U.S. Department of Housing and Urban Development
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Recipient Housing in the Housing Voucher and Certificate Programs

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EXECUTIVE SUMMARY

This report compares the housing occupied by recipients in the Housing Voucher and Housing Certificate programs. It is based on evaluations of the housing of approximately 900 recipients in each program, spread over 10 large urban Public Housing Agencies (PHAs). Because participants were randomly assigned to the Housing Voucher or Certificate program, comparison of the two groups provides a good estimate of differences in program outcomes within the PHAs sampled. The ten PHAs themselves were selected from among the sample of 18 large urban PHAs included in the Housing Voucher Demonstration. Although these 18 PHAs are a probability sample, the 10 selected for housing evaluation are not. We assigned the weights of the 18 large urban PHAs to the 10 housing evaluation PHAs based on PHA size and the region of the country in which they were located. Thus the results are reasonable rather than scientific projections for all large PHAs.

Both the Housing Voucher and Certificate Programs offer low-income households assistance in renting units in the private market. Both programs require recipients to occupy housing that meets program quality and occupancy requirements. Both are administered by Public Housing Agencies (PHAs) under contract to HUD. The two programs differ in the way in which they determine housing assistance payments and in their funding mechanisms.

The Housing Certificate Program determines the amount that a family will pay from its own resources (the tenant contribution) and then makes up the difference between this amount and the gross rent (contract rent plus scheduled utilities not included in the rent) charged by the recipient's landlord. The program is structured so that a family usually pays 30 percent of its net income as its contribution to rent. Because the assistance payment varies with the actual rent, the family is usually not permitted to rent units with rents that either exceed the HUD-determined Fair Market Rent (FMR) or are determined by the PHA to be unreasonable.

In the Housing Voucher Program, in contrast, there is a locally determined Payment Standard that initially is equal to the Fair Market Rent. The housing assistance payment or subsidy under the Housing Voucher Program is generally the difference between this Payment Standard and 30 percent of the recipient family's net income, regardless of the rent of the unit actually chosen by the family. Because Housing Voucher assistance payments are not tied to rent, the family assisted under Housing Vouchers is allowed to rent any unit that meets program quality and occupancy standards, and is not limited by the Fair Market Rent or PHA determination of rent reasonableness.

In the Certificate Program, the tenant contribution is a fixed percentage of family income, and housing assistance payments vary to make up the difference between the unit rent and the tenant contribution. In the Housing Voucher program, on the other hand, assistance payments for a family are fixed and tenant contributions vary to make up to the difference between unit rent and the assistance payment.[1]

The two programs also differ in their funding mechanisms. Under the Certificate Program, HUD allocates a fixed number of slots to PHAs and undertakes to fund the costs of these slots. Under the Housing Voucher Program, HUD allocates a five-year dollar budget to PHAs, which must then determine how many slots they can afford. In addition, under the Housing Voucher Program, PHAs have some flexibility in deciding between the depth of assistance offered and the number of slots that can be funded. Under the Certificate funding mechanism, the government absorbs any unforeseen increases or decreases in the costs of funding a given number of slots. Under the Housing Voucher funding mechanism the programs absorb unforeseen increases or decreases in costs by adjusting either the number of slots funded, or the depth of the subsidy, or both.

The differences in the payment formulas for the two programs would be expected to lead to differences in recipient housing choice. In particular, Certificate program recipients would be expected to rent units near the limits allowed by the program, while Housing Voucher program recipients would be expected to choose a wider range of rents. This is in fact the case, and, in addition, Housing Voucher recipients on average select units with slightly higher gross rents than Certificate program recipients.

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[1]If a recipient's gross rent is very low, the Housing Voucher assistance payment is reduced to assure that the tenant contribution is at least 10 percent of gross income. In the Certificate Program the required minimum (and maximum) tenant contribution is the larger of 10 percent of gross income, 30 percent of net income, or, in some states, the rent allowance established by AFDC (known as "welfare rent"); the largest of these is usually 30 percent of net income.

While it is easy to compare the rents paid by recipients in the two programs, it is more difficult to compare the actual housing obtained by recipients. We did this in two ways. First we asked whether recipients in either program appeared to be paying more for the same sort of housing than recipients in the other program. To do this we examined the way in which the rents that recipients paid related to the size, location, and amenities provided by their units. By comparing these rental cost functions for the two programs, we see whether recipients in one program were paying a premium over what recipients in the other program paid for the same sort of housing.

There are good reasons for comparing the prices paid by recipients in the two programs. For the private market in general, it is clear that housing prices vary within a metropolitan area and that more intensive shopping is likely to achieve better deals. In fact, the two programs impose different incentives and restrictions on recipient shopping. In the Certificate program more careful shopping may result in better housing, but in the Housing Voucher program it is directly translated into differences in what the recipient pays out of his or her own pocket. On the other hand, the Certificate program sets limits on recipient rents and requires that the local PHA certify that the rents paid are reasonable, whereas the Housing Voucher program imposes no such restrictions. By determining the extent to which these program differences lead to differences in the amount paid for similar housing, we are able to translate differences in rents paid into overall differences in the price paid for housing and in the real value of housing obtained.

The second approach used in comparing the housing of recipients in the two programs is direct comparison of recipient housing in terms of various characteristics such as space, unit amenities, and neighborhood. These comparisons are used to make the differences in the estimated value of recipient housing more concrete. For certain dimensions we can also compare recipient housing with the housing they occupied before joining the programs.

Key findings are presented below. Table references after each finding indicate the basic supporting material in the text.

1. Slightly more than two-thirds of the recipients in each program had moved from their pre-program units by the time the housing evaluations were conducted. The other third had been able to meet program housing requirements in their pre-enrollment unit and had not subsequently moved. Recipients who moved from their pre-

program units more than doubled their contract rents in both programs. Housing Voucher recipients who moved registered a modestly, but statistically significantly, larger increase in rent. As a result, average program rents for recipients who moved were $29 per month, or 6.7 percent, higher in the Housing Voucher Program than in the Certificate Program. (Table 2.5)

2. Comparison of estimated rental cost functions for the two programs indicates that the $29 per month higher rents paid by Housing Voucher recipients who move represent a combination of a $19 difference due to Housing Voucher movers paying significantly higher prices (4.3 percent above the prices paid by Certificate Program recipients for comparable units) and a $10 difference associated with better housing (a 2.3 percent higher housing value than that obtained by Certificate Program recipients). This does not mean, however, that voucher holders consistently paid higher prices for the same quality units. Further analysis of this average price difference suggests that Certificate holders actually pay higher prices for units in the lower quality ranges, while Voucher holders pay higher prices for higher quality units. Examination of the rules of the two programs suggests some reasons for this pattern. (Tables 3.3, 3.4, 3.5)

3. By the time of the Housing Voucher evaluations, the rents of recipients who stayed in their pre-program units were 23 percent higher than their pre-program levels in the Housing Voucher Program and 21 percent higher than in the Certificate Program. This difference in rent increases was not statistically significant. However, a combination of slightly higher pre-program rents and slightly larger increases did result in average rents for recipients still in their pre-program units that were $15 per month, or 4 percent, higher in the Housing Voucher Program than in the Certificate Program. This difference was statistically significant. (Table 2.5)

4. Comparison of estimated rental cost functions for recipients who stay in their pre-program units indicates that all of the 4 percent difference in average rents between the two programs is due to differences in prices paid, with no difference in the real level of housing obtained. However, estimates for this group are not precise. Neither the estimated change in prices nor the estimated real change in housing is statistically significant. (Table 3.3)

5. The lack of any large difference in housing between the two programs is confirmed by detailed examination of unit and locational features. Average ratings of unit condition and quality were slightly higher in the Housing Voucher Program, but the differences were small (2 percent or less) and only statistically significant for evaluator ratings of overall unit quality. There were no significant differences between the two programs in other ratings, in an overall measure of housing adequacy, or in any of a large number of specific amenities. Nor were there any significant differences between the two programs in recipient ratings of their neighborhoods, or in the median income or rent of the Census tracts in which units were located. (Tables 4.5, 4.9, 4.12, 4.15, 4.17, 4.18, 4.19, 4.21)

6. We can compare the program and pre-program housing of recipients in terms of unit size, recipient ratings of units and neighborhoods, and characteristics of the Census tracts in which they lived. There were no significant differences between the programs in the level of these measures or in their change from pre-program levels. Recipients in both programs showed significant increases over pre-program levels. Averaging estimates for the two programs, the average number of rooms per person in recipient units was 18 percent higher than in pre-program units. As might be expected, among recipients who stayed in their pre-program unit, there was no change in the average recipient rating of their units. Recipients who moved rated their new units 16 percent higher than their pre-program units and their new neighborhoods 10 percent higher. The average per capita income in tracts occupied by recipients who moved was 4 percent higher than that in the tracts in which they had previously lived. Similarly, median rents in these tracts were 9 percent higher. (Tables 4.1, 4.10, 4.20, 4.22)

9. Averaging the results for the two programs, non-minority recipients who moved had previously lived in Census tracts in which 21 percent of the residents were minorities. They moved to Census tracts with somewhat smaller proportions of minority residents, 19 percent, but the change is not statistically significant. Black (non-Hispanic) recipients who moved had previously lived in tracts in which 76 percent of the population were minorities. They moved to tracts in which 74 percent of the population were minorities. Again, this difference is not significant. Nor was there any significant change in the percent of the tract population who were either black or Hispanic. Hispanic recipients who moved moved to tracts with a significantly lower degree of minority concentration--from tracts in which on average 73 percent of the population was minority to tracts in which on average 63 percent of the population was minority. (Tables 4.25A, 4.25B, 4.25C)

CHAPTER ONE

INTRODUCTION

This report is one of a series of reports comparing the Section 8 Existing Housing Certificate and Housing Voucher Programs based on the results of the Freestanding Housing Voucher Demonstration.

Until 1974, HUD's principal programs for providing housing assistance to lower-income families involved subsidized construction or rehabilitation of housing units, which were then rented to lower-income families at below-market rents. During the 1960's, HUD began to develop a different approach. Under the Section 23 Leased Housing Program, Public Housing Authorities (PHAs) leased units from landlords in the private rental market and then sublet the units to eligible households at reduced rents. Subsequent modifications to the Section 23 program allowed some recipient households to find their own units, though the PHA still leased the units. Finally, in 1974, the Section 8 Existing Housing Certificate Program shifted responsibility and discretion for finding and leasing units to participating households.

The Certificate Program provides housing assistance payments to tenants living in privately owned, existing housing by paying a monthly stipend to the landlord on the tenant's behalf. The amount of the assistance payment is determined by the difference between the unit's rent (including scheduled allowances for utilities not included in the rent) and the family contribution as determined by the program. Recipients may live wherever they wish within the PHA's service area as long as (1) the selected unit meets HUD's housing quality criteria, (2) the rent is less than or equal to the local Fair Market Rent (FMR)[1] set by HUD, and (3) the rent is deemed by the PHA to be reasonable in terms of the local rental market.

The Certificate Program has been considered successful. There are currently more than 800,000 households receiving assistance in the program,

[1]The Fair Market Rent for an area is a schedule of rents by bedroom size. The schedule is generally set equal to the 45th percentile of rents for recent movers in each metropolitan area and non-metropolitan county. They are intended to approximate the typical local area rent for a modest rental unit of a size appropriate for each household.

and the cost per household served is lower than in other HUD programs offering comparable levels of assistance. In certain housing markets, however, tenants have had difficulty finding units that both meet the housing quality standards and are within the rent ceilings. The Housing Voucher Program was designed to improve upon the Certificate Program by allowing families a wider range of choice in finding acceptable units. It was believed that this would both increase family success in finding units that meet program standards and permit families to find units that more closely match their needs.

More specifically, the Housing Voucher Program removes ceilings on unit rents. This requires a change in the way program assistance payments are determined. In the Certificate Program, the tenant contribution is fixed by the program, and the assistance payment varies to make up the difference between the fixed tenant contribution and the actual unit rent (including utility allowances). Tenants have no motivation to lease a unit that rents for less than the program will allow. The assistance payment is capped by not allowing recipients to lease units that rent for more than the Fair Market Rent (FMR) level established by HUD for the PHA jurisdiction or, within this limit, for more than the level deemed reasonable by the PHA in terms of the local rental market.[1]

In the Housing Voucher Program, in contrast, assistance payments are fixed based on a payment standard (initially set equal to the Fair Market Rent), regardless of the rent actually paid. The tenant must then contribute whatever is necessary to meet the costs of housing that meets the program quality criteria and the tenant's needs. This will be more or less what the tenant would contribute under the Certificate Program depending on whether the tenant's rent is above or below the Certificate Program FMR. Since the assistance payment is fixed, no limit is placed on how much the tenant can pay for rent (though there is a minimum required tenant contribution).[2]

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[1]In addition, PHAs have some flexibility in allowing individual exceptions to the FMR ceiling.

[2]The Housing Voucher assistance payment is further limited by a requirement that the tenant's contribution (the out-of-pocket expenses for rent and utilities net of the Housing Voucher assistance payment) be at least 10 percent of gross income. The Certificate program assistance payment is similarly limited by a requirement that the tenant contribution be the larger of 30 percent of net income or 10 percent of gross income).

To make this description more concrete, in the most common case the two programs differ as follows:

Comparison of Payments in Prototypical Case

	Certificate Program	Housing Voucher Program
Tenant Contribution	30 percent of income	30 percent of income, but if gross rent is less than the local Payment Standard, then the tenant contribution is reduced by the amount of the difference, whereas if gross rent exceeds the local Payment Standard, then the tenant contribution is increased to make up the difference.
Program Payment	FMR minus 30 percent of income, but if gross rent is less than the FMR, the program payment is reduced by an amount equal to the difference, whereas if the PHA approves a gross rent above the FMR, the program payment is increased to make up the difference.	Payment Standard minus 30 percent of income
Limits on Rent	Reasonable and less than the local FMR	None

Special cases and variations are described in Chapter 2 and Appendix D. However, the main points should be clear. Both programs share an underlying common tenant contribution and program payment based on the estimated local Fair Market Rent (FMR) or Payment Standard and tenant income. In the Certificate Program, deviations between actual rent and the FMR accrue to the program, and rents are limited so that they are at or below the FMR. In the Housing Voucher Program, deviations between actual rent and the Payment Standard accrue to the tenant, and no limitations are placed on rent.

The absence of restrictions on rent in the Housing Voucher Program offers recipients greater flexibility and responsibility in selecting units and neighborhoods. Tenants both determine the rents they will accept and bear the cost of these rents in the form of higher or lower out-of-pocket contributions. These differences between the programs could be expected to affect the success of program applicants in becoming recipients, the type and quality of housing obtained by recipients, and both recipient and program costs.

Section 207 of the Housing and Urban/Rural Recovery Act of 1983, P.L. 98-181, authorizes HUD to conduct a Housing Voucher Demonstration in order to test the desirability of a Housing Voucher Program. There are two components to this demonstration: a component supporting a rental rehabilitation demonstration and a "freestanding" component. HUD will use the "freestanding" portion of the demonstration to test the impact of the Housing Voucher assistance payment formula on program outcomes and costs.

This report is one of a series on the "freestanding" component. The Freestanding Housing Voucher Demonstration is being conducted and analyzed by Abt Associates, Inc., under contract to HUD, in 20 PHAs across the country. These 20 PHAs consist of 18 larger urban PHAs and two statewide PHAs. The 18 urban PHAs are a stratified random sample of all larger, urban PHAs.[1] In addition, HUD is collecting similar information directly from a sample of 41 smaller urban and rural PHAs. Results from these smaller PHAs will be analyzed separately, by HUD.

Analysis of the Freestanding Housing Voucher Demonstration is based on direct comparison of outcomes and costs for about 4,000 Housing Voucher recipient slots and 4,000 current Section 8 Certificate Program recipient slots, spread across the 20 Demonstration PHAs. In each PHA, applicants for the Section 8 Existing program are randomly assigned to either the Section 8 Housing Voucher Program or the current Section 8 Certificate Program. Certificates included in the Demonstration sample were flagged to separate them from the rest of the PHA's Certificate Program. Data on both Housing Voucher and flagged Certificate families are taken from PHA operating records, using special forms designed for the Demonstration. These data were supplemented by

[1]The sample of PHAs was drawn for HUD by Westat. See Dietz, et al., for further details.

information from external sources such as the Census and American Housing Survey, as well as by housing inspections for a sample of recipients in each program. Information was also collected on Demonstration PHA administrative costs and procedures.

Demonstration operations began in San Antonio in April 1985. The last Demonstration PHA began operations in February 1986. In each PHA, Housing Vouchers and flagged Certificates were issued gradually until the sampling quota of recipients for each program was reached. Data collection ended in September 1988.

Housing Quality

Examination of results from the first year of Demonstration operations showed that in comparison with Certificate program recipients, Housing Voucher recipients tended to occupy units with somewhat higher average rents. Further, as expected, Housing Voucher recipients often occupied units with rents above the ceilings allowed under the Certificate program. The purpose of this report is to describe the differences in housing associated with these differences in recipient rents in the two programs.

Two sorts of concerns arise. The first has to do with the general level of housing obtained. Roughly speaking, one expects that in a given area at a given time, higher priced units tend to be better units, at least in the absence of rent control. However, we also know that units of similar quality do appear to rent for different amounts. Even within a single market, differences in luck and effort spent in shopping may lead people to pay different amounts for the same housing. The first question, then, is whether recipients, on average, are getting better housing for higher rents--that is, the extent to which differences in the average rents paid by recipients in the two programs reflect differences in the overall quantity and quality of housing obtained rather than differences in prices paid. This issue is especially salient in comparisons of the Housing Voucher and Certificate programs, since the two programs in fact impose quite different constraints on the amount that recipients may spend for housing and may create quite different incentives in shopping for housing.

The basic device used in the analysis of overall housing quantity and quality is the method of hedonic indices. Fundamentally, this involves regression of unit rents on a set of variables describing the unit's size, amenities, and location. These regressions yield estimates of the average rent charged for units with a given set of characteristics. By comparing the regressions for recipients in the two programs, we can determine whether the recipients in one program or another appear to pay different amounts on average for units of similar size and quality. Because we only have information on recipients in the two programs, we cannot compare the amounts they pay with the market rents paid by unsubsidized renters. We can, however, compare the two programs or compare groups of recipients within the programs.

When we compare the average rents paid for units of similar quality, we are in effect comparing the effective price of housing in the two programs. In everyday language, the price of a house of apartment refers to the amount paid to own or rent it. The price of housing is different from this. We think of the rent paid for a unit as equal to the "amount" of housing services supplied by the unit times the price of housing associated with that unit. Two units with the same rents but different amounts or qualities of housing services will have different prices of housing. When we compare average prices in the two programs, we are asking whether on average recipients in one program got more housing per dollar than recipients in the other program.

Although now widely used, the hedonic technique is not perfect for comparing the price of housing. We cannot hope to list every relevant feature of every unit. Deviations between the actual rent paid for a unit and its predicted average market rent may reflect real differences in unit characteristics not included in the hedonic equations as well as simply differences in prices paid. The extent to which differences between actual and predicted rents are systematically associated with omitted characteristics can be assessed by determining whether such differences are associated with variables that are known to influence the level of real housing that families purchase.

The second sort of concern involves translating abstract differences in rent or rental value into direct comparison of specific features of recipient units in the two programs. All units occupied by recipients in either program must be certified by the local PHA as meeting basic program occupancy and quality standards. Differences in housing beyond these standards may involve more space, better quality of construction or finish, special amenities, or a better neighborhood in terms of safety, environment, and schools or other public services. We can directly compare units in the two programs along many of these dimensions. In addition, for a limited set of characteristics, we can compare recipient housing with the housing they occupied before joining the program.

In reviewing specific features of recipient housing, special concern attaches to the extent to which recipients use the opportunities afforded by either program to break patterns of residential segregation. Again, we can compare the location of recipients in the two programs, and compare location of pre-program and program units. The measures available are, however, limited. We know the Census tract in which each recipient lives and hence can examine the extent to which recipients live in tracts that are predominantly black or white, Hispanic or non-Hispanic, poor or non-poor. However, although Census tracts are devised to be as homogenous as possible, they typically include from two to eight thousand people. Racial, ethnic, or economic segregation may take place at a much finer level of neighborhoods within tracts. In this case, differences in tract descriptors may simply be too gross a measure.

Samples and Data Used In This Report

The core data for this report comes from evaluations of recipient units conducted by staff of Research Triangle Institute, under subcontract to Abt Associates. These evaluations collected information on the physical characteristics of units and their surrounding areas. Brief interviews, conducted at the same time as the evaluation, elicited information on recipient ratings of their unit and neighborhood as well as details as to unit rents and the various services and utilities included in the rent. This information was supplemented by program records on recipient rent, income, and demographic characteristics, plus information on pre-program housing taken from interviews of recipients when they first entered the program.

Housing evaluations were conducted for a sample of recipients in 10 of the 20 Demonstration sites. Approximately 90 evaluations were completed for each program in each site for a total of just under 1800 evaluations. The recipients selected for evaluation were a random sample of recipients in the two programs as of June 1987. Recipient selection was stratified according to whether recipients had moved from or stayed in their pre-program unit. The evaluations themselves were conducted between August 24, 1987 and January 1988.

As noted earlier, the Demonstration PHAs consisted of 18 urban PHAs and 2 statewide PHAs. The 18 urban PHAs were a probability sample of all larger urban PHAs and results for this sample can be extrapolated to all large, urban PHAs. The 10 PHAs chosen for housing evaluations were not a probability sample of the Demonstration PHAs. Only some of the Demonstration PHAs had large enough recipient samples to provide the minimum number of observations necessary for estimation of hedonic indices within each site. The housing evaluation PHAs were chosen from among these to provide a reasonable mix of PHA sizes and regions. Accordingly, results for the PHAs included in the housing evaluation sample cannot be extrapolated to the universe of all larger urban PHAs.

At the same time, it was desirable to develop and present one set of numbers and comment on the variation in results across PHAs rather than burden the reader (or analyst) with 10 different sets of results. We could, of course, have simply averaged the results for the 10 PHAs. It seemed more useful, however, to develop summary results based on the way in which the Demonstration sample was originally drawn and the characteristics of the 10 housing evaluation PHAs. The original sample of 18 urban PHAs was drawn from the universe of all larger urban PHAs, stratified by size and region of the country. Following this, we assigned the sampling weights of the 18 urban PHAs to the ten housing evaluation PHAs based on size and region.

The resulting estimates are called summary projections in table titles to emphasize both that they are weighted averages of PHA results and that they are not scientific estimates of results for all large, urban PHAs with known sampling distributions. These projections are accompanied by estimates of the error of estimate (or in this case error of projection)--calculated both in terms of variation within the 10 PHAs involved and the variation that would have been estimated across the 10 PHAs had they in fact been a probability subsample. The latter statistics, however, should be regarded as summary descriptions of outcomes rather than statements about their sampling properties.

Organization of This Report

The next chapter describes the two programs and presents information on the rents paid by their recipients. Chapter 3 presents the results of the hedonic analysis to compare the overall prices paid and housing obtained by recipients in each program. Chapter 4 then turns to comparison of specific characteristics, dealing in turn with differences in terms of unit size and crowding, in terms of unit and building condition and amenities, and in terms of the immediate and general neighborhoods of units, including the degree of racial, ethnic, or economic segregation of the areas (Census tracts) in which recipients live.

Various appendices provide extensive technical backup for the main text. Appendix A describes the Demonstration sample and the details of the rationale used in creating weights for national projections from the 10 housing evaluation PHAs. Appendix B describes the sources of the data used in the report and the definition of variables. Appendix C presents the details of the basic statistics used to present results and discuss variation in results across sites. Finally, in support of the summary discussion of Chapters 2 and 3, Appendix D discusses the theory of housing choice in the two programs, and Appendix E both the theory and details of the actual estimation of the hedonic equation. Appendix F presents various supplementary tables.

CHAPTER TWO

RECIPIENT RENTS

The focus of this report is comparison of recipient housing in the Housing Voucher and Housing Certificate programs. This chapter lays the groundwork for that comparison by comparing the rents paid by recipients in the two programs. Section 2.1 describes how the two programs differ and what this would be expected to mean in terms of differences in recipient rents. Section 2.2 then presents the actual differences in recipient rent between the two programs. Chapters 3 and 4 then discuss the extent to which these differences in rent are associated with real differences in recipient housing.

The basic findings are as follows. Over two-thirds of the recipients in both programs moved from their pre-program unit (either when they first became recipients or later). In both programs, recipients who moved rented units with contract rents roughly twice as large as their pre-program contract rent. However, the increase was slightly greater in the Housing Voucher Program, with the result that average contract rent for Housing Voucher recipients who moved was $29 per month, or 6.7 percent, higher than the average contract rent for Certificate recipients who moved.

Among recipients who stayed in their pre-program unit, average contract rent at the time of the housing evaluation was 23 percent higher than average pre-program rent in the Housing Voucher Program and 21 percent higher in the Certificate Program. Recipient rents in the Housing Voucher Program were $15 per month, or 4 percent, higher than in the Certificate Program, reflecting a combination of slightly higher pre-program rents and slightly larger increases in rent after enrollment. The difference is not unexpected, since the Certificate Program by definition only allows recipients to remain in units that both meet the program's housing standards and rent for less than the maximum allowed rent.

2.1 The Two Programs

The Housing Voucher and Certificate Programs are each variants of the Section 8 Existing Housing Program and share certain basic features. In both programs, actual program operations are carried out by local public housing agencies (PHAs) under contract to HUD. Eligible applicants accepted by the PHA are given from two to four months to find acceptable housing in the private rental market. To be acceptable in either program, a unit must meet program quality and occupancy standards, and the unit's owner must agree to participate in the program. The owner then signs a lease with the applicant and a separate contract with the PHA. These contracts set the rent for the unit and specify the amount that the PHA will contribute towards paying the rent (the program contribution or housing assistance payment) and the amount to be paid by the tenant (the tenant contribution).

The central difference between the two programs is in the way in which they determine the size of housing assistance payments. Under the Certificate program, the recipient contribution is fixed at 30 percent of income, and the program pays the difference between this fixed contribution and the recipient's rent.[1] In order to set some limit on assistance payments, allowable rents must be limited. This is done in two ways, First, rents may not exceed the schedule of Fair Market Rents by bedroom size (FMRs) published annually by

[1]The actual rule is the larger of 10 percent of gross income, 30 percent of net income (gross income net of various deductions), or welfare rent. The 30 percent of net income figure was larger than 10 percent of gross income for 98 percent of the first 6,000 Demonstration applicants. The welfare rent rule applies only in certain states in which ADC payments include an allowance for rent equal to the ADC family's out-of-pocket expenses for rent up to a maximum amount, called the welfare rent. In these states, housing assistance payments that reduce the tenant contribution of ADC recipients below the welfare rent would be offset dollar for dollar by a reduction in ADC payments. Accordingly, in such "as-paid" states, the Certificate program sets the tenant contribution for ADC recipients equal to the larger of 30 percent of net income, 10 percent of gross income, or the welfare rent. Only two states included in the Demonstration were as-paid states--Michigan and New York--and Michigan has since changed its ADC rules. Accordingly, for simplicity the discussion in this chapter describes the programs in the case where the tenant contribution is 30 percent of net income. For a full discussion of all possible variations, see Appendix D.

HUD for each area of the country.[1] Second, the unit rent must be determined by the PHA to be reasonable, given local market conditions.

Under the Housing Voucher program, in contrast, the maximum assistance payment is fixed and the tenant contribution varies to make up the difference between the recipient's rent and the assistance payment. Accordingly, the Housing Voucher program places no limits on recipient rents.

The differences in payment formulas between the two programs mean that the relationship between what a recipient pays for housing out of his or her own pocket and the rent charged by the landlord will also be different. The Certificate program ties assistance payments directly to gross rent in order to maintain a program determined tenant contribution and limits the assistance payments by limiting recipients' gross rents. The Certificate program tenant contribution is fixed at the larger of ten percent of gross income or 30 percent of net income. If the recipient's gross rent is less than this, the assistance payment is zero. Above this level, the assistance payment increases dollar for dollar with recipient gross rent, making up the difference between gross rent and the fixed Certificate program tenant contribution, until rent reaches the maximum allowable limit set by the program. If a Certificate recipient wishes to spend more than this, he or she must leave the program and give up any assistance.

The Certificate program begins by calculating the tenant contribution (the larger of 30 percent of net income or 10 percent of gross income) and then calculates an assistance payment equal to the difference between gross rent and tenant contribution. The Housing Voucher program reverses this and begins by calculating an assistance payment (the Payment Standard minus 30 percent of net income), so that the tenant contribution is the difference

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[1]PHAs have some flexibility with respect to the FMR ceiling. In general, the gross rent (contract rent plus scheduled amounts for utilities paid by the tenant) must be less than the FMR schedule of rents by unit size and type established by HUD for the PHA jurisdiction. However, (1) the PHA may approve rents of up to 10 percent above the FMR on a case-by-case basis for up to 20 percent of units; (2) the PHA may approve such exceptions for more than 20 percent of units with HUD permission; (3) the PHA may obtain HUD approval for either categorical (size-type) or case-by-case increases in payment standard to up to 20 percent above the FMR. In addition, certain subsidized housing projects (e.g. Section 236 projects) have rent schedules that are separately approved by HUD. In these cases, the PHA may agree to accept the HUD-approved schedules for these projects, as long as they are below the FMRs.

between gross rent and the assistance payment. No limit is set on recipient rents. If a Housing Voucher recipient lives in a unit whose rent equals the Payment Standard, then the recipient's tenant contribution will be 30 percent of net income (as in the Certificate Program). If the recipient rents a unit for less than this, the assistance payment does not change, and the tenant contribution will be correspondingly reduced. If the recipient rents a unit for more than the Payment Standard, the assistance payment is again unchanged, and the tenant contribution will be correspondingly higher.

In fact, the Housing Voucher Program does set a minimum contribution of 10 percent of gross income. If recipient gross rent is below the minimum tenant contribution, the Housing Voucher assistance payment is zero. Above this level, the Housing Voucher assistance payment rises dollar for dollar with gross rent until the housing assistance payment reaches its maximum amount (the difference between the Housing Voucher Payment Standard and 30 percent of net income).

If 10 percent of gross income is larger than 30 percent of net income, the Housing Voucher minimum tenant contribution will equal the Certificate program tenant contribution. In fact, the Housing Voucher minimum tenant contribution is almost always less than the Certificate program tenant contribution.

The way in which the two formulas differ is illustrated in Table 2.1. The specific examples shown are for a family with a gross income of $660 per month, a net income of $500 per month, and an FMR and Payment Standard of $450 per month. The Certificate program sets the tenant contribution at $150;[1] the Housing Voucher program sets the assistance payment at $300. Thus, if the recipient rents a unit with a gross rent of $400 per month, he or she will pay $150 under the Certificate program, with the assistance payment equal to the difference between gross rent and tenant contribution ($250). The Housing Voucher program in contrast sets the assistance payment at $300 per

[1]That is, 30 percent of the recipients net income of $500 per month, since this is greater than 10 percent of gross income.

Table 2.1

ILLUSTRATION OF HOUSING ASSISTANCE PAYMENTS AND TENANT CONTRIBUTIONS AT VARIOUS RECIPIENT RENT LEVELS

Housing Voucher Program

Housing Assistance Payment	=	(Payment Standard)	-	(.3 Net Income)
Tenant Contribution	=	(Rent)	-	(Housing Assistance Payment)

Except that the housing assistance payment is reduced if the tenant contribution is less than 10 percent of gross income.

Housing Certificate Program

Tenant Contribution	=	The larger of 30 % of Net Income, 10 percent of Gross Income, or welfare rent
Housing Assistance Payment	=	(Gross Rent) - (Tenant Contribution)

Except that rent must be less than FMR (exceptions to 1.1 times FMR).

Example

FMR	=$450/month
Payment Standard	= 450/month
Gross Income	= 660/month
Net Income	= 500/month

1. Gross Rent = $400/Month

Housing Voucher Program

Housing Assist. Pay. = $450 - (0.3)(500) = $300

Tenant Contribution = $400 - 300 = $100

Housing Certificate Program

Tenant Contribution = (0.3)(500) = $150

Housing Assist. Payment = $400 = 150 = $250

2. Gross Rent = $450/month

Housing Voucher Program

Housing Assist. Pay. = $450 - (0.3)(500) = $300

Tenant Contribution = $450 - 300 = $150

Housing Certificate Program

Tenant Contribution = (0.3)(500) = $150

Housing Assist. Payment = 450 - 150 = $300

3. Gross Rent = $500/Month

Housing Voucher Program

Housing Assist. Payment = $450 - (0.3)(500) = $300

Tenant Contribution = $500 - 300 = $200

Housing Certificate Program

Unit cannot be rented at this rent level.

month and the tenant then pays the difference between the gross rent and the assistance payment (in this case \$100).[1]

At a gross rent equal to the payment standard and FMR of \$450 per month, tenant contributions and assistance payments are the same in the two programs. The Certificate program requires the same \$150 tenant contribution as it did the lower rent of \$400 per month, so the assistance payment increases with rent to \$300 per month. The Housing Voucher program pays the same assistance payment of \$300 per month that it did at the lower rent of \$400 per month, so the tenant contribution increases with rent to \$150 per month.

As gross rent rises above \$450 to \$500 per month, the Housing Voucher assistance payment remains at \$300 per month, so the tenant contribution rises further, to \$200 per month. In the Certificate program, where the tenant contribution is fixed at \$150 per month a gross rent of \$500 per month would require an assistance payment of \$350; to avoid this, the Certificate program simply prohibits rents above the FMR.[2]

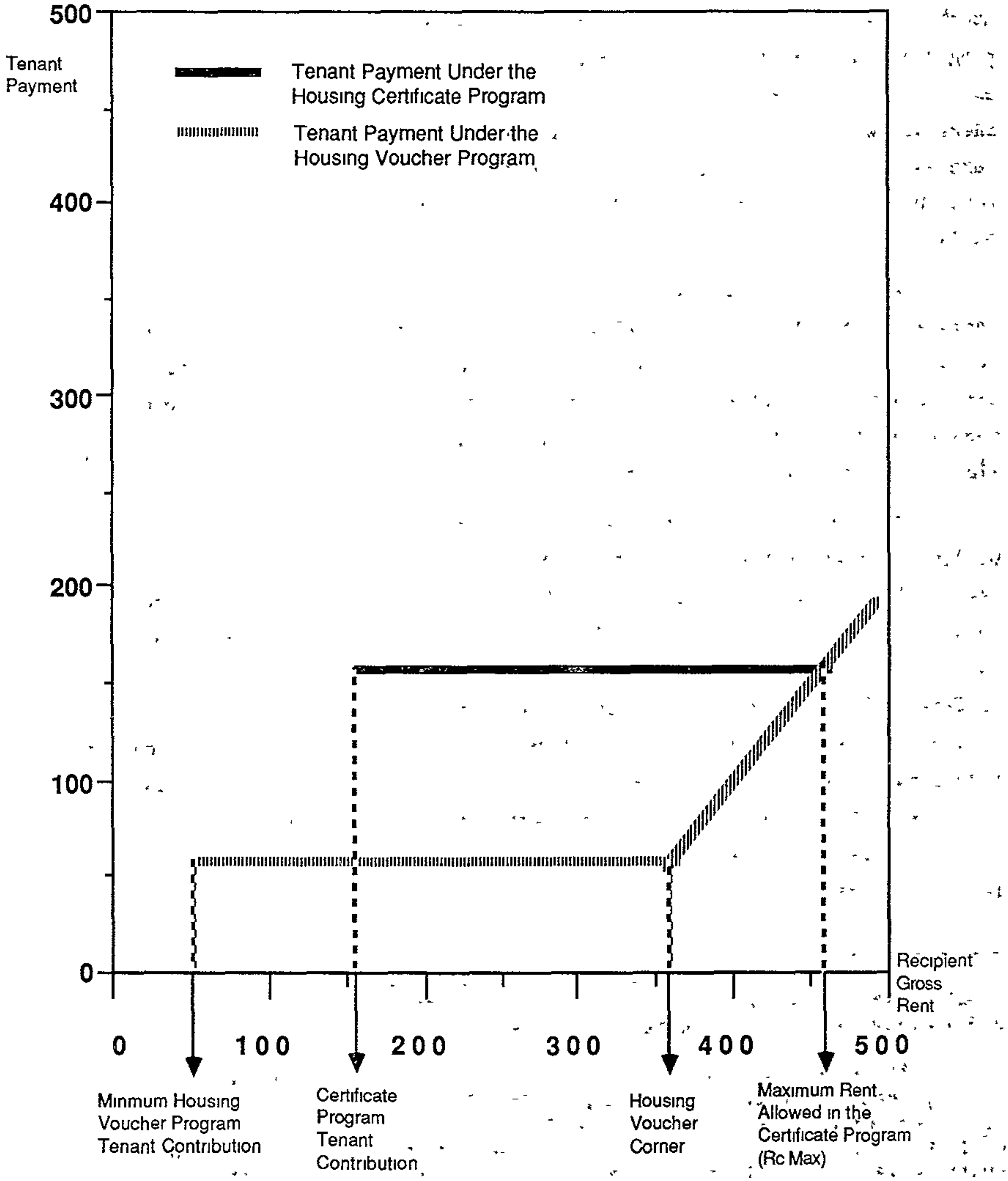
The recipient's out-of-pocket payment for gross rent is simply the difference between the recipient's gross rent and the housing assistance payment. This is shown in Figure 2.1. In the Certificate program, the recipient is only allowed to occupy units with gross rents between the minimum and maximum allowed levels. However, within this range of rents, the tenant payment is fixed. There is also a minimum gross rent in the Housing Voucher program (though it will generally be lower than that in the Certificate program), and also a range of rents over which tenant payments do not vary because assistance payments increase to match any higher rent. After a point, however, assistance payments stop increasing and any further increase in gross rent is paid by the recipient.

[1]But notice that if the gross rent were below \$366, the Housing Voucher assistance payment would be reduced so that the tenant contribution would always be at least 10 percent of gross income (\$66 per month).

[2]In fact, as already noted, PHAs can allow some recipients to rent up to 10 percent above the FMR. Thus, if the PHA chose to grant an exception, a gross rent of \$490 would result in a Certificate program tenant contribution of \$150 and assistance payment of \$340, whereas the Housing Voucher program would leave the assistance payment at \$300 and increase the tenant contribution to \$190.

Figure 2 1

Tenant Payment as a Function of Recipient Gross Rent



Certificate program recipients may, of course, elect to remain in their pre-program unit if it meets (or is repaired to meet) program occupancy and quality requirements. If they move, however, it seems likely that they will tend to rent units near the maximum allowable rent, since taking less expensive housing would not reduce their own tenant payment. Similarly, Housing Voucher recipients who move would be expected to look for units with gross rents at least as large as the "corner rent" in Figure 2.1. Above this, however, they may choose from among a range of rents either higher or lower than the Certificate program maximum, depending on their needs and the cost of housing that meets program standards.

We would expect that while average recipient rents in the Housing Voucher program might be higher or lower than in the Certificate program, they are likely to be more dispersed. In fact, as discussed further in Section 2.2 below, average recipient rents are somewhat higher in the Housing Voucher program and much more dispersed.

2.2 Recipient Rents

Table 2.2 shows the average gross rent paid by recipients in each program. The table format will be used repeatedly in this report and it is worth a moment to discuss its overall structure. For each outcome listed (in this case, recipient gross rent), the table first presents the average value for sampled recipients in each program and the difference in average value between the two programs. The next two lines under each outcome heading present estimates of the error in the sample estimates.[1]

The average gross rent paid by sampled recipients in the Housing Voucher program was about $25, or 5 percent higher than the average gross rent of $479 paid by recipients in the Certificate program.[2] Recipient rents are,

[1]Two errors of estimate are presented. One, labeled "within PHA standard error," reflects only on variation in estimates associated with samples of recipients in the Demonstration PHAs. The other, labeled "total error of estimate," reflects on the variation on estimates associated with the samples of recipients and the samples of PHAs. For details, see Appendix C.

[2]The figures presented in this chapter usually are based on the sample of recipients for whom all the information needed for the analyses of Chapters 3 and 4 was available. Figures for the full sample are presented in Appendix F. They are not materially different from those presented here.

TABLE 2.2

RECIPIENT RENTS[a]
(National Projections)

	Housing Voucher Program	Housing Certificate Program	Difference	t-Statistic for Difference
Gross Rent				
Mean	$503.98	$478.86	$25.12	
Within-PHA standard error	4.47	3.61	5.75	4.37**
Total standard error	28.35	28.92	5.75	4.37**
Contract Rent				
Mean	$448.99	$424.00	$24.99	
Within-PHA standard error	4.01	3.22	5.14	4.86**
Total standard error	30.32	31.51	5.42	4.61**

[a]Estimates are for sample with complete data for hedonic regressions. For complete sample, see Appendix F.

** = Significant at 0.01 level

* = Significant at 0.05 level

+ = Significant at 0.10 level

however, more dispersed in the Housing Voucher program, as indicated by the within-PHA standard error for Housing Voucher recipients of 4.47, which is about 24 percent larger than that for Certificate recipients, despite roughly equal sample sizes.

The larger dispersion of Housing Voucher recipient rents is presented graphically in Figure 2.2, which shows the overall distribution of recipient rents expressed in terms of the ratio of the rent to the FMR or Payment Standard used in determining payments.[1] As can be seen from the figure, rents are more dispersed in the Housing Voucher program. Recipient rents in both programs tend to cluster around the relevant FMR or Payment Standard. However, almost three-fourths of Certificate program recipients had rents within 10 percent of the relevant FMR, as compared to fewer than half of Housing Voucher recipients.[2]

The connection between recipient rents and the program payment formulas may be further illuminated by considering the difference between recipient rents in the program and their rents prior to the program. For this purpose, we need to compare contract rents, since we do not know gross rent for pre-program units. Since contract rents do not include allowances for utilities not included in the rent, they will tend on average to be somewhat lower than gross rents. Further, changes in contract rent may to some extent reflect changes in the utilities included in the rent.

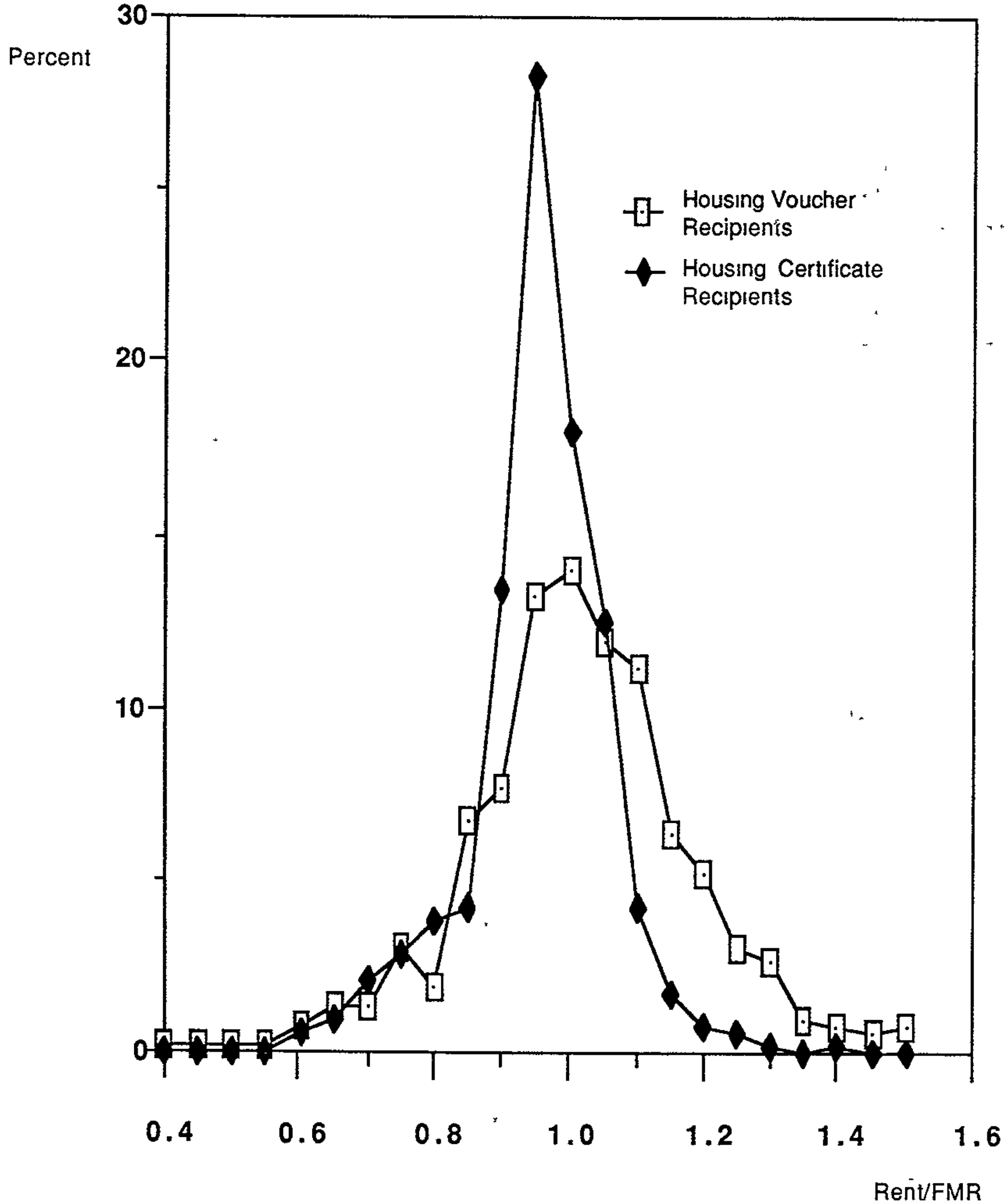
Recipient contract rents were 79 percent, or $198 per month, higher than pre-program rents in the Housing Voucher Program and 72 percent, or $177

[1]It should be noted that FMRs change over time and do not always equal the Payment Standard in effect at the same time.

[2]Examination of reported Certificate rents more than 10 percent above the FMR generally shows that there are some errors in reporting. These are not corrected here because the same rule could not be used to identify errors in rents reported for Housing Voucher recipients, who face no limit on allowable rent.

Figure 2 2

Distribution of Ratio of Rent to FMR's *



* Values below 0.6 are not shown. The top 1 percent of the distribution in each program is excluded. For details see Appendix F, Table F.2.

per month, higher in the Certificate Program.[1] The $21 larger increase in the Housing Voucher Program is statistically significant, although modest in contrast to the total increase in both programs. Combined with very slightly (and not statistically significantly) higher pre-program rents in the Housing Voucher Program, it results in Housing Voucher recipient contract rents that were $25 per month, or 6 percent, higher than recipient contract rents in the Certificate Program (Table 2.3).

The connection between the programs' rules and the change in recipient rents may be further illustrated by comparing the actual change in recipient rent with the change that we would expect from the discussion of the program rules in the previous section. In the Certificate Program we expect that recipients will tend to rent units with gross rents near the maximum allowed limit. Thus we would expect that the difference between recipient gross rent and recipient pre-program contract rent would closely match the difference between the FMR and pre-program contract rent. Of course, there will be exceptions. Certificate recipients who do not move may register quite different rent increases. Further, as noted earlier, the actual maximum allowable rent may be higher than the FMR in some cases by PHA-granted exceptions, or lower than the FMR where PHA rent reasonableness tests indicate lower-than-FMR rents.

Our expectations for the Housing Voucher Program are less precise. We expect the change in rent to be less closely related to the difference between pre-program rent and the Housing Voucher Payment Standard. Given the fact of higher average Housing Voucher rents, we also expect that we will find that some recipients increased their rent by more than this difference.

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[1] It should be noted that these changes in contract rent may be much larger than the changes caused by the program. The Housing Allowance Demand Experiment provided strong evidence that existing housing programs could to some extent tend to attract recipients who were about to move to higher rent units without the program. Because of this, simple calculation of changes in rent may overstate program effects. Such selection effects are strongest on variables that directly relate to program requirements. For a program similar to the Housing Voucher or Certificate program, the Demand Experiment found a substantial selection effect on the change in the proportion of recipients living in standard housing, but no selection effect on the change in expenditures (see Kennedy (1980), p. 176ff. and Friedman and Weinberg, Appendix IX).

TABLE 2.3

CHANGE IN CONTRACT RENT[a]
(National Projections)

	Housing Voucher Program	Housing Certificate Program	Difference	t-Statistic for Difference
Pre-Program Contract Rent				
Mean	$250.67	$246.88	3.78	
Within-PHA standard error	4.78	5.00	6.92	0.55
Total standard error	22.19	23.38	6.92	0.55
Recipient Contract Rent				
Mean	$448.99	$424.00	$24.99	
Within-PHA standard error	4.01	3.22	5.14	4.86**
Total standard error	30.32	31.51	5.42	4.61**
Change in Contract Rent[b]				
Mean	$198.47	$177.28	$21.18	
Within-PHA standard error	5.43	5.26	7.56	2.80*
Total standard error	22.97	23.20	7.56	2.80*

[a]Estimates are for sample with complete data for hedonic regressions. For complete sample, see Appendix F.

[b]Change data may not equal difference between program and pre-program levels due to missing values.

** = Significant at 0.01 level

* = Significant at 0.05 level

+ = Significant at 0.10 level

Table 2.4 presents figures on the ratio of the change in contract rent to the difference between pre-program rent and the Payment Standard or FMR. The table only includes recipients in the two programs who had pre-program contact rents below the relevant FMR or Payment Standard. As expected, in the Certificate Program the average and median change in rent are almost exactly equal to the difference between pre-program rent and the FMR. Further, a majority of recipients have changes that are fairly tightly distributed around this difference, with ratios varying between 0.85 and 1.08. In the Housing Voucher program, the mean and median ratios are well above one. Further, the much larger interquartile range indicates a substantially more dispersed distribution.

The changes in contract rent associated with the two programs can be usefully contrasted for the 69 percent of recipients in both programs who move from their pre-program unit and the 21 percent who stayed in their pre-program unit (Table 2.5).

Recipients who stay in their pre-program unit have to be able to meet the program's housing quality and occupancy requirements in their pre-program unit, either because their unit already meets these standards or because it can be repaired to meet them. As might be expected from this, recipients who stayed in their pre-program unit had higher pre-program rents than recipients who moved in both programs (Table 2.5). By the time of the housing evaluation, average contract rents for recipients who stayed in their pre-program units had increased 23 percent in the Housing Voucher Program and 21 percent in the Certificate Program. The increases in the Housing Voucher Program were not significantly greater than the increases in the Certificate Program. However, these higher increases, coupled with higher pre-program rents, meant that stayers in the Housing Voucher Program were paying an average rent of $405 per month--almost 4 percent above the rents paid by stayers in the Certificate program.

In both programs, recipients who moved more than doubled their pre-program contract rents. The increase was 116 percent in the Housing Voucher Program and 105 percent in the Certificate Program. The larger Housing Voucher increase was statistically significant and resulted in recipient rents for movers that were almost 7 percent higher than in the Certificate Program.

The next two chapters discuss how these differences in recipient rents were reflected in real differences in recipient housing.

TABLE 2.4

RATIO OF CHANGE IN RECIPIENT RENT TO THE DIFFERENCE BETWEEN PRE-PROGRAM RENT AND THE CERTIFICATE PROGRAM FMR OR VOUCHER PROGRAM PAYMENT STANDARD[a]

	Housing Voucher Program	Housing Certificate Program
Mean ratio	1.31	1.01
Median ratio	1.06	1.00
Inter-quartile range	0.86 to 1.28	0.85 to 1.08

[a]The table only shows values for the 96 percent of recipients who had pre-program contract rents below the relevant FMR or Payment Standard.

TABLE 2.5

CHANGE IN CONTRACT RENT FOR MOVERS AND STAYERS

	Housing Voucher Program	Housing Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Percent of Recipients Who Move	69.5%	68.9%	0.5 pts	0.75	0.28
Recipients Who Stay In Their Pre-Program Unit					
Pre-enrollment contract rent	$329.77	$321.79	7.98	0.80	0.48
Recipient contract rent	405.50	390.34	15.16	1.74‡	1.74‡
Change in contract rent	74.93	68.54	6.39	0.63	0.38
Within-PHA t-statistic for change	9.76**	10.23**	NA	NA	NA
Total error t-statistic for change	4.46**	4.12**	NA	NA	NA
Recipients Who Move From Their Pre-Program Units					
Pre-enrollment contract rent	$217.35	$214.21	3.14	0.36	0.36
Recipient contract rent	468.32	438.38	29.95	4.75**	4.33**
Change in contract rent[b]	251.37	224.36	27.02	2.77**	2.77**
Within-PHA t-statistic for change	35.55**	33.29**			
Total error t-statistic for change	13.07**	11.11**			

[a]Estimates are for sample with complete data for hedonic regressions. For complete sample, see Appendix F.

[b]Change data may not equal difference between program and pre-program levels due to missing values.

[c]Changes in contract rent include changes associated with any changes in the utilities included in the rent.

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

CHAPTER 3

OVERALL DIFFERENCES IN RECIPIENT HOUSING

The previous chapter found that Housing Voucher recipients had average contract rents that were about six percent higher than Certificate Program recipient contract rents. For recipients who stayed in their pre-program unit, the difference was four percent, reflecting a combination of higher pre-program rents and larger increases in rents. For recipients who moved from their pre-program unit, the difference was almost seven percent, due almost entirely to larger increases in rents paid from pre-program levels. One immediate question raised by the differences in recipient rents in the two programs is what they mean in terms of actual differences in housing. This is especially salient in this case. There is in fact reason to believe that the two programs may lead people to shop for housing in different ways, so that differences in rents paid may not reflect differences in housing obtained.

In a free market, we generally expect that units with higher rents in a given area will generally be larger or offer greater housing or locational amenities than units with lower rents. Roughly speaking, we may think of any housing unit as offering some amount of housing services in terms of its size, features, and location. The rent charged for the unit is then the price of housing services times the amount of housing services offered by the unit. Within a given market, we expect that there is a common, or market, price of housing services, with variations in rent reflecting variations in the housing services provided.

At the same time, it is clear that differences in rent do not always reflect only differences in the quantity and quality of housing services offered by the units, but often also reflect differences in the price of the housing provided by the units. Most obviously, the price of housing services varies across different cities and over time, so that rents for very similar units vary from one city to another or from one time to another. But prices vary within a city as well. Most people who have searched at all extensively for rental housing have found that apparently comparable units in comparable neighborhoods rent for sometimes quite different amounts. This may be due to a variety of factors, but in any case means that unit costs do not always reflect their average market value.[1]

On average, of course, exceptionally good or bad deals cancel out, so that the average rents paid by a group of households may well reflect the average market value of their units. There is reason to believe, however, that some groups of households may be better or worse shoppers than others and that different housing programs with different incentives may lead similar recipients to adopt different shopping behaviors. Thus, average rents paid by recipients could systematically over- or underestimate the market value of their units.

The comparison of recipient housing in the two programs is the focus of this report, and is addressed in two ways. In Chapter 4 we directly compare the housing obtained by recipients in the two programs in terms of occupancy standards (the living space provided by the unit), quality standards (unit condition and amenities), and neighborhood characteristics. Those comparisons provide substantial detail on specific differences in housing obtained by recipients in the two programs. However, no examination of individual features can provide us with an overall measure of real differences in housing. Indeed, differences in a large number of specific features that are individually too small to be either statistically significant or even noticeable may still add up to a substantial and statistically significant overall difference in housing.

In this chapter we decompose differences in recipient rents into differences in prices paid and real housing obtained. As discussed in Chapter 1 (and Appendix B), we collected detailed information on the rent and physical and locational attributes of the dwelling units occupied by a sample of recipients in 10 of the 20 Demonstration PHAs. This information was used to

[1]The basic reason for such cost differentials should be limited information. It takes time for tenants and landlords to assemble information about going rents and would be prohibitive for them to attempt a detailed inventory. Given this uncertainty, the pattern of cost differentials around average market value would be expected to be conditioned by tenant search behavior and landlord rent/vacancy rate strategies, as well as other systematic factors. (Merrill, 1977, e.g., finds strong evidence that long-term tenants tend to pay less on average than new tenants either because landlords discount rent to encourage good tenants to stay on and/or avoid the vacancy and maintenance costs of unit turnover, or because tenants with good deals tend to stay put.)

estimate average rental costs as a function of unit and neighborhood characteristics. These estimated cost functions (called hedonic indices) were then used to identity possible systematic differences in the prices paid by recipients in the two programs.

Section 3.1 presents the overall comparison of housing and rents in the two programs. Section 3.2 then discusses the way in which differences between the programs lead to differences in prices paid, summarizing the much more extensive discussion in Appendices D and E. Finally, Section 3.3 summarizes some key technical aspects of the methodology. These are further detailed in Appendix E.

3.1 Overall Differences in Recipient Housing (Hedonic Indices)

The program rental cost functions presented in this section are based on regression of recipient contract rents on the variables shown in Table 3.1. As discussed in Appendix E, statistical tests indicated that the equations should be estimated separately for recipients who moved from or stayed in their pre-program unit and within these groups for each site and program. Accordingly, we have estimated separate equations for each program in each site for recipients who moved. We did not have enough observations to estimate separate equations for recipients who stayed in their pre-program unit. For these recipients we estimated equations for each program in each site, pooling movers and stayers, and then used the coefficients to estimate differences for recipients who stayed (see Appendix E).

As shown in Table 3.2, both sets of equations predicted unit costs reasonably well. For the mover equations, the average adjusted R^2 was about 0.6 with a coefficient of variation[1] of 11 to 12 percent. For the pooled equation, the average adjusted R^2 was again about 0.6 with an average coefficient of variation of 12 to 14 percent. These equations, plus results for alternative specifications, are discussed in detail in Appendix E.

We used the equations estimated for each program to compare the prices paid by recipients in the two programs. For each site we divided the differ-

[1]The coefficient of variation is the regression root mean squared error as a percent of the mean rent.

TABLE 3.1

BASIC RENTAL COST FUNCTION SPECIFICATION

Specification

$$R = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_R X_R + \beta_s d_m + \varepsilon$$

where:

R	=	Unit contract rent
$X_1 \ldots X_R$	=	Descriptors of unit characteristics
d_m	=	Variable identifying recipients in mover stratum
$\beta_0 \ldots \beta_s$	=	Unknown coefficients, estimated separately for each program in each PHA

Housing Variables Used

Tenure
- Related to landlord
- Length of tenure (log of months)

Unit Size
- Square feet per room
- Number of bathrooms
- Log (number of rooms)

Building Type
- Single family detached
- Duplex or two-family
- Single family row house
- Highrise

Amenities
- Average evaluator rating of condition
- Log of building age
- Kitchen equipment provided
- Air conditioning provided
- No heat in unit
- Number of hazards
- Condition of common halls
- Amenities in bathroom
- Amenities in halls
- Balconies/porches/windows
- Amenities per room in other rooms

Neighborhood
- Rural area
- Commercial/industrial activities in neighborhood
- Abandoned buildings (evaluator)
- Abandoned buildings (tenant)
- Cleanliness of surrounding parcels
- Scaled median value of owner-occupied units in street
- Scaled median rent of renter-occupied units in tract

TABLE 3.2

OVERALL STATISTICS FOR THE RENTAL COST REGRESSIONS[a]

	Ten Housing Voucher Program Regressions	Ten Certificate Program Regressions
Mover Regressions		
Adjusted R-Square		
Range	0.49 to 0.81	0.30 to 0.77
Mean	0.62	0.59
Coefficient of Variation[b]		
Range	7% to 16%	6% to 14%
Mean	12.2%	10.5%
Pooled Mover/Stayer Regressions		
Adjusted R-Square		
Range	0.42 to 0.77	0.35 to 0.76
Mean	0.62	0.59
Coefficient of Variation[b]		
Range	11% to 21%	11% to 14%
Mean	13.6%	11.5%

[a]Separate regressions were estimated for each site-program combination (20 regressions).

[b]The root mean squared error of the regression as a percent of mean contract rent.

ence between the average contract rent paid by Housing Voucher and Certificate Program recipients into two pieces:

1. A difference in prices. We subtracted the average rent actually paid by Certificate recipients from the estimated amount that Housing Voucher recipients would have paid for the that housing. This was a direct estimate of how much more (or less) the average Housing Voucher recipient would pay for the same housing as Certificate Program recipients.

2. A real difference in housing. This is the difference between the average contract rent in the two programs net of the difference in prices paid. Alternatively, the same number can be obtained by valuing the difference in the average housing of recipients in the two programs using the Housing Voucher prices. This was an estimate of the value of the real difference in housing under the two programs.

The results are shown in Table 3.3. Among recipients who had moved from their pre-program unit, the average rents were $29 per month, or 6.7 percent, higher in the Housing Voucher Program. We estimate that $19 of this difference was due to 4.3 percent higher prices paid by Housing Voucher recipients. On average, the remaining $10 represents a significant real, 2.3 percent greater value of recipient housing in the Housing Voucher Program.

Among recipients who stayed in their pre-program units, the picture is more confused. Average rents for this group were $15 per month or 3.7 percent higher in the Housing Voucher Program. We cannot be very sure of the decomposition for this group. It appears that almost the entire difference in rent between the two programs reflects differences in prices paid. However, the error of estimate is large, and the estimated increase in prices, though similar to that found for movers, is not statistically significant. We can be sure that the numbers estimated cannot reflect simply differences in program shopping incentives. The higher rents paid by Housing Voucher recipients who stay in their pre-program units are due to both higher pre-program rents and larger increases in rent. If this entire difference is due to higher prices, then it must in part at least reflect higher prices paid before entering the program.

TABLE 3.3

DECOMPOSITION OF DIFFERENCES IN CONTRACT RENT

	Movers	Stayers
Contract Rent		
Mean Housing Voucher contract rent	$468.20	$405.50
Mean Certificate Program contract rent	$438.98	$390.34
Difference in contract rent:		
Dollars	$29.22	$15.16
Percent	6.7%	3.7%
Decomposition of Housing Voucher Prices		
Cost of Certificate bundle	$458.01	$407.47
Difference in price (standard error)	$19.03** (6.14)	$17.13 (10.52)
Percentage difference in price	4.3%	4.4%
Difference in real housing (standard error)	$10.18‡ (5.37)	$-1.97 (8.40)
Percentage difference in real housing	2.3%	-0.5%

** = Significant at 0.01 level

* = Significant at 0.05 level

+ = Significant at 0.10 level

3.2 Further Examination of Price Differences In the Two Programs

The results of the previous section indicate that the average contract rent paid by Housing Voucher recipients who move is 6.7 percent higher than the average contract rent paid by Certificate Program recipients who move. This higher average rent reflects the combination of a 2.3 percent higher average level of real housing and a 4.3 percent higher price per unit of real housing. The results for recipients who stay in place are less clear. The average contract rents for Housing Voucher recipients who stay in place is 3.7 percent higher than the average for Certificate Program recipients who stay in place.

Table 3.4 presents average rents, predicted rents, differences, and percent of cases with actual rent less than predicted rent at various levels of housing quality for (a) stayers, (b) movers, and (c) combined recipients. The entries in the differences column, if appropriately weighted, would average to the $19 overall differences shown in Table 3.3. The quality level is measured in terms of the ratio of the predicted rent from the Housing Voucher Program to the FMR.[1] The difference column in the right-hand panel indicates the extent to which actual average rent paid by Certificate Program recipients is above the average paid by Housing Voucher Program recipients for similar units in each quality range. At lower quality levels, Certificate Program recipients pay higher average prices than Housing Voucher recipients (i.e, actual Certificate Program average rents exceed predicted rents, producing positive entries in the differences column). At higher quality levels Certificate Program recipients pay lower prices than Housing Voucher recipients (i.e., actual Certificate Program average rents are below predicted rents, producing increasingly negative differences at higher quality levels).

The relationships in the tables are summarized by Figure 3.1, which graphs the regression of actual on predicted rent in the two programs. Since predicted rents are based on the Housing Voucher Program, actual and predicted rents for this program are the same, as indicated by the 45 degree line. The regression for the Certificate Program crosses the 45 degree line, indicating

[1] Tables organized in terms of the dollar predicted rent are presented in Appendix E.

TABLE 3.4A

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF PREDICTED RENT TO FMR OR PAYMENT STANDARD FOR STAYERS

	Housing Voucher Program					Certificate Program				
Ratio of Predicted Rent to FMR	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)
P≤0.7	26	294	295	-1	42	35	319	257	62**	23
		(18)	(16)	(10)	(10)		(14)	(15)	(16)	(7)
0.7<P≤0.8	50	361	345	16*	36	50	357	330	26**	30
		(18)	(15)	(7)	(7)		(14)	(12)	(8)	(7)
0.8<P≤0.9	55	412	401	10	45	62	418	403	15*	42
		(18)	(16)	(8)	(7)		(18)	(16)	(6)	(6)
0.9<P≤1.0	54	413	415	-2	46	46	400	440	-40**	67
		(14)	(12)	(6)	(7)		(15)	(15)	(9)	(7)
1.0<P≤1.1	51	446	459	-13*	55	29	426	493	-67**	83
		(18)	(17)	(6)	(7)		(26)	(29)	(12)	(7)
1.1<P	17	473	529	-56**	94	37	430	573	-143**	100
		(23)	(23)	(13)	(6)		(18)	(22)	(12)	(NA)

[a]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[b]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

TABLE 3.4B

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF PREDICTED RENT TO FMR OR PAYMENT STANDARD FOR MOVERS[a]

	Housing Voucher Program					Certificate Program				
Ratio of Predicted Rent to FMR	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
P≤0.55	36	326 (10)	325 (9)	0 (5)	47 (8)	51	342 (11)	311 (11)	31** (10)	29 (6)
0.55<P≤0.60	13	363 (12)	351 (15)	12 (12)	23 (12)	33	380 (13)	349 (13)	31** (12)	33 (8)
0.60<P≤0.65	23	370 (19)	374 (19)	-4 (5)	57 (11)	22	374 (17)	372 (13)	3 (13)	55 (11)
0.65<P≤0.70	24	380 (17)	379 (15)	0 (7)	46 (11)	24	380 (18)	386 (21)	-5 (13)	50 (10)
0.70<P≤0.75	22	356 (16)	351 (15)	5 (7)	50 (11)	30	372 (16)	379 (16)	-6 (13)	53 (9)
0.75<P≤0.80	36	419 (17)	416 (18)	3 (6)	47 (8)	38	387 (13)	401 (18)	-14 (12)	50 (8)
0.80<P≤0.85	30	389 (14)	390 (12)	-1 (6)	53 (9)	27	379 (22)	397 (18)	-18 (12)	63 (9)
0.85<P≤0.90	46	418 (16)	413 (13)	5 (6)	48 (7)	38	395 (14)	427 (15)	-32** (11)	68 (8)
0.90<P≤0.95	39	418 (13)	420 (12)	-2 (5)	46 (5)	30	409 (19)	446 (18)	-37* (18)	57 (9)
0.95<P≤1.00	32	451 (19)	452 (18)	-1 (7)	50 (9)	29	443 (21)	457 (23)	-14 (15)	52 (9)

[a]Because of the small number of observations, 10-point intervals are used for ratios above 1.1.

[b]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[c]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

TABLE 3.4B (cont.)

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF PREDICTED RENT TO FMR OR PAYMENT STANDARD FOR MOVERS[a]

	Housing Voucher Program					Certificate Program				
Ratio of Predicted Rent to FMR	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
1.00<P≤1.05	29	464 (17)	470 (18)	-6 (7)	62 (9)	25	460 (20)	499 (20)	-39** (13)	68 (10)
1.05<P≤1.10	31	491 (21)	492 (19)	-1 (8)	52 (9)	20	502 (30)	509 (29)	-7 (14)	55 (11)
1.10<P≤1.20	43	503 (20)	501 (17)	1 (8)	58 (8)	32	465 (23)	484 (19)	-19 (13)	66 (9)
1.20<P≤1.30	35	557 (18)	554 (16)	3 (8)	51 (9)	29	479 (25)	532 (26)	-53* (23)	76 (8)
1.30<P≤1.40	26	554 (27)	557 (25)	-3 (8)	54 (10)	20	508 (27)	555 (28)	-46* (20)	75 (10)
1.40<P	53	664 (19)	664 (16)	-0 (8)	45 (7)	55	569 (18)	668 (22)	-98** (18)	85 (5)

TABLE 3.4C

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF PREDICTED RENT TO FMR OR PAYMENT STANDARD FOR ALL RECIPIENTS[a]

Ratio of Predicted Rent to FMR	Housing Voucher Program: Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Certificate Program: Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
P≤0.55	40	315	313	3	43	59	336	291	45**	27
		(10)	(10)	(5)	(8)		(11)	(12)	(12)	(6)
0.55<P≤0.60	16	349	336	12	25	37	373	341	32**	32
		(13)	(14)	(10)	(11)		(12)	(12)	(10)	(8)
0.60<P≤0.65	29	348	357	-10	59	29	364	343	20	45
		(18)	(17)	(6)	(9)		(16)	(14)	(13)	(9)
0.65<P≤0.70	37	363	362	1	46	40	358	351	7	43
		(14)	(131)	(7)	(8)		(14)	(16)	(10)	(8)
0.70<P≤0.75	45	355	344	11‡	42	51	366	355	11	41
		(16)	(14)	(6)	(7)		(12)	(13)	(10)	(7)
0.75<P≤0.80	63	369	388	8	43	67	374	373	1	43
		(15)	(14)	(6)	(6)		(12)	(13)	(8)	(6)
0.80<P≤0.85	59	414	402	11	46	61	393	392	0	51
		(16)	(13)	(7)	(6)		(17)	(14)	(8)	(6)
0.85<P≤0.90	72	404	403	1	50	66	412	424	-12‡	58
		(13)	(11)	(5)	(6)		(14)	(14)	(7)	(6)
0.90<P≤0.95	64	416	416	-1	44	53	403	439	-36**	62
		(12)	(11)	(5)	(6)		(15)	(13)	(11)	(7)
0.95<P≤1.00	61	433	436	-3	51	52	426	455	-29**	58
		(13)	(11)	(5)	(6)		(14)	(15)	(11)	(7)
1.00<P≤1.05	64	442	453	-11*	63	46	450	500	-50**	72
		(14)	(13)	(5)	(6)		(18)	(20)	(10)	(7)

[a]Because of the small number of observations, 10-point intervals are used for ratios above 1.1.

[b]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[c]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

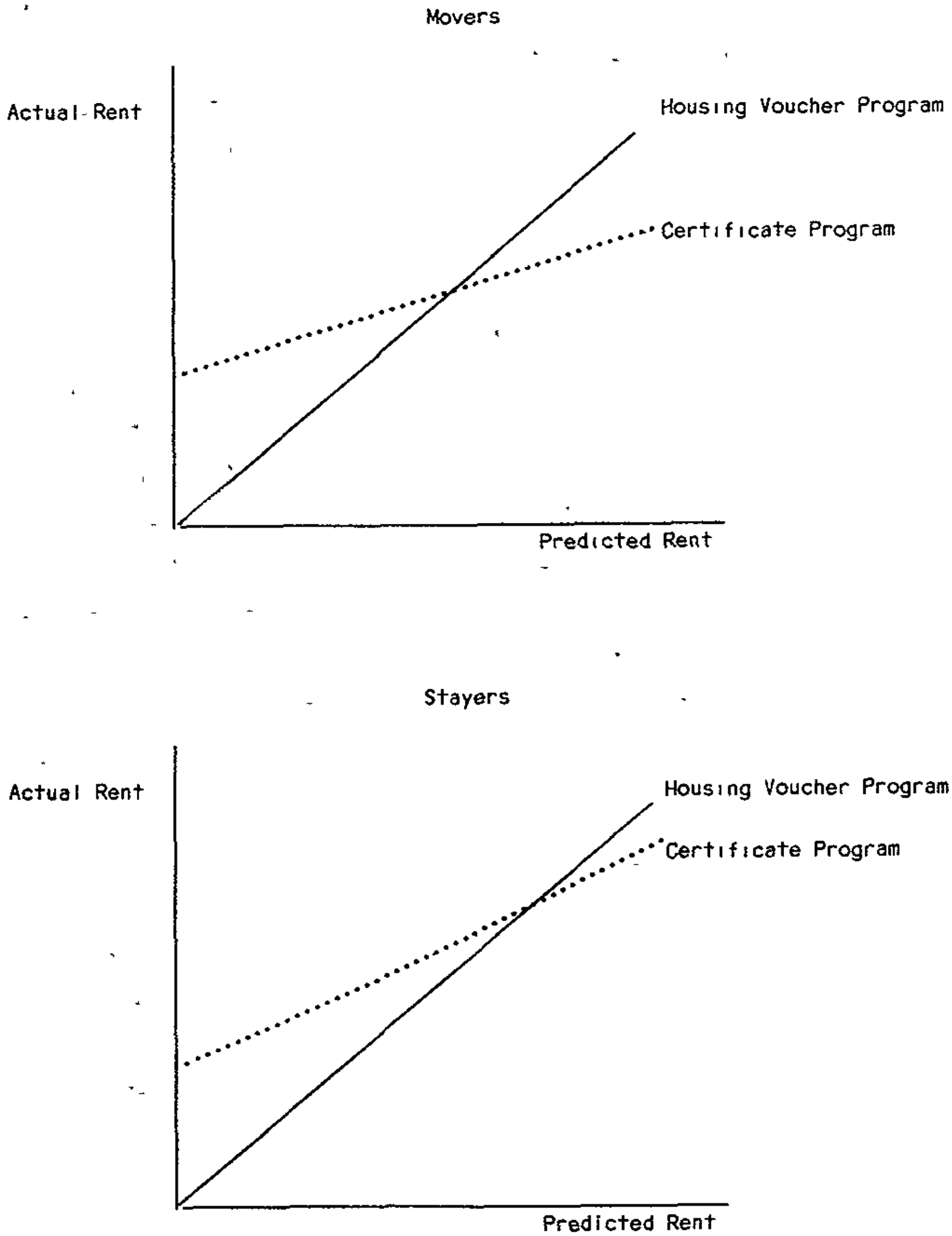
TABLE 3.4C (cont.)

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF PREDICTED RENT TO FMR OR PAYMENT STANDARD FOR ALL RECIPIENTS[a]

	Housing Voucher Program					Certificate Program				
Ratio of Predicted Rent to FMR	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
1.05<P≤1.10	47	492 (18)	495 (16)	-4 (6)	47 (7)	28	470 (25)	497 (22)	-27* (12)	68 (9)
1.10<P≤1.20	54	501 (17)	508 (15)	-7 (8)	65 (2)	51	457 (18)	509 (19)	-52** (11)	78 (6)
1.20<P≤1.30	40	541 (17)	549 (15)	-8 (9)	58 (7)	36	466 (22)	533 (23)	-67** (19)	81 (7)
1.30<P≤1.40	27	549 (27)	556 (24)	-8 (9)	56 (8)	25	504 (22)	580 (25)	-77** (20)	80 (8)
1.40<P	53	664 (19)	664 (16)	-0 (8)	45 (7)	61	549 (18)	661 (20)	-112** (17)	87 (4)

FIGURE 3.1

SCHEMATIC REPRESENTATION OF THE REGRESSION OF ACTUAL RENT ON PREDICTED RENTS[a]



——— = Housing Voucher Program
······· = Certificate Program

[a]See Table E.27 for details.

that actual Certificate Program rents are above predicted rents at lower levels of predicted rent and below predicted rent at higher levels.[1]

A pattern of higher Certificate Program prices at lower quality levels and lower Certificate Program prices at higher quality levels is not unreasonable. Housing Voucher recipients face the marginal cost of housing set by the market; if they decide to rent one unit that is more expensive than another, their out-of-pocket costs increase accordingly. Certificate holders, however, face a different cost structure, depending on the rent of the unit being considered. At lower quality levels where units are likely to rent well below the FMR, Certificate Program recipients pay no additional out-of-pocket costs for higher rent units. They have no incentive to economize on rent, whereas Housing Voucher recipients face dollar-for-dollar increases in out-of-pocket costs for each additional dollar increase in rent charged by the landlord. However, when rents are near the FMR, the situation is different. A Housing Voucher recipient can occupy a higher rent unit by paying the additional cost out of his or her own pocket. A Certificate Program recipient can only occupy a unit with rents above the FMR if they are willing to leave the program and lose their entire subsidy. Thus, at higher quality levels, where unit rents are more likely to be above the FMR, the Certificate holder has a larger incentive to economize on rent.[2]

This pattern of incentives would be expected to create the pattern of price differences shown above--with Certificate recipients paying higher prices for lower quality units, where they have a relatively smaller incentive to shop, and lower prices for higher quality units, where they must shop more intensively in order to meet the Certificate Program rent ceilings. Further, under this sort of model, the rental cost lines for the two programs always cross somewhere below the Certificate Program rent ceiling.

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[1]In fact, because predicted rent is an estimate based on Housing Voucher rents, the estimated regression of rent on predicted rent for the Certificate Program will tend to be rotated even if the prices in the two programs were the same. As discussed in the Note to Appendix E, this bias is probably not large enough to account for the extent of the rotation shown in Figure 3.1.

[2]Similarly, landlords faced with the Certificate Program ceilings may be tempted to agree to modest reductions in rent if they would bring the unit within the ceiling or to propose increases up to the ceiling.

Another possible explanation for this pattern is that, while not actually trying to economize on rent, Certificate holders, when looking at units at a quality level that can be bought for around the FMR, look only at units with rents that are below the FMR. Units of the same quality in a housing market will not have identical rents, but rents that vary around a central tendency. Because Certificate holders look only at units with rents below the FMR, this distribution is truncated, and only those units that are better than average deals get into the program.

Under this explanation differences in prices for Voucher and Certificate holders such as we observed would be generated by differences in the rents selected for consideration, not by pricing differences across programs. In other words, Certificate and Voucher holders would in fact obtain similar quality housing at identical rents. However, since Voucher holders generally select somewhat higher rent units for consideration, these higher search rents would lead to higher average prices.

We tested this interpretation by seeing whether or not the average level of housing quality obtained at a given rent was the same in the two programs. Table 3.5 follows the format of Table 3.4 for stayers and movers, except that now we consider the average housing quality obtained at a given rent. For recipients who move, the average level of housing quality obtained is the same in the two programs. This is confirmed by the regression of housing quality on rent for movers shown in Figure 3.2. This suggests that the pattern of price differences for recipients who move is in fact generated by selection effects.

For recipients who stay in place, there is still a pattern of differences in housing quality given rent. In this case, the program differences seem at least in part to reflect the differences in incentives to bargain with landlords discussed earlier. Unfortunately, because predicted rents are based on Housing Voucher rents, comparison of the regressions of predicted rents on rents in the two programs produces biased estimates of the actual differences. These biases are potentially large enough to make the results of Figure 3.2 inconclusive.[1]

[1] These alternative interpretations of program price differences are discussed more fully in Appendix E.

TABLE 3.5A

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF ACTUAL CONTRACT RENT TO FMR OR PAYMENT STANDARD FOR STAYERS

Ratio of Actual Rent to FMR	Housing Voucher Program: Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)	Certificate Program: Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)
A≤0.70	38	272 (12)	306 (13)	-34** (6)	76 (7)	36	277 (10)	325 (14)	-48** (11)	81 (7)
0.70<AP≤0.75	13	311 (31)	325 (38)	-14 (11)	62 (14)	22	309 (14)	359 (30)	-50* (25)	73 (10)
0.85<AP≤0.80	21	348 (23)	370 (24)	-21* (11)	67 (11)	23	381 (24)	402 (32)	-20 (13)	57 (11)
0.80<AP≤0.85	31	393 (21)	391 (20)	3 (7)	39 (9)	27	405 (19)	425 (24)	-21* (10)	70 (9)
0.85<AP≤0.90	26	390 (28)	394 (19)	-4 (9)	54 (10)	40	410 (19)	427 (23)	-17 (12)	50 (8)
0.90<AP≤0.95	38	448 (17)	447 (17)	1 (9)	47 (8)	4	435 (21)	464 (30)	-29 (20)	53 (8)
0.95<AP≤1.00	26	431 (20)	418 (17)	14‡ (8)	42 (10)	30	453 (21)	443 (26)	10 (14)	37 (9)
1.00<AP	56	493 (18)	472 (17)	21* (9)	29 (6)	35	423 (16)	396 (21)	27‡ (15)	26 (7)

[a]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[b]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

TABLE 3.5B

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF ACTUAL CONTRACT RENT TO FMR OR PAYMENT STANDARD FOR MOVERS

	Housing Voucher Program					Certificate Program				
Ratio of Actual Rent to FMR	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)
A≤0.5	24	308 (9)	329 (10)	-21** (6)	71 (9)	34	308 (9)	350 (15)	-42** (14)	68 (8)
0.5<AP≤0.6	28	358 (13)	354 (14)	5 (5)	39 (9)	52	352 (9)	386 (16)	-34** (13)	62 (7)
0.6<AP≤0.7	44	362 (12)	376 (13)	-13** (5)	59 (7)	75	379 (9)	421 (15)	-42** (11)	65 (6)
0.7<AP≤0.8	56	383 (11)	389 (11)	-6 (5)	64 (6)	61	369 (9)	403 (13)	-34** (10)	66 (6)
0.8<AP≤0.9	76	407 (11)	410 (11)	-3 (4)	53 (6)	58	405 (12)	401 (15)	4 (11)	47 (7)
0.9<AP≤1.0	69	427 (11)	432 (12)	-5 (5)	49 (6)	56	447 (15)	449 (17)	-1 (9)	52 (7)
1.0<AP≤1.1	67	490 (12)	491 (13)	-1 (5)	54 (6)	46	484 (17)	503 (21)	-19 (14)	52 (7)
1.1<AP≤1.2	44	468 (11)	463 (12)	5 (5)	43 (8)	32	428 (16)	449 (25)	-21 (16)	56 (9)
1.2<AP≤1.3	34	569 (19)	566 (19)	2 (8)	47 (9)	37	547 (21)	581 (25)	-35* (15)	68 (8)
1.3<AP	76	657 (16)	633 (15)	25** (6)	32 (5)	52	594 (17)	595 (24)	-1 (17)	50 (7)

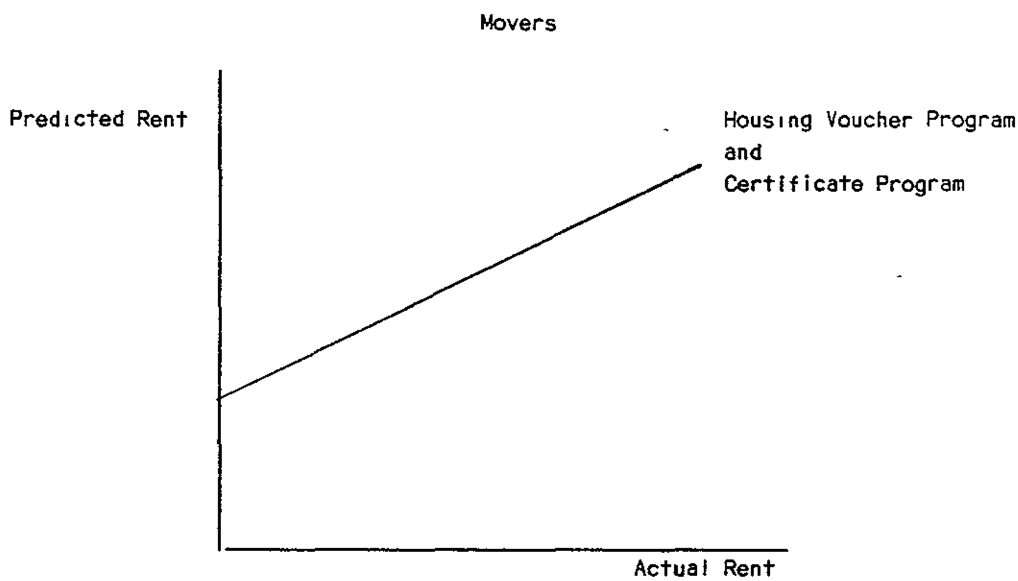
[a]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

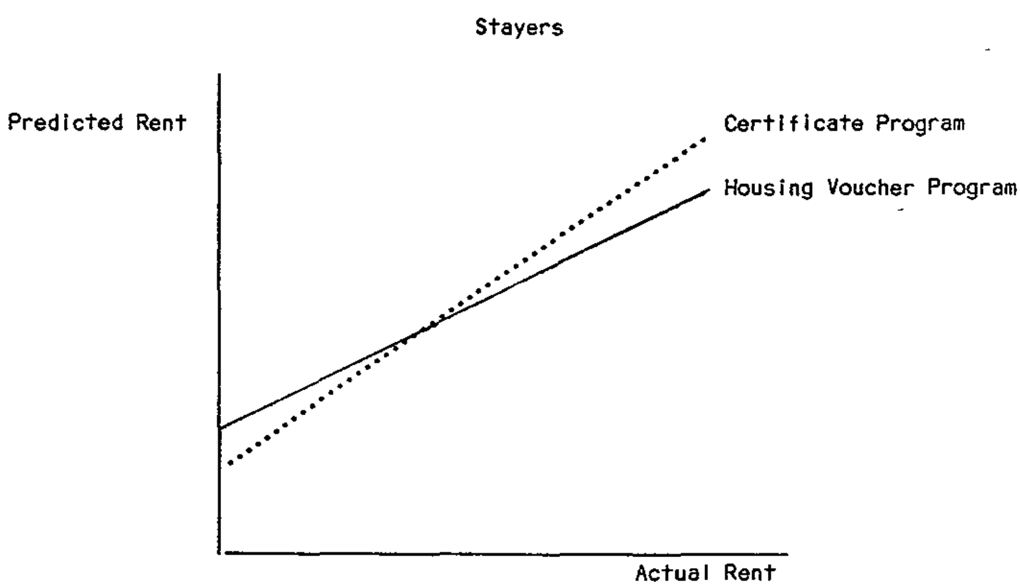
[b]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

FIGURE 3.2

SCHEMATIC REPRESENTATION OF THE REGRESSION OF PREDICTED RENTS ON ACTUAL RENT[a]





——— = Housing Voucher Program
········ = Certificate Program

[a]See Table E.27 for details.

3.3 The Rental Cost Function Methodology

The sorts of rental cost functions used in this chapter are generally called hedonic indices. The theory of hedonic indices and the methods used to estimate them for this report are extensively discussed in Appendix E. Nevertheless, it may be useful to summarize some key elements of that discussion.

