Housing Allowance Demand Experiment

Participation Under Alternative Housing Allowance Programs: Evidence From the Housing Allowance Demand Experiment

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PARTICIPATION UNDER ALTERNATIVE HOUSING ALLOWANCE PROGRAMS: EVIDENCE FROM THE HOUSING ALLOWANCE DEMAND EXPERIMENT

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ABSTRACT

This report analyzes program participation in the various forms of housing allowance programs tested in the Housing Allowance Demand Experiment. Two stages in participation are analyzed--accepting the initial enrollment offer and, for the forms of allowance which required households to live in units that met certain requirements, subsequently meeting requirements and participating once enrolled.

The analysis finds that, as expected, programs of income-conditioned transfer payments or rebates on rental expenditures have high participation rates. The imposition of housing requirements reduces participation rates considerably. There appears to be a reasonably stable relationship between participation and a household's normal probability of meeting requirements in the absence of the allowance offer. This relationship depends on the amount of the allowance payment offered, but not on the type of requirement imposed or household demographic characteristics.

The report also considers differences in participation for households that remained eligible for relatively long periods and discusses the implications of the results for program evaluation and design. Some attention is paid to the implications of the findings for other housing programs. In addition, technical concerns addressed in the report include evaluation of bias due to sample selection and attrition, effects of population turnover on participation, and development and testing of an underlying theoretical model of the participation decision.

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Billie Renos typed and organized the production of several early drafts, until an accident prevented her from working further on this report. Her place was taken by Joanne Tavilla, who picked up the work with care and unfailing tolerance for cryptic symbols and illegible writing.

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SUMMARY

This is one of a series of technical reports on the results of housing programs tested in the Housing Allowance Demand Experiment. The Demand Experiment, authorized by Congress in the Housing Act of 1970, was designed to test the concept of direct cash assistance (housing allowances) to low-income households to enable them to rent suitable housing. The experiment focused on the ways in which low-income renter households use housing allowances. It tested a variety of allowance plans involving approximately 1,200 Experimental households and 500 Control households at each of two sites: Allegheny County, Pennsylvania (Pittsburgh) and Maricopa County, Arizona (Phoenix), during 1973-1977. Each household enrolled in the experiment was offered allowance payments for three years. Analysis is based on data from the first two years.

This report discusses participation in the various programs tested by the Demand Experiment. Low-income housing programs in the United States typically have openings for only a small fraction of their eligible population. Because these programs are severely restricted by funding levels, they provide little information about their relative appeal for different types of households or their ultimate potential for serving all eligible households if they were to be fully funded. The analysis of participation in the Demand Experiment addresses these issues. Because the analysis is based on a sample of eligible households in each site, it estimates the responses of all eligible households from which the sample was drawn. Thus, although the Demand Experiment was itself limited in size, it simulates an open-enrollment program with universal entitlement for all eligible households.

The housing allowance programs tested in the Demand Experiment can be divided into three major types--Housing Gap, Unconstrained, and Percent of Rent. Housing Gap programs offered participants payments designed to make up all or part of the gap between the estimated costs of modest, existing standard housing in each site and the fraction of its income that a household might be expected to afford for housing. Households could only receive these payments if they lived in or moved to housing that met certain program requirements. Three different requirements were tested in the Demand Experiment--Minimum Standards and two levels (High and Low) of Minimum Rent.

Housing Gap households assigned to Minimum Standards programs had to occupy housing that met certain physical and occupancy standards in order to receive payments. Households assigned to Minimum Rent programs had to spend a minimum amount for housing in order to receive their allowance payments.

The other type of housing allowance program tested did not impose housing requirements. Percent of Rent plans offered households rebates equal to a fixed fraction of their monthly rent. Payments were tied directly to housing expenditures, but no other requirements were imposed. Households were free to spend as much or as little for housing as they wished and could occupy any private rental unit in the two counties. In addition, the Unconstrained plan offered households payments based on the same formula used for the Housing Gap plans, but without imposing any housing requirements. This plan was, in effect, a welfare or income maintenance program.

The experiment also included a group of Control households. Control households provide benchmark information on the housing that eligible households would occupy without assistance from the housing allowance programs.

The participation rates analyzed in this report are based on two household decisions. First, all households offered enrollment in the Demand Experiment had to decide whether to accept the enrollment offer. For Percent of Rent and Unconstrained households, this was the only participation decision. Once these households had accepted the enrollment offer and had been certified as eligible they were enrolled in the experiment and began to receive allowance payments immediately. Housing Gap households still had to meet the housing requirements. Some households were already living in units that met requirements when they enrolled. Other households had to arrange to meet requirements in their current unit or move to a different unit that did meet requirements in order to qualify for allowance payments. The participation rate of Housing Gap households, therefore, is the product of two rates--their acceptance rate and their subsequent participation rate after enrollment.

The major findings of the analysis are summarized below.

1. Participation rates for Percent of Rent and Unconstrained programs were high.

   Overall, 84 percent of the households that completed the initial

enrollment interview for the Percent of Rent and Unconstrained programs accepted the enrollment offer. Rates were similar in the two sites (82 percent in Pittsburgh and 87 percent in Phoenix). The reasons most often given for refusing to participate were program requirements (such as monthly income reports and periodic housing evaluations) and reluctance to accept money from the government. However, these reasons were rarely the only ones given; most households gave several reasons for rejecting the enrollment offer.

2. Participation rates for the Housing Gap programs were only about half those for the Percent of Rent and Unconstrained programs. This was a direct result of the housing requirements used in the Housing Gap programs.

   Housing Gap households accepted the initial enrollment offer only slightly less often than Percent of Rent and Unconstrained households (78 percent for the Housing Gap programs in the two sites as opposed to 84 percent for the Percent of Rent and Unconstrained programs). However, only 58 percent of enrolled Housing Gap households ever met the housing requirements and participated during the two years after enrollment. As a result, the overall participation rate for Housing Gap households was only 45 percent.

3. The Housing Gap programs tested in the Demand Experiment were able to reach less than one-fourth of the eligible households that would otherwise have been living in substandard housing (as defined by the program's requirements). As a result, a large majority of the households that did participate in the Housing Gap programs were households that would have met requirements on their own, without assistance from the allowance program.

   Housing Gap households that were already living in units that met requirements became participants as soon as they accepted the enrollment offer and were enrolled in the program. Thus these households had high participation rates similar to those of Percent of Rent and Unconstrained households. Among enrolled

Housing Gap households that were not already living in units that met requirements, on the other hand, only 38 percent later met requirements and participated. Furthermore, the experience of Control households indicates that almost half of these households would have met requirements on their own, regardless of the allowance offer. As a result, the estimated overall participation rate for enrolled households that would not have met the program requirements was less than 23 percent.

Almost 55 percent of the Housing Gap households that did participate were households that were already living in units that met requirements when they enrolled in the experiment. Another 20 percent were households that met requirements after enrollment on their own, and not because of the enrollment offer. Only one-fourth of all Housing Gap participants were induced to meet the housing requirements by the allowance offer.

Housing requirements did induce some households that would have lived in substandard housing to obtain housing that met the program's requirements. The requirement also guaranteed that all subsidized units met basic program standards. This was accomplished, however, by effectively excluding most households in substandard housing from the program.

4. More stringent housing requirements reduced participation rates, primarily by reducing the proportion of households that met requirements on their own without the assistance of the allowance offer.

The least stringent requirement tested was the Minimum Rent Low requirement, which over two-thirds (68 percent) of enrolled households would have met without any housing allowance program. As a result, participation rates for Housing Gap programs with this requirement were high--78 percent of enrolled households or 61 percent of all households offered enrollment. Because so many households would have met this requirement in any case, only 13 percent of the participants in these programs were households that were induced to meet the Minimum Rent Low requirement by the allowance program.

The Minimum Rent High requirement was more stringent; only 30 percent of enrolled households would have met this requirement on their own. Participation rates for programs with this requirement were accordingly lower--56 percent of enrolled households or 44 percent of all households offered enrollment participated. However, 29 percent of the participants were induced to meet the requirement because of the allowance program offer.

Finally, the most stringent requirement tested was Minimum Standards; only 17 percent of enrolled households would have met this requirement on their own. Participation rates under this requirement were accordingly lower yet--47 percent of enrolled households or 37 percent of all households offered enrollment. One-third of all participants under the Minimum Standards programs were induced to meet the requirements by the allowance offer.

5. Because households in housing that did not meet program requirements were unlikely to participate, participation rates in the Housing Gap program were significantly lower for those in the worst housing, including the very poor, minorities, and very large households. In contrast, there were no strong and consistent demographic differences in participation rates for programs without housing requirements.

   While there were significant demographic differences in acceptance rates at each site, they were generally either modest in size or inconsistent between the two sites. It appears that rejection of the enrollment offer was based on a variety of household concerns, with no strong causal links to demographic characteristics. This applied both to the Housing Gap programs and the Percent of Rent and Unconstrained programs.

   Subsequent participation after enrollment among Housing Gap households was, however, very strongly influenced by whether a household was already living in a unit that met the requirements when it enrolled. Likewise, households that were least likely to meet requirements on their own were also less likely

to participate. This included, in particular, the very poor, minorities and very large households.

The participation rate among nonminority Housing Gap households was 1.43 times that of black households and 1.40 times that of Spanish American households. Likewise, two-person households had a participation rate 1.47 times higher than that of households with five or more persons. Finally, households with annual incomes of more than $2,000 participated at 1.40 times the rate for households with incomes less than $2,000 per year.

6. There is evidence that, at least for a Minimum Standards requirement, participation rates can be increased by offering substantially higher payments. Unless these payments can be effectively targeted, however, the costs may be prohibitive.

   The Demand Experiment tested several different payment levels for each type of requirement. While changes in payment level had no significant effect on the participation of Minimum Rent households, they did result in a significant increase in participation among Minimum Standards households. A program that would have induced 40 percent of Minimum Standards households in substandard housing to meet the Minimum Standards requirements was estimated to require an average allowance payment for the two sites of about $115 per month, or $50 more than the actual average allowance payment offered at enrollment. Even with these payments, the estimated overall participation rate for all households would still be only 51 percent, and slightly over half of the participants would be households induced to meet requirements by the allowance offer.

7. There is evidence that the allowance offer had more impact on households that remained eligible for longer periods of time. However, the basic participation patterns indicated above were still maintained.

   Some Housing Gap households may not have participated because they did not remain eligible for long enough periods of time to be willing or able to change their housing to meet require-

ments. Participation rates among Housing Gap households that remained enrolled and eligible for two years after enrollment were the same as those for all enrolled households (58 percent).

However, a somewhat larger proportion of participants were households that were induced to meet requirements by the allowance offer. An estimated 34 percent of Housing Gap participants enrolled and eligible at the end of two years were households that had been induced to meet requirements by the allowance offer, as opposed to 25 percent of all Housing Gap participants.

8. The absolute participation rates estimated from the Demand Experiment may overstate the rates that would be observed in an ongoing program.

Participation rates estimated in the Demand Experiment are based on the responses of households that completed the initial enrollment interview. All of these households had received a brief description of the program including an estimate of the allowance payment that they would receive if they participated. To the extent that households eligible for an ongoing program would be less aware of the program's benefits, participation rates could be much lower.

9. Further research would be desirable on the extent to which the patterns of participation observed for housing allowances also hold for other programs.

The analysis of participation under the Housing Gap programs tested in the Demand Experiment shows a strong connection between a household's normal probability of living in housing that meets program standards and its willingness and ability to participate. As a result, relatively few participants were households that obtained standard housing because of the allowance offer. Most participants were households that obtained standard housing on their own. For these households the allowance program primarily offered financial relief rather than a material change in their housing.

The same pattern of limited housing change could also apply to other housing programs. The Housing Gap housing allowance programs are broadly similar in concept to such programs as Public Housing, Section 236 or Section 8, all of which offer eligible households housing that meets certain standards at below-market rents. In addition, the Section 8 (existing) Leased Housing Program and housing allowances share many specific program elements.

High participation rates for any of these programs would only be possible if a substantial proportion of eligible households were willing to change their housing. The results of the Demand Experiment suggest that this is not the case. However, direct empirical research is necessary to determine whether the pattern of relatively low potential participation rates and limited housing change found for housing allowances in fact applies to these programs.

SOURCES OF FINDINGS

1. For acceptance rates among Percent of Rent and Unconstrained households, see Table 3-1. For reasons given by households for rejecting the enrollment offer, see Tables 3-5 and 3-6.

2. See Table 2-3.

3. Figures are weighted averages of the figures for the different Housing Gap plans shown in Tables 2-9 and 4-6. See also the discussion of Table 6-3 in Chapter 6.

4. See Table 4-6.

5. For demographic differences in acceptance, see Tables 2-7 and 3-3 and accompanying discussion. For demographic differences in subsequent participation among Housing Gap households, see Tables 2-14, 4-7, and 4-8 and accompanying discussion. Participation rates cited in the finding are marginal rates from Table 2-14. The differences in marginal rates cited are also very close to the differences estimated in the logistic specification of Table 4-7, taking account of other demographic variables.

6. See Table 4-4 and the discussion following Table 4-6 for the computations based on a $50 increase in allowance payments. The participation rate of 40 percent reflects an acceptance rate of 28 percent and a subsequent participation rate of 50 percent. No attempt was made to adjust acceptance rates due to the small effects estimated for increases in payments above $40 (Table 3-3).

