Explaining Attrition in the Housing Voucher Program

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Abstract

This article uses administrative data on families that participated in the U.S. Department of Housing and Urban Development's Section 8 Housing Voucher Program between 1995 and 2002 combined with data from other sources to estimate the differences in attrition rates among families with demographic characteristics of greatest interest for housing policy and the effects on attrition of changes in the program's main parameters. The most important results are that large decreases in the program's payment standard and increases in the tenant contribution to rent will have small effects on program attrition. These results suggest that the overwhelming majority of voucher recipients receive substantial benefits from program participation. The empirical analysis also indicates that whether the head of the household is elderly and whether the head is disabled are by far the most important influences on the likelihood that the family will exit the tenant-based voucher program. Families with disabled heads of the household are about 37 percent less likely to exit the program and families with elderly heads of the household are about 23 percent less likely to exit the program each year than otherwise similar families. Differences in attrition rates based on other family characteristics are much smaller.

Introduction

Attrition in low-income housing programs has important effects on program performance. The success of these programs clearly depends in part on program parameters that can be changed without fundamental program reform. For example, an increase in the Section 8 Housing Voucher Program's payment standard or a decrease in the recipient's minimum contribution to rent will reduce the program's attrition rate. Reducing program attrition in this manner will reduce local housing authorities' workload in recycling vouchers, but it will also reduce the number of families that receive housing assistance and will further exacerbate the horizontal inequities of the current system of low-income housing programs. Changing these program parameters in the opposite direction will improve horizontal equity, albeit at the expense of additional administrative cost.

Despite the importance of program attrition for program performance, there have been few studies of its determinants (Freeman, 1998; Hungerford, 1996; Susin, 1999). A primary motivation of these studies has been to assess the validity of the concern that longer duration

of housing assistance itself increases the likelihood of remaining in assisted housing. These studies also estimate differences in attrition rates of families that have different characteristics, participate in different combinations of welfare programs, and live in areas with different market characteristics. In addition to making substantive contributions, Susin (1999) makes an important methodological contribution to the study of program attrition by showing that the uncritical use of national surveys such as the Survey of Income and Program Participation (SIPP) will lead to gross overestimates of the fraction of housing assistance spells that are short. Susin shows that the SIPP reports many spells that last for only one period and most of these spells involve the misreporting of housing assistance during that period.

The primary purpose of this article is to estimate statistical relationships explaining attrition in the Section 8 Housing Voucher Program that are useful for policy analysis. Unlike previous studies, this study estimates the effects of changes in program parameters on attrition.[1] These parameters are the major tools available to housing policymakers to influence attrition. As with previous studies, we estimate differences in attrition rates across families that have different demographic characteristics and live in housing markets with different characteristics. High attrition rates reflect low benefits from program participation. If housing policymakers consider attrition rates of some types of families to be too high relative to the attrition rates of other types of families, program parameters can be changed to decrease the former and increase the latter without spending more on housing assistance.

Our study has several advantages over previous research. First, our results are based on administrative data on program participation. Therefore, they are not subject to Susin's criticism of earlier studies based on the Panel Study of Income Dynamics and the SIPP. Second, the results are based on enormous samples. Our smallest sample is more than a million observations. Third, our empirical work is tied more closely to an explicit model of the decision about continued program participation. Our economic model provides guidance concerning what variables should be included in the statistical analysis and how these variables should be combined. Fourth, our results are based on a much better index of differences in rental housing prices than previous studies. Finally, we account for differences in income and Social Security taxes. These taxes affect what is possible for families in the presence and the absence of housing assistance.

Our general approach to studying program attrition is as follows. We first analyze theoretically the net benefit to a family from receiving a housing voucher. Families leave the program because the program's net benefit to them is no longer positive. In other words, such a family chooses to exit because its circumstances change in such a way that it would be better off without receiving a housing voucher. Consequently, the determinants of the decision to exit the voucher program are factors that influence the program's net benefit to a family. The program's net benefit to a family depends on the family's preferences and the combinations of housing and other goods that are possible for the family in the presence and absence of the program. Our analysis of net benefit takes account of participation costs, including stigma, and moving costs, including the costs of searching for a unit.

After establishing which factors will or might affect the net benefit a family receives from the voucher program, appropriate variables from administrative data and other sources are used to construct any of the variables not directly provided in the data. The variables suggested as possible determinants of program exit are then included as covariates in a Cox proportional hazard model.[2] The proportional hazard model specifies a functional form for the hazard rate that facilitates examination of the effect that each of the included covariates has on the likelihood that a family will exit the voucher program at a given time, conditional on the family's not having left the program before that time.

The results of the hazard rate analysis indicate that whether the head of the household is elderly and whether the head is disabled are by far the most important influences on the likelihood that the family will exit the tenant-based voucher program; families with disabled heads of the household are about 37 percent less likely to exit and families with elderly heads of the household are about 23 percent less likely to exit the program each year than other families that are the same with respect to the other covariates included in the analysis. Differences in attrition rates based on other family characteristics are much smaller.

The results of the hazard rate estimation indicate that program parameters have a modest influence on attrition rates in the expected direction. Based on data for the 75 largest metropolitan statistical areas (MSAs), the results show that, all else being equal, a $100 per month decrease in the local payment standard will be associated with about a 3 percent increase in the rate of program exit and an increase of $100 per month in the minimum tenant contribution to rent would increase program attrition by about 12.6 percent.[3] These results suggest that the overwhelming majority of voucher recipients receive substantial benefits from program participation.

Simple Model of Program Attrition

This section presents a simple model that explains voucher program attrition in terms of a family's preferences and what is possible for the family in the presence and absence of continued program participation. Throughout our analysis, we assume that each family has some fixed disposable income in each time period and uses that income to purchase two things: housing services H and other goods X. A family's disposable income Y is its earnings and cash assistance minus income and Social Security taxes. Our index of the quantity of housing services Q_H is the market rent of the housing unit divided by a housing price index P_H. The housing price index reflects the differences in market rents of identical units in identical neighborhoods across geographical locations. Within a single housing market, P_H is assumed to be the same for all dwelling units and differences in market rents reflect differences in the quantity of housing services provided by the unit. Across different housing markets, identical dwelling units can have different rents. If the value of P_H is 1 in area A and rents of identical units in identical neighborhoods are twice as high in area B as in area A, then P_H is 2 in area B.[4] Our index of the quantity of other goods Q_X is the amount spent on other goods divided by an index of the market prices of the goods in this category P_X. Initially, we assume that participation and moving costs are zero. Later, we discuss how we account for these costs in our estimation.