We began this chapter by arguing that individual units might rent for more or less than the average market value of similar units and that recipients in one of the two programs could well end up paying systematically more or less than recipients in the other program for similar housing. One way to address this possibility is to estimate the rental cost of units directly in terms of physical and locational characteristics.

The difference in the average unit rent paid by recipients in the two programs minus the difference in the average amount paid for similar units is a direct estimate of the overall difference in recipient housing. If recipients in one program have higher average unit rents and we also find that recipients in both programs pay similar amounts for units with similar characteristics, then we conclude that recipients with higher gross rents are obtaining "more" or "better" housing. If, on the other hand, we find that recipients in one program are paying $10 more on average than recipients in the other program for similar housing, then we would subtract the $10 from the difference in gross rents to determine the actual difference in real housing value.

The equation of more or better housing with higher average costs reflects a general notion that housing that is worth more in the market is also better housing, in much the same way that we expect that $40 worth of groceries involves more or better food than $10 worth. There is, of course, room for considerable individual variation in such evaluations. The vegetarian might well value his $2 worth of bean sprouts more highly than the meat-eater's $20 worth of meat. The fact that one unit commands a rent of $300 per month, and another $250 is no guarantee that any particular individual or policy maker will find the first unit preferable to the second. Nevertheless, we do expect that on average the relative rents commanded by housing units in a free market reflect some rough consensus as to their relative values.

The device of estimating rents as a function of unit physical and locational characteristics is generally referred to as estimated hedonic indices. For the purpose of this report, we begin by assuming that, in any given area unit rents are systematically related to unit characteristics. The underlying notion is that when people rent apartments they are really purchasing the services provided by the unit, which are in turn a function of its size, location, and various amenities. If this is true, then we would expect unit rents to be governed by their physical and locational characteristics, so thac

(1) $$R_i = \sum_r x_{ir}\beta_r + \varepsilon_i$$

where

R_i = The rent paid for the i^{th} unit in a market

X_{ir} = The presence or amount of the r^{th} characteristic in the i^{th} unit

β_r = The effect of the r^{th} characteristic on expected unit rent

ε_i = An error term

In words, we expect that in a well behaved competitive market, units with the same characteristics will tend to have similar rents and that units with more desirable characteristics will have higher rents.

Hedonic indices have been subject to various more or less plausible interpretations. For our purposes, we only need the most straightforward--that the hedonic index of rent (the $\Sigma x_{ir}\beta_r$ in Eq. 1) is simply the predicted average cost of renting a unit with given characteristics X_{ir}. If we find that hedonic indices estimated for Housing Voucher and Certificate recipients are different, then we in effect find that recipients in the two programs are paying different amounts for the same sorts of units. Since we have no information on rents and quality for non-subsidized units, we cannot compare the rents paid by program recipients with those paid in the unsubsidized private market.[1] We can, however, compare rental costs, and thus the prices paid for similar units, under the two programs.

While the general notion of using hedonic indices in this manner is quite plausible, there are some important assumptions involved in actually estimating a hedonic equation. The two major assumptions have to do with (1) the general specification of the equation, and (2) the problem of omitted variables. Each of these is discussed briefly below and more extensively in Appendix E.

First, in terms of the general specification, the central assumption involved is that expected rent can be expressed as some stable function of characteristics. Most obviously, this can fail if we mis-define the characteristics. If rent is actually a function of cubic feet of volume and we use square feet of area, the equation will be misestimated. It is difficult to assure that the hedonic equation is properly specified. To some extent, we rely on the fact that the estimated function may provide a reasonable approximation to the true function over the range of observed rents. We can also examine the sign and magnitude of the estimated coefficients. The rental value of having a unit with room air conditioners should not be much different from the amortized annual cost of the air conditioners. If it is, it suggests that the function has been mis-specified either in terms of the form of the variables included or in terms of omitted variables associated with those included in the equation.

There are, however, severe limits to the application of this sort of test to hedonic rent equations. At any time, the supply of housing in an area is determined by the current stock of housing. Characteristics in short supply may command premiums over cost for long periods as the housing stock slowly adjusts to meet the demand. Similarly, characteristics in excess supply may rent below cost for long periods. Accordingly, the coefficients of characteristics that cannot be readily changed may diverge substantially from long-run costs.

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[1]As discussed in Appendix E, collection of data similar to that collected in the American Housing Survey (AHS) would have permitted such comparisons. The pros and cons of this approach are discussed in Appendix E (Section E.2.1).

In addition, there are special problems associated with the assumption of a stable market equation. If a local housing market is substantially racially segregated, for example, then there may be no transfer of supplies between the separate markets. In this case, prices may differ substantially within a local area depending on which market a unit is in. This can be tested, but not with the number of observations available to this study in each local market. This problem is exacerbated in dealing with hedonic rent functions for program recipients. The units that are actually purchased by recipients must meet minimum occupancy and quality requirements and yet rent for amounts the recipients feel are affordable or in the case of the Certificate program, are below the program rent ceilings. There is no reason to believe that the costs incurred by recipients under these conditions will mirror general private market costs.

Such specification problems are common to this sort of analysis. While there is no way to assure that there are no specification errors, our confidence in the findings is increased by three facts. First, we developed the basic specification, including the functional form of the equation and the list of variables, from analysis of the extensive data collected for the 1980 evaluation of the Certificate Program (Wallace et al.). This avoided the major danger of mis-estimating program effects through over-fitting of estimated equations. This was especially important in this case, since the estimation of separate regressions for each site and program left us relatively few degrees of freedom.

Second, our confidence in the findings is increased to the extent that results are not sensitive to alternative specifications. To examine this, we compared the programs under an alternative hedonic specification based on a logarithmic form, with no material change in results (see Appendix E).

Finally, examination of the housing descriptors included in the hedonic equation reveals very little difference in the average value of any housing descriptor for the two programs. The estimated hedonic index is at least not missing any obvious differences in recipient housing.

The second potential problem in the interpretation of results is omitted variables. If we find that the two programs differ in their estimated hedonic rents for units with given characteristics, we know that on average recipients in one program paid different amounts than recipients in the other program for housing of similar characteristics. But the similar characteristics are only those that are included in the hedonic equation. The key question is whether the higher rents paid by recipients in one program were used to purchase larger amounts of some other amenities, not included in the hedonic equation, or rather in fact simply represent the results of less effective shopping.

The major test for this sort of problem is to see whether the residuals from the hedonic equation (the differences between actual and predicted unit rents) are systematically related to variables that would be expected to affect the level of housing purchased but not shopping behavior. Further, such tests can be used to develop a correction for omitted variables. Estimated corrections for omitted variables were usually insignificant and small (See Appendix E).

In summary, the findings reported in Section 3.1 seem both reasonable and likely to be accurate.

CHAPTER 4

DETAILS OF HOUSING IN THE TWO PROGRAMS

This chapter presents the results of a comparison of recipient housing in the two programs in terms of specific features. The sections present details of recipient housing along a number of dimensions--living space (Section 4.1), unit condition (Section 4.2), unit amenities (Section 4.3), and neighborhood (Section 4.4).

The measures for which we have data on both pre-program and program housing show clear evidence that recipient housing in both programs was materially better than their pre-program housing. Program units were larger and were rated more highly by recipients than pre-program units. Program units were located in Census tracts with modestly, but significantly, higher family incomes and median rental levels. There was little or no change in the extent to which recipients were located in areas with high concentrations of minority households--except that Hispanics on average moved to tracts with a significantly smaller percentage of minority households.

A large number of measures were available to compare recipient housing in the two programs. These included both summary measures such as overall evaluator or recipient ratings of units, plus detailed descriptions of the presence or condition of many specific features. The only significant difference in unit condition and quality was a slightly (one percent) higher evaluator rating of unit quality in the Housing Voucher Program. Overall, the pattern of findings for unit condition and quality is consistent with the findings of the previous chapter that Housing Voucher recipients who moved occupied very slightly better units than Certificate Program recipients: estimated differences tend to be positive, though never large and, with the one exception already noted, never significant. No pattern is even suggested by the comparisons of neighborhoods, although there was one significant difference: Certificate recipients who moved tended to live in Census tracts in which there was a slightly lower percentage of families on welfare (16.1 percent receiving welfare in tracts occupied by Certificate recipients as compared with 17.2 percent in the tracts occupied by Housing Voucher recipients).

4.1 Living Space

As shown in Table 4.1, recipients in both programs added an average of half a room to their pre-program average of around three rooms per family (excluding subunits). This represents a fairly substantial 15 to 20 percent increase in the average number of rooms per family. There was, however, no significant difference between the two programs in either the number of rooms occupied by recipients or in the change from pre-program levels. Nor, as shown in Table 4.2, was there any material difference between the two programs in the average unit size--whether expressed in area or number of rooms or in terms of space per person.[1] Except for rooms per person, the measures of average size are all slightly higher in the Housing Voucher Program, but the estimated differences are never significantly different from zero and are always small, ranging from one to two and a half percent of Certificate Program levels.

Although average unit size was quite similar in the two programs, it does appear that Housing Voucher households may have occasionally used the flexibility afforded by the Housing Voucher Program to obtain larger units. As shown in Table 4.3, almost four-fifths of the recipients in both programs selected units of a size equal to the program norm. A small percent selected smaller units. However, about 17 percent of Housing Voucher recipients, as compared with about 12 percent of Certificate program recipients, selected larger units than the program norm.

4.2 Unit Condition

The overall condition of a housing unit is difficult to measure, since it reflects the condition of a large number of housing attributes, including both structural elements (walls, floors, ceilings) and fixtures and appliances provided with the unit. A large number of summary measures have been used, of which we have chosen a few for this report. These selected measures include: overall ratings of units by evaluators, evaluator ratings of the

[1] The figures on change in rooms in Table 4.1 exclude households that were part of a larger household before joining the program (for whom we have no way to count the rooms that they actually used either exclusively or on a shared basis). The figures in Table 4.2 are for all recipients.

TABLE 4.2

RECIPIENT LIVING SPACE
(national projections)

	Housing Voucher Program	Certificate Program	Difference	t-Statistic
Hundreds of Square Feet				
Mean	8.00	7.92	0.08	
Within-PHA standard error	0.09	0.10	0.14	0.61
Total standard error	0.34	0.27	0.14	0.60
Hundreds of Square Feet per Person				
Mean	3.61	3.52	0.09	
Within-PHA standard error	0.06	0.06	0.09	1.05
Total standard error	0.16	0.13	0.10	0.94
Number of Rooms				
Mean	3.64	3.60	0.04	
Within-PHA standard error	0.04	0.04	0.06	0.69
Total standard error	0.14	0.15	0.06	0.69
Rooms per Person				
Mean	0.74	0.75	-0.01	
Within-PHA standard error	0.01	0.01	0.02	0.87
Total standard error	0.03	0.03	0.02	0.87

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE 4.3

COMPARISON OF RECIPIENT UNIT SIZE WITH PROGRAM NORM
(national projections)

	Housing Voucher Program	Certificate Program	Difference	t-Statistic
Percent of Recipients with More Bedrooms Than the Program Norm				
Mean	17.0%	11.7%	5.3 pts	
Within-PHA standard error	1.4	1.2	1.8	2.87**
Total standard error	2.8	2.7	1.8	2.87*
Percent of Recipients with the Same Number of Bedrooms As the Program Norm				
Mean	77.6%	80.3%	-2.7 pts	
Within-PHA standard error	1.5	1.4	2.1	1.29
Total standard error	3.9	3.9	2.1	1.29
Percent of Recipients with Fewer Bedrooms Than the Program Norm				
Mean	5.5%	8.0%	-2.6 pts	
Within-PHA standard error	0.9	1.0	1.3	1.90‡
Total standard error	1.7	1.6	1.3	1.90‡

** = Significant at 0.01 level

* = Significant at 0.05 level

+ = Significant at 0.10 level

condition of various components in the units, overall ratings of units by recipients, and finally a measure of adequacy, using a three-level index of housing condition. The presence of amenities, which is another dimension of housing quality, is discussed in a separate section (4.3).

4.2.1 Rating of Units by Evaluators

Evaluators rated unit condition and quality, using the following categories:

Condition	Quality
1 = Hazardous condition, requires major structural renovation	1 = Uninhabitable
2 = Serious defects, requires major surface renovations or repairs	2 = Barely habitable
3 = Surface defects, requires some surface repairs	3 = Low quality but adequate
4 = Cosmetic defects, requires only minor surface refinishing	4 = Moderate quality
5 = New or like new	5 = High quality
	6 = Superior quality/luxury

As shown in Figure 4.1 and Table 4.4, in both programs about three-quarters of the units' conditions were rated as requiring some surface repairs or having only cosmetic defects, while another seventh were rated as "like new", with about 5 percent rated as seriously deficient. Similarly, in terms of quality about four-fifths of the units in both programs were rated as being of moderate or high quality, another seventh as low quality but adequate, with the remaining 3 or 4 percent spread between the extremes of luxury and barely habitable or uninhabitable.

There was no substantial difference in the distribution of ratings for the two programs, though in each case Housing Voucher recipients received somewhat higher ratings. This is confirmed by Table 4.5, which shows the average ratings for each program. Both the average rating of condition and the average rating of quality were very slightly higher for Housing Voucher recipients (about one and a half percent above Certificate Program levels), significantly different from zero only for the average quality rating.

FIGURE 4.1

DISTRIBUTION OF EVALUATING RATINGS OF HOUSING CONDITION AND HOUSING QUALITY RATING IN HOUSING VOUCHER AND CERTIFICATE PROGRAM

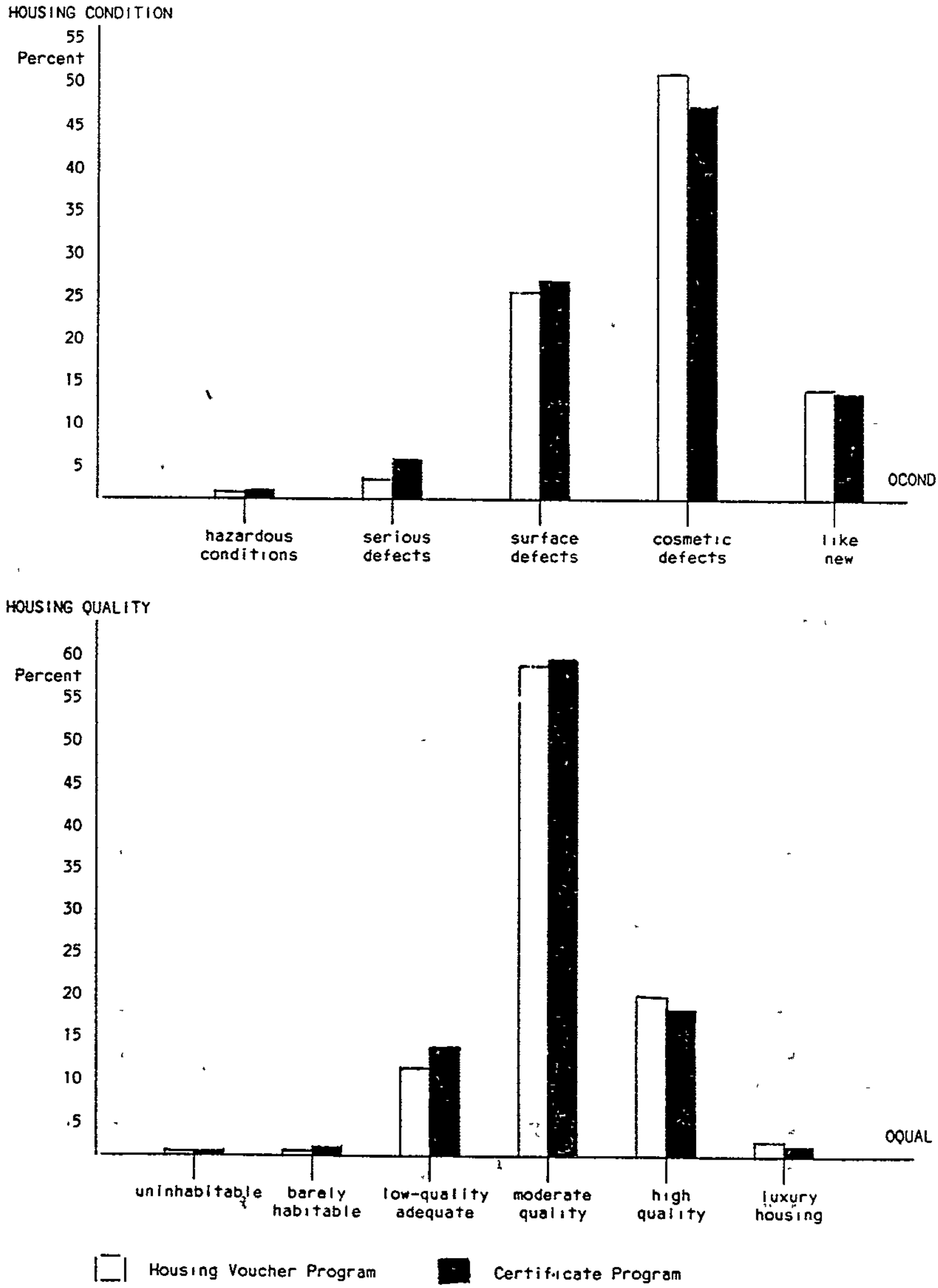

TABLE 4.4

DISTRIBUTION OF EVALUATOR RATINGS OF RECIPIENT UNITS

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic	Total Error t-statistic
Condition					
1 = Hazardous Condition	1.0%	0.7%	0.3 pts	0.55	0.53
2 = Serious Defects	4.2	6.2	-2.0	1.69‡	1.23
3 = Surface Defects	26.2	28.8	-2.6	1.10	0.93
4 = Cosmetic Defects	51.5	47.1	4.4	1.68‡	1.04
5 = Like New	14.9	14.7	0.2	0.11	0.11
Quality					
1 = Uninhabitable	0.4%	0.1%	0.3 pts	0.99	0.75
2 = Barely Habitable	0.4	1.1	-0.7	1.63	1.13
3 = Low Quality But Adequate	12.6	14.4	-1.7	0.95	0.95
4 = Moderate Quality	59.9	61.3	-1.5	0.59	0.56
5 = High Quality	22.3	19.6	2.7	1.32	1.13
6 = Luxury Housing	2.6	2.1	0.5	0.61	0.61

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE 4.5

AVERAGE EVALUATOR RATINGS OF UNITS

	Housing Voucher Program	Certificate Program	Difference	t-statistic for Difference
Average Condition Rating				
Mean	3.76	3.70	0.06	
Within-PHA Standard Error	0.03	0.03	0.04	1.51
Total Standard Error	0.07	0.07	0.05	1.37
Average Quality Rating				
Mean	4.13	4.06	0.07	
Within-PHA Standard Error	0.02	0.03	0.04	1.94+
Total Standard Error	0.09	0.08	0.04	1.94+

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

In addition to these overall ratings, evaluators were asked to rate the condition/quality of the walls, ceilings, and floors in each of the rooms, using the same scale as that used for the overall condition of the unit.[1] To summarize the separate ratings, we have used the average condition rating of walls, ceilings, and floors for all rooms in the unit, excluding storage rooms, utility rooms, or other rooms not intended for living or sleeping. Estimates for this summary measure are shown in Table 4.6. Again, there is no significant difference between programs. The average rating is high in both programs, suggesting that units are generally in need of only cosmetic repairs to surfaces. In both programs, the average room rating of Table 4.6 is higher than the average overall rating of unit condition shown earlier in Table 4.5, suggesting that evaluators' overall ratings of conditions may have been influenced by other factors such as the condition of the basement, common areas, or grounds, or have weighted individual rooms or defects differently.

Evaluators also rated the condition of the bathroom and kitchen . Table 4.7 presents the evaluator ratings of bathroom fixtures, kitchen sinks, and kitchen appliances, together with a summary measure reflecting the average of these plus ratings of the condition of bathroom grout and seals and the extent of waterproof construction in the bathroom. There is no material difference between the two programs. The estimated Housing Voucher ratings are slightly higher, but the differences between the two programs are only about one percent of the Certificate Program rating and never significantly different from zero.

Ratings were generally fairly high. Bathroom fixtures and kitchen sinks had an average rating of 2.3 to 2.4 on a scale of 1 (worst fixture or sink shows severe wear) to 3 (worst fixture or sink in good condition). Kitchen appliances had an average rating of about 3.2 on a scale of 1 (stove or refrigerator missing) to 4 (both stove and refrigerator in good condition). The overall average rating is somewhat harder to judge, since it combines both 3- and 4-point scales, as follows:

[1]The wording of the interviewer instructions for the ratings was, of course, changed slightly in each case to apply specifically to walls, ceilings, or floors, as appropriate.

TABLE 4.6

AVERAGE EVALUATION RATINGS OF SURFACES IN INDIVIDUAL ROOMS

	Housing Voucher Program	Certificate Program	Difference	t-statistic for Difference
Average Rating of Floors, Walls, and Ceilings				
Mean	4.28	4.27	0.01	
Within-PHA standard error	0.02	0.02	0.02	0.30
Total standard error	0.10	0.09	0.02	0.30

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE 4.7

OTHER EVALUATION RATINGS

	Housing Voucher Program	Certificate Program	Difference	t-statistic for Difference
Average Rating of Bathrooom Fixtures and Kitchen Appliances				
Mean	2.71	2.69	0.02	
Within-PHA standard error	0.02	0.02	0.02	0.82
Total standard error	0.10	0.10	0.02	0.77
Rating of Bathroom Fixtures				
Mean	2.35	2.32	0.03	
Within-PHA standard error	0.02	0.02	0.03	0.96
Total standard error	0.09	0.09	0.03	0.96
Rating of Kitchen Appliances				
Mean	3.21	3.19	0.02	
Within-PHA standard error	0.02	0.02	0.03	0.68
Total standard error	0.10	0.12	0.04	0.55
Rating of Kitchen Sink				
Mean	2.38	2.36	0.01	
Within-PHA standard error	0.02	0.02	0.03	0.42
Total standard error	0.08	0.08	0.03	0.42

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

Average Kitchen/Bathroom Rating:

Condition of worst fixture in bathroom: 1 (severe wear) to 3 (good or like new)

Condition of grouts and seals in bathtub and shower: 1 (completely missing) to 4 (good condition)

Extent of waterproof construction in bathroom: 1 (not waterproof anywhere) to 4 (both shower and tub waterproofed with ceramic tile or marble)

Condition of stove and refrigerator: 1 (either missing) to 4 (both in good or like new condition)

Condition of kitchen sink: 1 (severe wear) to 3 (good or like new)

In effect, the average of these creates a scale from 1 to 3.6, for which the average score in both programs was 2.7.

4.2.2 Rating of Units by Recipients

All recipients were asked to rate their pre-program unit before they were first issued a Housing Voucher or Certificate, using a scale of 1 to 4, defined as follows:[1]

4 = Excellent
3 = Good
2 = Fair
1 = Poor

Recipients in the housing quality sample were asked the same questions at the time of the inspection. We can therefore examine recipient ratings of their units and compare these ratings to the ratings of their pre-program units. As shown in Table 4.8, recipients in both programs rated their program units more highly than their pre-program units. The increase in average scores was 0.27 to 0.28, statistically significant and about 10.5 percent above pre-program levels.

Again, however, there was no significant difference between the two programs in the average recipient ratings. Housing Voucher recipients were

[1]In the actual interview instrument, the scale is reversed, with excellent coded as "1." For the reader's convenience in comparing recipient ratings with evaluator ratings we have renumbered the scale as indicated in the text.

TABLE 4.8

RECIPIENTS' RATINGS OF THEIR UNITS[a]

	Housing Voucher Program	Certificate Program	Difference	t-statistic for Difference
Rating of Pre-Program Unit				
Mean	2.62	2.60	0.02	
Within-PHA Standard Error	0.03	0.03	0.05	0.34
Total Standard Error	0.07	0.08	0.05	0.34
Rating of Program Unit				
Mean	2.90	2.87	0.03	
Within-PHA Standard Error	0.03	0.03	0.04	0.72
Total Standard Error	0.04	0.08	0.05	0.58
Change in Rating of Unit				
Mean	0.28	0.27	0.01	
Within-PHA Standard Error	0.04	0.04	0.06	0.28
Total Standard Error	0.05	0.09	0.06	0.23

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

[a]Rating scale is reversed from that used in the interview so that 4 = Excellent and 1 = Poor.

significantly less likely to rate their unit as "poor" (Table 4.9) but the difference is small and as shown in Table 4.8, did not carry over to any material difference in recipients' overall average ratings of their program units. The difference in average ratings was about one percent of the Certificate Program rating and was not significantly different from zero. It may largely reflect chance.

Table 4.10 examines recipients' ratings and change in ratings of their units by whether they moved from or stayed in their pre-program units. Recipients who moved registered material and significant increases in their ratings of their units--18 percent above pre-program levels in the Housing Voucher Program and 14 percent above pre-program levels in the Certificate Program. The estimated average ratings of program units was very slightly higher in the Housing Voucher Program (about 2 percent above the Certificate Program average), but the difference was not significantly different from zero.

As might be expected, recipients who stayed in their pre-program units rated their pre-program units more highly than recipients who moved and indeed showed no significant change in satisfaction from pre-program levels. For this group, Certificate Program recipients' estimated average satisfaction with their program units was slightly higher (under one percent above Housing Voucher levels) but again the difference is not significantly different from zero.

4.2.3 Rating of Units By an Index of Housing Adequacy

A number of adequacy measures or indices have been developed by researchers and policy makers. The index selected as the basis for the index used in this report is one which is heavily used by HUD and is tabulated by the Census Bureau for the units in the American Housing Survey. The index is a three-level index of physical problems, which classifies housing units as adequate, moderately inadequate, and severely inadequate, based on a set of basic housing deficiencies. It is not a pass/fail measure of housing quality and does not attempt to test for all Acceptability Criteria enforced by the PHAs.

Unfortunately, because inspection data are rarely available for large samples, these measures have been developed to make use of existing data sources such as the American Housing Survey (AHS) data base, which provides

TABLE 4.9

DETAILS OF RECIPIENTS' RATINGS OF THEIR UNITS

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Recipient Unit					
Excellent	23.8%	25.3%	-1.5 pts	0.67	0.67
Good	47.1	44.6	2.5	0.96	0.93
Fair	24.9	23.2	1.7	0.73	0.69
Poor	4.2	6.9	-2.7	2.09*	2.09*
Pre-Program Unit					
Excellent	18.6%	16.5%	2.1 pts	1.10	1.06
Good	38.5	39.0	-0.4	0.17	0.17
Fair	29.5	31.9	-2.3	0.95	0.95
Poor	13.4	12.6	0.8	0.50	0.50
Change					
Excellent	+5.2 pts	+8.8 pts	-3.6 pts	NA	NA
Good	+8.6	+5.6	+3.0	NA	NA
Fair	-4.6	-8.7	+4.1	NA	NA
Poor	-9.2	-5.7	-3.5	NA	NA

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE 4.10

RECIPIENTS' RATINGS OF THEIR UNITS, MOVERS AND STAYERS

	Housing Voucher Program	Certificate Program	Difference	t-statistic for Difference
Recipients Who Move From Pre-Program Unit				
Mean pre-program	2.41	2.45	-0.04	
Within-PHA standard error	0.04	0.04	0.06	0.72
Total standard error	0.08	0.09	0.06	0.72
Mean program	2.84	2.78	0.06	
Within-PHA standard error	0.04	0.04	0.06	1.10
Total standard error	0.04	0.08	0.06	1.02
Mean difference	0.44	0.34	0.10	
Within-PHA standard error	0.05	0.05	0.08	1.34
Total standard error	0.08	0.09	0.08	1.34
Recipients Who Stay In Pre-Program Unit				
Mean pre-program	3.06	2.95	0.12	
Within-PHA standard error	0.06	0.05	0.08	1.46
Total standard error	0.10	0.05	0.08	1.46
Mean program	3.01	3.03	-0.03	
Within-PHA standard error	0.05	0.05	0.07	0.38
Total standard error	0.05	0.08	0.07	0.38
Mean difference	-0.06	0.09	-0.15	
Within-PHA standard error	0.06	0.06	0.09	1.69‡
Total standard error	0.08	0.09	0.09	1.58

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

data on housing conditions as reported by recipients. They can be adapted to the information collected by housing evaluators, but are not, of course, strictly comparable. Table 4.11 shows the major elements of the housing adequacy index and how their derivation has been modified to use data from the Housing Quality Inspection Form, rather than AHS questions.

The results are presented in Table 4.12. There is no significant difference between the two programs. In both programs, 86 percent of all units are classified as adequate, about 7 percent as moderately inadequate, and about another 7 to 8 percent as severely inadequate. Although the incidence of moderately or severely inadequate units is low, it might still be the source of some concern. Closer examination of the index suggests, however, that the deficiencies involved may be less serious than they seem.

Consider first the units rated as severely inadequate. As shown in Table 4.13, almost all of the units that fall into this category do so on the basis of a single category of deficiency. Thus, for example, while a unit failing because of upkeep problems has at least three upkeep problems (four if the unit has a basement), it would almost never also be rated deficient in one of the other four categories in Table 4.11 (plumbing, heating, hallways, or electric). Accordingly, we can analyze the nature of the deficiencies in terms of the separate incidence of each of the five categories.

Electrical problems account for the largest percentage of units classified as severely inadequate in both programs (49 percent in the Housing Voucher and 58 percent in the Certificate Program).[1] But electrical hazards may be the result of tenant installation of improper extension cords. The presence of electrical hazards in one room and the lack of two outlets in another room is sufficient to classify the unit as deficient. We cannot be sure that serious hazards are not involved, but should realize that this category is potentially perhaps the least meaningful of the five severely deficient indicators.

Lack of plumbing or shared plumbing facilities is reported in about 27 percent of the severely inadequate units. Units in this category always

[1]Deficiencies in utility rooms, storage rooms, basement, or other non-living rooms were not counted in the construction of the index.

TABLE 4.11

INDEX OF HOUSING ADEQUACY[1]

DEFINITION OF PHYSICAL PROBLEMS	DEFINITION USING DATA FROM THE INSPECTION FORM
SEVERE	
A unit is considered severely deficient if it has any of the following five problems:	
• Plumbing. Lacking hot piped water or a flush toilet, or lacking both bathtub and shower, all for the exclusive use of the unit.	Bathroom outside of unit, no hot and cold water, no flush toilet, no shower or tub
• Heating. Having the heating equipment break down at least three times last winter, for at least six hours each time.	Heating equipment not working at time of inspection
• Upkeep. Having any five of the following six maintenance problems: leaky roof; leaky basement; holes in the floors; holes or open cracks in the walls or ceilings, more than a square foot of peeling paint or plaster, mice or rats in the last 90 days. If the unit has no basement, any four of the remaining five problems would be enough to count the unit as severely deficient.	Any four of the five following problems:[2] Damp walls or floors in basement Serious defects in floors or hazardous conditions Serious defects in ceilings or hazardous conditions Serious defects in walls or hazardous conditions Evidence of rats in unit or common areas
• Hallways. Having all of the following three problems in public areas: no working light fixtures, loose or missing steps; and loose or missing railings.	No working light fixtures and loose, broken, missing steps or handrails not firmly attached and presence of health or safety hazards in common areas
• Electric. Having no electricity, or all of the following three electrical problems: exposed wiring; a room with no working wall outlet, and three blown fuses or tripped circuit breakers in the last 90 days.	Presence of electrical hazard in the unit and at least one room (excludes storage and utility rooms) without two working outlets (or one working outlet and a light fixture)
MODERATE	
A unit is considered moderately deficient if it has any of the following five problems, but none of the severe problems:	
• Plumbing. Having the toilets all break down at once, at least three times in the last three months, for at least six hours each time.	No working toilet at the time of inspection
• Heating. Having unvented gas, oil, or kerosene heaters as the main source of heat, these give off unsafe fumes.	Unvented heaters (main heating equipment)
• Upkeep. Having any three of the six upkeep problems mentioned under SEVERE.	Two of the five problems described under SEVERE.
• Hallways. Having two of the Hallways problems mentioned under SEVERE.	Two of the three problems described under SEVERE.
• Kitchen. Lacking a sink, range, or refrigerator, all for the exclusive use of the unit.	Lacking a sink, range, or refrigerator in working condition at the time of the inspection.

[1] This three-level index of physical problems was developed for use with the American Housing Survey Data. The index is frequently used by HUD and housing researchers. For more detailed information, see the Codebook for the American Housing Survey Data Base, published by Abt Associates Inc.

[2] Any three of the problems if the unit does not have a basement.

TABLE 4.12
ADEQUACY INDEX

	Housing Voucher Program	Certificate Program	Difference	t-statistic for Difference
Adequate				
Percent	86%	86%	0 pts	
Within-PHA standard error	1 pt	1 pt	2 pts	.20
Total standard error	3 pts	3 pts	2 pts	.20
Moderately Inadequate				
Percent	7%	6%	1 pt	
Within-PHA standard error	1 pt	1 pt	1 pt	.70
Total standard error	2 pts	2 pts	1 pt	.70
Severely Inadequate				
Percent	7%	8%	-1 pt	
Within-PHA standard error	1 pt	1 pt	1 pt	-.89
Total standard error	2 pts	2 pts	2 pts	-.77

** = Significant at 0.01 level
* = Significant at 0.05 level
‡ = Significant at 0.10 level

TABLE 4.13

DEFICIENCIES OBSERVED IN MODERATELY AND SEVERELY INADEQUATE UNITS
(unweighted estimates)

	Housing Voucher Program			Certificate Program		
	Number of Units	Percent of Deficient Units	Percent of All Inspected Units	Number of Units	Percent of Deficient Units	Percent of All Inspected Units
Severely Inadequate Units						
Number of units inspected	886	--	--	869	--	--
Number of deficient units	55	100%	6%	67	100%	8%
One deficiency only	54	98	6	64	96	7
Type of deficiency:						
Plumbing	15	27	2	19	28	2
-Shared plumbing facilities	9	16	1	9	13	1
-Lacking all/some plumbing features	6	11	*	10	15	1
Heating equipment	6	11	*	5	7	*
Electricity	27	49	3	39	58	4
Upkeep	5	9	*	3	4	*
Hallways	2	4	*	1	2	*
Moderately Inadequate Units						
Number of units	63	100	7	57	100	8
Percent with one deficiency only	60	95	7	54	95	6
Type of deficiency:						
Kitchen	23	37	3	22	39	3
Unvented heating equipment	19	30	2	11	19	1
Toilet breakdowns	9	14	1	7	12	*
Upkeep	6	10	*	11	19	1
Hallways	6	10	*	6	11	*

Source: Housing Quality Inspection Form

either lacked some feature (hot water, flush toilet, and a tub or shower) or were reported as having shared facilities, but not both. We reviewed cases of shared plumbing separately to investigate whether they were located in congregate housing or studio apartments. No systematic pattern was found. We also looked to see whether plumbing deficiencies were concentrated in some sites, which might indicate some site-specific arrangements or specific housing evaluator's misunderstanding of the instructions.[1] No patterns were identified. Units with shared plumbing or incomplete plumbing are fairly evenly distributed across the ten sites. However, while the deficiencies reported seem to be real, they are also present in only 2 percent of recipient units.[2]

Finally, the incidence of heating, upkeep, and hallway deficiencies is extremely low, amounting to less than 1 percent of recipients in both programs. The actual incidence of heating deficiencies could be higher. For the Index presented in Table 4.12, heat deficiency is defined as having heating equipment which was rated by the evaluator as "not working." If the deficiency were defined to include furnaces rated "apparently unsound" as well as "not working," the number of severely inadequate units would increase to 9 percent in the Housing Voucher Program recipient units and 10 percent in the Certificate Program. The difference between the two programs would still be insignificant.

Table 4.13 also shows observed deficiencies for moderately inadequate units. Absence of complete kitchen facilities accounts for over one third of all moderately inadequate units. These units represent 3 percent of all units inspected. As for cases lacking plumbing facilities, these units are not systematically located in congregate housing or studio apartments, and are distributed over all sites. All have a kitchen or a kitchen area, but lacked some component of a complete kitchen. Sixty-two percent did not have a work-

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[1]A shared bathroom is a bathroom which is reported by the evaluator as being a "separate room outside the unit." The instructions state that this code should be used if the bathroom is shared with another unit. It is conceivable that in some cases a bathroom in a room adjacent to the unit is still meant for the exclusive use of the occupants of the unit.

[2]Some reported deficiencies may of course simply be errors in coding by evaluators or in subsequent transcriptions. We would generally expect that such errors would arise in well under 1 percent of cases.

ing refrigerator and 29 percent lacked a working range. Only one unit did not have a sink, and three units were missing both a refrigerator and range.

4.3 Characteristics of Buildings and Presence of Amenities

Tables 4.14 and 4.15 present details on the characteristics of the buildings in which units were located and the presence of various special amenities. Recipients in both programs occupied quite similar buildings. About two-fifths of recipients lived in multi-family apartment buildings of less than four stories. Another fifth were in single-family detached houses. Roughly one-third of the buildings were built between 1960 and 1986. About a quarter were built between 1920 and 1945 and another quarter between 1945 and 1960. Very few were newly constructed.

There were few recipients living in either attic or basement apartments. Most buildings had some sort of off-street parking facilities. Approximately one-fourth of recipients had access to common or private basements. Around 10 percent were rated as lacking adequate heat or having unvented heaters.[1]

There was no material difference between the programs in the incidence of the various amenities and special features listed in Table 4.15. About half of the recipients in both programs had some sort of yard. Many had simple kitchen amenities such as double sinks, range hoods, and counter backsplashes. The other amenities in the table were rarely present.

4.4 Neighborhoods

There was no material difference between the two programs in recipient ratings of their neighborhoods. Recipient ratings of their current neighborhood were materially higher than their ratings of their pre-program neighborhoods in both programs (Table 4.16).[2] The increases were somewhat less than the increase in recipients' satisfaction with their units--8 percent in the

[1]Approximately 2 percent of the units have unvented heaters, while the remaining units have no heating equipment or rely entirely on portable electric heaters, fireplaces, or woodstoves for their heating needs.

[2]As with recipient ratings of their units, the original ratings codes have been reversed so that 1 is poor and 4 is excellent.

TABLE 4.14

GENERAL CHARACTERISTICS OF THE BUILDINGS IN WHICH RECIPIENTS LIVE

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic	Total Error t-statistic
Type of Building					
Single Family Detached	23.3%	22.8%	0.5 pts	0.25	0.22
Single Family (Row House)	5.0	3.7	1.3	1.41	1.26
Duplex	9.8	9.6	0.2	0.14	0.12
3 to 4 Units	7.2	7.8	-0.6	0.47	0.47
Multi-Family (4 stories or less)	41.4	42.9	-1.5	0.63	0.63
Highrises (more than 4 stories)	10.7	10.9	-0.1	0.12	0.07
Age of Building					
1919 or Before	5.9%	7.3%	-1.4 pts	1.18	1.18
1920 - 1945	26.6	27.8	-1.2	0.54	0.54
1945 - 1960	26.9	27.9	-1.0	0.45	0.30
1960 - 1986	37.7	34.4	3.3	1.40	1.14
New Construction (less than 1 year)	0.3	0.5	-0.2	0.79	0.77
Location of Unit					
First Floor	59.1%	61.0%	-2.0 pts	0.81	0.80
Above First Floor	35.8	32.0	3.8	1.63	1.25
Basement Apartment	2.3	3.4	-1.1	1.44	0.91
Attic Apartment	2.8	3.6	-0.8		
Other Features					
Presence of Entrance Hall	39.5%	38.2%	1.3 pts	0.65	0.64
Common Basement	7.7	9.8	-2.2	1.69‡	1.69‡
Private Basement	16.3	15.6	0.7	0.42	0.42
Parking Facilities	65.5	63.7	1.9	0.90	0.90
Unvented or Inadequate Heat	12.2	11.6	0.6	0.37	0.30

** = Significant at 0.01 level
* = Significant at 0.05 level
‡ = Significant at 0.10 level

TABLE 4.15

PERCENT OF RECIPIENT UNITS WITH AMENITIES AND SPECIAL FEATURES

	Housing Voucher	Certificate	Difference	Within-PHA t-statistic	Total Error t-statistic
Outside the Building					
Outdoor Swimming Pool	11.9%	10.5%	1.4 pts	0.96	0.96
Playground	10.1	10.4	-0.2	0.17	0.17
Basketball/Volley Ball Court	3.0	4.6	-1.6	1.63	1.63
Shared Yard	28.1	28.8	-0.7	0.34	0.26
Private Yard	26.3	24.3	2.0	0.96	0.96
Shared Facilities					
Function Room	4.3%	2.5%	1.8 pts	2.08*	1.25
Fancy Foyer	1.5	1.8	-0.3	0.42	0.42
Social Services	0.9	0.6	0.3	0.84	0.84
Inside Unit					
Kitchen Nook	7.2%	5.4%	1.8 pts	1.57	1.05
Double Sink	49.5	49.1	0.3	0.15	0.15
Range Hood	34.9	37.0	-2.0	0.89	0.89
Pantry	7.2	9.2	-2.0	1.49	1.36
Backsplash at Counter	22.6	23.2	-0.6	0.31	0.31
Bathroom Features					
Built-in Vanity Tables	0.3%	0.3%	-0.1 pts	0.39	0.39
Glass Doors or Shower	0.3	0.1	0.2	0.80	0.78
Special Shower Head	5.7	6.4	-0.7	0.60	0.60
Other Amenities					
Balcony	5.1%	5.2%	-0.1 pts	0.13	0.11
Special Windows	5.3	5.5	-0.2	0.15	0.12
Fireplace	5.1	5.5	-0.4	0.40	0.37
Quality Landscaping	2.6	1.6	1.0	1.54	1.15

** = Significant at 0.01 level
* = Significant at 0.05 level
‡ = Significant at 0.10 level

TABLE 4.16

AVERAGE RECIPIENT RATING OF NEIGHBORHOOD

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
All Recipients					
Pre-Program Rating	2.47	2.53	-0.06	1.23	1.18
Recipient Rating	2.66	2.63	0.03	0.60	0.39
Change	0.19	0.11	0.08	1.40	1.02
Within-PHA t-statistic of Change	4.57**	2.48*	1.40	NA	NA
Total Error t-statistic of Change	4.57**	1.65	1.02	NA	NA
Recipients Who Moved From Their Pre-Program Unit					
Pre-Program rating	2.30	2.38	-0.08	1.29	1.29
Recipient Rating	2.61	2.55	0.06	0.96	0.69
Change	0.31	0.18	0.13	1.65‡	1.27
Within-PHA Error t-statistic of Change	5.44**	3.09**	1.65‡	NA	NA
Total Error t-statistic of change	5.20**	2.31*	1.27	NA	NA

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

Housing Voucher Program and 4 percent in the Certificate Program, as contrasted with increases of 11 and 10 percent, respectively, in satisfaction with units. There was, however, no material difference between the two programs. The difference in the estimated increase in satisfaction between the two programs was not significantly different from zero. Nor was the estimated level of satisfaction with program neighborhoods significantly higher in the Housing Voucher Program. The details of recipient ratings confirm this picture (Table 4.17).

Most recipients lived in largely residential areas. Only about one-sixth lived in heavily commercial or industrial areas. About the same proportion lived in areas with abandoned or boarded-up buildings. Similarly, about one-sixth felt that crime was a serious problem in their neighborhoods (Table 4.18). Again, there were no significant or substantial estimated differences between the two programs.

We can compare the Census tracts occupied by recipients before and after entering the program in terms of the income of tract residents, the housing in the tract, and the degree of racial or ethnic minority concentration in the tract. Table 4.19 characterizes the income of residents in terms of median family income, median per capita income, and the percent of families receiving welfare. As shown in the table, there were modest, but statistically significant changes in all three measures. Recipients in both programs lived in tracts with median family and per capita incomes that were about 5.5 and 3.4 percent higher, respectively, than the incomes of recipients in their pre-enrollment Census tracts. The percentage of families on welfare dropped by 1.4 percent in the Housing Voucher Program and 2.9 percent in the Certificate Program--about 8 and 15 percent below pre-program levels.

Again, differences between the two programs are small and insignificant. The reduction in the percentage of Census tract families receiving welfare is significantly larger in the Certificate Program, but the resulting difference in destination levels is small (only 0.5 points, or 3 percent below that of the Housing Voucher Program) and not statistically significant.

Tract characteristics for recipients who move from or stay in their pre-enrollment units are compared in Table 4.20. Recipients who stay start out in tracts with higher incomes than recipients who move. Recipients who move, move to tracts with higher incomes, not much different from those occu-

TABLE 4.17

RECIPIENT RATING OF NEIGHBORHOOD

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Percent Rating Current Neighborhood As:					
1 = Excellent	19.1%	19.0%	0.1 pts	0.04	0.04
2 = Good	39.9	38.8	1.1	0.45	0.45
3 = Fair	29.3	29.0	0.3	0.12	0.12
4 = Poor	11.7	13.3	-1.5	0.86	0.65
Percent Rating Pre-Program Neighborhood As:					
1 = Excellent	14.1%	13.7%	0.4 pts	0.27	0.20
2 = Good	37.1	40.3	-3.2	1.25	1.25
3 = Fair	30.5	30.4	0.1	0.04	0.04
4 = Poor	18.3	15.6	2.6	1.35	1.35
Change:					
1 = Excellent	+5.0 pts	+5.3 pts	+0.3 pts	NA	NA
2 = Good	+2.8	-1.5	+4.3	NA	NA
3 = Fair	-0.8	-1.4	+0.6	NA	NA
4 = Poor	-6.6	-2.3	-4.3	NA	NA

** = *Significant at 0.01 level*
* = Significant at 0.05 level
‡ = Significant at 0.10 level

TABLE 4.18

RATINGS OF SURROUNDING AREA

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Evaluator Classification of Immediate Area					
All Residential	48.1%	46.9%	1.2 pts	0.48	0.48
Mostly residential	34.6	34.5	0.1	0.06	0.06
Rural/Semi-Rural	0.9	0.5	0.4	1.20	0.79
Other	16.2	18.6	-2.4	1.22	1.22
Abandoned/Boarded-Up Units					
Evaluator Observation	15.8%	15.6%	0.2 pts	0.09	0.09
Recipient Perception	14.8	15.2	-0.4	0.23	0.20
Recipient Perception of Crime in the Neighborhood					
1 = Serious Problem	15.3%	15.1%	0.3 pts	0.14	0.11
2 = Somewhat of a Problem	24.8	25.1	-0.3	0.12	0.10
3 = Not Much of a Problem	59.9	59.9	0.0	0.0	0.0

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

TABLE 4.19

INCOME IN CENSUS TRACTS OCCUPIED BY RECIPIENTS

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Median Family Income (000s)					
Origin Census Tract	12.9	12.7	0.2	0.66	0.52
Destination Census Tract	13.6	13.4	0.2	0.81	0.81
Change	0.7	0.7	0.0	0.04	0.03
Within-PHA t-statistic of Change	4.51**	4.17**	0.04	NA	NA
Total Error t-statistic of Change	2.87**	1.83‡	0.03	NA	NA
Median Per-Capita Income (000's)					
Origin Census Tract	5.9	5.9	0.0	0.28	0.26
Destination Census Tract	6.1	6.1	0.0	0.42	0.42
Change	0.2	0.2	0.0	0.08	0.08
Within-PHA t-statistic of Change	2.81**	2.58**	0.08	NA	NA
Total Error t-statistic of Change	1.72‡	1.63	0.08	NA	NA
Percent of Families Receiving Welfare					
Origin Census Tract	18.2%	19.2%	-1.0 pts	1.54	1.54
Destination Census Tract	16.8	16.3	0.5	0.94	0.94
Change	-1.4 pts	-2.9 pts	1.5	2.49*	2.49*
Within-PHA t-statistic of Change	3.09**	6.38**	2.49*	NA	NA
Total Error t-statistic of Change	2.52*	6.38**	2.49*	NA	NA

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE 4.20

INCOME OF CENSUS TRACTS OCCUPIED BY RECIPIENTS: MOVERS AND STAYERS

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Median Family Income (000s)					
Stayers	13.3	13.3	-0.0	0.07	0.07
Movers' Origin Tract	12.6	12.5	0.0	0.08	0.07
Movers' Destination Tract	13.7	13.5	0.2	0.98	0.98
Change	1.1(**)	0.9(NS)	0.2	0.65	0.43
Median Per Capita Income (000s)					
Stayers	6.3	6.3	0.00	0.00	0.00
Movers' Origin Tract	5.7	5.7	-0.02	0.15	0.15
Movers' Destination Tract	6.0	5.9	0.06	0.64	0.64
Change	0.3(*)	0.2(NS)	0.1	0.59	0.57
Percent of Families Receiving Welfare					
Stayers	16.2%	16.9%	-0.7 pts	0.70	0.64
Movers' Origin Tract	19.3%	19.9%	-0.5 pts	0.74	0.74
Movers' Destination Tract	17.2	16.1	1.1 pts	1.79‡	1.79‡
Change	-2.1 pts(**)	-3.8 pts(**)	1.7 pts	2.00*	2.00*

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

pied by recipients who stayed in their pre-enrollment unit. The change in the tract income is significant only for the Housing Voucher Program, but there is no significant difference between the two programs in either the level or change.

Similarly, movers in both programs move to tracts with a modestly, but significantly, smaller proportion of families receiving welfare. The reduction is significantly larger in the Certificate Program and movers in the Certificate Program end up in tracts with modestly but significantly smaller percentages of families on welfare (1.1 points, or 6 percent below the Housing Voucher Program recipients).

Characterizing recipient Census tracts in terms of the median value of owner-occupied units, median rents, and the percent of units without adequate plumbing in Tables 4.21 and 4.22 yields patterns similar to those found for tract income. Changes in the median value of owner-occupied houses are small and usually not statistically significant. There is a modest (6 percent) but significant increase in the median rent of units in the tracts occupied by recipients (Table 4.21). Recipients who stay start in tracts with higher median rents than those who move. Recipients who move, move to tracts with median rents more like those of the tracts occupied by stayers, significantly higher (8 percent) than their origin tracts. There is no difference between the two programs.

The percentage of units in the tract without adequate plumbing is always small, but may serve as a proxy for the general quality of the stock. In any case, it drops in both programs. In this measure, recipients who stay do not start off in better tracts than those who move, though those who move do go to tracts with lower incidences of inadequate plumbing. Again, there is no material or significant difference between the two programs.

Overall, recipients lived in tracts with substantial minority populations. Again, there were small declines compared to pre-program locations (Table 4.23).

Tables 4.24A to 4.24C present changes in the racial/ethnic concentration of tracts for non-minority, black (non-Hispanic), and Hispanic recipients. While all three groups registered slight reductions in minority concentration, only Hispanic recipients showed a substantial and significant reduc-

TABLE 4.21

HOUSING MARKET CHARACTERISTICS OF
CENSUS TRACTS OCCUPIED BY RECIPIENTS

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Median Value of Owner-Occupied Units (000's)					
Origin Census Tract	$43.6	$43.2	0.4	0.42	0.42
Destination Census Tract	44.6	44.5	0.1	0.12	0.12
Change	0.9	1.2	-0.3	0.36	0.36
Within-PHA t-statistic of Change	1.55	2.08*	0.36	NA	NA
Total Error t-statistic of Change	1.06	1.57	0.36	NA	NA
Median Monthly Rent					
Origin Census Tract	$222	$222	$0	0.02	0.02
Destination Census Tract	235	235	0	0.12	0.12
Change	13	13	0	0.13	0.13
Within-PHA t-statistic of Change	5.87**	6.22**	0.13	NA	NA
Total Error t-statistic of Change	3.53**	3.97**	0.13	NA	NA
Percent of Units Without Adequate Plumbing					
Origin Census Tract	2.5%	2.4%	0.1 pts	0.49	0.49
Destination Census Tract	1.9	2.1	-0.2	1.50	1.50
Change	-0.6 pts	-0.3 pts	-0.3 pts	1.25	1.25
Within-PHA t-statistic of Change	**[a]	**[a]	1.25	NA	NA
Total Error t-statistic of Change	**[a]	**[a]	1.25	NA	NA

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

[a]Standard errors less than 0.001 point.

TABLE 4.22

HOUSING MARKET CHARACTERISTICS OF CENSUS TRACTS OCCUPIED BY RECIPIENTS: MOVERS AND STAYERS

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Median Value of Owner-Occupied Units (000s)					
Stayers	$47.7	$45.7	$2.0	1.05	1.05
Movers' Origin Tract	41.9	41.7	0.1	0.12	0.12
Movers' Destination Tract	43.1	43.4	-0.3	0.32	0.32
Change	1.2(NS)	1.6(NS)	0.4	0.37	0.37
Median Monthly Rent					
Stayers	$233	$240	$-7	1.41	1.29
Movers' Origin Tract	217	215	2	0.45	0.45
Movers' Destination Tract	235	234	2	0.48	0.48
Change	18(**)	18(**)	-0	0.0	0.0
Percent of Units Without Adequate Plumbing					
Stayers	2.6%	2.6%	-0.0 pts	0.01	0.01
Movers' Origin Tract	2.6%	2.2%	0.3 pts	0.83	0.83
Movers' Destination Tract	1.7%	1.9%	-0.2 pts	1.43	1.43
Change	-0.9 pts(**)	-0.4 pts(NS)	-0.5 pts	1.30	1.30

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE 4.23

CHANGE IN RACIAL/ETHNIC CONCENTRATION OF TRACTS OCCUPIED BY RECIPIENTS

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Percent Minority					
Origin Census Tract	61.4%	61.3%	0.1 pts	0.10	0.09
Destination Census Tract	59.4	58.7	0.7	0.60	0.54
Change	-2.0	-2.6	0.6	0.58	0.58
Within-PHA t-statistic of Change	2.83**	3.37**	0.58	NA	NA
Total Error t-statistic of Change	1.83‡	2.13*	0.58	NA	NA
Percent Black					
Origin Census Tract	43.6%	42.7%	0.9 pts	0.66	0.65
Destination Census Tract	42.5	41.1	1.4	1.11	1.11
Change	-1.1 pts	-1.6 pts	0.5	0.48	0.44
Within-PHA t-statistic of Change	1.30	1.97*	0.48	NA	NA
Total Error t-statistic of Change	0.92	1.50	0.44	NA	NA
Percent Hispanic					
Origin Census Tract	13.6%	14.3%	-0.7 pts	0.84	0.84
Destination Census Tract	13.0	13.8	-0.8	1.06	1.06
Change	-0.6 pts	-0.4 pts	-0.1	0.19	0.19
Within-PHA t-statistic of Change	1.07	1.00	0.19	NA	NA
Total Error t-statistic of Change	0.92	0.53	0.19	NA	NA

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE 4.24A

CHANGE IN RACIAL/ETHNIC CONCENTRATION OF TRACTS OCCUPIED BY NON-MINORITY RECIPIENTS

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Percent Minority					
Origin Census tract	20.5%	21.0%	0.5 pts	0.25	0.25
Destination Census tract	19.2%	20.2%	-1.0 pts	0.49	0.49
Change	-1.3 pts	-0.8 pts	-0.5 pts	0.35	0.26
Within-PHA t-statistic of change	1.33	0.83			
Total Error t-statistic of change	0.97	0.65			
Percent Hispanic					
Origin Census tract	6.2%	7.5%	-1.3 pts	1.24	1.24
Destination Census tract	6.0%	7.4%	-1.4 pts	1.39	1.12
Change	-0.3 pts	-0.1 pts	-0.1 pts	0.25	0.14
Within-PHA t-statistic of change	0.57	0.40			
Total Error t-statistic of change	0.36	0.16			
Percent Black					
Origin Census tract	9.0%	5.9%	0.1 pts	0.05	0.05
Destination Census tract	8.4%	8.4%	0.0 pts	0.01	0.01
Change	-0.5 pts	-0.5 pts	-0.1 pts	0.06	0.06
Within-PHA t-statistic of change	0.82	0.62			
Total Error t-statistic of change	0.82	0.62			

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE 4.24B

CHANGE IN RACIAL/ETHNIC CONCENTRATION OF TRACTS OCCUPIED BY BLACK (NON-HISPANIC) RECIPIENTS

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Percent Minority					
Origin Census tract	76.7%	77.8%	-1.2 pts	0.89	0.89
Destination Census tract	75.2%	75.6%	-0.4	0.35	0.30
Change	-1.5 pts	-2.2 pts	0.7	0.49	0.49
Within-PHA t-statistic of change	1.42	2.03*			
Total Error t-statistic of change	1.11	1.38			
Percent Hispanic					
Origin Census tract	8.8%	9.7%	-0.8 pts	1.09	0.97
Destination Census tract	9.1%	10.2%	-1.0	1.39	1.12
Change	0.3 pts	0.5 pts	-0.2	0.27	0.27
Within-PHA t-statistic of change	0.50	0.78			
Total Error t-statistic of change	0.50	0.70			
Percent Black					
Origin Census tract	64.0%	64.0%	0.0 pts	0.01	0.01
Destination Census tract	62.6%	62.1%	0.5	0.28	0.28
Change	-1.4	-1.8	0.4	0.25	0.25
Within-PHA t-statistic of change	1.13	1.36			
Total Error t-statistic of change	0.86	1.09			

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE 4.24C

CHANGE IN RACIAL/ETHNIC CONCENTRATION OF TRACTS OCCUPIED BY HISPANIC RECIPIENTS

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Percent Minority					
Origin Census tract	73.8%	71.5%	2.3 pts.	0.84	0.57
Destination Census tract	66.5%	64.5%	2.0 pts	0.69	0.51
Change	-7.3 pts	-7.0 pts	-0.3	0.10	0.10
Within-PHA t-statistic of change	4.04**	3.87**			
Total Error t-statistic of change	3.02**	3.25**			
Percent Hispanic					
Origin Census tract	52.9%	50.2%	2.7 pts	0.71	0.70
Destination Census tract	47.0%	45.4%	1.6 pts	0.45	0.36
Change	-5.9 pts	-4.9 pts	-1.1 pts	0.25	0.22
Within-PHA t-statistic of change	1.55	2.97**			
Total Error t-statistic of change	1.44	1.78‡			
Percent Black					
Origin Census tract	20.1%	18.0%	2.1 pts	0.67	0.44
Destination Census tract	18.4%	15.7%	2.7	1.03	0.55
Change	-1.7 pts	-2.3 pts	0.6	0.30	0.17
Within-PHA t-statistic of change	1.05	1.78‡			
Total Error t-statistic of change	0.55	1.78‡			

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

tion in the minority concentration of the tracts they occupied. These patterns are essentially the same if we only consider recipients who move from their pre-enrollment units (Tables 4.25A to 4.25C).

TABLE 4.25A

CHANGE IN RACIAL/ETHNIC CONCENTRATION OF TRACTS OCCUPIED BY NON-MINORITY RECIPIENTS WHO MOVED FROM THEIR PRE-ENROLLMENT UNIT

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Percent Minority					
Origin Census tract	22.7%	20.2%	2.5 pts	0.94	0.75
Destination Census tract	19.5	18.6	0.9	0.34	0.29
Change	-3.2 pts	-1.6 pts	-1.6	0.56	0.40
Within-PHA t-statistic of change	1.44	0.90			
Total Error t-statistic of change	1.14	0.67			
Percent Hispanic					
Origin Census tract	5.8%	6.0%	-0.2 pts	0.20	0.15
Destination Census tract	5.1%	5.9%	-0.8	0.92	0.49
Change	-0.7 pts	-0.1 pts	-0.6	0.55	0.26
Within-PHA t-statistic of change	0.88	0.14			
Total Error t-statistic of change	0.49	0.06			
Percent Black					
Origin Census tract	11.6%	9.8%	1.8 pts	0.76	0.76
Destination Census tract	10.2%	8.6%	1.6	0.69	0.69
Change	-1.4 pts	-1.2 pts	-0.2	0.11	0.11
Within-PHA t-statistic of change	0.93	0.83			
Total Error t-statistic of change	0.93	0.83			

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE 4.25B

CHANGE IN RACIAL/ETHNIC CONCENTRATION OF TRACTS OCCUPIED BY BLACK (NON-HISPANIC) RECIPIENTS WHO MOVED FROM THEIR PRE-ENROLLMENT UNIT

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Percent Minority					
Origin Census tract	75.8%	77.1%	-1.3 pts	0.86	0.86
Destination Census tract	73.8%	73.7%	0.2	0.11	0.11
Change	-1.9 pts	-3.4 pts	1.5	0.78	0.78
Within-PHA t-statistic of change	1.46	2.41*			
Total Error t-statistic of change	1.16	1.70‡			
Percent Hispanic					
Origin Census tract	7.9%	8.8%	-0.9 pts	1.10	1.07
Destination Census tract	8.4%	9.4%	-0.9	1.10	1.10
Change	0.5 pts	0.5 pts	-0.0	0.01	0.01
Within-PHA t-statistic of change	0.82	0.69			
Total Error t-statistic of change	0.82	0.59			
Percent Black					
Origin Census tract	63.8%	64.0%	-0.1 pts	0.08	0.08
Destination Census tract	61.9%	61.2%	0.6	0.34	0.34
Change	-2.0 pts	-2.8 pts	0.8	0.34	0.34
Within-PHA t-statistic of change	1.24	1.62			
Total Error t-statistic of change	0.91	1.31			

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE 4.25C

CHANGE IN RACIAL/ETHNIC CONCENTRATION OF TRACTS OCCUPIED BY HISPANIC RECIPIENTS WHO MOVED FROM THEIR PRE-ENROLLMENT UNIT

	Housing Voucher Program	Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Percent Minority					
Origin Census tract	73.2%	72.5%	0.8 pts	0.26	0.17
Destination Census tract	63.5%	63.1%	0.4	0.13	0.09
Change	-9.7 pts	-9.4 pts	0.3	0.10	0.10
Within-PHA t-statistic of change	4.22**	3.57**			
Total Error t-statistic of change	3.67**	3.47			
Percent Hispanic					
Origin Census tract	56.0%	53.0%	3.0 pts	0.74	0.63
Destination Census tract	48.0%	46.9%	1.1	0.28	0.17
Change	-8.0 pts	-6.1 pts	-1.9	0.38	0.33
Within-PHA t-statistic of change	1.82‡	2.62*			
Total Error t-statistic of change	1.82‡	1.75‡			
Percent Black					
Origin Census tract	16.8%	16.8%	0.0 pts	0.01	0.11
Destination Census tract	14.8%	13.5%	1.3	0.62	0.25
Change	-2.1 pts	-3.4 pts	1.3	0.47	0.31
Within-PHA t-statistic of change	1.02	1.77‡			
Total Error t-statistic of change	0.56	1.64‡			

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

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Appendix A

THE DEMONSTRATION SAMPLE

The sample of observations for the Demonstration consists of a sample of 20 PHAs and, within these PHAs, samples of Section 8 (Existing) Housing Program applicants randomly assigned to either the Housing Voucher or Housing Certificate program. This report is based on a subsample of ten PHAs and, within these PHAs, recipients in the two programs. This appendix describes each stage of the sampling procedures and the samples actually drawn.

A.1 The Sample of PHAs

The Demonstration sample of 20 PHAs consists of a probability sample of 18 larger urban PHAs, plus two statewide PHAs. The 18 larger urban PHAs comprise a stratified random sample of all larger urban PHAs. The two statewide PHAs were selected by HUD to provide some indication of program experience in smaller and/or less urban PHAs. (In addition, HUD is separately collecting information from a sample of 41 smaller urban and rural PHAs.)

The sample of 18 larger urban PHAs was drawn for HUD by Westat, Inc., from the universe of 106 non-statewide PHAs that were within the contiguous 48 states, had at least 1,000 authorized Section 8 Certificate Program slots in January 1984, and whose jurisdiction included an urban area with a population of at least 50,000.[1] Westat concluded that two of these PHAs--New York and Los Angeles--had such large Section 8 Certificate Programs that they should be included in the sample with certainty (that is, be included simply to represent themselves). The remaining 104 PHAs were then grouped into 28 strata formed by 7 regions and 4 size categories, as shown in Table A.1.

Since the remaining sample allowed for only 16 PHAs, Westat set marginal sampling targets for regions and size categories, and then drew a

[1]See Dietz et al., p. 3-1. HUD excluded, for administrative reasons, 6 of the 112 PHAs that met these criteria, leaving a total sample of 106.

TABLE A.1

STRATIFICATION OF NONCERTAINTY PHAs BY REGION AND SIZE TOGETHER WITH MARGINAL SAMPLING TARGETS

Region	PHA SIZE (Authorized Certificate Program Slots as of January, 1984) 4,000 to 8,000	2,700 to 4,000	1,700 to 2,700	Less Than 1,700	Total Number of PHAs	Total Number of Certificate Slots (000s)	Allocated Sample
New England	0	1	1	2	4	8.7	2
New York/New Jersey	1	0	2	3	6	14.2	1
Mideast	1	1	2	5	9	20.2	2
North Central	2	6	6	7	21	50.6	4
Southeast	0	2	3	11	16	28.5	2
South Central	2	2	3	6	13	30.6	2
West	5	7	11	12	35	84.4	3
Total Number of PHAs	11	19	28	46	104	237.2	
Allocated Sample	4	4	4	4	16	NA	16

Source: Dietz, et al., Tables 3-1 and 3-2.

sample of PHAs to meet these marginal conditions. The marginal sample allocations are shown in Table A.1. The equal allocation by size categories reflected approximately equal numbers of units in each category (Dietz et al., p. 3-3). It was felt that a sample allocation across regions proportional to the number of Certificate slots in the region would lead to too great a concentration of sample in the West. Accordingly, in order to assure greater regional variation, the sample targets by region were set to be less than the proportional-to-units allocation in the West and greater in the New England, Midwest, and North Central regions.

As described in Dietz et al., the sample of PHAs was drawn to satisfy the marginal conditions of Table A.1 using a method developed by Bryant, Hartley, and Jessen (1960). This resulted in the sample of PHAs listed in Table A.2.[1]

A.2 Properties of the Bryant/Hartley/Jessen Procedure

Following the original paper by Bryant et al., we summarize the properties of the Bryant/Hartley/Jessen (BHJ) procedure for a case in which we draw a single stage sample of individuals. Within this context, Bryant et al. provide the following facts concerning their procedure.

1. There is an unbiased estimate of the population mean, $\hat{y}_u$, provided by:

(1) $$\hat{y}_u = \frac{1}{n} \sum_{r,j} \frac{P_{rj}}{\Pi_{rj}} (\bar{y}_{rj} n_{rj})$$

where

$\hat{y}_u$ = Unbiased estimator of population mean

[1]Two details of the procedure followed may be mentioned. First, Westat used the special methods suggested by Bryant et al. (pp. 121ff.) for cases where the proportion of the population falling into any stratum (in this case measured by the Certificate Program units of PHAs in a stratum) is substantially different from the proportion of the sample that would be expected to fall in that stratum based on the sample targets for the strata marginals. This procedure also, as it happened, excluded one stratum--the smallest size category in the West--from the sample. Following Westat's suggestion, we have assumed that this stratum is represented by the other strata in that region.

Second, of the 18 urban PHAs sampled only one declined to participate. This PHA was replaced with a back-up candidate selected by Westat.

TABLE A.2

SAMPLE OF PHAs

PHA	Region	Authorized Certificate Slots in January 1984	Probability of Selection
New York City, NY	NY/NJ	38,595	1.000
Los Angeles, CA	W	17,505	1.000
Cuyahoga County (Cleveland), OH	NC	5,135	0.600
Houston, TX	SC	5,504	0.600
San Antonio, TX	SC	5,720	0.600
Oakland, CA	W	4,072	0.185
Boston, MA	NE	3,990	0.808
Metro Council (Minneapolis), MN	NC	3,162	0.200
Atlanta, GA	SE	3,723	0.200
San Diego, CA	W	3,065	0.107
Pittsburgh, PA	ME	2,035	0.225
Omaha, NE	NC	1,898	0.143
Dayton, OH	NC	1,278	0.143
Seattle, WA	W	2,116	0.073
New Haven, CT	NE	1,383	0.327
Erie (Buffalo), NY	NY/NJ	1,061	0.074
Montgomery County, MD	ME	1,495	0.132
Pinellas County (St. Petersburg), FL	SE	1,402	0.074
New Jersey	N/A	N/A	N/A
Michigan	N/A	N/A	N/A

Source: Dietz, et al., Table 3-3.

n = Sample size

P_{rj} = The proportion of the population in the sample in the $(i,j)^{th}$ stratum

Π_{rj} = The expected proportion of the sample in the $(i,j)^{th}$ stratum

$\bar{y}_{rj}$ = The sample mean for the r,j^{th} stratum

n_{rj} = The actual sample size in the r,j^{th} stratum.

2. Bryant et al. also present a biased estimator:

(2) $$\hat{y}_B = \frac{1}{n} \sum_{r,j} n_{rj}\bar{y}_{rj} .$$

3. In the special situation in which

(3) $$P_{rj} = (P_{r\cdot})(P_{\cdot j})$$

and in which without rounding

(4) $$\frac{n_{r\cdot}}{n} = P_{r\cdot} \; ; \; \frac{n_{\cdot j}}{n} = P_{\cdot j}$$

where $n_{i\cdot}$ and $n_{\cdot j}$ are integer marginal sample targets, then

(5) $$\Pi_{rj} = P_{rj}$$

(6) $$\hat{y}_B = \hat{y}_u$$

and the BHJ procedure will usually have a lower variance than a procedure that allocates a non-zero sample of the same total size to every stratum (with fewer strata). The relative efficiency in other situations is not known.

4. If true cell means are additive, so that

(7) $$\mu_{rj} = \mu_{r\cdot} + \mu_{\cdot j} - \mu$$

and if the factoring condition of Eq (3) is not met, but the non-rounding condition of Eq (4) is met, then $\hat{y}_B$ is unbiased and has a lower variance than $\hat{y}_u$.[1]

5. Under certain conditions, the sample will provide unbiased estimates of $\mathrm{Var}(\hat{y}_u)$ and $\mathrm{Var}(\hat{y}_B)$. These conditions were not met in this case.[2]

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[1]Bryant et al., p. 120. Actually Bryant et al. maintain that $\hat{y}_B$ may be biased under these circumstances. However, they give the bias as:

(i) $$B = \sum \sum \left[\frac{(n_{r\cdot})(n_{\cdot j})}{n^2} - P_{rj}\right] \mu_{rj}.$$

If

(ii) $$\mu_{rj} = \mu_{r\cdot} + \mu_{\cdot j} - \mu$$

then recalling that by the non-rounding assumption of Eq. (4),

(iii) $$\sum_r n_{r\cdot} = \sum_j n_{\cdot j} = n$$

(iv) $$\sum_r P_{rj} = P_{r\cdot} = \frac{n_{r\cdot}}{n}; \quad \sum_j P_{rj} = P_{\cdot j} = \frac{n_{\cdot j}}{n}$$

we have

$$B = \sum_r \frac{n_{r\cdot}}{n} \mu_{r\cdot} + \sum_j \left(\frac{n_{\cdot j}}{n}\right) \mu_{\cdot j} - \mu - \sum_r P_{r\cdot} \mu_r - \sum_j P_{\cdot j} \mu_j + \mu = 0$$

[2]In cases where some P_{rj} are very different from $(P_{r\cdot})(P_{\cdot j})$, Bryant et al. suggest a procedure to reduce variance. This procedure, which was followed by Westat, can (and in this case did) create a situation in which the variance cannot be directly estimated from the sample.

Accordingly, in approaching the sample of PHAs, we have a choice between a definitely unbiased and potentially biased estimator, and have in either case no unbiased estimate of the variance of estimate. (Asymptotic methods such as bootstrap estimation are, of course, available.) As discussed in more detail in Appendix B, our approach was to adopt yet another estimator and rely on a likely upper bound estimate of the variance. The estimator we adopted would, in the present context, be equivalent to the $\hat{y}_u$ of Eq (1) except that the weights $(P_{rj}n_{rj}/n\Pi_{rj})$ would be normalized so that they always sum to one within the sample (as well as in expectation). If strata means are not correlated with strata weights, normalizing the weights will result in unbiased estimates with lower variance.

In terms of estimating the variance, we used the variance under a simple alternative one-way stratification as an upper bound estimate. As indicated above, the results of Bryant et al. do not allow us to be sure that the BHJ procedure has a smaller variance than a one-way stratification unless strata population proportions are closely approximated by expected strata sample sizes. Dietz et al. do not provide information on this point. However, as discussed in Appendix B, it seems reasonable to use the one-way stratified variance as an upper bound in this case, especially since for key measures inter-PHA variation was expected to be quite small.

A.3 Sampling Households

PHAs selected for the Demonstration were allocated Housing Voucher Program funds. Funding levels for the individual PHAs were set by HUD to support sample sizes that would offset differences in the probability of PHA selection and create approximately self-weighting observations at the individual level (subject to a minimum prospective sample of 100 Housing Voucher slots in each Demonstration PHA). The actual number of Housing Vouchers funded was determined by each Demonstration PHA's estimation of the number of Housing Vouchers that could be supported with these funds, given expected five-year program subsidy costs.

The putative Housing Voucher slots were allocated by bedroom size. These allocations generally followed the PHA's then-current allocation of Certificate units, with some additional slots allocated to larger unit sizes. These are shown in Table A.3. As indicated there, in cases where PHAs had adopted an apparently permanent policy of not issuing Certificates to some bedroom size, the allocation for this size was set to zero even if the PHA had some recipients in these bedroom sizes from issuances prior to the current policy. In addition, the actual sample targets set for PHAs also tended, where possible, to allocate a greater than proportional number of sample slots to larger or smaller than average bedroom sizes in order to improve precision for these groups.

The Demonstration Housing Voucher slots were matched by an equal number of Certificate Program slots funded from the PHA's regular Certificate Program funds. These were called flagged Certificates to distinguish them from the rest of the PHA's Certificate Program.

The sample of Demonstration households was then drawn from the regular flow of program applicants. Each Demonstration PHA normally accepted applications for the Section 8 Existing Housing Program at various intervals. Some took applications each day; others once in several years. In any case, applicants were generally placed in a pool, rank-ordered by some combination of date of application, randomly assigned numbers, and/or priority group. As Certificate Program slots for a particular bedroom size became available, applicants of appropriate household size would be selected from the pool in order, verified eligible, and issued a Certificate. They then had some number of months in which to find a unit that met program requirements. If they succeeded, they became recipients. If not, their Certificate was reissued to another family.

The only modification to this process required for the Demonstration was that instead of all selected applicants being issued Certificates, they were randomly issued either a Housing Voucher or a Housing Certificate, depending on whether the last digit of the applicant's social security number was odd or even. This continued until all of the Housing Voucher or flagged Certificate slots in each bedroom size category had been filled. Once the Demonstration slots in any bedroom size/program category were filled, the succeeding applicants were issued regular Certificates. If a Demonstration Housing Voucher or flagged Certificate

TABLE A.3

CURRENT DISTRIBUTION OF SECTION 8 UNITS IN URBAN SAMPLE[a]

Site	Bedroom Size					Total
	0	1	2	3	4 or more	
Atlanta	0	497	2,457	552	215	3,721
Boston	0 (31)	0 (623)	1,823 (1,158)	1,589 (1,323)	523 (435)	3,935
Cleveland	33	1,398	2,367	1,222	164	5,184
Dayton	0	134	704	351	89	1,278
Buffalo	0 (4)	383 (382)	456 (454)	171 (170)	31 (31)	1,041
Houston	567	1,648	1,962	984	343	5,504
Los Angeles	1,141	8,433	5,855	1,480	290	17,199
Minnesota	0	741	1,928	452	41	3,162
Montgomery	80	228	541	414	109	1,372
New Haven	90	322	590	408	116	1,526
New York City	4,766	19,804	11,851	4,939	671	42,031
Oakland	1,243	181	1,560	852	236	4,072
Omaha	75	651	726	343	35	1,830
Pinellas	69	488	660	168	20	1,405
Pittsburgh	0 (90)	512 (489)	969 (916)	430 (411)	98 (93)	1,999
San Antonio	101	1,179	2,226	1,496	649	5,633
San Diego	0 (50)	1,555 (1,530)	1,154 (1,135)	275 (270)	81 (80)	3,065
Settle	0 (195)	753 (684)	826 (750)	430 (390)	105 (95)	2,114

[a]Where sites were no longer issuing Certificates in the same bedroom size category, these categories are set equal to zero and the current units in these categories allocated proportionately to other bedroom sizes. Actual current numbers are shown in parentheses.

recipient terminated, then the next applicant in that bedroom size category (with the appropriate social security number parity) would be issued a Demonstration Housing Voucher or flagged Certificate, respectively.[1]

Not all those issued Housing Vouchers or Certificates became recipients. In order to speed the enrollment process, PHAs issued more Housing Vouchers or Certificates than there were slots to fill. We were, however, still able to associate each Housing Voucher or Certificate holder with a particular slot. Issuances of Housing Vouchers and flagged Certificates were grouped by program, PHA, and bedroom size category and then within each program/PHA/bedroom size cell were ordered by date of issuance and, for issuances in the same day, by slot number.[2] This provided us with a sequential list of all issuances. Some of these expired; others became recipients. The issuances associated with filling the k^{th} recipient slot (in a given program/PHA/bedroom size category) are all issuances between the $(k-1)^{st}$ and k^{th} recipient on the list. Similarly repeating the process using only issuances to a specific demographic group will identify the issuances to that demographic group associated with filling the k^{th} recipient slot of that group. This sequencing in effect allows us to duplicate the process that would have occurred had PHAs in fact issued Certificates and Housing Vouchers for each slot one at a time until they had filled all the available program slots.

The first Demonstration PHA, in San Antonio, began issuing Housing Vouchers and flagged Certificates in April 1985; the last Demonstration PHA began issuing in February 1986. The bulk of the PHAs started Demonstration operations in either June/July or September/October of

[1]As we expected with 20 sites, we had one PHA in which there was a very long run of even social security numbers. The problem this posed at the PHA is that its rules would not allow it to skip ahead on the waiting list and issue for the other program. In order to maintain a calendar balance between the two programs, the current list of applicants was randomly assigned to the two programs by Abt Associates. The PHA issued Housing Vouchers and flagged Certificates according to the randomly assigned list and then returned to the even/odd rule when the list was exhausted.

[2]PHAs issued new Housing Vouchers or flagged Certificates sequentially, using the available slot with the lowest identification number first.

1985. Housing Vouchers and/or flagged Certificates continued to be issued as recipients terminate and openings become available. Data collection on issuances and recipients ended on September 15, 1988.[1]

A.4 The Housing Evaluation Sample

Housing evaluations were conducted for samples of recipients in ten PHAs. This section describes how these housing evaluation samples were selected.

A.4.1 Selecting PHAs for Housing Evaluations

One major use of the housing evaluations was in regression estimation of rents as a function of unit characteristics (hedonic indices). Since these estimates should ideally be developed separately by site, it was decided that each PHA included in the evaluation sample should have at least roughly 100 recipient evaluations in each program. Given the total sample size of about 2,000 evaluations, ten PHAs could be selected. The 18 urban PHAs included in the Demonstration constitute a probability sample of large, urban PHAs, drawn for HUD by Westat, Inc. This sample includes

1) New York City and Los Angeles, which were selected with certainty to be self-representing.
2) A sample of sixteen other urban PHAs drawn so as to assure that the sample would be spread over seven regions and four size categories in predetermined proportions.

It seemed desirable to draw the sample of 10 housing evaluation sites in a way that would provide representative national estimates. Accordingly, we originally intended to draw the sample of 10 housing evaluation PHAs as follows:

1) First we would include New York and Los Angeles.
2) Then we would draw a sample of 8 of the remaining 16 PHAs using the constraint that the marginal conditions used by Westat in drawing the original sample would continue to be met.

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[1]In the fall of 1987 the data collection process shifted from monthly reports on issuances, new recipients, and changes in recipient status, payments, income, or address to summary reports on each issuance or recipient, which were submitted at termination or the close of data collection in September 1988.

Unfortunately, due to the small samples allocated to some PHAs and variations in PHA startup, five of the 16 PHAs would not have had even 100 recipients in each program when housing evaluations were conducted. Collapsing PHAs to provide combined sites with enough recipients would not work in this case, since the sample size requirement was dictated by the need to allow for different hedonic coefficients in each location. Accordingly we had to draw the eight sites (in addition to New York and Los Angeles) from among the eleven sites with more than 100 Housing Vouchers.

In such a situation, with in effect a large number of missing observations, it seemed inappropriate to pretend to impose a formal sampling strategy as if we could draw a probability subsample. At the same time, it is enormously useful in presenting information from samples in 10 PHAs to be able to present a single summary statistic for all 10 combined. We selected the eight sites purposively and then developed national projections by assigning the weights of unincluded sites to the housing evaluation sites that seem to be closest in character. We do not pretend that this is a rigorous procedure--none is available in this situation--but we do believe that it yields useful overall summary statistics, at least when combined with careful assessment of the extent to which results appear to vary across PHAs.

Figure A.1 shows the eighteen urban PHAs included in the demonstration, by region and size category. PHAs in parentheses are ones which were excluded because they had fewer than one hundred Housing Voucher recipients at the time of the housing evaluations. The weights shown by each PHA indicate the number of Section 8 recipients represented by that PHA in the overall Demonstration sample.

Table A.4 shows the 10 PHAs selected for the housing evaluation sample and the weights allocated to each sampled PHA.

A.4.2 Samples of Recipients within PHAs

The samples of housing evaluation recipients within the sampled PHAs were developed as follows. In each sampled PHA, all recipients as of June 1987 who had been issued Housing Vouchers or flagged Certificates prior to November 30, 1986 were divided into the four groups defined by the two programs and by whether or not the household had moved from its

FIGURE A.1

URBAN PHAs IN THE DEMONSTRATION

Region	SIZE CATEGORY (Number of Section 8 Units)					Approximate Number of Total Section 8 Recipients in the Region
	Self-Representing	4,000 to 8,000	2,700 to 4,000	1,700 to 2,700	Less Than 1,700	
New England			(Boston) w=5K		(New Haven) w=4K	9K
New York/New Jersey	New York City w=39K				Buffalo w=14K	53K
Mideast				Pittsburgh w=9K	Montgomery Cty. w=11K	20K
North Central		(Cleveland) w=9K	Minneapolis 2=16K	Omaha w=13K (Dayton) w=9k		51K
Southeast			Atlanta w=19K		Pinellas w=19K	29K
South Central		(Houston) w=9K San Antonio w=10K				31K
West	Los Angeles w=18K	Oakland w=22K	San Diego w=29K	Seattle w=29k		102K

w = Site weight = Number of Section 8 recipients in site divided by the probability of selecting the site.

TABLE A.4

PHAs SELECTED FOR THE HOUSING EVALUATION SAMPLE

Sample Site Included in Housing Evaluation Sample	Deemed to Represent The Following Sites in The Sample	Weight	
		Number	Percent
Atlanta	Atlanta, Pinellas	38K	13.3%
Los Angeles	Los Angeles and San Diego	47K	16.3%
Minneapolis	Minneapolis, Cleveland	25K	8.6%
Montgomery County	Montgomery County, plus ½ of (Boston, New Haven, and Buffalo)	22K	8.2%
New York City	New York City	39K	13.7%
Oakland	Oakland	22K	7.8%
Omaha	Omaha, Dayton	22K	7.9%
Pittsburgh	Pittsburgh, plus ½ of (Boston, New Haven, and Buffalo)	20K	7.3%
San Antonio	San Antonio, Houston	19K	6.6%
Seattle	Seattle	29K	10.3%

pre-program address. Recipients within each group were randomly ordered and the first 50 selected for evaluation. In cases where there were not enough movers (stayers) in a program to provide 50 cases, the unused sample was allocated to the other mover/stayer stratum within the same PHA and program. Stratum weights were based on the proportion of recipients in each stratum (Table A.5).

The final samples are shown in Table A.6. As shown there, 1,998 recipients were assigned for evaluation. Although these cases were checked with the PHAs within a few months before the evaluation began, by the time of the evaluation, 134 had terminated from the program and so were dropped from the sample. Of the remaining 1,864 cases, 95 percent, or 1,770, were completed by RTI. The 94 cases remaining in the sample were not completed for any of a variety of reasons--in most (64) cases because the program recipient refused to allow the evaluation.

The 1,770 cases form the basic data set used in the analysis. One important part of the analysis involves the estimation of hedonic indices based on regression of unit rents on various housing characteristics. The sample of evaluations with data on all relevant characteristics was 1,616.

TABLE A.5

STRATUM WEIGHTS FOR MOVER STRATUM

Site	Housing Voucher Program	Certificate Program
Atlanta	0.917	0.801
Los Angeles	0.719	0.700
Minneapolis	0.565	0.570
Montgomery County	0.786	0.733
New York City	0.348	0.351
Oakland	0.771	0.843
Omaha	0.706	0.652
Pittsburgh	0.682	0.774
San Antonio	0.891	0.918
Seattle	0.680	0.693

TABLE A.6

HOUSING EVALUATION SAMPLE SIZES

OVERALL

Assigned	1,999
Eligible	1,864
Completed	1,770
Hedonic Equations	1,616

BY PHA

Site	No. Cases Assigned	No. Cases Ineligible	No. Cases Eligible	No. Cases Completed	Response Rate
Atlanta	199	27	172	166	95.5%
Los Angeles	200	17	183	177	96.7
Minneapolis	200	17	183	169	92.3
Montgomery Co., MD	200	10	190	182	95.8
New York City	200	5	195	176	90.3
Oakland	200	5	195	179	91.8
Omaha	200	9	191	182	95.3
Pittsburgh	199	21	178	170	95.5
San Antonio	200	9	191	191	100.0
Seattle	200	14	186	178	95.7
TOTAL	1,998	134	1,864	1,770	95.0%

APPENDIX B

DATA SOURCES AND DEFINITIONS

This appendix describes the data sources and basic variables used in this report. Various analytic variables derived from the basic set are described as they arise in the text. Three sources of data were used--various forms submitted by Demonstration PHAs on all Housing Voucher and Certification holders and recipients, housing evaluations of the units occupied by a sample of recipients, and 1980 Census data on the tracts occupied by recipients. Each of these is described briefly below.

B.1 Data from Demonstration Forms Submitted by PHAs

Data from three sorts of forms submitted by Demonstration PHAs were used in this report--the Pre-Program Information Form (PPIF), the Housing Search Log (HSL), and the Continued Participation Form (CPF).