7. See Table 5-5.

8. See Section 2.6 of Chapter 2 and Appendices V and VI.

9. For the nature of benefits to participants see Chapter 6 and the reports referenced there.

CHAPTER 1

INTRODUCTION

This is one of a series of technical reports on the Housing Allowance Demand Experiment. The Demand Experiment was designed to provide information on how low-income households use housing allowance payments. Evaluation is based on two years of observation at two sites; Pittsburgh (Allegheny County), Pennsylvania, and Phoenix (Maricopa County), Arizona. The experiment offered allowance payments to approximately 1,200 households selected at random in each area. Several different allowance plans were tested involving different payment formulas and housing requirements. In addition, a control group of approximately 500 households was maintained at each site. This report analyzes the participation of eligible households in the Demand Experiment and the impact of different allowance plans and household characteristics on household participation.[1]

Discussions of participation in housing programs in the United States have been dominated by the small number of subsidized units available compared to the very much larger eligible population. No housing program in the United States provides nearly enough units to serve all eligible households. This has raised serious issues of equity with critics asserting that housing programs in effect offer substantial aid to the lucky few that get into them and nothing to the many that do not find a place.[2] The Demand Experiment addresses a very different issue.

The opportunity to participate in the various housing allowance programs tested in the Demand Experiment was offered to a sample of eligible households in the Pittsburgh and Phoenix metropolitan areas. The responses of households to this offer estimate the response of all eligible households from which the sample was drawn. Thus, although the Demand Experiment was limited in size, it is intended to represent an open-enrollment universal

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[1] This report builds on the results of a preliminary analysis of participation during the first year of the experiment, presented in Kennedy, et al. (1977).

[2] See, for example, Weicher (1979, p. 36), and Muth (1973, p. 26).

entitlement program with extensive outreach rather than the limited enrollment programs common to low-income housing assistance in the United States.

In an open-enrollment program such as Food Stamps or Aid to Families with Dependent Children (AFDC), the participation rate has immediate implications for both program benefits and costs. High participation rates mean that the program effectively reaches, and makes payments to, most of its targeted population. Low participation rates mean lower total program costs, but also indicate that the program has failed to reach many of the households it was intended to serve. Whether such failures indicate the need for supplemental or alternative programs may depend in part on who participates. A program of assistance to low-income households may, for example, have reasonably high overall participation rates but still fail to reach the very poor, the working poor, or elderly households. Alternatively, if program participation rates are low only for households close to the program's income eligibility limits, there may be little desire to amend or supplement the program to reach this group.[1]

Such issues of program effectiveness and cost rarely arise in limited enrollment programs with a limited number of openings. Of course, if participation rates are very low, even a limited enrollment program may not be able to fill all of its openings. More usually, however, the program is able to fill its openings and indeed may be able to fill them according to a

[1]This is particularly true when the eligible population is extended beyond the original target population to include higher-income households in order to reduce program benefits gradually as household income increases (and thus reduce possible work disincentives). In this case, the higher income segment of the eligible population is not itself of direct policy concern. Lower participation rates among higher-income households also, of course, imply higher per unit costs in an income-conditioned program. Failure to account for this may undermine the program's financial feasibility. (For a case study of this problem in one of the eight experimental demonstration programs conducted under the Administrative Agency Experiment, see Holshouser, 1976.)

predetermined set of demographic targets.[1] In general, program operators never know whether their program effectively appeals to most eligible households. Indeed, overall housing programs in the United States could effectively interest as little as 20 percent of the eligible population with no obvious effect on enrollment or waiting lists.[2]

The Demand Experiment provides a rare opportunity to analyze potential participation in at least one form of housing program--housing allowances. The experiment tested a variety of different allowance plans involving major variations in the type of program offered as well as further variations in payment level and other program features within each major type of program. The analysis of differences in participation rates across these different program types and among different demographic groups can provide important insights not only into the way a housing allowance program would work, but also into the potential of existing limited enrollment programs to serve their targeted populations if enrollment were open to all eligible households.

Information on participation in the Demand Experiment is especially helpful in the analysis of relative participation rates for different demographic groups, different forms of a housing allowance, and different types of housing requirements. Indeed, the experiment was designed to analyze relative rather than absolute rates of participation, recognizing that the level of participation in an actual program might be different from that observed during the experiment. For example, the sample of

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[1] Differential participation rates may make extensive efforts necessary if the program is to obtain enough applicants to fill the openings allotted to a particular group. The Administrative Agency Experiment, for example, found that special outreach efforts were needed to reach both the elderly and the working poor. In the case of the elderly, this reflected both less awareness of the program's existence and a reluctance to apply. For the working poor, it apparently reflected a reluctance to apply (see MacMillan and Hamilton, 1977).

[2] The U.S. Department of Housing and Urban Development (1973, pp. 4-27) estimated in the early 1970s that all subsidized U.S. housing programs combined served less than 10 percent of any income stratum of eligible households. Thus, if only twice as many households as this would would want to participate, there would be an ample supply of households for program waiting lists.

households eligible for the Demand Experiment were approached in their homes and offered the opportunity to enroll. This individual outreach is undoubtedly more extensive than that of any ongoing program. Nevertheless, the absolute participation rates observed in the experiment are also of interest. In certain circumstances, the rates observed in the experiment may be considered upper bounds on the possible rates which might be observed in an actual program. Since many of the rates observed were quite low, their role as an upper bound supplies valuable information about the limits of participation.

The program variations tested in the Demand Experiment can be divided into three major prototypes, which characterize a number of nonhousing programs as well as possible housing allowance programs. The major form of allowance tested, called a Housing Gap allowance, offered households a payment equal to the difference between the estimated cost of modest, existing standard housing in their area and a fraction of household income that the household might reasonably be expected to afford for housing. In order to receive their allowance payment, households in these plans had to live in a unit that met certain housing requirements. Two types of requirements were tested--a Minimum Standards requirement, which set minimum physical standards for the unit as well as an occupancy standard, and a Minimum Rent requirement, which required that a household spend at least a certain minimum amount for housing.

The Housing Gap form of housing allowance shares certain features with all low-income housing assistance programs in the United States. All such programs effectively offer recipients units that meet certain standards at below market rents, which usually (but not always) depend on household size and income. The major differences among these programs are the extent to which they rely on the private market and the degree of responsibility and freedom of choice that they allow to recipients.

Housing Gap allowances are most closely related to the current Section 8 (existing) leased housing program, which indeed was to some extent designed to reflect the early experience in the Administrative Agency Experiment portion of the Experimental Housing Allowance Program.[1] As with a Housing Gap allowance,

[1]The Demand Experiment is one of three experiments conducted by HUD as part of the Experimental Housing Allowance Program. The other two experiments are the Administrative Agency Experiment and the Supply Experiment.

Section 8 offers recipients payments based on income and household size. Likewise, recipients must live in housing that meets certain standards but do not have to move if they already live in a unit that meets the standards or can arrange to have deficiencies repaired. The major differences between the two programs are that under Section 8 payments are made directly to the landlord, requiring agreements between the landlord and the local housing authority administering the program as well as between the landlord and tenant, and that Section 8 recipients are not permitted to rent units that cost more than a maximum amount.[1]

Under new construction programs such as Public Housing or Section 236, on the other hand, the local housing authority or developer is much more involved in the production of housing units. Units in these programs are newly built or rehabilitated for the program, either under contract to or regulation by federal or local agencies. Thus, these programs offer recipients a choice among units specifically created for the program.

The other allowance plans tested in the Demand Experiment did not directly impose housing requirements. Households assigned to the Unconstrained plan were offered payments calculated using the Housing Gap formula, but did not have to meet any housing requirements. These households essentially were offered a welfare or income maintenance payment. Indeed, although payments under the Unconstrained plan were determined by putative need for housing assistance rather than need for general income assistance, the formula used was similar in form to several tested in the various income maintenance experiments and in fact offered average payments of roughly the same size as those proposed under the 1972 Family Assistance Plan.[2]

Households assigned to the third type of allowance plan, called Percent of Rent, were offered payments equal to a fixed percent of their rental

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[1] Housing Gap allowances are also similar to the earlier Section 23 leased housing program under which local housing authorities leased housing from private landlords and sublet it to eligible low-income households at reduced rents. Under Section 23, however, the local housing authority generally selected and leased the unit. A Housing Gap allowance places responsibility for finding and renting units with recipients, with correspondingly greater freedom of choice. (There were provisions in Section 23 which allowed authorities to lease units found by recipients, but the practice was not common.)

[2] This was pointed out by Stephen Mayo in Conroy and Mayo (1974, p. 23).

expenditures. Payments were tied to housing because they depended on rent, but households could pay any rent and occupy any unit they chose. The Percent of Rent plan is similar in principle to a wide variety of subsidy programs. Most obviously, the current Food Stamp program essentially offers participants a reduced cost or rebate on their food expenditures (up to a maximum). Likewise, medical insurance programs and tax deductions and credits all effectively reduce the cost of various goods and services over some range of spending.

In addition to these three allowance plans, the Demand Experiment also enrolled a group of Control households. These households, paid $10 a month for providing all the information required of Experimental households, form a comparison group against which to measure the effects of the allowance programs.

The participation process in the Demand Experiment involved several stages. First, households had to be selected for the Demand Experiment sample and offered enrollment. Once offered enrollment, the households themselves had to decide whether or not to accept the enrollment offer. In addition, households could later drop out of the experiment either because they changed their mind about enrolling or because their circumstances changed. The analysis of participation in this report focuses on households' decisions about whether to accept the enrollment offer and, for Housing Gap households, their subsequent behavior in meeting housing requirements.

The first stage in the enrollment process was essentially the same for all households. Sampled households were identified as potentially eligible on the basis of an initial screening interview, assigned to one of the experimental allowance plans, and then approached at their homes, told what the program would involve, and offered enrollment. Thus, all of the households analyzed in this report knew about the program and were able to make a reasonably informed decision about whether they wanted to participate. Differences in participation should, therefore, reflect differences in program appeal rather than differences in outreach.[1]

Once offered enrollment in the experiment, households had to decide whether or not to accept the offer and enroll in the experiment. For households

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[1] For a discussion of the effects of different outreach methods in the Administrative Agency Experiment, see MacMillan and Hamilton (1977).

in the Percent of Rent and Unconstrained plans, no more was required. After they were certified as eligible, enrolled households in these groups began to receive payments immediately. For these households, participation essentially was decided once they accepted the enrollment offer. Participation among households in the Housing Gap plans required a further step. These households also had to meet requirements in order to receive payments. Some already met the requirements before they enrolled and began to receive allowance payments immediately. Others had to correct deficiencies in their current unit or move to a different unit that did meet requirements in order to participate in the allowance program and receive payments.

After households had enrolled and begun to receive payments, they might still drop out of the experiment either because they changed their minds about accepting the enrollment offer or because their circumstances changed. Thus, many households dropped out of the program because they were no longer eligible to receive payments due, for example, to increased incomes, moves out of the experimental area, or buying a house. Others apparently simply changed their minds about the program. These two sorts of attrition have different implications for program participation, basically depending on whether or not they represent permanent reversals.

Enrolled households that became ineligible were not replaced in the Demand Experiment. In an ongoing program, however, they would normally be replaced by newly eligible households (apart from any secular trend in the size of the eligible population). Indeed, the same could be true of households that changed their minds about the program. If these changes reflected actual experience with the program and represent a permanent revision of the household's enrollment decision, then they would permanently reduce the number of participating households in an ongoing program as well. It is not inconceivable, however, that households changed their minds due to other stresses that, for example, made the program's reporting requirements more burdensome and that could later be reversed. In this case, as with other changes in household circumstances, attrition from the Demand Experiment sample would normally be offset in an ongoing program by new participants.

It is impossible to determine with any certainty which of these situations maintained in the Demand Experiment, though some attempt can be made at least to indicate the potential magnitude of the implications for

participation rates. The most important aspect of the problem of enrollee turnover, however, is its implications for participation in the Housing Gap programs. Housing Gap households that did not already meet requirements at enrollment had either to arrange to have the deficiencies in their current units remedied or to move to new units that did meet the requirements. These steps take time, and in some cases considerable time. Some Housing Gap households may not have become participants because they did not have time to meet requirements before they became ineligible, for example. High turnover rates in the enrolled population could by themselves reduce the participation rate among Housing Gap households.[1] This would also be the case in an ongoing program. Nevertheless, there is some interest in sorting out the factor of enrollee turnover, and especially turnover due to ineligibility, from other factors. Low participation among households that were eligible for relatively short periods may be of relatively less concern than failure to serve households that were in need for considerable periods of time. Fortunately, most of the households enrolled in the Demand Experiment did remain eligible for at least two years after enrollment. The participation of these households can be analyzed to estimate the potential effectiveness of the program in reaching households that remain eligible for reasonably long periods.

Analysis of participation in the Demand Experiment thus involves several different program types and, for Housing Gap households, several different stages in participation. This is an admittedly complex, if analytically rewarding, structure. Chapter 2 provides a broad overview of the overall participation process for each type of program. It sets the stage for the analysis of later chapters in terms of both the conceptual framework and the basic facts about participation over the two years of the experiment. The importance of different stages in participation for the different allowance plans is discussed, and participation rates by demographic group, payment level, and type of housing requirements are presented. Chapter 3 then presents an analysis of the first stage of participation, accepting enrollment. As indicated above, this is the stage common to all

[1] The potential importance of this factor was pointed out to us by several analysts at the Rand Corporation in connection with their analysis of the Supply Experiment. See Appendix VII for references.

the programs tested. The emphasis of the chapter is on comparing acceptance rates among the different program types and identifying major demographic and program influences on household acceptance.

The remaining analyses focus on the Housing Gap allowance plans. Chapter 4 discusses and analyzes the extent to which Housing Gap households enrolled in the experiment eventually met requirements and received payments. It examines the role of housing requirements and payment levels as well as demographic characteristics in determining the participation of enrolled households. Chapter 5 then examines participation among enrolled Housing Gap households that remained eligible for the entire two years of the experimental period. A final chapter, Chapter 6, summarizes the results of the analysis and discusses their implications for housing assistance programs in general.

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CHAPTER 2
OVERVIEW

As indicated in Chapter 1, the analysis of participation in the Demand Experiment is both complex in structure and correspondingly rich in results. It concerns a variety of different programs and demographic groups, and deals with several different stages in the participation process. This chapter attempts both to motivate and summarize the analysis presented in the rest of this report.