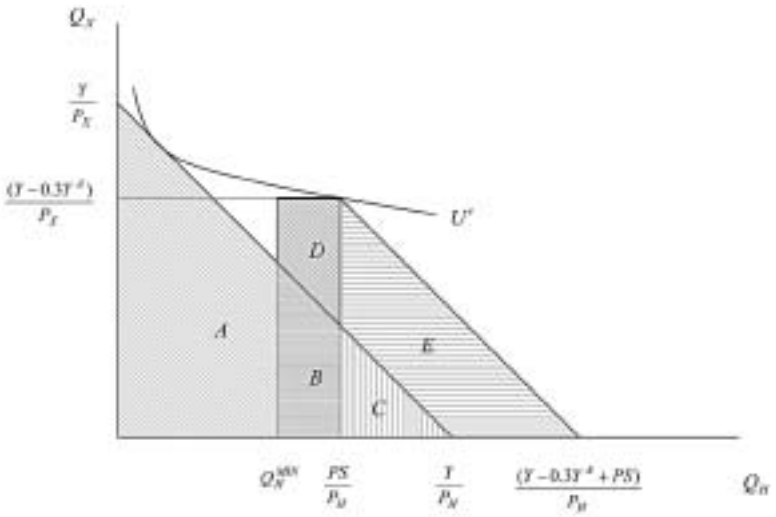
Exhibit 1 depicts what is possible for a voucher family if it continues to participate in the program and if it exits the program. In the absence of the housing voucher program, the quantity of housing services the family could purchase if it were to spend all of its income on housing is Y/P_H. Should the family spend none of its income on housing, but instead spend it on other goods, the family could purchase Y/P_X units of the other goods. Clearly, the family has many options between these two extremes. The prices of housing services and other goods, along with the family's income, determine the set of feasible consumption bundles that the family may purchase if it exits the voucher program. This set is areas A, B, and C in exhibit 1.[5]

Participation in the voucher program makes it possible for the family to purchase certain combinations of housing and other goods that are unattainable in the absence of housing assistance. The Housing Choice Voucher Program adds consumption bundles in areas D and E in exhibit 1.[6] Under this voucher program, a participating family is required to contribute at least 30 percent of its adjusted income Y^A to its housing expenses. This requirement places an upper limit on the family's consumption of other goods, namely, $(Y - 0.3Y^A)/P_X$. In addition, the voucher program's minimum housing standards essentially specify a minimum quantity of housing services a participating family is allowed to

consume. In exhibit 1, this amount is labeled Q_H^{MIN}. A participating family can receive a subsidy for the difference between the market rent of a unit that meets or exceeds the program's minimum housing standards and 30 percent of its adjusted income, subject to that figure not exceeding the difference between the local payment standard *PS* and 30 percent of Y^A. Thus, the maximum subsidy a family can receive is the difference between the local payment standard and 30 percent of its adjusted income. If a family chooses, it can occupy a dwelling unit renting for more than the payment standard, but the subsidy does not increase on that account. To participate in the Housing Choice Voucher Program, the family must choose a bundle of housing and other goods in the areas *B*, *C*, *D*, or *E*.

Exhibit 1

Consumption Possibilities With and Without the Voucher Program



Ignoring participation and moving costs, the family will continue to participate if it prefers some consumption bundle in area *B*+*C*+*D*+*E* to every bundle in area *A*+*B*+*C*. This decision depends in part on the locations of these areas. A family that would continue to participate if the program greatly expands its budget set might not participate if the program adds little to what is possible for the family. For example, a family might continue to participate if the payment standard is high and might exit the program if it is sufficiently low. Exhibit 1 illustrates this point. Suppose that the family whose situation is depicted in this figure is indifferent about choosing between any two combinations of housing services and other goods on the curve U', prefers any bundle above this curve to any bundle on it, and prefers any bundle on U' to any bundle below it. With the budget constraint parameters depicted in the figure, the family is indifferent between continuing to participate and dropping out of the program. If the payment standard were higher and all other budget constraint parameters were the same, the family would continue to participate. If the payment standard were lower and all other budget constraint parameters were the same, the family would exit the program.

The preceding model implies not only that program attrition depends on particular variables such as disposable income, the program's payment standard, and the housing price index but also that these variables should be combined in particular ways in the statistical analysis. Two families with different values of Y, P_H, P_X, PS, and Y^A but the same values of Y/P_H, Y/P_X, $(Y - 0.3Y^A)/P_X$, and PS/P_H are able to consume the same bundles of goods

if they continue to participate in the voucher program and are able to consume the same bundles if they exit the program. For example, if family A's disposable income and adjusted income are twice as great as family B's and if family A lives in a location where the voucher payment standard and all market prices are twice as great, then these families face the same real situation. Therefore, they will not make different decisions based on differences in what is possible. To be consistent with this insight, our statistical model explaining attrition includes as explanatory variables the four ratios rather than the five underlying variables.

The decision about whether to exit the program depends not only on how the program affects what is possible for the family but also on the family's preferences. Two families that could choose the same bundles of goods by participating in the program and the same bundles by leaving the program might make different decisions because they have different tastes.[7] Exhibits 2 and 3 illustrate this point. The budget constraints with and without the program are the same in the two exhibits. The family whose situation is depicted in exhibit 2 is indifferent about choosing between any two combinations of housing services and other goods on the curve U', prefers any bundle above this curve to any bundle on it, and prefers any bundle on U' to any bundle below it. This family will occupy an apartment renting for the payment standard and will devote 30 percent of its adjusted income to housing. It will continue to participate in the program because it prefers the consumption bundle *R* to any bundle possible if it leaves the program. Its net benefit as usually measured is *V*. This is the unrestricted cash grant that would be just as satisfactory to the family as participating in the voucher program. The family whose situation is depicted in exhibit 3 has different preferences. In particular, it places a lower value on better housing. It is indifferent about choosing between any two combinations of housing services and other goods on the curve U'', prefers any bundle above this curve to any bundle on it, and prefers any bundle on U'' to any bundle below it. All consumption bundles on the curve U''' are equally satisfactory to this family. This family will exit the program and choose the bundle *S*. These actions enable the family to consume more nonhousing goods than it could otherwise consume given its best choice under the program, albeit at the cost of living in worse housing.