The Pre-Program Information Form (PPIF) was used to collect detailed information on the household characteristics and on the housing conditions of Families before they entered the Certificate/Housing Voucher Program. It was completed by PHA staff, in a face-to-face interview with a representative of the applicant household as part of the Section 8 certification process. The interview was held before the applicant has been briefed as to which program they would be participating in.

The Housing Search Log (HSL) was used to track the family through the housing search process. The HSL was completed when a family was successful in finding a unit or when the Certificate/Housing Voucher expired or was surrendered. The HSL reflects PHA contacts with applicants or landlords and services provided on behalf of the applicant during the search process. It also lists information on units submitted by the family for approval, the results of inspections, whether the Certificate/Housing Voucher holder eventually became a recipient, and, for recipients, data on rent and housing assistance payments.

The Continued Participation Form (CPF) was used to track recipient families after a successful housing search. A recipient family, given no changes in family circumstances, income, or other factors, is followed up on a

CPF one year after the contract has been signed. There are five instances when Abt Associates would receive a CPF: (a) annually, (b) interim, when a recipient reports changes in income or family circumstance, (c) when a recipient moves to a new unit, (d) when utilities have been adjusted, or (e) when a recipient terminates from the program.

Processing, Cleaning and Tracking

Completed forms were sent to Abt Associates by the PHAs. The forms were immediately logged into a monitoring system, which was used to provide a master list for the data base and to track the timely receipt of forms once a Certificate/Housing Voucher had been issued. In particular, PHAs were sent monthly lists of households that had been issued a Housing Voucher or Certificate and for which various subsequent forms had not been received on schedule. Forms were then entered and examined for missing, out-of-range, or internally inconsistent values. An error listing identifying problem cases was prepared once a month and sent to the PHAs for resolution. Cleared forms were accumulated in separate files.

Cases with completed PPIFs, HSLs, and CPFs were periodically merged to permit further data cleaning based on comparison of information across the three forms. In particular, payments and recipient rent information from the HSL and CPF were compared with income and household size information in the PPIF to assure that they were consistent. Inconsistencies were sent to the PHA for resolution.

Not all of the information from such comparisons can be used, however. For example, there were sometimes errors in the recording of FMRs or Payment Standards. Although Abt Associates was generally notified of changes in these schedules, the exact point at which they become effective cannot be perfectly established from the forms. The procedure used is to identify points around the dates on which FMRs were changed at which the incidence of rents above the FMR ceiling (1.1 time the FMR) increases. This is used to identify the point at which the FMR change is effective. This date is usually checked through review of PHA records. Changes in Payment Standard for the Housing Voucher program are much more easily identified, since they yield an apparent error in the payment calculation exactly equal to a change in the Payment Standard.

Unfortunately, since the information available for identifying errors in FMRs or Payment Standards is not the same for the two programs, it cannot be used to correct data, but only to estimate the extent of errors in the data. Similarly, errors in recording gross rent will show up in an inconsistent payment calculation for the Certification program, but not for the Housing Voucher program. Again, the rent information cannot be corrected on this basis, since to do so could introduce bias in the comparison of the two programs.

We were able to use comparisons to identify possible errors in recorded income. Household net income sometimes changes between a recipient household's PPIF, completed at application, and its HSL, completed when the household becomes a recipient. If PHAs failed to note changes in household circumstance on the HSL, this led to inconsistent recipient payment, rent, and income data. Such cases were identified by comparing the subsidy recorded on the HSL with the calculated subsidy based on PPIF household size and income information and HSL information on recipient gross rent. Inconsistent cases were sent to PHAs for resolution.

The key variables from these forms used in this report are:

Household Size (HHSIZE):

This variable is the number of household members for whom a subsidy is being requested. HHSIZE is not always the number of individuals residing in the family's house/apartment when the Certificate/Housing Voucher is issued, which may include attendants, foster children and other individuals who are not related to the head of the household. HHSIZE can also include individuals that are temporarily absent and plan to return.

Birthdate (BDATE):

This variable is the birthdate of the head of household. It is entered as MM/DD/YY.

Race/Ethnicity (ORIGIN):

Applicants were asked separate questions on the PPIF relating to ethnicity and race. These are combined as follows:

1) All households identified as hispanic are classified Hispanic, regardless of race.

2) All non-Hispanic households are classified according to race, using the following categories: white, black, American Indian, and Alaskan Native, Asian or Pacific Islander. In this report, racial categories were reduced to white, black, and other minority, reflecting the small numbers of households in some individual categories.

Payment Standard (STANDARD or FMR):

This is the dollar amount of the Payment Standard applicable to a Housing Voucher holder when the Housing Voucher is issued or the FMR applicable to a Certification holder when the Certification is issued. At the beginning of the Demonstration the Payment Standard equaled the Section 8 Fair Market Rent schedule. Later the two schedules diverge.

Income Variables (TOTINC)

Total income is defined as the sum of:

- SALARY (the total dollar amount of wages, salaries, tips, commissions, and other earned income, as projected for the next year to determine eligibility)
- SOCSEC (the dollar amount of Social Security benefits, veterans pensions, military retirement, and income from other pensions/annuities, etc, as projected for the next year to determine eligibility)
- WELFARE (the total amount received from Aid to Families with Dependent Children (AFDC), General Assistance, Supplementary Security Income, or Tribal Welfare, as projected for the next year to determine eligibility)
- ASSETS (total income from assets in terms of interest, dividends, rent and other income from net assets, as projected for the next year to determine eligibility)
- OTHINC (the sum of all other income, including alimony, child support payments, educational benefits used for subsistence, earned income tax credit, unemployment compensation, and net income from operation of business, as projected for the next year to determine eligibility.

Deductions (DEDUC)

This variable is the Total Deductions from annual income and includes $480 for each minor (excluding head or spouse); medical expenses in excess of three percent of annual income; cost of allowable child care and allowable care attendent/apparatus for handicapped or disabled; and $400 for households headed by elderly, handicapped, or disabled.

Net Income (NETINC)

This variable is calculated by subtracting DEDUC (Total Deductions) from TOTINC (Total Family Income) leaving the Total Adjusted Income.

SUBUNIT:

A household is categorized as a subunit if it lived with another family (parents, friends, relatives) before becoming a recipient.

Pre-Program Contract Rent Paid by the Applicant Household (FRENT):

This variable is the monthly dollar amount the family pays for rent. It does not include the cost of utilities that are paid directly by the family.

Total Contract Rent Paid for the Pre-Program Unit (TOTRENT):

This variable is the total rent paid to the landlord in the pre-program unit. It does not include the cost of utilities if they are paid separately. It includes any amount paid regularly by the enrolled household, by others sharing the same unit, or by a friend, government agency, church or other organization toward rent.

Intention to Move (INTENT):

This variable determines if a family would rather stay, move or does not care if given a choice by the PHA.

Number of Bedrooms (ABTBED):

This variable equals the number of bedrooms a family is eligible for and is determined by the PHA.

In addition, the HSL and CPF are used to determine recipient rent and income at any point in time. Key variables are:

Recipient Contract Rent (CONRENT):

This variable is the total dollar amount paid to the landlord or owner for rent. Contract rent does not include utility cost directly paid by the tenant.

Utility Allowance (UTIL):

This variable is the utility allowance for utilities paid for directly by tenants. It is used in calculating Gross Rent and is not an actual payment to the family or landlord.

Recipient Gross Rent (GROSSR):

This variable is the recipient gross rent, which is the sum of contract rent (CONRENT) and any utility allowances (UTIL).

Amount of Subsidy (PAYMENT):

This variable is the total payments by the PHA including both payments to landlords and any reimbursement paid to recipients for utilities.

TOTAL INCOME

This variable is the Total Family Income as of the most recent recertification.

It should be noted, however, that the dates entered on these forms are not always the effective date of the form (as opposed to the date the form was completed or the date paperwork for a change--such as a new contract--was completed). Because of this, considerable matching on addresses and other information was used to establish the current information for an inspection unit. There may still, however, be some cases where the rent information from the program will not exactly correspond to the rent in effect at the exact date of inspection. This can happen if, for example, program records show a change in rent shortly after or shortly before inspection.

For most purposes such errors in exact timing make no difference. It is difficult to argue that the rent charged for a unit in one month is more clearly the "true" rent than the rent charged when the lease is renewed a month later. Problems in timing did, however, confuse one special comparison. In addition to the information available from program records, we also collected information from recipients on how much they paid for rent out of their own pocket. These questions were asked in order to see whether there was evidence that Certification program recipients might be evading the program limits on rents by making side payments to landlords.

As expected, the amounts cited by respondents sometimes differed dramatically from the amounts shown in program records. Examination of discrepancies indicated that in some cases respondents were clearly giving the total contract rent as opposed to what they personally paid. We also suspected that tenants might pay rent more often than monthly and gave that amount rather than the amount paid monthly. Accordingly, we tested discrepancies in order against the program record for:

- -- tenant payment
- -- tenant payment minus any utility reimbursement paid to the tenant
- -- contract rent
- -- tenant payment plus utility allowances
- -- tenant payment plus utility allowances minus any utility reimbursement paid to the tenant
- -- gross rent

We then, for each of these categories, tested against the possibility that the payment reported was made:

- -- monthly
- -- semi-monthly
- -- bi-weekly
- -- weekly

We then took all the cases where recipient-reported rent differed from agency records and assigned the error to the first category for which the discrepancy was less than $5. By considering only cases where either the discrepancy was less than $5 for monthly rent payments or was not less than $5 for any category, we eliminated cases where a plausible mistake would account for the discrepancy. In fact, only 57 of 1,715 observations fell into the plausible mistake categories--41 because the response involved contract rent or some other quantity than tenant payment and 16 because the response involved a less-than monthly time period.

The remaining 1,658 cases still involved some large discrepancies. However, the majority of the cases showed no discrepancy and 80 percent of recipients had discrepancies of less than $\pm$ \$16 in both programs (including zero). Most important, the average discrepancy was small and almost the same in both programs. Thus, there was no evidence of substantial side payments by Certificate program recipients to get around program limits on rent.

It is, of course, possible that real differences could be lost in the noise created by a few large errors. To test this, we compared discrepancies after eliminating those with absolute values greater than $100 per month as probable reporting errors. As shown in Table B.1, the two programs still had very similar and small average discrepancies.

B.2 Housing Inspections

Under subcontract to Abt Associates, the Research Triangle Institute (RTI) conducted housing quality inspections between August 24, 1987 and January 1988 on a sample of 1,999 cases drawn by Abt Associates.

Selection Criteria

An initial sample of 2,500 families was drawn across the 10 inspection sites. Each site was sent a list of 250 participants to be reviewed. PHAs were asked to review the addresses of the families selected for inspections in each site. PHAs were asked to correct or update addresses, and to provide telephone numbers and other useful information, such as a contact person for those families that did not speak English or had other disabling conditions. A final sample of 200 families (100 Housing Voucher and 100 Flagged Certificates) was drawn for each of the 10 sites. A tape containing all necessary information (including Abt identification number) was provided to RTI, which prepared the labels to be affixed to each blank form.

Another set of address labels was prepared by Abt Associates and sent to PHAs to facilitate their task in mailing a letter to families in the sample to explain the upcoming inspection activity. The names of the two interviewers hired in the sites were included in the letter, so that families could recognize the interviewer's name when contacted for setting up an appointment.

Training

Training for the Inspection Form took place in St. Louis from July 20 to July 23, 1987. Twenty-two evaluators and two regional field supervisors attended the training. The training, conducted jointly by Abt and RTI staff, consisted of classroom sessions in the morning and field practice in the afternoon. Eight units were visited during the training. The units were chosen to cover dwellings of different types (single family vs. apartment buildings), of different age (pre-war vs. new construction), and of various conditions. Units of lower quality were used to illustrate deficiencies such as electrical hazards, structural or surface deficiencies, etc., while higher

TABLE B.1

COMPARISON OF THE TENANT PAYMENT
AS SHOWN ON PROGRAM RECORDS AND AS REPORTED BY THE TENANT

	Mean Discrepancy	Standard Error	t-Statistic
All Recipients			
Housing Voucher Program	-$1.57	$1.83	1.49
Certificate Program	-$2.86	$1.52	2.64**
Difference	$1.29	$2.38	0.54
Recipients with Absolute Discrepancies of Less than $100			
Housing Voucher Program	-$1.05	$0.71	0.86
Certificate Program	-$1.69	$0.64	1.88+
Difference	$0.64	$0.95	0.67

** = significant at 0.001 level

* = significant at 0.05 level

\+ = significant at 0.10 level

quality units contained amenities that must be reported on the form.

During the training session, all interviewers' work was reviewed for accuracy. Later, issues and questions raised by interviewers, Abt and RTI were discussed in a memorandum which was sent to all field supervisors and evaluators.

The numerous variables derived from these evaluations are presented in the text and Appendix E as they arise. A complete copy of the instrument is included as a supplement to this Appendix.

B.3. Census Tract Coding and Data Collection

The purpose of this effort was to attach 1980 Census information to each recipient's Census tract of origin (PPIF address), and tract of destination (inspection unit). The address of the inspection unit was taken from RTI inspection address and the original Abt address sent to RTI. For tracts of origin the Pre-Program Information Form (PPIF) provided the necessary address information.

The sources used for coding the tracts were Census block level maps, appropriate city-level maps, odd/even street conventions for each city, city planning offices, and PHA site inspectors. The odd/even street conventions for each city were used to determine applicable tract numbers when a street was on a tract boundary. There were some uncodable street addresses, where a PPIF address fell outside of the SMSA definition, the inspection address was in a new development and did not appear on the Census block-level maps, or the address was unidentifiable by all of our sources.

Census Descriptors

For each site data was collected and keypunched for 29 tract level variables. The source used was tract level information from the 1980 U.S. Census (PHC80-2-260) of Population and Housing.

Data Issues

The Census does not report tract level information for tracts which are extremely small. In these instances variables in the Census descriptors have missing values. For the purposes of data base construction, missing values were recoded to zero (0). It should be noted for most variables in this report, entering zero for very rare events yields the appropriate value.

In addition, some of the tracts appeared as tract splits in the maps, but were not reported as a tract split in the 1980 Census data. In these cases data for the whole tract data were used.

SUPPLEMENT TO APPENDIX B

HOUSING EVALUATION FORM

OMB No.: 25280125
Expires: 12-31-87

HOUSING QUALITY INSPECTION/INTERVIEW FORM

NOTICE. All information on this form which would permit identification of the individual will be held in strict confidence, will be used only by persons engaged in and for the purposes of the survey, and will not be disclosed or released to other persons.

PART A. RECIPIENT IDENTIFICATION

PLACE LABEL HERE

PART B. ADDRESS CORRECTION

No. Street Apt.#

City State ZIP

Phone # ( )

PART C. RECORD OF CALLS

Day of Week	Date	Time	Type of Contact	Results/Notes	Code*
		am pm	TC PV		
		am pm	TC PV		
		am pm	TC PV		
		am pm	TC PV		
		am pm	TC PV		
		am pm	TC PV		

* PENDING CODES: (ENTER ABOVE)

01 No Action Taken
02 Appointment Made
03 No Respondent Home
04 Refusal
05 Breakoff
06 Language Barrier
07 Respondent Moved, Unable To Locate
08 Inspection/Interview Partially Complete
09 Other (SPECIFY IN NOTES ABOVE)

FINAL CODES: (CIRCLE ONE)

10 Inspection Completed
11 No Eligible Respondent Home after Repeated Visits
12 Refusal/Exterior Only
13 Breakoff/Partial Data
14 Language Barrier
15 Respondent Moved, Unable To Locate
16 No Longer a Recipient
17 Other (SPECIFY IN NOTES ABOVE)

NUMBER OF SUPPLEMENTS INCLUDED:

☐ Bathrooms ☐ Other Rooms ☐ Hallways ☐ Kitchen

PART C. RECORD OF CALLS (Continued)

Day of Week	Date	Time	Type of Contact	Results/Notes	Code*
		am pm	TC PV		
		am pm	TC PV		
		am pm	TC PV		
		am pm	TC PV		
		am pm	TC PV		
		am pm	TC PV		
		am pm	TC PV		
		am pm	TC PV		

STATEMENT OF INFORMED CONSENT

READ THE FOLLOWING STATEMENT TO THE RESPONDENT BEFORE BEGINNING THE INSPECTION/INTERVIEW.

Hello, I'm (YOUR NAME) from the Research Triangle Institute. We're conducting housing inspections and interviews for the U.S. Department of Housing and Urban Development. This study will provide the data necessary to evaluate the Section 8 Certificate and Housing Voucher Programs. I would like to conduct an inspection of your (HOUSE/APARTMENT) and then ask you a few questions. There are no known risks or direct benefits to you for participating in this study. You may be assured, however, that your participation is greatly appreciated and will be helpful to those responsible for housing planning and policy. All of your answers and any information collected that would permit your identification will be held in strict confidence. Your participation in this study is strictly voluntary, and there are no penalties for your refusal to participate.

PART A: BUILDING DESCRIPTORS

1. DWELLING UNIT TYPES

Mobile home............................01
Shack (shotgun or other)...............02
Single family detached.................03
Single family row house................04
Duplex or 2 family.....................05
3 or 4 family..........................06
Single family converted................07
Tenement...............................08
Garden apartment or other multi-family 4-story or less.................09
High rise--more than 4 stories.........10
Mixed use--small retail with dwelling units........................11

2. ESTIMATE AGE OF STRUCTURE

1919 or prior (pre World War I).........1
1920s, 1930s, to 1945 (World War II) ...2
Post World War II to 1959...............3
1960s; 1970s; 1980s.....................4
New, less than one year old.............5

3. FLOOR LOCATION OF UNIT

Basement apartment - below grade........00
First floor or basement walkout.........01
Attic...................................55
Other floor number.................. ☐☐

4. FLOOR AREA OF DWELLING UNIT
(measure and code in square feet)

☐☐☐☐

5. NOTES TO FACILITATE INTERVIEWER

A. CODE BEFORE ENTERING THE DWELLING UNIT OR DURING THE INSPECTION.

	PRESENT	NOT PRESENT
a. Garage	1	2
b. Covered off-street parking	1	2
c. Uncovered off-street parking	1	2
d. Outdoor swimming pool	1	2
e. Tennis court	1	2
f. Function room	1	2
g. Indoor swimming pool	1	2
h. Sauna/steamroom/hot tub	1	2
i. Garbage disposal	1	2
j. Dishwasher	1	2
k. Microwave	1	2
l. Air conditioning equipment	1	2
m. Current sewer/septic tank problem	1	2
n. Recent sewer/septic tank problem	1	2

PART B: COMMON AREAS--MULTI-FAMILY ONLY

COMPLETE ONLY IF DWELLING UNIT TYPE (ITEM 1, PAGE 1) IS CODED 06-11. OTHERWISE, GO TO PART C.

1. COMMON ENTRANCE HALL

Present..............................1

Not Present..........................2

2. ENTRANCE SECURITY

	PRESENT	NOT PRESENT
a. Security guard/reception desk/doorman	1	2
b. Intercom with television	1	2
c. Intercom--voice only	1	2

3. MAIN ENTRANCE LOCKED AT ALL TIMES

Yes..................................1

No...................................2

4. CONDITION OF COMMON AREAS

(Halls, entryways, staircases or other common areas)

No public areas......................1

Presence of a health or safety hazard............................2

Some elements need replacement or repair............................3

Some elements need cosmetic repair--show deferred maintenance...4

All elements in good condition.......5

All elements in superior condition...6

5. HALL AND STAIRWAY LIGHTING PRESENT AND WORKING

No hallways or stairs................1

Light present-not working............2

Light present-working................3

6. LOOSE, BROKEN, OR MISSING STEPS OR HANDRAILS NOT FIRMLY ATTACHED IN COMMON STAIRWAYS

Yes..................................1

No...................................2

No stairways.........................3

7. ELEVATOR WORKING

Yes..................................1

No...................................2

No elevator..........................3

8. OTHER COMMON INTERIOR FACILITIES

	PRESENT	NOT PRESENT
a. Social service facilities	1	2
b. Fancy foyer with extra amenities	1	2
c. Shared or private storage area	1	2
d. Convenience stores in building	1	2
e. Function room	1	2
f. Indoor swimming pool	1	2
g. Sauna/steamroom/hot tub	1	2

PART C: DWELLING UNIT INTERIOR - <u>LIVING ROOM</u> PRESENT...1 NOT PRESENT...2 → GO TO PAGE 4.

A. Dimensions (length by width) [|] by [|]   B. Area (square feet) [| | |]

---

1. ROOM USED FOR SLEEPING
   - Yes..................................1
   - No...................................2
2. WINDOW PRESENCE AND OPERABILITY
   - No window............................1
   - At least 1 window - not operable......2
   - At least 1 window - operable..........3
   - Windows designed not to be opened.....4
3. AT LEAST 2 OUTLETS OR 1 OUTLET AND 1 LIGHT FIXTURE PRESENT AND WORKING
   - Yes..................................1
   - No...................................2
4. EVIDENCE OF ELECTRICAL HAZARDS
   - Yes..................................1
   - No...................................2
5. CEILING CONDITION
   - Immediately hazardous conditions......1
   - Serious defects.......................2
   - Surface defects.......................3
   - Cosmetic defects......................4
   - Like new (may require cleaning).......5
6. WALL CONDITION
   - Immediately hazardous conditions......1
   - Serious defects.......................2
   - Surface defects.......................3
   - Cosmetic defects......................4
   - Like new (may require cleaning).......5
7. FLOOR CONDITION
   - Immediately hazardous conditions......1
   - Serious defects.......................2
   - Surface defects.......................3
   - Cosmetic defects......................4
   - Like-new (may require cleaning).......5
8. ADDITIONAL FEATURES:

	PRESENT	NOT PRESENT
a. High quality walls or wall coverings	1	2
b. High quality ceilings	1	2
c. High quality floors or floor coverings	1	2
d. Working fireplace/ Franklin stove	1	2
e. Balcony/patio/deck/porch	1	2
f. Special windows and doors	1	2
g. Special built-in lighting	1	2
h. Built-in shelves/bookcases/ cabinets	1	2
i. Other additional features	1	2

(IF PRESENT, LIST BELOW)

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PART C: DWELLING UNIT INTERIOR - KITCHEN PRESENT...1 NOT PRESENT...2 → GO TO PAGE 6

A. Dimensions (length by width) ☐☐ by ☐☐ B. Area (square feet) ☐☐☐☐

1. KITCHEN TYPE
   Kitchen area only..................1
   Separate kitchen...................2
2. WINDOW PRESENCE AND OPERABILITY
   No window..........................1
   At least 1 window - not operable...2
   At least 1 window - operable.......3
   Windows designed not to be opened..4
3. AT LEAST 2 OUTLETS OR 1 OUTLET AND 1 LIGHT FIXTURE PRESENT AND WORKING
   Yes................................1
   No.................................2
4. EVIDENCE OF ELECTRICAL HAZARDS
   Yes................................1
   No.................................2
5. VENTILATION SYSTEM
   Not present........................1
   Present - not working..............2
   Present - working..................3
6. HOT AND COLD RUNNING WATER
   None...............................1
   Cold only..........................2
   Hot only...........................3
   Both...............................4
7. KITCHEN SINK
   Not present........................1 → GO TO Q10
   Present - not connected............2
   Present - badly connected..........3
   Present - properly connected.......4
8. KITCHEN SINK CONDITION
   Shows severe wear..................1
   Shows moderate wear................2
   Good or like-new condition.........3
9. GARBAGE DISPOSAL IN SINK--CODE IN ITEM A5A, PAGE 1.
   Not present........................1
   Present............................2
10. DISHWASHER--CODE IN ITEM A5A, PAGE 1.
   None...............................1
   Portable...........................2
   Built-in...........................3
11. REFRIGERATOR
   Not present........................1
   Present - not working..............2
   Present - working..................3
12. COOKING STOVE OR RANGE
   Not present........................1 → GO TO Q14
   Present-not working................2
   Present - working..................3
   Not observable.....................4
13. TYPE OF COOKING STOVE OR RANGE
   Free standing and separate from counter top...............1
   Free standing and butts counter....2
   Built into countertop..............3

14. APPLIANCE CONDITION (Rate Worse)

None....................................1
Shows severe wear.......................2
Shows moderate wear.....................3
Good or like-new condition..............4

15. PRESENCE OF CABINETS

Yes.....................................1
No......................................2

16. CEILING CONDITION

Immediately hazardous conditions......1
Serious defects.......................2
Surface defects.......................3
Cosmetic defects......................4
Like new (may require cleaning).......5

17. WALL CONDITION

Immediately hazardous conditions......1
Serious defects.......................2
Surface defects.......................3
Cosmetic defects......................4
Like new (may require cleaning).......5

18. FLOOR CONDITION

Immediately hazardous conditions......1
Serious defects.......................2
Surface defects.......................3
Cosmetic defects......................4
Like new (may require cleaning).......5

19. ADDITIONAL FEATURES:

	PRESENT	NOT PRESENT
a. Eating counter/breakfast nook (built-in)	1	2
b. Pantry	1	2
c. Full backsplash at counter	1	2
d. Range hood	1	2
e. Double oven or self-cleaning oven	1	2
f. Microwave	1	2
CODE IN ITEM A5A, PAGE 1.		
g. Double sink	1	2
h. High quality ceilings	1	2
i. High quality walls or wall coverings	1	2
j. High quality floors or floor coverings	1	2
k. High quality kitchen cabinets	1	2
l. Working fireplace/ Franklin stove	1	2
m. Balcony/patio/deck/porch	1	2
n. Special windows and/or doors	1	2
o. Special built-in lighting	1	2
p. Special storage area(s)	1	2
q. Other additional features	1	2

(IF PRESENT, LIST BELOW)

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PART C: DWELLING UNIT INTERIOR - BATHROOM   PRESENT...1   NOT PRESENT...2 → GO TO PAGE 8

A. Dimensions (length by width) [|] by [|]   B. Area (square feet) [| | |]

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1. BATHROOM TYPE
   - Separate room - inside unit..........1
   - Separate room - outside unit.........2
   - Scattered facilities.................3

2. WINDOW PRESENCE AND OPERABILITY
   - No window............................1
   - At least 1 window - not operable.....2
   - At least 1 window - operable.........3
   - Windows designed not to be opened....4

3. AT LEAST 2 OUTLETS OR 1 OUTLET AND 1 LIGHT FIXTURE PRESENT AND WORKING
   - Yes..................................1
   - No...................................2

4. EVIDENCE OF ELECTRICAL HAZARDS
   - Yes..................................1
   - No...................................2

5. VENTILATION SYSTEM
   - Not present..........................1
   - Present - not working................2
   - Present - working....................3

6. FLUSH TOILET
   - None, or present not private, working or not......................1
   - Present, private - not working........2
   - Present, private - working...........3
   - Working condition cannot be determined..........................4

7. TUB OR SHOWER WORKING
   - Not present..........................1 → GO TO Q10
   - Neither working......................2
   - One, but not both, working...........3
   - Both working.........................4

8. WATERPROOF CONSTRUCTION
   - Not waterproof anywhere..............1
   - Floor <u>or</u> tub/shower area <u>only</u> is waterproof......................2
   - Floor and tub/shower area are <u>both</u> waterproof....................3
   - Floor <u>and</u> tub/shower area <u>both</u> waterproof <u>and</u> have superior waterproof materials.................4

9. CONDITION OF GROUT AND SEALS
   - No grout or seals....................1
   - Severely worn or missing.............2
   - Moderate wear........................3
   - Good condition.......................4

10. WASHBASIN OR LAVATORY
    - Not present..........................1
    - Present - not connected..............2
    - Present - badly connected............3
    - Present - properly connected.........4

11. CONDITION OF FIXTURES (Rate worse)
    - Shows severe wear....................1
    - Shows moderate wear..................2
    - Good or like-new condition...........3

12. CEILING CONDITION
    - Immediately hazardous conditions......1
    - Serious defects......................2
    - Surface defects......................3
    - Cosmetic defects.....................4
    - Like new (may require cleaning)......5

13. WALL CONDITION

Immediately hazardous conditions......1
Serious defects......................2
Surface defects......................3
Cosmetic defects......................4
Like new (may require cleaning).......5

14. FLOOR CONDITION

Immediately hazardous conditions......1
Serious defects......................2
Surface defects......................3
Cosmetic defects......................4
Like new (may require cleaning).......5

15. ADDITIONAL FEATURES:

	PRESENT	NOT PRESENT
a. Jacuzzi/whirlpool bath........	1	2
b. Special feature shower........	1	2
c. Built-in heat lamp with timer........	1	2
d. Wall-size mirrors........	1	2
e. Glass door on tub/shower........	1	2
f. Separate dressing area........	1	2
g. Built-in vanity table........	1	2
h. Double sink, two sinks, or other special lavatories	1	2
i. Other additional features....	1	2

(IF PRESENT, LIST BELOW)

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PART C: DWELLING UNIT INTERIOR - OTHER ROOMS

OTHER ROOM 1

PRESENT...1 NOT PRESENT...2 → GO TO PAGE 14

A. Dimensions (length by width) [ ][ ] by [ ][ ]

B. Area (square feet) [ ][ ][ ][ ]

1. ROOM CODE
   - Bedroom..............................1
   - Dining room..........................2
   - Second living room/family room/ parlor..............................3
   - Den/playroom/TV room/library/office...4
   - Unused or storage room...............5
   - Utility room/laundry room/workshop....6
   - Other non-sleeping room (SPECIFY).....7

   ____

2. PRIVACY
   - Not private..........................1
   - Open plan or loft....................2
   - Private..............................3

3. ROOM LOCATION
   - Main body of unit....................1
   - Finished attic.......................2
   - Unfinished attic.....................3
   - Finished basement....................4
   - Unfinished basement..................5
   - Converted garage.....................6
   - Enclosed year-round porch............7

4. WINDOW PRESENCE AND OPERABILITY
   - No window............................1
   - At least 1 window - not operable......2
   - At least 1 window - operable..........3
   - Windows designed not to be opened.....4

5. AT LEAST 2 OUTLETS OR 1 OUTLET AND 1 LIGHT FIXTURE PRESENT AND WORKING
   - Yes..................................1
   - No...................................2

6. EVIDENCE OF ELECTRICAL HAZARDS
   - Yes..................................1
   - No...................................2

7. CEILING CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning).......5

8. WALL CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning).......5

9. FLOOR CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning).......5

10. ADDITIONAL FEATURES:

	PRESENT	NOT PRESENT
a. High quality walls or wall coverings	1	2
b. High quality ceilings	1	2
c. High quality floors or floor coverings	1	2
d. Working fireplace/ Franklin stove	1	2
e. Balcony/patio/deck/porch	1	2
f. Special windows and/or doors	1	2
g. Special built-in lighting	1	2
h. Built-in shelves/bookcases/ cabinets	1	2
i. Other additional features	1	2

(IF PRESENT, LIST BELOW)

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OTHER ROOM 2

PRESENT...1 NOT PRESENT...2 → GO TO PAGE 14

A. Dimensions (length by width) [ ][ ] by [ ][ ]

B. Area (square feet) [ ][ ][ ][ ]

1. ROOM CODE

Bedroom..............................1
Dining room..........................2
Second living room/family room/
parlor...............................3
Den/playroom/TV room/library/office...4
Unused or storage room...............5
Utility room/laundry room/workshop....6
Other non-sleeping room (SPECIFY).....7

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2. PRIVACY

Not private..........................1
Open plan or loft....................2
Private..............................3

3. ROOM LOCATION

Main body of unit....................1
Finished attic.......................2
Unfinished attic.....................3
Finished basement....................4
Unfinished basement..................5
Converted garage.....................6
Enclosed year-round porch............7

4. WINDOW PRESENCE AND OPERABILITY

No window............................1
At least 1 window - not operable......2
At least 1 window - operable..........3
Windows designed not to be opened.....4

5. AT LEAST 2 OUTLETS OR 1 OUTLET AND 1 LIGHT FIXTURE PRESENT AND WORKING

Yes..................................1
No...................................2

6. EVIDENCE OF ELECTRICAL HAZARDS

Yes..................................1
No...................................2

7. CEILING CONDITION

Immediately hazardous conditions......1
Serious defects......................2
Surface defects......................3
Cosmetic defects.....................4
Like new (may require cleaning).......5

8. WALL CONDITION

Immediately hazardous conditions......1
Serious defects......................2
Surface defects......................3
Cosmetic defects.....................4
Like new (may require cleaning).......5

9. FLOOR CONDITION

Immediately hazardous conditions......1
Serious defects......................2
Surface defects......................3
Cosmetic defects.....................4
Like new (may require cleaning).......5

10. ADDITIONAL FEATURES:

	PRESENT	NOT PRESENT
a. High quality walls or wall coverings	1	2
b. High quality ceilings	1	2
c. High quality floors or floor coverings	1	2
d. Working fireplace Franklin stove	1	2
e. Balcony/patio/deck/porch	1	2
f. Special windows and/or doors	1	2
g. Special built-in lighting	1	2
h. Built-in shelves/bookcases/ cabinets	1	2
i. Other additional features	1	2

(IF PRESENT, LIST BELOW)

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OTHER ROOM 3

PRESENT...1 NOT PRESENT...2 → GO TO PAGE 14

A. Dimensions (length by width) [ ][ ] by [ ][ ]

B. Area (square feet) [ ][ ][ ][ ]

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1. ROOM CODE
   - Bedroom..............................1
   - Dining room..........................2
   - Second living room/family room/ parlor..............................3
   - Den/playroom/TV room/library/office...4
   - Unused or storage room...............5
   - Utility room/laundry room/workshop....6
   - Other non-sleeping room (SPECIFY).....7

   ____

2. PRIVACY
   - Not private..........................1
   - Open plan or loft....................2
   - Private..............................3

3. ROOM LOCATION
   - Main body of unit....................1
   - Finished attic.......................2
   - Unfinished attic.....................3
   - Finished basement....................4
   - Unfinished basement..................5
   - Converted garage.....................6
   - Enclosed year-round porch............7

4. WINDOW PRESENCE AND OPERABILITY
   - No window............................1
   - At least 1 window - not operable......2
   - At least 1 window - operable..........3
   - Windows designed not to be opened.....4

5. AT LEAST 2 OUTLETS OR 1 OUTLET AND 1 LIGHT FIXTURE PRESENT AND WORKING
   - Yes..................................1
   - No...................................2

6. EVIDENCE OF ELECTRICAL HAZARDS
   - Yes..................................1
   - No...................................2

7. CEILING CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning).......5

8. WALL CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning).......5

9. FLOOR CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning).......5

10. ADDITIONAL FEATURES:

	PRESENT	NOT PRESENT
a. High quality walls or wall coverings	1	2
b. High quality ceilings	1	2
c. High quality floors or floor coverings	1	2
d. Working fireplace/ Franklin stove	1	2
e. Balcony/patio/deck/porch	1	2
f. Special windows and/or doors	1	2
g. Special built-in lighting	1	2
h. Built-in shelves/bookcases/ cabinets	1	2
i. Other additional features	1	2

(IF PRESENT, LIST BELOW)

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OTHER ROOM 4

PRESENT...1 NOT PRESENT...2 → GO TO PAGE 14

A. Dimensions (length by width) [|] by [|]

B. Area (square feet) [| | |]

1. ROOM CODE

Bedroom....................................1
Dining room................................2
Second living room/family room/
parlor.....................................3
Den/playroom/TV room/library/office...4
Unused or storage room.....................5
Utility room/laundry room/workshop....6
Other non-sleeping room (SPECIFY).....7

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2. PRIVACY

Not private................................1
Open plan or loft..........................2
Private....................................3

3. ROOM LOCATION

Main body of unit..........................1
Finished attic.............................2
Unfinished attic...........................3
Finished basement..........................4
Unfinished basement........................5
Converted garage...........................6
Enclosed year-round porch..................7

4. WINDOW PRESENCE AND OPERABILITY

No window............................1

At least 1 window - not operable......2

At least 1 window - operable..........3

Windows designed not to be opened.....4

5. AT LEAST 2 OUTLETS OR 1 OUTLET AND 1 LIGHT FIXTURE PRESENT AND WORKING

Yes..................................1

No...................................2

6. EVIDENCE OF ELECTRICAL HAZARDS

Yes..................................1

No...................................2

7. CEILING CONDITION

Immediately hazardous conditions......1

Serious defects.......................2

Surface defects.......................3

Cosmetic defects......................4

Like new (may require cleaning).......5

8. WALL CONDITION

Immediately hazardous conditions......1

Serious defects.......................2

Surface defects.......................3

Cosmetic defects......................4

Like new (may require cleaning).......5

9. FLOOR CONDITION

Immediately hazardous conditions......1

Serious defects.......................2

Surface defects.......................3

Cosmetic defects......................4

Like new (may require cleaning).......5

10. ADDITIONAL FEATURES:

	PRESENT	NOT PRESENT
a. High quality walls or wall coverings	1	2
b. High quality ceilings	1	2
c. High quality floors or floor coverings	1	2
d. Working fireplace/ Franklin stove	1	2
e. Balcony/patio/deck/porch	1	2
f. Special windows and/or doors	1	2
g. Special built-in lighting	1	2
h. Built-in shelves/bookcases/ cabinets	1	2
i. Other additional features	1	2

(IF PRESENT, LIST BELOW)

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C: DWELLING UNIT INTERIOR - ENTRANCE HALL, VESTIBULES, FOYERS, CORRIDORS, HALLS, STAIRCASES

(WITHIN DWELLING UNIT)

AREA 1 PRESENT...1 NOT PRESENT...2 → GO TO PAGE 17

A. Dimensions (length by width) [ ][ ] by [ ][ ]

B. Area (square feet) [ ][ ][ ][ ]

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1. AREA CODE
   - Hall, corridor, stairway-not private..1
   - Hall, corridor, stairway - private....2
   - Vestibule, foyer, entrance hall.......3

2. WINDOW PRESENCE AND OPERABILITY
   - No window............................1
   - At least 1 window - not operable......2
   - At least 1 window - operable..........3
   - Windows designed not to be opened.....4

3. LIGHT FIXTURES PRESENT AND WORKING
   - None..................................1
   - Some..................................2
   - All...................................3

4. EVIDENCE OF ELECTRICAL HAZARDS
   - Yes...................................1
   - No....................................2

5. LOOSE, BROKEN, OR MISSING STEPS ON STAIRWAYS, OR HANDRAILS NOT FIRMLY ATTACHED
   - Yes...................................1
   - No....................................2
   - No staircase..........................3

6. CEILING CONDITION
   - Immediately hazardous conditions......1
   - Serious defects.......................2
   - Surface defects.......................3
   - Cosmetic defects......................4
   - Like new (may require cleaning).......5

7. WALL CONDITION
   - Immediately hazardous conditions......1
   - Serious defects.......................2
   - Surface defects.......................3
   - Cosmetic defects......................4
   - Like new (may require cleaning).......5

8. FLOOR CONDITION
   - Immediately hazardous conditions......1
   - Serious defects.......................2
   - Surface defects.......................3
   - Cosmetic defects......................4
   - Like new (may require cleaning).......5

9. ADDITIONAL FEATURES:

	PRESENT	NOT PRESENT
a. High quality staircase	1	2
b. High quality walls or wall coverings	1	2
c. High quality ceilings	1	2
d. High quality floors or floor coverings	1	2
e. Special windows and/or doors	1	2
f. Special built-in lighting	1	2
g. Other additional features	1	2

(IF PRESENT, LIST BELOW)

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AREA 2 PRESENT...1 NOT PRESENT...2 → GO TO PAGE 17

A. Dimensions (length by width) ☐☐ by ☐☐

B. Area (square feet) ☐☐☐☐

1. AREA CODE
   - Hall, corridor, stairway-not private..1
   - Hall, corridor, stairway - private....2
   - Vestibule, foyer, entrance hall.......3
2. WINDOW PRESENCE AND OPERABILITY
   - No window............................1
   - At least 1 window-not operable........2
   - At least 1 window-operable...........3
   - Windows designed not to be opened.....4
3. LIGHT FIXTURES PRESENT AND WORKING
   - None................................1
   - Some................................2
   - All.................................3
4. EVIDENCE OF ELECTRICAL HAZARDS
   - Yes.................................1
   - No..................................2
5. LOOSE, BROKEN, OR MISSING STEPS ON STAIRWAYS, OR HANDRAILS NOT FIRMLY ATTACHED
   - Yes.................................1
   - No..................................2
   - No staircase........................3
6. CEILING CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning)......5
7. WALL CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning)......5
8. FLOOR CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning)......5
9. ADDITIONAL FEATURES:

	PRESENT	NOT PRESENT
a. High quality staircase........	1.........	2
b. High quality walls or wall coverings..............	1.........	2
c. High quality ceilings.........	1.........	2
d. High quality floors or floor coverings.............	1.........	2
e. Special windows and doors.....	1.........	2
f. Special built-in lighting.....	1.........	2
g. Other additional features.....	1.........	2

(IF PRESENT, LIST BELOW)

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AREA 3 PRESENT...1 NOT PRESENT...2 → GO TO PAGE 17

A. Dimensions (length by width) [ ][ ] by [ ][ ]

B. Area (square feet) [ ][ ][ ][ ]

1. AREA CODE
   - Hall, corridor, stairway-not private..1
   - Hall, corridor, stairway - private....2
   - Vestibule, foyer, entrance hall.......3

2. WINDOW PRESENCE AND OPERABILITY
   - No window............................1
   - At least 1 window - not operable......2
   - At least 1 window - operable..........3
   - Windows designed not to be opened.....4

3. LIGHT FIXTURES PRESENT AND WORKING
   - None.................................1
   - Some.................................2
   - All..................................3

4. EVIDENCE OF ELECTRICAL HAZARDS
   - Yes..................................1
   - No...................................2

5. LOOSE, BROKEN, OR MISSING STEPS ON STAIRWAYS, OR HANDRAILS NOT FIRMLY ATTACHED
   - Yes..................................1
   - No...................................2
   - No staircase.........................3

6. CEILING CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning).......5

7. WALL CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning).......5

8. FLOOR CONDITION
   - Immediately hazardous conditions......1
   - Serious defects......................2
   - Surface defects......................3
   - Cosmetic defects.....................4
   - Like new (may require cleaning).......5

9. ADDITIONAL FEATURES:

	PRESENT	NOT PRESENT
a. High quality staircase	1	2
b. High quality walls or wall coverings	1	2
c. High quality ceilings	1	2
d. High quality floors or floor coverings	1	2
e. Special windows and doors	1	2
f. Special built-in lighting	1	2
g. Other additional features	1	2

(IF PRESENT, LIST BELOW)

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PART D1: BASEMENT

1. PRESENCE OF BASEMENT
   - Present, accessible....................1
   - Present, not accessible................2
   - Not present............................3

NOTE: IF ITEM 1 ABOVE IS CODED 2 OR 3, GO TO PART D2.

2. USE OF BASEMENT
   - Private, for use of occupants only....1
   - Common basement.......................2

3. BASEMENT TYPE

   COMPLETE ONLY IF ITEM 2 ABOVE IS CODED 1.
   - Crawl space only......................1
   - Full height--mechanical space, storage and/or laundry facilities....2
   - Full height--unfinished basement, at least part can be converted into living space....................3

4. DAMP WALLS AND/OR FLOORS
   - Yes...................................1
   - No....................................2

5. EVIDENCE OF SEWER/SEPTIC TANK LEAK OR BACK UP--CODE IN ITEM A5A, PAGE 1.
   - Condition present now.................1
   - Evidence of recently repaired condition..............................2
   - No evidence...........................3

PART D2: MECHANICAL SYSTEMS

1. PRESENCE OF ELECTRICAL HAZARDS
   - Yes...................................1
   - No....................................2
   - Not applicable, not accessible........3

2. PRIMARY HEATING SYSTEM
   - None..................................1
   - Unvented fuel burning space heaters...........................2
   - Fireplace or stove....................3
   - Portable electric heaters.............4
   - Vented fuel burning space heaters (free standing).........5
   - Floor, wall, or pipeless furnace (built-in).......................6
   - Central heating system--warm air/hot water/steam/built-in....7
   - Solar.................................8

3. FURNACE/BOILER CONDITION
   - Not present...........................1
   - Present - not working.................2
   - Present - apparently unsound.....3
   - Present - apparently sound.......4
   - Not applicable, not accessible, unknown...........................5

4. HOT WATER HEATER IN UNIT
   - Not present or inaccessible......1
   - Unsafe................................2
   - Safe..................................3

5. COOLING EQUIPMENT--CODE IN ITEM A5A, PAGE 1.
   - Not present...........................1 → GO TO PART E
   - Some rooms cooled by room units..2
   - All rooms cooled by room units...3
   - Central air conditioning.........4

6. COOLING ADEQUACY
   - Cannot determine......................1
   - Not working...........................2
   - Working...............................3

PART E: OVERALL RATING

NOTE: ITEMS 1-4 APPLY TO CONDITIONS OBSERVED ONLY IN THE COMMON AREAS OF THE BUILDING SUCH AS THE ENTRANCE HALL, STAIRWAYS, CORRIDORS, BASEMENT. DO NOT REPORT THE CONDITION IN ITEMS 1-4 IF OBSERVED IN THE DWELLING UNIT ITSELF.

COMMON AREAS PRESENT....................1

NO COMMON AREAS................2 → GO TO NOTE

1. UNCOVERED GARBAGE

   Yes....................................1

   No.....................................2

2. ACCUMULATED TRASH

   Yes....................................1

   No.....................................2

3. IMPROPER STORAGE OF FLAMMABLES

   Yes....................................1

   No.....................................2

4. ELECTRICAL HAZARDS - CODE ONLY IF DWELLING UNIT TYPE (ITEM 1, PAGE 1) IS CODED 08-11.

   Major hazards..........................1

   Minor hazards..........................2

   No hazards.............................3

   No access/not applicable...............4

NOTE: ITEMS 5 AND 6 APPLY TO CONDITIONS OBSERVED IN EITHER THE COMMON AREAS OR IN THE DWELLING UNIT ITSELF.

5. EVIDENCE OF RATS

   Yes....................................1

   No.....................................2

6. ANY DETRACTING OR DANGEROUS FEATURES NOT CODED ELSEWHERE

   Present (LIST).........................1

   ____

   ____

   ____

   Not present............................2

7. OVERALL CONDITION OF DWELLING

   Requires major structural renovation....1

   Requires major surface renovations or repairs..........................2

   Requires some surface repairs...........3

   Requires only minor surface refinishing...........................4

   New, like new, or superior condition....5

8. OVERALL QUALITY OF DWELLING

   Uninhabitable..........................1

   Barely habitable.......................2

   Low quality--adequate..................3

   Moderate quality.......................4

   High quality...........................5

   Superior quality/luxury................6

PART F: INTERVIEW QUESTIONS

I have completed the Housing Inspection. Before I leave I would like to ask you a few questions about your house/apartment.

1. FAMILY STATUS—COMPLETE THIS ITEM BEFORE STARTING THE INTERVIEW. REFER TO LOWER RIGHT CORNER OF LABEL. "S" INDICATES STAYER, "M" INDICATES MOVER.

   STAYER......................1

   MOVER.......................2

2. How long have you lived in this (house/apartment)?

   ________________ years
   OR
   ________________ months

2a. Has any member of your household lived here longer than you?

   Yes.........................1

   No..........................2 → GO TO Q4

3. What is the longest amount of time that any member of your household has lived here?

   ________________ years
   OR
   ________________ months

4. Does the owner of this building live on this property; that is, in this building or complex?

   Yes.........................01

   No..........................02

   Single family house.........03

   Don't know..................94

5. Is the owner of this building/house related to you or to anyone else who lives in this household?

   Yes.........................1

   No..........................2

IF QUESTION 1 IS CODED 1, SKIP TO QUESTION 8.

6. I know that it is sometimes difficult to find a new place to live. Can you tell me how you found this (house/apartment)? CIRCLE ONLY ONE.

   Ad in newspaper.............1 → GO TO Q6A

   PHA referral................2 → GO TO Q7

   For Rent sign on building....3 → GO TO Q7

   Real estate agency..........4 → GO TO Q6B

   Heard about it from a
    friend or relative.........5 → GO TO Q7

   Other (SPECIFY).............6 → GO TO Q7

   ____

6a. Did the ad in the newspaper mention Section 8 (Certificate or Housing Voucher) Program?

   Yes.........................1 → GO TO Q7

   No..........................2 → GO TO Q7

6b. When you went to the real estate agency, did they know about the Section 8 (Certificate or Housing Voucher) Program?

   Yes.........................1

   No..........................2

7. When you contacted the (owner/landlord) of this (house/apartment), would you say that he or she...

knew the Section 8 Certificate and Housing Voucher Program well........1

(VOUCHER HOLDERS ONLY - DESIGNATED BY "V" IN UPPER RIGHT CORNER OF LABEL)
knew about the Section 8 Certificate Program, but had never heard of the Housing Voucher Program.....2

had heard about the program, but did not know all the details, or....3

had never heard of the program before?.............4

8. REFER TO CODES IN ITEM A5A, PAGE 1, AND CODE a-d BELOW FOR THOSE NOT PRESENT.

I saw that you have a (READ ITEMS NOT CODED 9 BELOW). Is the (ITEM) provided by your landlord?

	YES	NO	NOT PRESENT
a. Garbage disposal	1	2	9
b. Dishwasher	1	2	9
c. Microwave	1	2	9
d. Air conditioning equipment	1	2	9

9. REFER TO QUESTION 8 AND ASK ONLY IF ITEM d IS CODED 9. OTHERWISE, GO TO Q10a.

I did not see any air conditioning equipment in your (house/apartment). Do you have window units that you can install when it's very hot?

Yes..........................1

No..........................2 → GO TO Q10a.

9a. Are the window air conditioning units provided by the landlord?

Yes..........................1

No..........................2

10a. REFER TO CODES IN ITEM A5A, PAGE 1. ASK Q10a ONLY IF ITEM b AND ITEM c ARE CODED 2. ASK Q10b IF ITEMS a, b, AND/OR c ARE CODED 1.

I did not see any parking facilities on this property. Are there offstreet parking facilities such as a garage, carport, or parking lot available for your use?

Yes..........................1 → GO TO Q10c

No..........................2 → GO TO Q11

10b. I noticed that there is a (garage/carport/parking lot) on this property. Is it available for your use?

Yes..........................1

No..........................2 → GO TO Q11

10c. Is the cost of the (garage/carport/parking space) included in your rent or do you pay extra for it?

Included in rent.............1 → GO TO Q11

Have to pay extra............2

10d. How much do you pay each month for this (garage/carport/parking space)?

$ ________________ per month

11. REFER TO CODES IN ITEM A5A, PAGE 1, AND CODE a-e BELOW FOR THOSE NOT PRESENT.

I saw that there (is/are)...(READ ITEMS NOT CODED 9 BELOW) in this (building/ complex). Is the cost of using these facilities included in your rent or do you have to pay extra?

	INCLUDED IN RENT	PAY EXTRA	NOT PRESENT
a. An outdoor swimming pool	1	2	9
b. An indoor swimming pool	1	2	9
c. Tennis courts	1	2	9
d. A function room	1	2	9
e. A sauna/steamroom/ hot tub	1	2	9

IF PAY EXTRA FOR ANY OF THE FACILITIES, ASK Q11A, OTHERWISE GO TO Q12.

11a. How much does using the (ITEMS) cost per month?

a. Outdoor pool charge $ ________

b. Indoor pool charge $ ________

c. Tennis court charge $ ________

d. Function room charge $ ________

e. Sauna,etc. charge,or $ ________

f. One charge for all $ ________

12. How would you rate your (house/apartment) as a place to live--would you say it is excellent, good, fair, or poor?

Excellent....................1

Good.........................2

Fair.........................3

Poor.........................4

13. How would you rate your neighborhood as a place to live--would you say it is excellent, good, fair, or poor?

Excellent....................1

Good.........................2

Fair.........................3

Poor.........................4

REFER TO NOTES IN ITEM A5A, PAGE 1. IF ITEM j IS CODED 1, ASK Q14A; IF ITEM k IS CODED 1, ASK Q14B. OTHERWISE, GO TO Q15A.

14a. I noticed that there is a (sewer/septic tank) problem in your basement. How long has it been since you first noticed the problem?

Days.........................1

Weeks........................2

Months.......................3

Had not noticed..............4

14b. It looks like there has recently been a (sewer/ septic tank) problem in your basement. How long did it take for the problem to be fixed?

Days.........................1

Weeks........................2

Months.......................3

Respondent unaware of problem......................4

15a. Here are a few conditions that many people have on their streets. Which, if any, do you have?

	YES	NO
a. Boarded up or abandoned structures?	1	2
b. Industries, business, stores of other non-residential activities?	1	2

15b. How much of a problem is crime in this neighborhood? Would you say it is...

a serious problem...........1

somewhat of a problem, or....2

not much of a problem?.......3

Housing costs have increased a lot in the last few years. I would like to ask you a few questions about your housing expenditures.

16. How much rent do you pay <u>to your landlord</u> every month for this (house/apartment)?

$ ____________ per month

17. Is this the only monthly payment that you make to your landlord or are there other things that you pay separately, besides parking and recreational fees?

No other payment............1 → GO TO Q18

Other payments..............2

17a. Please tell me how much these other monthly payments are and what they are for.

a.$ ________ per month

SPECIFY ____________________

b.$ ________ per month

SPECIFY ____________________

c.$ ________ per month

SPECIFY ____________________

18. Sometimes, people have to pay security advances or deposits when they move in. Did you have to give your landlord a security deposit for this (house/apartment)?

Yes.........................1

No..........................2 → GO TO Q19

18a. How much was the security deposit?

$ ____________

19. Sometimes people pay a one-time fee to the landlord when they move into a new (house/apartment). Did you pay a fee (in addition to your security deposit)?

Yes.........................1

No.................2 → TERMINATE INTERVIEW - GO TO PAGE 23.

19a. How much was this fee?

$ ____________

TERMINATE INTERVIEW - GO TO PAGE 23.

PART G: EXTERIOR AND GROUNDS

1. EXTERIOR STAIRS/RAILS/HEIGHTS

   Unsafe................................1

   Safe..................................2

   No stairs or heights..................3

2. OUTDOOR BASKETBALL/VOLLEYBALL COURT(S)

   Present...............................1

   Not present...........................2

3. OUTDOOR CHILDREN'S PLAYGROUND

   Present...............................1

   Not present...........................2

4. YARD--CODE <u>ONLY</u> IF DWELLING UNIT TYPE (ITEM 1, PAGE 1) IS CODED 01-07.

   None..................................1

   Unfenced, shared with other residents...2

   Fenced, shared use....................3

   Unfenced, exclusive use (not shared)....4

   Fenced, exclusive use (not shared)......5

5. GROUNDS QUALITY

   No grounds with building..............1

   Not observable/unseasonal.............2

   Muddy/dirty/unimproved space..........3

   Large bare patches--poor upkeep.......4

   Moderate upkeep.......................5

   Superior upkeep.......................6

6. LANDSCAPING

   None..................................1

   Not observable/unseasonal.............2

   Minor landscaping.....................3

   Moderate landscaping..................4

   Extensive landscaping.................5

7. SITE CLEANLINESS

   Not applicable........................1

   Major accumulation of litter/trash......2

   Moderate accumulation of litter/trash.................3

   Minor accumulation of litter/trash......4

   Very clean............................5

PART H: SURROUNDING PARCELS

1. PARCEL DESCRIPTION

	PARCEL 1	PARCEL 2	PARCEL 3	PARCEL 4
Residential, occupied unit	1	1	1	1
Mixed use, small retail with dwelling unit(s)	2	2	2	2
Residential, vacant unit (for sale or for rent)	3	3	3	3
Residential, vacant unit under repair or under construction	4	4	4	4
Unit boarded up, abandoned, or demolition site	5	5	5	5
Vacant parcel	6	6	6	6
Rural/semi-rural, public park, attractive water frontage	7	7	7	7
Other	8	8	8	8

2. PARCEL CLEANLINESS

	PARCEL 1	PARCEL 2	PARCEL 3	PARCEL 4
Not applicable	1	1	1	1
Major accumulations of litter/trash	2	2	2	2
Moderate accumulations of litter/trash	3	3	3	3
Minor accumulations of litter/trash	4	4	4	4
Very clean	5	5	5	5

APPENDIX C

BASIC ESTIMATION METHODOLOGY

This Appendix discusses the technical details of our analytic approach in terms of:

1. Comparison of estimated program outcomes across all large, urban PHAs (referred to as national projections),
2. Examination of patterns of outcomes across a limited set of demographic and/or locational descriptors.

Each of these areas is discussed in turn below. The methods described are generally straightforward and well known, but there is enough flexibility in their details to warrant documentation. The methods apply only to directly observed outcomes such as the number of rooms per person in recipient housing or changes in recipient satisfaction. The methods used for estimation of overall indices of housing quality based on hedonic indices are discussed in Appendix E.

C.1 National Projections

We start with the development of national projections of outcomes and differences in outcomes. As described in Appendix A, the 20 PHAs included in the Demonstration consist of a sample of 18 large urban PHAs, drawn for HUD by Westat. For the purposes of this section, it is sufficient to say that each of the 106 large urban PHAs had a known probability, P_i, of being included in the sample.[1] These 106 PHAs accounted for over 290,000 certificates--somewhat more than one-third of the Section 8 Existing program slots in 1984.

Once PHAs were selected, a target number of Housing Voucher slots for each bedroom size was established, together with an equal number of Certificate slots. The latter are referred to as flagged Certificate slots to distinguish them from the bulk of the current Certificate program in each PHA.

[1] The exact sample frame was non-statewide PHAs within the contiguous U.S. containing an urban area of at least 50,000 persons with at least 1,000 authorized Section 8 Existing Housing certificates in January 1984--excluding 6 PHAs which were deemed by HUD to be inappropriate (Dietz <u>et al</u>., p. 3-1).

Thereafter, applicants to the Section 8 Housing program were randomly assigned to either the Section 8 Housing Voucher program or the Section 8 Housing Certificate program until the targeted numbers of recipients were achieved.

Results for the two statewide agencies can be regarded as indicative of outcomes in less urban areas. Results for the sample of 18 large urban PHAs can be used to estimate results for the entire population of large urban PHAs. For convenience, we refer to these as national estimates, though it should be recalled that they are national estimates for large urban PHAs only.

This report deals with data for samples of recipients in 10 of the 18 PHAs included in the Demonstration. As discussed in Appendix A, the ten PHAs were not a probability sample. What this means analytically is that there is no obviously best way to present summary statistics for the ten PHAs as a group. We still have random samples of recipients in each PHA and can estimate results for each PHA, but we cannot definitely say what, for example, an average of the ten PHAs represents.

One approach to this problem would simply have been to present and discuss the ten sets of results separately. This was clearly undesirable. It would be enormously cumbersome and confusing for both the reader and the analyst. We did, of course, examine statistics for the hypothesis that differences between the programs are zero in all ten PHAs. But this only tells us whether the data reject the hypothesis that there were no program differences at the PHA level; it does not provide a summary measure.

Given the desirability of presenting some summary statistics for the ten sets of results, we considered two options--a simple average across the ten PHAs or a weighted average. We chose a weighted average based on the selection probabilities of the original urban PHAs and the region-size distribution of the ten housing evaluation PHAs. We call them national projections to emphasize that they are not estimates but are based on a reasonable projection of sample results to all large urban PHAs. This approach seemed most consonant with what we know about the sample and with the results of other reports that would be based on the full sample. Further, by paying careful attention to the variation in outcomes across PHAs, we could at least be alerted to the possibility of gross errors introduced by erroneous weights.

The relevant statistics for national projections are basically the same ones that would be developed if the ten PHAs had in fact been a probability sample with known probabilities of selection.

The remainder of this section discusses the general methods involved in developing the national projections and the specific estimation techniques used in this report.

As discussed in detail below, the key estimators are:

(1) $\hat{y}^k = \sum_j\sum_r\sum_i \delta_j (N_{jr}/P_j n^k_{jr}) y^k_{ijr} / \sum_j\sum_r\sum_i \delta_j (N_{jr}/P_j n^k_{jr})$ (See Eqs. 10 and 11, below)

(2) $\hat{\sigma}^2_k = \sum_j\sum_r\sum_i \delta_j (y^k_{ijr} - \bar{y}^k_{jr})^2/(n^k - m)$ (See Eq. 30, below)

(3) $$\widehat{\mathrm{Var}_2(\hat{y}^k)} = \hat{\sigma}^2_k \sum_j\sum_r\sum_i \delta_j (N_{jr}/P_j n^k_{jr})^2 / \left(\sum_j\sum_r\sum_i \delta_j (N_{jr}/P_j n^k_{jr})\right)^2$$

$$= \hat{\sigma}^2_k \sum_j\sum_r \delta_j (N_{jr}/P_j)^2 (1/n^k_{jr}) / \left(\sum_j\sum_r \delta_j N_{jr}/P_j\right)^2$$ (See Eq. 32, below)

(4) $$\widehat{\mathrm{Var}_1(\hat{y}^k)} = \sum \frac{\delta_j (N_j/P_j)(\hat{y}^k_j)^2}{\Sigma \delta_j N_j/P_j} - \left(\sum_j \frac{\delta_j (N_j/P_j)\hat{y}^k_j}{\Sigma_j \delta_j N_j/P_j}\right)^2$$

$$- \hat{\sigma}^2_k \left(\sum_j \delta_j \frac{(N_j/P_j)}{\Sigma N_j/P_j} \left(1 - \frac{N_j/P_j}{\Sigma N_j P_j}\right) \sum_r (N_{jr}/N_j)^2 (1/n^k_{jr}) \right) - (\hat{y}^k)^2$$

(See Eq. 42, below)

(5) $\mathrm{Var}(\hat{y}^k) = \mathrm{Var}_2(\hat{y}^k) + \frac{1}{t} \max\,(0, \mathrm{Var}_1(\hat{y}^k)).$ (See Eq. 45, below)

where

$\hat{y}^k$ = Projected mean outcome for the k^{th} program in all large urban PHAs

δ_j = 1 if the j^{th} PHA is included in the Demonstration housing quality sample, zero otherwise

N_{jr} = The number of Certificate program slots in the j^{th} PHA and r^{th} stratum[1] at the start of the Demonstration (1984)

P_j = The probability of selection of the j^{th} PHA

y^k_{ijr} = The outcome for the i^{th} person in the k^{th} program in the j^{th} PHA and r^{th} stratum

n^k_{jr} = The number of persons in the housing quality sample in the k^{th} program in the j^{th} PHA and r^{th} stratum

$\hat{\sigma}^2_k$ = The estimated within-PHA variance of outcomes across individuals in the k^{th} program

$\bar{y}^k_{jr}$ = The mean outcome of observations in the k^{th} program in the j^{th} PHA and r^{th} stratum

n^k = The number of observations in the k^{th} program ($= \sum_{jr}\sum \delta_j n^k_{jr}$)

m = The number of PHA/strata categories in the sample

$\widehat{Var_2(\hat{y}^k)}$ = The estimate of the variance of estimate of $\hat{y}^k$ given the sample PHAs--that is, the component of variance of $\hat{y}^k$ arising from variation within PHAs

$\widehat{Var_1(\hat{y}^k)}$ = The estimated variance in outcomes across PHAs

[1]The sample of recipients in each PHA was stratified by whether or not they had moved from their pre-program unit.

$\widehat{Var}(\hat{y}^k)$ = The estimated total variance of estimate of the projection, $\hat{y}^k$.

$N_j = \sum_r N_{jr}$

$\hat{y}_j^k = \sum_r (N_{jr}/N_j)\bar{y}_{jr}^k$

These estimators are derived as follows. First, we can estimate the mean outcome associated with recipients in the k^{th} program in the j^{th} PHA and r^{th} stratum:

$$(6) \qquad \hat{y}_{rj}^k = \sum_i y_{ijr}^k / n_{jr}^k$$

where

y_{jr}^k = The estimated mean outcome for the k^{th} program in the j^{th} PHA and r^{th} stratum

y_{ijr}^k = Actual outcome for the i^{th} sampled recipient in the k^{th} program in the j^{th} PHA and r^{th} stratum

n_{jr}^k = The sample size in the k^{th} program in the j^{th} PHA and r^{th} stratum.

We then estimate outcomes for the j^{th} PHA and k^{th} program by

$$(7) \qquad \hat{y}_j^k = \sum_{r=1} a_{jr}^k \hat{y}_{jr}^k = \sum_{r=1}^{3} \sum_{i=1}^{n_{jr}} a_{jr}^k y_{ijr}^k / n_{jr}^k$$

where

$\hat{y}_j^k$ = The estimated average costs for the k^{th} program in the j^{th} PHA

a_{jr}^{k} = Weights for the r^{th} stratum in the j^{th} PHA (set equal to the actual proportion of the k^{th} program's units that were in the r^{th} stratum when the sample was drawn.[1]

$\hat{y}_{jr}^{k}$ = Estimated average costs for the k^{th} program in the j^{th} PHA and r^{th} stratum (from Eq. (6)).

We can construct national projections for all large urban PHAs as a weighted average of PHA or PHA/stratum estimates:

$$\text{(8)} \qquad \hat{y}^{k} = \sum_{j} w_j \hat{y}_j^{k} = \sum_{j=1}^{10} \sum_{r=1}^{3} w_j a_{jr}^{k} \hat{y}_{jr}^{k}$$

$$\text{(9)} \qquad w_j = (N_j/NP_j)/(\sum_{\text{sample}} N_j/NP_j)$$

where

$\hat{y}^{k}$ = The projected average outcome for the k^{th} program

w_j = The weight for the j^{th} PHA

$\hat{y}_j^{k}$ = The estimated average outcome for the k^{th} program in the j^{th} PHA (from Eq. (7)

N_j = The number of Certificate program units in the j^{th} PHA at the start of the Demonstration

N = Total number of Certificate units in all Demonstration PHAs $(=\Sigma N_j)$

---

[1]In addition, the original allocations of sample over bedroom size categories in each program were stratified to yield slightly higher probabilities of selection for larger bedroom sizes. We ignored this in developing estimates for this report. Thus, the sample size in a bedroom size category is treated as proportional to the population in that category for each PHA.

P_j = The probability of selection for the j^{th} PHA.

Alternatively, we can rewrite Eq. (8) in terms of a weighted average of individual outcomes:

$$(10) \qquad \hat{y}^k = \sum_{j=1}^{10} \sum_{r=1}^{2} \sum_{i=1}^{n_{rj}^k} c_{jr}^k y_{ijr}^k$$

$$(11) \qquad c_{jr}^k = N_{jr}/(P_j n_{jr}^k)/(\sum_{jr}\sum N_{jr}/P_j)$$

We can also estimate the error of estimate for these estimates. The *sampling took place in two stages: first, PHAs were sampled, then individuals* within PHAs. In general, for any random variable, x,

$$(12) \qquad E(\hat{x}) = E_1(E_2(\hat{x}))$$

$$(13) \qquad Var(\hat{x}) = E_1(Var_2(\hat{x})) + Var_1(E_2(x))$$

where subscripts refer to the sampling stage over which expectations are taken. First consider the expected value of $\hat{y}^k$:

$$(14) \qquad E_2(\hat{y}^k) = \sum_j w_j \delta_j \sum_r \frac{N_{jr}}{N_j} \mu_{jr}^k = \sum_j w_j \delta_j \mu_j^k$$

where the summation is over all large PHAs in the universe, and

δ_j = 1 if the j^{th} PHA is included in the sample and 0 otherwise

μ_{jr}^k = The mean outcome for the k^{th} program in the j^{th} PHA and r^{th} stratum

μ_j^k = The mean outcome for the k^{th} program in the j^{th} PHA

N_{jr} = The number of units for the k^{th} program in the j^{th} PHA and r^{th} stratum

N_j = The number of units for the k^{th} program in the j^{th} PHA

Taking the expectation of Eq. (14) over the first sampling stage, yields

$$(15) \qquad E_1(E_2(\hat{y})) = \sum_j P_j E(w_j|\delta_j=1)\mu_j^k$$

The troublesome term in this equation is $E(w_j|\delta_j=1)$. This reflects the fact that the weights of Eq. (8) are normalized to sum to one; accordingly, the weight for any site will vary across samples (except in the special case in which the probability of selection for each PHA is proportional to size so that the sum of the unnormalized weights is constant across samples of sites). Thus, it is difficult to evaluate $E(w_j|\delta_j=1)$ without detailed examination of the selection process. We can, however, sidestep this problem by proceeding to consider the expectation of an estimator based on unnormalized weights, $\tilde{w}_j$, and then returning to the problems posed by normalization.

Let

$$(16) \qquad \hat{\tilde{y}}^k = \sum \tilde{w}_j \delta_j \hat{y}_j^k$$

$$(17) \qquad \tilde{w}_j = N_j/NP_j$$

where

$\hat{\tilde{y}}^k$ = The estimator with unnormalized PHA weights

$\tilde{w}_j$ = The unnormalized weight for the j^{th} PHA

Other terms = As in Eq. (9)

Thus, parallel to Eq. (14)

$$(18) \qquad E_2(\hat{\tilde{y}}^k) = \sum_j \tilde{w}_j \delta_j \mu_j^k = \sum_j (N_j/NP_j)\delta_j \mu_j^k$$

And since the sample indicators (δ_j) is one with probability P_j and zero with probability $(1-P_j)$,

$$(20) \qquad E_1(E_2(\hat{\tilde{y}}^k)) = \sum_j P_j(N_j/NP_j)\mu_j$$

$$= \sum_j (N_j/N)\mu_j^k$$

$$= \mu^k$$

where

μ_k = The mean costs of the k^{th} program among all larger urban PHAs.

Thus the unnormalized estimator $(\hat{\tilde{y}}^k)$ is unbiased. But we can write the unnormalized estimator as the product of the normalized estimator $(\tilde{y}^k)$ and the sum of the unnormalized weights $(\Sigma\tilde{w}_j)$

$$(21) \qquad \hat{\tilde{y}}^k = (\sum \delta_j\tilde{w}_j)(\hat{y}^k)$$

$$(22) \qquad E_2(\hat{\tilde{y}}^k) = (\sum \delta_j\tilde{w}_j)E_2(\hat{y}^k)$$

Thus

$$(23) \qquad E(\hat{\tilde{y}}^k) = E(\sum \delta_j\tilde{w}_j)E(\hat{y}^k) + \rho\sigma_w\sigma_y \; .$$

where

ρ = The correlation across samples of sites between $\Sigma\delta_j\tilde{w}_j$ and $E_2(\hat{y}^k)$

σ_w = the standard deviation across samples of $(\Sigma\delta_j\tilde{w}_j)$

σ_y = The standard deviation across samples of sites of $E_2(\hat{y}^k)$

Note that $E(\delta_j\tilde{w}_j)$ is one. Accordingly, if $(\Sigma\delta_j\tilde{w}_j)$ is uncorrelated with $E_2(\hat{y}^k)$--i.e., if $\rho=0$ in Eq. (19)--then $\hat{y}^k$ is also unbiased. Since $(\Sigma\delta_j\tilde{w}_j)$ is uncorrelated with w_j,[1] this amounts to asserting that high-weight sites are not systematically more likely to have higher or lower outcome levels.

The reason for worrying about this rather than simply adopting the unnormalized estimator is the variance of the two estimators. These are related by[2]

$$\text{(24)} \qquad \operatorname{Var}(\hat{\tilde{y}}^k) = (\mu_w)^2\sigma_y^2+(\mu_y)^2\sigma_w^2+(1-\rho^2)\sigma_y^2\sigma_w^2-2\mu_w\mu_y\rho\delta_w\delta_y+\operatorname{Cov}((\textstyle\sum\tilde{w}_j\delta_j)^2,\ (E_2(\hat{y}^k))$$

where

μ_w = Mean across samples of sites of $\Sigma\delta_j\tilde{w}_j$ (=1)

μ_y = Mean across samples of sites of $E_2(\hat{y}^k)$

σ_y^2 = Variance across samples of sites of $E_2(\hat{y}^k)$

σ_w^2 = Variance across samples of sites of $\Sigma\delta_j\tilde{w}_j$

ρ = Correlation across samples of sites between $E_2(\hat{y}^k)$ and $\Sigma\delta_j\tilde{w}_j$

If $\rho = 0$, we have (recalling that $\mu_w = 1$ and that if $\rho = 0$, then $\mu_y = \mu^k$):

$$\text{(25)} \qquad \operatorname{Var}(\hat{y}^k) = \sigma_y^2 \le \frac{\operatorname{Var}(\hat{\tilde{y}}^k) - (\mu^k)\ \sigma_w^2}{1+\sigma_w^2} < \operatorname{Var}(\hat{\tilde{y}}^k)$$

(unless $\Sigma\delta_j\tilde{w}_j$ is one across all samples).

The content of the lower variance of Eq. (21) may be clarified by considering the estimate for total rather than average outcomes. An unbiased

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[1]In essence, given a random sample of sites whose unnormalized weights sum to a given amount, S, then the expected weight for a sample site chosen at random from the sampled set is S/n. Accordingly the expected normalized weight is 1/n, regardless of the value of S.

[2]Kendall, p. 343.

estimate of a total program outcome (for example, the total rent paid by all recipients) is given by

(26) $$\hat{y}^k = \sum(N_j/P_j)(\hat{y}_j^k)$$

where:

$\hat{y}^k$ = The estimate of total outcomes in the k^{th} program

N_j = The number of program slots in the j^{th} PHA

P_j = The probability of selection of the j^{th} PHA

$\hat{y}_j^k$ = The average outcome for the k^{th} program in the j^{th} PHA

In effect, to arrive at an estimate of, for example, total program rents, we find average rents per recipient in each sampled PHA and then extrapolate these to all (large, urban) PHAs by letting each sampled PHA represent (N_j/P_j) recipients. When we want to estimate overall average rent per recipient, we have two choices: we can use normalized weights and divide the estimated total rents by the implied number of recipients in our extrapolation $(\Sigma N_j/P_j)$ or we can say that we know the total number of recipients and use unnormalized weights by dividing by the known total number of program recipients in the universe, regardless of the factors used to extrapolate rents. The latter seems implausible.[1]

Accordingly, we have chosen throughout this report to use normalized weights--assuming that given the design of the sample allocation across PHA size and region (see Appendix A), average outcomes were not systematically related to the probability of selection (and thus the sample weights). Readers who do not wish to adopt this assumption may multiply national projections by a factor of 0.968.

[1]As indicated in Appendix A, this may be the factor behind Bryant et al.'s suggestion that a potentially biased estimator (whose weights always sum to one) be considered when drawing samples following the procedures and by Westat in drawing the sample of Demonstration PHAs.

Now consider the variance of $\hat{y}^k$. Eq. (13) decomposed the variance into two pieces--$E_1(Var_2(\hat{y}^k))$, the expected value across samples of sites of the variance of $\hat{y}^k$ for a given sample of sites, and $Var_1(E_2(\hat{y}^k))$, the variance across samples of sites of the expected value of $\hat{y}^k$ for a given sample of sites. Consider first the variance of $\hat{y}^k$ given the sample of sites selected:

$$(27) \qquad Var_2(\hat{y}^k) = \sum_j w_j \delta_j \sum_r \left(\frac{N_{jr}}{N_j}\right)^2 \frac{\sigma^2_{kjr}}{n_{jr}}$$

where

σ^2_{kjr} = The variance of cost across individuals in the k^{th} program and j^{th} PHA and r^{th} stratum

n_{jr} = The sample size in the j^{th} PHA and r^{th} stratum

This is the variance of $\hat{y}^k$ given the PHAs actually sampled and formed the basis for our calculation of standard errors based on within-PHA variation. To estimate $Var_2(\hat{y}^k)$ we need estimates of σ^2_{kjr}. We used the usual sampling estimator for σ^2_{kjr}:[1]

$$(28) \qquad \hat{\sigma}^2_{kjr} = \sum_i (y^k_{ijr} - \bar{y}^k_{jr})^2/(n^k_{jr} - 1)$$

where

y^k_{ijr} = The outcome of the i^{th} person in the k^{th} program in the j^{th} PHA and r^{th} stratum

$\bar{y}^k_{jr}$ = The mean outcome for the k^{th} program in the j^{th} PHA and r^{th} stratum

[1]In models involving hedonic indices, we estimated a common regression with common variance for both strata in each site. Further, under some specifications, the variance is assumed to be the same in both programs (see Appendix E). Finally, in constructing F-statistics for the hypothesis that some parameter was zero in all sampled PHAs, we made the usual assumption of a common PHA variance as well.

n^k_{jr} = The number of observations in the k^{th} program in the j^{th} PHA and r^{th} stratum

m = The number of PHA/stratum categories

The estimator, $\hat{\sigma}^2_{kjr}$, is an unbiased estimate of σ^2_{kjr} so that

$$(29) \qquad E_2(\sum_j w_j^2 \delta_j^2 \sum_4 (\frac{N^2_{jr}}{N_j}) \frac{\hat{\sigma}^2_{kjr}}{n^k_{jr}}) = Var_2(\hat{y}^k))$$

and, obviously, therefore,

$$(30) \qquad E_1(E_2(\sum_j w_j^2 \delta_j^2 \sum_r (\frac{N^2_{jr}}{N_j})^2 \frac{\hat{\sigma}^2_{kjr}}{n^k_{jr}}) = E_1(Var_2(\hat{y}^k))$$

The hard part is the second expression in Eq. (13) -- $Var_1(E_2(\hat{x}))$. This is given by

$$(31) \qquad Var_1(E_2(\hat{x})) = E_1(\sum_j w_j \delta_j \mu^k_j - \sum_j P_j w_j \mu^k_j)^2$$

or

$$(32) \qquad Var_1(E_2(x)) = (y'Qy)$$

where

y' = $(w_1\mu^k_1, w_2\mu^k_2 \ldots w_T\mu^k_T)$

Q = $E_1(\delta_j - P_j)(\delta_j - P_j)'$

T = The total number of PHAs in the universe

The problem in evaluating this is that the $(\delta_j - P_j)$ are not independent of each other--that is, under the sampling scheme used to draw the sites, the selection of one site affects the probability of selection of the remaining sites.[1] $Var_1(E_2(x))$ can be estimated by various techniques. For this report, however, we took an especially simple approach. We assumed that the stratifications used by Westat in drawing the sample of large urban PHAs were in fact more efficient than a simple alternative scheme. We then used the variance under this alternative scheme to provide an upper bound on the variance under the sampling method actually used.

Specifically, Westat could have broken the PHAs into 16 strata of equal size (in terms of numbers of units) and sampled one PHA per stratum with probability proportional to size. Under this method, the Q-matrix from Eq. (32) is given by

(33) $$E(\delta_i - P_i)^2 = P_i(1 - P_i)$$

$$E(\delta_i - P_i)(\delta_j - P_j) = \begin{cases} 0 & \text{if i and j are in different strata} \\ -(P_i P_j) & \text{if i and j are in the same strata} \end{cases}$$

Thus

(34) $$y'Qy = \sum_s\sum_j y_{js}^2 P_{js} - \sum_s \left(\sum P_{js} y_{js}\right)^2$$

where

y_{js} = The value of y (Eq. 32) for the j^{th} PHA in the s^{th} stratum

P_{js} = The probability of selection for j^{th} PHA in the s^{th} stratum

Since one site is selected in each stratum, the values of P_{js} and w_{js} are given by

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[1] See Dietz, et al.

$$(35)\qquad P_{js} = N_{js}/N_s$$

$$w_{js} = \frac{N_{js}}{N} \cdot \frac{1}{P_{js}}$$

$$= \frac{N_s}{N}$$

$$= t$$

where

P_{js} = The probability of selection for the j^{th} PHA in the s^{th} stratum

N_{js} = The size of the j^{th} PHA in the s^{th} stratum

N_s = The size of the s^{th} stratum

t = The number of sites in the sample ($= N/N_s$ since all strata have equal sizes by assumption).

Substituting Eq. (35) into Eq. (32) and (34) yields:

$$(36)\qquad y'Qy = \sum_s \left(\frac{N_s}{N}\right)^2 \sum_j \frac{N_{js}}{N_s} \mu_{js}^2 - \sum_s \left(\frac{N_s}{N}\right)^2 \left(\sum_j \frac{N_{js}}{N_s} \mu_{js}\right)^2$$

$$= \frac{1}{t^2} \left(\sum_s \sum_j \frac{N_{js}}{N_s} \mu_{js}^2 - \sum_s \left(\sum_j \frac{N_{js}}{N_s} \mu_{js}\right)^2\right)$$

$$= - \left[\frac{\sum_s \sum_j \left(\frac{N_{js}}{N_s}(\mu_{js} - \sum_j \frac{N_{js}}{N_s} \mu_{js}\right)\right)}{t}\right]$$

$$= \frac{\sum\sum_{sj} \left(\frac{N_{js}}{N_s}(\mu_{js} - \frac{1}{t} \sum\sum_{sj} \frac{N_{js}}{N_s}\mu_{js})2\right)}{t} - \frac{1}{t} \sum_s \frac{\left(\sum \frac{N_{js}}{N_s}\mu_{js} - \frac{1}{t} \sum\sum_{sj} \frac{N_{js}}{N_s}\mu_{js}\right)^2}{t}$$

$$\leq \frac{1}{t} \frac{\sum\sum_{sj} \left(\frac{N_{js}}{N_s}(\mu_{js} - \frac{1}{t} \sum\sum_{sj} \frac{N_{js}}{N_s}\mu_{js})^2\right)}{t}$$

But the last expression is simply the inter-PHA variation. Thus

$$(37) \qquad Var_1(E_2(x)) < \sigma_s^2/t$$

where

σ_s^2 = The inter-PHA variation

t = The number of sampled PHAs.

We used an upward biased estimate of σ_s^2 to establish an upper bound on $Var_1(E_2(\hat{x}))$ and hence on $Var(\hat{x})$. Our estimate of σ_s^2, the inter-PHA variance, was derived as follows. We now want to drop the stratum notation and return to our previous notation, since we have to develop the estimator from the actual sample. Suppressing bedroom size subscripts and considering only PHA-level statistics, we can rewrite Eq. (37) as

$$(38) \qquad Var_1(E_2(\hat{y})) \leq \frac{\sum (N_j/N)\ (\mu_j - \mu)^2}{t}$$

and estimate the right-hand side of Eq. (38) by

$$(39) \qquad Est\ (\frac{\sum\ (N_j/N)\ (\mu_j\ -\ \mu)^2}{t} = \frac{t}{t-1}\ \hat{M}$$

$$(40) \qquad \hat{M} = \frac{1}{t-1}\ [\sum_j\ w_j\delta_j\hat{y}_j^2 - \sum\ w_j(1-w_j)\delta_j\hat{\sigma}_j^2 - \hat{y}^2]$$

where

μ = $\sum\ (N_j/N)_j$

$\hat{y}$ = $\sum\ w_j\hat{y}_j\delta_j$

w_j = $(\frac{N_j}{N})(1/P_j)$

and

μ_j = The true mean for the j^{th} PHA

$\hat{y}_j$ = An estimator for μ_j distributed (μ_j, σ_j^2)[1]

$\hat{\sigma}_j^2$ = An unbiased estimate of σ_j^2 [1]

N_j = The size of the j^{th} PHA

P_j = The probability of selection of the j^{th} PHA

δ_j = 1 if the j^{th} PHA is selected, zero otherwise.

Recall that for any random sample the sample moments around zero are unbiased estimates of the population moments. In particular, the second moment has the expectation

$$E(x^2) = [E(x)]^2 + Var(x) \tag{41}$$

Now consider the expected value of $\hat{M}$ in Eq. (40).

$$E_2(\hat{M}) = \frac{1}{t-1} [\sum w_j\delta_j E(\hat{y}_j^2) = \sum w_j(1-w_j)\delta_j E(\hat{\sigma}_j^2) - E(\hat{y}^2)] \tag{42}$$

$$= \frac{1}{t-1}\{\sum w_j\delta_j(\mu_j^2 + \sigma_j^2) - \sum w_j(w-2_j)\delta_j\sigma_j^2 - [(\sum w_j\delta_j\mu_j)^2 + \sum w_j^2\delta_j^2\sigma_j^2]\}$$

$$= \frac{1}{t-1} \{\sum w_j\delta_j\mu_j^2 - (\sum w_j\delta_j\mu_j)^2$$

---

[1] σ_j^2 is the variance of estimate of $\hat{y}_j$ (the estimator for the site mean), not the variance of the underlying individual variable. Hence, in terms of Eq. (27):

$$\sigma_j^2 = \sum_r (N_{jr}/N_j)^2\sigma_{kjr}^2/n_{jr}$$

$$(43)\qquad E_1(E_2(\hat{M})) = \frac{1}{t-1}\,[\sum P_j w_j \mu_j^2 - (\sum w_j P_j \mu_j)^2 - Var_1(\sum w_j \delta_j \mu_j)$$

$$= \frac{t}{t-1}\,(\sum P_j w_j \mu_j^2 - \mu^2 - Var_1(E_2(\hat{y})))$$

$$= \frac{1}{t-1}\,(\sum \frac{N_j}{} \mu_j^2 - \mu^2 - \hat{V}ar_1(E_2(\hat{y}))$$

$$= \frac{t}{t-1}\,Var_1(E_2(\hat{y})) + \varepsilon - \frac{1}{t-1}\,Var_1(E_2(\hat{y})),\ \varepsilon > 0$$

$$= Var_1(E_2(\hat{y})) + \varepsilon,\ \varepsilon > 0$$

Accordingly, $\hat{M}$ is an upper bound estimator for $Var_1(E_2(\hat{y}))$ under the stated conditions.

The estimated total variance for an estimate, $\hat{x}$, is then bounded by

$$(44)\qquad \left(\begin{array}{l}\text{Estimated Upper Bound}\\ \text{for Total Variance of}\\ \hat{y}^k\end{array}\right) = \left(\begin{array}{c}\text{Est }(E_1(Var_2(\hat{Z}^k\ ))\text{ from Eq. (27)}\\ \text{plus}\\ \text{Est }(Var_1(E_2(\hat{Z}^k\hat{M}))\text{ from Eq. (42)}\end{array}\right)$$

In fact, as discussed in Appendix A, the procedure used to draw the sample of PHAs may or may not be more efficient than a simple stratification. (Unfortunately, Dietz et al. does not provide the information necessary to judge this in more detail for this case.) Thus, the bound for inter-PHA variation established by Eq. (37) may or may not hold in fact. On the other hand, the bound estimated by $\hat{M}$ is definitely larger than the simple stratification variance unless there is no between strata variation, which should increase our confidence in the bound on total variance provided by Eq. (44). In addition, we have generally presented two errors of estimate. One, based on the expression for $Var_2(\hat{y}^k)$ in Eq. (27), reflects only the within-site variation. The other, based on Eq. (44), reflects total variation. This follows our general practice of examining the extent of inter-PHA variation. In particular, it would be important to notice a situation in which significant program differences within PHAs are masked by variations in the size and/or direction of the difference across PHAs. This practice also, of course, allows us to know if our estimate of inter-PHA variation is in fact changing our assessment of program differences and thus whether more elaborate exploration of alternative estimates for total variance might be warranted.