The chapter starts with a brief description of the actual process by which households became participants in the Demand Experiment allowance programs. This is done both to provide a precise definition of the participation rates analyzed in this report and to relate them to participation rates in ongoing programs. The next section describes the various allowance plans tested in the Demand Experiment and the way in which participation rates varied under the different plans. This is followed by separate discussions of the two major stages in participation--the initial decision to accept the enrollment offer and, for Housing Gap households, subsequent participation after enrollment. The subsequent participation of Housing Gap households is discussed first in terms of all enrolled households and then in terms of enrolled households that remained enrolled and eligible for two years. A final section summarizes a variety of technical issues relating to the definition of participation rates in this report and their interpretation in terms of an ongoing program.

2.1 THE PARTICIPATION PROCESS IN THE DEMAND EXPERIMENT

The actual process by which households became participants in the various program plans tested in the Demand Experiment involved a number of steps, only some of which relate to households' decisions to participate. These steps are different from those in an operating program and, in general, it appears that participation rates in the Demand Experiment should be regarded as upper bounds on the participation rate that would be observed in a similar operating program.

In a typical housing assistance program, eligible households may learn about the program from a variety of sources. They may see or hear public service announcements or advertisements sponsored by the housing agency; they may learn about the program from friends or relatives; or they may be referred to the program from another social service agency.[1] A number of eligible households may never hear about the program, and still others may hear about it but decide not to apply. Households that apply to the program may or may not be selected to be enrolled and, once enrolled, may have to locate a unit which meets certain requirements before they can begin to receive benefits. Several participation rates are of interest in such a program--the proportion of households in the eligible population that hear about the program, the proportion of these households that then apply for the program, the proportion of applicants that are enrolled, and the proportion of enrolled households that become payment recipients.

In the Housing Allowance Demand Experiment, application and enrollment were handled differently from the typical program procedures described above. The outreach process used in the experiment was structured to provide equal access to a sample of potentially eligible households within certain geographic areas. First, a sample of dwelling units was drawn at each site.[2] Households in these units were briefly interviewed in a Screening Interview to determine whether they were likely to be eligible for the experimental program. Households that were apparently eligible were then re-interviewed (the Baseline Interview) to obtain information on their pre-experimental situation. At no time during either the Screening or Baseline Interviews were households told about the

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[1] These were in fact the three major sources from which households learned about the housing allowance program in the Administrative Agency Experiment. Friends and relatives were the most important source, referral was second, and media announcements were third. See MacMillan and Hamilton (1977).

[2] The sample was drawn from lists of all units within Allegheny and Maricopa Counties excepting those in Census tracts with median (1970) incomes of over $12,000, blocks with fewer than 10 percent rental units or less than five rental units in number, blocks with only Public Housing or Section 23 units, and blocks scheduled for demolition.

experiment or offered enrollment. Thus, households that did not complete these interviews represent a pure interviewing loss.[1]

Households that completed both the Screening and Baseline Interviews were randomly assigned to the various experimental housing allowance plans and offered enrollment. This was the first time that households were told about the Experimental Housing Allowance Program. Households that accepted the offer and applied for the program completed a detailed report on their income, assets, rent, and household size. This information was reviewed and the reported income verified to determine actual household eligibility. Eligible households were then enrolled in the experiment.

Not all of the households that enrolled in the experiment became allowance recipients. In a number of the allowance plans, households were required to live in units that met certain requirements before they could receive an allowance payment. Enrolled households that already met these requirements or that were assigned to allowance plans that did not have housing requirements began to receive payments immediately after enrollment. Other households had to move to new units or upgrade their current units in order to meet the housing requirements and become program participants.

Participation in the Demand Experiment thus involved a number of stages as shown in Figure 2-1--being selected for the enrollment sample, being contacted for enrollment, completing the enrollment interview, deciding to accept the enrollment offer, being determined eligible, enrolling, and becoming a recipient. For the analysis of program participation, these stages can be combined into two major participation decisions--first, accepting the enrollment offer and enrolling in the experiment and second, once enrolled, actually participating in the program and receiving an allowance payment. The analysis of acceptance is based on households that got far enough in the enrollment process to receive a complete description of the program offer. The analysis of subsequent participation is based

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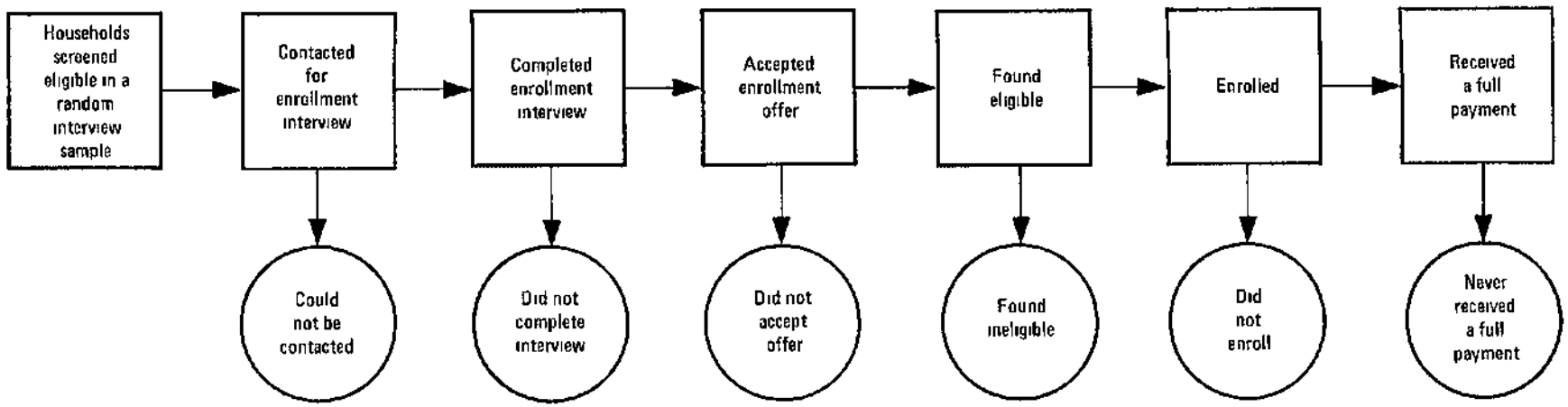
[1] Completion rates for the two interviews were as follows;

	Pittsburgh	Phoenix
Screening Interview	83.4%	82.3%
Baseline Interview	84.1	83.0

In addition, some apparently ineligible households were eliminated as a result of each interview.

Figure 2-1
THE PARTICIPATION PROCESS IN THE DEMAND EXPERIMENT



on enrolled households. Participants are defined as all enrolled households that ever received an allowance payment over the two years of the experiment. Overall participation rates are the product of the acceptance rate and the subsequent participation rate.[1]

These two stages do not correspond exactly to the stages of participation observed in a typical housing program. Participation rates in the experiment can yield information that is relevant to other programs, however. Most obviously, the experiment provides information on the relative participation of various groups in a situation in which an important initial variable--hearing about the program--is held constant. Furthermore, since the probability of hearing about a program is likely to vary by demographic group,[2] using a sample of households contacted in their homes allows the analysis to concentrate on the households' reaction to the offer, rather than on their probability of hearing about the program. The same argument holds for households' reactions to various program features such as payment amount and type of housing requirements. Households' reactions to the amount of the allowance offered them and the requirements they would have to meet in order to receive it give an indication of relative participation in different types of housing allowance programs. In addition, the success of enrolled households in the experiment in meeting the requirements and receiving payments gives an indication of the likely success of enrolled households in meeting such requirements in a more typical operating program.

At the same time, absolute participation rates are also of interest. As indicated above, the participation rates presented in this report are based on households that got far enough in the enrollment interview to receive a complete description of the program offer, adjusting for households that were found to be ineligible for the program (and hence could

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[1] The step between acceptance and enrollment indicated in Figure 2-1 can be ignored for analysis, since it was almost entirely a matter of eligibility review. Among accepting households that were determined to be eligible, 99 percent in Pittsburgh and 98 percent in Phoenix actually enrolled in the experiment.

[2] See MacMillan and Hamilton (1977).

not participate). The key issues in this definition are the elimination of households that did not complete the initial enrollment interview, the way in which ineligible households are handled, and the implications of attrition during the two years of the experiment. Each of these issues is discussed further in Section 2.6, below, and in various supporting appendices. In general, that discussion suggests that the absolute participation rates estimated in the Demand Experiment are, if anything, higher than those that would be observed in an operating program. The difference may not, however, be very great.

2.2 OVERALL PARTICIPATION RATES

As indicated in Chapter 1, the various allowance plans tested in the Demand Experiment each fall into one of three major types of program--Unconstrained, Percent of Rent, and Housing Gap. The Unconstrained plan is a typical income maintenance or welfare program. Eligible households assigned to this plan were offered a payment determined by

(1) $$P = C^* - bY$$

where

P = payment

C^* = a basic payment level, equal to the estimated cost of modest, existing standard housing in each site, and varied by site and household size

Y = household income, including income from other transfer programs such as Social Security and AFDC, and

b = the rate at which payment declines with income (set at 0.25 for the Unconstrained plan).

This payment formula is similar to formulas tested in the income maintenance experiments, except that the payment parameters, C* and "b", were set in terms of putative housing needs rather than needs for all sorts of consumption. Thus, C* was the estimated cost of modest, existing standard housing for various household sizes in each site. Likewise, "b" was set equal to the fraction of its income that a low-income household might be expected to devote to housing (specifically, 25 percent). Because of their housing orientation, both C* and "b" were lower than similar parameters in most income maintenance programs.

The Percent of Rent plans offered households a rebate on their monthly rent. Under these plans, payments were calculated by

(2) $$P = aR$$

where

a = the rebate fraction, and

R = household rental expenditures.

Five different Percent of Rent plans were tested, with different rebate levels of "a" (0.2, 0.3, 0.4, 0.5, and 0.6). These plans, in effect, reduced the cost of housing to recipients by the amount of the rebate. A household in the 0.5 rebate group, for example, could rent any unit in the program area at half its market cost.

The Housing Gap plans made up the major program type tested in the Demand Experiment. Under these plans, households were offered payments under the same general formula as the Unconstrained plan,

(3) $$P = dC^* - bY$$

where

P = payment

C^* = the estimated cost of modest, existing standard housing in each site, varied by site and household size

Y = household income

d = the multiple of C^* used in setting payments, and

b = the rate at which payment declines with income.

The only difference between payments in the Housing Gap and Unconstrained plans is that Housing Gap plans tested three different basic payment levels (dC^* equal to $1.2C^*$, C^*, and $0.8C^*$) and three different values of "b" (0.15, 0.25, and 0.35), whereas the Unconstrained plan calculated all payments under the same formula ($dC^* = C^*$ and $b = 0.25$).

In addition to differences in payment calculation, the major difference between the Housing Gap plans and the other program types was housing

requirements. Households assigned to the Housing Gap plans could only receive payments if they rented units that met certain housing requirements. Three different requirements were tested--a Minimum Standards requirement and two Minimum Rent requirements. Under Minimum Standards, households qualified for payments if their dwelling unit met certain physical requirements and occupancy standards. Under the Minimum Rent requirements, households qualified for payments if they spent at least a certain minimum amount for rent. The two Minimum Rent requirements tested were Minimum Rent Low, under which households had to spend at least 70 percent of the estimated cost of standard housing (0.7C*) on rent and Minimum Rent High, under which households had to spend at least 90 percent of the estimated cost of standard housing (0.9C*) on rent. The intent of the Minimum Rent requirements was to require households to spend enough for housing to obtain decent housing, while allowing them considerable flexibility with respect to specific unit features and location. If rent levels are highly correlated with housing quality, then a minimum rent level provides a straightforward and easily administered method of ensuring that participants obtain standard housing.

Table 2-1 shows the overall participation rates for each of the three program types and for Control households in each site, as well as further breakdowns by the Housing Gap subprograms defined by the different housing requirements. As can be seen from the table, participation rates were generally somewhat higher in Phoenix than in Pittsburgh. Among the different programs, participation rates are very similar and reasonably high for Percent of Rent and Unconstrained households, the two program types that did not impose housing requirements. They are much lower for the Housing Gap plans--roughly half as large as for the programs without any housing requirements. Furthermore, there is considerable variation in participation rates among different housing requirements used in the Housing Gap plans. The Minimum Rent Low plans have rates about half again as large as the rates for Minimum Standards and Minimum Rent High.

Higher payments would be expected to increase participation rates. As indicated above, the Housing Gap and Percent of Rent plans included variations in the payment formula that systematically varied the level of payment. A household assigned to the Percent of Rent plan with "a" equal

Table 2-1

OVERALL PARTICIPATION RATES BY TYPE OF HOUSING ALLOWANCE PROGRAM

ALLOWANCE PLAN	PITTSBURGH NUMBER IN GROUP	PITTSBURGH OVERALL PARTICIPATION RATE	PHOENIX NUMBER IN GROUP	PHOENIX OVERALL PARTICIPATION RATE
TYPE OF HOUSING ALLOWANCE PROGRAM				
Housing Gap households	1086; 592[a]	41%	1007; 662[a]	49%
Percent of Rent households	821	82	678	87
Unconstrained households	120	78	89	90
Control households	863	61	750	78
TYPE OF REQUIREMENT FOR HOUSING GAP HOUSEHOLDS				
Minimum Standards requirement	489; 268[a]	30	470; 307[a]	45
Minimum Rent Low requirement	287; 156[a]	60	258; 167[a]	61
Minimum Rent High requirement	310; 168[a]	42	279; 188[a]	44

SAMPLE: All households that completed the enrollment interview and received a subsidy estimate.