Exhibit 2

Families With Strongest Tastes for Housing Will Not Exit the Program

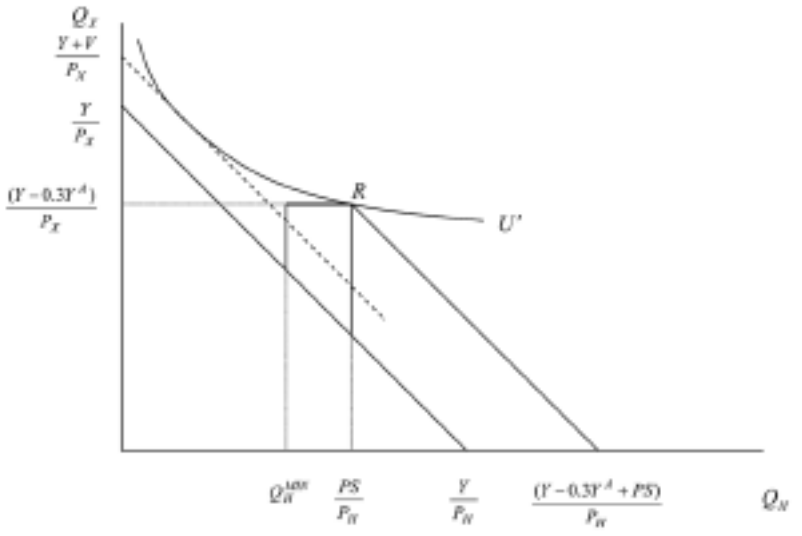
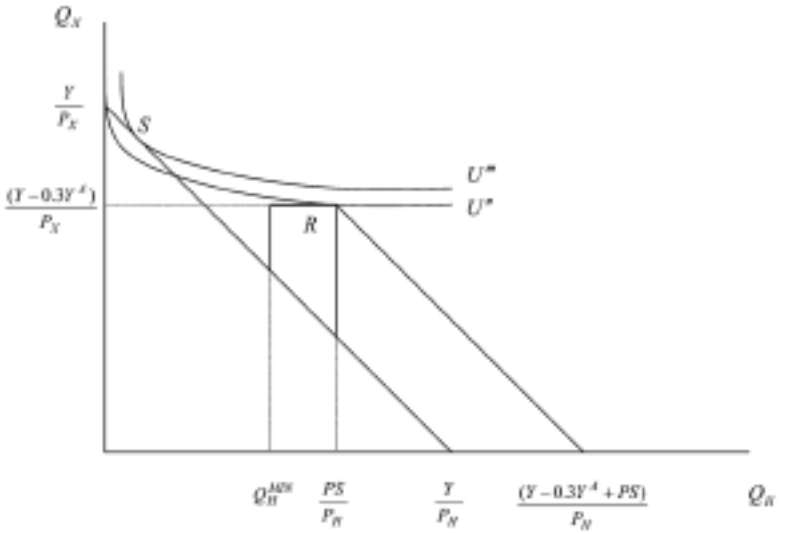


Exhibit 3

Families With Weakest Tastes for Housing Will Exit the Program



Economic theory does not suggest what accounts for differences in tastes. It also does not rule out differences in average tastes among different types of families. To allow for the possibility of these differences, we include family characteristics such as family size and age, race, sex, and marital status of the head of the household as explanatory variables in our statistical models. As will be mentioned later, these characteristics may affect the decision to exit the program for reasons other than differences in tastes for housing and other goods. This study does not attempt to disentangle how much of the effect of a given household characteristic on attrition is due to differences in tastes associated with that characteristic and how much of the effect is due to the other reasons to be discussed later. Indeed, it is not possible to disentangle these effects with the data available.

Up to this point in the analysis, we have ignored program participation and moving costs. Our study accounts for both to some extent. To continue receiving subsidies, participants must spend time filling out paperwork and dealing with program administrators, and they must reveal personal information. These activities are all inherent in operating a means-tested housing program. Furthermore, few enjoy accepting public or private charity. These participation costs reduce the program's net benefit to the families involved. As a result, some families that would continue to participate in the program in the absence of participation costs might leave the program. We do not have direct measures of participation cost, but previous research has indicated that participation cost in welfare programs is different for families with different characteristics. Thus, we try to account for differences in participation cost by the inclusion of family characteristics.

For project-based housing assistance, the effect of moving costs on continued participation is theoretically unambiguous. Since leaving the program almost always requires a family to move, higher moving costs will deter exit from the program. Under the voucher program, however, the family can move and remain in the program or exit the program without moving. It can be shown that in theory, the addition of moving costs may either increase or decrease program attrition.[8] Nevertheless, since moving cost can affect program attrition, we should attempt to account for it in our empirical analysis. We do not have direct

measures of moving costs. It is reasonable to believe, however, that they are higher for certain types of families. For example, housing search may be more difficult if the head of the household is disabled. So we account for differences in moving costs in part by the inclusion of family characteristics. We also estimate a separate hazard model for the 75 largest MSAs for which annual data on vacancy rates is available. This additional analysis enables us to include the rental housing vacancy rate as an explanatory variable that affects moving cost and hence program attrition.

All the variables mentioned above are relevant for explaining the net benefit of continued program participation. It is reasonable to believe that families that receive the smallest benefit from program participation in one period are the most likely to experience a change in their circumstances that causes their net benefit from continuing to participate to become negative. Our empirical analysis of program exit is based on data for departing families at the time of their last recertification before leaving the program. Consequently, our analysis explains departures from the program between years t and $t + 1$ based on variables that explain the level of net benefit in year t. We explain the details of this approach in greater detail in a later section outlining the proportional hazard estimation procedure.

Data

The primary database for this study is the recently created Longitudinal Occupancy, Demography, and Income (LODI) file that contains data from HUD's Multifamily Tenant Characteristics System (MTCS) and Tenant Rental Assistance Certification System for 1995 through 2002. This database provides information on the characteristics of all HUD-assisted families collected when they are admitted to a housing program and recertified for continued participation. It also identifies the primary program providing the housing assistance and the voucher program's local payment standard or fair market rent. This section explains how we used data from the LODI file and other sources to construct the analysis variables and how we dealt with certain problems that we encountered in attempting to determine when a spell of housing assistance had ended. Exhibit 4 provides the details about all variables used in the analysis.

