quad \underset{}{R_2} = \underset{}{2.85} + \underset{(2.3)}{1.72P} + \underset{(3.8)}{.53Y} \quad (R^2 = .46) \qquad (3.4)$$

$$(5)\quad \underset{}{R_3} = \underset{}{1.15} + \underset{(.7)}{1.43P} + \underset{(2.3)}{.78Y} \quad (R^2 = .37) \qquad (3.6)$$

All variables are in logarithmic form; R_1, R_2, R_3 refer to the low, moderate, and high rent levels in the *BLS* study; P refers to the general price level excluding the rental component; and Y refers to median income per household deflated by the general price level. The numbers in parentheses below each coefficient are t-ratios; and the coefficient of determination for each equation is adjusted for degrees of freedom.

When we add to these relationships measures of input prices, the coefficients of the general price level fall but the coefficients of real income remain nearly unchanged. The equations follow.

$$(6)\quad \underset{}{R_1} = \underset{}{2.72} + \underset{(2.3)}{1.13P} + \underset{(2.9)}{.55Y} + \underset{(3.7)}{.28C} + \underset{(3.3)}{.16O} - \underset{(1.8)}{.04H} \quad (R^2 = .71) \qquad (-2.7)$$

$$(7)\quad \underset{}{R_2} = \underset{}{2.50} + \underset{(1.8)}{1.26P} + \underset{(2.6)}{.60Y} + \underset{(3.3)}{.24C} + \underset{(2.4)}{.07O} - \underset{(.7)}{.04H} \quad (R^2 = .60) \qquad (-2.4)$$

$$(8)\quad \underset{}{R_3} = \underset{}{1.78} + \underset{(.8)}{1.24P} + \underset{(1.6)}{.70Y} + \underset{(2.4)}{.14C} - \underset{(.8)}{.09O} + \underset{(-.5)}{.004H} \quad (R^2 = .34) \qquad (.2)$$

In this equation R_1, R_2, R_3, P, and Y refer

to rents, prices, and real incomes as before; C refers to the price of capital inputs, O refers to the price of operating inputs, and H refers to the number of households. As before, all variables are in logarithmic form.

Even when input price variables are included, real income and the price of nonhousing goods have significant positive relationships to rent levels. The equations thus suggest that the supply of housing services per household is less than perfectly elastic, and that one of the possible varieties of diseconomies of scale is a source of the inelasticity. The relation to capital costs and operating costs is positive as expected, except for the insignificant relation of R_3 to operating costs. The relation of rents to the number of households is unexpectedly negative (but very close to zero) in two of the three equations, which suggests (following the discussion of the basic framework) that diseconomies in the production of housing services may be more important than diseconomies in the production of capital stock. Refitting the equations without the household variable gives these results:

$$(9)\quad R_1 = \underset{(4.1)}{4.39} + \underset{(2.1)}{.89P} + \underset{(2.4)}{.31Y} + \underset{(3.3)}{.31C} + \underset{(2.2)}{.20O} \qquad (R^2 = .66)$$

$$(10)\quad R_2 = \underset{(3.3)}{4.32} + \underset{(2.0)}{1.00P} + \underset{(2.2)}{.35Y} + \underset{(2.4)}{.27C} + \underset{(1.1)}{.12O} \qquad (R^2 = .54)$$

$$(11)\quad R_3 = \underset{(1.8)}{1.59} + \underset{(1.7)}{1.26P} + \underset{(3.1)}{.73Y} + \underset{(.8)}{.14C} - \underset{(-.6)}{.10O} \qquad (R^2 = .36)$$

They are similar to results including the household variable. The coefficients of real income are somewhat lower when the household variable is omitted, but the income and price variables continue to be statistically significant.

For thirty-five of the thirty-eight metropolitan areas it was possible to construct a crude measure of the rental vacancy rate as of the spring of 1967. Regressions including the vacancy rate did not change any of the results above. The simple correlation of the vacancy rate with rent levels is negative (ranging from $-.44$ for the low rent standard, to $-.20$ for the high standard) but the coefficient after taking into account income, price, and cost variables is practically zero in every case and never significant statistically.

One possible reason for the insignificance of the rental vacancy variable is measurement errors. The vacancy rate estimates are interpolations between *Housing Market Survey* benchmarks which are themselves estimates derived largely from postal vacancy surveys. Another possibility is that much of the variation in vacancy rates among metropolitan areas reflects differences in "normal" vacancy rates rather than different degrees of housing market tightness. It might be, for example, that in areas of rapid growth there is much more building ahead of demand than in areas of slow growth, and that normal vacancy rates tend therefore to be higher in rapid growth areas. Differences in normal turnover among housing types—single-family houses, apartments, boarding houses, and the like—might also cause differences among area-wide vacancy rates unrelated to housing market tightness. Whatever the explanation, the vacancy variable does not affect the principal finding of this section; namely, the significant influence of real income per household and nonhousing prices on rental price.