DATA SOURCES: Household Events List, payments file.

a. For Housing Gap households, participation rates are calculated as the product of the acceptance rate and the subsequent participation rate for enrolled households. The sample sizes for Housing Gap participation rates show the samples for each of these two rates. The base for subsequent participation is smaller than the total number of households that accepted the enrollment offer (see Appendix IV).

to 0.6, for example, would receive twice as large a payment as an identical household in the plan with "a" equal to 0.3 (see Equation (2)). Likewise, the higher dC* levels and lower "b" value plans tested for Housing Gap households offered higher payments than the low dC* or high "b" plans. Table 2-2 shows participation rates by payment level for the Housing Gap and Percent of Rent plans.[1]

While some positive relation between participation rates and payment levels is apparent in Table 2-2, it is not strong. Differences are more marked for Housing Gap than for Percent of Rent plans. In addition, participation rates for Unconstrained households and Percent of Rent households are generally similar, despite the larger average payments offered under the Unconstrained plan. The analyses of Chapter 3 and 4 basically confirm this finding. With some exceptions, higher payments do have a significant effect on participation. However, the effect for Percent of Rent and Unconstrained households tends to be small at payment levels of over $40 to $80 per month. There is a larger effect for Housing Gap households, partly because of the relationship between payment levels and meeting housing requirements.

In summary, major differences in participation rates among programs were associated with whether the program required households to change their housing in order to receive payments. The payment offered also had some effect, especially among Housing Gap households. Whether payments were calculated based on income and household size (as for Unconstrained households) or rent (as for Percent of Rent households) made little difference in the overall participation rate. When payments were tied to housing by requiring households to occupy certain types of units, ofen different from the units they already lived in, participation rates were substantially lower.

These differences in participation rates based on payment level and housing requirements would be expected to result in differences in participation among demographic groups in each program as well. For example,

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[1] In fact, eligibility requirements were different for the low payment Housing Gap plans and the a = 0.6 and a = 0.2 Percent of Rent plans. Thus, tabular differences associated with these plans may reflect demographic differences associated with different income levels.

Table 2-2

OVERALL PARTICIPATION RATES BY PAYMENT LEVEL

PAYMENT LEVEL	PITTSBURGH			PHOENIX		
	MEAN PAYMENT[b]	NUMBER IN GROUP	OVERALL PARTICIPATION RATE	MEAN PAYMENT	NUMBER IN GROUP[b]	OVERALL PARTICIPATION RATE
HOUSING GAP HOUSEHOLDS[a]						
All households	$43	1086;592[c]	41%	$66	1007;662[c]	49%
High payment level	56	314;185[c]	45	93	246;187[c]	60
Medium payment level	40	298;177[c]	48	69	301;213[c]	47
Low payment level	36	474;230[c]	34	50	460;262[c]	43
PERCENT OF RENT HOUSEHOLDS						
All households	35	821	82	43	678	87
a = 0.6	59	57	81	62	58	86
a = 0.5	46	184	85	56	150	89
a = 0.4	37	218	83	48	153	92
a = 0.3	30	186	82	35	188	86
a = 0.2	21	176	78	26	129	81
UNCONSTRAINED HOUSEHOLDS	51	120	78	66	89	90

SAMPLE: All households that completed the enrollment interview and received a subsidy estimate.

DATA SOURCES: Household Events List, payments file.

a. Housing Gap payment levels are defined as High ($dC^* = 1.2C^*$, $b = 0.25$ or $dC^* = C^*$, $b = 0.15$), Medium ($dC^* = C^*$, $b = 0.25$), Low ($dC^* = 0.8C^*$, $b = 0.25$ or $dC^* = C^*$, $b = 0.35$). Mean payments for high (low) "b" values and low (high) dC^* plans are almost identical, so that these plans are grouped together.

b. Mean payment is the mean allowance payment estimated during the enrollment interview.

c. For Housing Gap households, participation rates are calculated as the product of the acceptance rate and the subsequent participation rate for enrolled households. The sample sizes for Housing Gap participation rates show the samples for each of these two rates. The base for subsequent participation is smaller than the total number of households that accepted the enrollment offer (see Appendix IV).

although overall participation rates are roughly the same for Percent of Rent and Unconstrained households, payments in the Percent of Rent plans were larger for high rent households (which tended to be higher income households as well), while payments in the Unconstrained plan were smaller for higher income households (which tended to have higher rents). Thus, participation rates should tend to be somewhat differently related to income and rent in the two programs, being positively correlated with income and rent in Percent of Rent plans and negatively correlated with income and rent in the Unconstrained plan.[1]

More important, to the extent that the lower participation rates among the Housing Gap plans reflect the fact that households were required to meet certain housing requirements, these plans would also be expected to show different demographic patterns of participation. In particular, households that already met the requirments before enrolling, were relatively "close" to meeting requirements, or were relatively willing to move would be expected to participate more readily than other households. Thus, a Minimum Rent requirement, for example, would be expected to draw more participants from among households initially paying a high rent than a Minimum Standards or Unconstrained plan.

Such demographic differences are best explored in terms of specific steps in the participation process. The next two sections describe participation at each of the two major stages--acceptance of the enrollment offer and subsequent participation of enrolled households.

2.3 ANALYSIS OF STAGES IN PARTICIPATION--ACCEPTANCE

The analysis of participation in this report is based on separate analysis of the two major stages in the participation process described in Section 2.1--acceptance of the enrollment offer and subsequent participation of enrolled households. Conceptually, these two stages both relate

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[1] It is worth noting that the Percent of Rent plans used in the Demand Experiment were not intended to represent possible programs directly. Any rent rebate program would probably require that the percentage rebate (the "a" in Equation (2)) be lower at higher incomes. Such programs may be directly simulated from the Percent of Rent plans tested in the Demand Experiment. The use of a constant percentage rebate in the experiment was dictated by analytic convenience.

to the same decision, whether or not to participate. In fact, they more or less effectively isolate general factors common to all the programs and the special effects of the housing requirements imposed by the Housing Gap plans.

All households had to decide whether or not to accept the enrollment offer. Once enrolled, eligible Percent of Rent and Unconstrained households began to receive payments immediately. Housing Gap households, on the other hand, had to meet the housing requirements of the program. Thus, the second stage in the participation process is a direct result of the imposition of housing requirements. In theory, households could, of course, anticipate the effect of housing requirements and change their acceptance behavior in response to the housing requirements. In fact, the effect of housing requirements was largely confined to the second stage.

Table 2-3 shows the overall participation rate, acceptance rate, and subsequent participation rate for each of the three program types--Housing Gap, Percent of Rent, and Unconstrained--and Control households. Acceptance rates did differ among the three programs. The differences are, however, relatively minor compared to the difference in overall participation. In particular, while Housing Gap acceptance rates were lower than those for Percent of Rent and Unconstrained in both sites, the difference is swamped by the effects of housing requirements on subsequent participation. Even if Housing Gap households had had the same acceptance rate as Percent of Rent households, their overall participation rates in the two sites would still have been 46 percent in Pittsburgh and 51 percent in Phoenix, only marginally different from the actual rates of 41 and 49 percent, respectively. The same pattern is apparent among the three Housing Gap subprograms as shown in Table 2-4. Acceptance rates for Housing Gap households are essentially the same in each site regardless of the specific housing requirement used. Overall participation rates, however, vary considerably. This suggests that analysis of acceptance will mostly identify factors common to all programs and that analysis of subsequent participation will capture most of the effects of housing requirements.

The analysis of acceptance in Chapter 3 confirms this hypothesis. As indicated by the tabulations of Table 2-3, the acceptance rate of Housing Gap households was somewhat lower than that of Percent of Rent and Unconstrained households. However, once allowance is made for these differences in the

Table 2-3

STAGES IN PARTICIPATION

	PITTSBURGH				PHOENIX			
	HOUSING GAP HOUSE-HOLDS	PERCENT OF RENT HOUSE-HOLDS	UNCON-STRAINED HOUSE-HOLDS	CON-TROL HOUSE-HOLDS	HOUSING GAP HOUSE-HOLDS	PERCENT OF RENT HOUSE-HOLDS	UNCON-STRAINED HOUSE-HOLDS	CON-TROL HOUSE-HOLDS
Overall participation rate	41%	82%	78%	61%	49%	87%	90%	78%
Acceptance rate	74	82	78	61	83	87	90	78
(Number of cases)	(1086)	(821)	(120)	(863)	(1007)	(678)	(89)	(750)
Subsequent participation rate	56	100	100	100	59	100	100	100
(Number of cases)	(592)	(484)	(73)	(431)	(662)	(476)	(70)	(521)

SAMPLE: All households that completed the enrollment interview and received a subsidy estimate.
DATA SOURCES: Household Events List, payments file.

Table 2-4

PARTICIPATION RATES OF HOUSING GAP HOUSEHOLDS
BY TYPE OF HOUSING REQUIREMENT

	PITTSBURGH			PHOENIX		
	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
Overall participation rate	30%	60%	42%	45%	61%	44%
Acceptance rate	75	74	73	84	82	81
(Number of cases)	(489)	(287)	(310)	(470)	(258)	(279)
Subsequent participation rate	40	81	58	54	74	54
(Number of cases)	(268)	(156)	(168)	(307)	(167)	(188)

SAMPLE: All Housing Gap households that completed the enrollment interview and received a subsidy estimate.

DATA SOURCES: Household Events List, payments file.

general level of acceptance, it is not possible to reject the hypothesis that remaining demographic and payment effects are the same for all programs.

While the reasons for the modest difference in acceptance rates for the different allowance plans cannot be established exactly, examination of the reasons given by households for turning down the program does suggest that the housing requirements played some role in reducing acceptance rates among Housing Gap households. At the same time, the effect of the housing requirements was very general. They do not seem to have reduced participation among one demographic group more than another. Nor do objections to housing requirements seem to be particularly related to whether the household met the requirements or thought that it met the requirements.

Given the apparently small and amorphous effect of housing requirements and payment formulas on acceptance, differences in acceptance would be expected to reflect factors common to all three programs. Most obviously, acceptance rates would be expected to increase with the payment offered. At the completion of the enrollment interview, households were given an estimate of what their allowance payment would be if they participated. Households were sometimes found to be entitled to more or less than this amount after the collection of more exact data at enrollment. However, the estimate given to households during the interview is the amount that they knew and, thus, the amount that could have influenced their accaptance decision.

The effects of payment offers on acceptance may be illustrated in two ways. One method, presented in Table 2-5, is to present acceptance rates by the amount of payment offered. Since payment estimates vary with income and household size (for Housing Gap and Unconstrained plans) and with rent (for Percent of Rent plans), differences in acceptance may reflect the effects of demographic differences as well as payment amounts. A second method, presented in Table 2-6, is based on comparison of acceptance rates in more or less generous plans within each program type (similar to that made for overall participation rates in Section 2.2). As described in Section 2.1, the Housing Gap and Percent of Rent plans included variations in the

Table 2-5

ACCEPTANCE RATES BY PAYMENT AMOUNT

PAYMENT ESTIMATE	PITTSBURGH						PHOENIX					
	HOUSING GAP HOUSEHOLDS			PERCENT OF RENT AND UNCONSTRAINED HOUSEHOLDS			HOUSING GAP HOUSEHOLDS			PERCENT OF RENT AND UNCONSTRAINED HOUSEHOLDS		
	NUMBER THAT COMPLETED ENROLLMENT INTERVIEW	NUMBER THAT ACCEPTED ENROLLMENT OFFER	ACCEPT-ANCE RATE	NUMBER THAT COMPLETED ENROLLMENT INTERVIEW	NUMBER THAT ACCEPTED ENROLLMENT OFFER	ACCEPT-ANCE RATE	NUMBER THAT COMPLETED ENROLLMENT INTERVIEW	NUMBER THAT ACCEPTED ENROLLMENT OFFER	ACCEPT-ANCE RATE	NUMBER THAT COMPLETED ENROLLMENT INTERVIEW	NUMBER THAT ACCEPTED ENROLLMENT OFFER	ACCEPT-ANCE RATE
Estimate of payment amount given to households during enrollment interview												
$10	274	164	60%	44	28	64%	186	122	66%	20	16	80%
$11-30	197	116	59	368	274	74	115	87	76	215	167	78
$31-50	252	214	85	296	259	88	133	116	87	261	232	89
$51-70	163	138	85	153	135	88	153	136	89	150	139	93
$71-90	104	92	88	54	49	91	118	103	87	76	72	95
$91 or more	86	73	88	17	17	100	300	266	89	43	42	99

SAMPLE All Housing Gap households that completed the enrollment interview and received a subsidy estimate.
DATA SOURCE: Household Events List.

Table 2-6

ACCEPTANCE RATES BY PAYMENT LEVEL

PAYMENT LEVEL	PITTSBURGH MEAN PAYMENT[b]	PITTSBURGH NUMBER IN GROUP	PITTSBURGH ACCEPTANCE RATE	PHOENIX MEAN PAYMENT[b]	PHOENIX NUMBER IN GROUP	PHOENIX ACCEPTANCE RATE
HOUSING GAP HOUSEHOLDS[a]						
All households	$43	1,086	74%	$66	1,007	83%
High payment level	56	314	76	93	246	89
Medium payment level	40	298	74	69	301	83
Low payment level	36	474	73	50	460	79
PERCENT OF RENT HOUSEHOLDS						
All households	35	821	82	43	678	87
a = 0.6	59	57	81	62	58	86
a = 0.5	46	184	85	56	150	89
a = 0.4	37	218	83	48	153	92
a = 0.3	30	186	82	35	188	86
a = 0.2	21	176	78	26	129	81
UNCONSTRAINED HOUSEHOLDS	51	120	78	66	89	90

SAMPLE: All households that completed the enrollment interview and received a subsidy estimate.