In our analysis, disposable income Y is the family's total expenditure on housing and other private goods. The LODI file contains information on many sources of income such as labor earnings and Temporary Assistance for Needy Families payments. It does not contain information on assistance from the earned income tax credit or the Food Stamp program or on taxes paid. In order to accurately account for how much was available for each family to spend on housing and other goods each year, we subtracted each family's estimated state and federal tax burden from their reported income and added the dollar value of the amount of assistance for which the family was eligible under the Food Stamp program.[9] Details regarding the calculation of estimated tax burdens and Food Stamp eligibility appear in the variable descriptions provided in exhibit 4. Although the Food Stamp program is not literally a cash-assistance program, it was treated as such for the purposes of this study. Previous research has found that this is close to the truth. That is, replacing food stamps with equally costly cash assistance would have little effect on the consumption patterns of recipients.

Since reliable indices of the prices of nonhousing goods across all geographical areas are not available and previous research has indicated that housing prices vary much more than the prices of other goods across areas (Citro and Michael, 1995), we assume that the prices of other goods are the same everywhere at any point in time and construct a cross-sectional housing price index for one year.[10] We then account for changes in the prices of housing and other goods over time using the relevant components of the national Consumer Price Index (CPI).

Exhibit 4

Variable Descriptions

Variable Name	Description
AgeHead	The age of the head of household. Households for which the age of the household head was either missing, less than 15, or greater than 90 were excluded.
Disabled	A dummy variable equal to 1 if the household is classified as disabled and 0 otherwise. Households for which the value of Disabled was missing were excluded.
Elderly	A dummy variable equal to 1 if the household is classified as elderly and 0 otherwise. Households for which the value of Elderly was missing were excluded.
FamilySize	The number of people in the household. Households with values of FamilySize that were either missing, 0, or greater than 10 were excluded.
Hispanic	A dummy variable equal to 1 if the head of household was Hispanic and 0 otherwise. Households for which the ethnicity of the head of the household was either missing or not coded as 1 or 2 were excluded.
HsgPrice	A geographical index of housing prices. Details regarding the calculation of the index appear in the text. Index is 1 in Washington, D.C., in 2002. Values of the index for other years were calculated using the national Consumer Price Index (CPI) for housing, U.S. city average.
Kids	Equal to the number of children ages 17 and younger. Households for which information on the number of children (in any one of the given age ranges) was missing were excluded.
Male	A dummy variable equal to 1 if the head of household was male and 0 otherwise. Households for which the sex of the household head was either missing or not equal to 'm', 'M', 'f', or 'F' were excluded.
Married	A dummy variable equal to 1 if there is a spouse present in the household (such that one of the household members was classified as 's' or 'S') and 0 otherwise.
MaxOtherGoods Vouch	One of the budget constraint parameters appearing in exhibit 1. Equal to the value of TotIncome minus 30 percent of adjusted income divided by 1,200 times the value of OtherPrice so that MaxOtherGoodsVouch is in hundreds of dollars per month.
MTCSIncome	The total annual income of the household. Households with total incomes that were either missing or greater than $61,200 were excluded.
OtherPrice	An index of the prices of other goods based on the national CPI for all items minus shelter, U.S. city average. Index is 1 in all locations in 2002.
PayStand/ HsgPrice	One of the budget constraint parameters appearing in exhibit 1. When the local payment standard is nonmissing or nonzero, equal to the payment standard divided by 100 times HsgPrice so that PayStandard/HsgPrice is in hundreds of dollars per month. When the local payment standard is either missing or 0, equal to the fair market rent divided by 100 times HsgPrice. Households for which the local payment standard and the fair market rent are missing were excluded. In addition, households with a maximum subsidy (the payment standard when it is nonmissing and nonzero, the fair market rent otherwise) greater than 1.2 times the greatest 2002 fair market rent for the appropriate bedroom size were excluded.
TotIncome	The total amount of money available for the household to spend on housing and other goods in a particular year. Calculated by subtracting estimated yearly federal and state taxes from Multifamily Tenant Characteristics System Income and adding the total dollar value of federal food stamps for which the household was eligible each year. Yearly federal and state tax liabilities were estimated using the National Bureau of Economic Research's TAXSIM program, version 5.1, which accounts for the Earned Income Tax Credit. Households for which TotIncome was negative were excluded.
TotIncome/ HsgPrice	One of the budget constraint parameters appearing in exhibit 1. Equal to the value of TotIncome divided by 1,200 times the value of HsgPrice so that TotIncome/ HsgPrice is in hundreds of dollars per month.
TotIncome/ OtherPrice	One of the budget constraint parameters appearing in exhibit 1. Equal to the value of TotIncome divided by 1,200 times the value of OtherPrice so that TotIncome/ OtherPrice is in hundreds of dollars per month.
VacancyRate	For the 75 largest metropolitan statistical areas, equal to the yearly rental vacancy rate as indicated in the U.S. Census Bureau's Housing Vacancies and Homeownership Annual Statistics: 2002, Table 5.

Exhibit 4

Variable Descriptions (continued)

Variable Name	Description
Wage	The total amount of wage income received by the household. Households for which the value of wage was either missing or greater than $61,200 were excluded.
White	A dummy variable equal to 1 if the head of household was White and 0 otherwise. Households for which information on the race of the head of the household was either missing or was outside the range 1 through 5 were excluded.

Notes: Unless otherwise stated, the data come from the U.S. Department of Housing and Urban Development's Longitudinal Occupancy, Demography, and Income file described in the text. Caps for MTCSIncome and Wage were determined by adding $10,000 to the largest 50-percent income limit for a family of four in the country in 2000. For information regarding TAXSIM, see Feenberg and Coutts (1993). TAXSIM 5.1 is available on line at http://www.nber.org/taxsim/. Assistance from Dan Feenberg regarding the use of TAXSIM for this work is gratefully acknowledged. CPI data are available on line at http://www.bls.gov/cpi/home.htm#data. Housing vacancy rate data for the 75 largest MSAs are available on line at http://www.census.gov/hhes/www/hvs.html. Food stamp eligibility and monthly benefits were determined using program eligibility tests and benefit calculations described at http://www.fns.usda.gov/fsp/applicant_recipients/fs_Res_Ben_Elig.htm. Food stamp program parameters for the relevant time period were graciously supplied by Patrick Waldron of the Program Development Division of Food and Nutrition Service at the U.S. Department of Agriculture. Cutoff values for the maximum subsidy were determined using the following fair market rents for 2002: 0 BR–$1,131 (San Jose, CA), 1 BR– $1,382 (San Francisco, CA), 2 BR–$1,747 (San Francisco, CA), 3 BR–$2,396 (San Francisco, CA), and 4 BR–$2,536 (San Francisco, CA).