Presenting both errors of estimate based on within-PHA and total variation did lead to one modification of Eq. (44). Because the estimator of between-PHA variation ($\hat{M}$) involves decomposing variance into two components by taking the difference of two sums-of-squares, it is not guaranteed to be non-negative. This is a usual problem in this sort of situation.[1] Indeed, it is not clear that it is avoidable. The inter-site variation may be zero; accordingly, any unbiased estimator (of the upper bound) must be able to take on negative values.

The estimator for total variance will usually be positive, even when Est $(\mathrm{Var}_1(E_2(\hat{y}^k))$ is negative. However, because we frequently present both the error of estimate based on the within-site variance alone and the error of estimate based on the total variance, we were reluctant to present figures with an estimated total variance less than the estimated within-PHA component. Accordingly, we adopted the practice of treating the inter-PHA variance as zero when its estimate was negative. Since the estimated total variance is already an upper bound, this seemed reasonable. Thus the exact rule is:

$$(45) \qquad \left(\begin{array}{c}\text{Est Upper Bound} \\ \text{For Total Variance of } \hat{y}^k\end{array}\right) = \left(\begin{array}{c}\hat{M} \text{ from Eq. (35)} \\ \text{plus} \\ \max(0, \text{Est. } E_1(\mathrm{Var}_2 y^k)\end{array}\right)$$

C.2 Estimate for Demographic Groups

The methods of the previous section can also be used to develop national projections of program outcomes and differences in outcomes for any demographic subgroup of recipients. The individual weights for each observation are the same, since they are based on sampling probabilities. These methods yield national projections for any subgroup. They focus on how outcomes in the two programs differed for that subgroup rather than on how outcomes differ across subgroups.

[1] See, for example, the discussion of negative estimates of variance components in Searle, pp. 406-408.

When we estimate outcomes for different groups, however, we are frequently interested in the extent to which differences across groups seem to be associated with the groups themselves or with differences in where the groups are likely to be found or differences in other correlated characteristics. This can be pursued in a number of ways. For this report, where it seemed appropriate, we simply estimated the mean differences in outcomes across groups with site and other demographic covariates. This is an unweighted estimate and corresponds to the weighted sum of the estimated differences across groups within each PHA that has the smallest error of estimate.

APPENDIX D

THEORETICAL DIFFERENCES IN SHOPPING BEHAVIOR BETWEEN THE TWO PROGRAMS

This appendix provides the theoretical details behind the analysis of Chapter 2. The key conclusions are that (1) there is reason to believe that the Housing Voucher and Certificate programs will lead to different enrollee shopping behavior; (2) different shopping behavior may lead recipients in the two programs to pay different amounts for similar housing; and (3) while the theoretically expected net effects on average rents paid and housing obtained are not completely clear, to the extent that the Housing Voucher Voucher Program induces recipients to rent units above the FMR, Housing Voucher Recipients would be expected to shop more carefully.

The development of the theoretical model starts in Section D.1 with a simple model of housing choice in a world with known, homogenous prices and no uncertainty. This leads to expectations concerning differences in program success rates, recipient rents, and costs, as discussed in Section D.2. Section D.3 then extends this model to deal with search for housing that meets program requirements. This modifies the expectations of Section D.2. Section D.4 then further extends the model to take account of shopping for housing. Finally, Section D.5 indicates various caveats and extensions to the models. The work presented in Sections D.1 to D.3 was largely presented in a previous report (Kennedy and Finkel). It is included here for ease of reference.

D.1 Theoretical Incentives of the Two Programs

Consider first the ways in which the behavior of enrollees in the two programs would be expected to differ. We start by describing the two programs and the rents that recipients would be expected to choose.

The Programs. The Housing Voucher and Certificate Programs are each variants of the Section 8 Existing Housing Program and share certain basic features. In both programs, actual program operations are carried out by local public housing agencies (PHAs) under contract to HUD. Eligible applicants accepted by the PHA are given from two to four months to find acceptable housing in the private rental market. To be acceptable in either program, a unit must meet program quality and occupancy standards, and the unit's owner must agree to participate in the program. The owner then signs a lease with the applicant and a separate contract with the PHA. These contracts set the rent for the unit and specify the amount that the PHA will contribute towards paying the rent (the program contribution or housing assistance payment) and the amount to be paid by the tenant (the tenant contribution).

The central difference between the two programs is the way in which they determine the size of housing assistance payments. Under the Certificate program, the recipient contribution is usually fixed at 30 percent of income,[1] and the program pays the difference between this fixed contribution and the recipient's rent. In order to set some limit on assistance payments, allowable rents must be limited. This is done in two ways, First, rents may not exceed the schedule of Fair Market Rents by bedroom size (FMRs) published annually by HUD for each area of the country.[2] Second, the unit rent must be determined by the PHA to be reasonable, given local market conditions.

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[1]The actual rule is the larger of 10 percent of gross income, 30 percent of net income (gross income net of various deductions), or welfare rent. The 30 percent of net income figure was larger than 10 percent of gross income for 98 percent of the almost first 6,000 Demonstration applicants. The welfare rent rule applies only in certain states in which ADC payments include an allowance for rent equal to the ADC family's out-of-pocket expenses for rent up to a maximum amount, called the welfare rent. In these states, housing assistance payments that reduce the tenant contribution of ADC recipients below the welfare rent would be offset dollar for dollar by a reduction in ADC payments. Accordingly, in such "as-paid" states, the Certificate program sets the tenant contribution for ADC recipients equal to the larger of 30 percent of net income, 10 percent of gross income, or the welfare rent. Only two states included in the Demonstration were as-paid states--Michigan and New York--and Michigan has since changed its ADC rules.

[2]PHAs have some flexibility with respect to the FMR ceiling. In general, the gross rent (contract rent plus scheduled amounts for utilities paid by the tenant) must be less than the FMR schedule of rents by unit size and type established by HUD for the PHA jurisdiction. However, 1) the PHA may approve rents of up to 10 percent above the FMR on a case-by-case basis for up to 20 percent of units; 2) the PHA may extend this to more than 20 percent of units with HUD permission; 3) the PHA may obtain HUD approval for either categorical (size-type) or case-by-case increases in payment standard to up to 20 percent above the FMR. In addition, certain subsidized housing projects (e.g. Section 236 projects) have rent schedules that are separately approved by HUD. In these cases, the PHA may agree to accept the HUD-approved schedules for these projects, as long as they are below the FMRs.

Under the Housing Voucher program, in contrast, the maximum assistance payment is fixed, and the tenant contribution varies to make up the difference between the recipient's rent and the assistance payment. Accordingly, the Housing Voucher program does not have the upper limit on recipient rents imposed by the Certificate Program. In essence, the Housing Voucher recipient's out-of-pocket costs increase dollar for dollar with his or her unit's rent. This difference in program rules may affect both recipient and landlord behavior and program costs.

Recipient Choice. The theoretical effects of these differences in program payments can readily be described in the context of a simple economic model of housing choice. Under the simplest economic model of housing choice, a household is seen as allocating its spending between housing and other expenditures based on its relative preferences for housing and non-housing goods and its available choices given the prices of housing and other goods and the household's income.

Formally, this can be written as

(1) $$\underset{\{H,Z\}}{\text{Maximize}}\ U(H,Z) \text{ subject to } P_H H + P_Z Z \leq Y$$

where

$U(H,Z)$ = the households' preference ordering over Housing (H) and non-housing (Z) goods and services[1]

H = housing goods and services,

Z = non-housing goods and services,

P_H = the price per unit of H,

P_Z = the price per unit of Z, and

Y = household income.

---

[1]The preference ordering is in effect indexed by U. For convenience, the two classes of goods are defined so that they are in fact "goods" -- that is, so that U increases when either H or Z is increased (the partial derivatives U_H, U_Z are positive). The key assumption is that as one good is increased, the individual is willing to give up less of the other in return (the indifference curves or level curves of U are concave from above). In addition, unlike psychologist's models, economists always assume free disposability--that is the individual can never have so much of a good that it becomes a burden.

This is pictured graphically in Figure D.1. The diagonal line in Figure D.1 represents the pairs of (H,Z) values that satisfy the budget constraint.

(2) $$Y = P_H H + P_Z Z$$

The shaded area below the diagonal line is the feasible set--the set of all (H,Z) combinations that the household can afford. The curved lines in Figure D.1 represent level curves for U(H,Z)--that is, sets of (H,Z) pairs such that the household's level of utility (U) is constant. The household maximizes U by selecting the highest level curve within its feasible set--in this case (H*,Z*) tangent to the budget line.

Under the Section 8 Certificate Program, recipient households may rent any unit within the PHA jurisdiction provided that (1) the unit meets program quality and occupancy standards and (2) the unit's gross rent (including scheduled allowances for utilities not included in rent) is below or equal the local HUD-determined Fair Market Rent (FMR) and is determined by the PHA to be reasonable. Recipients pay an amount equal to the larger of 10 percent of gross income or 30 percent of net income.[1] The program pays the difference between gross rent and recipient contribution. Thus, for Housing that meets program standards, the Certificate program changes the budget constraint of Equation (2) to

(3) $$Y \begin{cases} P_H H + P_Z Z & \text{if } P_H H < \max\,[0.1Y_G, 0.3Y_N] \\ = \max\,(0.1Y_G, 0.3Y_N) + P_Z Z & \text{if } \max\,[0.1Y_G, 0.3Y_N] \leq P_H H \leq R^c_{max} \\ P_H H + P_Z Z & \text{if } P_H H > R^c_{max} \end{cases}$$

where

Y = the measure of household income relevant to household decision making,

H,Z = housing and non-housing consumption, respectively,

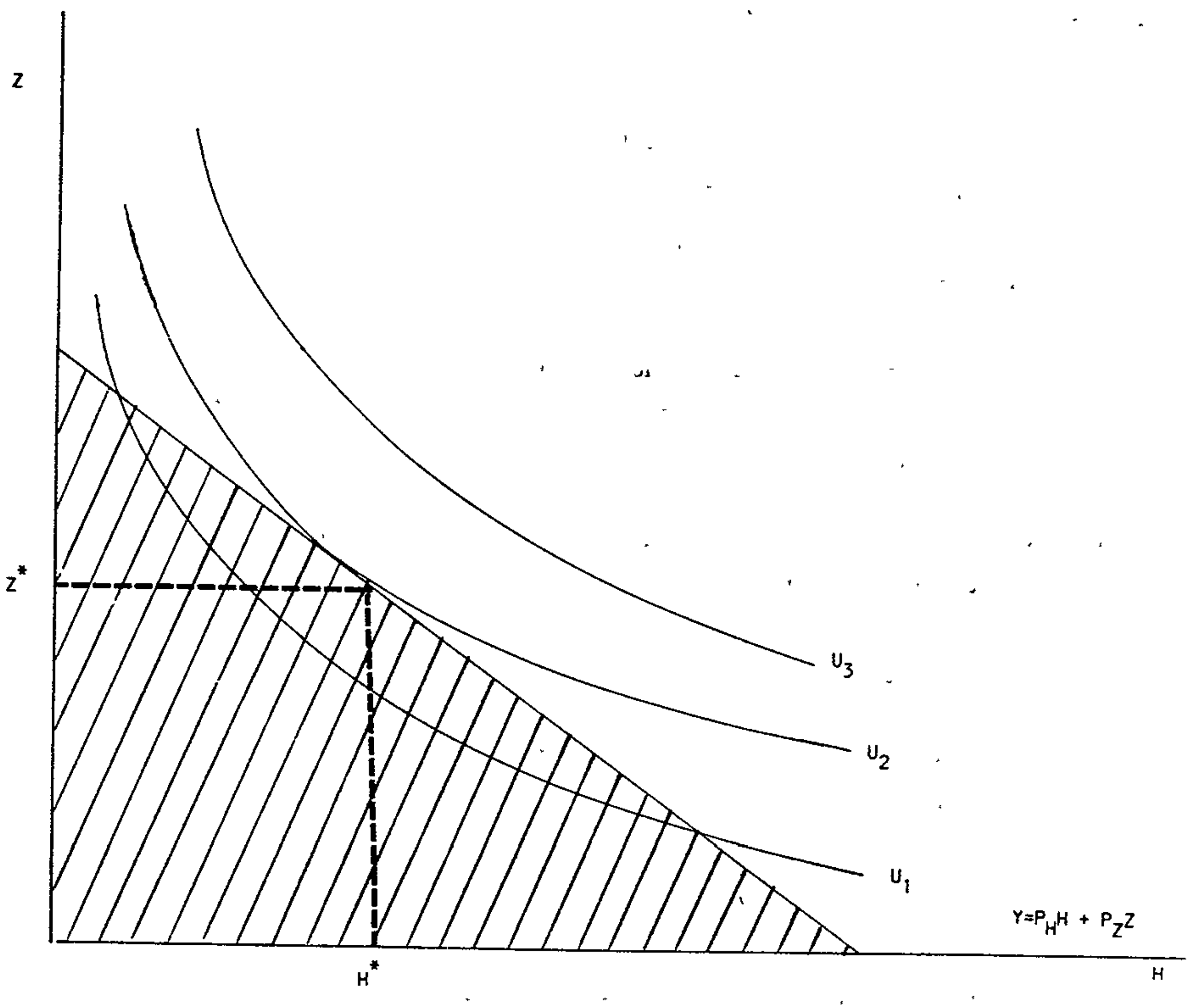
P_H, P_Z = the price per unit of housing and non-housing consumption, respectively,

Y_G = household gross income as defined by the program,

[1] Or welfare rent. See the note on welfare rent above.

FIGURE D.1

GRAPHICS OF HOUSING CHOICE



Y_N = household net income as defined by the program, and

R^c_{max} = the maximum gross rent allowed by the program.

This creates a corner in the budget line as shown in Figure D.2. For housing expenditures below the tenant contribution level (the larger of 10 percent of gross income or 30 percent of rent income), the household receives no assistance and remains on its pre-program budget line. Once expenditures on housing reach the tenant contribution level, fixed at R_{min}, the household can increase rent without increasing its out-of-pocket cost (without decreasing other expenditures) until it reaches the maximum allowed rent. Thus, above the tenant contribution level, the budget line is horizontal up to the maximum rent (indicating zero marginal cost for additional housing). Units above the maximum rent can only be rented outside the program at a sacrifice of the maximum subsidy (shown by the solid vertical line at H_{max} in Figure D.2). Above H_{max} the budget line returns to the original pre-program line.

The Housing Voucher Program substitutes a direct ceiling on the program assistance payment for the Certificate Program ceiling on unit rent. Specifically, under the Housing Voucher Program, recipients must still rent units that meet program housing standards, and the minimum tenant contribution is set at 10 percent of gross income.[1] For rents above this amount, the program pays the difference between gross rent and this tenant contribution up to a maximum amount. Thus the budget line becomes

$$(4) \qquad Y = \begin{cases} P_H H + P_Z Z & \text{if } P_H H \leq 0.1Y_G \\ 0.1Y_G + P_Z Z & \text{if } 0.1Y_G \leq P_H H \leq S^v_{max} + 0.1Y_G \\ P_H H - S^v_{max} + P_Z Z & \text{if } P_H H > S^v_{max} + 0.1Y_G \end{cases}$$

where

Y = the measure of household income relevant to household decision making,

H,Z = housing and non-housing consumption, respectively,

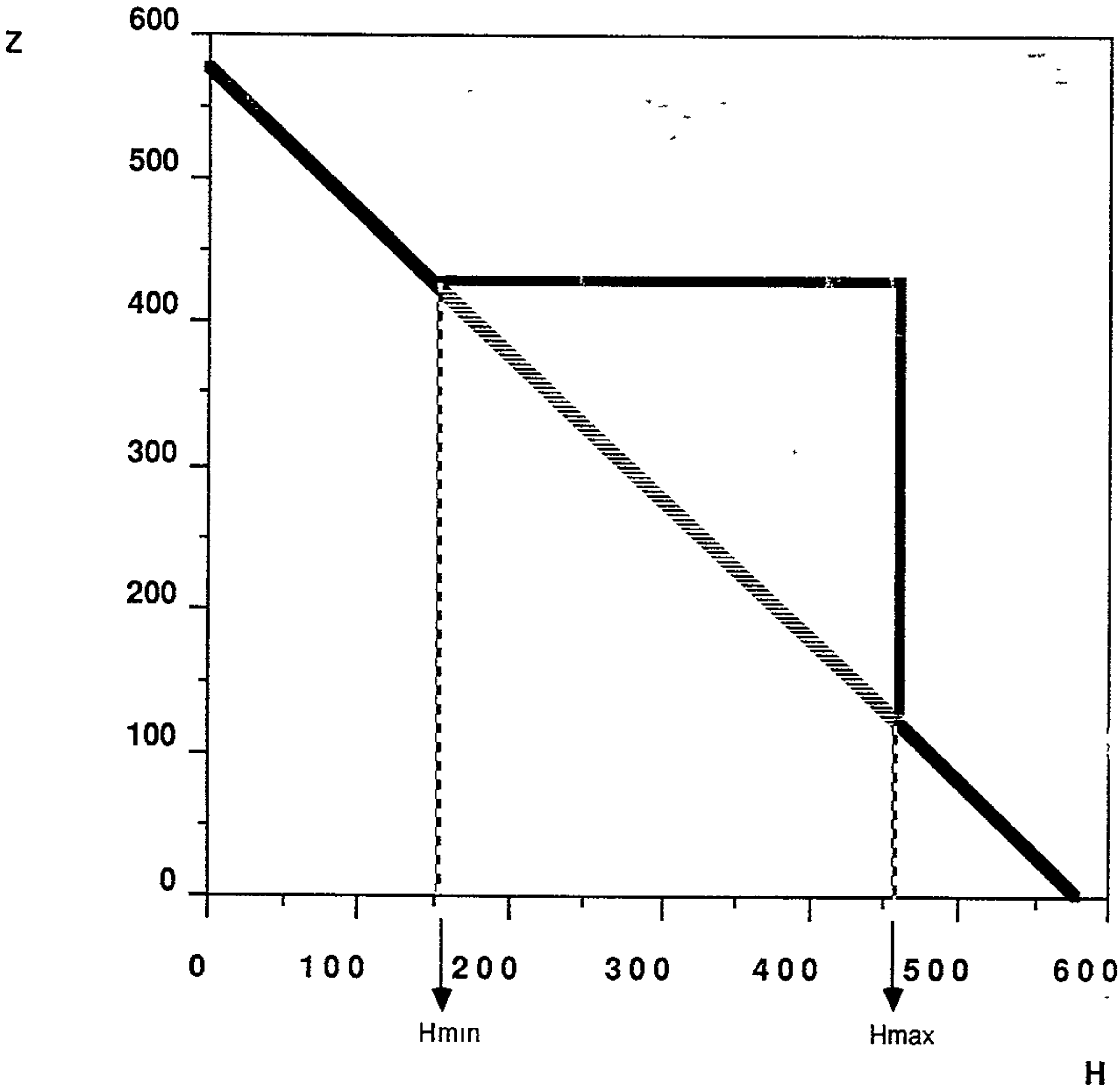
P_H,P_Z = the price per unit of housing and non housing consumption, respectively,

Y_G = household gross income as defined by the program, and

[1]Current legislation prohibits application of the Certificate program welfare rent rule to Housing Voucher recipients.

FIGURE D 2

THE CERTIFICATE PROGRAM BUDGET LINE



$H_{min} = R_{min}/P_H$, $H_{max} = R^c_{max}/P_H$

$R_{min} = \max[0.1Y_G, 0.3Y_N]$, $R_{max} = \min[FMR, R_R]$*

P_H = price of housing

H = housing goods and services

Z = non-housing goods and services

R = gross rent

Y_G = gross income

Y_N = net income

FMR = HUD-determined local Fair Market Rent Schedule (by unit size)

R_R = PHA-determined reasonable rent

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* The PHA is allowed to set R^S_{max} up to 10 percent above the FMR for up to 20 percent of the recipients.

S^v_{max} = the maximum allowed assistance payment under the Housing Voucher program.

This is depicted graphically in Figure D.3. Like the Certificate Program, the Housing Voucher Program creates a corner in the budget line at the point H_c.[1] Unlike the Certificate Program, however, the Housing Voucher Program does not require rts to leave the pr, sacrificing the full subsidy, if they wish to spend more for housing than R_c; thus the budget line above H_c does not return to the pre-program level. However, since the program assistance payment does not increase with rents larger than R_c, the cost of housing above H_c is paid by the tenant, so that the program budget line above H_c is shifted above, but parallel to, the pre-program line.

The maximum assistance payment in the Housing Voucher program is set at the difference between the program payment standard (generally the same as the Certificate Program maximum rent) and 30 percent of net income. Thus

$$(5) \qquad S^v_{max} = R^v_{max} - 0.3Y_N$$

where

S^v_{max} = the maximum assistance payment under the Housing Voucher program

R^v_{max} = the Housing Voucher payment standard,

Y_N = household net income as defined by the program.

The Housing Voucher R^v_{max} may, however, differ from the Certificate Program R^c_{max} for several reasons:

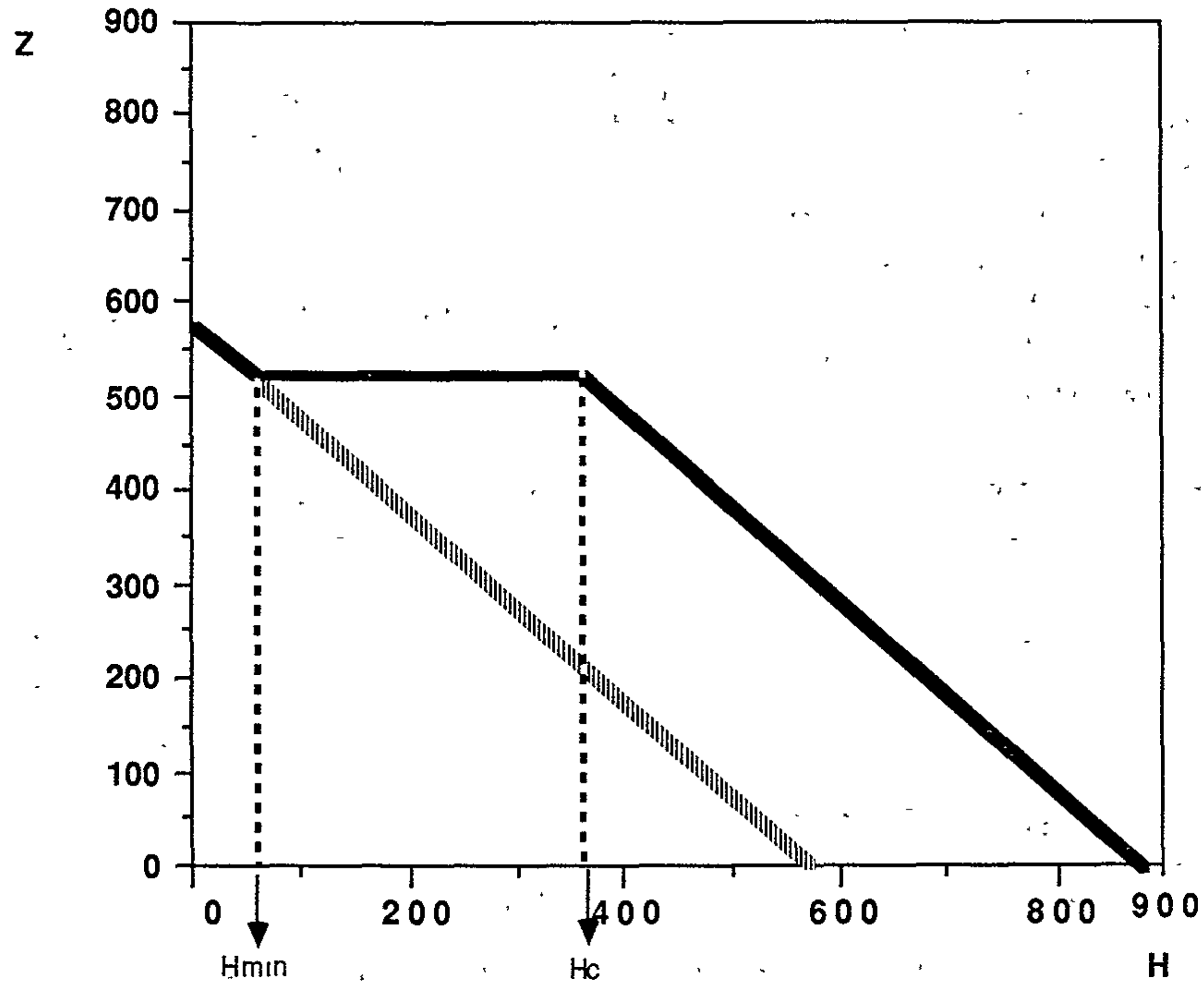
1. The Housing Voucher R^v_{max} may not exceed the HUD FMRs, whereas PHAs may allow up to 20 percent of Certificate recipients to pay rents up to 10 percent above the FMRs.

2. Certificate Program rent reasonableness limits may be

[1] H_c is not, however, usually equal to the H_{max} corner for the Certificate Program (see Figure 3.4, below).

FIGURE D.3

THE HOUSING VOUCHER PROGRAM BUDGET LINE



$H_{min} = R_{min}/P_H$ $\quad$ $H_c = R_c/P_H$

$R_{min} = 0.1Y_G$ $\quad$ $R_c = S^v_{max} + 0.1Y_G$

P_H = price of housing

H = housing goods and services

Z = non-housing goods and services

R = gross rent

Y_G = gross income

S^v_{max} = the maximum Housing Voucher assistance payment applied on a case-by-case basis, whereas the Housing Voucher Program R^v_{max} schedule is fixed for all households.

Most importantly, of course, R^c_{max} is actually the maximum rent allowed by the Certificate program, whereas R^v_{max} is simply the rent at which the Housing Voucher assistance payment stops increasing.

The difference between the two programs' budget lines is shown in Figure D.4 for the case in which the R_{max} for the two programs is the same. If 30 percent of net income is greater than 10 percent of gross income (Case A), the Housing Voucher budget line lies above the Certificate line for all gross rents above 10 percent of gross income. If 10 percent of gross income is greater than 30 percent of net income (Case B), the two budget lines coincide up to R_{max}/P_H, but thereafter the Housing Voucher budget line lies above the Certificate line. Case A is the usual one; indeed, there were only 121 instances of Case B among the first 5,854 applicants to the two programs.

D.2 Expected Differences in Behavior Under the Simple Model

Success Rates. In order to become recipients, enrollees in either program must obtain housing that meets program occupancy and quality requirements within two to four months of enrollment. A substantial proportion of enrollees do not qualify. Roughly speaking we might expect that the success rate among enrollees in becoming recipients would be larger if the value of the program to them were greater. In fact, as long as R_{max} is the same in the two programs, the Housing Voucher Program dominates the Certificate Program in the sense that any consumption pattern that is feasible under the Certificate Program is feasible under the Housing Voucher Program, while the Housing Voucher Program includes points that are not feasible under the Certificate Program. This is the basis for the belief that the Housing Voucher Program should have higher success rates than the Certificate Program.

Under the model posed here, a household might reject the Housing Certificate program under either of two circumstances. If the household has a low enough pre-program rent level (somewhere below 30 percent of net income), then it might be better off without the Certificate program, which would require some increase in household out-of-pocket costs, though generally offering much better housing. Similarly, if a household wants much better housing than can be obtained within the Certificate maximum allowable rent, it might also be better off without the program, which would reduce both its out-of-pocket costs and its housing quality.

More generally, the benefits of the Certificate program from the household's viewpoint are reduced to the extent that the corner point in the Certificate budget line requires housing expenditures different from those that the household would itself choose, given additional income equal to the maximum Certificate assistance payment. This is illustrated in Figure D.5. The dashed line shows the budget constraint that the household would face if it were simply given additional income equal to the Certificate assistance payment. If the household were allowed complete freedom of choice, the value of the assistance payment to the household would simply be its amount -- S^c_{max}. Under the Certificate Program, to the extent that the household would desire to spend a different amount on housing than R_{max} (i.e., to the extent that $R_N(Y+S_{max})\neq R_{max}$), then the value of the program to the household is reduced below S^c_{max}. This suggests that the reduction in value might be empirically specified as a function of the absolute difference between the program-constrained rent and the rent that the household would itself choose given additional income equal to the maximum Certificate assistance payment ($|R(Y+S_{max})-R^c_{max}|$).[1]

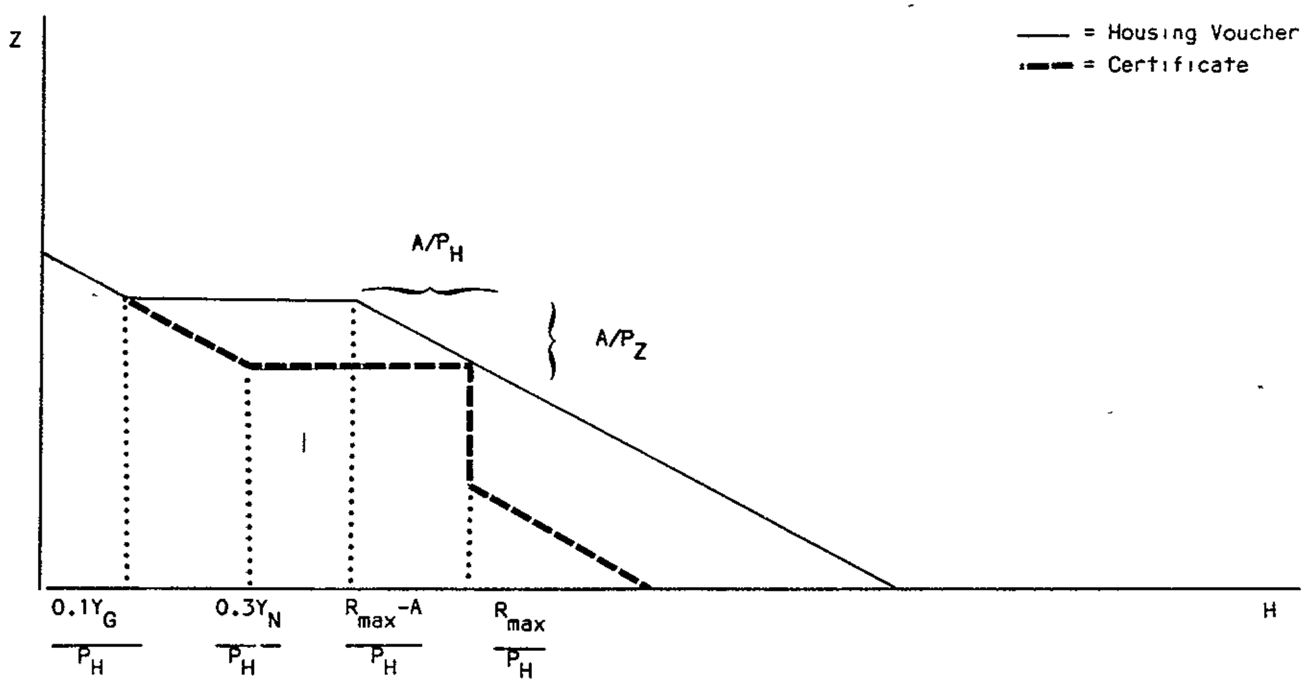
As shown earlier in Figure D.4, the Housing Voucher program allows households to choose to spend above R^v_{max} and also extends the program budget line for spending below R^v_{max} to the extent that $(0.3Y_N-0.1Y_G)$ is positive. Where the Housing Certificate offers a single point (at R^c_{max}) on the $(Y+S_{max})$ budget line, the Housing Voucher program offers a section of the $(Y+S_{max})$ budget line. Thus, a Housing Voucher program, by allowing recipients a greater range of choice, should, in principle, appeal to more eligible house-

[1]This is, of course, fairly arbitrary. The content for the household of the difference in desired and prescribed rent might be better captured in terms of real housing, which would require adjustment for the local price of housing. In the sites in which housing evaluations will be conducted, regressions of rents on housing characteristics (hedonic regressions) may be used to develop a price index across sites, if the program does not distort shopping behavior. Further, the theoretical impact on value is clearly non-linear, depends on the curvature of the indifference curves, and needs not be symmetrical (nor constant across different incomes).

FIGURE D.4

COMPARISON OF HOUSING VOUCHER AND CERTIFICATE PROGRAM BUDGET LINES
WHEN R_{max} IS THE SAME IN BOTH PROGRAMS

Case A: $0.3\ Y_N - 0.1\ Y_G = A > 0$



Case B $0.3\ Y_N - 0.1\ Y_G = A < 0$

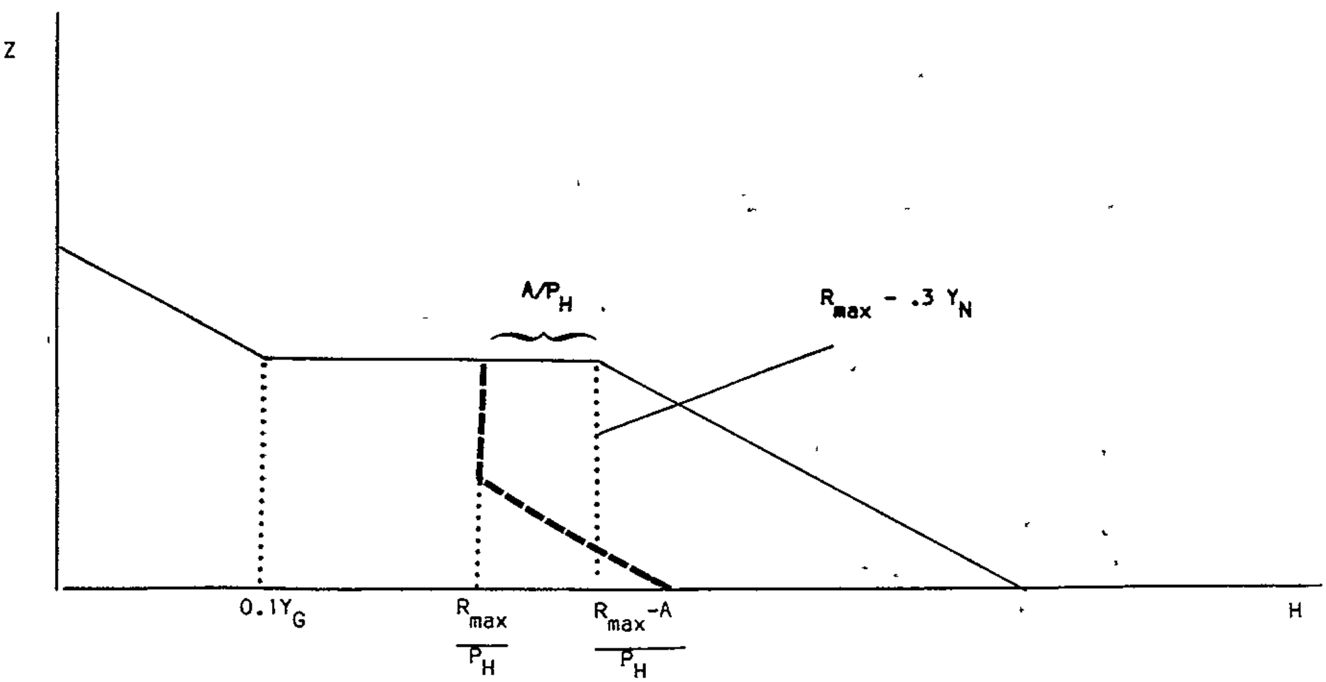
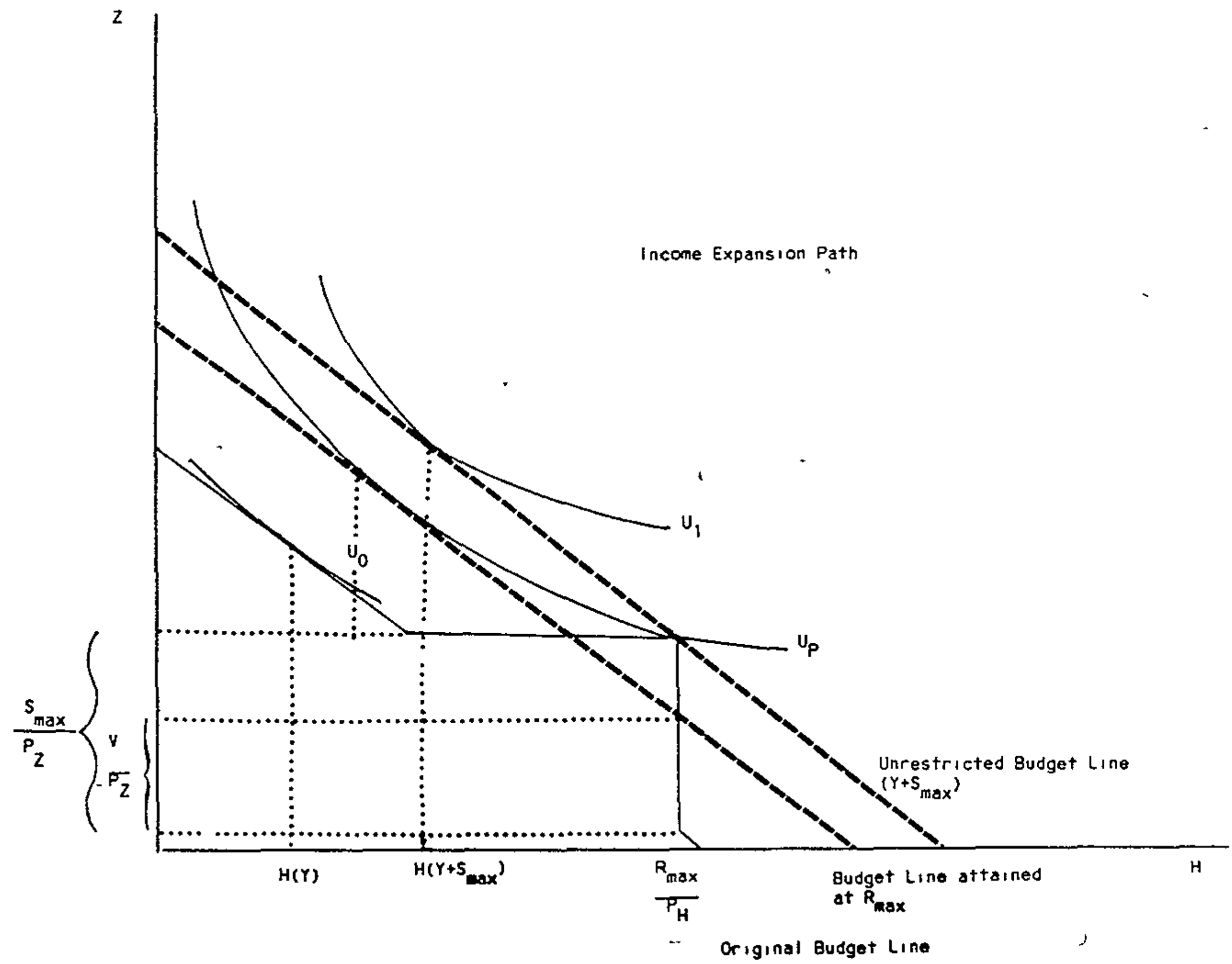


Figure D.5

HOUSEHOLD VALUATION OF THE CERTIFICATE PROGRAM PAYMENT



H(Y) = desired housing consumption at current income

$H(Y+S_{max})$ = desired housing consumption given an increased income of S^c_{max}

S_{max} = the maximum Certificate assistance payment

R_{max} = the ceiling on allowable rent

P_H = the price of housing

P_Z = the price of other goods

V = the income equivalent value of the assistance payment to the household holds and offer greater incentives to participate. In equations, this may be written

$$(6) \qquad \Delta U_P = S_P - L(H_P - H\ (Y+S))$$

where

ΔU_P	=	the value of the program to a recipient
S_P	=	the assistance payment paid by the program
L	=	a loss function due to program requirements or payment structures that force the recipient away from desired consumption patterns
H_P	=	the program level of housing
H(Y+S)	=	desired housing given at income Y+S
Y	=	household income

In terms of the two programs' restrictions we can write ΔU_P from Eq. (6) as

$$(7) \qquad \Delta U_C = S_c - L\ (R^c_{max} - R^*(Y+S)\ /\ P_H)$$

$$(8) \qquad \Delta U_V = S_v - \min L\ (R - R^*(Y+S)\ /\ P_H)\ \text{s.t.}\ (R \geq R^v_{max} - (0.3Y_N - 0.1Y_G)$$

Since the minimum value of L in Eq. (8) cannot be greater than the value of L in Eq. (7), the value of the Housing Voucher program to recipients cannot be less than the value of the Certificate program, i.e.:

$$(9) \qquad \Delta U_V \geq \Delta U_C$$

Recipient Rents. The statement that the Housing Voucher program offers a greater range of choice also implies that we may observe differences in the distribution of recipient rents. In particular, Housing Voucher rents would be expected to be less clustered at the corner in the program budget line. In terms of Figure D.4, all households in the Certificate program would be expected to have expenditures on housing close to the corner of the Certificate program budget line (at R^c_{max}); in the Housing Voucher program, only households whose desired spending on housing is less than the (generally lower) Housing Voucher budget line corner will cluster around the corner.[1]

However, because the corner in the Housing Voucher budget line is frequently below the corner in the Certificate program line, the overall expected effect on average rents is unclear. To see this, the equation for the theoretical range of responses are easily derived.

The household's desired program level of housing and tenant contribution in the Certificate Program are clearly given by renting at the maximum rent. On the one hand, from Figure D.2, the household cannot pay more than this and stay in the program; on the other, the household saves nothing by spending less. Thus, the theoretical housing situation for Certificate recipients should be

$$R_P^c = R_{max}^c$$

$$\text{(10)} \qquad B_P^c = \max[0.1Y_G, 0.3Y_N]$$

$$S^c = S_{max}^c = R_{max}^c - \max(0.1Y_G, 0.3Y_N)$$

where

R_P^c = the expected gross rent for the recipient unit under the Certificate program,

$B_P^c = R_P^c - S^c$ = the recipients out of pocket cost for rent under the Certificate program,

S^c = the assistance payment paid under the Certificate Program,

Y_G = recipient gross income.

Y_N = recipient net income.

Similarly, under the Housing Voucher Program, from Figure D.3, the household saves nothing by spending less than ($S_{max}^v + 0.1Y_G$) for housing. It can, however, elect to spend more than this. Accordingly, the values of

[1]In fact, among the Housing Voucher recipients in the Housing Evaluation Sample, only 13 of 911 recipients (less than 1.5 percent) actually had rents below the Housing Voucher corner.

program housing and recipient and program contribution for the Housing Voucher Program are given by

$$R_P^v = \max[S_{max}^v + 0.1Y_G, R_N(Y+S_{max})]$$

$$B_P^v = R_P^v - S_{max}^v \tag{11}$$

$$S^v = S_{max}^v = R_{max}^v - 0.3Y_N$$

where

R_P^v	=	the expected gross rent for the recipient unit under the Housing Voucher Program,
$B_P^v = R_P^v - S^v$	=	the recipient's out of pocket cost for rent under the Housing Voucher Program,
S^v	=	the assistance payment paid under the Housing Voucher program,
$R_N(Y+S_{max})$	=	normal recipient rental expenditures with income $Y+S_{max}$

If we define

$$A = (0.3Y_N - 0.1Y_G),$$

and assume that

$$R_{max}^c = R_{max}^v = R_{max},$$

then we can compare outcomes under the two programs by substituting Eqs. (10) into Eqs. (11). If, as is almost always the case, A is positive, we have

$$S^v = S^c \tag{12}$$

$$R_P^v \doteq R_P^c + \max[-A, R_N(Y+S^v) - R_{max}] \tag{13}$$

$$B_P^v \doteq B_P^c + \max[0, R_N(Y+S^v) + A - R_{max}] \tag{14}$$

In words, again, for $A > 0$, the standard model conclusions are

1. The expected assistance payment under the two programs is the same, but the value to the recipient of the Housing Voucher program may be greater, so that success rates in the Housing Voucher program may be higher.

2. The expected rent levels under the Housing Voucher program are lower unless the household would normally spend more than R_{max} (given the additional income from the assistance payment).

3. The expected out of pocket contribution under the Housing Voucher program is lower (higher) as expected rental expenditures are lower (higher) than in the Certificate program.

The next sections develop extensions of the standard model and indicate how these extensions may change the results of Eqs. (12) to (14).

D.3 Extending the Model to Take Account of Program Requirements

The discussion of the previous section focused solely on recipients' desired spending levels under the two programs, as if becoming a recipient was simply a matter of choosing to enter the program and selecting the appropriate rent level given the program rules. In fact, of course, households in both the Housing Voucher and Certificate programs must find units that meet the program quality and occupancy standards. This section focuses on individual decision making in searching for housing that meets program requirements.

Finding units that meet such program standards is not always easy. If the household simply searches in the private rental market, it may have few clues with which to work. Unit size requirements in terms of number of rooms are more or less set by the occupancy standards. Otherwise, unit rents tend to be positively, but imperfectly associated with meeting requirements and customary descriptions of units provide little information. Indeed, recognizing this, some landlords directly advertise units as suitable for Section 8 Existing Housing, and some PHAs post lists of landlords whose units tend to meet requirements and who are willing to participate in the program.

Imagine that households set rental targets in searching among units -- that, for example, they use rents to screen advertisements and decide which units to inspect or that they offer rent levels as a guide to realtors. If the probability of finding a unit that meets program requirements is positively associated with unit rents, then the household might select a search rent that would maximize the expected payoff. If this process is expressed as selecting the search rent level that maximizes expected utility, then the problem may be described as

$$(15a)\qquad \underset{\{R\}}{\text{Maximize}}\ E(U) = \pi(R)\, U_P(R) + (1-\pi(R))\, U_N$$

$$= U_N + \pi(R)\ (\Delta U(R))\ .$$

$$(15b)\qquad U_P(R) = U[R/P_H, (Y-R+S)/P_Z]$$

where

U_P = the level of utility obtained under the program with rent R;

U_N = the utility level obtained by the household without the program,

$\Delta U(R)$ = $U_P - U_N$

$\pi(R)$ = the probability of finding a unit that meets requirements, if the household searches at rent R,

R = the rent specified in search,

S = the assistance payment given R.

P_H, P_Z = the price of housing and non-housing goods, respectively.

This yields first order conditions:

$$(16)\qquad \frac{d\pi}{dR}\ \frac{1}{\pi} = -\frac{d\Delta U}{dR}\ \frac{1}{\Delta U}$$

$$= -\frac{\partial U_P/\partial H}{P_Z\ \Delta U}\left[\frac{P_Z}{P_H} - \frac{\partial U_P/\partial H}{\partial U_P/\partial Z}\right]$$

$$(17)\qquad = \left[\left.\frac{\partial Z}{\partial H}\right|_{U_P} - \left.\frac{\partial Z}{\partial H}\right|_{Y}\right]\cdot\left[\frac{\partial U_P/\partial H}{P_Z\ \Delta U}\right]$$

where, as usual,

$\left.\frac{\partial Z}{\partial H}\right|_{U_P}$ = the slope of the indifference curve at level U_P

$$\left.\frac{\partial Z}{\partial H}\right|_Y = \text{the slope of the budget line } (-P_Z/P_H)$$

The content of Eq. (17) can be developed graphically. The curve $(d\pi/dR)(1/\pi)$ is the ratio of a density function to its parent distribution function.[1] Thus for most standard distributions we have

(18) $\lim_{R \to \infty} (d\pi/dR)(1/\pi) = 0$ (or at least becomes small)

Otherwise, it is difficult to characterize $(-d\pi/dR)(1/\pi)$ in general, but two examples -- the logistic and normal distribution are shown in Figure D.6.

We can characterize $(-d\Delta U/dR)(1/\Delta U)$ by looking at the expression in the left-hand brackets of Eq. (17) and recalling that this is zero when the household is on its normal consumption path for income $(Y+S_{max})$. Further, as R moves sufficiently far away from this level, ΔU goes to zero. Accordingly, we can sketch the $(d\pi/dR)(1/\pi)$ and $(-d\Delta U/dR)(1/\Delta U)$ curves as shown in Figure D.7. R* always lies above $R_N(Y+S_{max})$, reflecting the fact that increases in R affect both U_P and the probability of obtaining U_P. Further, in general, as S increases, the distances $(R_N(Y+S)-\underline{R})$ and $(\bar{R} - R_N(Y+S))$ increase as indicated in Figure D.8.[2] Thus we expect that higher assistance payments increase R*. Similarly, a shift up the π - schedule will shift the $(d\pi/dR)(1/\pi)$ schedule to the left and reduce R*.

One interesting observation from this sort of model is that the Housing Voucher program could in theory reduce success rates. Under the Certificate program, all households are in theory induced to spend close to R^C_{max}. As indicated in the previous section, the Housing Voucher program is more likely to induce choices of search R below R^v_{max} (to the extent that $A=(0.3Y_N-0.1Y_G)$ is positive). Accordingly, Housing Voucher applicants may choose a lower value of R* and hence lower $\pi(R^*)$. If the search R's are more

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[1]If we think in terms of the probability of <u>not</u> finding a standard unit $(1-\pi)$ then $(d\pi/dR)(1/\pi)$ is the negative of the hazard rate.

[2]That this is true may be seen from Figure D.8. Since the indifference curve is downward sloping, $\bar{R}2/P_H-\bar{R}1/P_H$ is always greater than the horizontal distance between the two budget lines (S_2-S_1/P_H). On the other hand, non-housing consumption increases with income, $(R_N(Y+S_2)-R_N(Y+S_1))/P_H$ must be less than the horizontal distance. Hence $R_N(Y+S)-\bar{R}$ increases with increased income (if non-housing consumption is a normal good). Similarly, $\underline{R} - R_N(Y+S)$ will increase if housing has a positive income elasticity.

FIGURE D.6

EXAMPLES OF $(d\pi/dR)(1/\pi)$

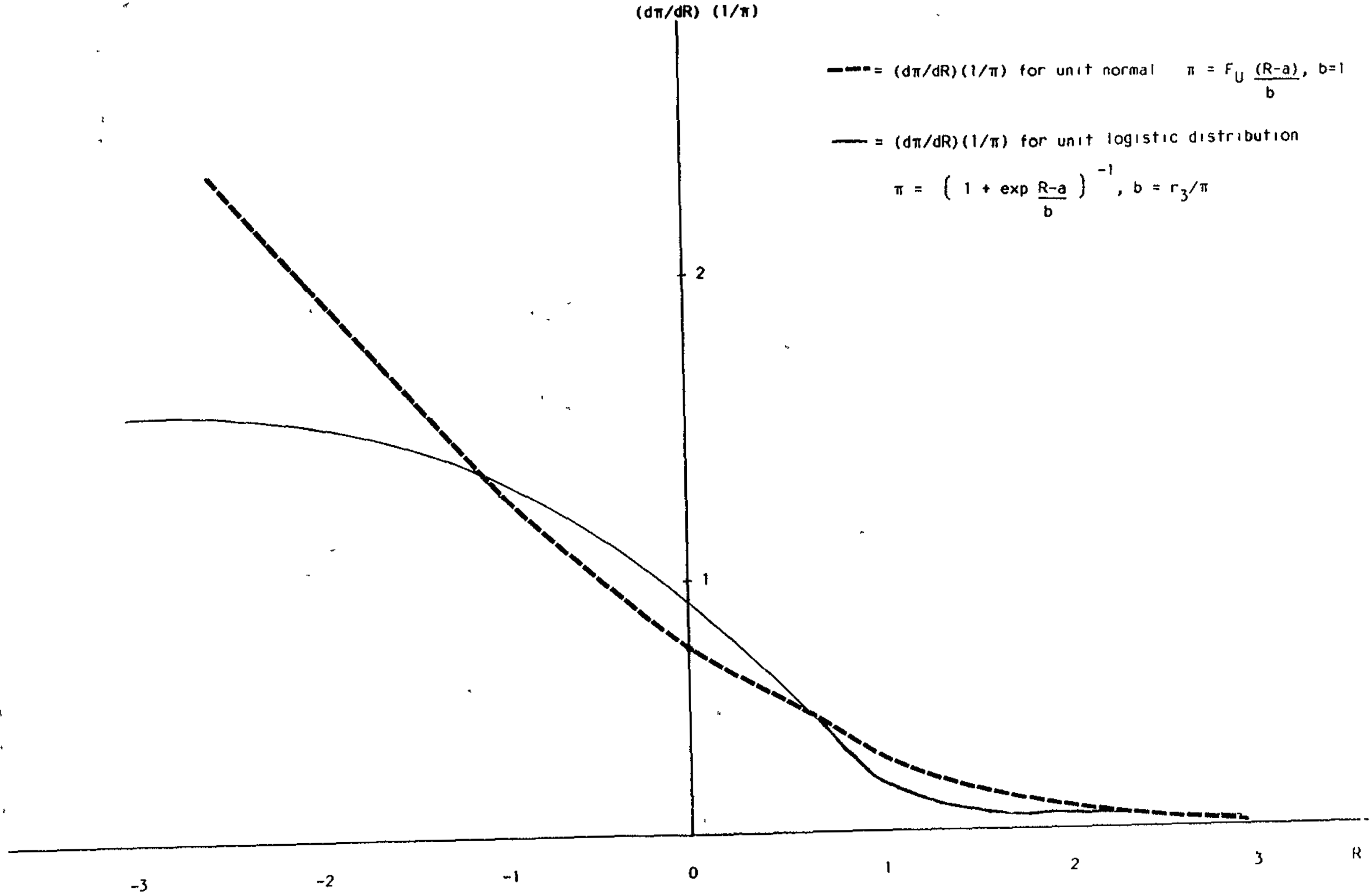


FIGURE D.7

π'/π AND $\Delta U'/U$

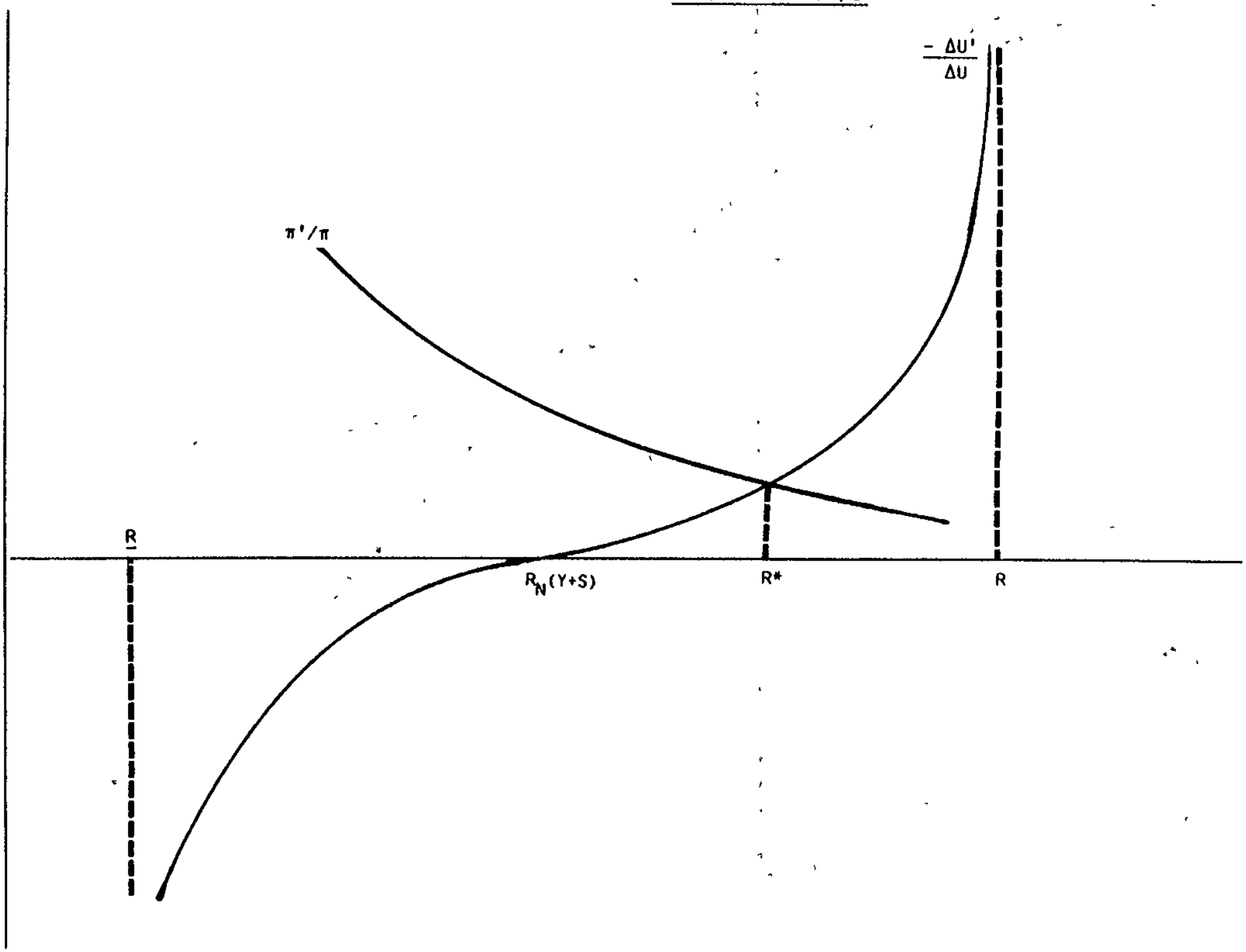
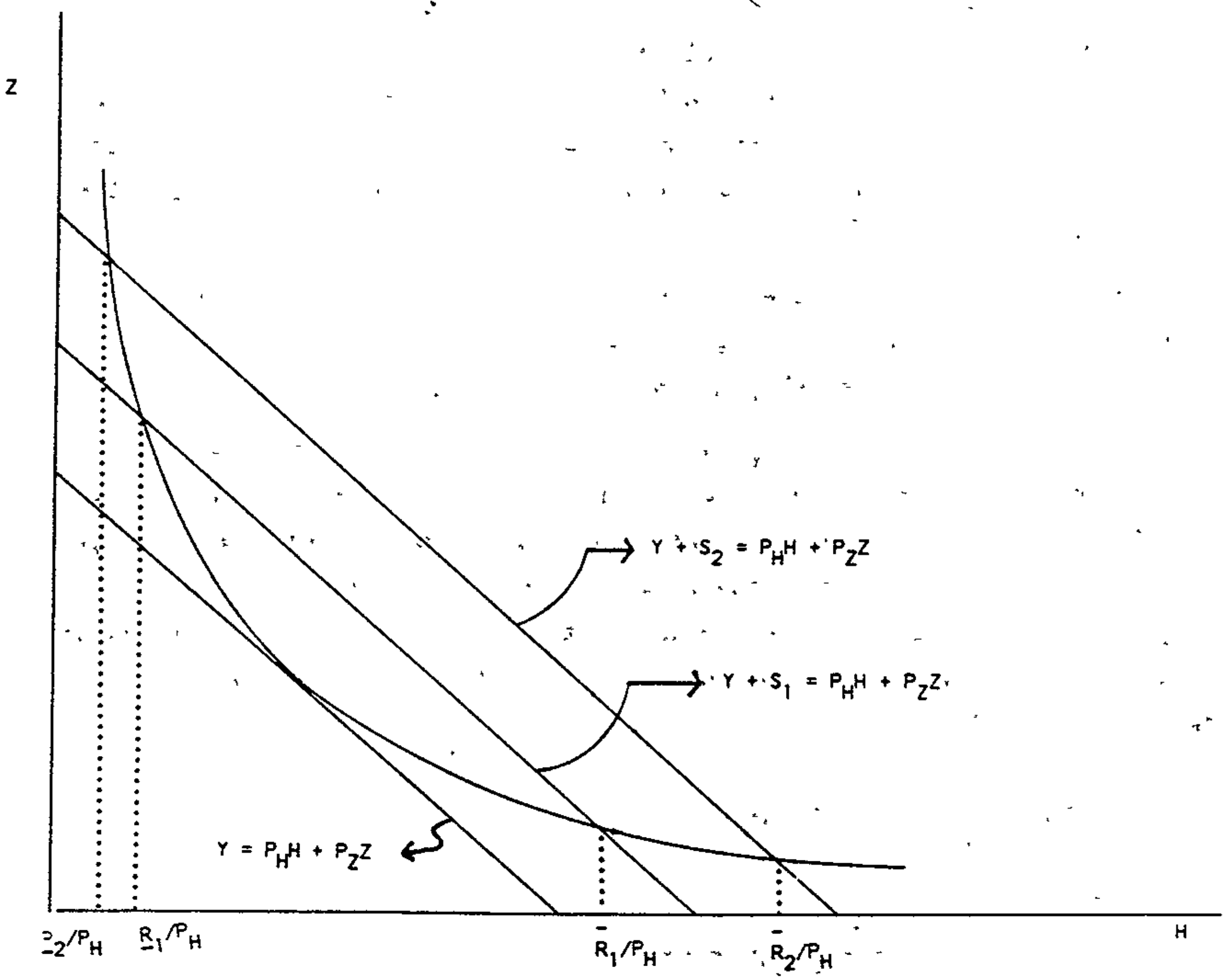


FIGURE D.8

($\underline{R}$, $\bar{R}$) AND ASSISTANCE PAYMENT



U_0 = pre-program utility level

Y = income

S_1, S_2 = assistance payment amounts

$\underline{R}_i$ = smallest rent at which program with assistance payment s_i is acceptable

$\bar{R}_i$ = largest rent at which program with assistance payment s_i is acceptable dispersed in the Housing Voucher program, we would expect a corresponding spread in success rates, with higher success rates among households that normally wish to spend more on housing.

D.4 Extending the Model to Take Account of Stochastic Prices

We can extend the model further to take account of the fact that housing prices are not fixed. In this context, the price is housing is not the rent but the ratio of rent to the "quantity" of housing (H) contained in the unit. Saying that prices vary simply means that different units with the same rent may carry different levels of housing (or, conversely, that similar units may have different rents).

We first consider a direct extension of the models of the previous section involving selection of target rents. We then consider alternative models of search and ask how they may be distinguished.

Imagine that, as in the previous section, individuals determine the rent they will consider and then search across units at this rent until they find one that offers an adequate level of housing services. In effect, people determine a maximum price that they will pay and then reject units that exceed this price. We now need to redefine the terms of Equation (15a,b) in terms of expectations. Let us further assume initially that each person only goes to look at one unit. Thus,

(19) $$\pi(R,\alpha) = \int_0^{\alpha} \rho(R/P_H) f(P_H) dP_H$$

(20) $$U_P(R,\alpha) = \frac{\int_0^{\alpha} U[R/P_H, \frac{Y-R+S}{P_z}] \rho(R/P_H) f(P_H) dP_H}{\pi(R,\alpha)}$$

where

$\pi(R,\alpha)$ = The probability of successfully finding a unit that meets program requirements as a function of search rent (R) and maximum acceptable price (α).

α = The maximum acceptable price

R = The search rent

$\rho(R/P_H)$ = The probability that a unit with real housing (R/P_H) meets program requirements

$f(P_H)$ = The density function for housing prices

$U_P(R,\alpha)$ = The expected level of utility if the household succeeds in participating

Other terms = As in Equation (15)

Given this redefinition of π and U_P, the choice problem is still written as in Equation (15). Further, it is obvious that the introduction of stochastic prices does not change the fundamental conclusion of the previous model with respect to the optimal search rent (R^*). Certificate program enrollees will search at the maximum rents allowed by the program; Housing Voucher enrollees may select higher or lower search rents depending on their normal income expansion path and the strength of the relationship between rent and success rates.

The interesting aspect of the new model is the condition determining the optimal maximum acceptable rent. This is given by the condition:

$$(21) \qquad U\left(\frac{R}{\alpha^*}, \frac{Y-R+S}{P_z}\right) = U_0$$

That is, the α^* is determined to be the value that just makes the recipient indifferent between participating and not participating.

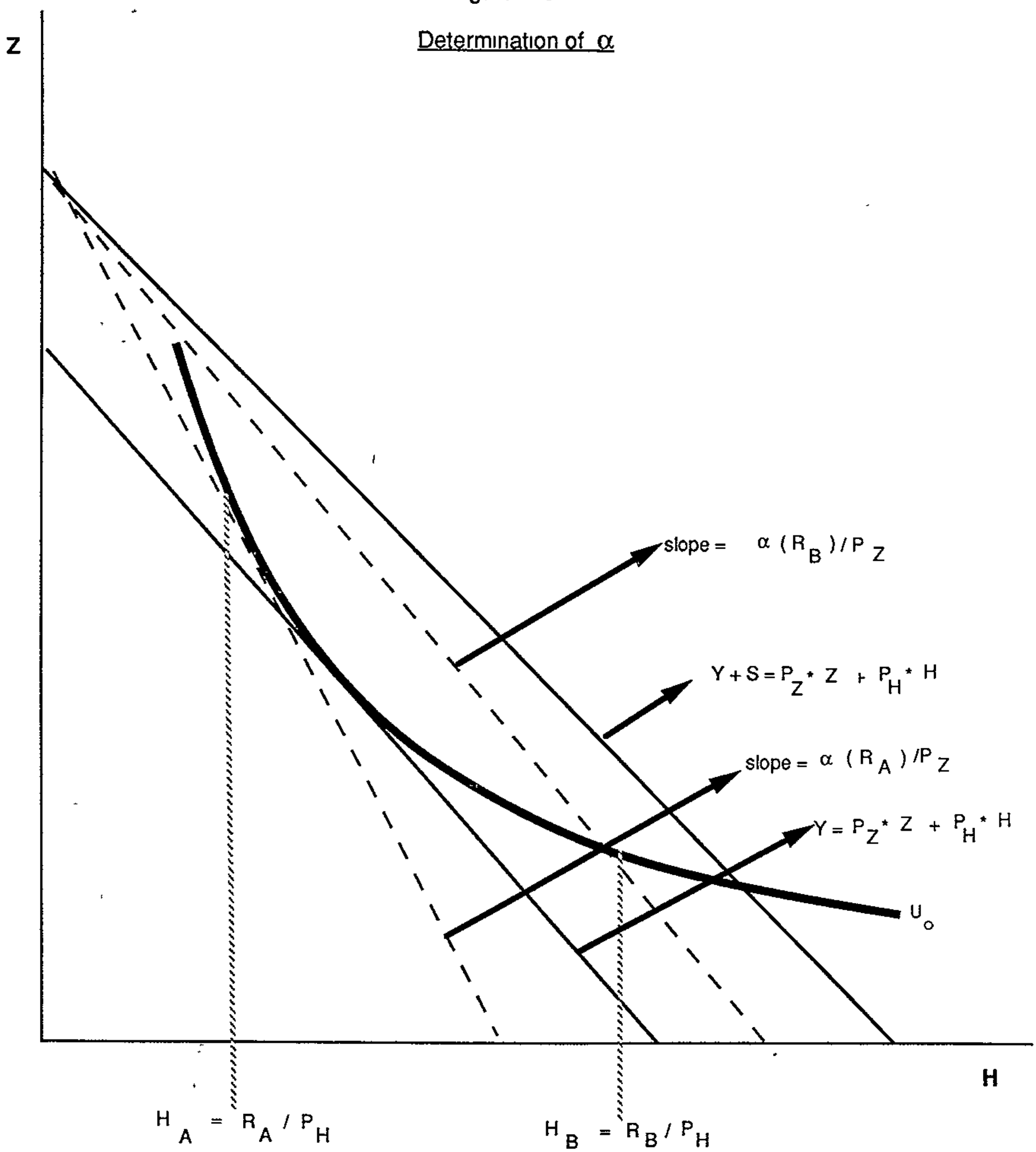
The realism of the model of Equations (19) and (20) may be increased by allowing individuals to choose an intensity of search as well. This should have no material effect on results, except of course through the Le Chatelier principle that introducing an added degree of freedom tends to reduce the absolute magnitude of the effects of exogeneous shocks.[1] (Intuitively, households may use search effort to arrive at lower α^* values, which will in turn weaken the connection between α^* and other variables.)

The determination of α^* is illustrated in Figure D.9. A recipient has a pre-program budget line ($Y = P_Z Z + P_H H$) and a program budget line ($Y + S = P_Z Z + P_H H$). If we fix program rental expenditures at R_B, then a recipient can consume Z_B ($= (Y + S - R_A)/P_Z$). The value of α^* is the price of housing that creates a budget line that intersects the original indifference curve at Z_B. Examination of the figure shows that this price increases as R increases from zero to R_A in Figure D.9 and then decreases as R increases above R_A, where R_A is the price of housing that would leave the recipient indifferent

[1]See Samuelson, 1947.

Figure D 9

Determination of α



H = Housing

Z = Other Goods

S = Subsidy

Y = Income

U_o = Pre-Program Indifference Curve

P_H = Price of Housing

P_Z = Price of Other Goods

α = maximum acceptable effective price of housing given the level of rental expenditures between his original budget constraint and a budget constraint with income (Y + S).

If an individual would spend R_C under the Certificate program, then he will require a higher or lower maximum price under the Housing Voucher program depending on whether his rental expenditures under the Housing Voucher program, R_V, are higher or lower than under the Certificate program and also on whether R_C is above or below R_A in Figure D.9. However, we know that R_A is always below pre-program (equilibrium) consumption. Thus R_C can only be below R_A in cases where the Certificate program reduces recipient rents below pre-program levels. This is very rare. Accordingly, we expect Housing Voucher maximum acceptable prices to be lower or higher to the extent that the Housing Voucher program increases or decreases recipient target rents. As noted earlier, the Housing Voucher program could in principle lead to either increases or decreases in individual target rents, but in fact on average increases recipient rents.

This is not the end of the story, however. The expected price depends also on the distribution of rents among units that meet program quality and occupancy requirements. Thus, the expected price actually paid is given by:

$$(22) \qquad E\ (P_H|R) = \frac{\int_0^{\alpha} P_H\ \rho\ (R/P_H)\ f\ (P_H)\ dP_H}{\pi}$$

Accordingly,

$$(23) \qquad \frac{dE\ (P_H|R)}{dR} = \frac{\rho\ (R|\alpha^*)\ f\ (\alpha^*)}{\pi} \left[\alpha^* - E\ (P_H|R)\right] \frac{\partial\alpha^*}{\partial R} + \frac{\partial E\ (P_H|R)}{\partial R}$$

The first term of Eq. 23 is negative, since $\frac{\partial\alpha^*}{\partial R}$ is negative. The second term is given by:

(24) $$\frac{\partial E\ (P_H/R)}{\partial R} = \frac{1}{\pi} \int_{\sigma}^{\alpha} \left(1 - \frac{E\ (P_H/R)}{P_H}\right) \rho'(\frac{R}{P_H})\ f(P_H)\ dP_H$$

$$= \frac{1}{\pi} \int_{\sigma}^{\alpha} (P_H - E\ [P_H/R])\ \frac{\rho'(R/P_H)}{P_H \rho(R/P_H)}\ \rho(R/P_H)\ f(P_H)\ dP_H$$

This last expression (in Eq. 24) will be positive if $(\rho'/P_H\rho)$, which equals $(\frac{\partial \rho}{\partial R}/\rho)$, is positively correlated with P_H. This is in fact what we usually expect. If we think of ρ (the probability of meeting requirements) as a function of the real housing index H, then we require that:

(25) $$\frac{\rho'\ (\lambda H)}{\rho\ (\lambda H)} < \frac{\rho'\ (H)}{\rho\ (H)} \text{ for } \lambda > 1$$

If, for example, ρ is logistic in H, then:

(26) $$\frac{\rho'\ (H)}{\rho\ (H)} = 1 - \rho\ (H)\ .$$

which satisfies Eq. 26. Equation 25 will also be met by a probit in H. Alternatively, if ρ is one or zero depending on whether H is above or below some threshold level, derivatives are not defined, but the term in Eq. 24 will be positive.

The remaining question is, of course, which of the two terms dominates. A particularly interesting version of this question is whether it is possible for the expected success rate, π, to increase while the expected price paid decreases. The answer to this is not clear. Further, even if we could sort out the relationship between target rent and prices, we only arrive at a statement of program differences by weighting the price-rent schedule by the difference between the two programs in the distribution of target rents. This seems unlikely to be very conclusive.

The critical feature of the model of Section D.4.1 is that the shopping incentives in the two programs are the same for any target rent. The program differences only arise from differences in the selection of target rents. If we imagine that the Housing Voucher program generates a joint distribution of rent and quality among its recipients, then under this model, the conditional distribution of quality given rent is the same in the two programs, while the distribution of rent given quality differs due to differences in the rents selected.

For concreteness, say that the search process in the Housing Voucher program generates a joint normal distribution of housing quality and rent:

$$(27) \qquad R_V = PH_V + \varepsilon_V$$

where

R_V = recipient rents in the Housing Voucher program

H_V = recipient housing in the Housing Voucher program $\sim N(\mu_H, \sigma_H)$

P = the price of housing paid in the Housing Voucher program

ε_V = a stochastic term $\sim N(0, \sigma_\varepsilon)$

Under joint normality, this induces a regression of housing quality on rent, given by:

$$(28) \qquad PH_V = \alpha + \beta R + \theta$$

$$\alpha = (1 - \beta)\,\mu_R\,,\ \beta = \frac{P^2\sigma_H^2}{P^2\sigma_H^2 + \sigma_\varepsilon^2},\ \mu_R = P\mu_H$$

$$\theta \sim N(0, \sigma_\theta^2),\ \sigma_\theta^2 = P^2\sigma_H^2(1 - \beta) = \beta(1 - \beta)\left[P^2\sigma_H^2 + \sigma_\varepsilon^2\right]$$

Now, imagine that, as we have suggested, the Certificate program does not alter the shopping incentives conditional on target rent, but selects a different set of target rents, inducing a new distribution of R. Then Eq. 28 will also apply to the Certificate program. However, this will induce a new regression of rent on housing quality in the Certificate program.

Example 1. Normally Distributed Certificate Program Rents. Assume that the Certificate program Certificate rents are still distributed normally with mean $\bar{R}_C$ and variance V_C. Since Eq. 28 still holds, we know that:

$$
\text{(29)} \qquad P\bar{H}_C = \alpha + \beta\bar{R}_C
$$

$$
= (1 - \beta)\ \mu_R + \beta\bar{R}_C
$$

Since $P\bar{H}_C$ is the Housing Voucher cost of $\bar{H}_C$, and $\bar{R}_C$ is the Certificate program cost, we have:

$$
\text{(30)} \qquad (\bar{R}_C - P\bar{H}_C) = (1 - \beta)\ (\bar{R}_C - \mu_R).
$$

That is, the average Certificate cost will be above or below the average Housing Voucher cost for the same bundle as the average rents selected in the Certificate Program are above or below the average Housing Voucher rents. In addition, the new distribution of Certificate program rents induces the regression:

$$
\text{(31)} \qquad R_C = \bar{R}_C + \frac{\beta V_C}{\beta^2 V_C + \sigma_\theta^2}\ (PH_C - PH_C) + \omega
$$

Substituting for $P\bar{H}_C$ and for α, β, σ_θ^2, and defining the variance of rents in the Housing Voucher program by:

$$
V_V = P^2\sigma_H^2 + \sigma_\varepsilon^2 ,
$$

so that

$$\sigma_\theta^2 = \beta\ (1 - \beta)\ V_V\ ,$$

Eq. 31 can be reduced to:

$$(32) \qquad R_C = \left(\frac{(1 - \beta)\ V_V V_C}{\beta V_C + (1 - \beta)\ V_V} \right) \left(\frac{\overline{R}_C}{V_C} - \frac{\mu_R}{V_V} \right) + \frac{V_C}{\beta V_V + (1 - \beta)\ V_V} PH_C + \omega$$

The Certificate program regression of rent on housing quality will have a flatter slope than the Housing Voucher regression if the selected Certificate program rents have a lower variance; the regression line will be shifted up or down depending on whether the standardized mean rent is increased or decreased.

The content of this may be clearer if we consider another example.

<u>Example 2</u>. <u>Upper and Lower Trunction of the Rent Distribution</u>. Assume that the mechanism by which Certificate enrollees select target rents truncates the distribution of rents so that:

$$(33) \qquad a < R_C < b$$

In this case,

$$(34) \qquad R_C = PH_C + E\ (\varepsilon/\text{trunction})$$

$$(35) \qquad R_C = PH_C - \sigma_\varepsilon^2 \left[\frac{f(b - PH) - f(a - PH)}{F(b - PH) - F(a - PH)} \right]$$

where

F = the distribution function for ε .

Since ε has a zero mean in the population, it is easy to see that:

$$(36) \qquad R_C \gtreqless PH_C \text{ as } b \gtreqless 2PH_C - a$$

If there is any upper trunction (b finite), then for large enough PH_C, the Certificate regression line will be below the Housing Voucher regression line. If there is any lower trunction (a finite), then for small enough PH_C, the Certificate program regression line will lie above the Housing Voucher regression line.

We can generalize these insights with a final example.

Example 3. General Selection of Certificate Program Rents. Say that Certificate program enrollees select from among the target rents considered by Housing Voucher enrollees with:

g (R) = the probability of selection for rent R, assumed to be independent of H.

Then

$$(37) \qquad E\ (R_C - PH_C) = E\ (\varepsilon | \text{selection})$$

$$(38) \qquad E\ (R_C - PH_C) = \frac{\int \varepsilon g\ (PH + \varepsilon)\ f(\varepsilon)\ d\varepsilon}{\int g\ (PH + \varepsilon)\ f(\varepsilon)\ d\varepsilon}$$

Consider first the slope of the regression. We can rewrite the integration in Eq. 38 in terms of R:

$$(39) \qquad E\ (R_C - PH_C) = \frac{\int (R - PH)\ g\ (R)\ f\ (R - PH)\ dR}{\int g\ (R)\ f\ (R - PH)}$$

$$(40) \qquad \frac{\partial\,(R_C - PH_C)}{\partial H_C} = -\,P - P\left[\frac{\int (R - PH)\,g\,(R)\,f'\,(Q - PH)}{\int gf} - E\,(R_C - PH_C)\,\frac{\int gf'}{\int gf}\right]$$

Recall that if f is a normal density function:

$$(41) \qquad f'\,(R - PH) = -\,\frac{R - PH}{\sigma_\varepsilon^2}\,f\,(R - PH)$$

thus Eq. 40 can be rewritten:

$$(42) \qquad \frac{\partial\,(R_C - PH_C)}{\partial H_C} = -\,P\left[1 - \frac{\int (R - PH)^2\,g\,(R)\,f\,(Q - PH)}{\sigma^2 \int gf} + \frac{(E\,[R - PH])^2}{\sigma^2}\right]$$

$$(43) \qquad \frac{\partial\,(R_C - PH_C)}{\partial H_C} = -\,P\left[1 - \frac{\mathrm{Var}\,(R - PH|\mathrm{selection})}{\sigma_\varepsilon^2}\right]$$

Accordingly, since

$$(44) \qquad \frac{\partial R_C}{\partial H_C} = P + \frac{\partial\,(R_C - PH_C)}{\partial H_C}$$

then substituting from Eq. 43 yields

$$(45) \qquad \frac{\partial R_C}{\partial H_C} = P\left[\frac{\mathrm{Var}\,(R - PH|\mathrm{selection})}{\mathrm{Var}\,(R - PH|\mathrm{without\ selection})}\right]$$

The slope of the Certificate program regression of rent on housing quality is greater or less than the slope of the Housing Voucher regression as the rent selection process increases or decreases the variance of rents at any given H.

Now consider the level of the Certificate regression line. Returning to Eq. 38, the Certificate line lies above or below the Housing Voucher line as:

$$(46) \qquad \frac{\int \varepsilon g\ (PH + \varepsilon)\ f\ (\varepsilon)\ d\varepsilon}{\int g\ (PH + \varepsilon)\ f\ (\varepsilon)\ d\varepsilon} \gtrless 0$$

Say that there is a rent such that Certificate recipients are less likely to select rents below this rent than above it. Then since the mean of $f(\varepsilon)$ is zero, it is clear that for low enough PH, the expression in Eq. 46 will be positive. Similarly, if there is a rent such that Certificate recipients are less likely to select rents above this rent than below it, it is clear that for high enough PH, the expression in Eq. 46 will be negative.

Accordingly, under the model of this section in which Certificate program rents tend to be more tightly clustered around FMRs than Housing Voucher rents, we expect that the Certificate regression line will have a flatter slope and be shifted up.

It is important in considering this class of models not to think of selection as a passive process. We expect that it will be more difficult to find units that meet program quality and occupany requirements at lower rents. As the model at the beginning of this section indicated, different rents will be associated with different prices and (implicitly) different incentives to expend effort in shopping. The point of the model in this section is not that the programs will not differ in average shopping intensity, but that under the model posed here these differences arise through differences in target rents and affect the joint distribution of rents and housing quality in very restricted ways.

<u>Alternative Search Models</u>. In the model of the previous section, individuals searching for housing select a target rent (or range of rents) and then shop for housing within this target range. It is clear, however, that

individuals in looking for housing can also to some extent identify a range of housing quality in terms of unit size, amenities, and location, and search across units that meet their quality criteria based on realtor descriptions or advertisements. Further, we can imagine that on finding a unit, tenants may bargain with landlords rather than accepting the landlord's first offer. Interestingly, such processes suggest a different outcome in terms of the pattern of program prices than that found under the model of the previous section.

Imagine now that individuals select a target level of housing and then search across units with this target level until they find (or negotiate) an acceptable rent. We need not consider the process that determines the target level of housing. What concerns us here is the shopping incentives associated with any level of housing services. For the Certificate program recipients searching at a given level of services, the only thing that matters about the price is that the unit's rent be less than the FMR ceiling. Thus the Certificate program creates the same sort of rent selection process found in the previous section. Compared with the market equations, the Certificate program regression of rent on quality should be rotated down and the regression of quality on rent unaffected.

Now consider a Housing Voucher enrollee. Again we are concerned with behavior given the level of housing quality selected. We still imagine that recipients set a maximum price, but this is given by:

$$(47) \qquad \underset{\{\alpha\}}{\text{Max}} \int_0^\alpha U\left(H, \frac{Y + S - P_H H}{Pz}\right) \rho(H)\, f(P_H) + \left[1 - \int_0^\alpha \rho(H)\, f(P_H)\right] U_o$$

The first order condition for the maximum price, α ,

$$(48) \qquad U\left(H, \frac{Y + S = \alpha H}{Pz}\right) - U_0 = 0$$

But this is simply a restatement of the condition for α^* in Eq. 21. Accordingly, we know that $\alpha(H)$ is an inverted U-shaped curve. Accordingly, the selection on rent $(R < \alpha(H) \cdot H)$ is a function of H, and the regression of H or R will be shifted.

Since under this model the regression of H on R is shifted from the market regression for the Housing Voucher program and the same as the market equation in the Certificate program, the regressions will differ in the two programs -- in contrast to the results of the previous section for the target new model.

Another approach to modelling price determination in the two programs is to consider landlord behavior. It is not unreasonable to suppose that landlords may adjust rents up or down to the FMR ceiling -- either as a discriminatory response to tenants who are Certificate program recipients or because the Certificate program is important enough to induce some landlords to set prices for this market. The exact mechanisms involved are not important. Again, however, we would expect such behavior to involve shifts in rent that vary with housing level and so shift the regression of quality or rent between the two programs.

Similar considerations would apply to models in which PHAs successfully bargain with landlords (as opposed to simply setting a ceiling like the FMR).

D.5 Some Caveats

The central assumption of the simple model of Sections D.1 and D.2 is, of course, that the potential decisions of the collection of individuals in a household can be characterized by a consistent preference ordering with concave indifference curves. In addition to this, however, the model clearly abstracts from reality in several ways. Three of these are discussed in this section.

Delayed Landlord Responses. Perhaps the most important omission is the fact that the models focus exclusively on applicant and recipient behavior. This is appropriate for competitive markets with perfect information and no transaction costs. Each of these assumptions is subject to question in this case.

First, as already noted, the general private market does not provide much information on whether units quality for Section 8. Accordingly, some PHAs offer applicants lists of units that are likely to qualify (and whose owners are willing to participate in the program) and some owners directly advertise units as meeting Section 8 requirements. This immediately suggests that success rates might be determined as much by landlords' willingness to participate in a Housing Voucher or Certificate program as by recipient behavior. Furthermore, if recipients are effectively restricted to the subset of the housing market provided by known Section 8 landlords, landlord price-setting behavior may be quite important in determining rents. The Certificate program sets rents through a combination of published ceilings and PHA rent-reasonableness determinations. Published ceilings may restrict rents but may also serve as price-setting signals. Likewise, PHAs may be more or less effective in negotiating rents. The Housing Voucher program substitutes individual negotiation and search for the published ceilings and PHA negotiation, though PHAs may still advise applicants on reasonable rent levels. But as noted, individuals may or may not be able to exert adequate competitive pressure depending on the availability of alternatives and the ease of moving.

Differences in landlord behavior are unlikely to arise rapidly. PHAs have been more or less active in explaining the Housing Voucher Program to landlords who currently participate in the Certificate program. If landlords respond to the program rules on an individual basis--changing their asking price depending on whether or not the prospective tenant holds a Certificate--then we might expect them to adjust quite rapidly to the differences between the programs. If, on the other hand, landlord responses come in the form of specializing in Section 8, setting rents to qualify for the Certificate Program, then it seems unlikely that this would generate rapid changes in behavior, especially since most such landlords would still draw the bulk of their Section 8 tenants from the Certificate program. A key event in this context may be annual recertifications. At annual recertifications, Housing Voucher landlords will both find that they are not granted automatic increases in rents based on the FMR adjustment schedule and that their Housing Voucher lease, unlike the Certificate program lease, allows them to raise rents at any time (the Housing Voucher lease prohibits rent increases within the first year of the lease).

Stayers and Movers. Relaxing assumptions of perfect information and zero transactions costs also affect models of applicant/recipient behavior. Most importantly, it appears that moving from one house to another is costly both in terms of the actual effort and expense involved in physically moving and in terms of the psychological and other costs involved in establishing new ties, finding new grocery stores, schools, commuting routes, and so forth. Accordingly, we may expect that households will maintain positions that seem less than optimal in order to avoid the costs of changing housing. In particular, households that meet program requirements in place may often have rents well below or above the values predicted by the models. This suggests the usefulness of separate analyses of movers and stayers.