The data analyzed in this section thus suggest that the long-run supply of housing services is less than perfectly elastic. The next section derives more precise estimates of the long-run supply elasticity. The cause of the rising supply

price does not appear to lie wholly in inelastic supplies of land or or other inputs, since the regression results indicate that upward shifts in demand factors (income and nonhousing prices) affect rents even after allowing for changes in input prices. The cause of the rising supply price appears to lie at least in part in one of the the possible sources of diseconomies of scale in the production of housing services.

III. Implications of the Results

The estimated equations show the influence on rents of a combination of supply factors and demand factors. From the equations alone it is not possible to disentangle the supply responses from the demand responses. By adding additional, outside information about the demand for housing, however, it is possible to derive supply relationships from the equations above. This final section of the paper presents this derivation and comments on the implications of the study for housing policies.

The Supply of Housing Services in the Long Run

To derive supply elasticities from the results of the previous section, we use information drawn from a review of cross section evidence on the demand for housing.[7] The review suggests an income elasticity for rental housing of about 1.0 or slightly below, and a price elasticity in the neighborhood of -1.0.

To combine this information with the equations above, we assume that the demand for rental housing services per household can be represented by the following relationship:

$$(12)\quad (S - H) = \alpha_1 + \beta_1 Y - \beta_2 (R - P)$$

All variables are measured in logarithmic form; S represents the quantity of housing services; H represents the number of households; Y represents real income; R represents rents per unit of housing service; and P represents the price level of nonhousing goods and services. Because of the logarithmic form, $(S-H)$ represents housing services per household and $(R-P)$ represents rents relative to other prices. The demand study just referred to suggested that β_1 and β_2 are each approximately 1.0.[8] On the supply side we assume the following relationship:

$$(13)\quad R = \alpha_2 + \beta_3 C + \beta_4 O + \beta_5 (S - H) + \beta_6 H$$

All variables are again measured in logarithmic form; R represents rents per unit of service; C represents the price of capital inputs; O represents the price of operating inputs; $(S-H)$ represents rental housing services per household; and H represents the number of households.

Setting β_1 and β_2 equal to 1.0 and solving this pair of equations for the rent variable leads to the following relationship:

$$(14)\quad R = \left(\frac{\alpha_2 + \alpha_1\beta_5}{1 + \beta_5}\right) + \left(\frac{\beta_3}{1 + \beta_5}\right) C + \left(\frac{\beta_4}{1 + \beta_5}\right) O + \left(\frac{\beta_5}{1 + \beta_5}\right) (Y + P) + \left(\frac{\beta_6}{1 + \beta_5}\right) H$$

This equation corresponds to the kind of relationship we have estimated empirically. It does not quite correspond to any of the relationships above, however, since it implies that the coefficient of real income and the coefficient of the general price level should be the same, whereas in the

[7] See de Leeuw.

[8] In the demand studies, the price level variable did not exclude the price of rental housing, as it did in this study. But it is possible to rewrite the demand results in terms of the narrower price variable by approximating the general price level by a weighted geometric average of the housing price and the prices of other goods and services. If the income and price elasticities are equal in absolute magnitude, rewriting the demand results in this way does not change either of the elasticities.

equations above they are permitted to differ. It is a simple matter to reestimate the equations above with this additional constraint, and the results of such estimates are as follows:

$$(15)\quad R_1 = \underset{(2.0)}{2.33} + \underset{(3.9)}{.321}C + \underset{(2.1)}{.183}O + \underset{(4.0)}{.593}(Y+P) - \underset{(-2.6)}{.036}H \qquad (R^2 = .70)$$

$$(16)\quad R_2 = \underset{(1.5)}{2.06} + \underset{(2.9)}{.287}C + \underset{(1.0)}{.102}O + \underset{(3.6)}{.653}(Y+P) - \underset{(-2.4)}{.040}H \qquad (R^2 = .59)$$

$$(17)\quad R_3 = \underset{(.6)}{1.43} + \underset{(1.1)}{.178}C - \underset{(-.4)}{.066}O + \underset{(2.6)}{.745}(Y+P) + \underset{(.2)}{.004}H \qquad (R^2 = .35)$$

The coefficients of C in these equations correspond to $\beta_3/(1+\beta_5)$ in the general relationship above. The coefficients of O correspond to $\beta_4/(1+\beta_5)$, the coefficients of $Y+P$ correspond to $\beta_5/(1+\beta_5)$, and the coefficients of H correspond to $\beta_6/(1+\beta_5)$.