Our geographical housing price index is based on data on the gross rent and numerous housing characteristics of tenant-based voucher units from HUD's 2000 Customer Satisfaction Survey (CSS) as well as information about the characteristics of the census tract of each unit from the 2000 decennial census.[11] The gross rent of a voucher unit is the rent received by the landlord plus any tenant-paid utilities. Previous research has indicated that the rents paid to the landlords of voucher units are very close to the rents of unsubsidized units with identical characteristics.

We used these data to estimate two general forms of a hedonic rent equation and used the one that best fit the data to create a cross-sectional housing price index. Both specifications assume that the percentage difference in rents between two areas is the same for any combination of housing and neighborhood characteristics. The two specifications are as follows:

$$MR_{ij} = (1 + \alpha_1 Z_{1ij} + ... + \alpha_m Z_{mij})(\beta_0 + \beta_1 X_{1ij} + ... + \beta_n X_{nij}) + \nu_{ij} \quad (1)$$

and

$$\ln MR_{ij} = \beta_0 + \beta_1 X_{1ij} + ... + \beta_n X_{nij} + \alpha_1 Z_{1ij} + ... + \alpha_m Z_{mij} + \nu_{ij}. \quad (2)$$

In these equations, MR_{ij} represents the gross rent of unit i in locality j, the Zs are dummy variables for each locality (with one locality omitted), the Xs represent housing and neighborhood characteristics, and v_{ij} represents unobserved determinants of gross rent. To create the dummy variables for localities, observations were grouped into m localities by geographical area. Several levels of aggregation were explored. In the end, we produced a separate housing price index for each metropolitan area and the nonmetropolitan part of each state.

To determine which of the two specifications to use in constructing the geographical price index, equations (1) and (2) were estimated separately for 23 MSAs and the nonmetropolitan areas of two states with a large number of observations, using a subset of the housing and neighborhood characteristics as explanatory variables.[12] Although the error variances were similar across the two specifications for most areas, the second model predicted rent more accurately in 18 of the 25 areas. Consequently, we constructed the geographical housing price index by estimating equation (2) using the full set of dwelling unit characteristics

from the CSS and more neighborhood information from the decennial census than were employed in the performance comparisons.

The fit of the hedonic equation was excellent (R^2 = .80), and the coefficients used to create the price indices were estimated with considerable precision. The estimated price index was usually consistent with popular views about differences in housing prices. Among the most expensive places to rent an apartment were San Francisco and San Jose, California; Stamford and Danbury, Connecticut; Boston, Massachusetts; and Nassau-Suffolk and New York City, New York. The least expensive places to rent tended to be nonmetropolitan parts of states and small metropolitan areas in the South.

The estimated hedonic equation and the national CPI for housing were used to produce a housing price index equal to 1 in Washington, D.C., in 2002. This assumes that relative housing prices across areas did not change over the period of our data.

Because good geographical indices of the prices of other goods are not available for all areas and previous research has indicated that housing prices vary much more across areas than the prices of other goods, we assume that the prices of other goods are the same everywhere at each point in time. We use the national CPI for all items minus shelter to construct a price index for other goods that is 1 for all areas in 2002.

The LODI file contains each family's adjusted income Y^A as well as information on the local payment standard PS in its area. Minimum housing standards that determine the location of Q_H^{MIN} are nationally uniform. Therefore, differences in this variable cannot explain differences in exit rates.

Before estimating the proportional hazard model, some effort was made to clean the data. Because we are seeking to explain program exits, the first step is to define what it means in our data for a family to exit the program. Each observation in the LODI file contains information on one family in one year. The number of observations for a particular family ranges from one to eight. We define an indicator variable for program exit as equal to 1 if, excluding End of Participation (EOP) reports, the observation satisfies two conditions: (1) it is the last observation for the family, and (2) the year of the observation is not 2002. Our reasons for this definition are given below.

If EOP records were available for and contained reliable information about each family that exited the program, it would be desirable to use this information to estimate the hazard model. Many families that appear in the LODI file in some years between 1995 and 2002, however, do not have records for the later years or EOP records. We assume that these families have exited the program without completing EOP forms. If we had used information in EOP records for families with these records and information in the last recertification record for other families, the data for these two types of families would have referred to a somewhat different period. For families with EOP records, it would refer to the period immediately before leaving the program. For other departing families, it would refer to an earlier period. These families leave the program sometime during the year after their last recertification; the information in the last recertification record refers to the period before that recertification. Furthermore, it seems plausible that the information in the EOP record is not as reliable as the information in recertification records because it is never checked for accuracy. Therefore, we ignore the information in EOP records and base our analysis on the information in the admission and recertification records. That is, for families with EOP records, we use the information in their last recertification record.

During the year after a recertification, a family may choose to stay in the voucher program or exit. A decision to exit during this period appears in one of two ways in the LODI file: either there is no recertification record for the family at the end of the period, or there is

an EOP record for the family during the period. After EOP records are eliminated, the only way for an exit to appear in the data is to observe a family at time t but not at time $t + 1$. However, because not all families are interviewed every year or the results are not reported to HUD, it is possible that a family is not observed at time $t + 1$ only to reappear in the data at time $t + 2$. In such an instance, condition (1) serves to avoid categorizing the gap as an exit and re-entry. Throughout this study, it is assumed that families that exit the voucher program between 1995 and 2002 do not re-enter it during this period.

Condition (2) simply takes right censoring of the data into account. If the last non-EOP observation of a family is in 2002, we do not know whether the family exits the program within the next year. All we can say for certain for those families is that they have remained in the program through their recertification in 2002.

In addition to defining program exit, it was necessary to eliminate from the data set families for which the values of one or more important variables appeared erroneous or were missing. Errors were assumed to be attributable to data entry or misreporting. Because of the nature of the study, it was imperative that entire families be dropped from the sample due to missing values or data errors, not just the single observation of the year in which the data problem occurred. To understand why, suppose we observed Family 1 in 1995, 1996, and 1997; that the observation in 1997 is not an EOP; and that in 1997 the family's total income is missing. Simply dropping the observation from 1997 would cause us to mistakenly regard the family as exiting the program in 1996. Deleting all three observations for Family 1 from the sample avoids this problem. Because of the LODI file's size, eliminating entire families due to data problems still leaves an extremely large number of observations to use in estimation. Since there is no reason to expect the deleted families' exit behavior to differ from the exit behavior of the other families with the same observed characteristics, there is no reason to believe that our results are biased on this account.