Second, the model of this section is firmly rooted in a static world. Thus, for example, it takes no account of the potential income dynamics that would affect a household's assistance payment over time (and thus, given transaction costs, its assessment of the program's present value). Recipients may make the "wrong" choices, for example choosing rents that they cannot support. This may come about for a variety of reasons, but could in principle be more severe for low income households, which may lack the resources to accommodate the errors in judgment and in guessing future income and prices that characterize anyone's consumption decisions. This problem, if it arises, would be expected to result in higher moving or dropout rates among Housing Voucher recipients.

A final obvious simplification in the models of this section is the assumption that we can characterize choices in terms of two overall classes of expenditures. This actually turns out to be less of a problem than it might seem. We can, in fact, assume that the household has a more complicated preference structure over various goods including a variety of housing-related services. In this case, the selection of housing and non-housing expenditures pictured in Figure D.1 essentially reflects a background optimization of expenditures on specific items, given the overall levels of housing and non-housing expenditures. In general, the important issue raised by this sort of aggregation of commodities is that household allocation of expenditures across the aggregate groups may vary if the underlying relative prices of items within an aggregate vary. Thus, estimated relationships may vary across sites if the underlying price vectors for the aggregates are not scalar multiples across sites.

This sensitivity to price structure does, however, affect the expression for the value of program participation. In both the Certificate and Housing Voucher programs, recipient housing must meet program-set standards for quality and rooms. This in effect introduces an implicit set of shadow prices reflecting the extent to which the standards force a household to obtain different housing than it would normally want to (if it were spending R_{max} on gross rent). To the extent that this happens, of course, the utility gain to the household is less.

Formally, we should rewrite Equation (4) to

(23) $\Delta U' = \Delta U - L(H_p, \text{Stds})$

where

$\Delta U'$	=	the value of the household of the Certificate offer net of the effects of standards on housing characteristics,
(H_p, Stds)	=	the loss in utility due to the difference (if any) between the characteristics of a unit meeting standards (at rent $P_H H_p$) and the unit characteristics that the household would prefer to purchase at that price, and
ΔU	=	as in Equation (6).

APPENDIX E

HEDONIC INDICES AND OTHER MEASURES OF HOUSING QUALITY

As discussed in Appendix D, we expect that recipients in the two programs may look for housing in different ways that may result in their paying different prices for the same housing. This appendix discusses how such differences in prices paid are estimated empirically. The basic technique used is called hedonic indices or hedonic regression. These are theoretically simply estimated cost functions, and the net effects of differences in shopping behavior may be summarized in terms of the differences in the cost function associated with recipients in the two programs (Section E.1). Actual estimation of such indices involves a number of judgmental decisions as to specification. In order to reduce the risk of overfitting the Demonstration sample, we developed a specification based to a large extent on previous studies (Section E.2). Given a final specification, there are several ways to approach comparison of the two programs (Section E.3). Finally, the interpretation of differences in estimated hedonic cost functions involves certain strong assumptions, some of which can be tested (Section E.4).

E.1 Alternative Measures of Housing

We can readily determine whether different groups of recipients have different average rents. However, if we are told that one group of recipients pays more than another, we are not immediately convinced that the first group has better housing. Two issues are involved. First, of course, is simply variation in tastes. Whether one unit is better than another may very much lie in the eye of the beholder (or policy maker). The second issue is variation in prices. If I tell you that the first group's rent refers to rents paid in 1986 and the second group's rent refers to rents paid in 1906, you will probably be willing to believe that the first group could pay a lot more than the second group without having better housing.

How, then, do we decide that one group of recipients has better housing than another? The short answer is that we don't. What we do instead is to describe the units in terms of specific features, in terms of commonly used measures, and in terms of whether, in a sense discussed further below, one group is getting more housing than another, and specifically whether differences in the amount of rent paid are consistent with differences in the housing obtained.

The basic difficulty in measuring housing is that it involves a collection of many different attributes. Individual features can and should be considered. Thus, Chapter 4 compares housing in the two programs in terms of a number of specific characteristics such as unit size, presence of specific amenities, and neighborhood characteristics. However, the large number of features and the many alternative ways of describing them require some summary measures as well.

Summary measures can be constructed from at least two different viewpoints--that of social policy and that of individual well-being. Social policy ratings attempt to evaluate housing in terms of externally set requirements. These requirements are usually based on notions of basic amenities, such as indoor plumbing and features necessary for safety and health, or on presumed externalities produced by decent housing, such as improved appearance, reduced crime and disease, and so on. The problem in developing ratings based on social policy considerations is lack of consensus. There is little question that faced with any specific index, individual policy makers would quarrel with the omission or inclusion of specific standards, or with the relative weight given to, for example, floor condition, safe electrical wiring, or presence of adequate plumbing.

HUD does in fact publish a set of minimum occupancy and quality requirements for the Housing Voucher and Certificate program. However, these only distinguish whether units do or do not meet the requirements. More to the point, all recipient units are certified by local PHAs as in fact meeting the occupancy and quality standards set by HUD. No attempt was made to design the Demonstration data collection effort to review compliance with standards.

Measures based on individual well-being, on the other hand, are basically concerned with the extent to which an individual household's housing needs are met. At their most ambitious, individually motivated measures attempt to abstract from particular households and to identify a common scale of housing needs and adequacy that reflects a general consensus about what constitutes "good" housing. As discussed below, hedonic indices may be seen as a special instance of this latter approach.

In terms of individual well-being, the obvious index is the tenant's expressed satisfaction with his or her housing. However, measures based directly on individuals' expressed satisfaction with dwelling unit or neighborhood may lack credibility or clear interpretation. Consider, for example, an individual's expressed satisfaction with his or her neighborhood. The measure itself is subject to a variety of limitations (such as the common observation that people tend in their ratings to ratify their present situation, and especially their recent choices). More important, the subjective nature of individual satisfaction may be unpersuasive on at least two grounds. First, individuals may be dissatisfied with their housing not because it is inadequate, but simply because it is unsuited to their unique needs (for example, a dwelling unit that is too large or too far from a new job). Second, differences in individuals' satisfaction with housing may reflect differences in expectations as much as differences in the housing itself. For example, a person may be satisfied with his housing because it meets his needs or because it was the best he could expect given what he could afford, however inadequate that may be.

One approach to these problems is to attempt to build a measure of housing by identifying an underlying structure of housing tastes or needs common to all individuals. Such approaches are epitomized by latent trait models and their associated factor analytic approaches. The problems with this approach are twofold. First, no observable variable validates the derived structure: because the identification of traits is dependent on prior restrictions, it is difficult to prove that the factors do indeed identify some common structure. This problem can be substantially overcome in cases where the identified factors possess strong surface plausibility or are replicated in different situations. Second, and more fundamentally, the latent traits, even if identified, are difficult to interpret. Once housing has been reduced to, for example, seven different dimensions, there is still no accepted scale for the dimensions and no immediate way to understand the importance of a change in any dimension. Justification and interpretation must ultimately rest on the experience built up by repeated applications of the factors to various outcomes, which establish both their significance in determining outcomes of interest and the magnitude of differences in outcomes associated with differences in factors. This sort of justification requires substantial time to develop, however.

If there is some observed variable that is commonly thought to be correlated with housing adequacy, it may be used to interpret the derived latent traits. Alternatively, housing attributes may be related to it directly, without attempting to identify an underlying structure. Indeed, this constitutes one approach to the interpretation of hedonic indices: based on the assumption that people will generally pay more for a dwelling only if it is better, different attributes are weighted according to the way in which the affect the market value of the unit. The total value of the unit's attributes is then its estimated normal market, or hedonic, value. This value is different from the unit's actual rent, which may reflect a variety of nonhousing factors, including the effects of inflation over time and the careful shopping or luck of individual households in finding especially good deals.[1]

In fact, the conditions under which hedonic indices can be interpreted in this way are stringent and probably not met. Hedonic indices of housing cannot reasonably be claimed to identify either a common set of consumer preferences and housing needs, or the underlying housing supply costs for different sorts of housing. Under certain circumstances, however, hedonic indices can be thought of as identifying common agreement not about whether one house is better than another, but rather about whether it is worth more and in some sense provides "more" housing.

The idea of "more" or "less" housing is best represented by the common habit of referring to a "$40,000 house" or a "$400 apartment" (or, for automobiles, to a high, medium, or low-priced car). This in effect characterizes houses (or cars) in terms of their normal market cost. A particular $40,000 house may sell for more or less than $40,000, and it may be more or less suited to a particular household's needs than another house. But there is, in conversation, the idea that it is "more" house than a $20,000 house and in some very loose sense, a better house. Put another way, if an individual with a $20,000 house were to purchase a $40,000 house, he would seek to purchase a "better" (for him) house. Hedonic indices provide a more detailed and objective version of this sort of characterization of housing, but their strengths and weaknesses can still be understood in terms of it.

[1]In addition, estimated hedonic values will of course differ from actual hedonic values due to errors in estimation.

The custom of referring to a \$40,000 house can be formally justified in terms of a remarkable theorem due to Hicks--the Composite Commodity Theorem.[1] Say that the relative prices of some subset, A, of goods are fixed--that is, the price of each good in the subset rises or falls proportionally. Then, under the conditions of utility maximization, every individual will act as if the subset of goods were a single composite commodity, α, defined by:

(1) $$\alpha = \sum_{i \varepsilon A} \left(\frac{P_i}{P_\alpha}\right) X_i$$

(2) $$P_\alpha = \sum_{i \varepsilon A} P_i .$$

As long as the subset of prices rises or falls proportionally, the weights that define α (the P_i/P_α) remain fixed. Thus α provides an index of the subset ($X_1 \ldots X_r$), and P_α provides an index of the subset prices.

It is important to understand what this theorem does and does not say. It does not define a single physical commodity that all individuals will purchase. The composition of the composite commodity in terms of the amounts of the individual goods involved (the X_i) may vary among individuals and, for any single individual, as income or price levels change. The theorem does maintain that in considering behavior we need not define any ultimate commodities: people can be thought of as deciding the level of α and then, behind the scenes as it were, allocating α among its individual elements.

Put another way, the composite commodity measures the quantity of food or housing an individual buys, not its quality. For example, if individual A buys two bags of groceries, one for \$5 and one for \$10, individual B may prefer the beer and pretzels that made up the first bag to the soybeans, spinach, and cabbage that made up the second. But in a general sense it would be agreed that the second bag contains more groceries. It has a higher value in the sense that if individual B were to buy \$10 worth of groceries, he would get more (or better) groceries--for him--than if he bought only \$5 worth. The Composite Commodity Theorem in effect provides a rigorous basis for the notion of talking about a \$25 bag of groceries or a \$40,000 house; it says that \$25

[1]The discussion of hedonic indices in terms of the Composite Commodity Theorem is taken from Kennedy and Merrill (1977).

worth of groceries does in fact refer to the cost of a composite good called "groceries" and does indeed measure the amount of "groceries" up to a scale factor (the price).[1]

Hedonic indices involve a further step: goods are seen as bundles of attributes. Thus, the houses in a particular city are seen not as hundreds of thousands of unique commodities, but rather as different combinations of a limited set of attributes. The Composite Commodity Theorem can be applied to the underlying attributes as well as to individually marketed commodities. If the relative prices of a subset of attributes are fixed, then the attributes may be formed into a composite attribute bundle. There is, however, no reason to assume that attributes will have prices in the usual sense. Attributes are embodied in marketed goods, so that the cost of an attribute set, x, is given by:

$$(3) \qquad C(x) = \min_t p_t t \text{ s.t. } F(t) \geq x,$$

where

x = The vector of attributes

t = The vector of marketed commodities

p_t = The vector of market prices

F = the function that maps t into x

The market cost function for the attributes, C(x), will be linear only under very special conditions. Most obviously, if each marketed good contains given amounts of attributes per unit, and if there are the same number of marketed goods as attributes, then

[1]The application of the Composite Commodity Theorem to hedonic indices of housing services is one example of a much larger problem. There is an abundance of commodities; there are dozens of brands of soap or models of cars or types of houses. Further, each car or house, at least, is potentially unique. Yet we are accustomed to think in terms of broad categories such as cars, housing, or even simply income. For economists, at least, this is not simply verbal sloppiness. Nor does it require assumptions about regularity of tastes. It can simply reflect the underlying unity of categories of goods engendered by a unity of changes in price.

(4) $$x = Qt$$

$$C(x) = p_t' t = p_t' Q^{-1} x$$

$$P_x = P_t' Q^{-1}$$

where

$\{Q_{ij}\}$ = The amount of the i^{th} attribute contained in a unit of the j^{th} marketed commodity (assumed to be nonsingular).

But this is a trivial case, since the point of considering attributes was to reduce dimensionality. Indeed, to the extent that there are more varieties of goods than attributes, this suggests that individuals are not efficient producers of attributes, that it pays to have firms produce different bundles. Thus, as Lucas (1975) points out, if the Q-matrix in Equation (4) is singular (that is, if there are more commodities than attributes), then the cost function, C(x), will be nonlinear (specifically a polygonal arc concave to the origin), except in the degenerate case in which some subset of commodities dominates (that is, in which there is no reason for there to be any more commodities marketed than attributes). In addition, Rosen (1974) points out that the formulation of Equation (4) is itself too simplistic; for example, two six-foot cars cannot be combined to give a 12-foot car.

Fortunately, the Composite Commodity Theorem does not depend on linear cost functions. A composite commodity, h(x), can be constructed as long as the cost of purchasing a set of attributes, x, can be expressed as:

(5) $$C(x) = \theta f(x) g(z),$$

where

θ = A shift parameter

$g(z)$ = Some function (possibly constant) of the other goods

$f(x)$ = a fixed function of the attributes[1]

[1]This can be proved as follows. Consider any nondecreasing index, $h(x)$. Define

$$\text{(a)} \qquad W(\alpha,z) = \max_{\{x\}} U(x,z) \text{ s.t. } h(x) = \alpha.$$

This defines a preference ordering over (α,z) and a set of correspondences between $\hat{x}$, the solution to Equation (a), and (α,z). If $h(x)$ is not convex, it may coincide with the indifference curves of $U(x,z)$ at multiple points. If this is the case, a function of $\hat{x}(\alpha,z)$ may be defined by choosing the least cost value among the x solutions:

$$\text{(b)} \qquad \max_{\{a,z\}} W(\alpha,z) \text{ s.t. } D(\alpha,z) = Y,$$

where $D(\alpha,z)$ is defined by

$$\text{(c)} \qquad D(\alpha,z) = E(\hat{x}(\alpha,z),z),$$

where $E(x,z)$ is the cost function for purchases (x,z). The index, $h(x)$, can be considered a composite commodity if the solution to Equations (a) and (b) yields the same solution for (x,z) as

$$\text{(d)} \qquad \max_{\{x,z\}} U(x,z) \text{ s.t. } E(x,z) = Y$$

By the Envelope Theorem and the first order conditions for Equation (a),

$$\text{(e)} \qquad \frac{\partial W}{\partial \alpha} = \mu = \left(\frac{\partial U}{\partial x_i}\right] \left(\frac{\partial h}{\partial x_i}\right)^{-1}; \quad \frac{\partial W}{\partial z_i} = \frac{\partial U}{\partial z_i}.$$

Substituting Equation (e) into the first order conditions for Equation (b) gives

$$\text{(f)} \qquad \frac{\partial U}{\partial x_i} = \eta\left(\frac{\partial h}{\partial x_i}\right) \frac{\partial D}{\partial \alpha_i}; \quad \frac{\partial U}{\partial z_i} = \eta \frac{\partial D}{\partial z_i}; \quad D = Y$$

whereas the first order conditions for Equation (d) are

$$\text{(g)} \qquad \frac{\partial U}{\partial x_i} = \eta \frac{\partial E}{\partial x_i}; \quad \frac{\partial U}{\partial z_i} = \lambda \frac{\partial E}{\partial z_i}; \quad E = y.$$

Assume that the cost function, E, can be written

(continuation of footnote from previous page)

(h) $$E(x,z) = \theta f(x)g(z) + k(z),$$

and define the composite commodity index, h(x) by

(i) $$\alpha = h(x) = \frac{f(x)}{f(1)} \text{ ,}$$

and the cost function D by

(j) $$D(\alpha,z) = p_\alpha \alpha + k(z),$$

where

(k) $$p_\alpha = \theta f(1)g(z).$$

Then Equations (f) and (g) can be rewritten

(f)′ $$\frac{\partial U}{\alpha x_i} = \eta\theta g(3)\frac{\partial f}{\partial x_i} = \frac{\partial U}{\partial z_i} = \eta f(x)\frac{\partial g}{\partial z_i} + \frac{\partial k}{\partial z_i} \text{ ; } \theta f(x)g(z) + k(z) = y$$

(g)′ $$\frac{\partial U}{\partial x_i} = \lambda\theta g(3) \frac{\partial f}{\partial x_i} \text{ ; } \frac{\partial U}{\partial z_i} = \lambda f(x) \frac{\partial g}{\partial z_i} + \frac{\partial k}{\partial z_i} \text{ ; } \theta f(x)g(z) + k(z) = y$$

which are identical. Thus Equation (h) is sufficient. On the other hand, Equations (e) and (f) require that

(l) $$\frac{\partial h}{\partial x_i} = (\frac{\lambda}{\eta})(\frac{\partial D}{\partial \alpha})^{-1} \frac{\partial E}{\alpha x_i} \text{ .}$$

Since h must be independent of z and since, because tastes are unrestricted, Equation (l) must hold for all values of x and z, the Equation (h) must also be necessary. Thus the basic requirements for indexing x across individuals is that all individuals face the same function of the "separable" form given by Equation (h).

The form of Equation (5) allows housing costs to depend on nonhousing consumption, z, as well as on housing consumption. In practice, hedonic indices for housing are usually estimated without considering nonhousing consumption. Thus the empirically appropriate form for Equation (5) is

$$(6) \qquad C(x) = \theta f(x).$$

Equation (6) simply requires that the cost of a given unit not change as other consumption (such as food purchases) changes. This requirement may seem innocuous at first glance, but is in fact important. Most obviously, Equation (6) requires that the attributes x, not be produced by the omitted goods, z. This is in effect a technical, or market separability, condition. The condition is stronger than a simple separability of attributes, however. Many urban economists would argue, for example, that the price of housing and indeed the relative price of various attributes changes with distance from the workplace and shopping centers. But this means that C(x) must be written as:

$$(7) \qquad C(x) = \theta f(x,t).$$

where t represents the location of the unit. The hedonic index for housing cannot be separated from location.[1]

The estimation of hedonic indices in effect attempts to estimate the weights for the composite commodity of quality attributes. Of course, if rent were determined only by housing quality, it could be used as a direct measure of the composite housing bundle. Hedonic estimation is used to sort out the

[1]It may be useful to distinguish two different problems here. If there is a price gradient along which relative prices shift, then that gradient must be included in estimating the hedonic index. This is a market cost descriptor. In addition, however, the travel costs associated with a particular location will vary from individual to individual, depending on exact work location, shopping needs, type of transport, and so forth. As long as an individual can purchase a given amount of "travel cost" for any housing bundle, "travel cost" can be regarded as another commodity (part of z) and will enter the housing cost equation as g(z) in Equation (5). In this case, the hedonic index is preserved. This preservation requires, in the extreme, that every housing bundle be available at every location (or, more exactly, that every relevant bundle be available at any given travel time from relevant work and shopping centers.

market value of quality attributes from the effects of individual shopping behavior, tenure conditions, and other nonquality factors, as well as the effects of price changes over time.

In addition, hedonic indices can be used to compare housing in different markets with different housing price structures. The composite rationale depends critically on the assumption that the relative attribute weights in the hedonic regression are fixed. Yet these weights will differ over time, between cities, and across submarkets within cities if the attribute cost function differs. If attribute costs only d ffer proportionally, then the composite commodity is of course maintained. The original weights can be used in both situations. This in effect simply adjusts for differences in the price level between the two times, cities, or submarkets. If the relative weights change, the composite commodity changes as well and can no longer be directly compared with the original composite; the two are not totally unrelated, however.

The problem of comparing housing composites across different markets with different attribute weights is essentially the problem of constructing price indices. A price index is simply a deflator that attempts to scale the overall composite commodity so that it is comparable to income under some set of base prices. The properties of such indices are well known and apply directly to comparison of housing bundles.

E.2 Specification of the Hedonic Index

Specification of the hedonic equation is a complex and often ad hoc empirical process. Neither the other types of models used in housing market analysis nor the general hedonic model provides much guidance in the selection or definition of appropriate variables. There are many attributes of the housing bundle and therefore many potential variables to be included in a hedonic equation. The variables are often highly correlated, so that empirical tests do not always readily distinguish among alternative subsets of variables.

The danger that this poses for empirical work is that we may grossly overfit the data. If we simply try alternative sets of variables or functional forms until we find the one with the highest R^2, for example, our results may be dominated by the chance association present in the sample.

Worse, to the extent that the distribution of variables differs across the two samples of program recipients, we may erroneously absorb or inflate estimated program differences. Further, the Demonstration sample is especially vulnerable to the problems of overfitting. There is no reason to believe that rental cost functions would be the same across PHAs or that they would differ in some simply parameterizable way. Accordingly, it is likely that we will need to estimate hedonic functions within each PHA. Although the overall sample was reasonably large, the sample in any single PHA was small. Testing alternative specifications within PHAs would, therefore, be very likely to overfit the data.

The appropriate response to such problems is, of course, to develop the specification based on other data. Such data are often not available. Fortunately in this case we had not only the results of a number of estimates of hedonic rent regressions but studies using data and populations similar to those we would expect to encounter in the Demonstration. One study in particular, using 1979 data on Certificate program recipients, was selected as the starting point. We then explored alternative specifications in terms of ease of integration, alternative data sources, evidence from other studies, and reliability of data collection. This resulted in the basic variable list that guided the development of the Housing Quality Inspection Form. This specification was then modified to reflect the results obtained from Demonstration data.

E.2.1 Alternative Data Sources

From the outset, we have had two alternative sources of data for estimating hedonic indices. First, American Housing Survey (AHS) data would be available for areas including 15 of the 18 urban PHAs. In principle, we could use the relatively large sample from the AHS to estimate a normal private market rent in each area. If we then collected similar information on Demonstration recipients' housing, we could compare the rents paid by recipients with the rents predicted from the AHS. Alternatively, we could simply collect information on recipient housing and estimate the extent to which the rents paid by recipients in one program were consistent with the rents paid by recipients in the other program. We adopted the second approach.

In considering the two approaches, we started by examining the availability of AHS data. As noted, AHS data were in principle available for 15 of the 18 urban PHAs in the Demonstration. However, in four sites (Buffalo, Minneapolis, San Antonio, and Seattle) the match of the AHS data collection area and the PHA jurisdiction was tenuous enough to suggest that AHS data might not provide a good representation of the jurisdiction. Further, revisions to the AHS, starting in 1984, included both substantial reductions in sample size and revisions in the AHS data collection instrument, which also suggested that there might be considerable delays in the availability of data for 1984 and later. Accordingly, we determined that AHS data from 1979 to 1983 was the likely candidate, and this was in fact available for 10 PHAs with reasonably good matches of the PHA jurisdiction and AHS data collection areas.[1]

The advantage of this data source was that it would yield observations on a large sample of about 20,000 renters. These could be used to estimate hedonic indices for each site, which in turn, if we collected AHS-like data for recipients in these sites, could be used to develop predicted rents for recipients based on local market conditions.

There were, however, three drawbacks to the use of AHS data. First was the problem posed by the fact that data on the housing of Demonstration recipients would generally not be collected in the same year as the AHS. We would need some way to update the AHS estimates. Otherwise we would have been comparing, for example, 1986 rent with 1981 prices. This might have been possible, however. We planned to use the AHS SMSA samples, which are fielded every three years. However, AHS data are also collected nationally each year. Data for small samples in our sites would be available from the national AHS samples and might be used to update the estimated index. Further, given the delays in site start-up, our concern about the timely availability of AHS data after 1983 was probably greater than it should have been.

The second drawback was that the Demonstration sample in several of the AHS sites was quite small. We would probably have wanted to increase the

[1]These were Atlanta, Boston, Cleveland, Houston, Los Angeles, New York, Oakland, Omaha, Pittsburgh, and San Diego.

Demonstration sample in these sites in order to provide an accurate basis for comparison with AHS data. Moreover, the set of PHAs with AHS data could not be considered a probability sample. This turned out to be true for other reasons in the alternative approach, but that was not apparent at the beginning of the Demonstration.

The most important, and indeed decisive, drawback to the use of AHS data was limitations on the data available from the AHS. These were of three sorts. First, the AHS does not provide information on the location of respondent beyond SMSA and, in some cases, central city/non-central city. This meant that we could not hope to capture effects associated with better neighborhoods even at as gross a level as Census tract, though, as we shall see later in the Appendix, these tract descriptors turned out to be not significant. Second, the AHS data are based on responses to interview questions rather than physical inspection by trained evaluators. This raises questions about the extent to which AHS data may vary due to idiosyncratic factors associated with the tenant or interviewer.[1] Finally, because the AHS data concentrate on the presence of defects, they tend to be relatively less reliable in estimating rents of units without defects.[2]

On the other hand, if we did not use AHS data, we could only compare the programs with each other and could not address the question of whether recipients in either program paid more or less on average than renters in the private market. Furthermore, the AHS offered much larger samples than we could hope to afford for new data collection.

We could in principle, of course, have pursued both approaches. Faced with a choice, we chose to adopt the second approach and forego the advantages of the AHS data in order to allow direct comparison on a wider array of housing attributes.

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[1]See, e.g., Sanchez.

[2]See Wallace et al., pp. 325-340, especially pp. 334-335.

E.2.2 Initial Specification

We started with the equations estimated by Merrill and Leger as part of a 1979 evaluation of the Section 8 Certificate program (Wallace et al.). These equations were based on 1979 data on the pre-program units of a sample of 1,109 Certificate program recipients in 15 SMSAs, plus a sample of 256 recently constructed private, unsubsidized, high quality units, which was added to provide observations of the upper end of the quality distribution. The data consisted of both survey data from interviews of tenants using questions from the Annual Housing Survey conducted by the U.S. Census for HUD, plus inspection data from housing evaluations performed by Abt Associates staff.

Four separate regional equations were estimated by Merrill and Leger using a common list of variables, plus dummies for the SMSAs in each region. This variable list, shown in Table E.1, provided our initial set of candidate variables. We then modified the list in four ways:

1. We reexamined the use of factor scores in the Merrill and Leger equations;
2. We reviewed several variables to determine whether interview data seemed to provide a useful supplement to the information from inspections;
3. We reviewed variables that had proven useful in other studies to see whether they should be included in the Demonstration data collection;
4. We reviewed the way in which utilities were entered; and
5. We reviewed field notes from the data collection for Merrill and Leger to see whether some items should be modified.

Each of these steps is discussed briefly below.

E.2.3 Testing Summary Variables versus Factor Scores

The factor scores used with the Section 8 equation estimated by Merrill and Leger encompass a large number of variables, as shown in Table E.2. We therefore started our analysis by investigating whether similar results could be obtained using summary variables rather than factor scores. Factor analysis had proven useful in the estimation of the Section 8 equation for quality variables, which were often very collinear when entered separately in the equation. Many of the variables were themselves insignificant and/or

TABLE E.1

INITIAL LIST OF CANDIDATE VARIABLES FROM MERRILL AND LEGER[a]

Related to the landlord (0,1)
Length of tenure (months; natural log)
Landlord resides in the building (0,1)
Air conditioning (supplied by landlord; 0,1)
Building age (years, natural log)
Single-family detached unit (0,1)
Duplex or two-family unit (0,1)
Garden apartment (0,1)
Multi-family (four stories or fewer; 0,1)
Highrise (more than four stories; 0,1)
No heat or inferior source of heat (0,1)
Living room quality and amenities (factor score)
Quality of multi-family buildings (factor score)
Kitchen quality and amenities (factor score)
Recreational facilities (factor score)
Overall quality and bathroom and kitchen features (factor score)
Availability of kitchen cabinets (factor score)
Balcony, porch or patio (factor score)
Electrical heating, and water hazards (factor score)
Well kept, landscaped grounds (0,1)
Heat per room (heat included in rent x number of rooms)
Abandoned and boarded-up buildings (natural log)
Proportion of the blockface that is residential
Attractive features of the unit (0,1)
Proportion of the blockface that is commercial or industrial
Proportion of the blockface used for public services
Cleanliness of surrounding parcels (4-point scale)
Census tract median housing value (dollars)
Census tract median contract rent (dollars)
Proportion of the blockface that is park
Number of rooms (excluding bath) (natural log)
Number of baths and half-baths
Square feet per room

[a]Reported in Wallace et al., Vol. II.

TABLE E.2

VARIABLES INCLUDED IN THE HOUSING MEASUREMENT SURVEY
PRINCIPAL COMPONENTS ANALYSIS OF DWELLING UNIT QUALITY

Electrical, septic tank, boiler, hot water heater, pipes, water, leaking gases, rats, structural hazards

Overall evaluation rating, unit immediately or potentially hazardous

Average of ceiling structure ratings in all rooms located in the main body of the unit and not used for storage, laundry, or utility

Average of ceiling surface ratings in all rooms located in the main body of the unit and not used for storage, laundry, or utility

Average of wall structure ratings in all rooms located in the main body of the unit and not used for storage, laundry, or utility

Average of wall surface ratings in all rooms located in the main body of the unit and not used for storage, laundry, or utility

Average of floor structure ratings in all rooms located in the main body of the unit and not used for storage, laundry, or utility

Average of floor surface ratings in all rooms located in the main body of the unit and not used for storage, laundry, or utility

Window sash or frame in the living room, bathroom, kitchen, or next rated room badly deteriorated or not weathertight

Range built into the countertop

Kitchen has no cabinets

Kitchen disposal present

Linear feet of cabinets or shelving in kitchen

Kitchen has high quality walls or floors or cabinets or special built-in lighting

Number of kitchen amenities present including breakfast nook, pantry, range hood, double oven or microwave, double sink, fireplace, balcony, special windows or doors, special lighting, special storage, or an extra large kitchen

Extent of waterproof construction in bathroom

Condition of the grout and seals in the bathroom

Condition of bathroom fixtures

Number of amenities in the bathroom including jacuzzi, bidet, heat lamp, other heat source, large mirrors, glass shower/tub door, separate dressing area, vanity, double sink

Built-in vanity table

Evaluator overall rating of condition in terms of need for repairs and rehabilitation

Evaluator overall rating of unit quality

Living room has high quality walls or ceilings or floor or built-in lighting or built-in shelves

Special windows or doors in living room

High quality floors or floor coverings in living room

Proportion of rooms where some or all of the windows are double-glazed or have storm windows

Central heating system

TABLE E.2 (continued)

VARIABLES INCLUDED IN THE HOUSING MEASUREMENT SURVEY
PRINCIPAL COMPONENTS ANALYSIS OF DWELLING UNIT QUALITY

Multi-family security; security guard or intercom with television or intercom with voice or locked entrance

Exterior pool

(The sum of) tennis courts, basketball, playrooms and playing fields

Number of amenities in the living room including high quality walls, ceilings, floors, fireplace or stove, balcony, patio or deck, special windows, built-in lighting, built-in shelves, and exceptional size

Bathroom has waterproof construction, good seals, and like-new fixtures

Basement is not a crawl space only and none of the floor is dirt

Balcony, deck, porch, or patio

Number of amenities in multi-family buildings including function room, indoor pool, sauna, social service centers, fancy foyer, storage areas, secure private storage, convenience stores, security guard or intercom or locked entrances, well-maintained entrance hall and common areas

Number of amenities in all other rooms rated by evaluator on the Housing Measurement Survey including high quality walls; high quality ceilings; high quality floors; fireplace or Franklin stove; balcony, patio, or deck, special windows and doors; special built-in lighting; built-in shelves, bookcases, cabinets; separate dressing area; exceptional size

Condition of kitchen appliances

Condition of kitchen sink

Age of kitchen appliances

Coordinated and balanced kitchen

Built-in dishwasher present

did not have the expected sign. The factor analysis identified ten major factors, eight of which were included in the final Section 8 equation.

The reason for using factor scores in this context is twofold. First, we want to identify sets of highly correlated variables. If a factor loads heavily on a few variables, it indicates that these form a relatively correlated set. There is, however, no reason to believe that the covariates used to develop the loading that construct factors from a set of variables bear any particular relationship to the variables' hedonic coefficients. Accordingly, a better use of factors for this purpose would seem to be to use the factors to identify sets of variables that are highly correlated and include the individual variables in the equation, but test their significance as a set, because the members of the set are too highly correlated to allow reasonable individual significance testing. Accordingly, we simply used the factor analyses for the Section 8 HMS hedonic equations to identify groups of variables that appeared to be highly correlated.

The second reason for using factor scores in this context is, of course, to reduce dimensionality. To the extent that much of the variation in a set of 20 variables can be captured by a few factors, we may be able to increase our degrees of freedom without much loss of explanatory power. When we examined the actual factors, however, we generally found that each factor was interpreted in terms of a few variables with high loadings on that factor, rather than suggesting some new dimensions of a more complex nature. Accordingly, it seemed to us more intelligible simply to combine the highly loaded variables into different summary variables, most often by simply taking their average, and see if this did as well as the factor scores.

No attempt was made to see whether factors could be replaced by simply including one or two of their component variables as separate variables. Individual variables had been extensively tested within the framework of the original Section 8 study and had led to the use of factors scores. Instead we identified the sets of variables that loaded heavily on each of the ten factors and constructed a summary measure for each set, which was then used in the estimation instead of the factor scores. A summary measure can be a sum (such as sum of all amenities in the kitchen and bathrooms) or an average (such as average condition of the kitchen appliances and bathroom fixtures). Several specifications of the summary measures were tested. The results did not change substantially and in all the regional equations the results compared favorably with the equations using factor scores. This indicated that the large number of variables on quality and availability of amenities could be retained in the estimation and that the estimation process could be greatly simplified without loss of explanatory power, by using summary variables rather than factor scores.

E.2.4 Testing Inspection Variables vs. Interview Variables

The Section 8 data base analyzed by Merrill and Leger contains data obtained through inspection of applicants' pre-program units and data collected by interviewing the occupants of the same units. The inspection and interview for each unit occurred within a few days of each other. A large number of variables are in fact available from both sources, from simple descriptors such as number of rooms to more complex concepts such as the composition of the neighborhood. The data base is therefore most appropriate to test the use of inspection variables or interview variables to measure the same (or similar) housing attributes.

The use of interview data always raises concerns about individual respondent variation in rating a given condition. Accordingly, there is some tendency to prefer evaluator ratings. Evaluator ratings can be made quite consistent by training, and in any case, by assigning half of each evaluator's units to each program, we assured that differences in evaluator ratings do not affect estimated program differences. Even so, there are cases where interview ratings must be used. Information on past events (such as broken plumbing) or on tenant perceptions obviously require interviews. Some concepts such as neighborhood are exceedingly difficult to define objectively; a tenant's answers to questions about the neighborhood may yield a more accurate characterization than a careful enumeration of features within a fixed radius of the unit. Alternatively, interview and inspection data, although ostensibly describing the same thing, may in fact be independent enough that both are useful. Finally, some data are simply easier to ask about, so that if interview responses are accurate, they will be preferred for reasons of cost.

In fact, extensive comparison of interview and inspection data had already been undertaken in developing the Section 8 HMS hedonic equation. Even so, we felt that it would be desirable to test a few summary variables.

It was not expected that interview questions would perform better than inspection questions, since most interview questions had already been tested earlier, but we wanted to see whether interview questions added to the explanatory power of the regressions, since occupants' perceptions may have an effect on their willingness to pay a higher or lower rent for a specific unit.

The variables identified for further testing are presented in Table E.3. In most cases, the interview variables did not add to the predictive power of the equation. However, the interview information on the presence of abandoned buildings in the neighborhood appeared to perform better than the number of corresponding variables as counted by inspectors. Both variables were included in the Housing Quality Inspection Form developed for the Housing Voucher Demonstration.

E.2.5 Review of Other Estimates

Three other sets of equations were reviewed--two based on AHS data and one on a combination of inspection, interview, and Census data.

- AHS-Based Indices from two studies were reviewed. These consisted of equations estimated by Follain and Malpezzi for 39 SMSAs, plus equations estimated by Malpezzi and Ozanne for each of the 15 SMSAs analyzed by Merrill and Leger. Malpezzi and Ozanne built on the procedures used by Follain and Malpezzi. The data used consisted of tenant responses to a special interview of the households in the Merrill-Leger sample, using AHS questions.
- The Housing Allowance Demand Experiment included four hedonic equations particularly relevant to this study: a linear and a semilog equation for each of the two experimental sites, Pittsburgh and Phoenix. The hedonic indices were estimated by Merrill, and are based on both inspection data and interview data. Data on the characteristics and conditions of the housing units were collected by inspectors, while information on neighborhood conditions and availability of services was obtained in interviews with occupants of the unit.

Overall, 62 separate equations were reviewed. The results are summarized in Table E.4. The first column of Table E.4 indicates whether the variable is based on ratings or measurements provided by physical inspection of the unit by housing evaluators (I), or on tenant responses to interview questions (S). The remaining columns indicate how well the variable did in the different studies. An entry of any sort in the column for any study means that the variable was included in the equation estimated for that study. The

TABLE E.3

DEFINITIONS OF SELECTED VARIABLES COLLECTED BY INSPECTION AND INTERVIEW

Variable Description	Inspection Variable	Interview Variable
Housing Quality/Condition		
Overall Condition of Unit Overall Quality of Unit	Rating (5-point scale) Rating (6-point scale)	Satisfaction with unit (4-point scale)
Presence of Hazards, including electrical, septic tank, boiler, hot water heater, gases, rats, and structural hazards	Record of presence	Number of defects reported by occupant. leaky basement, leaky roof, open cracks, holes in floors, broken plaster, rats. Poor facilities· incomplete plumbing, shared plumbing, no piped water, no public sewer or septic tanks, inadequate heating system
Neighborhood/Blockface Composition		
Neighborhood is Residential	No. of residential parcels/ total number of parcels	(NA)
Presence of Commercial and Industrial Activities	No. of commercial and industrial parcels/total number of parcels	Respondent perception of presence of commercial and industrial activities
Presence of Abandoned Buildings	No. of abandoned buildings in blockface	Respondent perception of presence of abandoned buildings
Availability of Services	No. of schools and hospitals/total number parcels	Respondent perception of access to services such as health services

TABLE E.4

VARIABLES INCLUDED IN REVIEWED HEDONIC EQUATIONS

	Type of Data[a]	Number of Equations In Which the Estimated Coefficient Had a t-Statistic of At Least One			
		Section 8 HMS Equations	Demand Equations[b]	Section 8 AHS Equations	Other AHS Equations
Number of Equations		4	4	15	39
Tenure Characteristics					
Length of Tenure	S	All	All	All	All
Related to landlord	S	3	All		
Landlord resides in building	S	2		10	
Building Descriptors					
Building Age	S[c]	3	All	10	All
Single-Family Detached	S[c]	2		11	17
Single-Family Attached	S[c]	1		9	
Duplex or 2-Family Unit	S[c]	2		12	
Garden Apartment	I	1			
Multi-Family (over 50 units)	S				
Multi-Family (LE 4 stories)	I	2			
Multi-Family (5 or more units)	I		All	13	
Highrise (5 stories of more)	I	3			
Elevator Present	I			14	
Number of Floors	S				23
Number of Units in Building	S				21
Unit Size					
Number of Rooms (excl. baths)	S				All
Number of rooms (excl. baths)	I	All	All		
Number of rooms (excl. bedrooms)	S			All	
Number of bedrooms	S			All	33
Number of bathrooms	S			All	38
Number of bathrooms	I	All			
Square feet per room	I	All	All		
Persons per room	S,I		All		23

TABLE E.4 (continued)

VARIABLES INCLUDED IN REVIEWED HEDONIC EQUATIONS

	Type of Data[a]	Number of Equations In Which the Estimated Coefficient Had a t-Statistic of At Least One: Section 8 HMS Equations	Demand Equations[b]	Section 8 AHS Equations	Other AHS Equations
Utilities					
Heat Included in Rent x Number of Rooms	S,I	4			
Heat Included in Rent	S			14	
Non-Heat Utilities Included in Rent	S			11	
Parking Included in Rent	S		0[d]	10	
Furniture Included in Rent			0[d]	3	22[d]
Utilities Included in Rent	S				38
Garage Included in Rent	S		2		
Off-Street Parking Included in Rent	S		Pittsburgh		
Gas, Heat, and Electricity Included	S		0[d]		
(Gas, Heat and Electricity Included x Number of Rooms)	S		0[d]		
Water Included in Rent x Number of Rooms	S		0[d]		
Stove/Refrigerator Included in Rent	S		2		
Dishwasher/Disposal Provided	S		2		
Dwelling Unit Quality					
Overall Ratings (Summary Measures)					
Breakdowns	S				11
Poor Facilities	S			All	
Number of Defects	S			6	
Satisfaction with Unit (4-pt scale)	S				15
Overall Evaluator Rating	I	0[f]	Pittsburgh		
Average Surface and Structural Quality	I	0[f]	Phoenix		
Working Condition of Plumbing	I	0	Pittsburgh (1)		
Overall Quality of Kitchen and Bath Facilities[f]	I	3			
Quality of Common Areas[f]	I	2			

TABLE E.4 (continued)

VARIABLES INCLUDED IN REVIEWED HEDONIC EQUATIONS

	Type of Data[a]	Number of Equations In Which the Estimated Coefficient Had a t-Statistic of At Least One: Section 8 HMS Equations	Demand Equations[b]	Section 8 AHS Equations	Other AHS Equations
Specific Deficiencies					
Not Heat or Inferior Source of Heat	S		Pittsburgh Phoenix (1)	31	
Not Heat or Inferior Source of Heat	I	2			
Rooms Wighout Heat	S			9	21
Exposed Wiring	I			9	
Electrical and Water Hazards (Factor Score)		3			
Rats		0[f]			11
Fuses					19
Cracks (Wall, Ceiling, Floors)	S				7
Broken Plaster					11
Poor Wall and Ceiling Surface (FS)		0	Pittsburgh		
Poor Window Condition (FS)	I	0	Pittsburgh		
Poor Bathroom Wall and Ceiling Surface (FS)	I	0	Pittsburgh		
Inadequate Exits	I		Pittsburgh		
Inadequate Ceilings Heights	I		Pittsburgh		
Inadequate Kitchen Facilities	I		Pittsburgh		
Bedrooms not Private	S		Pittsburgh	All	31
Problems with Common Halls	S			5	12
Inadequate Light and Ventilation	I		Phoenix		
Lack of Plumbing	I		Pittsburgh (1)		
High Quality Features and Amenities					
Many High Quality Features	I		Pittsburgh		
High Quality Kitchen	I		Pittsburgh		
Kitchen Quality and Amenities[f]	I	2			
Living Room Quality and Amenities[f]	I	3			
Presence of Kitchen Cabinet[f]	I	1			
Balcony, Porch, Patio[f]	I	2			
Private Yard			Pittsburgh (1)		

TABLE E.4 (continued)

VARIABLES INCLUDED IN REVIEWED HEDONIC EQUATIONS

	Type of Data[a]	Number of Equations in Which the Estimated Coefficient Had a t-Statistic of At Least One: Section 8 HMS Equations	Demand Equations[b]	Section 8 AHS Equations	Other AHS Equations
Recreational Facilities with Unit[f]	I	4			
Recreational Facilities with Unit[f]	S		All		
Well Kept Grounds	I	1			
Other Attractive Features in Unit	I	2			
Recent Interior Painting/ Papering	S		All		
Responsiveness of Landlord for Repairs	S		All		
Heating/Cooling Equipment and Fuels					
Air Conditioning Present	S		{Pittsburgh Phoenix (1)		
Air Conditioning Provided by Landlord	S,I	3			
Central Air Conditioning	S		Phoenix	13	33
Room Air Conditioning	S			14	
Central Heat	S		Phoenix		31
Wall or Room Heaters	S			15	
Steam Heat	S				26
Supplemental Heat	S				10
Thermostat	I		Common		
Heating Fuel	S				24
Cooking Fuel	S				31

TABLE E.4 (continued)

VARIABLES INCLUDED IN REVIEWED HEDONIC EQUATIONS

	Type of Data[a]	Number of Equations in Which the Estimated Coefficient Had a t-Statistic of At Least One			
		Section 8 HMS Equations	Demand Equations[b]	Section 8 AHS Equations	Other AHS Equations
Blockface Variables					
High Quality Blockface	I		Pittsburgh		
Percent of Blockface Residential	I	3			
Percent of Blockface Commercial or Industrial	I	3			
Percent of Blockface Public Services		I	3		
Percent of Blockface Park	I	2			
Number of abandoned/boarded-up buildings	I	3			
Quality of Landscaping	I		Phoenix		
Surrounding Parcels					
Cleanliness	I	2			
Neighborhood Conditions and Services					
Overall Neighborhood Quality[f]	S		Phoenix		
Good Neighborhood	S			12	
Excellent Neighborhood	S			All	
Poor Neighborhood	S			6	
Litter in Neighborhood	S			4	
Access to Shopping/Parking[f]	S		Phoenix		
No Convenient Shopping	S			11	
Abandoned/Boarded-up Buildings	S			All	
Traffic and Litter Problems[f]	S		Pittsburgh		
Problems with Crime and Public Services[f]	S		Pittsburgh		
Quality of Adult Recreational Facilities	S S		All		
Recreational Facilities[f]	S		All		
Street Rating	S				30
Deteriorating Street	S				27
Airplane Noise	S				17
Inadequate Schools	S				12

TABLE E.4 (continued)

VARIABLES INCLUDED IN REVIEWED HEDONIC EQUATIONS

	Type of Data[a]	Number of Equations In Which the Estimated Coefficient Had a t-Statistic of At Least One: Section 8 HMS Equations	Demand Equations[b]	Section 8 AHS Equations	Other AHS Equations
Street Crime	S				13
Street Traffic	S				4
Street Noise	S				14

[a]S = Surveys of tenants, I = inspection of units by housing evaluators.

[b]*Entries in this column give the site name if the variable had a t-statistic of at least one in only one site.* A (1) after the site name indicates the level was reached in only one of the two equations estimated for that site.

[c]In Section 8, HMS equations data were provided by inspectors.

[d]Used in equations to estimate costs of utilities.

[e]In 10 sites, this coefficient is positive. In the other 12 sites, the coefficient is negative.

[f]Included in Factor Scores, not entered as separate variables.

number shown in the entry indicates the number of study equations for which the t-statistic for that variable was greater than one. Thus, for example, the entry "3" in the "Section 8 HOUSEHOLDS Equations" column for the variable "Related to Landlord" means that this variable was included in the four regional Section 8 study equations and that it had a t-statistic greater than one in three of the four equations.

A t-statistic of at least 1.0 means that the variable was at least significant at the 32 percent level (for a two-tailed test). The use of a much less stringent than usual test level reflects an emphasis on predictive power. The hedonic regression is used primarily to derive an overall estimated housing index; our concern therefore is to include as many relevant variables as possible, so that differences between programs reflect differences in prices paid rather than amenities purchased. As Rao (1971) points out, omission of relevant variables biases the estimated coefficients of included variables, whereas including irrelevant variables only increases the error of estimate. We were willing, therefore, to risk including irrelevant variables up to the point at which their inclusion would increase the overall estimated standard error (reduce the adjusted R^2). As various authors have pointed out, the adjusted R^2 for an equation is improved by retaining any variable (or set of variables) that has a t-statistic (F-statistic for a set) greater than 1.0. (See, e.g., Hartovsky, 1969, and Rao, 1971.)

The list of variables included in previous studies is long. Review of the variables tested during the Section 8 study, however, reduced the list greatly. In many cases, the variables had already been tested and rejected in the development of the Merrill-Leger equations. Indeed, most of the additional variables identified as needing further testing were variables that had been included in the factor analysis for the Section 8 equation, but are not included in the summary variables described in Section E.3.1 above.

The list of variables that underwent additional testing is presented in Table E.5. The variables were added to the basic equation and this augmented equation was reestimated. The coefficient and associated t-ratio of each variable was examined. Variables were organized in subgroups (e.g., kitchen characteristics) and tested as a group using a F-test. When in doubt, that is, when the test did not provide conclusive results as to the significance of a variable, the data item was retained.

TABLE E.5

ADDITIONAL VARIABLES FROM OTHER STUDIES TESTED FOR INCLUSION IN THE HEDONIC EQUATION

Inspection Data	Kept	Dropped
Working elevator in building with 4 stories or more	x	
Deteriorated windows in living areas		x
Proportion of rooms where some or all of windows are double glazed or have storm-windows		x
Quality of basement (not a crawl space and not a dirt floor)		x
Boiler is sound and sufficient for unit	x[a]	
Linear feet of cabinets or shelving in kitchen		x
Kitchen disposal present	x	
Built-in dishwasher present	x	
Range built into countertop	x	
Age of kitchen appliances		x
Coordinated and balanced kitchen		x
Extent of waterproof construction in bathroom	x	
Problem with sewer or septic tank	x	
Average structure conditions	x	
Average surface conditions	x	
Interview Questions		
Janitor, manager or superintendent in building		x
Traffic or airplane noise in neighborhood		x
Poor street lighting		x
Street conditions		x
Neighborhood crime	x	
Litter, trash, or junk		x
Presence of rundown buildings		x
Satisfactory schools		x
Satisfactory police and fire protection		x
Satisfactory hospital or health clinics		x
Satisfactory outdoor recreation facilities		x
Heavy traffic		x
Satisfactory public transportation		x
Satisfactory shopping		x

[a]See discussion in Section E.2.6.

E.2.6 Utilities

We retained items for unusual appliances provided by landlords (such as disposals or microwaves) or special services (for example, parking). The major problem that concerned us was with basic utilities such as heat, electricity, and hot water, or appliances that are frequently provided in many cities (such as stoves). Basically, we can think of rent as covering the housing produced by the unit plus the utilities provided by the landlord. Thus a natural approach is simply to add variables for utilities included in the rent. The problem with this is that the combinations of utilities and fuels create a considerable list of some 18 or 20 variables, some of which will very rarely occur in any given city. Specification is further complicated by the fact that we expect that the value of included utilities will vary with the size of the unit.

In lieu of detailed specification of utilities, Merrill-Leger simply included a variable for whether or not heat was included in the rent, scaled by the number of rooms in the unit. While we collected information on what utilities were included in the rent, we also tried a different approach, using the information available from the Certificate or Housing Voucher program on the estimated value of utilities not provided by the landlord.

We start by imagining that gross rent, including all utilities (GR) can be expressed as a function of unit characteristics (x):

(8) $$GR = X\beta + \varepsilon$$

We do not observe gross rent. We observe contract rent, which by definition is gross rent minus the value of utilities not included in the rent, i.e.,

(9) $$CR = GR - U$$

(10) $$= X\beta - U + \varepsilon$$

where

GR = Gross rent

CR = Contract rent

X = Unit characteristics

U = The value of utilities not included in the rent

We do not, of course, know U. But we do have an estimate, $\hat{U}$, based on Section 8 schedules of utility allowances. Accordingly, we adopted the initial specification:

$$\text{(11)} \qquad CR = X\beta - \alpha\hat{U} + \varepsilon$$

where

$\hat{U}$ = Section 8 scheduled allowance for utilities not included in the rent

We actually expect α to be somewhat less than one if scheduled utilities allowances reflect actual costs. If we think of the market as clearing at a certain average allowance for utilities included in the rent, then we expect that landlords with high cost utilities will insist on charging separately. Then the differential in cost may be less than the observed differential in rent.

In fact, in actual estimation with Demonstration data neither the scheduled utility allowance nor the scaled heat variable used in the Merrill-Leger equations was clearly preferable.[1] Table E.6 presents the overall mean

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[1]For equations in the log of contract rent, we used a utility allowance variable of $\ln(1+U/CR)$. This was derived as follows:

$$\text{(i)} \qquad \ln GR = X\beta + \varepsilon$$

$$\text{(ii)} \qquad \begin{aligned} \ln CR &= \ln(GR-U) \\ &= \ln[GR(CR/GR)] \\ &= \ln[GR(GR/CR)^{-1}] \\ &= \ln[GR(1+U/CR)^{-1}] \end{aligned}$$

Thus

$$\text{(iii)} \qquad \ln CR = X\beta - \ln(1+U/CR) + \varepsilon$$

where

GR = Gross rent
CR = Contract rent
U = The value of utilities not included in the contract rent.

TABLE E.6

OVERALL MEAN SQUARED ERROR FROM REGRESSIONS STRATIFIED BY PROGRAM AND SITE UNDER ALTERNATIVE UTILITY SPECIFICATIONS

	Rent		Log Rent	
	Heat Dummy	Utility Allowance	Heat Dummy	Utility Allowance
Housing Voucher Program	62.23	63.19	0.1372	0.1398
Housing Certificate Program	48.52	48.54	0.1259	0.1249
All	55.82	56.37	0.1317	0.1326

squared error from estimates stratified by program and site. As can be seen, the two different utility specifications have almost identical mean squared errors, though usually slightly lower for the specifications with the variable for whether or not heat is included in the rent.

E.2.7 Review of Data Collection Issues

The analysis described above led to the specification of a "final" set of variables to be collected using an inspection form. This final set of variables was then reviewed against a second criterion--ease/complexity of administration. This review involved several steps: review of quality control reports and notes from previous studies discussing the difficulty encountered in administering certain items, review of instructions in the training manual, and discussion of items with staff members responsible for preparing the training manual and conducting the training sessions for the Housing Voucher Demonstration. An example of the ease/complexity review is the item reflecting soundness and sufficiency of the furnace/boiler. This item, included in factor scores in the Section 8 hedonic regressions, was also significant when entered directly in the equation or as part of a group of characteristics related to the heating system. It was determined that the concept of soundness can be easily conveyed through the use of pictures, while the concept of sufficiency is much more difficult to assess, as it involves BTUs and other information that is unlikely to be in the possession of the occupant of the unit. Accordingly, we restricted the item to soundness only on the grounds of feasibility. We also tested proxies for sufficiency that were available from interview data (e.g., need to use supplementary heating sources during the winter, need to close certain rooms as they were too cold, number of heating system breakdowns) as a substitute for sufficiency. However, none of them proved useful.

Finally, the set of variables was reviewed in light of the time required to complete the overall inspection. Three categories of variables were given special emphasis: (1) variables that need to be evaluated in each room; (2) surface and condition ratings; and (3) blockface characteristics. Variables in the first category included: condition of windows, presence of storm window or double glazed windows, and heat control, among others. Because these are time consuming to collect, we included them only if they seemed to be directly important in past equations and not susceptible to replacement by any general rating or interview question.

The surface and structural condition ratings for each room were of particular concern. Experience shows that these ratings have always presented a problem. They either enter the equation with a wrong sign or are insignificant. In the Section 8, all ratings loaded on a specific factor, but the factor was insignificant when entered in the equation. Average surface and structure conditions was then tested and entered as a summary variable rather than a factor score. The variable was significant but had the wrong sign. We attempted to enter two separate variables: average structure condition and average surface condition. The structure variable continued to have the wrong sign and the surface variable became insignificant. Overall ratings for the unit, on the other hand, are always significant. Nevertheless, we ultimately retained the individual ratings on the grounds that they may be important in forcing the evaluator to review each room and may thus condition the overall rating. We did, however, simplify the individual structure and surface ratings. These were previously measured separately. Upon review, however, it was apparent that a good surface rating is inconsistent with a bad structural rating. We therefore combined the structure and surface ratings into one, where the lowest rating reflects structural deficiencies and the three higher ratings deal with surface conditions only.

The blockface variables were carefully reevaluated. The Housing Measurement Survey used in the 1979 Section 8 Evaluation called for a time-consuming blockface survey asking evaluators to count the number of parcels falling into a number of categories such as single family units, garden apartments, duplexes, and highrises, as well as categories for other land uses such as commercial and industrial. None of these specific breakdowns were used in the Section 8 final equation. The only variables which were significant were the percent of residential units in the blockface, the percent of commercial and industrial parcels, and the presence of attractive features such as public parks. These variables were tested to see if they could be replaced by a few questions asked of the occupant. As discussed in Section E.3.4, the inspection variables performed better than the interview questions. The derivation of these few variables, however, did not seem to warrant the extremely time consuming process of categorizing and counting each panel in the blockface for 30 or more subcategories. The three variables that proved significant were derived by aggregating all subcategories into overall categories such as residential, commercial, and industrial. Based on this experience, the blockface portion was redesigned to collect the data on a much less detailed basis.

The final candidate set of variables is listed in Table E.7. These formed the basis for design of the Housing Quality Inspection form, discussed in Appendix B.

E.2.8 Refining the Specification Using Demonstration Data

We adopted the variables of Table E.7 as the pre-specified set of variables for inclusion in the hedonic equations. We then refined this list further in two ways, using Demonstration data:

1. We chose among alternative variables.
2. We eliminated some variables that were clearly not associated with rent in our samples.

Each of these is discussed below.

Alternative Variables. Several of the variables listed in Table E.7 are potentially redundant. We examined a pooled equation for all PHAs using only Housing Voucher households to select from among alternative sets. We used only one program to avoid decisions that might be based on correlations with program differences. Specifically, we

- Used a combined commercial/industrial dummy instead of separate ones for more than 50 percent (MIXED instead of COMMERCIAL and INDUSTRIAL).
- Determined that there seemed to be no useful distinctions between more than 75 percent and 100 percent residential.
- Determined that scaling the number of amenities in other rooms by the number of rooms (AMOTHRMS) seemed preferable to the unscaled variable (AMENOTH).
- Determined that it seemed preferable to include living room amenities with other features (VR9 instead of NAMENLU).
- Determined that it seemed desirable to omit certain commonly found amenities from the count of kitchen amenities (use NAMENK2 instead of NAMENK).

These all constituted minor refinements to the specifications.

TABLE E.7

FINAL SET OF CANDIDATE VARIABLES USED IN DESIGN OF HOUSING QUALITY INSPECTION FORM

Variable Name	Description
Tenure	
*X1 (RELATE)	Landlord or owner is related to family (0,1)
*X2 (LNTIME)	Length of tenure in unit (# months, natural log)
X3 (RESIDTLL)	Landlord or owner lives in building or complex (0,1)
Unit Size	
*X14 (SQTOTRM)	Square feet per room (total unit size divided by number of rooms in unit-(rooms includes storage utility and kitchen))
*X15 (NBATH)	Number of full baths plus one-half the number of half baths (does not have to be in working order)
*X16 (LNROOMS2)	Natural log of the number of rooms including the kitchen (excludes storage, utility, non-sleeping rooms, bathrooms, and halls)
Dwelling Unit Quality	
*VAR 1B	Average housing quality rating (rating on condition of rooms, ceilings, walls, floors, kitchen appliances, bathroom fixtures)
*X4 (LNBLDAGE)	Building age (natural log; 78 = 1919 or earlier; 56 = 1920-1945; 36 = 1946-1959; 19 = 1960-1986; 1 if <1 year)
*KITEQUIP	Total number of dishwashers, disposals and microwaves provided by the landlord
X18 (PSERV)	Public service near building (includes schools, hospitals and churches (0,1))
*VAR 6	Number of recreational facilities (e.g., pools, basketball courts) provided with building
*LLAC	Air conditioning equipment is present and provided by the landlord (0,1)
*X10 (NOHEAT)	No heat or interior source of heat (fireplace, stove, unvented space heaters, portable electric heaters (0,1))
*VAR 10A	Number of hazards present in unit (includes boilers, hot water heaters, sewers, rats, electrical systems)
*VAR 3B	Condition of amenities in common halls
NAMENK	Number of amenities in kitchen
NAMENK2	Number of amenities in kitchen (excluding items which have high occurrences. double sink, double oven, backsplash and range hood)
*NAMENB	Number of amenities in bathroom
*AMENHALL	Number of amenities in halls or vestibules
NAMENLV	Number of amenities in living room
*VAR 9	Number of balconies, porches, and special windows in living room, kitchen, and first other room
AMENOTH	Number of amenities in other rooms
*AMOTHRMS	Number of amenities per room (outside of living room, kitchen, and bath)
X13 (ATTRACT)	Number of other attractive features of unit not recorded elsewhere

TABLE E.7 (continued)

FINAL SET OF CANDIDATE VARIABLES USED IN DESIGN OF HOUSING HOUSING INSPECTION FORM

Variable Name	Description
Utilities	
*HUTIL	Scheduled allowance for utilities not included in the rent as calcualted by the Section 8 Program
*X22 (HEATRMB)	A scaled variable indicating that heat is included in the contract rent (equals zero if heat is not included and otherwise equals the number of rooms in the unit, excluding storage, utility rooms, non-sleeping rooms, bathrooms, and halls)
Building Type	
*X5 (SFAMDET)	Single family, detached unit (0,1)
*X6 (DUPLEX)	Duplex or two family unit (0,1)
*X7 (GARDMULT)	Garden apartment or other multi-family house four stories or fewer (0,1)
*X8 (SINGLE)	Single family, row, or converted (0,1)
*X9 (HIGHRISE)	Highrise, more than four stories (0,1)
Building Exterior and Grounds	
X17 (PPARK)	Presence of a park (includes waterfront, woods, farmland, or clean open fields (0,1)
X11 (NICEYD)	Quality of yard (superior maintenance, extensive landscaping, cleanliness (0,1)
Blockface	
RES75	Blockface ≥75% residential (0,1)
RES100	Blockface 100% residential (0,1)
MIXED	Blockface that is 50% or more mixed use (0,1))
COMMERCIAL	Blockface that is 50% or more commercial (0,1)
INDUSTRIAL	Blockface that is 50% or more industrial (0,1)
*RURAL	Blockface that is 50% or more rural (includes semi-rural (0,1))
*X20 (COMMIND)	Presence of commercial or industrial activities (0,1)
*ABANI	Abandoned building in the vicinity--evaluator observation (0,1)
*ABANS	Abandoned building in the vicinity--respondent perception (0,1)
Surrounding Parcels and Grounds	
*X12 (CLEANPAR)	Cleanliness of surrounding residential parcels (1 if major litter; 2 if moderate litter, 3 if minor litter; 4 if very clean)
*CMEDVAL	Median 1980 value (in thousands of dollars) of owner-occupied units in the Census tract, times the percent of occupied units in the tract that are owner-occupied
*CMEDGRT	Median 1980 rent of renter-occupied units in the Census tract, times the percent of occupied units in the tract that are renter-occupied.

* = Variable retained in final specification (see Section E.2.8).

Eliminating Variables. Given a prior specification, there is always some question as to whether the data used in estimation should be used to select a subset of the prior variables. We adopted a very conservative rule for dropping variables from the pre-specification. We ran equations using contract rent and the log of contract rent:

- For each program pooling all PHAs (four equations, two for rent and two for log rent).
- For each PHA pooling the two programs (20 equations, 10 for rent and 10 for log rent).

We dropped a variable only if all of the following considerations were met:

1. In the four pooled site equations, three or more of the t-statistics for the variable were less than 1.2.
2. There was no evidence that the variable was useful in the individual site equations in that for both the rent and log rent equations it was
   - Never significant at the 0.05 level
   - Significant at the 0.1 level no more than once
   - Had a t-statistic greater than 1.2 no more than twice
   - Had a t-statistic greater than 1 no more than three times.

This resulted in dropping the following variables:

X3	Landlord or owner lives in building
VRS6	Number of sports facilities provided by building
NAMENK2	Number of unusual amenities in the kitchen
X13	Superior yard
X11	Other attractive features
MIXED	More than 50 percent of blockface is commercial or industrial
RES75	More than 75 percent residential
X17	Presence of park
X18	Public buildings nearby

The final set of variables are those asterisked in Table E.7.

E.3 Comparison of the Two Programs

Having arrived at a final specification for the hedonic equations, we then considered the specification of the comparison of the two programs. Thus far, we had specified that in general

(12) $R = X'\beta + \varepsilon$

where:

R = Contract rent or the log of contract rent

X = A vector of values for the characteristics discussed in previous sections

β = The vector of hedonic coefficients

ε = A stochastic term

In principle, the hedonic coefficients (the β) may vary across sites, programs, and the mover/stayer strata. Accordingly, our first step was to see whether estimates could be provided across any of these sets of observations. In each case we tested complete stratification against pooling with a dummy variable included to distinguish the collapsed strata. Thus, for example, in testing for pooling sites, we compared:

(12) Fully Stratified: $R^k_{ijr} = X^k_{ijr}\beta_{jr} + \varepsilon^k_{ijr}$

(13) Pooled Sites: $R^k_{ijr} = X^k_{ijr}\beta^k_r + S^k_{ijr}\delta^k_r + \varepsilon^k_{ijr}$

where

R^k_{ijr} = Rent of i^{th} person in j^{th} PHA and r^{th} stratum and k^{th} program

X^k_{ijr} = Vector of housing descriptors for i^{th} person in j^{th} PHA in r^{th} stratum in k^{th} program

β^k_{jr} = Set of coefficients allowed to vary across each PHA/stratum/program combination

β^k_r = Set of coefficients allowed to vary across each stratum and program combination

S^k_{ijr} = A vector of dummies indicating in which site the i^{th} observation in the j^{th} PHA and r^{th} stratum in the k^{th} program) falls

δ_r^k = Coefficients of the dummies, allowed to differ for each stratum and program combination.

We considered both overall tests for pooling and the test statistics for specific strata. The results are presented in Table E.8, which shows both the test statistics and the percentage change in the (unweighted) mean standard error associated with each stratification. Basically, the tests reject pooling along any dimension. In each specification, pooling programs or mover/stayer strata increases the standard error less than pooling across sites. Indeed, pooling programs (up to a shift term) is not rejected for the stayer stratum in the linear and log specifications involving the dummy variable for whether or not heat is included in the rent. Pooling strata (up to a shift term) is not rejected for the Certificate Program in three of the four specifications. Even so, pooling is always rejected for the sample as a whole and is always rejected for subgroups in at least one specification.

These results pose a problem for the analysis. The sample size was too small to permit estimation of the fully stratified hedonic equation for the stayer stratum in four sites (Atlanta, Montgomery County, Pittsburgh, and San Antonio). Indeed, in two sites estimates could not be derived for the stayer stratum with pooled programs. Accordingly, we were forced to pool the mover and stayer strata if we were to develop estimates for the entire sample.

We adopted the following strategy. First, we estimated equations based on pooling the mover/stayer strata (up to a shift term).[1] We then estimated separate equations for movers and compared these estimates with the estimates for movers from the pooled mover/stayer specification. We also developed estimates for stayers based on the pooled specification. In doing this we hoped to provide both the best estimates for movers (based on separate specification) and some sense of whether estimates based on the pooled mover/stayer specifications were likely to be materially misleading.

[1]We could, of course, have weighted the observations with their sampling weights in developing the pooled estimates. Unfortunately, the weighted regression programs available to us are based on econometric models in which weighting is used to improve efficiency in the presence of heteroskedasticity. In these models, weights reflect relative variances of the stochastic term across individuals rather than sampling weights. Because of this, these programs compute the wrong standard errors for situations where weights are based on sampling probabilities.

TABLE E.8

TEST STATISTICS FOR POOLED ESTIMATES

	Degrees of Freedom	Rent with Heat Dummy		Rent with Utility Allowance		Log Rent with Heat Dummy		Log Rent with Utility Allowance	
		F-Statistic	Percentage Increase in St. Dev. of Residual	F-Statistic	Percentage Increase in St. Dev. of Residual	F-Statistic	Percentage Increase in St. Dev. of Residual	F-Statistic	Percentage Increase in St. Dev. of Residual
Pooling Sites (stratified by program and mover/stayer)									
Housing Voucher Program	F (385,342)	1.89**	21.4%	1.85**	20.5%	1.87**	20.8%	1.93**	22.3%
Certificate Program	F (384,341)	1.73**	17.8%	1.75**	18.2%	1.85**	20.4%	1.62**	15.2%
Mover stratum	F (432,564)	1.82**	16.4%	1.74**	14.9%	1.82**	16.4%	1.56**	11.5%
Stayer stratum	F (337,119)	1.73**	24.0%	1.88**	28.6%	1.48**	16.2%	1.76**	25.1%
All	F (769,683)	1.83**	19.9%	1.81**	19.6%	1.86**	20.6%	1.78**	18.8%
Pooling Programs (stratified by site and mover/stayer)									
Mover stratum	F (231,564)	1.41**	5.8%	1.31**	4.4%	1.63**	8.8%	1.31**	4.4%
Stayer stratum	F (163,119)	1.23	6.5%	1.33*	9.3%	1.14	4.0%	1.40*	11.0%
All	F (394,683)	1.37**	6.5%	1.33**	5.8%	1.55**	10.0%	1.44**	7.7%
Pooling Mover/Stayer Strata (stratified by site and program)									
Housing Voucher Program	F (186,342)	1.37**	6.2%	1.37**	6.4%	1.56*	9.4%	1.71**	11.9%
Certificate Program	F (183,341)	0.98	-0.4%	0.95	-0.9%	1.45**	7.6%	1.09	1.5%
All	F (369,683)	1.21*	3.6%	1.20*	3.5%	1.51**	8.6%	1.41**	7.0%

** = Significant at 0.01 level
* = Significant at 0.05 level
‡ = Significant at 0.10 level

The rest of this section and the next describe the results of the pooled mover/stayer estimation. Section E.5 describes the results of equations estimated separately for the mover stratum. Section E.6 then presents the estimations for stayers and movers based on the pooled mover/stayer equations and discusses the extent to which the estimate for movers from the pooled mover/stayer specification differs from the estimate from the equation estimated for movers alone.

Our specification for the hedonic pooled mover/stayer equation was:

$$(14) \qquad R = X\beta_j^k + \varepsilon_j^k$$

where:

R = Rent

X = A set of descriptors including a dummy (0,1) variable for the mover/stayer stratum

β_j^k = A set of coefficients allowed to vary across each site/program combination.

Given the general lack of difference associated with the two utility specifications in Tables E.6 and E.8, we confined ourselves to the linear and log specifications using the dummy variable to indicate whether or not heat was included in the rent.[1] The 40 equations estimated following these two specification are presented in the Supplement to this appendix. For convenience, some key features are presented in Tables E.9 to E.11. The linear equations' fit was reasonably good with an average R^2 of 70 percent or more and an adjusted R^2 of around 60 percent. The linear specification's

[1]The only substantial difference in results for specifications using the two different utility adjustments was in the test for pooling the mover/stayer strata for the Certificate Program in the log (rent) equations. When the heat-included dummy was used in the log (rent) equations pooling strata in the Certificate Program increased the standard error by 7.6 percent and was rejected. In equations using the utility allowance variable in the log (rent) equation, pooling the mover/stayer strata in the Certificate Program increased the standard error by only 1.5 percent and was not rejected. Pooling the mover/stayer strata for the Certificate Program was not rejected in the linear (rent) equations for either utility variable.

TABLE E.9

SUMMARY OF SUMMARY STATISTICS FOR HEDONIC REGRESSIONS STRATIFIED BY PHA AND PROGRAM

	Ten Housing Voucher Program Regressions	Ten Certificate Program Regressions
Degrees of Freedom:		
Range	41-60	48-57
Mean	53	52
Linear Regression		
R^2		
Range	0.61 to 0.84	0.57 to 0.84
Mean	0.74	0.73
Adjusted R^2		
Range	0.42 to 0.77	0.35 to 0.76
Mean	0.62	0.59
Root MSE		
Range	\$41.04 to \$89.56	\$33.87 to \$62.27
Mean	\$59.48	\$43.67
Coefficient of variation		
Range	11% to 21%	11% to 14%
Mean	13.6%	11.5%
Log Linear Regression		
R^2		
Range	0.64 to 0.86	0.56 to 0.85
Mean	0.75	0.71
Adjusted R^2		
Range	0.46 to 0.78	0.33 to 0.78
Mean	0.63	0.56
Root MSE (x 100)		
Range	9.2 to 19.4	9.4 to 19.4
Mean	13.3	12.3

TABLE E.10A

LINEAR SPECIFICATION COEFFICIENTS

Variable	Expected Sign[a]	Housing Voucher Program: Number of Times Dropped	Housing Voucher Program: Significant Positive[c]	Housing Voucher Program: Significant Negative[c]	Certificate Program: Number of Times Dropped	Certificate Program: Significant Positive[c]	Certificate Program: Significant Negative[c]
Heat included in contract rent	+		4	1		5	1
Tenure related to landlord	-	1		2	3		3
Length of tenure (log of months)	-			4		1	5
Square feet per room	+		7			6	
Number of bathrooms	+		4			5	
Log (number of rooms)	+		10			9	
Average evaluator rating of condition	+		2			1	
Log of building age	-		2				2
Kitchen equipment provided	+			1		1	2
Air conditioning provided	+	1	1			3	
No heat in unit	-	5	1		7		
Number of hazards	-		2			1	1
Condition of common halls	+		1			1	1
Amenities in bathrooms	+		2	1			
Amenities in halls	+					1	1
Balconies/porches/windows	+		1			1	
Amenities per room in other rooms	+			4			
Single family detached	+	1	6	1			1
Duplex or two-family	?	1	1			1	1
Single row family house	+	3		1	3		2
Highrise	?	3			4	2	1
Rural area	?	8			8	1	
Commercial/industrial actilities in area	-	1	1	2			
Abandoned buildings (evaluator)	-		1	1	1		
Abandoned buildings (tenant)	-	1		1			
Cleanliness of surrounding parcels	-			3			
Scaled median value owner-occup. units in tract	+		1			1	1
Scaled median rent-renter occup. units in tract	+		1			1	
Mover stratum	?		3			3	

[a]See Table E.7 for definitions of variables.
[b]Number of equations in which the variable appears.
[c]Significant at 0.10 level.

TABLE E.10B

LOG SPECIFICATION COEFFICIENTS

Variable	Expected Sign[a]	Housing Voucher Program			Certificate Program		
		Number of Times Dropped	Significant Positive[c]	Significant Negative[c]	Number of Times Dropped	Significant Positive[c]	Significant Negative[c]
Heat included in contract rent	+		4	1		5	1
Tenure related to landlord	-	1		1	3		3
Length of tenure (log of months)	-			4		1	5
Square feet per room	+		6			7	
Number of bathrooms	+		3			4	
Log (number of rooms)	+		10			9	
Average evaluator rating of condition	+		2		7	1	1
Log of building age	-		2				2
Kitchen equipment provided	+			1		1	1
Air conditioning provided	+	1	1			3	
No heat in unit	-	5					
Number of hazards	-		3	1			1
Condition of common halls	+		1			1	
Amenities in bathrooms	+		2	1			
Amenities in halls	+					1	1
Balconies/porches/windows	+		1			1	
Amenities per room in other rooms	+			4			
Single family detached	+	1	5	1			1
Duplex or two-family	?	1					1
Single row family house	+	3	1	1	3		1
Highrise	?	3			4	1	1
Rural area	?	8			8	1	
Commercial/industrial actitities in area	-	1	1	1			
Abandoned buildings (evaluator)	-		1		1		
Abandoned buildings (tenant)	-	1		1			
Cleanliness of surrounding parcels	-		2	2			
Scaled median value owner-occup. units in tract	+		2	1		1	
Scaled median rent-renter occup. units in tract	+		1			1	
Mover stratum	+		2			2	

[a]See Table E.7 for definitions of variables.
[b]Number of equations in which the variable appears.
[c]Significant at 0.10 level.

TABLE E.11

TESTS OF VARIABLE SETS FOR HEDONIC EQUATIONS STRATIFIED BY PHA AND PROGRAM

	Housing Voucher Program		Certificate Program	
	F-Statistic	Percentage Increase in Std. Error	F-Statistic	Percentage Increase in Std. Error
Linear Specification				
Unit quality and building descriptors	F (136,528) = 1.82**	8.1%	F (137,524) = 1.50**	5.1%
Neighborhood variables	F (60,528) = 1.27‡	1.4	F (62,524) = 1.06	0.3
Combined unit, building, and neighborhood	F (196,528) = 1.73**	9.5	F (199,524) = 1.53**	7.0
Log Specification				
Unit quality and building descriptors	F (136,528) = 1.85**	8.3	F (137,524) = 1.40*	4.1
Neighborhood variables	F (60,528) = 1.57**	2.9	F (62,524) = 0.86	-0.7
Combined building, unit, and neighborhood	F (196,528) = 1.89**	11.4	F (199,524) = 1.42**	5.6

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

coefficient of variation was about the same as the log-linear standard error--indicating that both specifications do about equally well.[1]

There is a relatively small number of degrees of freedom in each site. If we had been using these observations to select variables for the hedonic equations and to select among alternative specifications, we would be concerned about over-fitting and would discount the R^2 obtained. Use of a pre-specified equation based on other data removes this concern.

Tables E.10A and E.10B present information on the sign patterns of the individual coefficients. Table E.10A deals with the linear specification, Table E.10B with the log specification. For each of these we estimated 10 separate equations (one for each site) for each program. The tables show for each set of 10 program equations the number of times a coefficient had a significant positive or negative value. A test level of 0.10 is used, so we

---

[1]For a regression of the form

$$R = X\beta + \varepsilon$$

the coefficient of variation is defined by

$$c.v. = \frac{\hat{\sigma} \times 100}{\bar{R}}$$

where

$c.v.$ = Coefficient of variation.

$\hat{\sigma}$ = The estimated standard deviation of the residual

$\bar{R}$ = The mean of the dependent variable

Under a log-linear specification,

$$\ln R = X\beta + \varepsilon$$

$$c.v.(R) = \frac{\exp(\overline{\ln R})[(\exp \sigma^2)(1-\exp \sigma^2)]^{\frac{1}{2}}}{\exp(\overline{\ln R}) \exp(\sigma^2/2)}$$

$$=(1 - \exp \sigma^2)^{\frac{1}{2}}$$

$$\cong \hat{\sigma}_\varepsilon$$

could expect a spuriously significant coefficient in one of the ten sites for each variable.

An additional column for each program in Tables E.10A and E.10B shows the number of times that the variable was dropped from a site equation for that program. As already indicated, our basic specification in each site for each program included all of the asterisked variables from Table E.7. However, some variables (such as located in a rural area) did not vary for the observations in some sites and programs. In these cases, we have no way to estimate a coefficient for that variable in that site-program combination, and the variable is simply dropped, though retained for other site-program equations.[1]

With this in mind, the results seem generally reasonable. The most frequently significant variables were found among the variables on condition of tenure (especially whether heat was included in the rent and length of stay) and the variables on unit size (number of rooms, number of baths, and square feet per room). Given the expectation of one spurious significant coefficient per variable, the sign patterns were generally reasonable. The only obviously odd result was the fact that the variable counting other amenities per room (outside of bathrooms and halls) had a significant negative coefficient in 4 of the 10 Housing Voucher equations in both the linear and log specifications. In addition, the variable for number of hazards was significantly positive in two sites and the variable for building age significantly negative in the two sites in the Housing Voucher equations. The variable for single family row house and the variable for kitchen equipment provided by the landlord were each significantly negative in two sites in the Certificate Program equations.

Based on Table E.10, many of the individual variables do not appear to be significant except by chance. This was not unexpected. As discussed in Section E.2.5, the concern in selecting variables was to include as many relevant variables as possible, reflecting a willingness to improve overall predictive power at the expense of less precision for specific coefficients. It is, however, appropriate to examine the extent to which sets of variables

[1]Since the dropped variables have the same value for all observations, their effect is simply subsumed in the constant term.

in fact contribute to the equations' fit, and this is done in Table E.11. As shown, the various unit quality and building descriptors were significant in both programs. Omission of these variables in all ten site estimates increased the estimated standard error by about 8 percent in the Housing Voucher Program and 4 to 5 percent in the Certificate Program. The neighborhood variables, on the other hand, were significant only for the Housing Voucher Program under the logarithmic specification. Even in that case, omission of these variables only increases the estimated standard error by about 3 percent. We do not seem to have done very well in capturing neighborhood differences.

The estimated hedonic equations for the two programs can now be used to compare the differences in the value of recipient housing. Consider first the linear specification. The linear hedonic specification essentially says that, on average, units' rents are determined by the sum of their attributes times the price per unit paid for each attribute--that is,

$$R = X'\beta_{jk} \tag{15}$$

where

- R = Unit rent
- X = The vector of the amounts of each attribute provided by the unit
- β_{jk} = The vector of hedonic "prices" for the k^{th} program in the j^{th} site.

Accordingly, the difference in average rents between the two programs in any site may be written:

$$\overline{R}_v - \overline{R}_c = \overline{X}_v\beta_v - \overline{X}_c\beta_c \tag{16}$$

We can decompose the difference in rents from Eq. (16) into a difference in value and a difference in price in either of two ways:

$$\overline{R}_v - \overline{R}_c = \overline{X}_c(\beta_v - \beta_c) + (\overline{X}_v - \overline{X}_c)\beta_v \tag{17}$$

or, at the site level,

$$(18) \qquad \bar{R}_{jv} - \bar{R}_{jc} = \bar{X}_{jc}(\beta_{jv} - \beta_{jc}) + (\bar{X}_{jv} - \bar{X}_{jc})\beta_{jv})$$

Notice that, as usual, we have a choice of price/value decompositions. In words, we evaluate the difference in prices between the two programs in the j^{th} site by comparing the cost of the average Certificate Program housing bundle under the prices paid by recipients in each program-- $X_{jc}(\beta_{jv}-\beta_{jc})$. Conversely, the real difference in housing is evaluated as the differences in attributes valued at Housing Voucher Program prices-- $(\bar{X}_{jv}-\bar{X}_{jc})\beta_{jv}$.

We could, of course, reverse the decomposition and evaluate price changes in terms of the Housing Voucher bundle-- $\bar{X}_{jv}(\beta_{jv}-\beta_{jc})$ --and real change in terms of Certificate Program program prices-- $(\bar{X}_{jv}-\bar{X}_{jc})\beta_{jc}$. Usually there is no reason to prefer one decomposition to another. In this case, however, there is some reason to prefer the decomposition of Eq. (17) and 18 based on Housing Voucher prices. This is because models of shopping behavior under the two programs suggest that estimated prices for the Certificate Program may tend to systematically underestimate the cost of deviations from the mean Certificate bundle. We will discuss this problem further in Sections E.4 and E.5, below. For the moment we simply present the Housing Voucher decompositions. Specifically, we decompose the difference in average contract rent between the two programs in each PHA as follows:

Mean Housing Voucher Contract Rent	$\bar{R}_{jv}\ (= \bar{X}_{jv}\hat{\beta}_{jv})$
Mean Certificate Program Contract Rent	$\bar{R}_{jc}(= \bar{X}_{jc}\hat{\beta}_{jc})$
Difference in Contract Rent	$\bar{R}_{jv} - \bar{R}_{jc}$
<u>Decomposition in Terms of Housing Voucher Prices</u>	
Cost of Certificate Bundle	$\bar{X}_{jc}\hat{\beta}_{jv}$
Difference Due to Cost	$\bar{X}_{jc}(\hat{\beta}_{jv} - \hat{\beta}_{jc}) = \bar{X}_{jc}\hat{\beta}_{jv} - \bar{R}_{jc}$
Percentage Difference in Cost	$\bar{X}_{jc}(\hat{\beta}_{jv} - \hat{\beta}_{jc})/\bar{X}_{jc}\hat{\beta}_{jc}$
Difference in Real Housing	$(\bar{X}_{jv} - \bar{X}_{jc})\hat{\beta}_{jv}$
Percentage Difference in Real Housing	$(\bar{X}_{jv} - \bar{X}_{jc})\hat{\beta}_{jv}/\bar{X}_{jc}\hat{\beta}_{jv}$

where

$\bar{R}_{jk}$ = Mean contract rent of recipient units in the k^{th} program in the j^{th} PHA (k = c or v)

$\bar{X}_{jk}$ = Mean vector of housing attributes of recipient units units in the k^{th} program in the j^{th} PHA

$\hat{\beta}_{jk}$ = The estimated hedonic coefficient for the linear hedonic specification

Further, we can construct the same numbers from the logarithmic specification by replacing $X\beta$ by $\exp(X\beta)$.[1]

We combine the individual site estimates for each element of the decomposition into an overall estimate by taking weighted averages across sites. The results are presented in Table E.12.[2]

The results indicate that all or almost all of the difference in average rents paid by recipients in the two programs is accounted for by differences in price. Housing Voucher recipients on average pay about 6 percent more in rent than Certificate Program recipients. Of this, roughly 5 percent is accounted for by higher prices for comparable units than Certificate Program recipients and the remaining one percent or less by a (statistically insignificant) improvement in real housing.

Table E.13 compares the weighted mean values of all of the hedonic variables in the two programs. As can be seen there is little obvious evidence of large or systematic differences. Most differences are relatively small in percentage terms. The few large percentage changes generally represent small absolute changes in dummy variables with very low incidences. The two exceptions are at 6.5 percent higher value for the scaled heat dummy in the Housing Voucher Program and the percentage differences in

[1]The $\text{Exp}(X\beta)$ is an estimate of median rent under the log specification so that R is replaced by estimated median rents.

[2]Estimates of price differences in each site are presented in Appendix F.

TABLE E.12

DECOMPOSITION OF DIFFERENCES IN AVERAGE CONTRACT RENT

	Linear Specification with Heat Dummy					Log Specification with Heat Dummy[a]				
	Value	Within Std. Error	(t)	Total Std.Error	t-Statistic	Value	Within Std. Error	t-Statistic	Total Std. Error	t-Statistic
Mean Housing Voucher contract rent	$448.99	4.01	NR	$30.32	NR	$429.19	$0.59	NR	$4.70	NR
Mean Certificate Program contract rent	$424.00	3.22	NR	31.51	NR	$406.71	0.48	NR	4.86	NR
Difference in contract rent										
Dollars	$24.99	5.14	4.86**	5.42	4.61**	$22.48				
Percent	5.9%					5.5%	1.1 pts	4.91**	1.1 pts	4.09**
Decomposition of Housing Voucher Prices										
Cost of Certificate bundle	$445.85	3.74	119.31**	110.77	4.03**	$425.60	0.55	NR	$141.85	NR
Difference in price[b]	$21.85	4.19	5.21**	5.85	3.74**	$18.89				
Percentage difference in price	5.2%					4.6%	0.9 pts	4.96	1.1 pts	4.14
Difference in real housing[b]	$3.13	2.72	1.15	5.74	0.55	$3.59				
Percentage difference in real housing	1.0%					0.8%	0.5 pts	1.48	1.1 pts	0.76

[a]Entries under the log specification are estimated medians (i.e., the exponentiated log estimates).