DATA SOURCE: Household Events List.

a. Housing Gap payment levels are defined as High ($dC^* = 1.2C^*$, $b = 0.25$ or $dC^* = C^*$, $b = 0.15$), Medium ($dC^* = C^*$, $b = 0.25$), Low ($dC^* = 0.8C^*$, $b = 0.25$ or $dC^* = C^*$, $b = 0.35$). Mean payments for high (low) "b" values and low (high) dC^* plans are almost identical, so that these plans are grouped together.

b. Mean payment is the mean allowance payment estimated during the enrollment interview.

payment level offered to similar households. Since assignment to these plans was random, differences in acceptance rates should largely reflect differences in payment levels alone.[1]

The two tabulations both show some association of acceptance with payment, but the association is much more marked in the tabulation by payment amount in Table 2-5 than in the tabulation by payment level in Table 2-6. This partly reflects the fact that the tabulation by payment amount covers a much wider range of payments than the mean differences in payments associated with the experimental variations in payment levels. It also, however, reflects the fact that the effects of larger payments are most apparent at low payments of less than $30 to $50. With the exception of Housing Gap households in Phoenix, Experimental households that were offered only $10 accepted the program at much the same rate (60 percent in Pittsburgh and 80 percent in Phoenix) as Control households (which also received a $10 payment each month for providing information similar to that provided by Experimental households). Acceptance rates in both sites rose sharply with payments over $10, up to payments of $30 to $50 a month. Thereafter, the increase in acceptance rates was more modest, in part no doubt because acceptance rates were already so high that they left relatively little room for further increases.[2]

Apart from the payment offered, a household's acceptance of the allowance offer might be expected to reflect its assessment of the effort and inconvenience involved in meeting program reporting requirements, its estimate of the effect which the program might have on other benefits, its general attitudes toward government programs, and its willingness to accept money

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[1] As indicated in Section 2.2, the low payment Housing Gap plans and the a = 0.6 and a = 0.2 Percent of Rent plans had somewhat different income eligibility requirements from the remaining plans. Thus, tabular differences associated with these plans may reflect the effect of demographic differences associated with different income levels.

[2] At the same time, it is worth noting that even at $10 a month acceptance rates never fell below 60 percent. This in part, no doubt, reflects the importance of any additional income to very poor households. It may also reflect a willingness to take a chance, to see what the program would turn out to offer, before finally deciding. Thus, the acceptance rates observed here should be qualified by examination of the household's later behavior after enrollment. This is discussed further in Section 2.6, below.

from the government. As discussed in Chapter 3, interviews with households that did not accept the allowance offer indicate that all of these factors did play an important role in leading households to reject the allowance offer. Interestingly enough, however, there does not seem to be any strong and consistent association between such assessments of the allowance program and demographic characteristics.

Table 2-7 shows acceptance rates by demographic group. In both sites, older households were less likely to accept than younger households and households that had moved several times in the three years preceding the interview were more likely to accept than households that had not moved. However, differences in acceptance associated with these variables are much larger in Pittsburgh than in Phoenix. Minority households were more likely to accept the offer in Pittsburgh, but not in Phoenix. Households headed by women were more likely to accept the offer at both sites, but the difference was small in Phoenix. Household size had no consistent effect. Households at both the low and high ends of the income distribution were less likely to accept than households in the mid-range. Households that had received either welfare payments or Food Stamps in the 12 months preceding the interview were more likely to accept the offer at both sites, but again differences were much larger in Pittsburgh than in Phoenix. Households that were dissatisfied with their unit or their neighborhood were somewhat more likely to accept than were satisifed households, but the difference was not a large one.

Thus, while demographic differences in acceptance are apparent in each site, they are rarely consistent. Differences are usually substantial in only one site, if at all, and sometimes reverse between the two. This is confirmed by the analysis of Chapter 3 which finds significantly different but equally uninformative patterns of demographic effects in the two sites. It appears, then, that in terms of a general willingness to participate, as represented by the acceptance decision, programs may be expected to appeal more or less strongly to different demographic groups, but that the differences are likely to vary from place to place with no strong overall pattern.

Table 2-7

ACCEPTANCE RATES BY
HOUSEHOLD CHARACTERISTICS

DEMOGRAPHIC CHARACTERISTIC	PITTSBURGH			PHOENIX		
	NUMBER THAT COMPLETED ENROLLMENT INTERVIEW	NUMBER THAT ACCEPTED ENROLLMENT OFFER	ACCEPTANCE RATE	NUMBER THAT COMPLETED ENROLLMENT INTERVIEW	NUMBER THAT ACCEPTED ENROLLMENT OFFER	ACCEPTANCE RATE
Age of household head						
under 30	825	671	81%	1040	893	86%
30-61	1205	902	75	965	788	82
62 and over	860	528	61	519	408	79
Household size						
1 person	506	319	63	340	272	80
2 persons	765	559	73	730	593	81
3-4 persons	1066	791	74	930	796	86
5-6 persons	393	312	79	351	279	79
7 or more persons	160	120	75	173	149	86
Mobility in the previous three years						
no moves	1462	976	67	562	425	76
1 move	810	607	75	667	551	83
2 moves	352	284	81	486	401	82
3 or more moves	263	231	88	801	705	88
Race or ethnicity of household head						
Non-minority	2309	1640	71	1764	1495	85
Black	581	461	79	188	147	78
Spanish American	--	--	--	572	447	78
Sex of household head						
Male	1504	1094	70	1680	1380	82
Female	1326	1007	76	884	709	84
Income						
$1-1,999	372	244	66	305	246	81
$2,000-3,999	842	650	77	586	497	85
$4,000-5,999	781	585	75	648	556	86
$6,000-7,999	525	384	73	523	428	82
$8,000-9,999	228	150	66	272	222	82
$10,000 or more	142	88	62	190	140	74
Welfare recipient status						
Welfare recipient	1160	932	80	523	443	85
Non-recipient	1730	1169	68	2001	1646	82
Food Stamp recipient status						
Food Stamp recipient	1162	936	81	589	512	87
Non-recipient	1728	1165	67	1935	1577	81
Satisfaction with unit						
Satisfied	2051	1453	71	1843	1519	82
Dissatisfied	839	648	77	678	568	84
Satisfaction with neighborhood						
Satisfied	2251	1613	72	2049	1688	82
Dissatisfied	635	484	76	474	400	84

SAMPLE All Housing Gap households that completed the enrollment interview and received a subsidy estimate
DATA SOURCES Baseline Interview, Household Events List.

2.4 ANALYSIS OF STAGES IN PARTICIPATION--SUBSEQUENT PARTICIPATION OF ENROLLED HOUSEHOLDS

As indicated in the previous section, households enrolled in the Percent of Rent and Unconstrained plans became program participants and began receiving allowance payments immediately after enrollment. Households enrolled in the Housing Gap plans, on the other hand, did not become program participants and begin receiving allowance payments until they had met housing requirements. This additional step largely accounts for the much lower participation rates of Housing Gap households shown in Table 2-3. This section discusses this second stage of participation for Housing Gap households--meeting requirements and receiving full payments after enrollment.

As described at the beginning of this chapter, the Housing Gap plans each involved one of three different housing requirements--Minimum Standards and two levels of Minimum Rent. The Minimum Standards requirement concerned the physical characteristics of the dwelling unit, such as the presence of basic facilities, the condition of walls and floor surfaces, and the adequacy of light and ventilation.[1] The standard also included an occupancy requirement. A unit had to be judged adequate on all components of the standard in order to pass the Minimum Standards requirement.

Households in the Minimum Rent group were simply required to pay a certain amount for rent each month. Minimum rent levels were set in terms of fractions of the estimated cost of modest, existing standard housing (the C* schedule used in determining Housing Gap payments) and thus varied by household size and by site. Households in the Minimum Rent Low group were required to pay a monthly rent equal to at least 70 percent of the estimated cost of modest standard housing. Households in the Minimum Rent High group were required to pay a monthly rent of at least 90 percent of the estimated cost of modest standard housing.

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[1] For a more complete description of the Minimum Standards requirement, see Appendix II. A detailed description of each component and how often each caused households to fail the Minimum Standards requirement is presented in Bakeman, et al. (1979).

Table 2-8 shows the subsequent participation rate for each of the three housing requirements used in Housing Gap plans--Minimum Standards, Minimum Rent Low, and Minimum Rent High.

Subsequent participation rates vary substantially among the different requirements. The Minimum Rent Low requirement was apparently by far the easiest requirement for households to meet at both sites. Among households that were enrolled and eligible in this group, 81 percent in Pittsburgh and 74 percent in Phoenix met the requirement and received a full payment at some time during the two years of the experiment. The Minimum Standards requirement was the most difficult requirement to meet in Pittsburgh; only 40 percent of the enrolled households in this group ever received a full payment. The Minimum Standards and the Minimum Rent High requirements were equally difficult for households in Phoenix; 54 percent of the enrollees in both groups were able to meet the requirements and participate.

For Housing Gap households that already met requirements when they enrolled, subsequent participation involved no special step. Like Percent of Rent and Unconstrained households, Housing Gap households that already met requirements began to receive allowance payments immediately after enrollment. Differences in subsequent participation rates among the different requirements might, therefore, be expected to reflect both differences in the proportion of enrolled households that already met requirements and differences in subsequent participation among households that did not meet requirements. Table 2-9 shows how the subsequent participation rate for each type of requirement was determined by these two factors.

Requirements that had the highest proportion of households already meeting them at enrollment also tended to have higher participation rates among households that did not meet the requirements at enrollment. The relationship is by no means exact, however. Differences in subsequent participation rates for households that did not meet requirements at enrollment are much less pronounced than differences in the rates of initially meeting requirements. Thus, one important factor in determining subsequent participation rates was simply the proportion of households that already met requirements at enrollment. Indeed, such households account for from one-half to four-fifths of all participants in the Minimum Rent plans and for about one-third of all participants in the Minimum Standards plans.

Table 2-8

SUBSEQUENT PARTICIPATION RATE OF HOUSING GAP HOUSEHOLDS BY TYPE OF HOUSING REQUIREMENT

	PITTSBURGH			PHOENIX		
	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
Subsequent participation rate	40%	81%	58%	54%	74%	54%
(Number of cases)	(268)	(156)	(168)	(307)	(167)	(188)

SAMPLE: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCE: Payments file.

Table 2-9

INITIAL PAYMENT STATUS AND SUBSEQUENT PARTICIPATION

	PITTSBURGH				PHOENIX			
	ALL HOUSING GAP HOUSEHOLDS	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM HIGH RENT REQUIREMENT	ALL HOUSING GAP HOUSEHOLDS	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
Percentage of enrolled households that received a full payment at enrollment	33%	15%	64%	35%	29%	19%	53%	27%
(Number of cases)	(592)	(268)	(156)	(168)	(662)	(307)	(167)	(188)
Subsequent participation rate for households that received a full payment at enrollment	100	100	100	100	100	100	100	100
(Number of cases)	(197)	(39)	(100)	(58)	(195)	(57)	(88)	(50)
Subsequent participation rate for households that did not receive a full payment at enrollment	34	30	48	35	42	44	46	37
(Number of cases)	(395)	(229)	(56)	(110)	(467)	(250)	(79)	(138)
Subsequent participation rate for all enrolled households	56	40	81	58	59	54	74	54
(Number of cases)	(592)	(268)	(156)	(168)	(662)	(307)	(167)	(188)
Percentage of all participants that received a full payment at enrollment	60	36	79	60	50	34	71	50
(Number of cases)	(331)	(107)	(127)	(97)	(391)	(166)	(124)	(101)

SAMPLE. Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCE. Payments file.

Households that did not already meet requirements at enrollment had all enrolled in the experiment and thus indicated an interest in and willingness to participate in the program. They might later change their mind about this decision, as they experienced the program or as their own circumstances (and possibly their allowance payment) changed over time. Apart from such revisions in the acceptance decision, however, subsequent participation would be expected to revolve around the housing requirements. This suggests that the subsequent participation of households that did not already meet requirements at enrollment would depend on four factors--how much they would have to change their housing in order to meet requirements, how large a payment they were offered, how willing they were to move if necessary to meet requirements, and whether they would normally meet requirements in the absence of the allowance offer.

A household that did not meet its housing requirements at enrollment had to obtain housing that did meet the requirements in order to receive payments. For Minimum Rent households, this simply amounted to spending more for housing than they were spending already. The changes involved might range from very small amounts that could well be met in their current unit or by moving to a not very different unit to amounts that would involve a very substantial increase in their housing expenditures. Likewise, Minimum Standards households had to correct deficiencies that might range from missing switchplates or broken windows which were relatively easy for the household itself to repair, to a need for additional rooms, more adequate light and ventilation, or general structural and surface repairs which would either involve major rehabilitation by the household's current landlord or require the household to move to a different, and frequently more expensive, unit.

It seems reasonable to suppose that, for a given allowance payment, households would be more likely to participate if meeting requirements involved a relatively modest change from their current housing. One way to characterize the change involved is by the change in expenditures required. For Minimum Rent households, this may be calculated simply as the difference between the amount of rent the households were paying at enrollment and the amount set by the Minimum Rent requirement. For Minimum Standards households, it is more difficult to estimate the increase in expenditures

necessary for them to meet their requirement, because the requirement involved the physical characteristics of the unit rather than a dollar expenditure amount. However, the estimated cost of a modest standard unit for a household of a given size used to calculate the payment amount for Housing Gap households (see Section 2.2) may be used as an indication of the rent the household would have had to pay on average to meet the Minimum Standards requirement.

Table 2-10 shows the participation rates of enrolled Housing Gap households as a function of their distance from meeting their housing requirement at enrollment (as measured by the estimated increase in expenditures necessary to meet the requirement). As expected, households that would have had to increase their expenditures by a large amount in order to meet requirements had a much lower rate of subsequent participation than households that were quite close to meeting the requirements at enrollment. Among households that would have had to increase expenditures by $10 or less to meet the requirements, 64 percent in Pittsburgh and 60 percent in Phoenix eventually met requirements and received a full payment. Among households that were more than $50 away from meeting the requirements, only 19 percent in Pittsburgh and 34 percent in Phoenix ever participated.