Descriptions of the final set of variables included at various points in the analysis appear in exhibit 4, along with details regarding what values (if any) of each variable resulted in the family's being eliminated from the sample. Exhibit 5 reports summary statistics. The original LODI file contained 10,052,673 observations on 3,356,640 families with housing vouchers. The final samples used in estimating the proportional hazard models consisted of 2,430,956 observations on 1,101,825 families (data from all areas) and 1,270,975 observations on 571,519 families (data from the 75 largest MSAs). Exhibit 5 indicates that the mean income of these families (in 2002 Washington, D.C., prices) was about $10,700 and the mean family size was about 2. Of the households, 64 percent were White, 32 percent had elderly heads of the household, and 30 percent had disabled heads of the household.

Statistical Methods

The data described in the previous section was used to estimate a Cox proportional hazard model. This model assumes that the hazard rate can be specified as

$$h(t) = h_0(t)e^{X(t)\beta} \tag{3}$$

where $h_0(t)$ represents the baseline hazard function, $X(t)$ is the set of covariates described in the previous section, and β is a vector of coefficients to be estimated.

The hazard rate gives the likelihood of exit at time t for a family with observed characteristics $X(t)$. One important implication of this simple model is that the percentage difference between the hazard rates for families with two different combinations of characteristics that have been in the program the same number of years is the same no matter how many years they have been in the program. For example, if a family with one child is twice as

Exhibit 5

Means and Standard Deviations of Explanatory Variables

	1995		2002		1995–2002	
	All Areas	75 Largest MSAs	All Areas	75 Largest MSAs	All Areas	75 Largest MSAs
TotIncome/OtherPrice	10.77	11.18	11.68	12.25	10.70	11.24
	(4.946)	(5.116)	(5.300)	(5.534)	(4.926)	(5.156)
MaxOtherGoodsVouch	8.54	8.77	9.17	9.56	8.39	8.75
	(3.748)	(3.827)	(4.077)	(4.225)	(3.790)	(3.937)
PayStand/HsgPrice	7.76	7.91	8.35	8.73	7.62	7.87
	(2.035)	(1.890)	(2.417)	(2.305)	(2.080)	(1.995)
TotIncome/HsgPrice	14.18	12.78	13.83	12.96	13.07	12.12
	(6.787)	(5.993)	(6.428)	(6.033)	(6.134)	(5.681)
FamilySize	2.26	2.20	2.17	2.21	1.95	1.99
	(1.468)	(1.475)	(1.407)	(1.454)	(1.364)	(1.408)
AgeHead	47.58	49.31	46.06	47.01	50.11	51.45
	(18.658)	(18.66)	(18.431)	(18.496)	(18.758)	(18.705)
White	0.67	0.60	0.60	0.50	0.64	0.56
	(0.471)	(0.490)	(0.491)	(0.500)	(0.479)	(0.497)
Black	0.31	0.38	0.37	0.46	0.33	0.41
	(0.463)	(0.484)	(0.484)	(0.498)	(0.469)	(0.491)
Male	0.21	0.21	0.22	0.21	0.24	0.23
	(0.409)	(0.405)	(0.411)	(0.407)	(0.425)	(0.422)
Kids	0.92	0.86	0.95	0.99	0.72	0.74
	(1.219)	(1.220)	(1.278)	(1.326)	(1.181)	(1.221)
Married	0.12	0.09	0.08	0.08	0.09	0.09
	(0.320)	(0.292)	(0.274)	(0.278)	(0.281)	(0.283)
Hispanic	0.07	0.08	0.14	0.16	0.12	0.14
	(0.256)	(0.275)	(0.348)	(0.365)	(0.328)	(0.346)
Disabled	0.23	0.22	0.30	0.28	0.30	0.28
	(0.418)	(0.412)	(0.459)	(0.447)	(0.459)	(0.447)
Elderly	0.28	0.31	0.24	0.25	0.32	0.35
	(0.451)	(0.464)	(0.424)	(0.434)	(0.467)	(0.476)
VacancyRate	7.22	7.22	7.81	7.80	7.29	7.29
	(2.491)	(2.491)	(3.301)	(3.301)	(3.323)	(3.323)
Number of Observations	168,290	76,105	604,531	324,180	2,430,956	1,270,975

Notes: Variables are defined in Exhibit 4. Standard deviations are in parentheses.

likely to exit after 1 year of program participation as an otherwise identical family with no children, then a family with one child is also twice as likely to exit after 3 years of program participation as an identical family with no children. This does not mean that the *rate* of exit is the same for both families at both points in time, but rather that the *ratio* of the two rates of exit is identical.

This simple specification of the hazard rate allows us to estimate the β coefficients without specifying a particular baseline hazard function. The estimated coefficients can be used to analyze the effects of the individual covariates on the rate at which families will exit the voucher program. In general, if the coefficient of an explanatory variable is positive, an increase in that explanatory variable increases the likelihood of exit. More specifically, the percentage difference in the hazard rate between two families that differ by one in the value of variable X_i and not at all with respect to other explanatory variables is $100(e^{\beta_i} - 1)$. For example, if one of the included covariates is a binary variable that takes the value of 1 if the head of the household is White and 0 otherwise and its estimated coefficient is .05, the results imply that the likelihood of exit for a family with a White head of the household is about 5.13 percent greater than the likelihood of exit of a family with a non-White head of the household. If the estimated coefficient is –.05, the likelihood of exit is about 4.88 percent less for White families.

Empirical Results

Exhibit 6 reports the parameter estimates of the Cox proportional hazard models based on data from all areas (column 1) and from the 75 largest MSAs (column 3). Standard errors of the parameter estimates are given in parentheses. In every case in which there is a good basis to expect a coefficient of a determinant of exit from the voucher program to have a particular sign, the estimated coefficient had that sign. Because of the sample's tremendous size, we were able to estimate the coefficients in each of the models with an extraordinarily high degree of precision. With very few exceptions, a Wald test rejects the null hypothesis that the coefficient was equal to 0 at the less than 1-percent level.