[b]Estimated Differences in Cost and Differences in Real Housing are each estimated directly from the hedonic coefficients and may not sum to the total difference in contract rent due to rounding errors.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

TABLE E.13

AVERAGE LEVEL OF HOUSING CHARACTERISTICS INCLUDED IN THE HEDONIC EQUATION

Variable	Housing Voucher Program	Certificate Program	Difference	Within PHA Standard Error of Difference	Percentage Difference
Heat included (x number of rooms)	1.49	1.40	0.09	0.08	6.5%
Tenure					
Related to landlord	2.3%	2.9%	-0.6 pts	0.8 pts	-20.7
Length of tenure (log of months)	3.02	2.98	0.05	0.04	1.6
Unit Size					
Square feet per room	133.10	133.28	-0.18	1.38	-0.1
Number of bathrooms	1.11	1.10	0.01	0.02	1.2
Log (number of rooms)	1.49	1.48	0.01	0.01	0.4
Amenities					
Average evaluator rating of condition	3.66	3.65	0.01	0.02	0.4
Log of building age	3.50	3.52	-0.02	0.02	-0.5
Kitchen equipment provided	61.3%	55.8%	5.5 pts	3.9 pts	9.9
Air conditioning provided	32.5%	32.4%	0.1 pts	1.9 pts	0.5
No heat in unit	2.2%	1.3%	0.9 pts+	0.5 pts	71.1
Number of hazards	0.17	0.19	-0.01	0.03	-7.8
Condition of common halls	1.23	1.21	0.02	0.06	1.9
Amenities in bathroom	0.62	0.56	0.06	0.05	10.5
Amenities in halls	0.22	0.28	-0.06	0.04	-20.4
Balconies/porches/windows	0.46	0.42	0.03	0.04	7.8
Amenities per room in other rooms	0.16	0.15	0.01	0.02	8.8
Building Type					
Single family detached	23.8%	22.9%	0.9 pts	2.1 pts	3.7
Duplex or two-family	9.2%	9.9%	-0.7 pts	1.5 pts	7.2
Single row family house	4.8%	3.1%	1.7 pts+	0.8 pts	54.0
Highrise	10.6%	11.5%	-0.9 pts	1.3 pts	-7.9
Neighborhood					
Rural area	1.1%	0.4%	0.7 pts+	0.4 pts	163.0
Commercial/industrial activities in neighborhood	5.2%	6.5%	-1.2 pts	1.1 pts	-19.1
Abandoned buildings (evaluator)	14.7%	15.6%	-0.9 pts	1.9 pts	-5.5
Abandoned buildings (tenant)	14.1%	14.7%	-0.6 pts	1.9 pts	-4.0
Cleanliness of surrounding parcels	3.25	3.22	0.03	0.04	0.9
Scale median value of owner-occupied units in tract	19.09	18.70	0.39	0.62	2.1
Scaled median value of renter-occupied units in tract	127.79	131.17	-3.38	2.51	2.6

** = significant at 0.01 level
* = significant at 0.05 level
\+ = significant at 0.10 level

the amenity variables for bathrooms (higher in the Housing Voucher Program) and other rooms (lower in the Housing Voucher Program). None of these differences is statistically significant.

The next section discusses the extent to which the results may be influenced by omitted variables. After that, in Sections E.5 and E.6, we consider the extent to which results may reflect an inappropriate pooling of movers and stayers. Finally, Section E.7 discusses the interpretation of these differences in price in terms of comparison of the two programs.

E.4 Specification Error and Omitted Variables

In the preceding section, we have interpreted differences in estimated hedonic coefficients for recipients in the two programs as estimating differences in the average amounts the recipients pay for similar housing. This requires that the hedonic equation be properly specified. We cannot, of course, guarantee this. To some extent we must rely on the combination of substantial pre-specification and investigation of results under alternative specifications to guard against specification error. There are, however, two problems that deserve special mention--omitted variables and cross-sectional versus longitudinal regressions.

Consider first the problem of omitted variables. We cannot reasonably believe that the housing characteristics included in the hedonic equation constitute a complete description of the units. We must assume that there are other, omitted characteristics that also contribute to the units' market value. The problem this poses for analysis of the two programs is that we cannot be sure whether differences in rents paid net of market value reflect differences in prices or differences in omitted characteristics. To see this more clearly we can write the hedonic specification with omitted variables

$$(19) \qquad R = R^c = x\beta^c_j + A^c_j + \eta^c_j$$

$$(20) \qquad R^v = X\beta^v_j + A^v_j + \eta^v_j$$

where

R^k = Unit rents in the k^{th} program

X = Included variables

β_j^k = The hedonic coefficients for the k^{th} program in the j^{th} site

A = The contribution of omitted housing characteristics to market value

We estimated price effects in each site by computing

$$(21) \qquad \hat{P}_v = \hat{R}_j^v(\overline{X}_j^c) - \hat{R}_j^c(\overline{X}_j^c) = \overline{X}_j^c(\hat{\beta}_j^v - \hat{\beta}_j^c)$$

where

$\hat{P}_v$ = The difference in Housing Voucher and Certificate rents due to price differences

$\hat{R}_j^v(X_j^v)$ = The estimated rent in the j^{th} site for the mean Certificate Program bundle under Housing Voucher prices (= $\overline{X}_j^c\hat{\beta}_j^c = \overline{R}_j^c$))

$\hat{R}_j^c(X_j^c)$ = The estimated rent in the j^{th} site for the mean Certificate Program bundle under Certificate Program prices (= $\overline{X}_j^c\hat{\beta}_j^c = \overline{R}_j^c$)

$X^c{}_j$ = The mean value of included attributes in the Certificate Program in the j^{th} site

$\hat{\beta}_j^v$ = The estimated Housing Voucher hedonic coefficients in the j^{th} site

$\hat{\beta}_j^c$ = The estimated Certificate Program hedonic coefficients in the j^{th} site

If there are omitted variables, then error term in the estimated hedonic regression will consist of the sum of omitted variables (A) and the stochastic term (η). The included variables, X, will absorb the variation in A that is represented by a linear regression of A on X, so we assume that we are considering A as the residuals from such a regression. We are thus guaranteed that A is orthogonal to X in the sample. Accordingly, we can still be sure that:

$$(22) \qquad E(\hat{R}^c_j(\overline{X}^c_j)) = E(\overline{X}^c_j\hat{\beta}^c_j)$$

$$= \overline{X}^c_j\beta^c_j$$

$$= \overline{X}^c_j\beta^c_j + E(A^c_j + \eta^c_j|\overline{X}^c_j)$$

$$= E(R^c_j|\overline{X}^c_j)$$

Since X includes a constant term, the orthogonality of A to X in the sample guarantees that the mean effect of omitted variables at the sample mean $(X^c{}_j)$ is zero. However, this does not mean that the expected value of A is independent of X (i.e., that A always has a mean of zero). Thus, the estimated cost of the Certificate Program bundle under Housing Voucher prices may be biased. Specifically,

$$(23) \qquad E(\hat{R}^v_j(\overline{X}^v_j)) = E(\overline{X}^c_j\hat{\beta}^v_j)$$

$$= \overline{X}^c_j\beta^v_j$$

$$= E(R^v_j|\overline{X}^c_j) - E(A^v_j - \overline{A}^v_j)|\overline{X}^c_j)$$

Thus the price term is biased by including the value of the change in omitted quality items that would be associated with a change in purchases by Housing Voucher recipients from their actual mean level to the Certificate Program bundle of included items $(X^c{}_j)$. To correct for this we must estimate $(A^v_j(\overline{X}^c_j) - \overline{A}^v_j)$.

One approach to this problem is to use an instrumental variable. We are not concerned with $\Delta\overline{A}$ as a random variable, but with the possibility that it varies systematically with the X's. If we found that recipients in the two programs had the same housing in terms of X but paid significantly different rents, we would attribute this to differences in prices. If we find that recipients in the two programs have different average values for X, then we are not sure whether the difference is in prices or omitted variables. Given the small differences in the housing characteristics of recipients in the two programs reported earlier in Table E.13, the former interpretation seems reasonable. Even so, it is worth testing explicitly for the effects of omitted variables in the estimates.

In the private market, income is known to affect the level of housing consumption. If we find that hedonic residuals are correlated with income, it suggests that they include omitted variables.[1] This was the basis of a test for omitted variables in the hedonic equations estimates for the Housing Allowance Demand Experiment (Kennedy and Merrill). We wished to determine the relationship between A and the estimated values $\hat{Q}(=X\hat{\beta})$, provided by the hedonic equations. Thus we wished to estimate the coefficients of

$$(24) \qquad A = a_0 + a_1 Q + \theta$$

If we knew the value of the coefficient, a_1, we would estimate ΔA by

$$(25) \qquad \Delta A = a_1 \Delta \hat{Q}$$

We assumed that Q would vary with income, so that

$$(26) \qquad Q = b_0 + b_1 Y + \delta$$

Further, we had, from the hedonic residuals, estimates of $(A + \eta)$. If income is uncorrelated with realized prices $\eta\varepsilon$), then

$$(27) \qquad A + \eta = a_0 + a_1 Q + \theta + \eta$$

$$(28) \qquad = (a_0 + a_1 b_0) + a_1 b_1 Y + a_1 \delta + \theta + \eta$$

In terms of our estimated hedonic values and estimated residuals, we have

$$(29) \qquad (\hat{Q} = Q + X\acute{X})^{-1} X'(A + \eta)$$

[1]Income could in principal affect search behavior and thus realized prices through effects on the allocation of time or on the determination of α in the model of Appendix D.

$$(30) \quad (A + \eta) = (I - X(X\acute{X})^{-1}X\acute{})(A + \eta)$$

Since A is orthogonal to X in the sample by assumption, Eqs. (29) and (30) can be written:

$$(29a) \quad \hat{Q} = Q = X(X'X)^{-1}X'\eta$$

$$(30a) \quad (A + \eta) = A + (I - X(X'X)^{-1}X)\eta$$

Substituting Eq. (26) into Eq. (29a) and (30a) yields:

$$(31) \quad \hat{Q} = b_0 + b_1Y = \delta + X(X'X)^{-1}X'\eta$$

$$(32) \quad (A + \eta) = (a_0 + a_1b_0) + a_1b_1Y + a_1\delta + \theta + (I - X(X'X)^{-1}X')\eta$$

Thus we can estimate (a_1b_1) by regressing the hedonic residuals on Y. But the regression of $\hat{Q}$ on Y yields an estimate of b_1. Thus we can derive a consistent estimate of a_1 as

$$(33) \quad \hat{a}_1 = \frac{(a_1b_1) \text{ from regression of hedonic residual on income}}{(\hat{b}_1) \text{ from regression of hedonic value on income}}$$

$$(34) \quad \text{plim } \hat{a}_1 = a_1$$

$$(35) \quad \text{Asymptotic Var}(\hat{a}_1) = \left(\frac{a_1b_1}{b_1}\right)^2 \left[\frac{\text{Var}(a_1b_1)}{(a_1b_1)^2} + \frac{\text{Var}(\hat{b}_1)}{(b_1)^2} - \frac{2\ \text{cov}(a_1b_1,\hat{b}_1)}{(a_1b_1)(b_1)} \right]$$

Consulting the regression equations (31 and (32) yields

$$(36) \quad \text{Var}(a_1b_1) = (S_y^2)^{-1}\left[a_1^2\sigma_\eta^2 + \sigma_\theta^2 + (n-k)\sigma_\eta^2\right]$$

$$(37) \quad \text{Var}(\hat{b}_1) = (S_y^2)^{-1}[\sigma_\delta^2 + k\sigma_\eta^2]$$

$$(38) \quad \text{Cov}(a_1\hat{b}_1,\hat{b}_1) = (S_y^2)^{-1}\ a_1\sigma_\delta^2$$

where:

n-k = The degrees of freedom in the original hedonic regression.

Substituting these expressions into Eq. (33) yields

$$(39) \qquad \text{Asymp.Var}(\hat{a}_1) = (b_1^2 S_y^2)^{-1}[a_1^2\sigma_\delta^2+\sigma_\theta^2+(n-k)\sigma_\eta^2+a_1^2(\sigma_\delta^2+k\sigma_\eta^2)-2a_1^2\sigma_\delta^2]$$

$$= (b^2 S^2)^{-1}[\sigma_\theta^2-(n-k+a_1^2 k)\sigma_\eta^2]$$

Under the null hypothesis that a_1 is zero we have:

$$(40) \qquad \text{Asymp. Var }(\hat{a}_1) = \text{Var}(a_1 b_1) \cdot (b_1^2)$$

$$(41) \qquad \frac{\hat{a}_1}{\text{Asymp. Var. }(\hat{a}_1)} = \frac{a_1 b_1}{\text{Var }(a_1 b_1)} \cdot \left(\frac{b_1}{\overline{b}_1}\right)^2$$

so that the t-statistic for $a_1 b_1$ from the regression of the residuals in income can serve as an asymptotic t-statistic for $\hat{a}_1$.

We can also calculate the asymptotic variance of "corrected" predicted rent. Our "corrected" prediction of the rent of a unit with characteristics z is:

$$(42) \qquad \hat{R}^c = z'\hat{\beta} + (z - \overline{z})\hat{\beta}\hat{a}_1$$

where:

$\hat{R}^c$ = Corrected predicted rent for z

z = Unit characteristics

$\overline{z}$ = The mean of z in the sample for which $\hat{\beta}$ was estimated

$\hat{\beta}$ = Estimated hedonic coefficients

$\hat{a}_1$ = Estimated correction coefficient

We have:

(43) $\quad \mathrm{A\ Var}\ (\hat{R}^c) = z'(\mathrm{Var}\hat{\beta})z + 2z'(\mathrm{Var}\hat{\beta})a_1(z-z)$

$$+ (z-\bar{z})'[a_1^2\mathrm{Var}\hat{\beta} + \beta\beta'\mathrm{Var}(\hat{a}_1) + 2\beta\mathrm{Cor}(\hat{\beta},\hat{a}_1)](z-\bar{z})$$

$$= (z' + (z-z)a_1)'(\mathrm{Var}\hat{\beta})(z + (z-\bar{z})a_1)$$

$$+ [(z - \bar{z})'\beta]^2\mathrm{Var}(\hat{a}_1)$$

$$+ 2(z - \bar{z})'\beta\ \mathrm{Cor}(\hat{\beta},\hat{a}_1)(z = \bar{z})$$

But the $\mathrm{Cov}(\hat{\beta},\hat{a}_1)$ is zero, since

(44) $\quad \hat{a}_1 = \dfrac{(y')^{-1}y'[I - X(X'X)^{-1}X']R}{(y'y)^{-1}y'X(X'X)^{-1}X'R}$

(45) $\quad \hat{\beta} = (X'X)^{-1}X'R$

Substituting the equation for $R(R=X\beta + A + \eta)$ and recalling that $(X'A = 0)$ in the sample, we have

(46) $\quad \hat{a}_1 = \dfrac{(y'y)^{-1}y'[A + \eta - X(X'X)^{-1}X'\eta]}{(y'y)^{-1}y'[X\beta + X(X'X)^{-1}X'\eta}$

(47) $\quad \hat{\beta} = \beta + (X'X)^{-1}X'\eta$

Substituting Eq. (26) and (27) in Eq. (46) gives:

(48) $\quad \hat{a}_1 = \dfrac{a_1b_1 + (y'y)^{-1}y'[a\delta + \theta + (I - x(X'X)^{-1}X')\eta]}{b_1 + (y'y)^{-1}y'[\delta + X(X'X)^{-1}X'\eta]}$

Thus $\quad \mathrm{A\ Cov}\ (\hat{\beta}_1\hat{a}_1) = \mathrm{AE}((\hat{\beta}-\beta)\hat{a}\ )$

$$= \mathrm{AE}[\frac{(x'x)^{-1}x'\eta[a_1b_1+(y'y)^{-1}y'(a\delta+\theta+(I-X(X'X)^{-1}X')\eta)]}{b_1+(y'y)^{-1}y'[\delta+X(X'X)^{-1}X'\eta]}$$

$$= 0$$

since the expectation of the numerator is zero.

In essence, the approach used by Kennedy and Merrill used the variation in the value of included and omitted variables associated with income to infer the change in omitted characteristics that would be associated with program-induced changes in included variables. This approach is clearly suspect for Certificate Program recipients, since, as discussed in Appendix D, we have no reason to believe that the housing selected by Certificate Program recipients would vary with recipient income. We can apply the procedure to most Housing Voucher recipients, since their housing choice would be expected to vary with income. The relationship may be weaker than for nonprogram households, however, so that the use of income as an instrument may be less efficient in this case.

Further, as discussed in Appendix D, each recipient in the Housing Voucher program would be expected to select rents above a certain minimum level (corresponding to H_c in Figure D.3). This suggests the need to develop estimates that take account of this truncation. Fortunately, examination of the Housing Voucher recipient rents showed that only 13 of 911 recipients (less than 1.5 percent) had rents below the minimum level. No attempt was made to take account of truncation effects for these few households.

The implied correction factor (the "$\hat{a}_1$" of Eq are shown in Table E.14. The estimates are not very precise, and are frequently not significant even when large. They are significant (at the ten percent level) for one PHA in the Housing Voucher Voucher program (Minneapolis) and two PHAs in the Certificate Program (Atlanta and New York). In any case, since the difference in estimated hedonic values in the two programs is small, the implied correction, which is the product of the correction factor and the difference in the mean estimated hedonic value between the two programs is also small. These are shown in Table E.15. In sum, it does not appear that the difference between the two programs is due to omitted variables.

The second potential problem in the interpretation of the hedonic equations lies in the use of equations estimated from cross-sectional analysis of program recipients to predict the rents that would be paid if the program as a whole shifted to a different mean housing bundle. This is a potential problem in all applications of hedonic indices, though it seems generally not to have been noticed.

We should say at the outset that the concern raised by this issue in this case is clearly minor. Given the very small differences between the mean values of the hedonic regressions in the two programs, errors of projection are almost irrelevant.

TABLE E.14

CORRECTION FACTORS FOR OMITTED QUALITY IN THE POOLED HEDONIC EUQATION

Site	Rent with Heat Indicator: Housing Voucher Program	Rent with Heat Indicator: Certificate Program	Log Rent with Heat Indicator: Housing Voucher Program	Log Rent with Heat Indicator: Certificate Program
Atlanta	0.403 (1.06)	1.001 (2.99**)	0.391 (1.02)	0.925 (2.84**)
Los Angeles	-0.258 (1.25)	0.091 (0.66)	-0.229 (1.04)	0.057 (0.406)
Minneapolis	0.702 (1.81‡)	-0.222 (0.33)	0.827 (2.00*)	-0.187 (0.26)
Montgomery County	0.002 (0.00)	0.315 (0.95)	0.060 (0.17)	0.320 (0.87)
New York	0.174 (0.35)	1.460 (3.45**)	0.201 (0.44)	1.475 (3.27**)
Oakland	0.083 (0.52)	0.091 (0.77)	0.077 (0.48)	0.090 (0.80)
Omaha	-1.365 (1.08)	-0.065 (0.07)	-0.929 (0.93)	-0.082 (0.11)
Pittsburgh	-0.305 (0.50)	-0.78 (1.41)	-0.532 (0.58)	-0.771 (1.39)
San Antonio	-0.388 (1.07)	-6.903 (1.30)	-0.379 (1.12)	-9.889 (1.54)
Seattle	0.822 (1.32)	0.532 (1.68)	0.703 (1.17)	0.818 (1.58)

** = significant at 0.01 level

* = significant at 0.05 level

‡ = significant at 0.10 level

TABLE E.15

ESTIMATED CORRECTIONS FOR TABLE E.12

Linear Specification	Mean	At Housing Voucher Prices: Within Std. Error (t-Statistic)	Total Std. Error (t-Statistic)
Difference in cost			
Original	$21.85	4.19 (5.21**)	5.85 (3.74)**
Corrected	$20.21	4.77 (4.24**)	6.65 (3.04**)
Log (ratio of cost)			
Original	0.045	0.009 (4.96**)	0.011 (4.14**)
Corrected	0.043	0.010 (4.13**)	0.012 (3.54**)

The problem in its general form is as follows. Say that as we have argued in Appendix D, shopping behavior varies across individuals in a way that is correlated with their target rents. Cross-sectionally predicted rents will reflect the results of both changes in real housing and changes in shopping behavior. This may mis-estimate the change in rents associated with a shift in population demand.

To give an extreme example, as discussed at the end of the previous section, under the search model of Appendix D we would expect there to be little systematic relationship between the limited variation in rents paid by Certificate Program recipients and the variation in unit amenities. This would not mean that a shift to higher average rents by increases in FMRs would in fact result in no change in housing quality; there is a divergence between the cross-sectional and "longitudinal" regression lines. As it turned out, the model of Appendix D was not consistent with observed results. Nor, as pointed out earlier, would it be likely to matter. Since there is so little apparent difference in the mean values of the hedonic variables in the two programs, there is little room for such projective error to matter.

E.5 Recipients Who Move

Since recipients who move from their pre-program unit have much larger changes in rent than recipients who do not move, and since most of the difference in rents between the two programs arises from the higher rents paid by Housing Voucher recipients who move, it is natural to ask whether the conclusions of Table E.12 apply directly to recipients who move. We can address this question in two ways.

First, we can simply estimate the hedonic equations and comparisons of Section E.4 based solely on recipients who move. If we want a summary comparison of two sets of estimated coefficients, we can obtain one by forming overall estimates using the same PHA sampling weights as were used in Section E.4. If we want a direct estimate for movers, we use sampling weights for PHAs modified to reflect the incidence of movers.

Alternatively, we could retain the hedonic estimates of Section E.4, but value price and real housing effects in terms of the mean housing bundles observed for movers. In this case, we have to modify our definition of estimated rent. The most straightforward definition is simply:

(50) $\hat{R}^k_j(X) = X\hat{\beta}^k_j$

where

$R^k_j(X)$ = Predicted rent for bundle X at the prices of the k^{th} program in the j^{th} site

$\hat{\beta}^k_j$ = Estimated hedonic coefficients for the k^{th} program in the j^{th} site

In principle, however, we also want to take account of any deviation between actual and predicted rent for movers. Thus we modify the $\hat{R}^k_j(X)$ of Eq. (50) to:

(51) $A_m\hat{R}^k_j(X) = X\hat{\beta}^k_j + Res^k_{mj}$

where

$A_m\hat{R}^k_j(X)$ = Predicted rent for bundle X in the j^{th} site at the prices of the k^{th} program for the m^{th} demographic group

Res^k_{mj} = The mean error of estimate in the hedonic regression for the m^{th} demographic group for the k^{th} program in the j^{th} site

Given the fact that pooling the mover and stayer strata was rejected by the test statistics presented earlier in Table E.8, the first approach--separate estimation for movers--is clearly preferable. We pursue the second as well in order to obtain some sense of the potential importance of the pooling mis-specification on the results of Section E.4.

Tables E.16 to E.18 present summary statistics of the mover regressions like those presented earlier in Tables E.9 to E.11. The adjusted R^2, standard errors and coefficients of variation for the mover equations have means and ranges similar to those reported for the pooled equations in Table E.9. In terms of coefficient signs, the same variables have two cases of "wrong" signs, as did the pooled regressions (amenities per room in other rooms, number of hazards, building age, kitchen equipment provided, and

TABLE E.16

SUMMARY OF SUMMARY STATISTICS FOR HEDONIC REGRESSIONS STRATIFIED BY PHA AND PROGRAM--MOVERS ONLY

	Housing Voucher Program	Certificate Program
Degrees of Freedom:		
Range	14-49	17-47
Mean	29	28
Linear Regression		
R^2		
Range	0.74 to 0.92	0.68 to 0.90
Mean	0.81	0.79
Adjusted R^2		
Range	0.49 to 0.81	0.30 to 0.77
Mean	0.62	0.59
Rent MSE		
Range	\$32.27 to \$90.24	\$26.34 to \$79.78
Mean	\$56.25	\$45.27
Coefficient of variation		
Range	7% to 16%	6% to 14%
Mean	12.2%	10.5%

TABLE E.17

SIGN PATTERN OF LINEAR SPECIFICATION COEFFICIENTS (MOVERS ONLY)

Variable	Expected Sign[a]	Housing Voucher Program: Number of Times Dropped	Housing Voucher Program: Significant Positive[c]	Housing Voucher Program: Significant Negative[c]	Certificate Program: Number of Times Dropped	Certificate Program: Significant Positive[c]	Certificate Program: Significant Negative[c]
Heat included in contract rent	+	--	3	--	--	2	1
Tenure related to landlord	-	3	--	1	4	--	1
Length of tenure (log of months)	-	--	1	3	--	1	2
Square feet per room	+	--	4	--	--	5	--
Number of bathrooms	+	--	4	--	--	4	--
Log (number of rooms)	+	--	9	--	--	9	--
Average evaluator rating of condition	+	--	1	--	--	--	1
Log of building age	-	--	2	--	--	--	2
Kitchen equipment provided	+	--	--	--	1	1	2
Air conditioning provided	+	1	2	1	2	1	--
No heat in unit	-	6	--	--	6	--	--
Number of hazards	-	--	2	--	--	2	--
Condition of common halls	+	--	1	--	--	1	--
Amenities in bathrooms	+	--	2	--	--	1	1
Amenities in halls	+	--	1	--	--	1	1
Balconies/porches/windows	+	--	--	--	--	1	--
Amenities per room in other rooms	+	--	--	2	--	--	--
Single family detached	+	1	5	--	--	1	1
Duplex or two-family	?	1	2	--	--	1	1
Single row family house	+	3	--	--	5	--	2
Highrise	?	5	--	1	6	--	--
Rural area	?	9	--	--	7	1	--
Commercial/industrial actilities in area	-	4	1	--	2	2	--
Abandoned buildings (evaluator)	-	--	--	1	1	1	--
Abandoned buildings (tenant)	-	1	--	--	1	--	--
Cleanliness of surrounding parcels	-	--	1	--	--	1	--
Scaled median value owner-occup. units in tract	+	--	2	2	--	--	1
Scaled median rent-renter occup. units in tract	+	--	1	--	--	--	--
Mover stratum	+	4	--	1	5	1	--

[a]See Table E.7 for definitions of variables.
[b]Number of equations in which the variable appears.
[c]Significant at 0.10 level.
[d]Cases were assigned to strata on the basis of PHA records. In some cases these were in error and some movers were in the stayer stratum.

TABLE E.18

TESTS OF VARIABLE SETS FOR LINEAR HEDONIC EQUATIONS STRATIFIED BY PROGRAM AND SITE: MOVERS ONLY

	Housing Voucher Program		Certificate Program	
	F-Statistic	Percentage Increase in Std. Error	F-Statistic	Percentage Increase in Std. Error
Unit quality and building descriptors	F (132,288) = 1.67**	10.1%	F (129,282) = 1.43**	6.5%
Neighborhood variables	F (56,288) = 1.38*	3.1	F (59,282) = 1.11	1.0
Combined unit, building, and neighborhood	F (188,288) = 1.69**	12.9	F (188,282) = 1.38*	7.3

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

single-family town house), plus two others (commercial/industrial activities in the area and scaled median value of owner-occupied units). Finally, the test statistics for the sets of quality and neighborhood variables in Table E.18 yield results similar to those of Table E.11 for the pooled equations. As for the pooled equations, the use of a hedonic specification selected on the basis of other data is important, since the numbers of degrees of freedom in each site are frequently small.

Table E.19 presents the decomposition of differences between the two programs in the rents of movers based on the mover hedonic equation. In this case, whether we value changes in terms of Housing Voucher or Housing Certificate prices makes a substantial difference. If we value price effects in terms of the estimated Housing Voucher cost of the Certificate bundle, and real changes in terms of the Housing Voucher valuation of the difference in mean attributes, then we estimate that price differences account for $19 of the $29 per month difference in average contract rent between the two programs, with a significant real change in housing valued at $10 per month.[1,2]

The significant average difference in real housing found in Table E.19 under Housing Voucher prices only amounts to a 2.3 percent increase over the Certificate average. As might be expected with differences this small, no individual amenities show up as being significantly different in the two programs (Table E.20). Nor are there obvious differences from the similar comparison presented earlier for all recipients in Table E.13.

As in Section E.5, we can test for the presence of omitted variables by comparing regressions in income of the hedonic residual and hedonic value. As shown in Table E.21 the correction factors are significant in two sites for each program (Los Angeles and Minneapolis for the Housing Voucher Program and Atlanta and Pittsburgh for the Certificate Program). This does not suggest a substantial problem with omitted variables. Even so,

[1]The estimates in Table E.16 are national projections for recipients who move. Accordingly they are based on different PHA weights than were used to project results for all recipients in Section E.4. This reweighting does not, however, have a material effect on the results.

[2]Estimates of price differences in each site are presented in Appendix F.

TABLE E.19

DECOMPOSITION OF DIFFERENCES IN AVERAGE CONTRACT RENT FOR MOVERS
(Based on Separate Mover Equations--Linear Specification with Heat Dummy)

	Value	Within Std. Error	t-Statistic	Total Std.Error	t-Statistic
Mean Housing Voucher contract rent	$468.20	4.87	96.14**	32.06	14.60**
Mean Certificate Program contract rent	$438.98	4.01	109.47	32.03	13.45**
Difference in contract rent.					
Dollars	$29.22	6.31	4.63*	6.91	4.23
Percent	6.7%				
Decomposition of Housing Voucher Prices					
Cost of Certificate bundle	$458.01	$5.57	82.24**	$94.96	4.82**
Difference in price[a]	$19.03	6.14	3.10**	6.14	3.10**
Percentage difference in price	4.3%				
Difference in real housing[a]	$10.18	4.71	2.16*	5.37	1.90‡
Percentage difference in real housing	2.3%				
Decomposition of Certificate Program Prices					
Cost of Housing Voucher bundle	$440.37	4.20	104.94**	100.70	4.37**
Difference in price[a]	$27.83	5.13	5.42**	8.76	3.18**
Percentage difference in price	6.3%				
Difference in real housing[a]	$1.39	3.30	0.42	5.37	0.26
Percentage difference in real housing	0.3%				

[a]Estimated Differences in Cost and Differences in Real Housing are each estimated directly from the hedonic coefficients and may not sum to the total difference in contract rent due to rounding errors.

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE E.20

AVERAGE LEVEL OF HOUSING CHARACTERISTICS INCLUDED IN THE HEDONIC EQUATIONS FOR MOVERS

Variable	Housing Voucher Program	Certificate Program	Difference	Within PHA Standard Error of Difference	Percentage Difference
Heat included (x number of rooms)	1.21	1.14	0.07	0.10	6.0%
Tenure					
Related to landlord	1.7%	1.3%	0.4 pts	0.7 pts	28.1%
Length of tenure (log of months)	2.60	2.59	0.01	0.04	0.5%
Unit Size					
Square feet per room	134.65	133.42	1.23	1.64	0.9%
Number of bathrooms	1.13	1.13	0.01	0.03	0.4%
Log (number of rooms)	1.52	1.52	0.00	0.02	0.3%
Amenities					
Average evaluator rating of condition	3.68	3.65	0.03	0.03	0.8%
Log of building age	3.45	3.45	0.00	0.03	0.1%
Kitchen equipment provided	66.4%	59.0%	7.3 pts	0.05	12.4%
Air conditioning provided	34.3%	35.2%	-0.9 pts	2.3 pts	-2.5%
No heat in unit	2.2%	1.3%	1.0 pts	0.7 pts	71.1%
Number of hazards	0.18	0.20	-0.02	0.03	-9.6%
Condition of common halls	1.06	1.03	0.04	0.07	3.5%
Amenities in bathroom	0.60	0.56	0.04	0.06	7.4%
Amenities in halls	0.21	0.27	-0.06	0.05	-21.2%
Balconies/porches/windows	0.43	0.44	-0.01	0.04	1.3%
Amenities per room in other rooms	0.14	0.14	0.01	0.02	5.1%
Building Type					
Single family detached	28.0%	25.6%	2.4 pts	2.7 pts	9.4%
Duplex or two-family	10.0%	9.3%	0.7 pts	1.8 pts	7.8%
Single row family house	5.1%	3.5%	1.5 pts	1.2 pts	43.1%
Highrise	6.0%	5.2%	0.8 pts	1.0 pts	15.9%
Neighborhood					
Rural area	0.3%	0.6%	-0.3 pts	0.3 pts	-48.4%
Commercial/industrial activities in neighborhood	5.4%	6.5%	-1.1 pts	1.5 pts	-16.9%
Abandoned buildings (evaluator)	15.3%	16.6%	-1.2 pts	2.3 pts	-7.4%
Abandoned buildings (tenant)	15.4%	16.0%	-0.6 pts	2.2 pts	-3.7%
Cleanliness of surrounding parcels	3.27	3.25	0.03	0.04	0.8%
Scale median value of owner-occupied units in tract	19.59	19.25	0.34	0.75	1.8%
Scaled median value of renter-occupied units in tract	120.67	124.57	-3.90	2.84	-3.1%

** = significant at 0.01 level
* = significant at 0.05 level
+ = significant at 0.10 level

TABLE E.21

CORRECTION FACTORS FOR OMITTED QUALITY IN THE POOLED HEDONIC EUQATION

	Rent with Heat Indicator	
	Housing Voucher Program	Certificate Program
Site		
Atlanta	0.143	0.939
	(0.56)	(3.00**)
Los Angeles	-0.447	0.000
	(2.11*)	(0.00)
Minneapolis	0.949	0.318
	(3.46*)	(0.23)
Montgomery County	-0.217	0.226
	(0.42)	(0.78)
New York	6.384	0.154
	(1.12)	(0.76)
Oakland	0.008	0.093
	(0.05)	(0.62)
Omaha	0.456	-0.166
	(0.76)	(0.34)
Pittsburgh	-0.213	6.309
	(0.74)	(2.10*)
San Antonio	-0.352	-4.863
	(1.19)	(0.95)
Seattle	0.047	0.052
	(0.23)	(0.58)

** = significant at 0.01 level

* = significant at 0.05 level

‡ = significant at 0.10 level

application of the correction factor makes a substantial difference in the estimated price differences, as shown in Table E.22.

Given the general lack of significance of the estimated correction factors, it seems unwise to rely on the corrected estimates of Table E.22. Further, examination of the corrections by site shows that the Housing Voucher correction is dominated by a single site with an insignificant (but large) correction factor (see Table E.23). The Certificate correction is dominated by two sites, only one of which has a significant correction factor. Given these facts, the best estimates for movers would appear to be those of Table E.19.

E.6 Estimates for Movers and Stayers Using the Pooled Equations

As discussed at the beginning of Section E.5, we can also estimate effects of using the regressions of Section E.4 but valuing the differences at the average bundles observed for movers (plus a term in the difference between the programs in the mean mover residual). Our interest in these equations is indirect. The test-statistics of Table E.8 rejected specifications that pooled the mover and stayer strata. However, we cannot estimate a stayer equation separately. Accordingly, we would like to know whether the mis-specification of the pooled equation materially affects the results.

The answer is, unfortunately, that it does. Table E.24 presents the results of separate decomposition for movers and stayers based on the pooled regressions. Consider first the decomposition based on Housing Voucher prices. The pooled regressions estimate a higher price differential and a smaller real difference than the regressions for movers only, presented in the previous section. This suggests that the stayer regression is "flatter" than the mover regression in the Housing Voucher Program. This is not completely unreasonable. Recipients who stay in their pre-enrollment units have to meet the program quality and occupancy requirements. Although Housing Voucher recipients are not required to have rents below the FMRs, it seems likely that recipients who stay do have unusually good units compared to the norm for their incomes. This could in part reflect a greater willingness to spend for

TABLE E.22

ESTIMATED CORRECTIONS FOR TABLE E.19 (MOVERS)

Linear Specification	Mean	At Housing Voucher Prices: Within Std. Error (t-Statistic)	Total Std. Error (t-Statistic)
Difference in cost			
Original	$19.03	6.14 (3.10**)	6.14 (3.10)**
Corrected	$6.19	12.12 (0.51)	12.12 (0.51)

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE E.23

ESTIMATED PRICE EFFECTS AND PRICE EFFECT CORRECTION BY SITE (MOVERS ONLY)

Site	Valued at Housing Voucher Program Prices			Valued at Certificate Program Prices		
	Estimated Price Effect	Estimated Correction	t-Statistic for Corrective Factor	Estimated Price Effect	Estimated Correction	t-Statistic for Corrective Factor
Atlanta	$8.99	-5.10	0.56	$40.52	-3.80	3.00**
Los Angeles	9.99	-0.93	2.11	8.45	0.00	0.00
Minneapolis	31.50	-3.18	3.46	-1.53	-11.58	0.23
Montgomery County	21.21	0.68	0.42	26.52	0.49	0.78
New York	46.01	-167.87	1.12	73.90	0.52	0.76
Oakland	55.70	0.13	0.05	74.93	3.31	0.62
Omaha	-7.76	4.58	0.76	12.29	-1.67	0.34
Pittsburgh	23.41	3.78	0.74	48.53	46.76	2.10
San Antonio	16.57	0.31	1.19	4.20	64.38	0.95
Seattle	7.50	-0.69	0.23	4.77	-0.90	0.58

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE E.24A

DECOMPOSITION OF DIFFERENCES IN AVERAGE CONTRACT RENT FOR MOVERS (POOLED ESTIMATION OF LINEAR SPECIFICATION)

	Value	Within Std. Error	(t)	Total Std.Error	t-Statistic
Mean Housing Voucher contract rent	$468.32	NA	NA	NA	NA
Mean Certificate Program contract rent	$438.37	NA	NA	NA	NA
Difference in contract rent:					
Dollars	$29.95	NA	NA	NA	NA
Percent	6.8%				
Decomposition of Housing Voucher Prices					
Cost of Certificate bundle	$462.69	4.07	113.69**	107.95	4.29**
Difference in price[a]	$24.31	4.71	5.16**	5.89	4.13**
Percentage difference in price	5.5%				
Difference in real housing[a]	$5.63	2.91	1.93‡	5.68	0.99
Percentage difference in real housing	1.3%				

[a]Estimated Differences in Cost and Differences in Real Housing are each estimated directly from the hedonic coefficients and may not sum to the total difference in contract rent due to rounding errors.

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

TABLE E.24B

DECOMPOSITION OF DIFFERENCES IN AVERAGE CONTRACT RENT FOR STAYERS (POOLED ESTIMATION OF LINEAR SPECIFICATION)

	Value	Within Std. Error	(t)	Total Std.Error	t-Statistic
Mean Housing Voucher contract rent	$405.50	NA	NA	NA	NA
Mean Certificate Program contract rent	$390.34	NA	NA	NA	NA
Difference in contract rent.					
Dollars	$15.16	NA	NA	NA	NA
Percent	3.7%				
Decomposition of Housing Voucher Prices					
Cost of Certificate bundle	$407.47	7.86	51.82**	53.14	7.67**
Difference in price[a]	$17.13	8.62	1.99*	10.52	1.63
Percentage difference in price	4.4%				
Difference in real housing[a]	$-1.97	5.99	0.33	8.40	0.23
Percentage difference in real housing	-0.5%				

[a]Estimated Differences in Cost and Differences in Real Housing are each estimated directly from the hedonic coefficients and may not sum to the total difference in contract rent due to rounding errors.

** = Significant at 0.01 level

* = Significant at 0.05 level

‡ = Significant at 0.10 level

housing, but would also be expected to reflect better than average deals.[1] In this case, we would expect the stayer regression to be flatter (show a smaller change in rent for a given change in quality) for stayers.

Indeed, using Housing Voucher prices, the entire difference in spending between stayers in the two programs is attributed to a price effect. In fact, real housing is estimated to be lower in the Housing Voucher Program (though not significantly so). There is some fuzziness to these estimates; neither the estimated price change nor the estimated real change in housing is statistically significant. Further, if we believe that the Housing Voucher regression for stayers is materially flattened by the sort of income-based selection mechanism described above, then we might regard the estimate as an artifact of the flattened regression. In this case it would reflect a misestimate of the Housing Voucher cost rather than a genuine price difference.

E.7 Further Investigation of Price Differences Between the Two Programs

The previous section established that Housing Voucher recipients who move pay modestly higher prices for their units than Certificate Program recipients who move. There is weaker evidence that this may also be true for recipients who stay in their pre-enrollment unit. This section discusses how this finding may be interpreted and what it suggests about shopping behavior under the two programs.

We have regarded estimated hedonic indices as estimated rental cost functions--a schedule of the average rents paid by recipients in each program for a given quality of housing services. The finding that Housing Voucher recipients paid higher prices relates to the average price paid by all recipients. However, a higher average price may come about in a number of different ways. How we understand the finding of higher Housing Voucher prices depends on how they arose.

For example, we could imagine that Housing Voucher recipients are simply not as equipped as PHAs to bargain with landlords. This would suggest

[1] This is an effect like that proposed by Olsen and Reeder for the Certificate Program but based in this case on the limits on rental expenditures imposed by recipient income rather than the program FMRs.

that the PHA rent reasonableness test in fact obtained reduced prices for Certificate recipients. However, if this were true we would expect that Housing Voucher recipients would simply pay somewhat higher prices for any level of housing; the entire cost schedule would be shifted up. (See Figure E.1A.)

Alternatively, Appendix D presented a number of models in which the combination of the rent ceilings imposed by the Certificate Program and the incentives provided under the Housing Voucher Program would rotate the Certificate cost function so that Certificate Program recipients would tend to pay higher prices for lower quality units and lower prices for higher quality units, as shown in Figure E.1B.

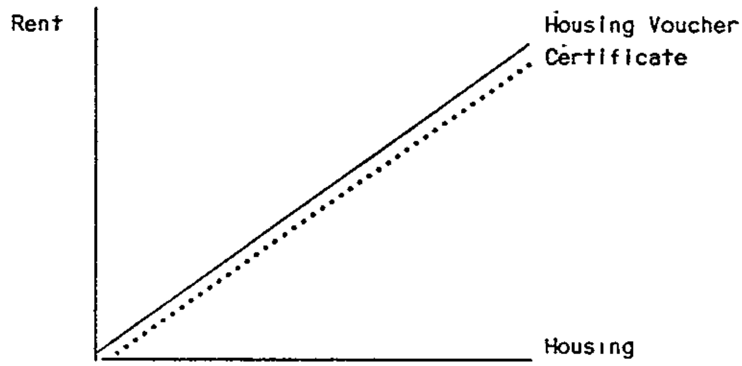
The models of Appendix D themselves involved two basic variants. In one set of models, the rotation of the Certificate Program reflected real differences in the shopping behavior of recipients in the two programs. Behaviorally these differences arose from what we referred to as bargaining models. These consisted of direct and indirect bargaining models. In direct bargaining models, landlords and tenants negotiate rents in face-to-face bargaining, including, for example, scenarios in which landlords adjust rents when they learn the details of a tenant's program. In indirect bargaining models, tenants "bargain with their feet"--comparing the prices of comparable units-as well as models in which landlords set unit prices to fit into the Section 8 market.

The other basic search model was one in which Housing Voucher or Certificate holders essentially set a target rent and then examine a number of units with this rent, looking for the best housing they can obtain. The interesting feature of this model was that shopping incentives were identical under the two programs. The rotation of the Certificate rental cost function arises only through differences in the distribution of search rents engendered by the Certificate Program rent ceiling. Under this model, the rotation of the estimated Certificate Program regressions is an artifact of the distribution of search rents, and does not predict the way in which average program prices will change as average rents change. Specifically, under this model, if the average level of housing quality is the same in the two programs, then average prices and rents will also be the same. To the extent

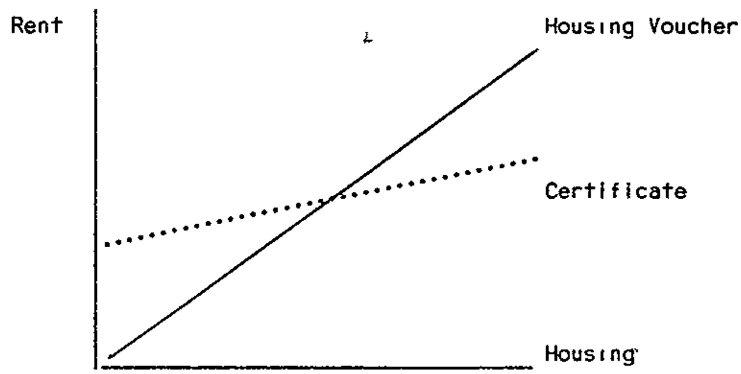
FIGURE E.1

SOME ALTERNATIVE PATTERNS OF PROGRAM RENTAL COST FUNCTIONS

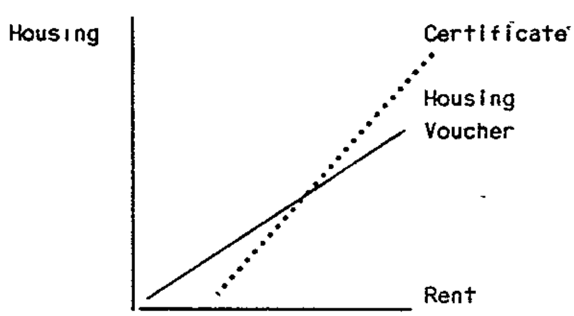
A. PHA Negotiation



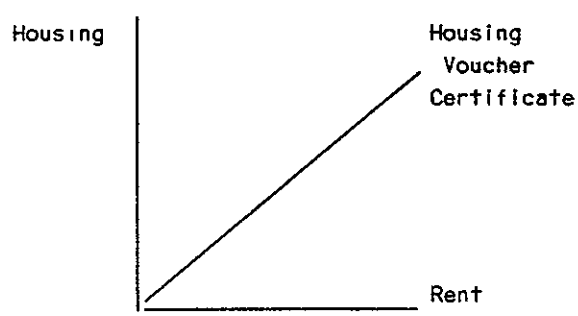
B. Search Models for Rent Ceilings and Incentives



B.1 Bargaining Models



B.2 Rent Search Models



that Housing Voucher holders search for better housing they will both increase their chances of success and tend to pay higher average prices.

The possibility that the Certificate rent regression could be materially affected by the distribution of search rents was also the reason for the decision to analyze the price/quality decomposition of differences in average program rent in terms of the Housing Voucher regressions. In the extreme case, for example, if all Certificate Program recipients obtained units with rents exactly equal to the FMR, there would be no variation in Certificate Program rents and no relationship between rent and quality.

The search rent model only applies to movers. However, selection effects can be generated for stayers by appealing to the rent truncation model developed by Olsen and Reeder to explain the often substantial increases in rent observed for new recipients in the Section 8 Certificate Program who did not move from their pre-program unit. Olsen and Reeder argued that units that qualified for the program were likely to have below average rents because the FMR ceiling screened out higher priced units. Furthermore, the effect of this screening on average prices would increase with housing quality since the FMR would screen out larger proportions of above average priced (overpriced) units from the program at progressively higher quality levels. When Olsen and Reeder simulated such selection effects using AHS data from several cities they found that the effects were substantial--on the order of a 10 to 18percent reduction in mean rent below the market-wide average, for comparable units. Of course, in Olsen and Reeder's model, below average rents are a transient phenomenon. The artificially low pre-program rent is the source of substantial increases to bring program rents in line with normal market practice. We could, however, imagine that the increases only partially offset the selection effects, in which case program rents for stayers would remain below the market average.[1]

In contrast to the Olsen and Reeder selection model, a bargaining model would generate real differences in recipient prices by imagining that

[1]One could also propose a similar truncation for movers. Specifically, we could imagine that the FMR ceiling simply excludes movers who bring in high rent units. However, the difference in success rates between the two programs is too small for simple truncation to account for the difference in recipient rents among movers (see Kennedy and Leger, 1989, Appendix D).

Certificate holders with pre-program units that can meet program quality and occupancy standards may be able to talk landlords into somewhat smaller than normal increases in rent if these would allow the unit to qualify for the Section 8 program. Alternatively, such Certificate holders, announcing the rent that the program will allow, might also induce the landlords to ask for larger increases if their rents would normally have remained below the ceiling.

As discussed in Appendix D, the bargaining and rent search models both imply that the Certificate rental cost function will be rotated as in Figure E.1B. However, they have different implications for the regression of housing quality on rent. Specifically, the target rent models imply that this regression will be the same in both programs, whereas the bargaining models imply that the regression will be rotated or shifted.

To test these alternative models, we estimated the cost of each recipient's housing based on the estimated Housing Voucher hedonic equations. For recipients who stayed in place, we used the combined mover-stayer estimates; for recipients who moved, we used the separate estimates for movers. We then grouped observations by predicted rent categories and compared the actual and predicted average rent in each category across programs, as shown in Table E.25. Because program differences were expected to be associated with the FMR ceiling, we also formed categories based on the ratio of predicted rent to FMR or Payment Standard, as shown in Table E.26.[1] For both types of categories, the tables present results for all recipients and for stayers and movers separately.

The results are summarized in Figure E.2 for recipients who stayed and in Figure E.3 for recipients who moved. The figures show the table values for both the predicted rent and predicted rent/FMR categories, so every observation is represented twice. Both figures clearly suggest that the regression of actual rents on values in the Certificate Program crosses the regression for the Housing Voucher Program--indicating that the program differences are generated by the shopping models of Appendix D rather than any simple shift in shopping behavior.

[1]These categories are only intended to scale the data across sites. Predicted rent is predicted contract rent, whereas FMRs refer to gross rent.

TABLE E.25A

ACTUAL AND PREDICTED RENT BY PREDICTED RENT CATEGORY FOR STAYERS

	Housing Voucher Program					Certificate Program				
Predicted Rent	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)
PR≤250	23	220	226	-6	48	23	274	198	76**	17
		(7)	(5)	(7)	(11)		(13)	(11)	(22)	(8)
250<PR≤300	27	283	275	8	37	44	297	278	18**	34
		(8)	(2)	(8)	(9)		(7)	(2)	(7)	(7)
300<PR≤350	40	327	325	2	45	39	338	325	13	49
		(6)	(2)	(6)	(8)		(8)	(2)	(9)	(8)
350<PR≤400	45	367	376	-9	64	41	368	371	-3	49
		(7)	(2)	(7)	(7)		(11)	(2)	(11)	(8)
400<PR≤450	46	424	419	4	48	22	372	423	-51**	73
		(9)	(2)	(8)	(7)		(15)	(4)	(14)	(10)
450<PR≤500	22	462	471	-9	45	23	426	475	-49**	78
		(11)	(4)	(11)	(11)		(14)	(3)	(13)	(9)
500<PR	50	590	529	-2	46	67	537	616	-79**	73
		(16)	(11)	(11)	(7)		(13)	(12)	(12)	(5)

[a]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[b]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

TABLE E.25B

ACTUAL AND PREDICTED RENT BY PREDICTED RENT CATEGORY FOR MOVERS[a]

	Housing Voucher Program					Certificate Program				
Predicted Rent	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
PR≤275	15	258 (6)	252 (4)	6 (5)	40 (13)	40	302 (7)	241 (4)	61** (8)	10 (5)
275<PR≤300	26	301 (5)	291 (1)	10‡ (6)	42 (10)	28	325 (7)	288 (2)	37** (8)	18 (7)
300<PR≤325	35	315 (5)	313 (1)	2 (5)	46 (9)	43	337 (7)	314 (1)	25** (7)	30 (7)
325<PR≤350	42	335 (5)	336 (1)	-2 (5)	52 (8)	42	345 (11)	337 (1)	8 (11)	50 (8)
350<PR≤375	57	364 (4)	364 (1)	-0 (4)	47 (7)	48	341 (8)	361 (1)	-20* (8)	56 (7)
375<PR≤400	49	391 (6)	388 (1)	3 (6)	53 (7)	36	370 (9)	387 (1)	-18* (9)	67 (8)
400<PR≤425	41	414 (5)	412 (1)	2 (4)	46 (8)	39	389 (8)	410 (1)	-21* (8)	74 (7)
425<PR≤450	39	425 (6)	438 (1)	-13* (5)	62 (8)	44	416 (11)	437 (1)	-21* (10)	66 (7)
450<PR≤475	41	453 (7)	461 (1)	-8 (6)	68 (7)	28	461 (17)	461 (1)	0 (18)	54 (10)
475<PR≤500	37	496 (8)	486 (1)	10 (7)	35 (8)	26	446 (19)	489 (1)	-42* (18)	69 (9)
500<PR≤550	42	525 (7)	524 (2)	1 (7)	50 (8)	44	490 (14)	524 (2)	-34* (14)	66 (7)
550<PR≤600	40	575 (8)	580 (2)	-5 (7)	55 (8)	45	529 (14)	574 (2)	-45** (14)	73 (7)

TABLE E.25B (cont.)

ACTUAL AND PREDICTED RENT BY PREDICTED RENT CATEGORY FOR MOVERS[a]

	Housing Voucher Program					Certificate Program				
Predicted Rent	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
600<PR≤650	32	611	624	-13	53	25	574	623	-49**	72
		(11)	(3)	(12)	(9)		(18)	(3)	(17)	(9)
650<PR	54	744	735	10	44	53	617	758	-141**	89
		(12)	(9)	(7)	(7)		(16)	(12)	(18)	(4)

[a]Because of the small number of observations, $25 intervals are used for Predicted Rent above $500.

[b]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[c]Significance only indicated for Difference.

** = Significant at 0.01 level
* = Significant at 0.05 level
‡ = Significant at 0.10 level

TABLE E.25C

ACTUAL AND PREDICTED RENT BY PREDICTED RENT CATEGORY FOR ALL RECIPIENTS[a]

	Housing Voucher Program					Certificate Program				
Predicted Rent	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
PR≤250	29	225	228	-3	41	46	285	211	74**	11
		(6)	(4)	(6)	(9)		(8)	(6)	(11)	(5)
250<PR≤275	21	272	263	9	38	35	291	263	27**	31
		(7)	(2)	(6)	(11)		(8)	(1)	(8)	(8)
275<PR≤300	41	296	288	8	44	54	318	288	31**	22
		(5)	(1)	(6)	(8)		(6)	(1)	(6)	(6)
300<PR≤325	57	317	313	4	46	61	340	314	26**	31
		(4)	(1)	(4)	(7)		(6)	(1)	(6)	(6)
325<PR≤350	60	334	337	-3	50	63	341	337	5	54
		(4)	(1)	(4)	(6)		(8)	(1)	(8)	(6)
350<PR≤375	78	360	364	-4	53	71	344	361	-16*	55
		(4)	(1)	(4)	(6)		(7)	(1)	(7)	(6)
375<PR≤400	73	388	388	-0	56	54	376	387	-10	59
		(5)	(1)	(5)	(6)		(8)	(1)	(8)	(7)
400<PR≤425	72	413	412	2	44	52	379	410	-32**	73
		(5)	(1)	(5)	(6)		(8)	(1)	(8)	(6)
425<PR≤450	54	431	437	-6	61	53	415	438	-23*	68
		(6)	(1)	(6)	(7)		(9)	(1)	(9)	(6)
450<PR≤475	52	451	460	-10	65	39	441	461	-20	64
		(6)	(1)	(6)	(7)		(14)	(1)	(15)	(8)
475<PR≤500	48	493	486	7	35	38	450	488	-38**	68
		(6)	(1)	(6)	(7)		(13)	(1)	(13)	(8)
	(11)	(8)	(7)	(6)		(13)	(10)	(14)	(4)	
500<PR≤525	34	518	513	5	38	35	486	512	-26*	63
		(8)	(1)	(8)	(8)		(14)	(1)	(14)	(8)
525<PR≤550	24	524	537	-13	63	28	494	537	-43*	68
		(9)	(2)	(9)	(10)		(17)	(1)	(18)	(9)

TABLE E.25C (cont.)

ACTUAL AND PREDICTED RENT BY PREDICTED RENT CATEGORY FOR ALL RECIPIENTS[a]

	Housing Voucher Program					Certificate Program				
Predicted Rent	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
550<PR≤600	57	578	578	0	51	62	525	573	-49**	74
		(9)	(2)	(9)	(7)		(12)	(2)	(12)	(6)
600<PR≤650	39	608	624	-17	56	35	567	623	-56**	69
		(10)	(2)	(10)	(8)		(17)	(2)	(17)	(8)
650<PR	64	742	732	10	44	74	611	751	-140**	89
	(11)	(8)	(7)	(6)		(13)	(10)	(14)	(4)	

[a]Because of the small number of observations, $25 intervals are used for Predicted Rent above $500.

[b]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[c]Significance only indicated for Difference.

** = Significant at 0.01 level
* = Significant at 0.05 level
‡ = Significant at 0.10 level

TABLE E.26A

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF PREDICTED RENT TO FMR OR PAYMENT STANDARD FOR STAYERS

	Housing Voucher Program					Certificate Program				
Ratio of Predicted Rent to FMR	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)
P≤0.7	26	294	295	-1	42	35	319	257	62**	23
		(18)	(16)	(10)	(10)		(14)	(15)	(16)	(7)
0.7<P≤0.8	50	361	345	16*	36	50	357	330	26**	30
		(18)	(15)	(7)	(7)		(14)	(12)	(8)	(7)
0.8<P≤0.9	55	412	401	10	45	62	418	403	15*	42
		(18)	(16)	(8)	(7)		(18)	(16)	(6)	(6)
0.9<P≤1.0	54	413	415	-2	46	46	400	440	-40**	67
		(14)	(12)	(6)	(7)		(15)	(15)	(9)	(7)
1.0<P≤1.1	51	446	459	-13*	55	29	426	493	-67**	83
		(18)	(17)	(6)	(7)		(26)	(29)	(12)	(7)
1.1<P	17	473	529	-56**	94	37	430	573	-143**	100
		(23)	(23)	(13)	(6)		(18)	(22)	(12)	(NA)

[a] Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[b] Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

TABLE E.26B

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF PREDICTED RENT TO FMR OR PAYMENT STANDARD FOR MOVERS[a]

	Housing Voucher Program					Certificate Program				
Ratio of Predicted Rent to FMR	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
P≤0.55	36	326 (10)	325 (9)	0 (5)	47 (8)	51	342 (11)	311 (11)	31** (10)	29 (6)
0.55<P≤0.60	13	363 (12)	351 (15)	12 (12)	23 (12)	33	380 (13)	349 (13)	31** (12)	33 (8)
0.60<P≤0.65	23	370 (19)	374 (19)	-4 (5)	57 (11)	22	374 (17)	372 (13)	3 (13)	55 (11)
0.65<P≤0.70	24	380 (17)	379 (15)	0 (7)	46 (11)	24	380 (18)	386 (21)	-5 (13)	50 (10)
0.70<P≤0.75	22	356 (16)	351 (15)	5 (7)	50 (11)	30	372 (16)	379 (16)	-6 (13)	53 (9)
0.75<P≤0.80	36	419 (17)	416 (18)	3 (6)	47 (8)	38	387 (13)	401 (18)	-14 (12)	50 (8)
0.80<P≤0.85	30	389 (14)	390 (12)	-1 (6)	53 (9)	27	379 (22)	397 (18)	-18 (12)	63 (9)
0.85<P≤0.90	46	418 (16)	413 (13)	5 (6)	48 (7)	38	395 (14)	427 (15)	-32** (11)	68 (8)
0.90<P≤0.95	39	418 (13)	420 (12)	-2 (5)	46 (5)	30	409 (19)	446 (18)	-37* (18)	57 (9)
0.95<P≤1.00	32	451 (19)	452 (18)	-1 (7)	50 (9)	29	443 (21)	457 (23)	-14 (15)	52 (9)
1.00<P≤1.05	29	464 (17)	470 (18)	-6 (7)	62 (9)	25	460 (20)	499 (20)	-39** (13)	68 (10)
1.05<P≤1.10	31	491 (21)	492 (19)	-1 (8)	52 (9)	20	502 (30)	509 (29)	-7 (14)	55 (11)

TABLE E.26B (cont.)

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF PREDICTED RENT TO FMR OR PAYMENT STANDARD FOR MOVERS[a]

	Housing Voucher Program					Certificate Program				
Ratio of Predicted Rent to FMR	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
1.10<P≤1.20	43	503	501	1	58	32	465	484	-19	66
		(20)	(17)	(8)	(8)		(23)	(19)	(13)	(9)
1.20<P≤1.30	35	557	554	3	51	29	479	532	-53*	76
		(18)	(16)	(8)	(9)		(25)	(26)	(23)	(8)
1.30<P≤1.40	26	554	557	-3	54	20	508	555	-46*	75
		(27)	(25)	(8)	(10)		(27)	(28)	(20)	(10)
1.40<P	53	664	664	-0	45	55	569	668	-98**	85
		(19)	(16)	(8)	(7)		(18)	(22)	(18)	(5)

[a]Because of the small number of observations, 10-point intervals are used for ratios above 1.1.

[b]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[c]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

TABLE E.26C

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF PREDICTED RENT TO FMR OR PAYMENT STANDARD FOR ALL RECIPIENTS[a]

Ratio of Predicted Rent to FMR	Housing Voucher Program: Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Certificate Program: Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
P≤0.55	40	315 (10)	313 (10)	3 (5)	43 (8)	59	336 (11)	291 (12)	45** (12)	27 (6)
0.55<P≤0.60	16	349 (13)	336 (14)	12 (10)	25 (11)	37	373 (12)	341 (12)	32** (10)	32 (8)
0.60<P≤0.65	29	348 (18)	357 (17)	-10 (6)	59 (9)	29	364 (16)	343 (14)	20 (13)	45 (9)
0.65<P≤0.70	37	363 (14)	362 (131)	1 (7)	46 (8)	40	358 (14)	351 (16)	7 (10)	43 (8)
0.70<P≤0.75	45	355 (16)	344 (14)	11‡ (6)	42 (7)	51	366 (12)	355 (13)	11 (10)	41 (7)
0.75<P≤0.80	63	369 (15)	388 (14)	8 (6)	43 (6)	67	374 (12)	373 (13)	1 (8)	43 (6)
0.80<P≤0.85	59	414 (16)	402 (13)	11 (7)	46 (6)	61	393 (17)	392 (14)	0 (8)	51 (6)
0.85<P≤0.90	72	404 (13)	403 (11)	1 (5)	50 (6)	66	412 (14)	424 (14)	-12‡ (7)	58 (6)
0.90<P≤0.95	64	416 (12)	416 (11)	-1 (5)	44 (6)	53	403 (15)	439 (13)	-36** (11)	62 (7)
0.95<P≤1.00	61	433 (13)	436 (11)	-3 (5)	51 (6)	52	426 (14)	455 (15)	-29** (11)	58 (7)
1.00<P≤1.05	64	442 (14)	453 (13)	-11* (5)	63 (6)	46	450 (18)	500 (20)	-50** (10)	72 (7)
1.05<P≤1.10	47	492 (18)	495 (16)	-4 (6)	47 (7)	28	470 (25)	497 (22)	-27* (12)	68 (9)

TABLE E.26C (cont.)

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF PREDICTED RENT TO FMR OR PAYMENT STANDARD FOR ALL RECIPIENTS[a]

	Housing Voucher Program					Certificate Program				
Ratio of Predicted Rent to FMR	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[b] (s.e.)[c]	Percent of Cases With Rent Less Than Predicted (s.e.)
1.10<P≤1.20	54	501 (17)	508 (15)	-7 (8)	65 (2)	51	457 (18)	509 (19)	-52** (11)	78 (6)
1.20<P≤1.30	40	541 (17)	549 (15)	-8 (9)	58 (7)	36	466 (22)	533 (23)	-67** (19)	81 (7)
1.30<P≤1.40	27	549 (27)	556 (24)	-8 (9)	56 (8)	25	504 (22)	580 (25)	-77** (20)	80 (8)
1.40<P	53	664 (19)	664 (16)	-0 (8)	45 (7)	61	549 (18)	661 (20)	-112** (17)	87 (4)

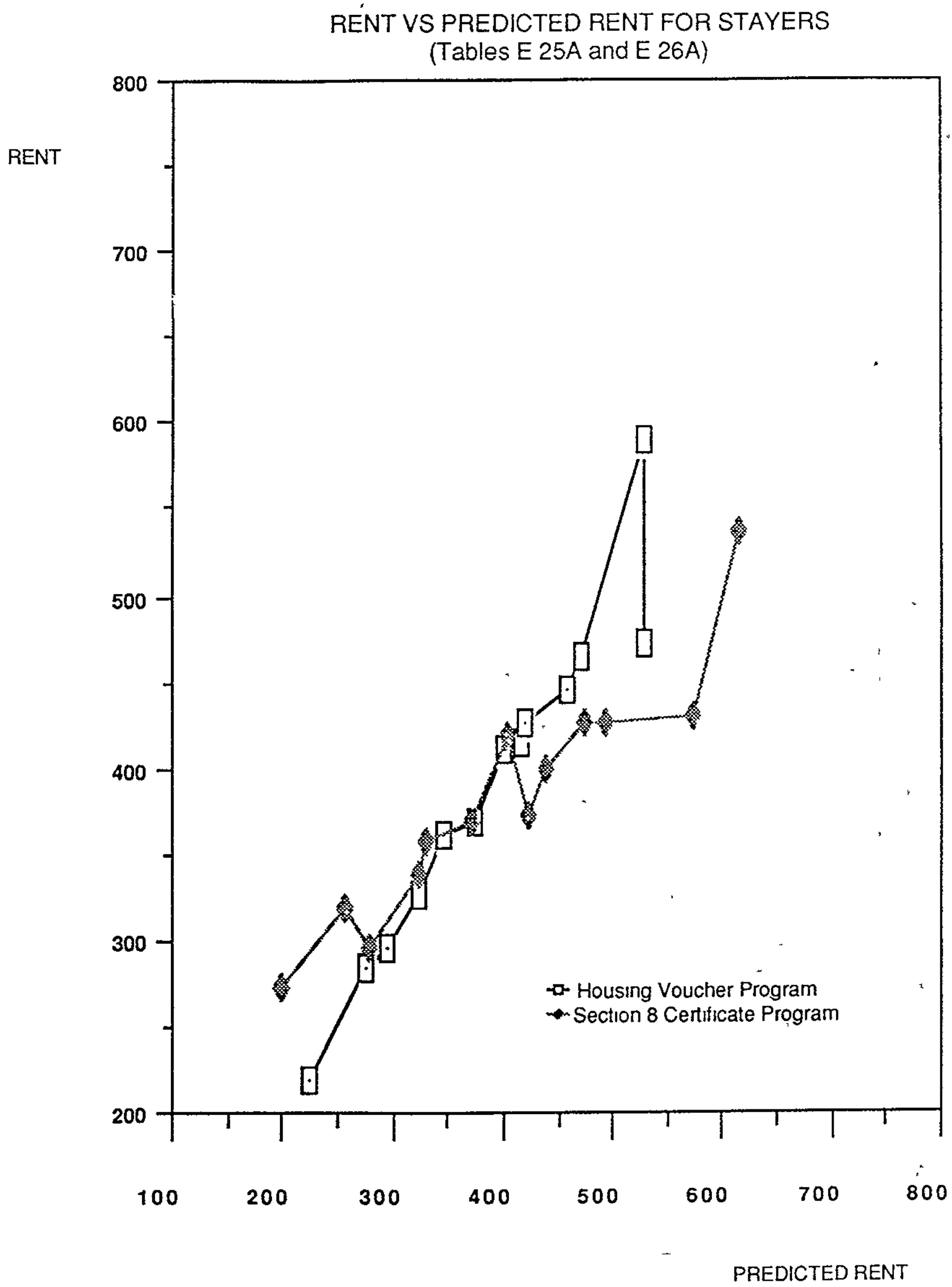
[a]Because of the small number of observations, 10-point intervals are used for ratios above 1.1.

[b]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[c]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

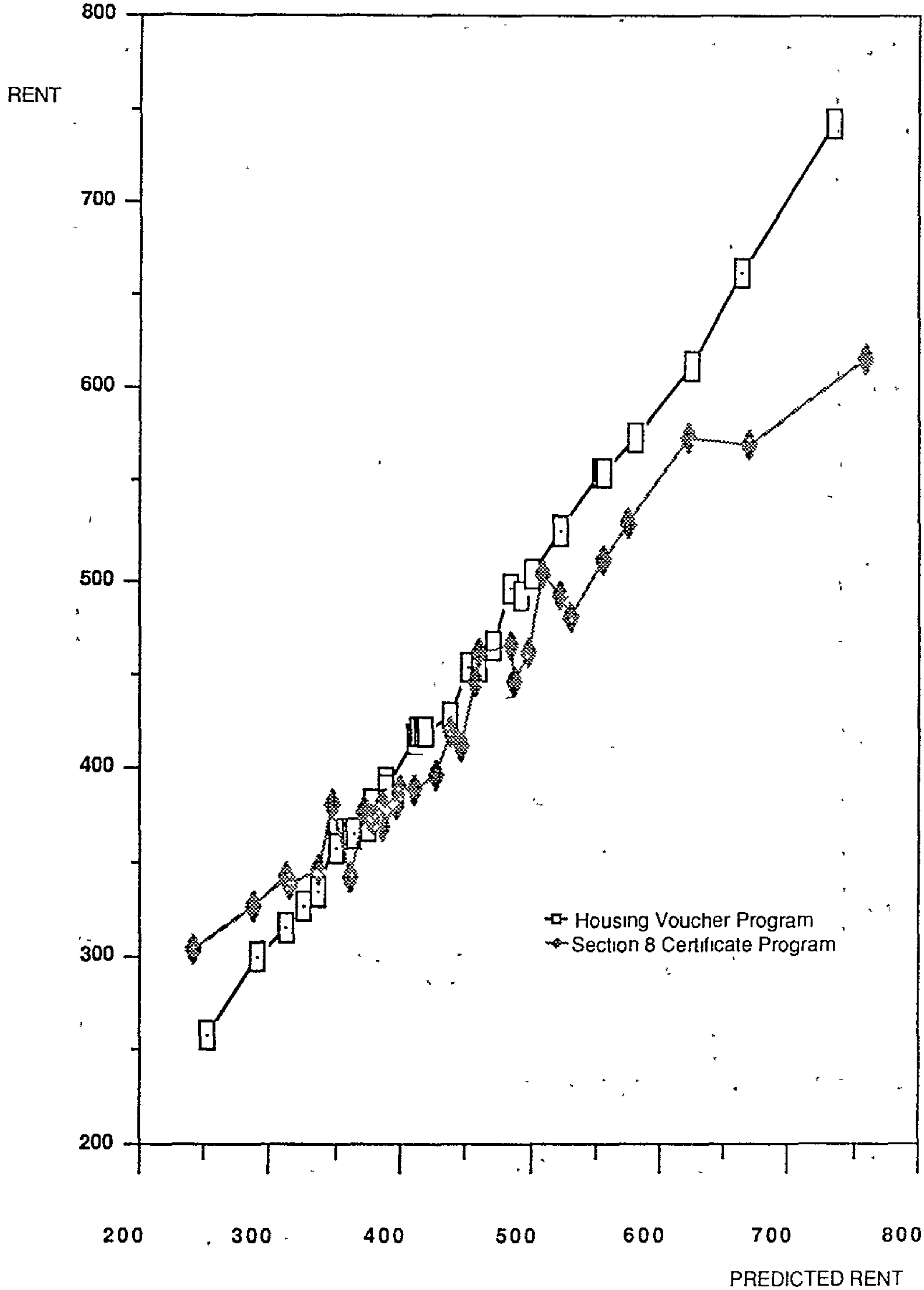
Figure E.2



RENT VS PREDICTED RENT FOR STAYERS
(Tables E 25A and E 26A)
RENT
800
700
600
500
400
300
200
100
200
300
400
500
600
700
800
Housing Voucher Program
Section 8 Certificate Program
PREDICTED RENT

Figure E.3

RENT VS PREDICTED RENT FOR MOVERS
(Tables E 25B and E 26B)



These results are confirmed by regressions of actual rent on predicted values as shown in Table E.27. These regressions show the regression of actual rent on predicted (Housing Voucher) rent. The regressions are unweighted. For both stayers and movers, the Certificate Program regression is shifted up and rotated down from the Housing Voucher regression.

As discussed in the Note to this Appendix, because we use Housing Voucher recipient rents to estimate predicted values, we would expect some rotation in the estimated regression of actual Certificate Program rents on predicted value even if the actual regression of rent on value were the same in the two programs. However, this bias should not be large enough to account for the full estimated rotation.

Having confirmed the shopping models of Appendix D, we then considered the regression of predicted rent on rent. Tables E.28 and E.29 tabulate rent and predicted rent for stayers and movers within categories of actual contract rent or contract rent to FMR ratios. The results are summarized for stayers in Figure E.4 and for movers in Figure E.5. Neither graph is very revealing. For stayers there appears to be some divergence between the programs at higher rents, with Certificate recipients obtaining somewhat better housing. For movers, the regression lines appear to be the same, though the Certificate line may be shifted up somewhat at all levels of rent.

Regressions of estimated housing quality on rent yield more definite results. Because the R^2 of the hedonic regressions of rent on housing quality varies across sites, we expect that the regression of quality on rent will also vary across sites. Accordingly, we tested for differences between the two programs using the specification:

$$(52) \qquad V = \sum \alpha_i s_i + \sum \beta_i s_i R + c\gamma + CR\delta + \theta$$

where:

V = Estimated value based on the Housing Voucher hedonic regressions

S_i = A dummy variable (0,1) for the i^{th} site

R = Actual rent

C = A dummy variable for the Certificate Program

TABLE E.27

REGRESSION OF ACTUAL RENT ON PREDICTED RENT (STAYERS)

STAYERS

Housing Voucher Program

$$R = 1.6 + 0.99^{**}V$$
$$\quad (11.7) \quad (0.03)$$

N=253 RMSE=53.4 CV=13%

Certificate Program

$$R = 128.5^{**} + 0.64^{**}V$$
$$\quad (13.2) \quad (0.03)$$

N=259 RMSE=73.0 CV=19%

Combined Program

$$R = 1.6 + 0.99^{**}V + 126.9^{**}C - 0.35^{**}CV$$
$$\quad (14.0) \quad (0.03) \quad (7.0) \quad (0.04)$$

N=512 RMSE=64.0 CV=16%

MOVERS

Housing Voucher Program

$$R = 0.0 + 1.00^{**}V$$
$$\quad (6.3) \quad (0.01)$$

N=550 RMSE=41.1 CV=9%

Certificate Program

$$R = 130.0^{**} + 0.66^{**}V$$
$$\quad (10.6) \quad (0.02)$$

N=541 RMSE=77.0 CV=18%

Combined Program

$$R = 0.0 + 1.00^{**}V + 130.0^{**}C - 0.34^{**}CV$$
$$\quad (9.4) \quad (0.02) \quad (12.7) \quad (0.03)$$

N=1091 RMSE=61.6 CV=14%

Notes:

R = Actual contract rent

V = Predicted contract rent based on the estimated Housing Voucher hedonic equation

C = A dummy (0,1) variable for the Certificate Program

TABLE E.28A

ACTUAL AND PREDICTED RENT BY ACTUAL RENT CATEGORY FOR STAYERS

Actual Rent	Housing Voucher Program: Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)	Certificate Program: Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)
AR≤300	56	250 (5)	268 (6)	-19** (5)	63 (7)	64	263 (4)	292 (10)	-30** (9)	67 (6)
300<AR≤350	52	332 (2)	347 (6)	-14* (6)	60 (7)	55	325 (2)	338 (10)	-13 (9)	55 (7)
350<AR≤400	35	379 (2)	379 (7)	-0 (7)	57 (8)	38	381 (2)	377 (16)	4 (16)	34 (8)
400<AR≤450	44	430 (2)	438 (8)	-9 (8)	48 (8)	30	422 (11)	460 (18)	-38* (15)	50 (7)
450<AR≤500	13	476 (5)	447 (10)	30** (10)	0 (0)	26	478 (3)	471 (24)	7 (23)	65 (10)
500<AR	53	600 (13)	573 (13)	27** (9)	30 (6)	46	593 (11)	620 (18)	-27‡ (15)	50 (7)

[a]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[b]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

TABLE E.28B

ACTUAL AND PREDICTED RENT BY ACTUAL RENT CATEGORY FOR MOVERS

	Housing Voucher Program					Certificate Program				
Actual Rent	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)
AR≤275	26	260 (3)	280 (7)	-19** (6)	73 (9)	26	248 (8)	296 (14)	-48** (18)	69 (9)
275 ≤300	27	292 (1)	312 (5)	-20** (5)	78 (8)	44	289 (1)	320 (9)	-31** (10)	68 (7)
300<AR≤325	31	318 (1)	326 (6)	-8 (6)	61 (9)	49	315 (1)	330 (9)	-15‡ (8)	61 (7)
325<AR≤350	45	341 (1)	346 (5)	-5 (4)	53 (8)	54	341 (1)	380 (16)	-39* (15)	56 (7)
350<AR≤375	56	366 (1)	368 (5)	-2 (5)	52 (7)	59	365 (1)	375 (9)	-10 (9)	53 (7)
375<AR≤400	54	391 (1)	396 (4)	-5 (4)	54 (7)	67	390 (1)	406 (11)	-16 (11)	52 (6)
400<AR≤425	37	416 (1)	429 (8)	-13‡ (8)	57 (8)	36	415 (1)	444 (15)	-29* (15)	64 (8)
425<AR≤450	50	441 (1)	444 (5)	-3 (5)	52 (7)	21	442 (2)	479 (16)	-37* (16)	71 (10)
450<AR≤475	18	467 (2)	472 (13)	-5 (12)	50 (12)	26	465 (1)	490 (16)	-25 (16)	66 (10)
475<AR≤500	35	494 (1)	475 (7)	18* (8)	31 (9)	30	492 (1)	514 (17)	-21 (17)	50 (10)
500<AR≤525	31	517 (1)	522 (8)	-5 (8)	48 (9)	23	518 (1)	552 (17)	-34* (17)	65 (10)
525<AR≤550	19	543 (2)	531 (11)	11 (11)	37 (11)	24	543 (1)	572 (18)	-29 (18)	58 (10)
550<AR	121	670 (9)	653 (8)	16** (4)	38 (4)	82	653 (7)	654 (14)	-2 (13)	48 (6)

[a]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[b]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

TABLE E.29A

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF ACTUAL CONTRACT RENT TO FMR OR PAYMENT STANDARD FOR STAYERS

	Housing Voucher Program					Certificate Program				
Ratio of Actual Rent to FMR	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)
A≤0.70	38	272	306	-34**	76	36	277	325	-48**	81
		(12)	(13)	(6)	(7)		(10)	(14)	(11)	(7)
0.70<A≤0.75	13	311	325	-14	62	22	309	359	-50*	73
		(31)	(38)	(11)	(14)		(14)	(30)	(25)	(10)
0.85<A≤0.80	21	348	370	-21*	67	23	381	402	-20	57
		(23)	(24)	(11)	(11)		(24)	(32)	(13)	(11)
0.80<A≤0.85	31	393	391	3	39	27	405	425	-21*	70
		(21)	(20)	(7)	(9)		(19)	(24)	(10)	(9)
0.85<A≤0.90	26	390	394	-4	54	40	410	427	-17	50
		(28)	(19)	(9)	(10)		(19)	(23)	(12)	(8)
0.90<A≤0.95	38	448	447	1	47	4	435	464	-29	53
		(17)	(17)	(9)	(8)		(21)	(30)	(20)	(8)
0.95<A≤1.00	26	431	418	14‡	42	30	453	443	10	37
		(20)	(17)	(8)	(10)		(21)	(26)	(14)	(9)
1.00<A	56	493	472	21*	29	35	423	396	27‡	26
		(18)	(17)	(9)	(6)		(16)	(21)	(15)	(7)

[a]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[b]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

TABLE E.29B

ACTUAL AND PREDICTED RENT BY LEVEL OF RATIO OF ACTUAL CONTRACT RENT TO FMR OR PAYMENT STANDARD FOR MOVERS

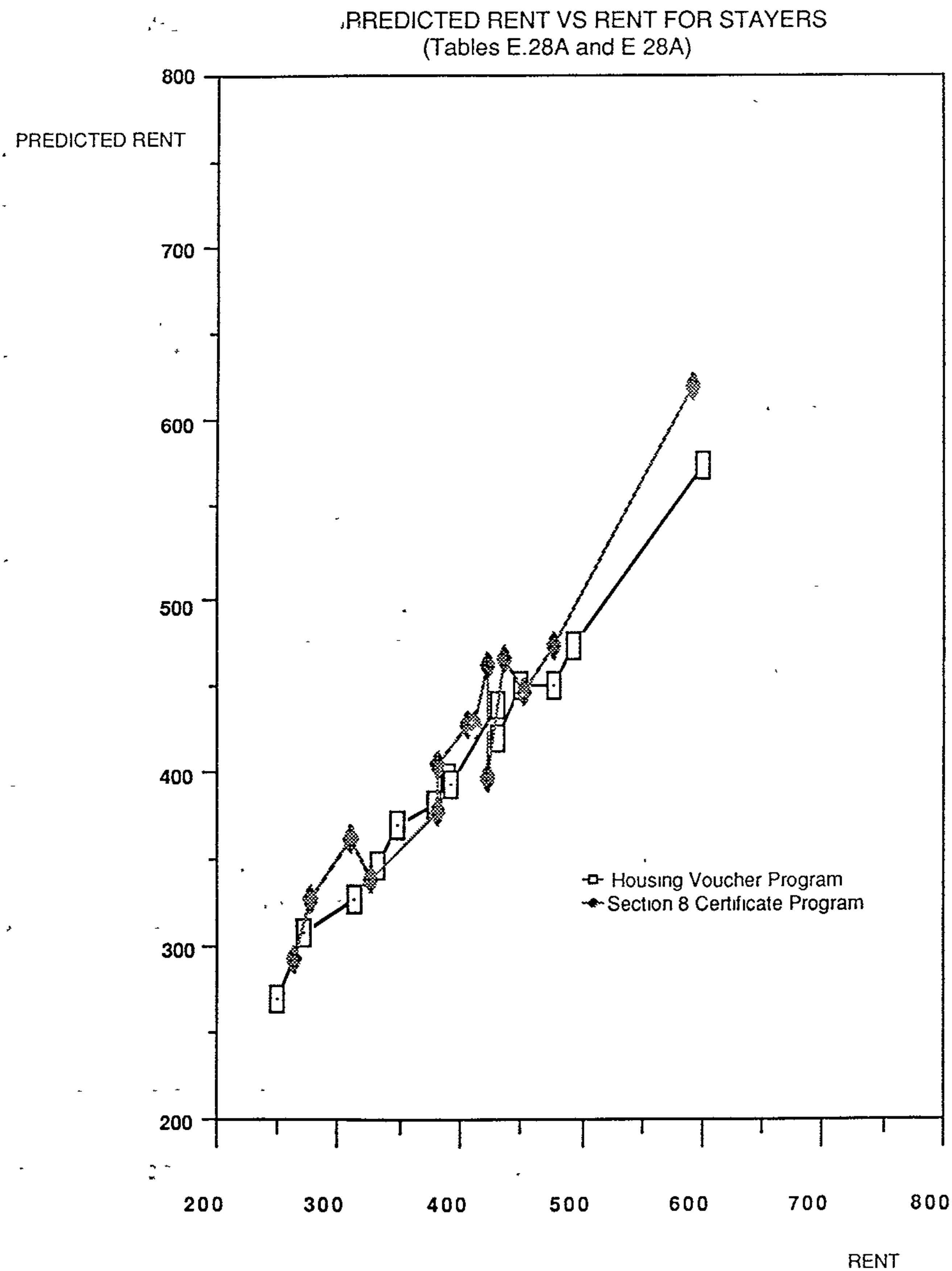
	Housing Voucher Program					Certificate Program				
Ratio of Actual Rent to FMR	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)	Sample Size	Actual Rent (s.e.)	Predicted Rent (s.e.)	Difference[a] (s.e.)[b]	Percent of Cases With Rent Less Than Predicted (s.e.)
A≤0.5	24	308	329	-21**	71	34	308	350	-42**	68
		(9)	(10)	(6)	(9)		(9)	(15)	(14)	(8)
0.5<A≤0.6	28	358	354	5	39	52	352	386	-34**	62
		(13)	(14)	(5)	(9)		(9)	(16)	(13)	(7)
0.6<A≤0.7	44	362	376	-13**	59	75	379	421	-42**	65
		(12)	(13)	(5)	(7)		(9)	(15)	(11)	(6)
0.7<A≤0.8	56	383	389	-6	64	61	369	403	-34**	66
		(11)	(11)	(5)	(6)		(9)	(13)	(10)	(6)
0.8<A≤0.9	76	407	410	-3	53	58	405	401	4	47
		(11)	(11)	(4)	(6)		(12)	(15)	(11)	(7)
0.9<A≤1.0	69	427	432	-5	49	56	447	449	-1	52
		(11)	(12)	(5)	(6)		(15)	(17)	(9)	(7)
1.0<A≤1.1	67	490	491	-1	54	46	484	503	-19	52
		(12)	(13)	(5)	(6)		(17)	(21)	(14)	(7)
1.1<A≤1.2	44	468	463	5	43	32	428	449	-21	56
		(11)	(12)	(5)	(8)		(16)	(25)	(16)	(9)
1.2<A≤1.3	34	569	566	2	47	37	547	581	-35*	68
		(19)	(19)	(8)	(9)		(21)	(25)	(15)	(8)
1.3<A	76	657	633	25**	32	52	594	595	-1	50
		(16)	(15)	(6)	(5)		(17)	(24)	(17)	(7)

[a]Difference Amount may differ from difference of actual and predicted rent entries due to rounding.

[b]Significance only indicated for Difference.