Even though households may have needed to increase their housing expenditures in order to meet the Housing Gap requirements, they may have been compensated for much or all of this increase by the housing allowance payments they received once they met the requirements. If the payment amount offered by the program was greater than the amount by which the household had to increase its expenditures, then the household realized a net cash gain from the allowance--that is, they could increase their expenditures enough to meet the housing requirements and still have money from the allowance available for other purposes if they wished. Households for which the amount of the allowance payment was less than the needed increase in expenditures, in contrast, would have had to increase their own out-of-pocket expenditures on housing in order to participate.

It seems reasonable to expect that households for which the net payment was positive would be more likely to meet the requirements and participate than households that would have had to increase their out-of-pocket expenditures in order to participate. Table 2-11 shows that this is the

Table 2-10

SUBSEQUENT PARTICIPATION RATE OF
HOUSING GAP HOUSEHOLDS BY
INITIAL DISTANCE FROM MEETING REQUIREMENTS

	PITTSBURGH			PHOENIX		
	NUMBER ENROLLED AND ELIGIBLE	NUMBER THAT EVER RECEIVED A FULL PAYMENT	SUBSEQUENT PARTICIPATION RATE	NUMBER ENROLLED AND ELIGIBLE	NUMBER THAT EVER RECEIVED A FULL PAYMENT	SUBSEQUENT PARTICIPATION RATE
Households that received a full payment at enrollment	197	197	100%	195	195	100%
Distance from meeting requirements (in dollars) for households that did not receive a full payment at enrollment						
Less than $10[a]	77	49	64	48	29	60
$10-25	69	26	38	59	33	56
$26-50	154	40	26	108	47	44
More than $50	89	17	19	244	83	34

SAMPLE: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial Household Report Form, payments file.

a. Includes some households in the Minimum Standards group that were actually paying more than the estimated cost of modest standard housing but still did not meet the Minimum Standards requirement.

Table 2-11

SUBSEQUENT PARTICIPATION RATE OF HOUSING GAP HOUSEHOLDS BY VALUE OF THE ALLOWANCE PAYMENT

	PITTSBURGH			PHOENIX		
	NUMBER ENROLLED AND ELIGIBLE	NUMBER THAT EVER RECEIVED A FULL PAYMENT	SUBSEQUENT PARTICIPATION RATE	NUMBER ENROLLED AND ELIGIBLE	NUMBER THAT EVER RECEIVED A FULL PAYMENT	SUBSEQUENT PARTICIPATION RATE
Households that received a full payment at enrollment	197	197	100%	195	195	100%
Net value of the allowance payment (payment amount minus distance from meeting requirements) for households that did not receive a full payment at enrollment						
$-40 or less	20	1	5	88	20	23
$-39 to $-20	41	10	24	61	23	38
$-19 to 0	70	13	19	58	19	33
$1 to $19	89	26	29	69	27	39
$20 to $39	82	36	44	58	26	45
$40 to $80	70	37	53	78	47	60
$81 or more	11	8	73	50	34	68

SAMPLE: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial Household Report Form, payments file.

case. Among households that did not already meet the requirements at enrollment, households for which the allowance offer had a high net payment value were much more likely to participate than those with a low net payment. Households that could have increased their expenditures enough to meet the requirments and still have had more than $80 of the allowance payment available for other purposes had a participation rate of 73 percent in Pittsburgh and 68 percent in Phoenix. Households that would have had to increase their own out-of-pocket expenditures on housing by $40 or more, in contrast, had a subsequent participation rate of 5 percent in Pittsburgh and 23 percent in Phoenix. Clearly, the amount of the allowance offer, in conjunction with the amount households would have had to increase their expenditures to meet requirements, had a substantial effect on participation for Housing Gap households.

A household's willingness to move is also expected to have been an important factor in participation subsequent to enrollment. Households that were living in units that did not meet the requirements and did not wish to move could not participate unless they made repairs to the unit themselves or negotiated upgrading of the unit with their landlord. For households living in seriously deficient units, upgrading to meet the requirements may have been impossible.

Households that normally moved fairly frequently would be expected to be willing to move to a new unit if they were unable to meet the housing requirements in the unit in which they were living at enrollment. One way of estimating a household's normal likelihood of moving is to use the behavior observed among Control households in the experiment. The probability that a Control household moved over the two years of the experiment may be estimated as a function of the household's demographic characteristics and its mobility history.[1] The resulting equation may then be used to predict the normal probability of moving among Experimental households.

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[1]The variables included in the equation are those found to be important in the analysis of mobility during the experiment (see MacMillan, 1978). See Appendix XI for the results of the logit estimation of the probability of moving among Control households.

It seems likely that households with a higher predicted normal probability of moving would be more likely to participate than households with a low normal probability of moving. Table 2-12 shows that this was the case in Phoenix, but not in Pittsburgh. In Pittsburgh, participation rates were the same for households no matter what their predicted normal probability of moving, except for households with a probability of 0.75 or more. In Phoenix, participation rates for households with a probability of moving of 0.50 or more were higher than for households with a lower probability of moving.

Finally, some households that did not meet requirements at enrollment would normally have come to meet them even without an allowance offer. These households, like those that already met requirements at enrollment, would, in effect, participate automatically as they met requirements. Some indication of the extent of such "normal participation" can be obtained by examining the rate at which Control households that did not meet the various requirements at enrollment (and which were not offered an allowance payment) met requirements.

Table 2-13 compares the rates at which Housing Gap and Control households qualified for payment under the various requirements.[1] The figures for Control households suggest that many, and often most, of the Housing Gap households that later met requirements would have done so in the absence of an allowance offer. This also suggests that part of the effect of distance and the probability of moving may arise because of their influence on the household's normal probability of meeting requirements as well as their effect on the willingness of households that would not normally meet requirements to meet requirements and participate in the allowance program.

The analysis of Chapter 4 confirms the overall pattern indicated by these tabulations, although results differ with respect to some important

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[1]Figures for Housing Gap households in Table 2-13 are based on payment records and those for Control households on reported rents and housing evaluations. For details on the comparability of the two, see Appendix III.

Table 2-12

SUBSEQUENT PARTICIPATION RATE OF HOUSING GAP HOUSEHOLDS BY THEIR PREDICTED NORMAL PROBABILITY OF MOVING DURING THE EXPERIMENT

	PITTSBURGH			PHOENIX		
	NUMBER ENROLLED AND ELIGIBLE	NUMBER THAT EVER RECEIVED A FULL PAYMENT	SUBSEQUENT PARTICIPATION RATE	NUMBER ENROLLED AND ELIGIBLE	NUMBER THAT EVER RECEIVED A FULL PAYMENT	SUBSEQUENT PARTICIPATION RATE
Households that received a full payment at enrollment	197	197	100%	195	195	100%
Predicted normal probability of moving for households that did not receive a full payment at enrollment						
.00 to .24	127	42	33	82	27	33
.25 to .49	117	39	33	89	27	30
.50 to .74	66	22	33	79	36	46
.75 to 1.00	25	10	40	132	66	50

SAMPLE: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Initial Household Report Form, payments file.

Table 2-13

COMPARISON OF THE RATES AT WHICH CONTROL AND HOUSING GAP HOUSEHOLDS THAT DID NOT MEET REQUIREMENTS AT ENROLLMENT LATER QUALIFIED FOR ALLOWANCE PAYMENTS

	PITTSBURGH			PHOENIX		
	MINIMUM STANDARDS REQUIRE-MENT	MINIMUM RENT LOW REQUIRE-MENT	MINIMUM RENT HIGH REQUIRE-MENT	MINIMUM STANDARDS REQUIRE-MENT	MINIMUM RENT LOW REQUIRE-MENT	MINIMUM RENT HIGH REQUIRE-MENT
Housing Gap households	30%	48%	35%	44%	46%	37%
(Number of cases)	(229)	(56)	(110)	(250)	(79)	(138)
Control households	16	36	22	26	22	16
(Number of cases)	(338)	(160)	(290)	(397)	(264)	(377)

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment and Control households that did not meet housing requirements at enrollment, excluding households with incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial and subsequent Housing Evaluation Forms, Initial and periodic Household Report Forms, payments file.

details. First, the analysis of Chapter 4 confirms the importance of distance and the household's normal probability of moving in determining subsequent participation rates among households that did not meet requirements at enrollment. Indeed, unlike the tabulation of Table 2-12, the effect of the probability of moving is not generally smaller in Pittsburgh than in Phoenix, once the other variables are taken into account. As was suggested above, however, most of the effect of distance and the probability of moving is through their effect on the household's normal probability of meeting requirements.

The estimated difference between Housing Gap participation rates and the normal probability of meeting requirements is similar to that indicated by Table 2-13, with the exception of the Minimum Standards requirements in Pittsburgh, for which the estimates of Chapter 4 give results more similar to those for the Minimum Rent requirements. In addition, once differences in the normal probability of moving are accounted for, participation rates in the two sites are not significantly different. The analysis of Chapter 4 suggests that two-thirds or more of the participants under each requirement were households that either already met the requirement when they enrolled or would normally have met it after enrollment.

Participation rates after enrollment may also vary substantially among different demographic groups. Table 2-14 shows participation rates for enrolled households in the Housing Gap plans by demographic group. There are several substantial differences that are consistent across the two sites. Younger households were more likely to meet requirements and participate than were older ones. Large households--seven or more persons--appear to have had special trouble meeting the requirements. Households with a history of more frequent moves were more likely to participate, as were nonminority households and households with female heads at both sites. Households in the lowest and highest income groups were less likely to meet requirements and participate than households in the middle-income group. Recipients of welfare or Food Stamps were somewhat less likely to participate at both sites. Satisfaction with unit or neighborhood had little relationship to participation, with the exception of unit satisfaction in Pittsburgh.

Table 2-14

SUBSEQUENT PARTICIPATION RATES FOR ENROLLED HOUSING GAP HOUSEHOLDS BY HOUSEHOLD CHARACTERISTICS

DEMOGRAPHIC CHARACTERISTIC	PITTSBURGH			PHOENIX		
	NUMBER ENROLLED AND ELIGIBLE	NUMBER THAT EVER RECEIVED A FULL PAYMENT	SUBSEQUENT PARTICIPATION RATE	NUMBER ENROLLED AND ELIGIBLE	NUMBER THAT EVER RECEIVED A FULL PAYMENT	SUBSEQUENT PARTICIPATION RATE
Age of household head						
under 30	178	106	60%	259	177	68%
30-61	260	150	58	264	139	53
62 and over	153	75	49	139	75	54
Household size						
1 person	108	51	47	91	54	59
2 persons	153	100	65	178	119	67
3-4 persons	209	123	59	245	154	63
5-6 persons	86	44	51	89	45	51
7 or more persons	35	13	37	59	19	32
Mobility in the previous three years						
no moves	271	133	49	144	60	42
1 move	167	97	58	171	107	63
2 moves	86	58	67	119	66	55
3 or more moves	66	41	62	225	156	69
Race or ethnicity of household head						
Non-minority	448	266	59	439	289	66
Black	144	65	45	41	16	39
Spanish American	--	--	--	182	86	47
Sex of household head						
Male	230	119	52	416	234	56
Female	361	212	59	246	157	64
Income						
$1-1,999	73	33	45	75	30	40
$2,000-3,999	264	145	55	174	97	56
$4,000-5,999	190	119	63	239	156	65
$6,000-7,999	63	34	54	136	88	65
$8,000-9,999	--	--	--	27	15	56
$10,000 or more	--	--	--	11	5	43
Welfare recipient status						
Welfare recipient	349	191	55	170	77	45
Non-recipient	243	140	58	492	314	64
Food Stamp recipient status						
Food Stamp recipient	347	183	53	178	97	54
Non-recipient	245	148	60	484	294	61
Satisfaction with unit						
Satisfied	419	247	59	461	271	59
Dissatisfied	173	84	49	201	120	60
Satisfaction with neighborhood						
Satisfied	453	255	56	520	305	59
Dissatisfied	137	75	55	142	86	61

SAMPLE Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing

DATA SOURCES Baseline Interview, Initial Household Report Form, payments file

Many of the demographic variables in Tables 2-14 are highly correlated. Previous mobility is highly related to age, for example, with older households moving much less than younger ones.[1] Household size and income are also correlated because of eligibility rules. Income limits varied by household size, so higher-income households were not eligible unless they had a large number of family members. Most important, many of the demographic variables are associated with the determinants of participation discussed earlier--how large a change, if any, in its housing the household had to make to meet requirements, the amount of the allowance payment offered, and the household's willingness to move. Indeed, the analysis of Chapter 4 finds that these factors account for the demographic differences observed. Demographic differences in participation rates appear to result mainly from differences in initial housing, payment amount, and normal mobility. Thus, program design decisions with respect to payment levels and housing requirements not only change the overall level of participation, but affect the demographic composition of the participating population as well.

2.5 PARTICIPATION AMONG HOUSEHOLDS STILL ACTIVELY ENROLLED AND ELIGIBLE AFTER TWO YEARS

The previous section discussed the subsequent participation of Housing Gap households in terms of the proportion of enrolled households that ever received an allowance payment during the two years after enrollment. This section presents an alternative measure, analyzed further in Chapter 5, based on participation at the end of two years. Under this measure, participation is measured in terms of the proportion of households still actively enrolled and eligible at the end of two years that qualified for full payments at that time. The difference between these two measures may be related to the effects of turnover in the eligible and interested population.[2]

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[1] See MacMillan (1978).

[2] The potential importance of this factor was pointed out to us by analysts at the Rand Corporation in connection with their analysis of the Supply Experiment and previous work by Rand on participation in AFDC in New York City.