Exhibit 6

Cox Proportional Hazard Estimation Results

	All Areas		75 Largest MSAs	
	(1) Coefficient	(2) Hazard Ratio	(3) Coefficient	(4) Hazard Ratio
TotIncome/OtherPrice	0.0437	1.045	0.0468	1.048
	(0.0021)		(0.0029)	
MaxOtherGoodsVouch	– 0.1139	0.892	– 0.1189	0.888
	(0.0031)		(0.0043)	
PayStand/HsgPrice	– 0.0411	0.960	– 0.0307	0.970
	(0.0009)		(0.0014)	
TotIncome/HsgPrice	0.0402	1.041	0.0465	1.048
	(0.0004)		(0.0009)	
FamilySize	0.1506	1.162	0.1443	1.155
	(0.0028)		(0.0038)	
AgeHead	– 0.0075	0.993	– 0.0044	0.996
	(0.0001)		(0.0002)	
White	– 0.0632	0.939	– 0.0884	0.915
	(0.0075)		(0.0099)	
Black	– 0.1697	0.844	– 0.1705	0.843
	(0.0077)		(0.0100)	
Male	0.0670	1.069	0.0934	1.098
	(0.0035)		(0.0051)	
Kids	– 0.0426	0.958	– 0.0397	0.961
	(0.0029)		(0.0039)	
Married	0.0205	1.021	– 0.0119	0.988
	(0.0052)		(0.0077)	
Hispanic	– 0.0697	0.933	– 0.0591	0.943
	(0.0043)		(0.0060)	
Disabled	– 0.4673	0.627	– 0.4454	0.641
	(0.0041)		(0.0061)	
Elderly	– 0.2614	0.770	– 0.2772	0.758
	(0.0065)		(0.0093)	
VacancyRate	–	–	– 0.0068	0.993
			(0.0007)	
Number of observations	2,430,956		1,270,975	

Notes: Variables are defined in exhibit 4. Standard errors are in parentheses. For all but one estimated coefficient, Wald tests of the null hypotheses that an individual coefficient is equal to zero reject the null hypotheses at the less than 1-percent level. The lone exception is that the coefficient on Married in column 3 is significant at the 15-percent level.

For ease of analysis, exhibit 6 also reports estimated hazard ratios. Column 2 provides ratios for all areas and column 4 provides ratios for the 75 largest MSAs. Each hazard ratio is the ratio of the estimated rates of exit of families that differ by one unit with respect to a particular covariate. If a given hazard ratio is greater than 1, then all else being equal, an increase in the value of the corresponding variable will increase the rate of program exit. On the other hand, if the hazard ratio is less than 1, an increase in the

value of the covariate decreases the rate of program exit, all else being equal. If the hazard ratio is exactly equal to 1, then holding everything else constant, the covariate does not affect the rate of exit. The farther away the hazard ratio is from 1, the greater the effect of the covariate. Consequently, examining the estimated hazard ratios presented in exhibit 6 provides straightforward insight into what factors affect a family's likelihood of exiting the program as well as the relative influence of each factor. Specifically, the estimated fractional increase in the likelihood of attrition associated with a one unit increase in a particular variable is equal to the hazard ratio reported in exhibit 6 minus 1.

Budget Constraint Parameters Without Housing Assistance

The simple model underlying the estimation assumes that what is possible for a family in the absence of assistance is determined by two variables, namely, *TotIncome/HsgPrice* (Y/P_H) and *TotIncome/OtherPrice* (Y/P_X). The model implies that families with the same values of the other explanatory variables and higher values of either of these variables will exit at a higher rate. That is, the expected sign of their coefficients is positive. To understand this theoretical expectation, it is important to remember that *PayStand/HsgPrice* (PS/P_H) and *MaxOtherGoodsVouch* ($(Y - .3Y^A)/P_X$) are among the other explanatory variables in the hazard model. These variables describe what is possible for the family under the voucher program. Holding what is possible under the voucher program constant, the higher the family's income, the less the voucher program adds to what is possible for the family. (See exhibit 1.) It is important to recognize that families with different incomes can have the same value of *MaxOtherGoodsVouch* due to differences in the adjustments used in calculating the tenant's adjusted income. Based on data for the largest 75 MSAs, the results indicate that families whose maximum monthly expenditure on housing in the absence of housing assistance is $100 greater have an attrition rate that is about 4.8 percent higher than otherwise similar families and families whose maximum monthly expenditure on other goods in the absence of housing assistance is $100 greater have an attrition rate that is about 4.8 percent higher than otherwise similar families.[13]

Payment Standard and Minimum Tenant Contribution

Based on the data for the 75 largest MSAs, the estimated coefficient of variable *PayStand/HsgPrice* indicates that, all else being equal, a $100 increase in the monthly value of the local payment standard will be associated with a 3.0 percent reduction in the rate of program exit. A decrease of $100 per year in the minimum tenant contribution to rent (currently 30 percent of adjusted income) would increase *MaxOtherGoodsVouch* by this amount and decrease program attrition by about 11.2 percent. The difference in the coefficients of these two variables shows clearly that program attrition depends on the magnitudes of the individual parameters that determine the maximum subsidy rather than the maximum subsidy itself. The two changes in program parameters mentioned above have the same effect on the maximum subsidy but very different effects on attrition.

Elderly and Disability Status

By far, the two largest influences on a family's decision to leave the voucher program are whether the head of the household is elderly and whether the head is disabled. At a given point in time after entering the program, a family with an elderly head of the household is about 23 percent less likely to leave the program than an otherwise similar family with a head of the household who is not elderly. The effect of being disabled is even more pronounced. For two families that are identical in all respects included in these models, but one head of the household is disabled and the other is not, the family with the disabled head of the household is roughly 37 percent less likely to leave the voucher program. Because a family will exit the voucher program only when its circumstances change in such a way that the program's net benefit to the family is no longer positive, these two

results are not surprising. Families with elderly and disabled heads of the household are less likely to experience significant changes in their circumstances than similar families with nonelderly, nondisabled heads of the household. Furthermore, moving costs are likely to be higher for these families. Consequently, we would expect that such families should also be less likely to exit the program.

Race

The race of the head of the household has a modest effect on the likelihood that the family will exit the voucher program. Because dummy variables for both White and African-American races were included in each model specification, the estimated hazard ratios for those variables are relative to non-White, non-African-American families (that is, American Indian, Alaskan Native, Asian, or Pacific Islander). The estimated hazard ratios in exhibit 6 indicate that a White family is about 8.5 percent less likely to leave the voucher program than an otherwise identical non-White, non-African-American family. Similarly, an African-American family is around 15.7 percent less likely to exit the program than an otherwise identical non-White, non-African-American family. It is difficult to pinpoint the causal relationship responsible for these results. As mentioned earlier, the differences in likelihood of exit could reflect differences in average tastes for housing and other goods across different races. The results could be due to differences across race in the average amount of perceived stigma associated with program participation or moving costs. Other explanations are surely possible. Unfortunately, we cannot determine how much of the observed influence of race is attributable to each possibility. Whatever the reason, these results suggest that, compared to non-White, non-African-American families, White families are somewhat less likely to exit the program, and African-American families are even less likely than White families to exit.