** = Significant at 0.01 level
 * = Significant at 0.05 level
 ‡ = Significant at 0.10 level

Figure E.4



PREDICTED RENT VS RENT FOR STAYERS
(Tables E.28A and E 28A)
PREDICTED RENT
800
700
600
500
400
300
200
200
300
400
500
600
700
800
RENT
Housing Voucher Program
Section 8 Certificate Program

Figure E.5

PREDICTED RENT VS RENT FOR MOVERS
(Tables E.28B and E 29B)

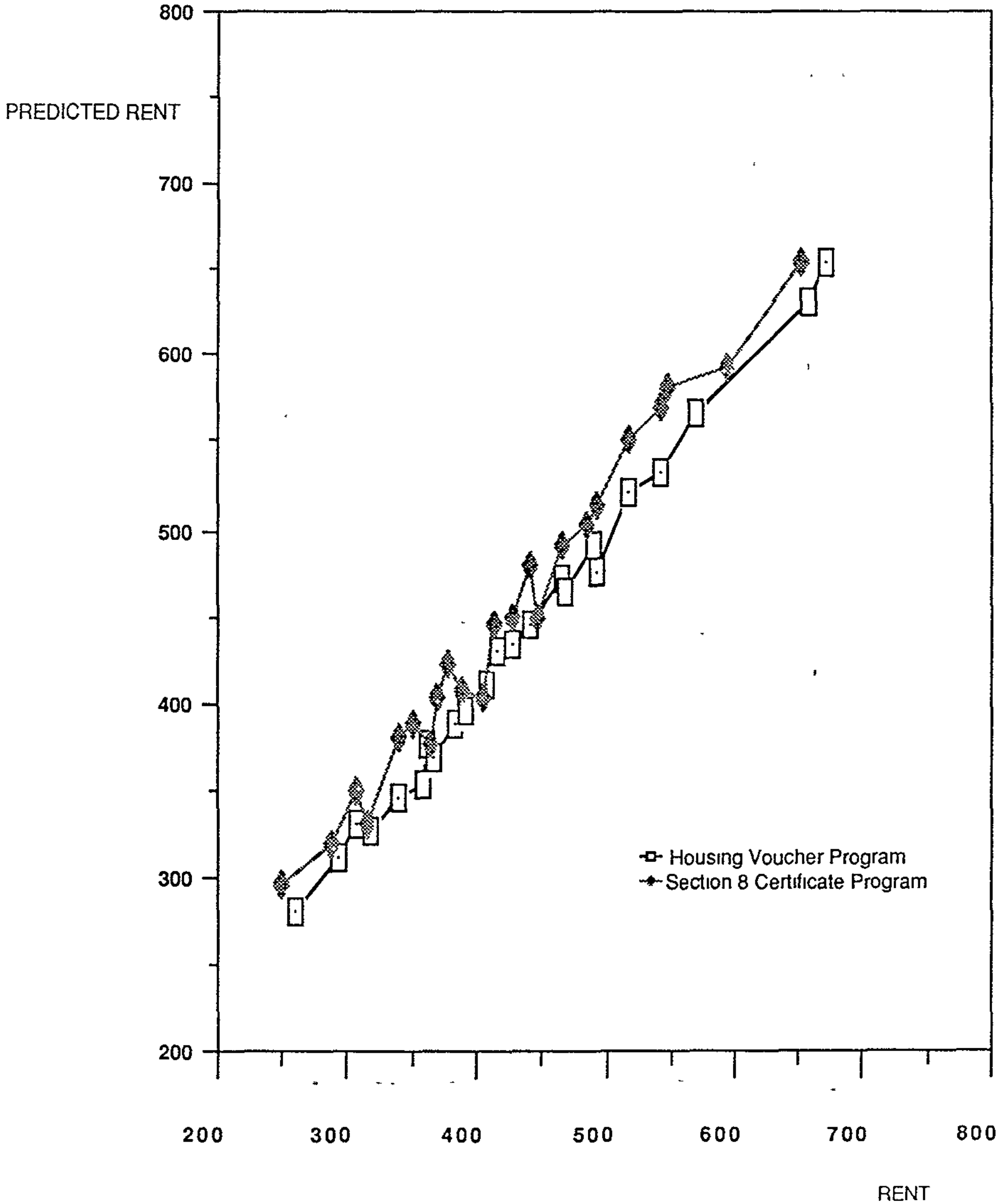


TABLE E.30

REGRESSION OF ESTIMATED VALUE ON RENT

STAYERS

Unweighted

$$V = \sum s_i \hat{\alpha}_i + \sum s_i R\hat{\beta}_i - \underset{(19.9)}{34.0‡C} + \underset{(0.05)}{0.12*CR}$$

N=512 RMSE=66.9 CV=16% R^2=0.77

Weighted

$$V = \sum s_i \hat{\alpha}_i + \sum s_i R\hat{\beta}_i' - \underset{(16.6)}{31.16‡} + \underset{(0.04)}{0.10*CR}$$

N=512 RMSE=54.4 CV=15% R^2=0.80

MOVERS

Unweighted

$$V = \sum s_i \hat{\alpha}_i + \sum s_i R\hat{\beta}_i + \underset{(14.6)}{13.3C} + \underset{(0.03)}{0.00CR}$$

N=1091 RMSE=67.0 CV=15% R^2=0.77

Weighted

$$V = \sum s_i \hat{\alpha}_i + \sum s_i R\hat{\beta}_i + \underset{(5.6)}{12.39} - \underset{(0.04)}{0.01CR}$$

N=1091 RMSE=86.9 CV=21% R^2=0.89

Notes for Tables E.30

R = Actual contract rent

V = Predicted contract rent based on the estimated Housing Voucher hedonic equation

C = A dummy (0,1) variable for the Certificate Program

$V_i = x_i' \hat{\beta}_v$

where:

$$\text{Weight} = \begin{cases} S_v^2(1 - x'(Z'Z)^{-1}x) & \text{for Housing Voucher} \\ S_v^2(1 = x'(Z'Z)^{-1}x) & \text{for Certificate} \end{cases}$$

S_v^2 = The mean squared error for the Housing Voucher hedonic regression

Z = The matrix of housing characteristics in the Housing Voucher hedonic regressions

weight = $R^2 S^2 x'(Z'Z)^{-1} x$

where

(R^2) = R^2 from Housing Voucher hedonic equation

S^2 = Mean squared error from Housing Voucher hedonic equation

Z = The matrix of characteristics in the Housing Voucher hedonic equation

χ = The vector of characteristics for the unit

The results are shown in Table E.30. For recipients who move there is no significant or substantial difference between the programs in the regression of estimated value on rent. This would appear to confirm the search rent model for recipients who move, so that we would conclude that there is no effective difference in shopping incentives and that apparent difference in average prices are artifacts created by differences in average housing quality.

For recipients who stay, there is a significant rotation of the Certificate Program regression. This indicates that one or another of the bargaining models is in effect (in addition to the effects of differences induced by the selection effects associated with the FMR rent ceiling). Most plausibly, we would surmise that for recipients who qualify in place, Certificate Program landlords tend to adjust rent increases to meet the program ceiling--advancing higher increases if they would normally be below the ceiling and smaller increases if their normal increases would bring them above the ceiling.

Unfortunately, as discussed in the Note to this Appendix, comparison of the regressions of predicted rent on rent in the two programs is subject to biases large enough to make these findings inconclusive.

NOTE TO APPENDIX E
ON REGRESSION OF RENT AND PREDICTED RENT

In Section E.7 we compared actual rents in both programs with predicted rents based on the estimated hedonic coefficients in the Housing Voucher program. In particular, we noted that:

1. The estimated regression of actual rents on predicted rents is flatter in the Certificate Program than in the Housing Voucher program.

2. The estimated regression of predicted rents on actual rents is the same in both programs for movers, but not for stayers.

From this we concluded that the actual regression of rent on housing quality is flatter in the Certificate Program and that the actual regression of housing quality on rent may be the same for movers in the two programs.

These conclusions cannot be immediately drawn from the estimated regressions. Since we base predicted rents on the estimated hedonic equation for Housing Voucher rents, the regression of <u>actual rents</u> on <u>predicted rents</u> will tend to be flatter in the Certificate Program even if the actual regression of rent on housing quality is the same in the two programs. We demonstrate below that the expected size of this effect is too small to account for the observed regressions, so that the conclusion that the true regression of rent on housing quality is flatter in the Certificate Program seems reasonable.

In a similar way, even if the true regression of housing quality on rent is the same in the two programs, the regression of <u>predicted rent</u> on <u>actual rent</u> would tend to be different. We show that this difference may be large enough so that, within our error of estimate, we would reject the hypothesis that the regressions of housing quality on rent are the same for movers in the two programs.

Consider first the regression of actual rents on predicted rents. Say that the regression of rent on housing characteristics is the same in both programs so that:

(N.1) $R = X\beta + \varepsilon$

Where

R = the vector of unit rents

X = the matrix of housing characteristics

β = unknown coefficients

ε = a stochastic term, assumed i.i.n. $(0,\sigma^2)$

We use the estimates of β from the Housing Voucher observations to create predicted rents.

(N.2) $\hat{\beta}_v = (X_v'X_v)^{-1}X_v'R_v$

$= \beta + (X_v'X_v)^{-1}X_v'\varepsilon_v$

(N.3) $V_c = X_c\hat{\beta}_v$

$= X_c\beta + X_c(X_v'X_v)^{-1}X_v'\varepsilon_v$

(N.4) $V_v = X_v\hat{\beta}_v$

$= X_v\beta + X_v(X_v'X_v)^{-1}X_v'\varepsilon_v$

Where

$\hat{\beta}_v$ = the estimate of β based on Housing Voucher observations

V_c = the predicted rents for the Certificate Program recipients based on their housing characteristics (X_c) and the estimated Housing Voucher coefficients (β_v)

V_v = the predicted rents for the Housing Voucher Program recipients based on their housing characteristics (X_v) and their estimated coefficients (β_v)

We note that in terms of asymptotic expectations, given X_c and X_v:

(N.5) $$E^A \left(\frac{R_c'R_c}{n_c}\right) = \frac{\beta'X_c'X_c\beta}{n_c} + \sigma^2$$

(N.6) $$E^A \left(\frac{R_v'R_v}{n_v}\right) = \frac{\beta'X_v'X_v\beta}{n_v} + \sigma^2$$

(N.7) $$E^A \left(\frac{V_v'R_v}{n_v}\right) = \frac{\beta'X_v'X_v\beta}{n_v} + \frac{k}{n_v}\sigma^2$$

(N.8) $$E^A \left(\frac{V_v'V_v}{n_v}\right) = \frac{\beta'X_v'X_v\beta}{n_v} + \frac{k}{n_v}\sigma^2$$

(N.9) $$E^A \left(\frac{V_c'R_c}{n_c}\right) = \frac{\beta'X_c'X_c\beta}{n_c}$$

(N.10) $$E^A \left(\frac{V_c'V_c}{n_c}\right) = \frac{\beta'X_c'X_c\beta}{n_c} + \frac{a}{n_c}\sigma^2$$

where "a" in Eq. (N.10) is defined by

(N.11) $$a = tr[(X_c'X_c)(X_v'X_v)^{-1}]$$

and

n_c = the number of observations in the Certificate Program

n_v = the number of observations in the Housing Voucher Program

k = the number of parameters in the Housing Voucher hedonic regressions

Now consider the regression of R on V -- that is:

(N.12) $$R = \alpha_0 + \alpha_1 V$$

Armed with the asymptotic expectations of Eq. (N.5) to (N.11) we see that:

(N.13) $$\text{Plim} \begin{pmatrix} \hat{\alpha}_0 \\ \hat{\alpha}_1 \end{pmatrix}_{\text{VOUCHER}} = \begin{pmatrix} 1 & \\ \bar{X}_v \beta & \dfrac{\beta' X_v' X_v \beta}{n_v} + \dfrac{k}{n_v} \sigma^2 \end{pmatrix}^{-1} \begin{pmatrix} \bar{X}_v \beta \\ \dfrac{\beta X_v' X_v \beta}{n_v} + \dfrac{k}{n_v} \sigma^2 \end{pmatrix}$$

$$= \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

(N.14) $$\text{Plim} \begin{pmatrix} \hat{\alpha}_0 \\ \hat{\alpha}_1 \end{pmatrix}_{\text{CERT}} = \begin{pmatrix} 1 & \\ \bar{X}_c \beta & \dfrac{\beta' X_c' X_c \beta}{n_c} + \dfrac{a}{n_c} \sigma^2 \end{pmatrix}^{-1} \begin{pmatrix} \bar{X}_c \beta \\ \dfrac{\beta X_c' X_c \beta}{n_c} \end{pmatrix}$$

$$= \begin{pmatrix} 0 \\ 1 \end{pmatrix} - \begin{pmatrix} -\bar{X}_c \beta \\ 1 \end{pmatrix} \left(\frac{(a/n_c)\sigma^2}{\dfrac{\beta' X_c' X_c \beta}{n_c} - (\bar{X}_c \beta)^2 + (\dfrac{a}{n_c})\sigma^2} \right)$$

This is the usual errors-in-variable result: the estimated coefficient on predicted rent in the Certificate Program is biased downward in proportion to the ratio of the error variance of predicted rent to the total variance. This does not happen in the Housing Voucher program because the error in the estimate of predicted rent is correlated with actual rents.[1]

We are concerned with the size of the last term in parentheses in Eq. (N.14). We note first that given the relatively larger dispersion of rents in the Housing Voucher Program, it seems reasonable to assume that:

$$\text{(N.15)} \quad a = \text{tr}[(X_c'X_c)(X_v'X_v)^{-1}]$$

$$< (n_c/n_v)\ \text{tr}[(X_c'X_c)(X_v'X_v)^{-1}]$$

$$= \frac{n_c k}{n_v}$$

thus

$$\text{(N.16)} \quad \begin{array}{l}\text{(Last term}\\ \text{of Eq. 14)}\end{array} < \frac{(k/n_v)\sigma^2}{\frac{\beta' X_c' X_c \beta}{n_c} - (\bar{X}_c \beta)^2 + (k/n_v)\sigma^2}$$

$$= \frac{(k/n_v)\sigma^2}{\text{Var}\ (R_c) - ((k - n_v)/n_v)\sigma^2}$$

Table E.N.1 tabulates this number by site using the observed variance of Certificate Program rents to estimate ($\text{Var}R_c$) and the estimated mean squared error from the Housing Voucher hedonic regression to estimate σ^2. The estimated asymptotic bias would account for some, but not all, of the observed rotation of the Certificate regression line.

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[1]A better test would be to compare $X_c\hat{\beta}_c$ and $X_c\hat{\beta}_v$.

TABLE E.N.1

ESTIMATE OF ASYMPTOTIC BIAS
IN REGRESSION OF CERTIFICATE PROGRAM
RENTS IN PREDICTED VALUES

	Movers		Stayers	
	n[a]	Bias	n[a]	Bias
Atlanta	71	-0.22	6	-0.16
Los Angeles	42	-0.27	40	-0.03
Minneapolis	42	-0.09	32	-0.10
Montgomery City	62	-0.14	19	-0.12
New York City	38	-0.03	39	-0.08
Oakland	52	-0.12	26	-0.05
Omaha	46	-0.67	35	-0.17
Pittsburgh	66	-0.44	23	-0.13
San Antonio	74	-0.13	5	-0.09
Seattle	44	-0.02	34	-0.12
Wtd. Avg.	531	-0.22	259	-0.10
Estimated Coefficient from Table E.27 Minus One		-0.36		-0.34
(std. err.)		(0.03)		(0.04)

[a] n = number of Certificate observations

Now consider the regression of <u>predicted</u> rents on <u>actual</u> rents. Our hypothesis is that the regression of $X\beta$ on actual rent is the same in the two programs. Since our estimate of β is based on the Housing Voucher Program, the regression of Certificate rents on V_c is an asymptotically unbiased estimate of the regression of Certificate rents on $X\beta$. The problem arises in the regression of Housing Voucher rents on V_v. Since the Housing Voucher rents were used to form V_v, the estimated regression tends to overstate the relationship between rents and $X\beta$. Thus, for

$$(\text{N.17}) \qquad V_v = \alpha_0' + \alpha_1' R$$

we have

$$(\text{N.18}) \qquad \text{Plim}\begin{pmatrix} \hat{\alpha}_0 \\ \\ \hat{\alpha}_1 \end{pmatrix}_{\text{VOUCHER}} = \begin{pmatrix} 1 & \bar{R} \\ \\ \bar{R} & \text{Var } R + (\bar{R})^2 \end{pmatrix}^{-1} \begin{pmatrix} \bar{R} \\ \\ \text{Plim } \dfrac{V_v' R_v}{n_v} \end{pmatrix}$$

From Eq (N.7),

$$(\text{N.19}) \qquad \text{Plim}\left(\frac{V_v' R_v}{n_v}\right) = \frac{\beta' X_v' X_v \beta}{n_v} + \frac{k}{n_v}\,\sigma^2$$

$$= \text{Plim}\left(\frac{\beta' X_v' R_v}{n_v}\right) + \frac{k}{n_v}\,\sigma^2$$

Accordingly,

$$\text{(N.20)} \quad \text{Plim} \begin{pmatrix} \hat{\alpha}_0 \\ \\ \hat{\alpha}_1 \end{pmatrix}_{\text{VOUCHER}} = \begin{pmatrix} \text{Coefficients of} \\ \text{Regression of} \\ X_v\beta \text{ on } R_v \end{pmatrix} + \begin{pmatrix} -\bar{R}_v \\ \\ 1 \end{pmatrix} \left(\frac{(R/n_v)\sigma^2}{\text{Var } R_v} \right)$$

Again, we estimate σ^2 from the Housing Voucher MSE and VarR_v from the observed variation in Housing Voucher rents. The results, shown in Table E.N.2, indicate that the asymptotic bias is large enough to conceal a significant difference in the regressions for the two programs.[1]

[1]A better procedure would be to estimate β based on the pooled Housing Voucher and Certificate observations and then test whether the regression of predicted rents on rent is the same in both programs.

TABLE E.N.2

ESTIMATE OF ASYMPTOTIC
BIAS IN REGRESSION OF VALUE ON RENT

	Movers		Stayers	
	n[a]	Bias	n[a]	Bias
Atlanta	66	-0.08	9	-0.09
Los Angeles	47	-0.23	37	-0.25
Minneapolis	46	-0.10	27	-0.12
Montgomery City	54	-0.16	14	-0.13
New York City	39	-0.32	41	-0.19
Oakland	59	-0.09	26	-0.07
Omaha	47	-0.26	33	-0.13
Pittsburgh	57	-0.20	24	-0.14
San Antonio	75	-0.14	9	-0.13
Seattle	50	-0.28	33	-0.16
Wtd. Avg.[b]	540	-0.18	253	-0.15
Est. Differences from Table E.30 (std. err)		0.00 (0.03)		0.12 (0.05)
Wtd. Avg. of differences in each site[b]		-0.15		-0.08

[a] n = number of Housing Voucher observations.

[b] Weighted by the number of Housing Voucher observations.

SUPPLEMENT TO APPENDIX E

HEDONIC REGRESSIONS BY PHA

This appendix presents the estimated hedonic equations for both progams--both for all recipients and for movers only. Note that the mover stratum variable appears in some mover equations where recipients who actually moved were initially sampled in the stayer stratum. In addition, where variables have the same value for all observations in a given regression, the regression is estimated without them and the coefficient is set at 0 with missing standard errors.

POOLED HEDONIC RENT EQUATIONS

POOLED HEDONIC RENT EQUATIONS
BY SITE (ATLANTA)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-25.3937	153.2885	-0.166	0.8691
CONDTIONS OF TENURE				
Heat Included in Contract Rent	15.50319	3.903599	3.972	0.0002
Tenure Related to Landlord	-154.016	55.1391	-2.793	0.0074
Length of Tenure (log of months)	-23.4422	11.21491	-2.090	0.0417
SIZE OF UNIT				
Square Feet per Room	0.5396685	0.194254	2.778	0.0077
Number of Bathrooms	66.42695	21.92647	3.030	0.0039
Log (number of rooms)	142.2764	37.52446	3.792	0.0004
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	7.23568	18.97884	0.381	0.7046
Log of Building Age	32.60339	24.04415	1.356	0.1812
Kitchen Equipment Provided	-17.2832	14.17264	-1.219	0.2284
Air Conditioning Provided	-20.6633	16.59245	-1.245	0.2188
No Heat in Unit	0	.	.	.
Number of Hazards	-3.00013	12.4934	-0.240	0.8112
Condition of Common Halls	6.885762	11.8091	0.583	0.5625
Amenities in Bathrooms	21.23306	7.320152	2.901	0.0055
Amenities in Halls	8.190284	16.86971	0.486	0.6294
Balconies/porches/windows	-17.0664	11.52362	-1.481	0.1449
Amenities per room in other rooms	16.29797	26.01054	0.627	0.5338
BUILDING TYPE				
Single Family Detached	70.50144	23.53775	2.995	0.0043
Duplex or Two-Family House	0	.	.	.
Single Row Family House	64.24129	42.14605	1.524	0.1337
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0.3522876	20.35591	0.017	0.9863
Abandoned Buildings (Evaluator)	-19.8169	35.72998	-0.555	0.5816
Abandoned Buildings (Tenant)	-28.4873	35.65531	-0.799	0.4281
Cleanliness of Surrounding Parcels	-10.9572	13.42722	-0.816	0.4183
Scaled Median Owner Occup. Tract	-2.18781	1.048684	-2.086	0.0421
Scaled Median Rent - Renter Occup. Tract	-0.0226792	0.1645815	-0.138	0.8910
SAMPLE STRATUM				
Mover Stratum	33.79998	24.8528	1.360	0.1799
Observations	75			
Degrees of Freedom	50			
R2	0.8266			
Adjusted R2	0.7400			
Root Mean Square Error	46.27185			
Coefficient of Variation	11.27207			

POOLED HEDONIC RENT EQUATIONS
BY SITE (ATLANTA)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	64.44174	104.3837	0.617	0.5397
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-1.7468	4.072451	-0.429	0.6697
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-30.1254	11.13686	-2.705	0.0092
SIZE OF UNIT				
Square Feet per Room	0.4305042	0.2438835	1.765	0.0834
Number of Bathrooms	26.4758	16.38218	1.616	0.1121
Log (number of rooms)	177.6711	36.5983	4.855	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	1.564543	20.06764	0.078	0.9382
Log of Building Age	21.94684	16.08866	1.364	0.1784
Kitchen Equipment Provided	13.12669	10.78536	1.217	0.2291
Air Conditioning Provided	4.00555	16.73231	0.239	0.8117
No Heat in Unit	0	.	.	.
Number of Hazards	-12.6007	13.52727	-0.932	0.3559
Condition of Common Halls	3.776171	9.165466	0.412	0.6820
Amenities in Bathrooms	19.18572	12.18247	1.575	0.1214
Amenities in Halls	-13.997	17.76506	-0.788	0.4343
Balconies/porches/windows	4.244243	10.74188	0.395	0.6944
Amenities per room in other rooms	16.60661	20.20698	0.822	0.4149
BUILDING TYPE				
Single Family Detached	-3.20853	23.24796	-0.138	0.8908
Duplex or Two-Family House	11.90005	25.60583	0.465	0.6441
Single Row Family House	-80.9947	42.87544	-1.889	0.0645
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-12.4791	17.79616	-0.701	0.4863
Abandoned Buildings (Evaluator)	4.510215	20.08359	0.225	0.8232
Abandoned Buildings (Tenant)	-2.98184	19.24272	-0.155	0.8775
Cleanliness of Surrounding Parcels	-12.8808	12.67497	-1.016	0.3142
Scaled Median Owner Occup. Tract	-2.68429	1.547341	-1.735	0.0887
Scaled Median Rent - Renter Occup. Tract	-0.0211583	0.2136411	-0.099	0.9215
SAMPLE STRATUM				
Mover Stratum	-3.0291	20.9198	-0.145	0.8854

Observations	77
Degrees of Freedom	52
R2	0.6956
Adjusted R2	0.5492
Root Mean Square Error	42.14706
Coefficient of Variation	11.41483

POOLED HEDONIC RENT EQUATIONS
BY SITE (LOS ANGELES)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	210.9798	337.3209	0.625	0.5342
CONDTIONS OF TENURE				
Heat Included in Contract Rent	5.450156	16.1334	0.338	0 7368
Tenure Related to Landlord	-24.391	75.3028	-0.324	0.7472
Length of Tenure (log of months)	-27.3617	23.95191	-1.142	0.2582
SIZE OF UNIT				
Square Feet per Room	0.425213	0.7834999	0.543	0.5895
Number of Bathrooms	-56.8062	43.81657	-1.296	0.2001
Log (number of rooms)	333.2946	94.54217	3.525	0.0009
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	33.83455	54.37283	0.622	0.5363
Log of Building Age	-7.30141	46.44881	-0.157	0.8757
Kitchen Equipment Provided	50.50753	32.53607	1.552	0.1262
Air Conditioning Provided	20.6577	63.88088	0.323	0.7476
No Heat in Unit	-6.20846	142.3757	-0.044	0.9654
Number of Hazards	-18.1024	39.50252	-0.458	0.6485
Condition of Common Halls	21.06472	20.55746	1.025	0.3099
Amenities in Bathrooms	-7.7805	19.39979	-0.401	0.6899
Amenities in Halls	41.09112	31.85976	1.290	0.2024
Balconies/porches/windows	19.31747	32.32557	0.598	0.5525
Amenities per room in other rooms	-169.087	92.0103	-1.838	0.0714
BUILDING TYPE				
Single Family Detached	92.17459	46.82308	1.969	0.0540
Duplex or Two-Family House	105.6006	58.4824	1.806	0.0763
Single Row Family House	-20.7831	94.13843	-0.221	0.8261
Highrise	42.62611	160.4216	0.266	0.7914
NEIGHBORHOOD				
Rural Area	0	.	.	
Commercial - Industrial Activities in Area	78.5417	150.1912	0.523	0.6031
Abandoned Buildings (Evaluator)	59.57096	80.81249	0.737	0.4641
Abandoned Buildings (Tenant)	-55.6431	77.5765	-0.717	0.4762
Cleanliness of Surrounding Parcels	-48.4681	28.47906	-1.702	0.0943
Scaled Median Owner Occup. Tract	-1.90068	1.962035	-0.969	0.3368
Scaled Median Rent - Renter Occup. Tract	-0.314197	0.5655778	-0.556	0.5807
SAMPLE STRATUM				
Mover Stratum	-32.053	50.78447	-0.631	0.5305

Observations	84
Degrees of Freedom	56
R2	0.5023
Adjusted R2	0.2535
Root Mean Square Error	124.6947
Coefficient of Variation	23.34694

POOLED HEDONIC RENT EQUATIONS
BY SITE (LOS ANGELES)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-80.9478	194.5528	-0.416	0.6789
CONDTIONS OF TENURE				
Heat Included in Contract Rent	14.01898	7.445212	1.883	0.0648
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-22.2949	13.27989	-1.679	0.0987
SIZE OF UNIT				
Square Feet per Room	0.6954934	0.3544996	1.962	0.0547
Number of Bathrooms	63.69231	23.59699	2.699	0.0091
Log (number of rooms)	339.0476	40.92179	8.285	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	47.69788	28.24664	1.689	0.0968
Log of Building Age	-9.43841	23.52609	-0.401	0.6898
Kitchen Equipment Provided	-23.1811	14.00456	-1.655	0.1034
Air Conditioning Provided	53.32997	25.27541	2.110	0.0393
No Heat in Unit	0	.	.	.
Number of Hazards	25.34634	14.77001	1.716	0.0916
Condition of Common Halls	-5.43563	10.72393	-0.507	0.6142
Amenities in Bathrooms	-7.22395	11.07119	-0.653	0.5167
Amenities in Halls	-10.4855	15.39661	-0.681	0.4986
Balconies/porches/windows	3.831971	14.1922	0.270	0.7881
Amenities per room in other rooms	-5.15865	27.1263	-0.190	0.8499
BUILDING TYPE				
Single Family Detached	-6.41962	25.28231	-0.254	0.8005
Duplex or Two-Family House	0.6093523	26.99991	0.023	0.9821
Single Row Family House	43.99616	86.56417	0.508	0.6132
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-39.6532	34.57504	-1.147	0.2562
Abandoned Buildings (Evaluator)	-21.3626	31.24927	-0.684	0.4970
Abandoned Buildings (Tenant)	-32.8925	25.21561	-1.304	0.1973
Cleanliness of Surrounding Parcels	-9.83645	14.5632	-0.675	0.5021
Scaled Median Owner Occup. Tract	-1.14076	1.297264	-0.879	0.3829
Scaled Median Rent - Renter Occup. Tract	-0.371795	0.2939367	-1.265	0.2111
SAMPLE STRATUM				
Mover Stratum	12.40712	21.3713	0.581	0.5638

Observations	82
Degrees of Freedom	57
R2	0.7961
Adjusted R2	0.7067
Root Mean Square Error	62.26609
Coefficient of Variation	11.51971

POOLED HEDONIC RENT EQUATIONS
BY SITE (MINNEAPOLIS)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-208.771	182.5002	-1.144	0.2587
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-10.1567	4.2084	-2.413	0.0199
Tenure Related to Landlord	108.3207	73.99044	1.464	0.1501
Length of Tenure (log of months)	-20.3794	8.35065	-2.440	0.0187
SIZE OF UNIT				
Square Feet per Room	1.101291	0.3543501	3.108	0.0033
Number of Bathrooms	102.8216	24.07648	4.271	0.0001
Log (number of rooms)	229.5921	42.90184	5.352	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	58.98758	30.4636	1.936	0.0591
Log of Building Age	9.155827	23.34701	0.392	0.6968
Kitchen Equipment Provided	-3.94106	7.530751	-0.523	0.6033
Air Conditioning Provided	-7.4025	26.55462	-0.279	0.7817
No Heat in Unit	0	.	.	.
Number of Hazards	60.99203	24.18423	2.522	0.0153
Condition of Common Halls	-3.38292	7.035156	-0.481	0.6329
Amenities in Bathrooms	-14.9993	9.249666	-1.622	0.1119
Amenities in Halls	33.08352	29.47529	1.122	0.2676
Balconies/porches/windows	1.16781	7.537537	0.155	0.8776
Amenities per room in other rooms	-29.2959	22.43039	-1.306	0.1982
BUILDING TYPE				
Single Family Detached	-95.363	49.26148	-1.936	0.0592
Duplex or Two-Family House	-8.74776	37.66333	-0.232	0.8174
Single Row Family House	-78.5914	39.75033	-1.977	0.0542
Highrise	-13.6364	55.26822	-0.247	0.8052
NEIGHBORHOOD				
Rural Area	13.07553	23.00542	0.568	0.5726
Commercial - Industrial Activities in Area	-54.0839	31.01961	-1.744	0.0881
Abandoned Buildings (Evaluator)	-10.1729	59.51085	-0.171	0.8650
Abandoned Buildings (Tenant)	-90.5782	85.01444	-1.065	0.2924
Cleanliness of Surrounding Parcels	-7.2378	6.725477	-1.076	0.2876
Scaled Median Owner Occup. Tract	-0.876155	0.7784445	-1.126	0.2663
Scaled Median Rent - Renter Occup. Tract	-0.0709747	0.2446972	-0.290	0.7731
SAMPLE STRATUM				
Mover Stratum	-7.2226	17.84863	-0.405	0.6876

Observations	73
Degrees of Freedom	45
R2	0.8061
Adjusted R2	0.6855
Root Mean Square Error	42.68935
Coefficient of Variation	9.283836

POOLED HEDONIC RENT EQUATIONS
BY SITE (MINNEAPOLIS)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	120.7204	162.6149	0.742	0.4615
CONDTIONS OF TENURE				
Heat Included in Contract Rent	5.992977	3.302111	1.815	0.0758
Tenure Related to Landlord	-75.0554	22.23259	-3.376	0.0015
Length of Tenure (log of months)	-6.72841	6.630633	-1.015	0.3153
SIZE OF UNIT				
Square Feet per Room	0.7335353	0.218392	3.359	0.0015
Number of Bathrooms	-4.42622	26.90135	-0.165	0.8700
Log (number of rooms)	130.4149	30.55508	4.268	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	18.07259	29.09356	0.621	0.5374
Log of Building Age	-26.0146	10.77682	-2.414	0.0196
Kitchen Equipment Provided	-0.0880484	6.783854	-0.013	0.9897
Air Conditioning Provided	1.630593	21.16801	0.077	0.9389
No Heat in Unit	0	.	.	.
Number of Hazards	30.73487	38.95306	0.789	0.4340
Condition of Common Halls	-5.58901	4.613807	-1.211	0.2317
Amenities in Bathrooms	-1.3363	8.148647	-0.164	0.8704
Amenities in Halls	34.73435	17.66319	1.966	0.0550
Balconies/porches/windows	-6.87877	7.536403	-0.913	0.3659
Amenities per room in other rooms	23.31231	37.30995	0.625	0.5350
BUILDING TYPE				
Single Family Detached	38.25279	26.43831	1.447	0.1544
Duplex or Two-Family House	5.684231	27.66174	0.205	0.8381
Single Row Family House	0	.	.	.
Highrise	-117.858	34.03105	-3.463	0.0011
NEIGHBORHOOD				
Rural Area	34.13973	40.07679	0.852	0.3985
Commercial - Industrial Activities in Area	16.67354	28.43879	0.586	0.5604
Abandoned Buildings (Evaluator)	0	.	.	.
Abandoned Buildings (Tenant)	41.625	51.86995	0.802	0.4262
Cleanliness of Surrounding Parcels	-3.59399	5.865422	-0.613	0.5429
Scaled Median Owner Occup. Tract	0.7675796	0.9979755	0.769	0.4456
Scaled Median Rent - Renter Occup. Tract	0.2743184	0.251003	1.093	0.2799
SAMPLE STRATUM				
Mover Stratum	3.806187	13.62162	0.279	0.7811
Observations	74			
Degrees of Freedom	48			
R2	0.8007			
Adjusted R2	0.6927			
Root Mean Square Error	36.89765			
Coefficient of Variation	8.58271			

POOLED HEDONIC RENT EQUATIONS
BY SITE (MONTGOMERY)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-396.592	283.2731	-1.400	0.1690
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-0.667416	6.252241	-0.107	0.9155
Tenure Related to Landlord	-26.5361	78.2273	-0.339	0.7362
Length of Tenure (log of months)	-26.9586	13.42418	-2.008	0.0512
SIZE OF UNIT				
Square Feet per Room	0.4632258	0.606071	0.764	0.4491
Number of Bathrooms	-11.5748	23.61202	-0.490	0.6266
Log (number of rooms)	242.8663	76.18469	3.188	0.0027
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	8.360157	43.99359	0.190	0.8502
Log of Building Age	53.14378	25.00834	2.125	0.0397
Kitchen Equipment Provided	-3.25547	13.53701	-0.240	0.8112
Air Conditioning Provided	86.58577	30.7516	2.816	0.0074
No Heat in Unit	0	.	.	.
Number of Hazards	184.8345	51.88002	3.563	0.0009
Condition of Common Halls	11.80976	13.07469	0.903	0.3717
Amenities in Bathrooms	35.34828	14.6497	2.413	0.0204
Amenities in Halls	18.254	22.40833	0.815	0.4200
Balconies/porches/windows	-3.58875	16.99131	-0.211	0.8338
Amenities per room in other rooms	-55.4037	23.4267	-2.365	0.0228
BUILDING TYPE				
Single Family Detached	138.9226	68.54098	2.027	0.0492
Duplex or Two-Family House	96.30776	70.51349	1.366	0.1794
Single Row Family House	14.31959	43.59034	0.329	0.7442
Highrise	-13.8449	47.79464	-0.290	0.7735
NEIGHBORHOOD				
Rural Area	-172.914	118.6133	-1.458	0.1525
Commercial - Industrial Activities in Area	-131.119	78.87979	-1.662	0.1041
Abandoned Buildings (Evaluator)	-183.475	103.6522	-1.770	0.0841
Abandoned Buildings (Tenant)	0	.	.	.
Cleanliness of Surrounding Parcels	43.27248	42.38239	1.021	0.3132
Scaled Median Owner Occup. Tract	1.331083	0.8747593	1.522	0.1358
Scaled Median Rent - Renter Occup. Tract	0.3274928	0.3117228	1.051	0.2996
SAMPLE STRATUM				
Mover Stratum	46.9255	27.95762	1.678	0.1009

Observations	68
Degrees of Freedom	41
R2	0.7926
Adjusted R2	0.6561
Root Mean Square Error	67.94522
Coefficient of Variation	11.63243

POOLED HEDONIC RENT EQUATIONS
BY SITE (MONTGOMERY)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-63.9857	197.8426	-0.323	0.7477
CONDITIONS OF TENURE				
Heat Included in Contract Rent	2.729254	3.498683	0 780	0.4388
Tenure Related to Landlord	-118.255	56.98563	-2 075	0.0428
Length of Tenure (log of months)	-17.4115	11.41211	-1.526	0.1330
SIZE OF UNIT				
Square Feet per Room	0.8560279	0.4123617	2.076	0.0428
Number of Bathrooms	29.0726	15.4431	1.883	0.0653
Log (number of rooms)	193.0546	41.26632	4.678	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	6.067231	32.8411	0.185	0.8541
Log of Building Age	23.29805	18.05879	1.290	0.2026
Kitchen Equipment Provided	-16.5588	11.70641	-1.415	0.1631
Air Conditioning Provided	43.32586	18.97853	2.283	0.0265
No Heat in Unit	0	.	.	.
Number of Hazards	-37.8135	28.32031	-1.335	0.1875
Condition of Common Halls	-17.2921	10.23979	-1.689	0.0971
Amenities in Bathrooms	3.399151	13.17446	0.258	0.7974
Amenities in Halls	-53.5965	16.7192	-3.206	0.0023
Balconies/porches/windows	34.99032	11.99584	2.917	0.0052
Amenities per room in other rooms	24.178	17.05365	1.418	0.1621
BUILDING TYPE				
Single Family Detached	-90.364	31.78933	-2.843	0.0063
Duplex or Two-Family House	-75.0456	39.76584	-1.887	0.0646
Single Row Family House	-132.418	38.48068	-3.441	0.0011
Highrise	37.5641	37.88719	0.991	0.3260
NEIGHBORHOOD				
Rural Area	221.9613	76.48586	2.902	0.0054
Commercial Industrial Activities in Area	115.7659	93.41867	1.239	0.2207
Abandoned Buildings (Evaluator)	26.11735	45.75901	0.571	0.5706
Abandoned Buildings (Tenant)	-38.0596	66.27575	-0.574	0.5682
Cleanliness of Surrounding Parcels	17.40097	13.83329	1.258	0.2139
Scaled Median Owner Occup. Tract	0.09792212	0.7854148	0.125	0.9013
Scaled Median Rent - Renter Occup. Tract	0.1675905	0.2096023	0.800	0.4275
SAMPLE STRATUM				
Mover Stratum	40.93916	19.7988	2.068	0.0436

Observations	81
Degrees of Freedom	53
R2	0.7507
Adjusted R2	0.6190
Root Mean Square Error	56.43072
Coefficient of Variation	9.98149

POOLED HEDONIC RENT EQUATIONS
BY SITE (NEW YORK)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-110.79	252.4643	-0.439	0.6625
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-8.07036	16.7829	-0.481	0.6326
Tenure Related to Landlord	92.53205	92.39208	1.002	0.3210
Length of Tenure (log of months)	8.743356	19.33675	0.452	0.6530
SIZE OF UNIT				
Square Feet per Room	-0.0358458	0.5341705	-0.067	0.9467
Number of Bathrooms	87.09459	74.95594	1.162	0.2504
Log (number of rooms)	301.0668	86.94498	3.463	0.0011
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	14.82779	35.01071	0.424	0.6736
Log of Building Age	-11.5257	32.48122	-0.355	0.7241
Kitchen Equipment Provided	27.77249	80.732	0.344	0.7322
Air Conditioning Provided	37.16385	66.69513	0.557	0.5797
No Heat in Unit	192.7901	104.2539	1.849	0.0699
Number of Hazards	-6.72112	34.21028	-0.196	0.8450
Condition of Common Halls	8.404643	15.53987	0.541	0.5908
Amenities in Bathrooms	14.10535	22.86999	0.617	0.5400
Amenities in Halls	17.41352	18.45635	0.943	0.3496
Balconies/porches/windows	12.16675	24.74482	0.492	0.6249
Amenities per room in other rooms	4.291965	47.50344	0.090	0.9283
BUILDING TYPE				
Single-Family Detached	0	.	.	.
Duplex or Two-Family House	-38.249	53.86226	-0.710	0.4807
Single Row-Family House	96.57441	113.2495	0.853	0.3976
Highrise	-33.2265	29.20899	-1.138	0.2603
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0	.	.	.
Abandoned Buildings (Evaluator)	34.14875	44.41072	0.769	0.4453
Abandoned Buildings (Tenant)	2.410605	46.08614	0.052	0.9585
Cleanliness of Surrounding Parcels	4.89437	12.62989	0.388	0.6999
Scaled Median Owner Occup. Tract	-0.163321	2.169672	-0.075	0.9403
Scaled Median Rent - Renter Occup. Tract	-0.242921	0.2443417	-0.994	0.3246
SAMPLE STRATUM				
Mover Stratum	101.588	40.46154	2.511	0.0151

Observations	80
Degrees of Freedom	54
R2	0.6056
Adjusted R2	0.4158
Root Mean Square Error	89.55728
Coefficient of Variation	21.36901

POOLED HEDONIC RENT EQUATIONS
BY SITE (NEW YORK)

CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	553.7774	179.2471	3.089	0.0032
CONDTIONS OF TENURE				
Heat Included in Contract Rent	25.10262	9.545533	2.630	0.0113
Tenure Related to Landlord	9.373838	40.41448	0.232	0.8175
Length of Tenure (log of months)	-32.8058	11.14043	-2.945	0.0049
SIZE OF UNIT				
Square Feet per Room	-0.0106409	0.236227	-0.045	0.9642
Number of Bathrooms	20.11304	43.6143	0.461	0.6466
Log (number of rooms)	6.071094	45.41643	0.134	0.8942
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-6.92508	18.28321	-0.379	0.7064
Log of Building Age	-48.8661	29.20809	-1.673	0.1004
Kitchen Equipment Provided	-23.1407	80.21385	-0.288	0.7741
Air Conditioning Provided	-48.5363	43.67399	-1.111	0.2716
No Heat in Unit	0	.	.	.
Number of Hazards	1.655047	15.76414	0.105	0.9168
Condition of Common Halls	4.172433	9.440337	0.442	0.6604
Amenities in Bathrooms	12.63788	16.98606	0.744	0.4603
Amenities in Halls	-7.58462	9.834622	-0.771	0.4441
Balconies/porches/windows	5.350488	20.22814	0.265	0.7925
Amenities per room in other rooms	-3.2609	27.90287	-0.117	0.9074
BUILDING TYPE				
Single Family Detached	21.15794	68.22292	0.310	0.7577
Duplex or Two-Family House	6.377414	36.88518	0.173	0.8634
Single Row Family House	0	.	.	.
Highrise	-11.9622	19.13122	-0.625	0.5346
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-61.8895	84.83895	-0.729	0.4690
Abandoned Buildings (Evaluator)	8.96511	37.49772	0.239	0.8120
Abandoned Buildings (Tenant)	-1.96115	37.29011	-0.053	0.9583
Cleanliness of Surrounding Parcels	-4.90121	10.97589	-0.447	0.6571
Scaled Median Owner Occup. Tract	-0.0556375	1.213556	-0.046	0.9636
Scaled Median Rent - Renter Occup. Tract	0.1964885	0.1988612	0.988	0.3278
SAMPLE STRATUM				
Mover Stratum	1.00338	21.60295	0.046	0.9631
Observations	77			
Degrees of Freedom	51			
R2	0.5724			
Adjusted R2	0.3545			
Root Mean Square Error	52.52062			
Coefficient of Variation	14.24263			

POOLED HEDONIC RENT EQUATIONS
BY SITE (OAKLAND)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T
Intercept	-305.059	260.008	-1.173	0.2453
CONDTIONS OF TENURE				
Heat Included in Contract Rent	27.07003	9.056016	2.989	0.0041
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-19.139	11.12643	-1.720	0.0906
SIZE OF UNIT				
Square Feet per Room	1.029739	0.4622054	2.228	0.0296
Number of Bathrooms	66.87029	34.34367	1.947	0.0562
Log (number of rooms)	383.8588	38.80896	9.891	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	2.87821	47.93988	0.060	0.9523
Log of Building Age	-15.2915	27.10364	-0.564	0.5747
Kitchen Equipment Provided	-5.42218	18.47907	-0.293	0.7702
Air Conditioning Provided	129.5282	89.51242	1.447	0.1531
No Heat in Unit	16.19451	45.04347	0.360	0.7205
Number of Hazards	4.637046	21.96364	0.211	0.8335
Condition of Common Halls	-0.0262495	15.96083	-0.002	0.9987
Amenities in Bathrooms	12.3176	19.10552	0.645	0.5216
Amenities in Halls	-11.6062	19.95868	-0.582	0.5631
Balconies/porches/windows	1.791047	18.56269	0.096	0.9235
Amenities per room in other rooms	-96.3257	29.02024	-3.319	0.0015
BUILDING TYPE				
Single Family Detached	88.20873	28.70904	3.073	0.0032
Duplex or Two-Family House	24.05209	26.50192	0.908	0.3677
Single Row Family House	0	.	.	.
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-67.5056	49.82568	-1.355	0.1805
Abandoned Buildings (Evaluator)	51.74015	29.47908	1.755	0.0843
Abandoned Buildings (Tenant)	-57.3177	30.16106	-1.900	0.0622
Cleanliness of Surrounding Parcels	37.92758	24.70625	1.535	0.1300
Scaled Median Owner Occup. Tract	-0.486688	1.542757	-0.315	0.7535
Scaled Median Rent - Renter Occup. Tract	0.2656881	0.3924625	0.677	0.5010
SAMPLE STRATUM				
Mover Stratum	34.30932	23.52273	1.459	0.1499

Observations	85
Degrees of Freedom	60
R2	0.8401
Adjusted R2	0.7735
Root Mean Square Error	74.54453
Coefficient of Variation	12.81986

POOLED HEDONIC RENT EQUATIONS
BY SITE (OAKLAND)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	227.4033	248.419	0.915	0.3642
CONDTIONS OF TENURE				
Heat Included in Contract Rent	7.235215	5.207526	1.389	0.1706
Tenure Related to Landlord	-17.8255	34.81894	-0.512	0.6109
Length of Tenure (log of months)	-21.9584	10.55094	-2.081	0.0424
SIZE OF UNIT				
Square Feet per Room	0.5294645	0.4381594	1.208	0.2324
Number of Bathrooms	6.819065	29.33865	0.232	0.8171
Log (number of rooms)	364.9874	42.46443	8.595	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-79.447	48.83474	-1.627	0.1098
Log of Building Age	-34.0369	22.45367	-1.516	0.1356
Kitchen Equipment Provided	43.18235	17.46658	2.472	0.0167
Air Conditioning Provided	-103.798	65.97632	-1.573	0.1217
No Heat in Unit	6.83271	53.06902	0.129	0.8981
Number of Hazards	-29.1258	39.68796	-0.734	0.4663
Condition of Common Halls	0.4722939	9.047509	0.052	0.9586
Amenities in Bathrooms	3.413555	13.25824	0.257	0.7978
Amenities in Halls	10.50101	17.4351	0.602	0.5496
Balconies/porches/windows	-15.8313	17.53685	-0.903	0.3708
Amenities per room in other rooms	-35.1166	53.15484	-0.661	0.5118
BUILDING TYPE				
Single Family Detached	-4.46344	25.92381	-0.172	0.8640
Duplex or Two-Family House	-8.40598	24.07817	-0.349	0.7284
Single Row Family House	0	.	.	.
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	
Commercial - Industrial Activities in Area	-5.01546	46.94956	-0.107	0.9153
Abandoned Buildings (Evaluator)	-28.0806	39.25617	-0.715	0.4776
Abandoned Buildings (Tenant)	8.914504	36.91288	0.242	0.8101
Cleanliness of Surrounding Parcels	-5.19037	14.47548	-0.359	0.7214
Scaled Median Owner Occup. Tract	1.122492	1.011983	1.109	0.2724
Scaled Median Rent - Renter Occup. Tract	0.7577364	0.4263826	1.777	0.0814
SAMPLE STRATUM				
Mover Stratum	37.93933	20.30539	1.868	0.0673

Observations	78
Degrees of Freedom	52
R2	0.8387
Adjusted R2	0.7580
Root Mean Square Error	60.70814
Coefficient of Variation	11.34463

POOLED HEDONIC RENT EQUATIONS
BY SITE (OMAHA)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-3.47043	125.8127	-0.028	0.9781
CONDTIONS OF TENURE				
Heat Included in Contract Rent	8.431012	4.156514	2.028	0.0475
Tenure Related to Landlord	-20.675	49.78683	-0.415	0.6796
Length of Tenure (log of months)	-9.67775	6.440796	-1.503	0.1388
SIZE OF UNIT				
Square Feet per Room	0.4599747	0.2717099	1.693	0.0962
Number of Bathrooms	30.70952	21.76569	1.411	0.1640
Log (number of rooms)	155.8569	24.56556	6.345	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	16.80167	17.89477	0.939	0.3520
Log of Building Age	-8.48876	18.20102	-0.466	0.6428
Kitchen Equipment Provided	3.63058	9.493889	0.382	0.7037
Air Conditioning Provided	-7.44622	16.12717	-0.462	0.6461
No Heat in Unit	0	.	.	.
Number of Hazards	34.7427	21.87637	1.588	0.1181
Condition of Common Halls	10.81313	6.618137	1.634	0.1081
Amenities in Bathrooms	-4.34522	7.918115	-0.549	0.5854
Amenities in Halls	6.590985	7.338809	0.898	0.3731
Balconies/porches/windows	-9.70425	9.717259	-0.999	0.3224
Amenities per room in other rooms	-24.8186	13.8047	-1.798	0.0778
BUILDING TYPE				
Single Family Detached	12.42718	18.51647	0.671	0.5050
Duplex or Two-Family House	-38.2772	30.86482	-1.240	0.2203
Single Row Family House	0	.	.	
Highrise	-3.80954	26.88324	-0.142	0.8878
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	57.17244	26.53071	2.155	0.0356
Abandoned Buildings (Evaluator)	19.03738	18.04401	1.055	0.2961
Abandoned Buildings (Tenant)	-21.0063	21.89303	-0.959	0.3416
Cleanliness of Surrounding Parcels	-19.2007	7.873358	-2.439	0.0181
Scaled Median Owner Occup. Tract	2.292529	1.160232	1.976	0.0533
Scaled Median Rent - Renter Occup. Tract	-0.0135444	0.2298156	-0.059	0.9532
SAMPLE STRATUM				
Mover Stratum	6.171738	14.24614	0.433	0.6666
Observations	80			
Degrees of Freedom	54			
R2	0.7369			
Adjusted R2	0.6102			
Root Mean Square Error	41.04189			
Coefficient of Variation	13.43732			

POOLED HEDONIC RENT EQUATIONS
BY SITE (OMAHA)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	179.0213	102.7323	1.743	0.0871
CONDTIONS OF TENURE				
Heat Included in Contract Rent	7.473261	3.432425	2.177	0.0339
Tenure Related to Landlord	-18.4447	21.8887	-0.843	0.4031
Length of Tenure (log of months)	-13.9706	5.758405	-2.426	0.0186
SIZE OF UNIT				
Square Feet per Room	0.09252439	0.2592372	0.357	0.7226
Number of Bathrooms	53.48317	19.60343	2.728	0.0086
Log (number of rooms)	85.27533	21.65552	3.938	0.0002
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-17.2581	21.48516	-0.803	0.4253
Log of Building Age	-5.52518	15.43602	-0.358	0.7218
Kitchen Equipment Provided	14.93457	9.073715	1.646	0.1056
Air Conditioning Provided	46.80119	12.16951	3.846	0.0003
No Heat in Unit	0	.	.	.
Number of Hazards	-46.5552	22.15687	-2.101	0.0403
Condition of Common Halls	5.332903	6.036779	0.883	0.3809
Amenities in Bathrooms	-10.0227	10.08217	-0.994	0.3246
Amenities in Halls	-1.29456	2.641281	-0.490	0.6260
Balconies/porches/windows	-3.80186	9.063844	-0.419	0.6765
Amenities per room in other rooms	-11.7844	11.33765	-1.039	0:3032
BUILDING TYPE				
Single Family Detached	13.49906	18.39199	0.734	0.4661
Duplex or Two-Family House	42.60216	22.6441	1.881	0.0653
Single Row Family House	26.5151	36.13042	0.734	0.4662
Highrise	74.59106	38.21474	1.952	0.0561
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-10.8342	29.29	-0.370	0.7129
Abandoned Buildings (Evaluator)	25.0166	18.95034	1.320	0.1924
Abandoned Buildings (Tenant)	-25.5611	18.76065	-1.362	0.1787
Cleanliness of Surrounding Parcels	-4.0096	7.980589	-0.502	0.6174
Scaled Median Owner Occup. Tract	0.2420986	1.029181	0.235	0.8149
Scaled Median Rent - Renter Occup. Tract	0.1853381	0.2775855	0.668	0.5072
SAMPLE STRATUM				
Mover Stratum	12.65193	12.81065	0.988	0.3277

Observations	81
Degrees of Freedom	54
R2	0.7026
Adjusted R2	0.5539
Root Mean Square Error	38.37794
Coefficient of Variation	12.51637

POOLED HEDONIC RENT EQUATIONS
BY SITE (PITTSBURGH)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > |T|
Intercept	-555.039	148.358	-3.741	0.0004
CONDTIONS OF TENURE				
Heat Included in Contract Rent	20.5311	4.025957	5.100	0.0001
Tenure Related to Landlord	46.94787	46.11018	1.018	0.3131
Length of Tenure (log of months)	6.075668	8.690961	0.699	0.4875
SIZE OF UN'T				
Square Feet per Room	1.298878	0.2234633	5.812	0.0001
Number of Bathrooms	22.86032	17.66987	1.294	0.2013
Log (number of rooms)	91.25276	27.33822	3.338	0.0015
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	72.66964	19.56627	3.714	0.0005
Log of Building Age	55.0812	15.02153	3.667	0.0006
Kitchen Equipment Provided	-24.9617	13.63767	-1.830	0.0727
Air Conditioning Provided	-3.47209	16.07945	-0.216	0.8299
No Heat in Unit	0	.	.	.
Number of Hazards	-20.7154	14.11574	-1.468	0.1480
Condition of Common Halls	-4.39522	8.297316	-0.530	0.5985
Amenities in Bathrooms	13.70718	10.41969	1.316	0.1939
Amenities in Halls	11.6894	15.47666	0.755	0.4534
Balconies/porches/windows	-13.5866	13.53069	-1.004	0.3198
Amenities per room in other rooms	15.97378	16.52624	0.967	0.3381
BUILDING TYPE				
Single Family Detached	-8.78936	25.9231	-0.339	0.7359
Duplex or Two-Family House	17.53779	25.55706	0.686	0.4955
Single Row Family House	28.41717	21.13401	1.345	0.1844
Highrise	-2.0135	26.55648	-0.076	0.9398
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-65.3438	52.37562	-1.248	0.2176
Abandoned Buildings (Evaluator)	14.4064	22.68196	0.635	0.5280
Abandoned Buildings (Tenant)	-18.3641	23.89177	-0.769	0.4455
Cleanliness of Surrounding Parcels	-3.88306	7.014988	-0.554	0.5822
Scaled Median Owner Occup. Tract	-0.708489	0.7903672	-0.896	0.3740
Scaled Median Rent - Renter Occup. Tract	0.01028786	0.1820555	0.057	0.9551
SAMPLE STRATUM				
Mover Stratum	61.48493	14.02017	4.385	0.0001

Observations	81
Degrees of Freedom	54
R2	0.7170
Adjusted R2	0.5755
Root Mean Square Error	44.23494
Coefficient of Variation	12.96007

POOLED HEDONIC RENT EQUATIONS
BY SITE (PITTSBURGH)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	45.69647	108.484	0.421	0.6752
CONDTIONS OF TENURE				
Heat Included in Contract Rent	11.0373	3.578395	3.084	0.0032
Tenure Related to Landlord	4.133592	30.30528	0.136	0.8920
Length of Tenure (log of months)	-7.58978	7.693523	-0.987	0.3282
SIZE OF UNIT				
Square Feet per Room	0.2629935	0.1653321	1.591	0.1174
Number of Bathrooms	-11.8038	20.98763	-0.562	0.5761
Log (number of rooms)	139.7363	23.13032	6.041	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-0.761323	15.50894	-0.049	0.9610
Log of Building Age	13.75687	11.91544	1.155	0.2533
Kitchen Equipment Provided	-21.2037	11.61487	-1.826	0.0733
Air Conditioning Provided	15.74636	17.11254	0.920	0.3615
No Heat in Unit	38.78734	63.33739	0.612	0.5428
Number of Hazards	-6.80401	11.90401	-0.572	0.5699
Condition of Common Halls	10.67112	5.346033	1.996	0.0509
Amenities in Bathrooms	-2.44631	7.833746	-0.312	0.7560
Amenities in Halls	17.30141	15.06052	1.149	0.2556
Balconies/porches/windows	-4.08085	10.46083	-0.390	0.6980
Amenities per room in other rooms	1.159928	14.13502	0.082	0.9349
BUILDING TYPE				
Single Family Detached	-4.59606	18.85103	-0.244	0.8083
Duplex or Two-Family House	-20.392	17.93325	-1.137	0.2604
Single Row Family House	6.957208	15.96745	0.436	0.6648
Highrise	-4.56499	18.8071	-0.243	0.8091
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	14.91319	44.30976	0.337	0.7377
Abandoned Buildings (Evaluator)	-10.7078	24.99819	-0.428	0.6701
Abandoned Buildings (Tenant)	6.707144	22.06025	0.304	0.7622
Cleanliness of Surrounding Parcels	-10.6964	6.888566	-1.553	0.1262
Scaled Median Owner Occup. Tract	1.232567	0.6220923	1.981	0.0526
Scaled Median Rent - Renter Occup. Tract	0.1187575	0.1198077	0.991	0.3259
SAMPLE STRATUM				
Mover Stratum	-6.38253	11.38686	-0.561	0.5774

Observations	83
Degrees of Freedom	55
R2	0.6912
Adjusted R2	0.5320
Root Mean Square Error	36.06079
Coefficient of Variation	11.69855

POOLED HEDONIC RENT EQUATIONS
BY SITE (SAN ANTONIO)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-201.981	137.9446	-1.464	0.1485
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-1.19283	2.759476	-0.432	0.6672
Tenure Related to Landlord	-40.8392	38.09193	-1.072	0.2881
Length of Tenure (log of months)	-3.02428	6.876407	-0.440	0.6617
SIZE OF UNIT				
Square Feet per Room	0.7459798	0.2253504	3.310	0.0016
Number of Bathrooms	14.31261	13.06843	1.095	0.2780
Log (number of rooms)	155.0773	34.57763	4.485	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	25.76835	21.35324	1.207	0.2324
Log of Building Age	3.984391	23.07466	0.173	0.8635
Kitchen Equipment Provided	2.913924	8.481613	0.344	0.7324
Air Conditioning Provided	-2.95427	22.02661	-0.134	0.8938
No Heat in Unit	-12.195	21.36434	-0.571	0.5703
Number of Hazards	54.89977	36.33288	1.511	0.1362
Condition of Common Halls	15.65644	11.88262	1.318	0.1928
Amenities in Bathrooms	-2.95885	7.135237	-0.415	0.6799
Amenities in Halls	38.50857	33.05268	1.165	0.2488
Balconies/porches/windows	16.93092	16.33169	1.037	0.3042
Amenities per room in other rooms	-93.6451	51.95639	-1.802	0.0767
BUILDING TYPE				
Single Family Detached	37.28602	19.17728	1.944	0.0567
Duplex or Two-Family House	-11.6278	29.17603	-0.399	0.6917
Single Row Family House	0	.	.	.
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	37.32413	29.64486	1.259	0.2131
Abandoned Buildings (Evaluator)	-32.4374	37.08471	-0.875	0.3854
Abandoned Buildings (Tenant)	35.50958	34.13213	1.040	0.3025
Cleanliness of Surrounding Parcels	19.01464	10.20321	1.864	0.0674
Scaled Median Owner Occup. Tract	1.058688	0.8748178	1.210	0.2311
Scaled Median Rent - Renter Occup. Tract	0.006624108	0.1887479	0.035	0.9721
SAMPLE STRATUM				
Mover Stratum	-5.62617	20.79089	-0.271	0.7877

Observations	84
Degrees of Freedom	58
R2	0.7158
Adjusted R2	0.5885
Root Mean Square Error	47.2828
Coefficient of Variation	12.79663

POOLED HEDONIC RENT EQUATIONS
BY SITE (SAN ANTONIO)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	13.50455	97.33244	0.139	0.8902
CONDTIONS OF TENURE				
Heat Included in Contract Rent	0.6794179	2.909679	0.234	0.8163
Tenure Related to Landlord	-65.9663	27.52114	-2.397	0.0202
Length of Tenure (log of months)	18.36401	5.332504	3.444	0.0012
SIZE OF UNIT				
Square Feet per Room	0.5124812	0.2558124	2.003	0.0505
Number of Bathrooms	26.50157	9.059243	2.925	0.0051
Log (number of rooms)	98.30188	24.3717	4.033	0.0002
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-2.23778	17.83235	-0.125	0.9006
Log of Building Age	-7.15151	7.584303	-0.943	0.3502
Kitchen Equipment Provided	-6.35715	6.738826	-0.943	0.3499
Air Conditioning Provided	12.13598	14.44873	0.840	0.4049
No Heat in Unit	-12.9519	16.21609	-0.799	0.4282
Number of Hazards	-22.1205	13.91592	-1.590	0.1181
Condition of Common Halls	-0.975165	7.764273	-0.126	0.9005
Amenities in Bathrooms	0.3794557	5.819645	0.065	0.9483
Amenities in Halls	-41.3847	25.81311	-1.603	0.1151
Balconies/porches/windows	4.25175	11.9046	0.357	0.7225
Amenities per room in other rooms	-9.52712	32.82287	-0.290	0.7728
BUILDING TYPE				
Single Family Detached	15.73869	17.09927	0.92]	0.3617
Duplex or Two-Family House	7.240683	19.62768	0.369	0.7137
Single Row Family House	-58.4579	49.80967	-1.174	0.2460
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	41.96921	38.44263	1.092	0.2801
Commercial - Industrial Activities in Area	26.92311	17.08572	1.576	0.1213
Abandoned Buildings (Evaluator)	-24.5743	34.96666	-0.703	0.4854
Abandoned Buildings (Tenant)	18.21244	27.63838	0.659	0.5129
Cleanliness of Surrounding Parcels	-7.44879	6.519469	-1.143	0.2586
Scaled Median Owner Occup. Tract	0.5983708	0.4732595	1.264	0.2118
Scaled Median Rent - Renter Occup. Tract	-0.0301672	0.1144877	-0.263	0.7932
SAMPLE STRATUM				
Mover Stratum	76.71475	19.99783	3.836	0.0003

Observations	79
Degrees of Freedom	51
R2	0.6832
Adjusted R2	0.5093
Root Mean Square Error	33.87374
Coefficient of Variation	9.596301

POOLED HEDONIC RENT EQUATIONS
BY SITE (SEATTLE)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	60.54846	175.2153	0.346	0.7310
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-6.95986	9.025624	-0.771	0.4439
Tenure Related to Landlord	-97.6653	58.13758	-1.680	0.0985
Length of Tenure (log of months)	-3.61414	9.900467	-0.365	0.7165
SIZE OF UNIT				
Square Feet per Room	0.4023357	0.3420206	1.176	0.2444
Number of Bathrooms	32.75336	33.71659	0.971	0.3355
Log (number of rooms)	152.0381	36.7003	4.143	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	12.81719	29.79087	0.430	0.6687
Log of Building Age	-39.5405	25.18089	-1.570	0.1220
Kitchen Equipment Provided	-0.967362	10.79798	-0.090	0.9289
Air Conditioning Provided	0	.	.	.
No Heat in Unit	-95.6899	76.21092	-1.256	0.2145
Number of Hazards	-1.31306	24.81227	-0.053	0.9580
Condition of Common Halls	4.813886	7.272377	0.662	0.5107
Amenities in Bathrooms	-2.76694	8.253281	-0.335	0.7387
Amenities in Halls	-10.3912	18.73387	-0.555	0.5813
Balconies/porches/windows	0.7141202	10.64832	0.067	0.9468
Amenities per room in other rooms	4.436305	23.00485	0.193	0.8478
BUILDING TYPE				
Single Family Detached	101.5238	33.39565	3.040	0.0036
Duplex or Two-Family House	36.44683	31.3555	1.162	0.2500
Single Row Family House	12.22102	50.47866	0.242	0.8096
Highrise	40.25429	34.94198	1.152	0.2542
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-15.2979	31.93936	-0.479	0.6338
Abandoned Buildings (Evaluator)	-13.8354	26.33539	-0.525	0.6014
Abandoned Buildings (Tenant)	33.21179	25.08838	1.324	0.1910
Cleanliness of Surrounding Parcels	-0.515557	10.26161	-0.050	0.9601
Scaled Median Owner Occup. Tract	0.8173431	1.002001	0.816	0.4181
Scaled Median Rent - Renter Occup. Tract	0.7220966	0.3682629	1.961	0.0549
SAMPLE STRATUM				
Mover Stratum	6.4734	22.72068	0.285	0.7768

Observations	83
Degrees of Freedom	56
R2	0.6607
Adjusted R2	0.4971
Root Mean Square Error	58.90132
Coefficient of Variation	14.98374

POOLED HEDONIC RENT EQUATIONS
BY SITE (SEATTLE)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-65.9512	162.9681	-0.405	0.6874
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-26.1138	8.164808	-3.198	0.0024
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-2.67706	9.204973	-0.291	0.7724
SIZE OF UNIT				
Square Feet per Room	0.7630936	0.3207826	2.379	0.0211
Number of Bathrooms	55.19374	29.54582	1.868	0.0675
Log (number of rooms)	165.4857	36.64611	4.516	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-0.252455	25.67436	-0.010	0.9922
Log of Building Age	20.68058	22.65759	0.913	0.3657
Kitchen Equipment Provided	-2.21577	11.88956	-0.186	0.8529
Air Conditioning Provided	-69.231	77.10492	-0.898	0.3735
No Heat in Unit	-14.1582	65.12005	-0.217	0.8288
Number of Hazards	4.793119	20.52563	0.234	0.8163
Condition of Common Halls	4.571827	5.715802	0.800	0.4275
Amenities in Bathrooms	9.947749	9.752981	1.020	0.3126
Amenities in Halls	12.07414	14.52677	0.831	0.4098
Balconies/porches/windows	-1.27707	11.61381	-0.110	0.9129
Amenities per room in other rooms	-14.0186	20.55463	-0.682	0.4983
BUILDING TYPE				
Single Family Detached	37.07171	28.79258	1.288	0.2037
Duplex or Two-Family House	-32.4234	30.33059	-1.069	0.2901
Single Row Family House	14.19332	36.17813	0.392	0.6965
Highrise	75.86845	38.04405	1.994	0.0515
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-34.5497	25.09855	-1.377	0.1747
Abandoned Buildings (Evaluator)	35.37275	28.82948	1.227	0.2255
Abandoned Buildings (Tenant)	-29.6281	27.75958	-1.067	0.2909
Cleanliness of Surrounding Parcels	6.561098	7.594404	0.864	0.3917
Scaled Median Owner Occup. Tract	-0.933526	0.9317406	-1.002	0.3211
Scaled Median Rent - Renter Occup. Tract	-0.100597	0.3062865	-0.328	0.7439
SAMPLE STRATUM				
Mover Stratum	6.129787	21.18754	0.289	0.7735
Observations	78			
Degrees of Freedom	51			
R2	0.7570			
Adjusted R2	0.6284			
Root Mean Square Error	53.13171			
Coefficient of Variation	14.3403			

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (ATLANTA)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	5.11268	0.3129968	16.335	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.02813258	0.007970682	3.530	0.0009
Tenure Related to Landlord	-0.304141	0.1125874	-2.701	0.0094
Length of Tenure (log of months)	-0.0563676	0.02289949	-2.462	0.0173
SIZE OF UNIT				
Square Feet per Room	0.001249305	0.0003966433	3.150	0.0028
Number of Bathrooms	0.118719	0.04477123	2.652	0.0107
Log (number of rooms)	0.3624658	0.07662046	4.731	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.01154733	0.03875251	0.298	0.7670
Log of Building Age	0.04006548	0.04909528	0.816	0.4183
Kitchen Equipment Provided	-0.0248681	0.02893882	-0.859	0.3943
Air Conditioning Provided	-0.0340699	0.03387979	-1.006	0.3194
No Heat in Unit	0	.	.	.
Number of Hazards	-0.0133049	0.02551002	-0.522	0.6043
Condition of Common Halls	0.02043248	0.02411276	0.847	0.4008
Amenities in Bathrooms	0.04903798	0.01494687	3.281	0.0019
Amenities in Halls	0.009127913	0.03444593	0.265	0.7921
Balconies/porches/windows	-0.0321568	0.02352985	-1.367	0.1779
Amenities per room in other rooms	0.04864121	0.05311041	0.916	0.3641
BUILDING TYPE				
Single Family Detached	0.1918114	0.04806126	3.991	0.0002
Duplex or Two-Family House	0	.	.	.
Single Row Family House	0.1574662	0.08605717	1.830	0.0732
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0.01359098	0.04156433	0.327	0.7450
Abandoned Buildings (Evaluator)	0.008504932	0.07295633	0.117	0.9077
Abandoned Buildings (Tenant)	-0.10217	0.07280387	-1.403	0.1667
Cleanliness of Surrounding Parcels	-0.0278455	0.02741678	-1.016	0.3147
Scaled Median Owner Occup. Tract	-0.00424975	0.002141288	-1.985	0.0527
Scaled Median Rent - Renter Occup. Tract	-.0000428627	0.0003360557	-0.128	0.8990
SAMPLE STRATUM				
Mover Stratum	0.04781572	0.05074644	0.942	0.3506

Observations	75
Degrees of Freedom	50
R2	0.8546
Adjusted R2	0.7819
Root Mean Square Error	0.09448156
Coefficient of Variation	1.575718

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (ATLANTA)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	5.133742	0.2784386	18.438	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	-0.00709122	0.01086307	-0.653	0.5168
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-0.0751046	0.02970703	-2.528	0.0145
SIZE OF UNIT				
Square Feet per Room	0.001224241	0.0006505474	1.882	0.0655
Number of Bathrooms	0.06825339	0.04369867	1.562	0.1244
Log (number of rooms)	0.44662	0.09762419	4.575	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.01487713	0.05352946	0.278	0.7822
Log of Building Age	0.04682071	0.04291572	1.091	0.2803
Kitchen Equipment Provided	0.04571211	0.02876944	1.589	0.1181
Air Conditioning Provided	0.01355336	0.04463262	0.304	0.7626
No Heat in Unit	0	.	.	.
Number of Hazards	-0.0271278	0.03608335	-0.752	0.4556
Condition of Common Halls	0.01275433	0.02444844	0.522	0.6041
Amenities in Bathrooms	0.04267208	0.03249615	1.313	0.1949
Amenities in Halls	-0.0338137	0.04738745	-0.714	0.4787
Balconies/porches/windows	0.001085479	0.02865343	0.038	0.9699
Amenities per room in other rooms	0.04046475	0.05390115	0.751	0.4562
BUILDING TYPE				
Single Family Detached	0.01174104	0.0620128	0.189	0.8506
Duplex or Two-Family House	0.03212665	0.06830232	0.470	0.6401
Single Row Family House	-0.179606	0.1143682	-1.570	0.1224
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-0.0261835	0.04747039	-0.552	0.5836
Abandoned Buildings (Evaluator)	0.003201817	0.05357201	0.060	0.9526
Abandoned Buildings (Tenant)	-0.0171982	0.05132904	-0.335	0.7389
Cleanliness of Surrounding Parcels	-0.0441245	0.03380988	-1.305	0.1976
Scaled Median Owner Occup. Tract	-0.00665373	0.004127459	-1.612	0.1130
Scaled Median Rent - Renter Occup. Tract	.0000341791	0.0005698773	0.060	0.9524
SAMPLE STRATUM				
Mover Stratum	-0.0174907	0.05580255	-0.313	0.7552

Observations	77
Degrees of Freedom	52
R2	0.6903
Adjusted R2	0.5414
Root Mean Square Error	0.1124252
Coefficient of Variation	1.906268

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (LOS ANGELES)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	5.134291	0.4083054	12.575	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	-0.00167502	0.01952845	-0.086	0.9320
Tenure Related to Landlord	0.06186754	0.09114923	0.679	0.5001
Length of Tenure (log of months)	-0.0396566	0.02899226	-1.368	0.1768
SIZE OF UNIT				
Square Feet per Room	0.001891991	0.0009483766	1.995	0.0509
Number of Bathrooms	0.07260026	0.05303716	1.369	0.1765
Log (number of rooms)	0.6786017	0.1144373	5.930	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.05213366	0.06581484	0.792	0.4316
Log of Building Age	-0.030354	0.05622331	-0.540	0.5914
Kitchen Equipment Provided	0.03344051	0.03938284	0.849	0.3994
Air Conditioning Provided	0.02583199	0.07732372	0.334	0.7396
No Heat in Unit	0.05356146	0.1723367	0.311	0.7571
Number of Hazards	-0.00932436	0.04781528	-0.195	0.8461
Condition of Common Halls	0.05159094	0.02488349	2.073	0.0428
Amenities in Bathrooms	-0.0373949	0.02348221	-1.592	0.1169
Amenities in Halls	-0.0222978	0.0385642	-0.578	0.5654
Balconies/porches/windows	0.08961018	0.03912804	2.290	0.0258
Amenities per room in other rooms	-0.144395	0.1113726	-1.296	0.2001
BUILDING TYPE				
Single Family Detached	0.08720295	0.05667635	1.539	0.1295
Duplex or Two-Family House	0.08033748	0.07078921	1.135	0.2613
Single Row Family House	-0.117496	0.1139486	-1.031	0.3069
Highrise	0.1984436	0.1941801	1.022	0.3112
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0.1846986	0.1817969	1.016	0.3140
Abandoned Buildings (Evaluator)	0.0311387	0.09781836	0.318	0.7514
Abandoned Buildings (Tenant)	0.03025236	0.0939014	0.322	0.7485
Cleanliness of Surrounding Parcels	-0.0638618	0.03447208	-1.853	0.0692
Scaled Median Owner Occup. Tract	-0.000242216	0.002374918	-0.102	0.9191
Scaled Median Rent - Renter Occup. Tract	-0.000292343	0.0006845958	-0.427	0.6710
SAMPLE STRATUM				
Mover Stratum	0.04434488	0.06147135	0.721	0.4737

Observations	84
Degrees of Freedom	56
R2	0.7178
Adjusted R2	0.5767
Root Mean Square Error	0.1509349
Coefficient of Variation	2.403418

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (LOS ANGELES)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > |T|
Intercept	5.127798	0.3542302	14.476	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.02269043	0.0135558	1.674	0.0996
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-0.0421306	0.02417924	-1.742	0.0868
SIZE OF UNIT				
Square Feet per Room	0.001164955	0.0006454521	1.805	0.0764
Number of Bathrooms	0.1230264	0.04296401	2.863	0.0059
Log (number of rooms)	0.6180744	0.07450799	8.295	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.09096593	0.05142982	1.769	0.0823
Log of Building Age	-0.022218	0.04283492	-0.519	0.6060
Kitchen Equipment Provided	-0.0365963	0.02549868	-1.435	0.1567
Air Conditioning Provided	0.1069061	0.04601999	2.323	0.0238
No Heat in Unit	0	.	.	.
Number of Hazards	0.04024304	0.02689236	1.496	0.1401
Condition of Common Halls	-0.0133998	0.01952551	-0.686	0.4953
Amenities in Bathrooms	-0.019397	0.02015778	-0.962	0.3400
Amenities in Halls	-0.0238539	0.02803324	-0.851	0.3984
Balconies/porches/windows	0.01882069	0.02584033	0.728	0.4694
Amenities per room in other rooms	-0.00806995	0.04938998	-0.163	0.8708
BUILDING TYPE				
Single Family Detached	-0.00791292	0.04603254	-0.172	0.8641
Duplex or Two-Family House	-0.0251285	0.04915985	-0.511	0.6112
Single Row Family House	0.07095089	0.157611	0.450	0.6543
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-0.0829904	0.06295221	-1.318	0.1927
Abandoned Buildings (Evaluator)	-0.02878	0.05689685	-0.506	0.6149
Abandoned Buildings (Tenant)	-0.0495009	0.0459111	-1.078	0.2855
Cleanliness of Surrounding Parcels	-0.0162666	0.02651582	-0.613	0.5420
Scaled Median Owner Occup. Tract	-0.00165697	0.002361981	-0.702	0.4858
Scaled Median Rent - Renter Occup. Tract	-0.000578806	0.0005351826	-1.082	0.2840
SAMPLE STRATUM				
Mover Stratum	0.02228125	0.03891161	0.573	0.5692

Observations	82
Degrees of Freedom	57
R2	0.7990
Adjusted R2	0.7108
Root Mean Square Error	0.1133704
Coefficient of Variation	1.807966

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (MINNEAPOLIS)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	4.695228	0.3929042	11.950	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	-0.0194282	0.009060252	-2.144	0.0374
Tenure Related to Landlord	0.2117379	0.1592938	1.329	0.1905
Length of Tenure (log of months)	-0.0389472	0.01797809	-2.166	0.0356
SIZE OF UNIT				
Square Feet per Room	0.002273424	0.0007628792	2.980	0.0046
Number of Bathrooms	0.2024778	0.05183418	3.906	0.0003
Log (number of rooms)	0.5150455	0.09236325	5.576	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.1228567	0.06558499	1.873	0.0675
Log of Building Age	0.01432594	0.05026372	0.285	0.7769
Kitchen Equipment Provided	-0.00868166	0.01621293	-0.535	0.5950
Air Conditioning Provided	-0.0226744	0.05716937	-0.397	0.6935
No Heat in Unit	0	.		.
Number of Hazards	0.1216808	0.05206617	2.337	0.0239
Condition of Common Halls	-0.00177821	0.01514597	-0.117	0.9071
Amenities in Bathrooms	-0.0342537	0.01991358	-1.720	0.0923
Amenities in Halls	0.0678221	0.06345728	1.069	0.2909
Balconies/porches/windows	0.004329227	0.01622754	0.267	0.7909
Amenities per room in other rooms	-0.0713951	0.04829033	-1.478	0.1463
BUILDING TYPE				
Single Family Detached	-0.195616	0.1060549	-1.844	0.0717
Duplex or Two-Family House	-0.0123023	0.08108527	-0.152	0.8801
Single Row Family House	-0.189244	0.08557836	-2.211	0.0321
Highrise	-0.0588999	0.1189868	-0.495	0.6230
NEIGHBORHOOD				
Rural Area	0.03302718	0.04952829	0.667	0.5083
Commercial - Industrial Activities in Area	-0.109041	0.06678203	-1.633	0.1095
Abandoned Buildings (Evaluator)	-0.0271682	0.1281207	-0.212	0.8330
Abandoned Buildings (Tenant)	-0.169935	0.1830273	-0.928	0.3581
Cleanliness of Surrounding Parcels	-0.0179448	0.01447926	-1.239	0.2216
Scaled Median Owner Occup. Tract	-0.00191181	0.001675911	-1.141	0.2600
Scaled Median Rent - Renter Occup. Tract	-0.000224728	0.0005268079	-0.427	0.6717
SAMPLE STRATUM				
Mover Stratum	0.0009899373	0.03842627	0.026	0.9796

Observations	73
Degrees of Freedom	45
R2	0.7970
Adjusted R2	0.6707
Root Mean Square Error	0.09190577
Coefficient of Variation	1.50223

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (MINNEAPOLIS)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	5.187114	0.4180698	12.407	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.01760714	0.00848946	2.074	0.0435
Tenure Related to Landlord	-0.175791	0.05715818	-3.076	0.0035
Length of Tenure (log of months)	-0.0161443	0.01704682	-0.947	0.3484
SIZE OF UNIT				
Square Feet per Room	0.001880336	0.0005614682	3.349	0.0016
Number of Bathrooms	-0.0253789	0.0691612	-0.367	0.7153
Log (number of rooms)	0.2931039	0.07855463	3.731	0.0005
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.06550098	0.0747972	0.876	0.3855
Log of Building Age	-0.0552257	0.02770633	-1.993	0.0519
Kitchen Equipment Provided	-0.000122156	0.01744074	-0.007	0.9944
Air Conditioning Provided	0.009641526	0.05442124	0.177	0.8601
No Heat in Unit	0	.	.	.
Number of Hazards	0.08888531	0.1001452	0.888	0.3792
Condition of Common Halls	-0.0172046	0.01186172	-1.450	0.1534
Amenities in Bathrooms	-0.00225764	0.02094951	-0.108	0.9146
Amenities in Halls	0.08060612	0.04541062	1.775	0.0822
Balconies/porches/windows	-0.0159333	0.01937548	-0.822	0.4149
Amenities per room in other rooms	0.05075012	0.09592086	0.529	0.5992
BUILDING TYPE				
Single Family Detached	0.09119293	0.06797076	1.342	0.1860
Duplex or Two-Family House	0.02416377	0.07111608	0.340	0.7355
Single Row-Family House	0	.	.	.
Highrise	-0.34576	0.08749107	-3.952	0.0003
NEIGHBORHOOD				
Rural Area	0.06270593	0.1030342	0.609	0.5457
Commercial - Industrial Activities in Area	0.0357668	0.07311382	0.489	0.6269
Abandoned Buildings (Evaluator)	0	.	.	.
Abandoned Buildings (Tenant)	0.1305875	0.1333534	0.979	0.3324
Cleanliness of Surrounding Parcels	-0.00640039	0.01507953	-0.424	0.6731
Scaled Median Owner Occup. Tract	0.001917614	0.002565714	0.747	0.4585
Scaled Median Rent - Renter Occup. Tract	0.0008058104	0.0006453084	1.249	0.2178
SAMPLE STRATUM				
Mover Stratum	0.01488261	0.03502008	0.425	0.6728

Observations	74
Degrees of Freedom	48
R2	0.7901
Adjusted R2	0.6765
Root Mean Square Error	0.09486086
Coefficient of Variation	1.56779

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (MONTGOMERY)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T
Intercept	4.610817	0.5167256	8.923	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.001722585	0.01140487	0 151	0.8807
Tenure Related to Landlord	-0.0531376	0.1426964	-0.372	0.7115
Length of Tenure (log of months)	-0.0495755	0.02448739	-2.025	0.0495
SIZE OF UNIT				
Square Feet per Room	0.0005683835	0.001105549	0.514	0.6099
Number of Bathrooms	-0.0147351	0.04307127	-0.342	0.7340
Log (number of rooms)	0.4021784	0.1389704	2.894	0.0061
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.03535789	0.0802498	0.441	0.6618
Log of Building Age	0.09569507	0.04561834	2.098	0.0421
Kitchen Equipment Provided	-0.00341266	0.0246932	-0.138	0.8908
Air Conditioning Provided	0.1567376	0.05609476	2.794	0.0079
No Heat in Unit	0	.	.	.
Number of Hazards	0.3381347	0.09463564	3.573	0.0009
Condition of Common Halls	0.01892854	0.02384986	0.794	0.4320
Amenities in Bathrooms	0.05452696	0.02672288	2.040	0.0478
Amenities in Halls	0.04028149	0.0408756	0.985	0.3302
Balconies/porches/windows	-0.0127676	0.03099426	-0.412	0.6825
Amenities per room in other rooms	-0.12752	0.04273323	-2.984	0.0048
BUILDING TYPE				
Single Family Detached	0.2170561	0.1250273	1.736	0.0901
Duplex or Two-Family House	0.1958524	0.1286254	1.523	0.1355
Single Row Family House	0.03609453	0.07951423	0.454	0.6523
Highrise	-0.00603117	0.08718339	-0.069	0.9452
NEIGHBORHOOD				
Rural Area	-0.287687	0.2163654	-1.330	0.1910
Commercial - Industrial Activities in Area	-0.506042	0.1438866	-3.517	0.0011
Abandoned Buildings (Evaluator)	-0.296437	0.1890746	-1.568	0.1246
Abandoned Buildings (Tenant)	0	.	.	.
Cleanliness of Surrounding Parcels	0.0674903	0.07731077	0.873	0.3878
Scaled Median Owner Occup. Tract	0.002836459	0.00159567	1.778	0.0829
Scaled Median Rent - Renter Occup. Tract	0.0006594738	0.0005686213	1.160	0.2528
SAMPLE STRATUM				
Mover Stratum	0.08015128	0.05099819	1.572	0.1237

Observations	68
Degrees of Freedom	41
R2	0.8246
Adjusted R2	0.7090
Root Mean Square Error	0.1239406
Coefficient of Variation	1.952794

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (MONTGOMERY)
CERTIFICATE PROGRAM

1

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	5.058576	0.3796742	13.323	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.006821819	0.006714226	1.016	0.3142
Tenure Related to Landlord	-0.222237	0.1093595	-2.032	0.0472
Length of Tenure (log of months)	-0.036248	0.02190066	-1.655	0.1038
SIZE OF UNIT				
Square Feet per Room	0.001863037	0.0007913518	2.354	0.0223
Number of Bathrooms	0.05270577	0.02963642	1.778	0.0811
Log (number of rooms)	0.351902	0.07919304	4.444	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.02567857	0.06302445	0.407	0.6853
Log of Building Age	0.04537532	0.03465613	1.309	0.1961
Kitchen Equipment Provided	-0.0314357	0.02246544	-1.399	0.1676
Air Conditioning Provided	0.08601658	0.03642117	2.362	0.0219
No Heat in Unit	0	.	.	.
Number of Hazards	-0.056646	0.05434873	-1.042	0.3020
Condition of Common Halls	-0.0286767	0.01965089	-1.459	0.1504
Amenities in Bathrooms	0.00737716	0.02528275	0.292	0.7716
Amenities in Halls	-0.0930217	0.03208536	-2.899	0.0054
Balconies/porches/windows	0.06574719	0.02302088	2.856	0.0061
Amenities per room in other rooms	0.03368094	0.0327272	1.029	0.3081
BUILDING TYPE				
Single Family Detached	-0.175945	0.06100603	-2.884	0.0057
Duplex or Two-Family House	-0.13925	0.07631352	-1.825	0.0737
Single Row Family House	-0.24367	0.07384721	-3.300	0.0017
Highrise	0.06344818	0.07270826	0.873	0.3868
NEIGHBORHOOD				
Rural Area	0.4036482	0.1467819	2.750	0.0081
Commercial - Industrial Activities in Area	0.2452627	0.1792772	1.368	0.1771
Abandoned Buildings (Evaluator)	0.0587943	0.08781485	0.670	0.5061
Abandoned Buildings (Tenant)	-0.0522136	0.127188	-0.411	0.6831
Cleanliness of Surrounding Parcels	0.04296515	0.02654709	1.618	0.1115
Scaled Median Owner Occup. Tract	-0.000314059	0.001507268	-0.208	0.8357
Scaled Median Rent - Renter Occup. Tract	0.00019745	0.0004022421	0.491	0.6255
SAMPLE STRATUM				
Mover Stratum	0.07471749	0.03799534	1.966	0.0545