Not all households enrolled in the Demand Experiment remained eligible for the full two years after enrollment analyzed in this report. Households frequently became ineligible due to, for example, changes in income or household size or because they moved out of the experimental jurisdiction.[1] In an ongoing program, such turnover in the eligible population would result in a corresponding turnover in the enrolled population as households that ceased to be eligible were replaced by newly eligible households.[2] This would also, however, be expected to reduce participation rates both in the experiment and in an ongoing program. Households that did not meet requirements at enrollment needed time, and in some cases considerable time, to meet the requirements and participate. If some households did not remain eligible for long periods, they may not have participated simply because they were not eligible for long enough.

Households that became ineligible were not replaced in the Demand Experiment. Under certain circumstances, discussed in Appendix VII, the cumulative participation rate of all enrolled households will estimate the current participation rate in an ongoing program. In effect, the time that enrolled households remained eligible matches the time profile of the enrolled population. Thus, households that would not remain eligible long enough to participate in an ongoing program are matched by enrolled households that did not remain eligible long enough to participate in the Demand Experiment programs.

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[1] These changes were no doubt under the household's control and implied a decision to give up eligibility for the allowance program. At the same time, they appear to involve considerations that would overwhelm any relatively fine issues of participation. In addition, of course, some reasons for ineligibility such as death or institutionalization were clearly not dependent on households' control.

[2] There could, of course, be trends in the size of the eligible population as well as simply turnover. The reasoning of this section applies only to steady state situations in which the total size of the eligible population is fixed over time.

Turnover need not only be a matter of eligibility. Enrolled households were both eligible and in a general sense interested in participating. Changes in household circumstances over time may leave households eligible, but also make participation more or less appealing, by changing their prospective allowance payment or making reporting requirements appear more or less onerous. As long as such revision in the households' pre-enrollment assessment of the program in fact represents a turnover process, the same conclusions apply as for turnover in the eligible population alone.[1]

At the same time there is also reason for examining participation rates apart from the effects of population turnover. First, population turnover rates may change from time to time or place to place. Indeed, the accounting period used to determine eligibility may itself alter turnover rates in the eligible population. Second, a housing allowance program might serve the temporarily and permanently poor in quite different ways. For the temporarily poor, it might provide a form of emergency assistance, essentially helping to relieve the financial strain of remaining in decent housing. For the permanently poor, an allowance might more often provide the means for obtaining the decent housing that they otherwise would not possess. It is conceivable, for example , that the preponderance among participants of households that would have met requirements normally in the absence of the allowance offer, noted in Chapter 4, in part simply reflects the program's effect for temporarily poor households.

This section describes participation among the more permanently poor enrolled households. All the households considered in this section had annual incomes below the modal eligibility limits for the Housing Gap programs in the year prior to enrollment and in the second year after

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[1] Reassessments of the household's acceptance decision represent a turnover process if they are based on changes in household circumstances that are, in theory, matched by opposite changes among households that rejected the enrollment offer. In this case, the cumulative participation rate of enrolled households would give the current participation rate for eligible and interested households in an ongoing program. If the acceptance rate gives the proportion of eligible households that are "interested" in the program, the product of the two rates would give the current participation rate of eligible households in an ongoing program. As discussed in Section 2.6, this assumes that no time is required for the household to decide to apply once eligible. Further, it is unlikely that all sample attrition fell into this category.

enrollment.[1] Furthermore, all remained actively enrolled in the experiment for two years, completing all reporting and interviewing requirements. Analysis of participation among these households should therefore indicate the eventual response of households that were both eligible and interested and exposed to the experimental offer for reasonably long periods of time.

Table 2-15 compares the subsequent participation rates based on the accumulated participation of all enrolled households and on households still enrolled and eligible at the end of two years. The overall rates are very similar for the two measures. Thus, the relatively low participation rates observed in the previous section persist even for households that were exposed to the allowance offer for two years. The impact of the allowance offer, indicated by the comparison with Control households, however, is much larger for households still enrolled and eligible at the end of two years.[2] The allowance offer does, as expected, appear to have more effect on households that had a considerable period of time in which to respond.[3]

2.6 TECHNICAL ISSUES IN THE INTERPRETATION OF EXPERIMENTAL PARTICIPATION RATES

The concerns discussed in this section reflect a variety of hypothetical issues, discussed at greater length in several appendices. The purpose of this section is twofold. First, it is intended to indicate the nature of the issues involved and the caveats which should be born in mind in considering the results of this and later chapters. Second, the

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[1]This is an admittedly crude approximation to the eligible population. Some Housing Gap plans had higher and some lower eligibility limits. In addition, payments were calculated based on monthly income (with a carry over from previous months in which households exceeded the eligibility limits). The simple criterion used here was adopted to allow an appropriate single standard for all households including Control households.

[2]The comparison with Control households shown in Table 2-15 is constructed using the rates at which Control households met requirements but controlling for the proportion of Housing Gap households that met requirements at enrollment.

[3]Results of the multivariate logit analysis in Chapters 4 and 5 confirm the larger impact for households that were still enrolled and eligible at the end of two years. The estimated difference is, however, somewhat less than the tabulations of Table 2-15 would suggest.

Table 2-15

COMPARISON OF SUBSEQUENT PARTICIPATION RATES BASED ON ALL ENROLLED HOUSEHOLDS AND ON HOUSEHOLDS STILL ENROLLED AND ELIGIBLE AT THE END OF TWO YEARS

	PITTSBURGH			PHOENIX		
	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
Subsequent participation rate for:						
All enrolled households	40%	81%	58%	54%	74%	54%
(Number of cases)	(268)	(156)	(168)	(307)	(167)	(188)
Households enrolled and eligible at two years	44	83	52	56	76	50
(Number of cases)	(174)	(111)	(93)	(154)	(87)	(101)
Simulated Control rate for:[a]						
All enrolled households	29	77	49	40	63	39
Households enrolled and eligible at two years	26	73	41	35	50	27
Difference between actual and simulated data for:						
All enrolled households	11	4	9	14	11	15
Households enrolled and eligible at two years	18	10	11	21	26	24

a. Simulated rates are calculated by using Control rates for households that did and did not meet requirements at enrollment, weighted by the proportion of Housing Gap households that did and did not meet the requirements at enrollment.

discussion suggests that many potential biases may be effectively bracketed by the two participation rates described in Section 2.4 and 2.5. Since these two are reasonably close to one another, many of the potential concerns described here, especially with regard to relative participation rates, may not in fact have a substantial effect on the analysis.

The primary focus of the discussion is on the relative participation rates under the various programs tested and on comparisons with Control households, though some attention is also paid to absolute rates. The Demand Experiment was designed to estimate differences in participation among different programs. Evidence on absolute participation rates is available from the Supply Experiment. In general, it appears that the participation rates estimated in the Demand Experiment should, if anything, overestimate participation in an ongoing nonexperimental program. The rates found for the Demand Experiment are low enough, however, that this overestimation may not be seriously misleading in terms of program outcomes. Furthermore, rough comparison with rates observed in the Supply Experiment at least suggests that the extent of the overestimation may not be large.

The three subsections below deal in turn with the analysis of acceptance, of subsequent participation among all enrolled households, and of subsequent participation among households still enrolled and eligible at the end of two years. In each case the discussion first indicates how the rates observed in the experiment might be expected to differ from those in an ongoing program; the extent to which these differences would also be expected to affect the relative participation rates among the different programs tested in the Demand Experiment; and finally, where appropriate, problems that may arise in comparing the responses of Experimental and Control households. A final subsection summarizes the various factors discussed.

Acceptance

The analysis of acceptance was based on households that completed the enrollment interview. Thus all households considered in the analysis had been given a brief description of the program, including an estimate of the payment that they would receive if they participated. It is not at all clear that anything like 100 percent of households eligible for

an ongoing program would be aware of the program or aware that they were eligible for the program. To the extent that this is true, acceptance rates would, of course, overestimate actual application and acceptance rates among an eligible population. There is, however, no reason to believe that this would affect relative acceptance rates among the different programs tested. Nor is it clear that a reasonably well publicized program would not eventually be known to most eligible households.[1]

In addition, however, households may have revised their acceptance decision after enrollment, not because of the sorts of changes in household circumstances discussed in Section 2.5, but because they had better information on how the program actually operated. The results of Section 2.3 suggested that households' decisions to accept or reject the enrollment offer were based on a very general picture of the program offers. In particular, there is little evidence of any strong or consistent reactions to housing requirements or to differences in payment formulas beyond the immediate payment estimate provided during the enrollment interview. Such behavior seems quite reasonable. Faced with an offer about which little was known, households may well have decided to ignore the details of the offer and see how the program actually worked before finally making up their minds about it.

In an ongoing program, however, household impressions of the program, based on either their own past experience or the anecdotes of friends and relatives, might be much clearer than the verbal descriptions provided by the enrollment interview. If the enrolled households often reversed their acceptance decision after enrollment, they might simply not apply for an ongoing program. To the extent that such reversals involved meeting housing requirements under the Housing Gap allowance plans, they are explicitly analyzed in the analysis of subsequent participation.

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[1] As discussed in Appendix IV, available evidence from the Administrative Agency Experiment and Supply Experiment is inconclusive as to the magnitude of this problem. It appears that reasonable outreach efforts may make most of the population aware that a program exists. It is not clear, however, that most households will have enough information to guess whether they are eligible or what the program might offer them.

What is of concern here is the extent to which the general willingness to participate in a transfer program, represented by the acceptance decision, is itself reversed.

While it is difficult to pinpoint the extent of such reversals in acceptance, analysis presented in Appendix V indicates that they could amount to as much as 10 to 15 percent of the enrolled population, indicating that overall participation rates could be reduced in an ongoing program by a factor of 0.90 to 0.85. This reduction would not, however, apply equally to all households. The most likely estimate of the reduction involved suggests that most reversals occurred in Phoenix and that the adjusted acceptance rate for Percent of Rent and Unconstrained households would be from 75 to 80 percent in both sites.

The problem raised by revisions in the acceptance decision is particularly acute for Unconstrained households, Percent of Rent households and Housing Gap households that already met the requirements at enrollment. Under the definition of participation used in previous sections all of these households became participants at enrollment. Housing Gap households that did not already meet requirements at enrollment, on the other hand, had more time to revise their acceptance decision before being counted as participants. One simple correction for this effect in terms of relative participation rates is to consider the subsequent participation of Housing Gap households that were still enrolled and eligible after two years.[1] These households all had ample time to revise their acceptance decision, so that relative rates of participation should no longer be biased by this factor. Indeed, as discussed below, using the subsequent participation of households still enrolled after two years should overestimate the relative Housing Gap participation.

Finally, the sort of turnover in the interested and eligible population described in Section 2.5 could also lower application rates for an ongoing program. The subsequent participation of enrolled households only takes account of the time involved in meeting requirements. If households also

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[1]The participation rate among Percent of Rent and Unconstrained households still enrolled and eligible after two years, was, of course, still 100 percent.

take time to decide to apply for a program, then application rates would also be reduced by population turnover. Again, however, this effect would be expected to apply equally to all the programs tested in the Demand Experiment. Furthermore, the investigations of Appendix V suggest that application lags of up to six months would have little effect on the acceptance rate observed in the Demand Experiment.

Subsequent Participation Among Enrolled Households

Section 2.5 suggested that the cumulative participation rate among enrolled households might be interpreted as taking account of turnover in the eligible and interested population. Unfortunately, it may in fact overcorrect for population turnover. This problem arises if there is turnover not only in the eligible and interested population, but among the households that normally met housing requirements as well.

The subsequent participation rate among enrolled households accumulates all households that ever met the housing requirements as participants. If some of these households would, while remaining eligible, later cease to meet requirements, the participation rate may overestimate the current program participation rate in an ongoing program. Except for Minimum Rent in Pittsburgh, not all households that met requirements of enrollment continued to meet them two years later. At that same time, the shift of households from meeting to not meeting requirements is small. Indeed, evidence based on comparison of the cumulative measure of participation with the rate at which households actually met requirements in two years, presented in Appendix VII, suggests that accumulation of households that normally met requirements might overstate participation rates by no more than five percentage points for both Housing Gap and Control households.

A second problem relates to the fact that not all ineligible households are automatically dropped from the sample when they become ineligible. Thus some households that met requirements after enrollment could in theory have done so after they became ineligible. This problem applies in particular to Control households, since these households did not receive payments conditioned by household income. Evidence presented in Appendix VII suggests that this failure to eliminate all ineligible households could lead to an

overstatement of Housing Gap participation rates by two or three percentage points and could also overstate the rate at which Control households met requirements while eligible by an additional two or three points.

Subsequent Participation Among Households That Were Still Actively Enrolled and Eligible at the End of Two Years

The proceeding two subsections discussed attrition of the enrolled population in terms of revisions of the acceptance decision and turnover in the eligible and interested population. The term "interested" referred to a general willingness to participate in a program, meeting the various reporting requirements and accepting payments from the government. The effects of this sort of reversal or turnover could be removed by considering the subsequent participation of Housing Gap households that were still enrolled and eligible after two years. These rates are, however, themselves subject to bias if attrition among Housing Gap households is also related to their willingness to meet the housing requirements.

It seems reasonable to suppose that eligible households that did not meet the housing requirements and become participants were more likely to drop out than households that did meet requirements. Thus, the participation rate among households still actively enrolled and eligible after two years would be expected to overstate the participation rate among all eligible households. This would also overstate participation relative to Control households, since Control households received no additional payment if they met the various housing requirements. Preliminary analysis of this problem in Appendix VI suggests that its effects may be surprisingly small, but it cannot be entirely discounted.

Summary

Table 2-16 summarizes the various effects discussed above. The first two columns indicate the effect of each factor on the participation rate of Housing Gap households relative to that for Percent of Rent or Unconstrained households. The last column indicates the expected effect on the participation rate of Percent of Rent and Unconstrained households relative to an ongoing program.