From these results we can derive relationships describing how landlords set their rent levels in the long run. The derivations imply the following landlord responses:

(a) the elasticity of rents with respect to capital costs is .8, .8, and .7 in the three equations;
(b) the elasticity of rents with respect to operating costs is .5, .3, and −.3 in the three equations;
(c) the elasticity of rents with respect to the amount of housing services per household is 1.5, 1.9, and 2.9 in the three equations; and
(d) the elasticity of rents with respect to the number of households is −.1, −.1, and zero in the three equations.

Another way of expressing these long-term relationships is to look at the supply of housing services instead of at the rent level as the dependent variable. To do this, we solve the basic supply equation for S the supply of rental housing services instead of R the rent level, and insert the empirical values of the β's. Looked at in this way, the empirical results imply that:

(a) the elasticity of the supply of housing services with respect to rent per unit of service is .7, .5, and .3 in the three equations;
(b) the elasticity of the supply of housing services with respect to the price of capital inputs is −.5, −.4, and −.2 in the three equations;
(c) the elasticity of the supply of housing services with respect to the price of operating inputs is −.3, −.2, and .1 in the three equations; and
(d) the elasticity of the supply of housing services with respect to the number of households is 1.1, 1.1, and 1.0 in the three equations.

For the most part these implications seem plausible. The negative coefficient of operating costs in the "high rent" equation is the one obvious exception. The supply elasticities with respect to rental price, which fall in the range .3 to .7, do not include any correction for the effects of possible measurement errors in the rental price measure. If there are errors of the sort discussed in the previous section, then these estimated elasticities with respect to rental price are too low.

The Aggregate Supply Elasticity and Housing Policies

Little can be concluded about policy questions of general interest from this single study. Nevertheless, it is useful to

discuss the relation of the findings of this study to policies to increase the demand for housing by low-income households. Such policies include both earmarked assistance programs such as rent certificates, or programs of general income assistance which can be expected to be channeled in part into housing demand.

Superficially, the implication of this study would seem to be that programs to increase the demand for housing would in part serve to drive up rents. Some of the disbursements under such programs, that is, would be dissipated in higher rental prices rather than increasing the level of housing services. This section will conclude that the superficial implication is probably correct. But the conclusion rests on a number of additional assumptions and qualifications, which it is important to make explicit.

To begin with, it is worthwhile repeating that the results relate to long-run responses. Obviously, no conclusion is warranted from these results about the initial response of rents to an increase in demand.

Less obvious, but nevertheless important, is the point that the empirical results relate to the effects of changes in *average* demand per household on rents. The policies, in contrast, involve in part *shifts* in demand from one income-class to another. The implications of the empirical results for housing demand policy therefore involve the problem of how increases and decreases in demands in different subsectors of the housing market relate to the average responses studied in this paper.

By no means all of the demand assistance provided under a national income assistance or rent certificate program would simply consist of shifts in housing demand from one subsector of a metropolitan area rental market to another. A significant part of whatever demand changes were involved would consist of transfers out of high-income areas and into low-income areas. This is obvious when we consider the large differences between the average incomes of different metropolitan areas—within the thirty-nine *BLS* areas, for example, between Cedar Rapids ($4,218 per capita) or San Francisco ($4,401) at one extreme, and Durham ($2,728) or Orlando ($2,691) at the other.[9] Transfers from one area to another would presumably lead to higher rent increases in areas with a net inflow of income than in those with a net outflow. Furthermore, a significant part of any demand changes would be transfers from suburban homeowners to inner-city renters. They would involve, in other words, widely differing housing types, different geographic locations, and different political jurisdictions. It is hard to imagine a housing market flexible enough to accomodate such shifts without corresponding shifts in the relative price of housing services even over fairly long periods. Finally, an assistance program financed out of general revenue but earmarked in some degree for housing, such as a rent certificate program, would involve a net increase in housing demand as well as a shift in demand from one group to another.

Nevertheless, some portion of a program to increase low-income housing demand would consist of shifts in demand within metropolitan area rather than overall increases in area demands of the sort studied in this paper. The shift component would be relatively more important for a general income assistance program than for an earmarked program, and it would be more important for a locally financed program than for a national program involving transfers between metropolitan areas.