Observations	81
Degrees of Freedom	53
R2	0.7385
Adjusted R2	0.6004
Root Mean Square Error	0.1082946
Coefficient of Variation	1.712551

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (NEW YORK)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	4.968258	0.5468672	9.085	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	-0.0224229	0.03635373	-0.617	0.5400
Tenure Related to Landlord	0.1909011	0.2001321	0.954	0.3444
Length of Tenure (log of months)	-0.00573358	0.04188567	-0.137	0.8916
SIZE OF UNIT				
Square Feet per Room	.00005680361	0.001157076	0.049	0.9610
Number of Bathrooms	0.1852389	0.1623634	1.141	0.2590
Log (number of rooms)	0.7189028	0.188333	3.817	0.0004
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.0346714	0.07583731	0.457	0.6494
Log of Building Age	-0.0527192	0.07035813	-0.749	0.4569
Kitchen Equipment Provided	0.1258258	0.174875	0.720	0.4749
Air Conditioning Provided	0.05445067	0.1444695	0.377	0.7077
No Heat in Unit	0.3725005	0.2258263	1.650	0.1049
Number of Hazards	0.01436825	0.07410349	0.194	0.8470
Condition of Common Halls	0.01859617	0.03366118	0.552	0.5829
Amenities in Bathrooms	0.030751	0.04953909	0.621	0.5374
Amenities in Halls	0.02805415	0.03997862	0.702	0.4859
Balconies/porches/windows	-0.01000836	0.05360018	0.187	0.8526
Amenities per room in other rooms	0.03356077	0.102898	0.326	0.7456
BUILDING TYPE				
Single Family Detached	0	.	.	.
Duplex or Two-Family House	-0.0741669	0.116672	-0.636	0.5277
Single Row Family House	0.2874379	0.2453116	1.172	0.2465
Highrise	-0.0730772	0.06327011	-1.155	0.2532
NEIGHBORHOOD				
Rural Area	0	.	.	
Commercial - Industrial Activities in Area	0	.	.	.
Abandoned Buildings (Evaluator)	0.05515368	0.09619884	0.573	0.5688
Abandoned Buildings (Tenant)	0.005281897	0.099828	0.053	0.9580
Cleanliness of Surrounding Parcels	0.004187783	0.02735783	0.153	0.8789
Scaled Median Owner Occup. Tract	-0.00171461	0.004699765	-0.365	0.7167
Scaled Median Rent - Renter Occup. Tract	-0.000392661	0.0005292729	-0.742	0.4614
SAMPLE STRATUM				
Mover Stratum	0.2032282	0.08764445	2.319	0.0242

Observations	80
Degrees of Freedom	54
R2	0.6345
Adjusted R2	0.4585
Root Mean Square Error	0.1939916
Coefficient of Variation	3.231684

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (NEW YORK)

CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	6.398211	0.4840152	13.219	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.06274293	0.02577549	2.434	0.0185
Tenure Related to Landlord	0.006815339	0.1091299	0.062	0.9504
Length of Tenure (log of months)	-0.0856696	0.03008214	-2.848	0.0063
SIZE OF UNIT				
Square Feet per Room	-.0000252752	0.0006378761	-0.040	0.9685
Number of Bathrooms	0.06702539	0.1177703	0.569	0.5718
Log (number of rooms)	0.006420473	0.1226365	0.052	0.9585
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-0.0267545	0.04936957	-0.542	0.5902
Log of Building Age	-0.120966	0.07886965	-1.534	0.1313
Kitchen Equipment Provided	-0.11569	0.2165988	-0.534	0.5956
Air Conditioning Provided	-0.101633	0.1179314	-0.862	0.3928
No Heat in Unit	0	.	.	.
Number of Hazards	-0.00436423	0.04256739	-0.103	0.9187
Condition of Common Halls	0.01225375	0.02549143	0.481	0.6328
Amenities in Bathrooms	0.02242356	0.0458669	0.489	0.6270
Amenities in Halls	-0.0204502	0.02655611	-0.770	0.4448
Balconies/porches/windows	0.01137811	0.05462139	0.208	0.8358
Amenities per room in other rooms	0.002589173	0.0753452	0.034	0.9727
BUILDING TYPE				
Single Family Detached	0.07387734	0.1842201	0.401	0.6901
Duplex or Two-Family House	0.03685928	0.09959985	0.370	0.7129
Single Row Family House	0	.	.	.
Highrise	-0.0316149	0.05165942	-0.612	0.5433
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-0.182717	0.2290878	-0.798	0.4288
Abandoned Buildings (Evaluator)	0.02973518	0.1012539	0.294	0.7702
Abandoned Buildings (Tenant)	-0.0141773	0.1006933	-0.141	0.8886
Cleanliness of Surrounding Parcels	-0.0133931	0.02963784	-0.452	0.6533
Scaled Median Owner Occup. Tract	-.0000640092	0.003276925	-0.020	0.9845
Scaled Median Rent - Renter Occup. Tract	0.0004670366	0.0005369785	0.870	0.3885
SAMPLE STRATUM				
Mover Stratum	0.009647727	0.05833375	0.165	0.8693

Observations	77
Degrees of Freedom	51
R2	0.5582
Adjusted R2	0.3329
Root Mean Square Error	0.1418197
Coefficient of Variation	2.405715

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (OAKLAND)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	4.766886	0.442246	10.779	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.04317007	0.01540332	2.803	0.0068
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-0.0355507	0.01892488	-1.879	0.0652
SIZE OF UNIT				
Square Feet per Room	0.002361017	0.0007861625	3.003	0.0039
Number of Bathrooms	0.1097613	0.05841494	1.879	0.0651
Log (number of rooms)	0.6599156	0.06600992	9.997	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.01613408	0.08154066	0.198	0.8438
Log of Building Age	-0.0415733	0.04610042	-0.902	0.3708
Kitchen Equipment Provided	-0.00639943	0.03143095	-0.204	0.8394
Air Conditioning Provided	0.211842	0.1522511	1.391	0.1692
No Heat in Unit	0.03592041	0.07661417	0.469	0.6409
Number of Hazards	-0.00288629	0.03735783	-0.077	0.9387
Condition of Common Halls	-0.0153214	0.02714769	-0.564	0.5746
Amenities in Bathrooms	0.01550129	0.03249646	0.477	0.6351
Amenities in Halls	-0.0228001	0.0339476	-0.672	0.5044
Balconies/porches/windows	0.004678152	0.03157317	0.148	0.8827
Amenities per room in other rooms	-0.152441	0.04936036	-3.088	0.0030
BUILDING TYPE				
Single Family Detached	0.1506644	0.04883104	3.085	0.0031
Duplex or Two-Family House	0.04552937	0.04507696	1.010	0.3165
Single Row Family House	0	.	.	.
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-0.126595	0.08474821	-1.494	0.1405
Abandoned Buildings (Evaluator)	0.09158164	0.05014079	1.826	0.0728
Abandoned Buildings (Tenant)	-0.101493	0.05130077	-1.978	0.0525
Cleanliness of Surrounding Parcels	0.07561239	0.04202271	1.799	0.0770
Scaled Median Owner Occup. Tract	-0.00219004	0.002624066	-0.835	0.4073
Scaled Median Rent - Renter Occup. Tract	0.0003714947	0.0006675372	0.557	0.5799
SAMPLE STRATUM				
Mover Stratum	0.05827829	0.04000967	1.457	0.1504

Observations	85
Degrees of Freedom	60
R2	0.8497
Adjusted R2	0.7870
Root Mean Square Error	0.1267923
Coefficient of Variation	2.003376

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (OAKLAND)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T
Intercept	5.807694	0.4646746	12.498	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.01042312	0.009740823	1.070	0.2895
Tenure Related to Landlord	-0.0253326	0.06512979	-0.389	0.6989
Length of Tenure (log of months)	-0.0527954	0.01973583	-2.675	0.0100
SIZE OF UNIT				
Square Feet per Room	0.00106423	0.0008195893	1.298	0.1998
Number of Bathrooms	-0.00727388	0.05487876	-0.133	0.8951
Log (number of rooms)	0.7174367	0.0794309	9.032	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-0.164127	0.09134674	-1.797	0.0782
Log of Building Age	-0.0846107	0.04200022	-2.015	0.0491
Kitchen Equipment Provided	0.07576798	0.03267172	2.319	0.0244
Air Conditioning Provided	-0.184994	0.1234105	-1.499	0.1399
No Heat in Unit	0.03168087	0.09926709	0.319	0.7509
Number of Hazards	-0.0558842	0.07423743	-0.753	0.4550
Condition of Common Halls	0.00831116	0.01692362	0.491	0.6254
Amenities in Bathrooms	0.01376776	0.02479991	0.555	0.5812
Amenities in Halls	0.03398806	0.03261284	1.042	0.3022
Balconies/porches/windows	-0.0342454	0.03280316	-1.044	0.3013
Amenities per room in other rooms	-0.0549758	0.09942761	-0.553	0.5827
BUILDING TYPE				
Single Family Detached	0.003444184	0.0484912	0.071	0.9436
Duplex or Two-Family House	0.001453504	0.04503889	0.032	0.9744
Single Row Family House	0	.	.	.
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-0.0278753	0.08782047	-0.317	0.7522
Abandoned Buildings (Evaluator)	-0.0668947	0.07342976	-0.911	0.3665
Abandoned Buildings (Tenant)	*0.04661676*	*0.06904656*	*0.675*	0.5026
Cleanliness of Surrounding Parcels	-0.018005	0.0270768	-0.665	0.5090
Scaled Median Owner Occup. Tract	0.002298258	0.001892942	1.214	0.2302
Scaled Median Rent - Renter Occup. Tract	0.001490608	0.0007975605	1.869	0.0673
SAMPLE STRATUM				
Mover Stratum	-0.06322201	0.03798179	1.665	0.1020

Observations	78
Degrees of Freedom	52
R2	0.8509
Adjusted R2	0.7763
Root Mean Square Error	0.1135563
Coefficient of Variation	1.815464

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (OMAHA)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	4.766102	0.4250843	11.212	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.03242495	0.01404364	2.309	0.0248
Tenure Related to Landlord	-0.044509	0.1682151	-0.265	0.7923
Length of Tenure (log of months)	-0.0276882	0.02176157	-1.272	0.2087
Square Feet per Room	0.001438852	0.0009180283	1.567	0.1229
SIZE OF UNIT				
Number of Bathrooms	0.07098385	0.0735399	0.965	0.3387
Log (number of rooms)	0.5240662	0.08299985	6.314	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.05030502	0.0604612	0.832	0.4091
Log of Building Age	-0.0312051	0.06149592	-0.507	0.6139
Kitchen Equipment Provided	0.01052676	0.03207708	0.328	0.7441
Air Conditioning Provided	-0.0140426	0.05448898	-0.258	0.7976
No Heat in Unit	0	.	.	.
Number of Hazards	0.1023385	0.07391386	1.385	0.1719
Condition of Common Halls	0.03374757	0.02236075	1.509	0.1371
Amenities in Bathrooms	-0.00695338	0.026753	-0.260	0.7959
Amenities in Halls	0.0281044	0.02479569	1.133	0.2620
Balconies/porches/windows	-0.0247981	0.03283178	-0.755	0.4533
Amenities per room in other rooms	-0.0960184	0.04664205	-2.059	0.0444
BUILDING TYPE				
Single Family Detached	0.02736473	0.06256173	0.437	0.6636
Duplex or Two-Family House	-0.148471	0.1042832	-1.424	0.1603
Single Row Family House	0	.	.	.
Highrise	-0.00157512	0.09083062	-0.017	0.9862
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0.1835017	0.08963951	2.047	0.0455
Abandoned Buildings (Evaluator)	0.06069371	0.06096542	0.996	0.3239
Abandoned Buildings (Tenant)	-0.0846471	0.07397015	-1.144	0.2575
Cleanliness of Surrounding Parcels	-0.0765201	0.02660178	-2.877	0.0057
Scaled Median Owner Occup. Tract	0.006802517	0.003920083	1.735	0.0884
Scaled Median Rent - Renter Occup. Tract	-0.000138624	0.0007764796	-0.179	0.8590
SAMPLE STRATUM				
Mover Stratum	0.04587436	0.04813354	0.953	0.3448

Observations	80
Degrees of Freedom	54
R2	0.7285
Adjusted R2	0.5978
Root Mean Square Error	0.1386685
Coefficient of Variation	2.433426

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (OMAHA)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T
Intercept	5.222683	0.3488132	14.973	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.02442803	0.01165432	2.096	0.0408
Tenure Related to Landlord	-0.0461712	0.07432005	-0.621	0.5370
Length of Tenure (log of months)	-0.0546662	0.01955187	-2.796	0.0072
SIZE OF UNIT				
Square Feet per Room	0.000358125	0.0008802038	0.407	0.6857
Number of Bathrooms	0.1453118	0.06656073	2.183	0.0334
Log (number of rooms)	0.2943319	0.07352832	4.003	0.0002
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-0.0238277	0.07294988	-0.327	0.7452
Log of Building Age	-0.0163068	0.05241085	-0.311	0.7569
Kitchen Equipment Provided	0.05024682	0.03080854	1.631	0.1087
Air Conditioning Provided	0.1496367	0.0413199	3.621	0.0006
No Heat in Unit	0	.	.	.
Number of Hazards	-0.171182	0.07523059	-2.275	0.0269
Condition of Common Halls	0.01547717	0.02049705	0.755	0.4535
Amenities in Bathrooms	-0.0412872	0.03423263	-1.206	0.2330
Amenities in Halls	-0.00470196	0.008968102	-0.524	0.6022
Balconies/porches/windows	-0.0197703	0.03077502	-0.642	0.5233
Amenities per room in other rooms	-0.0426095	0.0384954	-1.107	0.2733
BUILDING TYPE				
Single Family Detached	0.03650637	0.06244747	0.585	0.5613
Duplex or Two-Family House	0.1284619	0.07688491	1.671	0.1009
Single Row Family House	0.09494996	0.1226758	0.774	0.4423
Highrise	0.2477954	0.1297528	1.910	0.0619
NEIGHBORHOOD				
Rural Area	0	.	.	
Commercial - Industrial Activities in Area	-0.0426328	0.09945014	-0.429	0.669
Abandoned Buildings (Evaluator)	0.07370179	0.06434325	1.145	0.257
Abandoned Buildings (Tenant)	-0.0820885	0.0636992	-1.289	0.203
Cleanliness of Surrounding Parcels	-0.024066	0.02709698	-0.888	0.378
Scaled Median Owner Occup. Tract	0.001152192	0.00349444	0.330	0.742
Scaled Median Rent - Renter Occup. Tract	0.0008061621	0.0009425032	0.855	0.396
SAMPLE STRATUM				
Mover Stratum	0.04648246	0.04349677	1.069	0.290

Observations	81
Degrees of Freedom	54
R2	0.6968
Adjusted R2	0.5452
Root Mean Square Error	0.130307
Coefficient of Variation	2.283008

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (PITTSBURGH)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	3.001589	0.4666501	6.432	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.064795	0.01266337	5.117	0.0001
Tenure Related to Landlord	0.2020132	0.1450364	1.393	0.1694
Length of Tenure (log of months)	0.01339495	0.02733683	0.490	0.6261
SIZE OF UNIT				
Square Feet per Room	0.004093712	0.0007028885	5.824	0.0001
Number of Bathrooms	0.07113475	0.05557939	1.280	0.2061
Log (number of rooms)	0.2344564	0.08599049	2.727	0.0086
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.2317769	0.06154437	3.766	0.0004
Log of Building Age	0.1943674	0.0472492	4.114	0.0001
Kitchen Equipment Provided	-0.0886735	0.04289636	-2.067	0.0435
Air Conditioning Provided	-0.0135534	0.05057681	-0.268	0.7897
No Heat in Unit	0	.	.	.
Number of Hazards	-0.0747084	0.04440011	-1.683	0.0982
Condition of Common Halls	-0.0180793	0.02609864	-0.693	0.4914
Amenities in Bathrooms	0.04899987	0.03277443	1.495	0.1407
Amenities in Halls.	0.04973961	0.04868079	1.022	0.3115
Balconies/porches/windows	-0.0428524	0.04255986	-1.007	0.3185
Amenities per room in other rooms	0.03178838	0.05198217	0.612	0.5434
BUILDING TYPE				
Single Family Detached	-0.0390198	0.08153934	-0.479	0.6342
Duplex or Two-Family House	0.04032055	0.08038798	0.502	0.6180
Single Row Family House	0.07865523	0.06647558	1.183	0.2419
Highrise	0.01070968	0.08353161	0.128	0.8985
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-0.206084	0.1647439	-1.251	0.2164
Abandoned Buildings (Evaluator)	0.03509354	0.07134457	0.492	0.6248
Abandoned Buildings (Tenant)	-0.0711187	0.07514994	-0.946	0.3482
Cleanliness of Surrounding Parcels	-0.00648432	0.02206517	-0.294	0.7700
Scaled Median Owner Occup. Tract	-0.00199022	0.002486046	-0.801	0.4269
Scaled Median Rent - Renter Occup. Tract	-0.000122245	0.000572643	-0.213	0.8318
SAMPLE STRATUM				
Mover Stratum	0.2073455	0.04409947	4.702	0.0001

Observations	81
Degrees of Freedom	54
R2	0.7174
Adjusted R2	0.5762
Root Mean Square Error	0.139136
Coefficient of Variation	2.394143

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (PITTSBURGH)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	4.763758	0.3730422	12.770	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.03461269	0.01230497	2.813	0.0068
Tenure Related to Landlord	0.01496723	0.1042103	0.144	0.8863
Length of Tenure (log of months)	-0.0274024	0.02645559	-1.036	0.3048
SIZE OF UNIT				
Square Feet per Room	0.0009576105	0.0005685249	1.684	0.0978
Number of Bathrooms	-0.0504937	0.07216983	-0.700	0.4871
Log (number of rooms)	0.4817339	0.07953786	6.057	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.0140717	0.05333035	0.264	0.7929
Log of Building Age	0.04818468	0.04097343	1.176	0.2447
Kitchen Equipment Provided	-0.0689262	0.03993986	-1.726	0.0900
Air Conditioning Provided	0.0478918	0.05884461	0.814	0.4192
No Heat in Unit	0.1861712	0.2177972	0.855	0.3964
Number of Hazards	-0.00585426	0.04093412	-0.143	0.8868
Condition of Common Halls	0.03407233	0.01838332	1.853	0.0692
Amenities in Bathrooms	-0.00727684	0.02693778	-0.270	0.7881
Amenities in Halls	0.0527309	0.05178837	1.018	0.3130
Balconies/porches/windows	-0.0224181	0.03597148	-0.623	0.5357
Amenities per room in other rooms	0.003478014	0.04860587	0.072	0.9432
UNIT QUALITY				
Single Family Detached	-0.0198964	0.06482272	-0.307	0.7601
Duplex or Two-Family House	-0.100473	0.06166678	-1.629	0.1090
Single Row Family House	0.02060248	0.05490701	0.375	0.7089
Highrise	0.00244887	0.06467168	0.038	0.9699
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0.01105141	0.1523672	0.073	0.9424
Abandoned Buildings (Evaluator)	-0.0281289	0.08596089	-0.327	0.7447
Abandoned Buildings (Tenant)	0.008233095	0.07585823	0.109	0.9140
Cleanliness of Surrounding Parcels	-0.0333946	0.0236876	-1.410	0.1642
Scaled Median Owner Occup. Tract	0.003928304	0.002139179	1.836	0.0717
Scaled Median Rent - Renter Occup. Tract	0.0003445124	0.0004119809	0.836	0.4066
SAMPLE STRATUM				
Mover Stratum	-0.0214098	0.0391558	-0.547	0.5867

Observations	83
Degrees of Freedom	55
R2	0.6756
Adjusted R2	0.5105
Root Mean Square Error	0.1240016
Coefficient of Variation	2.169443

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (SAN ANTONIO)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	4.268607	0.3654869	11.679	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	-0.00226791	0.007311283	-0.310	0.7575
Tenure Related to Landlord	-0.0816921	0.1009253	-0.809	0.4216
Length of Tenure (log of months)	-0.012954	0.01821917	-0.711	0.4799
SIZE OF UNIT				
Square Feet per Room	0.002340603	0.0005970702	3.920	0.0002
Number of Bathrooms	0.04175072	0.03462505	1.206	0.2328
Log (number of rooms)	0.4353863	0.09161407	4.752	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.06861851	0.05657581	1.213	0.2301
Log of Building Age	0.02029812	0.06113675	0.332	0.7411
Kitchen Equipment Provided	0.01677616	0.02247219	0.747	0.4584
Air Conditioning Provided	-0.013172	0.05835991	-0.226	0.8222
No Heat in Unit	-0.061082	0.05660522	-1.079	0.2850
Number of Hazards	0.1821694	0.09626465	1.892	0.0634
Condition of Common Halls	0.03643835	0.03148322	1.157	0.2519
Amenities in Bathrooms	-0.0114181	0.01890495	-0.604	0.5482
Amenities in Halls	0.07971355	0.08757369	0.910	0.3665
Balconies/porches/windows	0.04540108	0.04327112	1.049	0.2984
Amenities per room in other rooms	-0.289932	0.1376594	-2.106	0.0395
BUILDING TYPE				
Single Family Detached	0.09641405	0.05081057	1.898	0.0627
Duplex or Two-Family House	-0.0569215	0.07730243	-0.736	0.4645
Single Row Family House	0	.	.	.
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0.1069135	0.0785446	1.361	0.1787
Abandoned Buildings (Evaluator)	-0.0939674	0.09825663	-0.956	0.3429
Abandoned Buildings (Tenant)	0.08442662	0.09043373	0.934	0.3544
Cleanliness of Surrounding Parcels	0.04990344	0.0270336	1.846	0.0700
Scaled Median Owner Occup. Tract	0.002720516	0.002317846	1.174	0.2453
Scaled Median Rent - Renter Occup. Tract	.00003315704	0.0005000911	0.066	0.9474
SAMPLE STRATUM				
Mover Stratum	-0.00433083	0.05508586	-0.079	0.9376

Observations	84
Degrees of Freedom	58
R2	0.7513
Adjusted R2	0.6398
Root Mean Square Error	0.1252767
Coefficient of Variation	2.126455

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (SAN ANTONIO)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	4.877856	0.2787526	17.499	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	0.002287221	0.008333097	0.274	0.7848
Tenure Related to Landlord	-0.179327	0.07881843	-2.275	0.0271
Length of Tenure (log of months)	0.05173929	0.01527188	3.388	0.0014
SIZE OF UNIT				
Square Feet per Room.	0.001378571	0.0007326269	1.882	0.0656
Number of Bathrooms	0.07658013	0.02594497	2.952	0.0048
Log (number of rooms)	0.2847895	0.06979867	4.080	0.0002
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-0.00599144	0.05107047	-0.117	0.9071
Log of Building Age	-0.0184614	0.02172086	-0.850	0.3993
Kitchen Equipment Provided	-0.0210348	0.01929948	-1.090	0.2809
Air Conditioning Provided	0.03217485	0.04138005	0.778	0.4404
No Heat in Unit	-0.0411963	0.04644162	-0.887	0.3792
Number of Hazards	-0.0564177	0.03985411	-1.416	0.1630
Condition of Common Halls	0.001294851	0.02223628	0.058	0.9538
Amenities in Bathrooms	0.001549394	0.01666701	0.093	0.9263
Amenities in Halls	-0.105884	0.07392675	-1.432	0.1582
Balconies/porches/windows	0.007347959	0.03409385	0.216	0.8302
Amenities per room in other rooms	-0.0330965	0.09400216	-0.352	0.7262
BUILDING TYPE				
Single Family Detached	0.04244038	0.04897099	0.867	0.3902
Duplex or Two-Family House	0.02389776	0.05621215	0.425	0.6725
Single Row Family House	-0.170447	0.142651	-1.195	0.2377
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0.1298477	0.1100967	1.179	0.2437
Commercial - Industrial Activities in Area	0.07988378	0.04893217	1.633	0.1087
Abandoned Buildings (Evaluator)	-0.0738701	0.1001418	-0.738	0.4641
Abandoned Buildings (Tenant)	0.06007702	0.07915419	0.759	0.4514
Cleanliness of Surrounding Parcels	-0.0169737	0.01867125	-0.909	0.3676
Scaled Median Owner Occup. Tract	0.001468739	0.001355379	1.084	0.2836
Scaled Median Rent - Renter Occup. Tract	-0.000107495	0.000327884	-0.328	0.7444
SAMPLE STRATUM				
Mover Stratum	0.2197707	0.05727223	3.837	0.0003

Observations	79
Degrees of Freedom	51
R2	0.6774
Adjusted R2	0.5002
Root Mean Square Error	0.09701176
Coefficient of Variation	1.656291

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (SEATTLE)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > |T|
Intercept	5.063655	0.4396372	11.518	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	-0.0248349	0.02264643	-1.097	0.2775
Tenure Related to Landlord	-0.232439	0.1458745	-1.593	0.1167
Length of Tenure (log of months)	-0.0104841	0.02484152	-0.422	0.6746
SIZE OF UNIT				
Square Feet per Room	0.0009283658	0.0008581728	1.082	0.2840
Number of Bathrooms	0.07439772	0.08459916	0.879	0.3829
Log (number of rooms)	0.3745049	0.09208567	4.067	0.0002
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.04589117	0.07474906	0.614	0.5417
Log of Building Age	-0.0982874	0.06318202	-1.556	0.1254
Kitchen Equipment Provided	-0.00980229	0.0270935	-0.362	0.7189
Air Conditioning Provided	0	.	.	.
No Heat in Unit	-0.218296	0.1912228	-1.142	0.2585
Number of Hazards	-0.0142924	0.06225711	-0.230	0.8193
Condition of Common Halls	0.01365603	0.01824731	0.748	0.4574
Amenities in Bathrooms	-0.00660521	0.02070852	-0.319	0.7509
Amenities in Halls	0.001488703	0.04700563	0.032	0.9748
Balconies/porches/windows	0.004687849	0.02671798	0.175	0.8614
Amenities per room in other rooms	-0.0136289	0.05772205	-0.236	0.8142
BUILDING TYPE				
Single Family Detached	0.2502938	0.0837939	2.987	0.0042
Duplex or Two-Family House	0.1037659	0.0786749	1.319	0.1926
Single Row Family House	0.01370092	0.1266573	0.108	0.9142
Highrise	0.1249213	0.08767383	1.425	0.1598
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-0.0341079	0.08013988	-0.426	0.6720
Abandoned Buildings (Evaluator)	-0.0515884	0.06607882	-0.781	0.4383
Abandoned Buildings (Tenant)	0.09366449	0.06294991	1.488	0.1424
Cleanliness of Surrounding Parcels	-0.00103453	0.02574768	-0.040	0.9681
Scaled Median Owner Occup. Tract	0.002811541	0.002514147	1.118	0.2682
Scaled Median Rent - Renter Occup. Tract	0.00192748	0.000924018	2.086	0.0415
SAMPLE STRATUM				
Mover Stratum	0.02035417	0.05700904	0.357	0.7224

Observations	83
Degrees of Freedom	56
R2	0.6650
Adjusted R2	0.5034
Root Mean Square Error	0.1477906
Coefficient of Variation	2.4816

POOLED HEDONIC LOG RENT EQUATIONS
BY SITE (SEATTLE)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	4.8209	0.5959927	8.089	0.0001
CONDITIONS OF TENURE				
Heat Included in Contract Rent	-0.109948	0.02985963	-3.682	0.0006
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-0.0123684	0.03366363	-0.367	0.7148
SIZE OF UNIT				
Square Feet per Room	0.002065648	0.001173138	1.761	0.0843
Number of Bathrooms	0.09471319	0.1080524	0.877	0.3848
Log (number of rooms)	0.4341058	0.134019	3.239	0.0021
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.01007512	0.09389404	0.107	0.9150
Log of Building Age	0.08003592	0.08286139	0.966	0.3387
Kitchen Equipment Provided	0.01607452	0.04348147	0.370	0.7131
Air Conditioning Provided	-0.0602847	0.2819814	-0.214	0.8316
No Heat in Unit	-0.0623481	0.2381514	-0.262	0.7945
Number of Hazards	0.00766558	0.07506457	0.102	0.9191
Condition of Common Halls	0.01493744	0.02090334	0.715	0.4781
Amenities in Bathrooms	0.01611116	0.03566776	0.452	0.6534
Amenities in Halls	-0.0212789	0.05312606	-0.401	0.6904
Balconies/porches/windows	-0.00296345	0.04247302	-0.070	0.9446
Amenities per room in other rooms	-0.0123198	0.07517063	-0.164	0.8705
BUILDING TYPE				
Single Family Detached	0.08800793	0.1052977	0.836	0.4072
Duplex or Two-Family House	-0.157206	0.1109224	-1.417	0.1625
Single Row Family House	0.04785932	0.1323075	0.362	0.7190
Highrise	0.2125503	0.1391314	1.528	0.1328
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-0.127787	0.09178824	-1.392	0.1699
Abandoned Buildings (Evaluator)	0.06647598	0.1054327	0.631	0.5312
Abandoned Buildings (Tenant)	-0.0840469	0.1015199	-0.828	0.4116
Cleanliness of Surrounding Parcels	0.01715883	0.0277736	0.618	0.5394
Scaled Median Owner Occup. Tract	-0.00464423	0.003407481	-1.363	0.1789
Scaled Median Rent - Renter Occup. Tract	-0.00073467	0.001120125	-0.656	0.5148
SAMPLE STRATUM				
Mover Stratum	-0.0119162	0.07748525	-0.154	0.8784

Observations	78
Degrees of Freedom	51
R2	0.6297
Adjusted R2	0.4336
Root Mean Square Error	0.1943087
Coefficient of Variation	3.301522

HEDONIC RENT EQUATIONS--MOVER SAMPLE

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (ATLANTA)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	27.378	155.9851	0.176	0.8615
CONDTIONS OF TENURE				
Heat Included in Contract Rent	18.68636	4.093331	4.565	0.0001
Tenure Related to Landlord	-155.986	54.59758	-2.857	0.0066
Length of Tenure (log of months)	-21.6944	12.31826	-1.761	0.0855
SIZE OF UNIT				
Square Feet per Room	0.5906969	0.2061166	2.866	0.0065
Number of Bathrooms	66.97353	21.69914	3.086	0 0036
Log (number of rooms)	119.1031	38.41763	3.100	0 0034
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	10.43025	19.10979	0.546	0.5881
Log of Building Age	34.19117	25.83819	1.323	0.1929
Kitchen Equipment Provided	-12.9748	14.80005	-0.877	0.3857
Air Conditioning Provided	-31.9622	18.20086	-1.756	0.0864
No Heat in Unit	0	.	.	.
Number of Hazards	-5.51775	13.49455	-0.409	0.6847
Condition of Common Halls	0.1979725	12.16368	0.016	0.9871
Amenities in Bathrooms	25.57488	7.462551	3.427	0 0014
Amenities in Halls	-1.58035	17.22938	-0.092	0.9274
Balconies/porches/windows	-11.8578	11.95518	-0.992	0.3269
Amenities per Room in Other Rooms	34.63342	26.87281	1.289	0.2045
BUILDING TYPE				
Single Family Detached	61.87293	24.72217	2.503	0.0163
Duplex or Two-Family House	0	.	.	.
Single Row Family House	73.24342	61.6813	1.187	0.2417
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	19.85039	21.82289	0.910	0.3682
Abandoned Buildings (Evaluator)	-71.1741	41.39377	-1.719	0.0929
Abandoned Buildings (Tenant)	19.73866	39.65627	0.498	0.6213
Cleanliness of Surrounding Parcels	-10.4253	14.238	-0.732	0.4681
Scaled Median Owner Occup. Tract	-2.41403	1.07007	-2.256	0.0293
Scaled Median Rent - Renter Occup. Tract	-0.128985	0.1713823	-0.753	0.4559
SAMPLE STRATUM				
Mover Stratum	0	.	.	.

Observations	66
Degrees of Freedom	42
R^2	0.8571
Adjusted R^2	0.7754
Root Mean Square Error	44.76241
Coefficient of Variation	10.80945

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (ATLANTA)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO PARAMETER=0	PROB > |T|
Intercept	51.23433	111.0176	0.461	0.6466
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-1.96457	4.359358	-0.451	0.6543
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-28.297	12.02346	-2.353	0.0228
SIZE OF UNIT				
Square Feet per Room	0.5159143	0.27207	1.896	0.0641
Number of Bathrooms	27.99924	18.22402	1.536	0.1311
Log (number of rooms)	182.4834	39.03032	4.675	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	2.45205	21.15629	0.116	0.9082
Log of Building Age	16.77561	17.43225	0.962	0.3408
Kitchen Equipment Provided	13.15501	12.28898	1.070	0.2899
Air Conditioning Provided	3.468629	17.81164	0.195	0.8464
No Heat in Unit	0	.	.	.
Number of Hazards	-14.3494	14.50902	-0.989	0.3277
Condition of Common Halls	6.320233	9.892849	0.639	0.5260
Amenities in Bathrooms	18.32238	13.48602	1.359	0.1[illegible]
Amenities in Halls	-16.017	19.9972	-0.801	0.4272
Balconies/porches/windows	0.7822357	12.03902	0.065	0.9485
Amenities per Room in Other Rooms	13.1487	22.42277	0.586	0.5604
BUILDING TYPE				
Single Family Detached	5.140594	25.38795	0.202	0.8404
Duplex or Two-Family House	22.95527	30.00856	0.765	0.4481
Single Row Family House	-70.0332	47.5736	-1.472	0.1477
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-10.7626	18.89402	-0.570	0.5716
Abandoned Buildings (Evaluator)	8.059442	23.40568	0.344	0.7321
Abandoned Buildings (Tenant)	-6.41979	22.13339	-0.290	0.7731
Cleanliness of Surrounding Parcels	-14.353	13.99651	-1.025	0.3104
Scaled Median Owner Occup. Tract	-2.79772	1.74086	-1.607	0.1147
Scaled Median Rent - Renter Occup. Tract	0.01333859	0.2410171	0.055	0.9561
SAMPLE STRATUM				
Mover Stratum	0	.	.	.

Observations	71
Degrees of Freedom	47
R2	0.6922
Adjusted R2	0.5351
Root Mean Square Error	43.72221
Coefficient of Variation	11.83147

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (LOS ANGELES)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-164.161	385.8137	-0.425	0.6746
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-26.7491	46.93532	-0.570	0.5745
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-12.3435	32.55775	-0.379	0.7082
SIZE OF UNIT				
Square Feet per Room	2.943299	0.9539342	3.085	0.0054
Number of Bathrooms	128.5072	56.0504	2.293	0.0318
Log (number of rooms)	152.3117	126.7652	1.202	0.2423
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	75.30502	68.74914	1.095	0.2852
Log of Building Age	6.582275	58.66834	0.112	0.9117
Kitchen Equipment Provided	-7.09084	31.4203	-0.226	0.8235
Air Conditioning Provided	104.2826	136.4779	0.764	0.4529
No Heat in Unit	81.26723	123.6731	0.657	0.5179
Number of Hazards	2.420905	52.64858	0.046	0.9637
Condition of Common Halls	8.885296	27.22634	0.326	0.7472
Amenities in Bathrooms	-38.5389	31.34536	-1.229	0.2319
Amenities in Halls	-8.81804	32.46296	-0.272	0.7864
Balconies/porches/windows	-10.7025	74.15526	-0.144	0.8866
Amenities per Room in Other Rooms	-68.0256	128.2888	-0.530	0.6012
BUILDING TYPE				
Single Family Detached	48.29517	59.12659	0.817	0.4228
Duplex or Two-Family House	18.5899	62.8709	0.296	0.7702
Single Row Family House	-83.9689	113.7318	-0.738	0.4681
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	1.462723	146.7588	0.010	0.9921
Abandoned Buildings (Evaluator)	30.27338	82.07038	0.369	0.7158
Abandoned Buildings (Tenant)	23.50677	82.78313	0.284	0.7791
Cleanliness of Surrounding Parcels	-46.0431	36.79971	-1.251	0.2240
Scaled Median Owner Occup. Tract	-0.104508	2.063736	-0.051	0.9601
Scaled Median Rent - Renter Occup. Tract	-0.890058	0.7787258	-1.143	0.2653
SAMPLE STRATUM				
Mover Stratum	0	.	.	.

Observations	47
Degrees of Freedom	22
R2	0.7961
Adjusted R2	0.5645
Root Mean Square Error	90.2449
Coefficient of Variation	15.80125

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (LOS ANGELES)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	110.3255	436.2392	0.253	0.8031
CONDTIONS OF TENURE				
Heat Included in Contract Rent	15.02938	13.94739	1.078	0.2947
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-31.3863	47.03363	-0.667	0.5126
SIZE OF UNIT				
Square Feet per Room	0.7907591	0.8441846	0.937	0.3607
Number of Bathrooms	63.08633	50.42201	1.251	0.2261
Log (number of rooms)	303.1837	95.3266	3.180	0.0049
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	35.71644	65.52735	0.545	0.5921
Log of Building Age	-22.8942	46.78335	-0.489	0.6302
Kitchen Equipment Provided	-39.4137	30.13664	-1.308	0.2065
Air Conditioning Provided	50.08185	52.31701	0.957	0.3505
No Heat in Unit	0	.	.	.
Number of Hazards	9.067273	40.09606	0.226	0.8235
Condition of Common Halls	-3.8259	21.34241	-0.179	0.8596
Amenities in Bathrooms	-6.21687	27.47815	-0.226	0.8234
Amenities in Halls	-20.9421	35.79185	-0.585	0.5654
Balconies/porches/windows	-9.56486	28.60748	-0.334	0.7418
Amenities per Room in Other Rooms	-17.9256	51.57028	-0.348	0.7320
BUILDING TYPE				
Single Family Detached	19.68081	49.10587	0.401	0.6931
Duplex or Two-Family House	21.9504	80.42362	0.273	0.7878
Single Row Family House	0	.	.	.
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-32.4312	92.69473	-0.350	0.7303
Abandoned Buildings (Evaluator)	-11.2007	63.37596	-0.177	0.8616
Abandoned Buildings (Tenant)	-15.8767	70.25529	-0.226	0.8236
Cleanliness of Surrounding Parcels	-8.02234	35.73723	-0.224	0.8248
Scaled Median Owner Occup. Tract	-1.11199	2.458906	-0.452	0.6562
Scaled Median Rent - Renter Occup. Tract	-0.515967	0.6188296	-0.834	0.4148
SAMPLE STRATUM				
Mover Stratum	0	.	.	.

Observations	42
Degrees of Freedom	19
R2	0.7592
Adjusted R2	0.4676
Root Mean Square Error	79.7826
Coefficient of Variation	14.16571

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (MINNEAPOLIS)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0 PARAMETER=0	PROB > |T|
Intercept	-0.715995	245.249	-0.003	0.9977
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-2.06671	5.212347	-0.397	0.6959
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-23.9498	11.4084	-2.099	0.0487
SIZE OF UNIT				
Square Feet per Room	0.2698478	0.4094823	0.659	0.5174
Number of Bathrooms	24.83738	27.01911	0.919	0.3689
Log (number of rooms)	201.7527	42.60264	4.736	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	16.25387	34.09339	0.477	0.6387
Log of Building Age	18.12577	22.6247	0.801	0.4325
Kitchen Equipment Provided	8.303203	7.967361	1.042	0.3098
Air Conditioning Provided	3.72058	29.61994	0.126	0.9013
No Heat in Unit	0	.	.	.
Number of Hazards	66.79534	24.68324	2.706	0.0136
Condition of Common Halls	-5.68213	10.33245	-0.550	0.5885
Amenities in Bathrooms	-10.4934	10.03135	-1.046	0.3080
Amenities in Halls	7.480205	30.05219	0.249	0.8060
Balconies/porches/windows	-1.20633	7.988148	-0.151	0.8815
Amenities per Room in Other Rooms	-25.7787	21.1932	-1.216	0.2380
BUILDING TYPE				
Single Family Detached	39.71572	79.87094	0.497	0.6244
Duplex or Two-Family House	22.45596	50.63692	0.443	0.6622
Single Row Family House	55.81746	55.98912	0.997	0.3307
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	25.28563	40.79749	0.620	0.5424
Commercial - Industrial Activities in Area	-57.4148	38.52799	-1.490	0.1518
Abandoned Buildings (Evaluator)	-23.5955	60.08112	-0.393	0.6987
Abandoned Buildings (Tenant)	-80.1009	81.09086	-0.988	0.3351
Cleanliness of Surrounding Parcels	-0.0435645	7.514896	-0.006	0.9954
Scaled Median Owner Occup. Tract	1.122127	1.580034	0.710	0.4858
Scaled Median Rent - Renter Occup. Tract	0.7171097	0.381833	1.878	0.0750
SAMPLE STRATUM				
Mover Stratum	-59.4038	29.97594	-1.982	0.0614

Observations	46
Degrees of Freedom	20
R2	0.9193
Adjusted R2	0.8145
Root Mean Square Error	32.27175
Coefficient of Variation	6.656306

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (MINNEAPOLIS)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0. PARAMETER=0	PROB > |T|
Intercept	135.3683	184.[illegible]391	0.732	0.4735
CONDITIONS OF TENURE				
Heat Included in Contract Rent	1.228625	4.309041	0.285	0.7788
Tenure Related to Landlord	-47.1235	62.33964	-0.756	0.4595
Length of Tenure (log of months)	-3.17053	7.840313	-0.404	0.6907
SIZE OF UNIT				
Square Feet per Room	0.9333211	0.3362702	2.776	0.0125
Number of Bathrooms	191.2548	82.56312	2.316	0.0325
Log (number of rooms)	178.5355	41.56064	4.296	0.0004
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-26.6897	36.70709	-0.727	0.4765
Log of Building Age	-33.2817	9.719615	-3.424	0.0030
Kitchen Equipment Provided	-1.32772	7.151717	-0.186	0.8548
Air Conditioning Provided	-5.40209	30.6589	-0.176	0.8621
No Heat in Unit	0	.	.	.
Number of Hazards	100.3415	48.9587	2.050	0.0553
Condition of Common Halls	-1.68104	4.625338	-0.363	0.7205
Amenities in Bathrooms	-27.1782	10.08075	-2.696	0.0148
Amenities in Halls	16.80873	23.22706	0.724	0.4786
Balconies/porches/windows	-6.74587	7.127267	-0.946	0.3564
Amenities per Room in Other Rooms	42.96055	100.5253	0.427	0.6742
BUILDING TYPE				
Single Family Detached	-49.1034	60.21649	-0.815	0.4255
Duplex or Two-Family House	-49.3974	31.46422	-1.570	0.1338
Single Row Family House	0	.	.	.
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	-20.0276	71.68955	-0.279	0.7831
Commercial - Industrial Activities in Area	-41.4885	43.27051	-0.959	0.3504
Abandoned Buildings (Evaluator)	0	.	.	.
Abandoned Buildings (Tenant)	0	.	.	.
Cleanliness of Surrounding Parcels	-5.35026	7.629386	-0.701	0.4921
Scaled Median Owner Occup. Tract	-1.03923	0.9822871	-1.058	0.3041
Scaled Median Rent - Renter Occup. Tract	-0.180001	0.2768493	-0.650	0.5238
SAMPLE STRATUM				
Mover Stratum	63.19404	22.64558	2.791	0.0121

Observations	42
Degrees of Freedom	18
R2	0.9007
Adjusted R2	0.7684
Root Mean Square Error	26.34293
Coefficient of Variation	5.96936

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (MONTGOMERY)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	.96743	323.8317	0.191	0.8495
CONDTIONS OF TENURE				
Heat Included in Contract Rent	0 3.473723	6.3585	0.546	0.5889
Tenure Related to Landlord	-27.9021	74.54093	-0.374	0.7108
Length of Tenure (log of months)	-28.5551	16.28131	-1.754	0.0897
SIZE OF UNIT				
Square Feet per Room	0. 0.1216903	0.6186003	0.197	0.8454
Number of Bathrooms	-13.2279	25.79324	-0.513	0.6118
Log (number of rooms)	157.715	79.14894	1.993	0.0555
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-10.4584	45.39224	-0.230	0.8193
Log of Building Age	49.87555	23.77037	2.098	0.0444
Kitchen Equipment Provided	15.89099	15.05955	1.055	0.2998
Air Conditioning Provided	56.03669	30.99261	1.808	0.0806
No Heat in Unit	0	.	.	.
Number of Hazards	123.6044	70.76538	1.747	0.0909
Condition of Common Halls	10.60268	14.03956	0.755	0.4560
Amenities in Bathrooms	46.8215	15 66535	2 989	0.0055
Amenities in Halls	11.50307	23.37225	0.492	0.6262
Balconies/porches/windows	17.88497	18.95112	0.944	0.3528
Amenities per Room in Other Rooms	-51.4516	22.15426	-2.322	0.0272
BUILDING TYPE				
Single Family Detached	212.6766	68.6611	3.097	0.0042
Duplex or Two-Family House	230.7726	93.5024	2.468	0.0195
Single Row Family House	38.46022	48.10072	0.800	0.4302
Highrise	-26.2532	46.65591	-0.563	0.5778
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0	.	.	.
Abandoned Buildings (Evaluator)	-157.919	101.2304	-1.560	0.1292
Abandoned Buildings (Tenant)	0	.	.	.
Cleanliness of Surrounding Parcels	21.28377	43.18353	0.493	0.6257
Scaled Median Owner Occup. Tract	0.5897072	0.9303712	0.634	0.5310
Scaled Median Rent - Renter Occup. Tract	-0.0914093	0.3430937	-0.266	0.7917
SAMPLE STRATUM				
Mover Stratum	0	.	.	.

Observations	54
Degrees of Freedom	30
R2	0.8022
Adjusted R2	0.6440
Root Mean Square Error	62.16249
Coefficient of Variation	10.34067

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (MONTGOMERY)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-64.1465	223.4238	-0.287	0.7757
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-3.35477	4.61583	-0.727	0.4722
Tenure Related to Landlord	-74.108	65.29861	-1.135	0.2641
Length of Tenure (log of months)	-27.5951	18.11579	-1.523	0.1367
SIZE OF UNIT				
Square Feet per Room	0.8083211	0.6166992	1.311	0.1985
Number of Bathrooms	18.78244	18.16396	1.034	0.3082
Log (number of rooms)	255.8708	55.78757	4.587	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-7.54343	36.21324	-0.208	0.8362
Log of Building Age	26.63222	22.15429	1.202	0.2374
Kitchen Equipment Provided	-28.7829	15.41119	-1.868	0.0702
Air Conditioning Provided	58.64111	24.30857	2.412	0.0212
No Heat in Unit	0	.	.	.
Number of Hazards	-53.5034	32.19277	-1.662	0.1055
Condition of Common Halls	-9.71036	12.53119	-0.775	0.4436
Amenities in Bathrooms	-6.07465	14.21396	-0.427	0.6717
Amenities in Halls	-46.9022	20.46756	-2.292	0.0281
Balconies/porches/windows	41.40074	14.16223	2.923	0.0060
Amenities per Room in Other Rooms	27.47416	17.52113	1.568	0.1259
BUILDING TYPE				
Single Family Detached	-128.594	38.11797	-3.374	0.0018
Duplex or Two-Family House	-108.759	43.51554	-2.499	0.0173
Single Row Family House	-140.905	39.13188	-3.601	0.0010
Highrise	-28.8052	50.5252	-0.570	0.5722
NEIGHBORHOOD				
Rural Area	250.7659	79.18118	3.167	0.0032
Commercial - Industrial Activities in Area	0	.	.	.
Abandoned Buildings (Evaluator)	31.40966	44.75521	0.702	0.4874
Abandoned Buildings (Tenant)	-71.8576	81.274	-0.884	0.3827
Cleanliness of Surrounding Parcels	25.15854	14.83905	1.695	0.0989
Scaled Median Owner Occup. Tract	-0.0296052	0.9233809	-0.032	0.9746
Scaled Median Rent - Renter Occup. Tract	0.09912815	0.269397	0.368	0.7151
SAMPLE STRATUM				
Mover Stratum	37.30543	51.56998	0.723	0.4742

Observations	62
Degrees of Freedom	35
R2	0.7965
Adjusted R2	0.6395
Root Mean Square Error	54.264
Coefficient of Variation	9.444517

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (NEW YORK)
HOUSING [illegible] PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0 PARAMETER=0	PROB > |T|
Intercept	1448.879	792.0152	1.829	0.0887
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-8.361	18.54857	-0.451	0.6591
Tenure Related to Landlord	48.05773	126.7842	0.379	0.7103
Length of Tenure (log of months)	-60.2514	55.69832	-1.082	0.2976
SIZE OF UNIT				
Square Feet per Room	0.7110753	0.8253928	0.861	0.4035
Number of Bathrooms	60.45553	101.393	0.596	0.5605
Log (number of rooms)	377.2909	107.4658	3.511	0.0035
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-90.5534	79.39416	-1.141	0.2732
Log of Building Age	-263.787	165.3344	-1.595	0.1329
Kitchen Equipment Provided	1.730563	137.8043	0.013	0.9902
Air Conditioning Provided	-116.3	186.8524	-0.622	0.5437
No Heat in Unit	207.2564	124.2243	1.668	0.1174
Number of Hazards	-40.2721	56.74763	-0.710	0.4896
Condition of Common Halls	-24.7718	26.70954	-0.927	0.3694
Amenities in Bathrooms	-25.2118	43.54224	-0.579	0.5718
Amenities in Halls	60.83761	31.63933	1.923	0.0751
Balconies/porches/windows	61.2885	68.44259	0.895	0.3857
Amenities per Room in Other Rooms	-11.4736	126.0435	-0.091	0.9288
BUILDING TYPE				
Single Family Detached	0	.	.	.
Duplex or Two-Family House	-119.408	98.19778	-1.216	0.2441
Single Row Family House	-31.1386	138.1521	-0.225	0.8249
Highrise	-142.451	60.19688	-2.366	0.0329
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0	.	.	.
Abandoned Buildings (Evaluator)	-57.0852	80.21713	-0.712	0.4884
Abandoned Buildings (Tenant)	-32.7574	73.63242	-0.445	0.6632
Cleanliness of Surrounding Parcels	-8.64582	18.66836	-0.463	0.6504
Scaled Median Owner Occup. Tract	1.487414	5.126098	0.290	0.7759
Scaled Median Rent - Renter Occup. Tract	0.2556588	0.3169908	0.807	0.4334
SAMPLE STRATUM				
Mover Stratum	0	.	.	. 2

Observations	39
Degrees of Freedom	14
R2	0.8163
Adjusted R2	0.4883
Root Mean Square Error	77.95812
Coefficient of Variation	16.72831

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (NEW YORK)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO. PARAMETER=0	PROB > |T|
Intercept	937.3917	158.4701	5.915	0.0001
CONDTIONS OF TENURE				
Heat Included in Contract Rent	38.97004	8.577908	4.543	0.0003
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-14.1726	12.39416	-1.143	0.2687
SIZE OF UNIT				
Square Feet per Room	0.4193851	0.2405822	1.743	0.0994
Number of Bathrooms	-16.4461	48.01737	-0.343	0.7362
Log (number of rooms)	88.02463	35.47101	2.482	0.0238
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-34.008	17.30631	-1.965	0.0660
Log of Building Age	-150.947	30.28616	-4.984	0.0001
Kitchen Equipment Provided	0	.	.	.
Air Conditioning Provided	0	.	.	.
No Heat in Unit	0	.	.	.
Number of Hazards	0.8056616	18.48552	0.044	0.9657
Condition of Common Halls	-11.6752	8.832107	-1.322	0.2037
Amenities in Bathrooms	59.50764	16.71152	3.561	0.0024
Amenities in Halls	12.4896	10.49418	1.190	0.2503
Balconies/porches/windows	29.79063	24.13955	1.234	0.2340
Amenities per Room in Other Rooms	-49.755	33.80901	-1.472	0.1594
BUILDING TYPE				
Single Family Detached	195.6609	55.48959	3.526	0.0026
Duplex or Two-Family House	-70.1486	33.32165	-2.105	0.0504
Single Row Family House	0	.	.	.
Highrise	-9.48368	17.5148	-0.541	0.5952
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0	.	.	.
Abandoned Buildings (Evaluator)	-0.991862	36.81037	-0.027	0.9788
Abandoned Buildings (Tenant)	-38.3128	36.47576	-1.050	0.3083
Cleanliness of Surrounding Parcels	-10.0623	8.999322	-1.118	0.2791
Scaled Median Owner Occup. Tract	-3.77208	1.345609	-2.803	0.0122
Scaled Median Rent - Renter Occup. Tract	-0.0877507	0.1635321	-0.537	0.5985
SAMPLE STRATUM				
Mover Stratum	0	.	.	.

Observations	38
Degrees of Freedom	17
R2	0.8832
Adjusted R2	0.7390
Root Mean Square Error	31.15349
Coefficient of Variation	7.912641

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (OAKLAND)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	43[illegible].598	373.1055	-1.304	0.2009
CONDTIONS OF TENURE				
Heat Included in Contract Rent	29.84477	10.64271	2.804	0.0083
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-27.1856	16.84761	-1.614	0.1159
SIZE OF UNIT				
Square Feet per Room	1.15325	0.6793257	1.698	0.0987
Number of Bathrooms	103.3289	52.09119	1.984	0.0554
Log (number of rooms)	384.2942	47.4002	8.107	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	6.027593	61.72501	0.098	0.9228
Log of Building Age	11.30191	35.20362	0.321	0.7501
Kitchen Equipment Provided	3.510123	23.04189	0.152	0.8798
Air Conditioning Provided	171.8136	101.4621	1.693	0.0995
No Heat in Unit	11.82362	62.15308	0.190	0.8503
Number of Hazards	17.03223	23.07395	0.738	0.4655
Condition of Common Halls	-8.18186	18.51696	-0.442	0.6614
Amenities in Bathrooms	-18.2841	27.49452	-0.665	0.5105
Amenities in Halls	-3.06306	25.10618	-0.122	0.9036
Balconies/porches/windows	13.57349	28.4505	0.477	0.6363
Amenities per Room in Other Rooms	-93.3575	38.92184	-2.399	0.0221
BUILDING TYPE				
Single Family Detached	78.90412	35.36997	2.231	0.0324
Duplex or Two-Family House	30.67786	33.68659	0.911	0.3689
Single Row Family House	0	.	.	.
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	61.07127	63.2387	0.966	0.3410
Abandoned Buildings (Evaluator)	43.77499	31.94289	1.370	0.1795
Abandoned Buildings (Tenant)	-28.6822	37.98845	-0.755	0.4554
Cleanliness of Surrounding Parcels	45.51394	31.62806	1.439	0.1593
Scaled Median Owner Occup. Tract	-0.276234	1.846091	-0.150	0.8819
Scaled Median Rent - Renter Occup. Tract	0.8274617	0.5221863	1.585	0.1223
SAMPLE STRATUM				
Mover Stratum	-29.2251	60.92221	-0.480	0.6345

Observations	59
Degrees of Freedom	34
R2	0.8759
Adjusted R2	0.7847
Root Mean Square Error	72.4704
Coefficient of Variation	11.88559

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (OAKLAND)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	195.4017	399.2211	0.489	0.6286
CONDITIONS OF TENURE				
Heat Included in Contract Rent	1.090388	8.538114	0.128	0.8994
Tenure Related to Landlord	-67.7848	67.06892	-1.011	0.3215
Length of Tenure (log of months)	-12.4509	18.08498	-0.688	0.4973
SIZE OF UNIT				
Square Feet per Room	0.111638	0.6847475	0.163	0.8718
Number of Bathrooms	-18.5221	46.54571	-0.398	0.6939
Log (number of rooms)	411.2834	59.89545	6.867	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-87.7824	79.66349	-1.102	0.2806
Log of Building Age	-36.7244	29.19578	-1.258	0.2196
Kitchen Equipment Provided	58.06073	27.6383	2.101	0.0455
Air Conditioning Provided	-121.238	74.96238	-1.617	0.1179
No Heat in Unit	35.80557	74.96552	0.478	0.6369
Number of Hazards	14.51648	57.90942	0.251	0.8040
Condition of Common Halls	6.997892	14.50569	0.482	0.6335
Amenities in Bathrooms	4.196792	20.41155	0.206	0.8387
Amenities in Halls	5.814534	35.425	0.164	0.8709
Balconies/porches/windows	-29.3085	28.30852	-1.035	0.3101
Amenities per Room in Other Rooms	-43.1824	153.2136	-0.282	0.7803
BUILDING TYPE				
Single Family Detached	18.85255	36.43802	0.517	0.6093
Duplex or Two-Family House	-8.58132	40.90732	-0.210	0.8355
Single Row Family House	0	.	.	.
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-4.01946	77.3659	-0.052	0.9590
Abandoned Buildings (Evaluator)	-9.05867	51.41435	-0.176	0.8615
Abandoned Buildings (Tenant)	25.90487	51.06221	0.507	0.6162
Cleanliness of Surrounding Parcels	0.4492823	18.28473	0.025	0.9806
Scaled Median Owner Occup. Tract	1.648521	1.54809	1.065	0.2967
Scaled Median Rent - Renter Occup. Tract	1.005663	0.6631787	1.516	0.1415
SAMPLE STRATUM				
Mover Stratum	14.45055	84.82388	0.170	0.8660

Observations	52
Degrees of Freedom	26
R2	0.8415
Adjusted R2	0.6829
Root Mean Square Error	64.99325
Coefficient of Variation	11.504

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (OMAHA)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-34.755	185.4693	-0.187	0.8531
CONDTIONS OF TENURE				
Heat Included in Contract Rent	10.32728	6.410851	1.611	0.1215
Tenure Related to Landlord	-70.5278	60.89536	-1.158	0.2592
Length of Tenure (log of months)	9.766887	13.27432	0.736	0.4696
SIZE OF UNIT				
Square Feet per Room	0.2964715	0.377618	0.785	0.4408
Number of Bathrooms	7.500622	27.25738	0.275	0.7857
Log (number of rooms)	151.5173	42.31641	3.581	0.0017
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-20.8293	24.4556	-0.852	0.4035
Log of Building Age	-5.24118	30.77107	-0.170	0.8663
Kitchen Equipment Provided	-2.76021	15.26996	-0.181	0.8582
Air Conditioning Provided	30.87193	23.89396	1.292	0.2098
No Heat in Unit	0	.	.	.
Number of Hazards	7.476507	27.17135	0.275	0.7858
Condition of Common Halls	-7.85192	14.46268	-0.543	0.5927
Amenities in Bathrooms	-1.17738	14.69327	-0.080	0.9369
Amenities in Halls	5.384975	12.60402	0.427	0.6734
Balconies/porches/windows	-2.36641	15.46319	-0.153	0.8798
Amenities per Room in Other Rooms	-27.336	20.6653	-1.323	0.1995
BUILDING TYPE				
Single Family Detached	1.591851	38.05008	0.042	0.9670
Duplex or Two-Family House	-61.4572	93.36668	-0.658	0.5172
Single Row Family House	0	.	.	.
Highrise	27.06519	44.23122	0.612	0.5469
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0	.	.	.
Abandoned Buildings (Evaluator)	24.52652	27.14673	0.903	0.3761
Abandoned Buildings (Tenant)	8.618505	34.40384	0.251	0.8045
Cleanliness of Surrounding Parcels	27.27835	16.96426	1.608	0.1221
Scaled Median Owner Occup. Tract	3.041521	1.530871	1.987	0.0595
Scaled Median Rent - Renter Occup. Tract	0.1575473	0.3953681	0.398	0.6941
SAMPLE STRATUM				
Mover Stratum	-4.44381	57.44846	-0.077	0.9390

Observations	47
Degrees of Freedom	22
R2	0.7705
Adjusted R2	0.5097
Root Mean Square Error	39.61188
Coefficient of Variation	12.01498

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (OMAHA)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	3.78455	193.9405	0.020	0.9846
CONDTIONS OF TENURE				
Heat Included in Contract Rent	0.8768123	7.060855	0.124	0.9024
Tenure Related to Landlord	-71.0064	77.55757	-0.916	0.3708
Length of Tenure (log of months)	-18.2136	9.635796	-1.890	0.0733
SIZE OF UNIT				
Square Feet per Room	-0.0798345	0.4058235	-0.197	0.8460
Number of Bathrooms	83.97216	34.96197	2.402	0.0261
Log (number of rooms)	58.8634	54.38767	1.082	0.2920
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-10.8034	44.15742	-0.245	0.8092
Log of Building Age	9.739347	32.88679	0.296	0.7702
Kitchen Equipment Provided	3.235994	20.1027	0.161	0.8737
Air Conditioning Provided	34.65249	20.6194	1.681	0.1084
No Heat in Unit	0	.	.	.
Number of Hazards	-37.7592	33.36666	-1.132	0.2712
Condition of Common Halls	15.62852	14.17296	1.103	0.2833
Amenities in Bathrooms	11.98773	25.1448	0.477	0.6387
Amenities in Halls	0.04994129	4.296315	0.012	0.9908
Balconies/porches/windows	-10.2672	20.25286	-0.507	0.617
Amenities per Room in Other Rooms	-21.6432	18.95566	-1.142	0.2670
BUILDING TYPE				
Single Family Detached	65.47938	58.57923	1.118	0.2769
Duplex or Two-Family House	103.7419	56.26491	1.844	0.0801
Single Row Family House	0	.	.	.
Highrise	111.2854	74.96647	1.484	0.1533
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-88.8171	71.05034	-1.250	0.2257
Abandoned Buildings (Evaluator)	19.09621	23.61622	0.809	0.4283
Abandoned Buildings (Tenant)	-29.3096	24.09012	-1.217	0.2379
Cleanliness of Surrounding Parcels	19.0519	16.7893	1.135	0.2699
Scaled Median Owner Occup. Tract	0.7716438	2.255715	0.342	0.7359
Scaled Median Rent - Renter Occup. Tract	0.05912491	0.4729173	0.125	0.9018
SAMPLE STRATUM				
Mover Stratum	50.93431	49.22626	1.035	0.3132

Observations	46
Degrees of Freedom	20
R2	0.6940
Adjusted R2	0.2961
Root Mean Square Error	42.47927
Coefficient of Variation	12.94932

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (PITTSBURGH)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO. PARAMETER=0	PROB > |T|
Intercept	-820.968	204.5535	-4.013	0.0004
CONDTIONS OF TENURE				
Heat Included in Contract Rent	16.39178	5.54646	2.955	0.0059
Tenure Related to Landlord	-3.20799	67.43336	-0.048	0.9624
Length of Tenure (log of months)	37.32123	13.06749	2.856	0.0076
SIZE OF UNIT				
Square Feet per Room	1.118677	0.2457043	4.553	0.0001
Number of Bathrooms	55.50051	23.34673	2.377	0.0238
Log (number of rooms)	154.431	32.78392	4.711	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	92.97472	26.35862	3.527	0.0013
Log of Building Age	44.7734	17.543	2.552	0.0159
Kitchen Equipment Provided	-20.1427	16.08453	-1.252	0.2198
Air Conditioning Provided	-19.6878	21.23576	-0.927	0.3610
No Heat in Unit	0	.	.	.
Number of Hazards	-9.81275	16.53925	-0.593	0.5573
Condition of Common Halls	1.552051	10.95255	0.142	0.8882
Amenities in Bathrooms	11.20264	11.62813	0.963	0.3428
Amenities in Halls	12.62315	18.44061	0.685	0.4987
Balconies/porches/windows	-11.6053	16.95939	-0.684	0.4989
Amenities per Room in Other Rooms	32.6301	21.21605	1.538	0.1342
BUILDING TYPE				
Single Family Detached	9.470212	30.48402	0.311	0.7581
Duplex or Two-Family House	62.56692	28.37777	2.205	0.0350
Single Row Family House	35.29869	27.00045	1.307	0.2007
Highrise	20.23781	32.37869	0.625	0.5365
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	0	.	.	.
Abandoned Buildings (Evaluator)	8.869359	24.87396	0.357	0.7238
Abandoned Buildings (Tenant)	-5.94687	25.74379	-0.231	0.8188
Cleanliness of Surrounding Parcels	14.07713	10.25815	1.372	0.1798
Scaled Median Owner Occup. Tract	-2.04967	1.110049	-1.846	0.0744
Scaled Median Rent - Renter Occup. Tract	0.1657024	0.2094186	0.791	0.4348
SAMPLE STRATUM				
Mover Stratum	9.410309	46.16004	0.204	0.8398

Observations	57
Degrees of Freedom	31
R2	0.7572
Adjusted R2	0.5535
Root Mean Square Error	39.78202
Coefficient of Variation	11.1542

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (PITTSBURGH)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	-82.9199	159.288	-0.521	0.6061
CONDITIONS OF TENURE				
Heat Included in Contract Rent	12.35137	4.917437	2.512	0.0171
Tenure Related to Landlord	30.0757	52.96659	0.568	0.5740
Length of Tenure (log of months)	1.175455	13.19802	0.089	0.9296
SIZE OF UNIT				
Square Feet per Room	0.2046648	0.236931	0.864	0.3939
Number of Bathrooms	-26.6158	30.79466	-0.864	0.3937
Log (number of rooms)	177.4153	41.38363	4.287	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	2.911479	24.04668	0.121	0.9044
Log of Building Age	23.08103	17.17907	1.344	0.1883
Kitchen Equipment Provided	-26.9768	18.48005	-1.460	0.1538
Air Conditioning Provided	3.023372	25.94417	0.117	0.9079
No Heat in Unit	73.51883	82.13292	0.895	0.3772
Number of Hazards	-13.364	15.67128	-0.853	0.3999
Condition of Common Halls	13.93953	7.331118	1.901	0.0660
Amenities in Bathrooms	-9.11953	12.42214	-0.734	0.4681
Amenities in Halls	13.51834	19.72862	0.685	0.4980
Balconies/porches/windows	8.886085	15.81701	0.562	0.5780
Amenities per Room in Other Rooms	-10.9252	19.90446	-0.549	0.5868
BUILDING TYPE				
Single Family Detached	-6.66992	30.5735	-0.218	0.8286
Duplex or Two-Family House	-20.9278	26.78604	-0.781	0.4402
Single Row Family House	1.020753	23.93867	0.043	0.9662
Highrise	-18.3543	31.1917	-0.588	0.5602
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	13.27906	53.45397	0.248	0.8053
Abandoned Buildings (Evaluator)	-2.18729	36.65164	-0.060	0.9528
Abandoned Buildings (Tenant)	-19.2898	32.57431	-0.592	0.5578
Cleanliness of Surrounding Parcels	-1.58398	17.17048	-0.092	0.9271
Scaled Median Owner Occup. Tract	0.3640517	0.9671245	0.376	0.7090
Scaled Median Rent - Renter Occup. Tract	0.1129389	0.1705165	0.662	0.5124
SAMPLE STRATUM				
Mover Stratum	0	.	.	.

Observations	60
Degrees of Freedom	33
R2	0.6750
Adjusted R2	0.4092
Root Mean Square Error	41.37259
Coefficient of Variation	13.12801

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (SAN ANTONIO)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0 PARAMETER=0	PROB > |T|
Intercept	54.457	146.2095	-1.056	0.2960
CONDTIONS OF TENURE				
Heat Included in Contract Rent	0.2608666	2.665788	0.098	0.9224
Tenure Related to Landlord	18.57075	53.24517	0.349	0.7288
Length of Tenure (log of months)	-6.92034	7.440343	-0.930	0.3569
SIZE OF UNIT				
Square Feet per Room	0.4474099	0.265897	1.683	0.0988
Number of Bathrooms	23.42479	12.69083	1.846	0.0710
Log (number of rooms)	142.7471	34.423	4.147	0.0001
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	0.6750266	22.59163	0.030	0.9763
Log of Building Age	4.51682	24.65545	0.183	0.8554
Kitchen Equipment Provided	4.91054	8.504674	0.577	0.5663
Air Conditioning Provided	11.70424	24.89346	0.470	0.6403
No Heat in Unit	-9.50635	22.7609	-0.418	0.6780
Number of Hazards	40.95492	35.71697	1.147	0.2571
Condition of Common Halls	13.7154	11.60754	1.182	0.2431
Amenities in Bathrooms	-7.2279	7.388566	-0.978	0.3328
Amenities in Halls	26.75319	31.32261	0.854	0.3972
Balconies/porches/windows	18.12575	15.67515	1.156	0.2532
Amenities per Room in Other Rooms	-79.3324	48.94153	-1.621	0.1114
BUILDING TYPE				
Single Family Detached	39.2431	19.54951	2.007	0.0502
Duplex or Two-Family House	31.34677	36.32028	0.863	0.3923
Single Row Family House	0	.	.	.
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	75.14556	39.0522	1.924	0.0601
Abandoned Buildings (Evaluator)	-24.9227	37.81368	-0.659	0.5129
Abandoned Buildings (Tenant)	25.08413	32.50164	0.772	0.4440
Cleanliness of Surrounding Parcels	22.99274	11.21824	2.050	0.0458
Scaled Median Owner Occup. Tract	0.4229925	0.9771824	0.433	0.6670
Scaled Median Rent - Renter Occup. Tract	-0.0926589	0.1816783	-0.510	0.6123
SAMPLE STRATUM				
Mover Stratum	82.48774	77.75046	1.061	0.2939

Observations	75
Degrees of Freedom	49
R2	0.7346
Adjusted R2	0.5937
Root Mean Square Error	44.02574
Coefficient of Variation	11.87773

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (SAN ANTONIO)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	62.26594	98.24657	0.634	0.5293
CONDTIONS OF TENURE				
Heat Included in Contract Rent	0.6522848	2.978966	0.219	0.8276
Tenure Related to Landlord	-64.0859	27.9974	-2.289	0.0266
Length of Tenure (log of months)	18.01874	5.453459	3.304	0.0018
SIZE OF UNIT				
Square Feet per Room	0.4798208	0.2756848	1.740	0.0883
Number of Bathrooms	27.70584	9.438999	2.935	0.0051
Log (number of rooms)	101.0849	25.67105	3.938	0.0003
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	3.967535	18.49402	0.215	0.8311
Log of Building Age	-5.32304	7.882844	-0.675	0.5028
Kitchen Equipment Provided	-4.91988	6.908705	-0.712	0.4799
Air Conditioning Provided	11.30568	15.26083	0.741	0.4625
No Heat in Unit	-4.98457	17.16717	-0.290	0.7728
Number of Hazards	-20.1706	14.58682	-1.383	0.1733
Condition of Common Halls	-2.82885	8.016744	-0.353	0.7258
Amenities in Bathrooms	-0.187031	6.336137	-0.030	0.9766
Amenities in Halls	-41.9247	26.18894	-1.601	0.1161
Balconies/porches/windows	4.423351	12.14206	0.364	0.7173
Amenities per Room in Other Rooms	-6.55627	33.88636	-0.193	0.8474
BUILDING TYPE				
Single Family Detached	15.44605	17.44232	0.886	0.3804
Duplex or Two-Family House	8.436223	19.82287	0.426	0.6724
Single Row Family House	-53.0099	51.16503	-1.036	0.3055
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	40.01614	38.86617	1.030	0.3085
Commercial - Industrial Activities in Area	27.72631	17.34404	1.599	0.1166
Abandoned Buildings (Evaluator)	-21.2979	35.45949	-0.601	0.5510
Abandoned Buildings (Tenant)	15.58154	28.03025	0.556	0.5809
Cleanliness of Surrounding Parcels	-6.9524	6.605885	-1.052	0.2980
Scaled Median Owner Occup. Tract	0.5053335	0.4823131	1.048	0.3001
Scaled Median Rent - Renter Occup. Tract	-0.0633123	0.1223769	-0.517	0.6073
SAMPLE STRATUM				
Mover Stratum	0	.	.	.

Observations	74
Degrees of Freedom	47
R2	0.6790
Adjusted R2	0.4946
Root Mean Square Error	34.17553
Coefficient of Variation	9.631613

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (SEATTLE)
HOUSING VOUCHER PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	177.7025	318.6987	0.558	0.5823
CONDTIONS OF TENURE				
Heat Included in Contract Rent	0.8517341	35.24824	0.024	0.9809
Tenure Related to Landlord	-43.8679	66.85052	-0.656	0.5179
Length of Tenure (log of months)	-26.0226	18.38668	-1.415	0.1698
SIZE OF UNIT				
Square Feet per Room	-0.445091	0.7550296	-0.590	0.5610
Number of Bathrooms	2.467936	39.83883	0.062	0.9511
Log (number of rooms)	147.2073	60.7081	2.425	0.0232
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	41.46758	52.13479	0.795	0.4342
Log of Building Age	-50.448	37.63031	-1.341	0.1926
Kitchen Equipment Provided	-9.95091	16.95641	-0.587	0.5628
Air Conditioning Provided	0	.	.	.
No Heat in Unit	0	.	.	.
Number of Hazards	6.846454	32.24511	0.212	0.8336
Condition of Common Halls	27.23966	11.77878	2.313	0.0296
Amenities in Bathrooms	-6.6198	10.96782	-0.604	0.5518
Amenities in Halls	-31.1589	65.40736	-0.476	0.6381
Balconies/porches/windows	15 37029	15.64668	0.982	0.3357
Amenities per Room in Other Rooms	-13.8492	45.22544	-0.306	0.7621
BUILDING TYPE				
Single Family Detached	161.69	48.59543	3.327	0.0028
Duplex or Two-Family House	83.19905	49.7724	1.672	0.1076
Single Row Family House	99.77566	127.5596	0.782	0.4418
Highrise	21.4154	105.0906	0.204	0.8402
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	-40.2308	38.753	-1.038	0.3096
Abandoned Buildings (Evaluator)	61.31683	60.56074	1.012	0.3214
Abandoned Buildings (Tenant)	10.20856	37.05024	0.276	0.7853
Cleanliness of Surrounding Parcels	-19.6932	15.27502	-1.289	0.2096
Scaled Median Owner Occup. Tract	3.760308	2.051871	1.833	0.0793
Scaled Median Rent - Renter Occup. Tract	0.599657	0.5365728	1.118	0.2748
SAMPLE STRATUM				
Mover Stratum	-49.5688	57.72397	-0.859	0.3990

Observations	50
Degrees of Freedom	24
R2	0.7382
Adjusted R2	0.4545
Root Mean Square Error	59.20174
Coefficient of Variation	14.36867

HEDONIC RENT EQUATIONS - MOVER SAMPLE
BY SITE (SEATTLE)
CERTIFICATE PROGRAM

VARIABLE	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
Intercept	221.421	188.8312	1.173	0.2547
CONDTIONS OF TENURE				
Heat Included in Contract Rent	-95.8149	13.13773	-7.293	0.0001
Tenure Related to Landlord	0	.	.	.
Length of Tenure (log of months)	-35.9983	23.23123	-1.550	0.1369
SIZE OF UNIT				
Square Feet per Room	0.6293744	0.289558	2.174	0.0419
Number of Bathrooms	57.09535	24.54256	2.326	0.0306
Log (number of rooms)	186.7464	41.98091	4.448	0.0002
UNIT QUALITY				
Average Evaluator Rating of Apt. Condition	-37.2174	26.14951	-1.423	0.1701
Log of Building Age	-27.5363	24.76648	-1.112	0.2794
Kitchen Equipment Provided	-22.1392	11.49862	-1.925	0.0685
Air Conditioning Provided	0	.	.	.
No Heat in Unit	0	.	.	.
Number of Hazards	19.57271	20.99874	0.932	0.3624
Condition of Common Halls	2.072454	5.922364	0.350	0.7300
Amenities in Bathrooms	19.71607	15.199	1.297	0.2093
Amenities in Halls	47.50577	17.60204	2.699	0.0138
Balconies/porches/windows	5.061276	10.7682	0.470	0.6434
Amenities per Room in Other Rooms	-14.305	18.36193	-0.779	0.4451
BUILDING TYPE				
Single Family Detached	7.959412	41.41182	0.192	0.8495
Duplex or Two-Family House	-13.4455	29.31235	-0.459	0.6514
Single Row Family House	16.39976	30.94489	0.530	0.6020
Highrise	0	.	.	.
NEIGHBORHOOD				
Rural Area	0	.	.	.
Commercial - Industrial Activities in Area	355.5964	69.53328	5.114	0.0001
Abandoned Buildings (Evaluator)	45.56297	23.03231	1.978	0.0618
Abandoned Buildings (Tenant)	-2.51295	26.19563	-0.096	0.9245
Cleanliness of Surrounding Parcels	-3.7225	9.315856	-0.400	0.6937
Scaled Median Owner Occup. Tract	1.562565	1.068964	1.462	0.1593
Scaled Median Rent - Renter Occup. Tract	0.5206422	0.3426975	1.519	0.1444
SAMPLE STRATUM				
Mover Stratum	-9.04228	47.88852	-0.189	0.8521

Observations	44
Degrees of Freedom	20
R2	0.9424
Adjusted R2	0.8734
Root Mean Square Error	34.4272
Coefficient of Variation	8.732944

APPENDIX F

SUPPLEMENTARY TABLES

TABLE F.1

FULL SAMPLE RECIPIENT RENTS
(National Projections)

	Housing Voucher Program	Housing Certificate Program	Difference	t-Statistic for Difference
Gross Rent				
Mean	$503.02	$476.90	$26.12	
Within-PHA standard error	$ 4.33	$ 3.54	$ 5.59	4.67**
Total standard error	$ 28.60	$ 28.69	$ 7.15	3.65**
Contract Rent				
Mean	$445.06	$421.59	$23.47	
Within-PHA standard error	4.07	3.21	5.19	4.52**
Total standard error	29.17	31.35	8.29	2.83**

** = Significant at 0.01 level

* = Significant at 0.05 level

\+ = Significant at 0.10 level

TABLE F.2

DETAILS OF DISTRIBUTION OF RATIO OF GROSS RENT TO FMR OR PAYMENT STANDARD[a]
(Backup to Figure 2.3)

	Housing Voucher Program	Housing Certificate Program
Ratio ≤ 0.4	6.9	6.1
.4 < Ratio ≤ 0.45	0.2	0.0
0.40 < Ratio ≤ 0.50	0.1	0.0
0.50 < Ratio ≤ 0.55	0.2	0.0
0.55 < Ratio ≤ 0.60	0.1	0.0
0.60 < Ratio ≤ 0.65	0.7	0.6
0.65 < Ratio ≤ 0.70	1.3	0.9
0.70 < Ratio ≤ 0.75	1.3	2.1
0.75 < Ratio ≤ 0.80	3.1	2.8
0.80 < Ratio ≤ 0.85	1.9	3.9
0.85 < Ratio ≤ 0.90	6.7	4.2
0.90 < Ratio ≤ 0.95	7.6	13.4
0.95 < Ratio ≤ 1.00	13.1	28.3
1.00 < Ratio ≤ 1.05	14.0	18.0
1.05 < Ratio ≤ 1.10	11.9	12.4
1.10 < Ratio ≤ 1.15	11.0	4.2
1.15 < Ratio ≤ 1.20	6.4	1.7
1.20 < Ratio ≤ 1.25	5.2	0.7
1.25 < Ratio ≤ 1.30	3.0	0.5
1.30 < Ratio ≤ 1.35	2.6	0.1
1.35 < Ratio ≤ 1.40	1.0	0.0
1.40 < Ratio ≤ 1.45	0.7	0.1
1.45 < Ratio ≤ 1.50	0.5	0.0
1.50 < Ratio ≤	0.8	0.0

[a]Distributions are weighted to national projections. Percents may not add to 100 because of rounding.

TABLE F.3

FULL SAMPLE CHANGE IN CONTRACT RENT
(National Projections)

	Housing Voucher Program	Housing Certificate Program	Difference	t-Statistic for Difference
Pre-Program Contract Rent				
Mean	$248.97	$244.34	$4.63	
Within-PHA standard error	4.51	4.81	6.60	0.70
Total standard error	21.88	22.68	6.60	0.70
Recipient Contract Rent				
Mean	$445.06	$421.59	$23.47	
Within-PHA standard error	4.07	3.21	5.19	4.52**
Total standard error	29.17	31.35	8.29	2.83**
Change in Contract Rent				
Mean	$196.09	$177.25	$18.84	
Within-PHA standard error	5.27	5.11	7.35	2.56*
Total standard error	21.92	23.81	7.35	2.56*

** = Significant at 0.01 level

* = Significant at 0.05 level

+ = Significant at 0.10 level

TABLE F.4

FULL SAMPLE CHANGE IN CONTRACT RENT FOR MOVERS AND STAYERS

	Housing Voucher Program	Housing Certificate Program	Difference	Within-PHA t-statistic for Difference	Total Error t-statistic for Difference
Recipients Who Stay In Their Pre-Program Unit					
Pre-enrollment contract rent	$326.08	$315.30	$10.78	1.15	0.70
Recipient contract rent	398.43	381.70	16.74	2.04*	1.76‡
Change in contract rent	72.38	67.69	4.69	0.48	0.29
Within-PHA t-statistic for change	10.17**	10.20**			
Total error t-statistic for change	4.44**	4.00**			
Recipients Who Move From Their Pre-Program Units					
Pre-enrollment contract rent	$216.03	$212.99	$3.04	0.37	0.37
Recipient contract rent	462.70	435.15	27.55	4.25**	3.13**
Change in contract rent	247.00	222.67	24.33	2.53*	2.53*
Within-PHA t-statistic for change	35.29**	33.89**			
Total error t-statistic for change	14.22**	10.68**			

TABLE F.5

INDIVIDUAL SITE ESTIMATES OF PRICE DIFFERENCES--ALL RECIPIENTS, POOLED LINEAR REGRESSION

	Average Contract Rent		Difference in Rent Associated with Difference in Housing Voucher Prices			
			Evaluated at Housing Voucher Prices		Evaluated at Certificate Program Prices	
	Housing Voucher Program	Certificate Program	Mean	S.D.	Mean	S.D.
Atlanta	411.58	368.74	6.79	9.92	39.41**	9.70
Los Angeles	554.51	549.08	22.24	14.28	4.62	12.73
Minneapolis	457.56	431.14	33.69**	9.70	17.22‡	9.17
Montgomery Cty. MD	583.17	564.87	5.55	13.75	12.02	12.37
New York City	405.58	361.32	33.69*	15.64	34.86*	14.01
Oakland	588.63	552.61	64.03**	15.21	74.45**	14.36
Omaha	312.18	312.00	-5.42	8.10	6.14	7.59
Pittsburgh	340.75	309.45	19.51*	7.77	26.73**	7.57
San Antonio	369.70	352.41	19.32*	8.43	10.36	7.60
Seattle	400.81	378.27	20.33‡	11.60	16.48	10.54

** = Significant at 0.01 level

* = Significant at 0.05 level

+ = Significant at 0.10 level

TABLE F.6

INDIVIDUAL SITE ESTIMATES OF PRICE DIFFERENCES--
MOVERS, SEPARATE MOVER LINEAR REGRESSION

	Average Contract Rent		Difference in Real Housing Evaluated at Housing Voucher Prices	
	Housing Voucher Program	Certificate Program	Mean	S.D.
Atlanta	414.10	369.54	8.99	9.76
Los Angeles	571.13	563.21	9.99	26.07
Minneapolis	480.44	445.60	31.50**	9.49
Montgomery Cty. MD	601.15	576.79	21.21	16.50
New York City	466.03	393.72	46.01	28.85
Oakland	606.88	567.46	55.70**	20.38
Omaha	330.74	328.51	-7.76	17.05
Pittsburgh	356.27	315.15	23.41*	9.75
San Antonio	372.27	354.83	16.57‡	9.12
Seattle 12.28	416.59	394.30	7.50	19.34

** = Significant at 0.01 level

* = Significant at 0.05 level

\+ = Significant at 0.10 level

TABLE F.7

INDIVIDUAL SITE ESTIMATES OF PRICE DIFFERENCES--MOVERS, POOLED LINEAR REGRESSION

	Average Contract Rent		Difference in Rent Associated with Difference in Housing Voucher Prices			
			Evaluated at Housing Voucher Prices		Evaluated at Certificate Program Prices	
	Housing Voucher Program	Certificate Program	Mean	S.D.	Mean	S.D.
Atlanta	414.10	369.54	9.63	9.73	40.22**	9.83
Los Angeles	571.12	563.21	20.15	17.44	8.12	17.09
Minneapolis	485.64	441.86	27.96**	9.90	39.31**	10.93
Montgomery Cty. MD	601.14	574.43	17.30	15.53	25.18‡	13.79
New York City	466.03	393.72	52.02*	20.87	67.78**	18.77
Oakland	608.76	566.55	63.67**	17.73	82.84**	17.79
Omaha	330.12	328.21	2.35	10.25	10.73	9.56
Pittsburgh	356.68	315.15	32.02**	9.38	42.95**	9.08
San Antonio	370.79	354.83	13.44	8.99	4.85	7.89
Seattle	413.87	394.26	24.65	15.52	22.98‡	13.05

** = Significant at 0.01 level

* = Significant at 0.05 level

+ = Significant at 0.10 level

TABLE F.8

INDIVIDUAL SITE ESTIMATES OF PRICE DIFFERENCES--
STAYERS, POOLED LINEAR REGRESSION

	Average Contract Rent		Difference in Real Housing Evaluated at Housing Voucher Prices	
	Housing Voucher Program	Certificate Program	Mean	S.D.
Atlanta	383.67	365.50	-4.62	31.83
Los Angeles	519.73	516.12	27.63	25.05
Minneapolis	416.30	414.59	42.59*	19.24
Montgomery Cty. MD	517.14	534.84	-31.36	26.51
New York City	373.32	343.79	23.77	21.69
Oakland	521.09	474.31	72.06**	22.53
Omaha	268.62	278.50	-21.63+	12.64
Pittsburgh	304.36	289.96	-21.47	15.42
San Antonio	359.67	325.40	84.93**	26.84
Seattle	366.88	339.12	9.87	16.20

** = Significant at 0.01 level

* = Significant at 0.05 level

+ = Significant at 0.10 level

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