Other Family Characteristics

The estimated hazard ratios in exhibit 6 also indicate the effects of the other included family characteristics on the rate of program exit. The likelihood of leaving the voucher program increases with the size of the family, and it is higher if the head of the household is male. It decreases with the age of the head of the household, the number of children present, and if the family is Hispanic. In the large sample, families with a spouse present are more likely to exit. In the sample from the 75 largest MSAs, however, families with a spouse present are less likely to exit.

Vacancy Rates

The coefficient estimates in exhibit 6, column 3, are very similar to those in column 1. The only difference between the two specifications is that the model specified in column 3 includes the prevailing rental housing vacancy rate and it is estimated with the subset of families that live in the 75 largest MSAs. The estimated hazard ratio indicates that if the vacancy rate increases by 1 percentage point, a family is seven-tenths of a percent less likely to leave the voucher program. In the article's theoretical section, we justified the inclusion of the vacancy rate as a covariate to capture the effects of moving costs. We argued that moving costs had a theoretically ambiguous effect on attrition in the voucher program. The empirical results in the third column indicate that higher moving costs lead to more attrition, albeit by a miniscule amount.

Conclusion

This study provides insight into what determines the likelihood that a family will leave a tenant-based voucher program. The hazard rate analysis indicates that whether a head of the household is elderly and whether the head is disabled are by far the most important

influences on the likelihood that the family will exit the program. Families with disabled heads of the household are about 37 percent less likely to exit and families with elderly heads of the household are about 23 percent less likely to exit each year than otherwise similar families. Differences in attrition rates based on other family characteristics are much smaller. White families are about 9 percent less likely to leave the program than non-White, non-African-American families, and African-American families are around 16 percent less likely to leave than non-White, non-African-American families. The likelihood of leaving the voucher program increases with the size of the family, and it is higher if the head of the household is male. It decreases with the age of the head of the household, with the number of children present, and if the family is Hispanic.

The results of the hazard rate estimation indicate that program parameters have a modest influence on attrition. Based on data for the 75 largest MSAs, the results indicate that, all else being equal, a $100 per month decrease in the local payment standard will be associated with a 3 percent increase in the rate of program exit and an increase of $100 per month in the minimum tenant contribution to rent would increase program attrition by 12.6 percent.

Although exit rates could be reduced by increasing payment standards or decreasing tenant contributions, these facts do not imply that they should be reduced by these means. The families that would be induced to remain in the program would be the least needy among those currently served, there are long waiting lists for participation in the voucher program in almost all localities, and the waiting lists contain many needier families. Decreasing the payment standard or increasing the tenant contribution to rent would induce few recipients to leave the voucher program, but it would provide the resources to serve many additional families that are as needy as the neediest current recipients without spending more money on the program. Congress could increase the number of vouchers without increasing the program's budget and limit these additional vouchers to those families on the waiting list that have the lowest incomes.

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Notes

1. Hungerford (1996) included the Section 8 fair market rent as a determinant of attrition but viewed it as a rental housing price index as well as an indication of the generosity of the housing subsidy. We disentangle these two determinants of attrition by including as explanatory variables a housing price index as well as the voucher program's local payment standard.

2. Altman (1991), Kahn and Sempos (1989), and Selvin (1996) provide introductions to this model. Lancaster (1990) provides a more detailed account.

3. The local payment standard determines a family's maximum subsidy. Specifically, the maximum subsidy a family can receive is the difference between the local payment standard and 30 percent of its adjusted income. The payment standard is larger for larger families, and the subsidy is lower if the family occupies a unit renting for less than the payment standard.

4. In reality, the percentage difference between the rents of identical units may be different for units with different combinations of housing and neighborhood characteristics. We ignore this complication.

5. If a minimum amount of either good is necessary for survival, then consumption bundles involving less than this amount of the good involved are not feasible. Accounting for this aspect of reality does not affect the conclusions of the analysis.

6. As with all attempts to model what is possible under a government program, this description is a simplification of reality. For example, some of the data used in the analysis is for years prior to the Housing Choice Voucher Program. The budget constraints of the earlier certificate and voucher programs were slightly different. Furthermore, the description in the text does not accurately describe the Housing Choice Voucher Program. For example, the minimum tenant contribution to rent is 10 percent of gross income rather than 30 percent of adjusted income for a small fraction of recipients.

7. In economics, "tastes" and "preferences" refer to all factors other than what is possible that determine an individual's choices. When two people with the same options choose different consumption bundles, they are said to have different tastes. Tastes for particular goods are relative concepts. To say that a person has a stronger than average taste for a particular good means that the person has a weaker than average taste for at least one good. As economists use these terms, no one has stronger than average tastes for all goods.

8. The proof is available on request.

9. Since many eligible families do not participate in the Food Stamp program, their incomes are overstated on this account. These nonparticipants tend to be the families eligible for the smallest subsidies; thus, the overstatement will typically be small. Offsetting this overstatement of income is the underreporting of income by many recipients of housing assistance (Edin and Lein, 1997).

10. An alternative was to limit the analysis to the urban areas covered by the American Chamber of Commerce Researchers Association (ACCRA) Cost of Living Index and use its index of the prices of nonhousing goods. These areas account for about 70 percent of the U.S. urban population. In addition to recognizing the limited geographical coverage of the ACCRA index, it is important to realize that the consumption bundle underlying the ACCRA index is intended to be typical of affluent professional and managerial families rather than the low-income families in our study. Our housing price index is unambiguously better than the ACCRA housing index because it accounts for many more housing and neighborhood characteristics. For the same reason, it is better than Malpezzi, Chun, and Green's (1998) housing price index. Their hedonic equation explaining rent has 19 regressors representing 11 underlying characteristics. Ours has 182 regressors representing many more characteristics. Our housing price index is also better than Thibodeau's (1995) because it has somewhat more detail about housing and neighborhood characteristics and it is available for all locations throughout the country. We are happy to share our housing price index and the underlying hedonic equation with others at any time.

11. University of Illinois at Urbana-Champaign (1998) describes the pilot studies that led up to the survey. Olsen can provide the questionnaire used in the 2000 Customer Satisfaction Survey.

12. Because it is not linear in its parameters, estimation of equation (1) using all the available data and explanatory variables was not feasible with the computers and statistical programs used.

13. Throughout this section, all dollar amounts are in 2002 Washington, D.C., prices.

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