To relate the findings of the paper to shifts in housing demand, it is helpful to

[9] The numbers in parentheses are estimated 1967 per capita incomes in each metropolitan area (see Office of Business Economics).

consider two extreme sets of assumptions about the submarkets of a metropolitan area housing market. At one extreme we can interpret what the empirical findings imply if the housing market of a metropolitan area is highly flexible. If there are very few barriers to conversion of housing units from one level of service to another, very few barriers to households moving within an area, and if cross-elasticities of demand between areas are high, then changing demand in any one sector of the housing market should have a very much smaller impact on overall rents than the average responses we have studied empirically. There is little reason in this case for expecting the price of housing services to be affected by redistribution of income within a metropolitan area.

At the other extreme, we can interpret what the empirical findings imply on the assumption that metropolitan area housing markets are highly inflexible—that is, that high costs, zoning laws, and other barriers prevent the conversion of housing units from one level of service to another, and that racial discrimination and other demand barriers restrict the movement of households from one neighborhood to another. In this case, the empirical findings about the response of average rents to income is in effect a sample of what goes on in the housing submarkets of a metropolitan area. It is a sample drawn mainly from the moderate-income sector of the market, and it uses average incomes in the entire market as a proxy to represent average incomes in that sector of the market. For the moderate-income portions of the rental housing market an increase of 1 percent in real income per household leads to an increase in rents per unit of housing service estimated to be in the neighborhood of one-half of 1 percent (see equations (6)–(11) above). If the low-income housing submarket is like the moderate-income sector in this respect, then this estimate of .5 should carry over into the low-income sector of the market. If demands and supplies are less price elastic in the low-income sector, a response greater than .5 might be expected; while if demands are less income elastic in the low-income sector, a smaller response might be expected.

The truth doubtless lies in between these two extreme sets of assumptions. On the one hand, racial discrimination, zoning laws, and costs of conversion of a housing unit from one level of service to another are important aspects of housing markets and make the "completely flexible" assumptions implausible. On the other hand, fairly rapid changes in the economic composition and level of housing services of particular neighborhoods have occurred in almost every big city. Unfortunately, our present understanding of housing market segmentation does not permit us to go beyond these broad generalizations.

Taken together, all of these observations about the rental housing market suggest that the response of rents to income changes estimated in this paper is probably an upper limit to the long-run change in rents which recipients of an income subsidy would face. The reduced-form response estimated in this paper is an elasticity in the neighborhood of .5 (see equations (6)–(11) above)—that is, a half a percent increase in rent for each 1 percent increase in income. Because of the possible statistical bias in this estimate and because of the possibility that flexibility among housing submarkets would reduce rent effects, the true effect is probably below .5. An elasticity range of .1 to .4 is probably as precise a judgment as can be made at present. This range would imply that a general income assistance program which raised average incomes in poor neighborhoods by 10 percent would raise rents in those neighborhoods by 1 to 4 percent in the long run.

The results of an income assistance program would of course depend on the pro-

visions and the comprehensiveness of the program. In particular, a demand subsidy program specifically earmarked for housing could have severe rent effects. A program which raised average incomes in poor neighborhoods by 10 percent and channeled all of the increase into housing would raise recipients' housing demands by something like 40 percent.[10] An elasticity range of .1 to .4 would imply an average rent increase of 4 to 16 percent in this case. But since the overall increase in housing demand would be greater for an earmarked program than for a general income assistance program, the range of .1 to .4 might be too low in this case. A significant fraction of disbursements under a housing allowance program might thus be dissipated in rent increases rather than leading to more housing services.

The contrast between a general income assistance program and an earmarked-housing subsidy leads to a final point. The issue of earmarked versus general income subsidies is usually discussed in terms of the preferences of recipients and taxpayers as to the allocation of total consumption. The point suggested by this study is quite distinct. It is that an earmarked program which causes a significant rise in the price of the earmarked service tends to be less effective in assisting total consumption levels than a program of general income assistance. A higher proportion of the disbursements are dissipated in price increases in the former case than in the latter. Consumption of the earmarked service by beneficiaries will of course rise more under an earmarked program than under a general program; but consumption of all goods and services by beneficiaries, after correction for price changes, will rise less.

The present study suggests that subsidizing the demand for low-income housing would drive up rents. There are undoubtedly other services for which a demand subsidy would be even more inflationary; medical services, for example, may be one of these. There are a great many goods and services, however, for which a shift in demand would probably encounter much less serious constraints on supply or separation of submarkets than in the case of housing. Hence, an income subsidy earmarked for housing is probably a less cost-effective way to raise real incomes of recipients than a general income subsidy.

[10] This estimate assumes that low-income families normally spend 25 percent of their incomes on housing.

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