Table 2-16

POSSIBLE EFFECTS OF REVERSALS, TURNOVER, AND ATTRITION ON ESTIMATED PARTICIPATION RATES

FACTORS AFFECTING PARTICIPATION RATE ESTIMATES	EFFECT ON RATES FOR THE HOUSING GAP PLAN RELATIVE TO THE PERCENT OF RENT AND UNCONSTRAINED PLANS		EFFECT ON RATES FOR THE PERCENT OF RENT AND UNCONSTRAINED PLANS RELATIVE TO AN ONGOING PROGRAM
	MEASURE BASED ON ALL ENROLLED HOUSEHOLDS	MEASURE BASED ON HOUSEHOLDS STILL ENROLLED AND ELIGIBLE AFTER TWO YEARS	
Acceptance rates based on households that completed the enrollment interview	No effect	No effect	Overestimate
Reversal of acceptance decision based on program experience	Underestimate	No effect	Overestimate
Turnover of eligible and interested population	Estimate is comparable to program rate	Estimate for households that remain eligible is comparable to program rate	Overestimate
Turnover of population that meets requirements (Comparison with Control households)	Overestimate of program rate (Underestimate of Effect of Allowance)	No effect (No effect)	No effect (No effect)
Attrition of households that reject housing requirements (Comparison with Control households)	No effect (No effect)	Overestimate (Overestimate of Effect of Allowance)	No effect (No effect)

As indicated in the table, participation rates among Percent of Rent and Unconstrained households should, if anything, be expected to overestimate participation in an ongoing program. The possible extent of this overestimate has not been established with any certainty. If programs are generally well known, and if turnover rates are low or most households do not take very long to apply for a program after becoming eligible, evidence based on participation rates for Percent of Rent and Unconstrained households could be overstated by as much as 1.15. The actual degree of overstatement could, however, be much larger.

Participation rates based on households that were still enrolled and eligible at the end of two years may overestimate Housing Gap participation rates relative to Percent of Rent and Unconstrained rates. If participation measures are based on the less restricted population of all enrolled households, on the other hand, they may underestimate relative participation among Housing Gap households, depending on which of the two factors listed predominates. Thus, overall participation rates relative to Percent of Rent or Unconstrained households may not be bracketed by the two measures. They are at least bounded, however, by the measure based on households enrolled and eligible after two years.

Finally, in terms of comparisons with Control households, comparisons based on meeting requirements by all enrolled households may underestimate the effect of the allowance offer, while those based on households still enrolled and eligible at the end of two years may overestimate the effect of the allowance offer. Thus estimates of the impact of the allowance effect in the rate at which households met requirements would be expected to bracket the actual effect. Differences in estimates under the two definitions are not, however, by themselves evidence of important effects due to attrition or turnover in the population that met requirements. Turnover in the eligible and interested population would itself be expected to produce different impacts under the two measures.

The possible biases in the relative participation rates of Housing Gap households or in comparisons of Housing Gap and Control households that might arise from reversal of the acceptance decision, turnover in the

population that met requirements or attrition of households that rejected the housing requirements are discussed further in various Appendices. The results of these analyses at least suggest that these factors may be relatively unimportant. In particular, differences between the results of the two measures may well reflect the effects of turnover in the eligible and interested population rather than the biases listed above. This is, therefore, the interpretation adopted in the rest of this report. This finding is not conclusive, however, and must be tempered with some appreciation of the possible biases introduced by the other considerations described in this section.

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CHAPTER 3

THE DECISION TO ENROLL

This chapter analyzes the first stage of participation--accepting the enrollment offer. All households had to decide whether or not to accept the enrollment offer and enroll in the experiment. Indeed, as discussed in Chapter 2, acceptance was the participation decision for households assigned to the Percent of Rent and Unconstrained plans. Once accepting households in these plans were certified as eligible and enrolled, they immediately began to receive payments. Accepting households assigned to the Housing Gap plans, on the other hand, also had to meet housing requirements before they received allowance payments. The analysis of acceptance thus investigates the stage of the participation process that was common to all of the experimental allowance programs. Indeed, as the analysis of this chapter indicates, the most important factors in acceptance frequently appear to concern issues common to participation in any transfer program more than factors specifically related to the housing focus of the Percent of Rent and Housing Gap plans.

Section 3.1 analyzes the probability that a household accepted the enrollment offer and agreed to enroll in terms of the type of offer made and household characteristics. Special attention is paid to distinguishing the effects of payment amounts offered from the effects of other differences in the Experimental programs associated with differences in payment formulas and in particular the imposition of housing requirements in the Housing Gap plan. This analysis is complemented by Section 3.2, which describes the reasons given by a sample of households for not accepting the enrollment offer and also examines Housing Gap households' perceptions of the housing requirements and the importance of those requirements in their decision not to enroll. The role of housing requirements and payment formulas (as opposed to payment amounts) in determining acceptance is further explored in Section 3.3. Finally, Section 3.4 summarizes the factors that affected the acceptance decision.

3.1 THE PROBABILITY OF ACCEPTING THE ENROLLMENT OFFER

The analysis of acceptance starts with households that had completed the initial enrollment interview. All of these households had received a brief but complete description of the program including the way in which payments were calculated, an estimate of the payment that they would receive if they participated, a description of reporting requirements, and, for households assigned to the Housing Gap plans, of the housing requirements they would have to meet in order to receive payment. Thus, all households in theory had enough information to make a reasonably informed choice about whether or not they wanted to enroll.[1]

A variety of factors might be expected to influence acceptance. The major benefit of participating was, of course, the allowance payment itself. Against this, the household could weigh its own willingness to accept money from the government, the burden of meeting reporting requirements, the effect of the allowance on benefits from other programs, and, for Housing Gap households, the costs and effort involved in meeting the housing requirements. In order to receive their monthly allowance payment, households were required to submit a brief report and to cooperate with income verification procedures and periodic survey interviews. The amount of the allowance payment may not always have been enough to compensate households for the time and effort involved in these requirements. Also, other government transfers such as AFDC, Food Stamps, and Social Security all take account of some forms of other income in calculating their benefits, and households participating in these programs might fear that they would lose some benefits because of the extra money from the allowance payment. In fact, allowance payments were not counted in computing benefits under any other programs except Food Stamps, and households were assured of this during the enrollment interview. In addition, Housing Gap households faced the potential cost of meeting the housing requirements. Households that suspected that their units did not meet

[1] Given the limitations of verbal descriptions, a household might well have accepted and then later changed its mind on the basis of actual experience with the program. As discussed in Section 2.6 of the previous chapter and Appendix V, this does not seem to have occurred very often, at least not within the first six months after enrollment. It may, however, account for the somewhat higher acceptance rates in Phoenix.

the requirements might have to upgrade their unit or move to a new unit which did meet the requirements in order to participate. This might involve both the effort and expenses of finding and moving to a new unit or negotiating repairs with the landlord and an increase in rental expenditures necessary to secure a unit which complied with the requirements.

Many of these factors might be expected to vary with household characteristics. The amount of allowance payment itself, of course, varied with either income and household size (for Housing Gap and Unconstrained plans) or rent (for Percent of Rent plans). Likewise, elderly households or less educated households might have found the reporting requirements more burdensome than other households. Households already receiving government transfers, on the other hand, might find reporting requirements less forbidding and might be generally less likely to have negative attitudes towards accepting transfer payments. Poorer households, in more desperate situations, might find any payment worth more effort than households with higher incomes.

Many of the factors potentially involved in acceptance are common to all of the Experimental plans. All plans had the same reporting and interview requirements and involved accepting payments from the government.[1] The differences among the plans related to the amount of payment offered, the way in which payments were calculated, and the presence of housing requirements. Thus, differences in acceptance rates among the different plans should reflect these three factors. In particular, once the payment amount is taken into account, remaining differences should reflect either the effects of the payment formula or of the imposition of housing requirements

Two payment formulas were used in the Demand Experiment. For Percent of Rent households, the allowance payment was simply a fixed percentage of their monthly rent. For Housing Gap and Unconstrained households, the allowance payment was equal to the gap between the estimated monthly cost of modest standard housing for a household of that size and some

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[1] Control households, of course, received no allowance payment, though they were paid $10 a month for completing the reporting requirements. In addition, however, these households, unlike Experimental households, were explicitly appealed to in terms of helping with a government study of housing conditions.

fixed proportion of the household's monthly income. Thus, for Percent of Rent households, the allowance payment would be unchanged by later changes in the household's income and size unless these led to changes in rental expenditures. For Housing Gap and Unconstrained households, the allowance would decrease if the household's income went up or some family members left the household. A difference in the enrollment acceptance rates of households assigned to the Percent of Rent plan, compared to households assigned to the Unconstrained and Housing Gap plans, would indicate that the payment formula was an important factor in the decision to enroll.

For analysis of the importance of housing requirements, a different comparison is appropriate. Percent of Rent and Unconstrained households were required only to submit monthly reports and to comply with income verification and periodic surveys. Housing Gap households faced the possible additional costs of meeting housing requirements. A comparison of acceptance of the enrollment offer among Percent of Rent and Unconstrained households with that of households in the Housing Gap group can thus indicate the importance of the housing requirements in the decision to enroll.

In fact, although there are statistically significant differences in acceptance rates among the three types of allowance plans, the differences are relatively modest. Table 3-1 shows the acceptance rates among households completing the initial enrollment interview by type of housing allowance plan. The most obvious difference in acceptance rates is between households assigned to the Percent of Rent plans and those assigned to the Housing Gap plans, though the difference is not large. The acceptance rate of Percent of Rent households was 8 percentage points higher than that of Housing Gap households in Pittsburgh and 4 percentage points higher in Phoenix (statistically significant at both sites).

A difference between Percent of Rent and Housing Gap households could result from either a payment formula or a housing requirement effect, since the two groups differ on both counts. Examination of the rate for Unconstrained households should give an indication of which factor is most important. Unfortunately, Unconstrained households are a small group, and results are inconsistent across the two sites.

Table 3-1

ACCEPTANCE RATES BY TYPE OF
HOUSING ALLOWANCE PLAN

	PITTSBURGH		PHOENIX	
	NUMBER IN GROUP	ACCEPTANCE RATE	NUMBER IN GROUP	ACCEPTANCE RATE
Housing Gap households	1086	74%	1007	83%
Percent of Rent households	821	82	678	87
Unconstrained households	120	78	89	90
t-statistic for the difference between Housing Gap and Percent of Rent households	4.24**		2.28*	
t-statistic for the difference between Housing Gap and Unconstrained households	1.00		2.06*	
t-statistic for the difference between Percent of Rent and Unconstrained households	1.00		.87	

SAMPLE: Housing Gap, Percent of Rent and Unconstrained households that completed the enrollment interview.

DATA SOURCES: Baseline Interview, Household Events List.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

In Pittsburgh, the acceptance rate for Unconstrained households falls between the Percent of Rent and Housing Gap rates and is not significantly different from either. This might suggest that both factors--payment formula as well as housing requirements--may play a role in acceptance. In Phoenix, on the other hand, the acceptance rate for Unconstrained households is somewhat higher than that for Percent of Rent households and is significantly higher than that for the Housing Gap group. This suggests that housing requirements, rather than payment formula, were the reason for the lower acceptance rate among Housing Gap households.

These differences were investigated further in a multivariate analysis, taking account of the allowance payment amount and household characteristics. Table 3-2 shows the variables used. Most of the variables describe common demographic characteristics such as age, household size, race/ethnicity, and income. The only one of these variables that may not be self-explanatory is the income variable, which has been entered as a three-part spline. Spline-coding of continuous variables simply allows the variable to have different effects over its range. Thus the first element in the spline (labeled "under $3,000") captures the effect of differences in income in the income range of zero to $3,000. The next element (labeled "$3,000 to $8,000") is coded so that it captures the change in the effect of differences in income in this range from that of the zero to $3,000 range. (Thus, the total effect of a difference in income in the $3,000 to $8,000 range is the sum of the coefficients for the first two spline elements). The third element of the income spline captures the further change in the effect of differences in income in the range of incomes above $8,000 from the effects in the range below $8,000.[1]

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[1]The exact coding of the variables is

$$D_1 = Y$$
$$D_2 = (Y - \$3,000) \text{ if } Y \geq \$3,000$$
$$D_3 = (Y - \$8,000) \text{ if } Y \geq \$8,000$$

where Y is income. Recoding of D_2 and D_3 in terms of (Y - $3,000) and (Y - $8,000) guarantees that the function is continuous in Y. Thus, in an equation specifying some variable R as a function of income, the specification

(footnote continued on next page)

Table 3-2

VARIABLES USED IN THE ANALYSIS

VARIABLE	DESCRIPTION	USUAL RANGE
Elderly household	= 1 if household head is 62 or older = 0 otherwise	0-1
Young household	= 1 if household head is younger than 30 = 0 otherwise	0-1
Black household	= 1 if household head is black = 0 otherwise	0-1
Spanish American household	= 1 if household head is Spanish American = 0 otherwise	0-1
Large household	= 1 if household has 5 or more members = 0 otherwise	0-1
Single parent household	= 1 if household head is single and nonelderly and children are present in the household = 0 otherwise	0-1
Prior mobility	Number of moves during the three years prior to the experiment (continuous)	0-3
Dissatisfaction with unit or neighborhood	= 1 if household is dissatisfied with either unit or neighborhood prior to enrollment = 0 otherwise	0-1
Participation in other transfer programs	= 1 if household received benefits from Food Stamps, AFDC, or other transfer programs during the 12 months prior to enrollment = 0 otherwise	0-1
Income (in thousands)	Net income prior to enrollment	
Under $3,000	Captures the effect of income for households with incomes under $3,000 (continuous)	$1,000-3,000
$3,000-8,000	Captures the difference in the effect of income for households with incomes under $3,000 and those with incomes $3,000-8,000 (continuous)	$3,000-8,000
Over $8,000	Captures the difference in the effect of income for households with incomes $3,000-8,000 and those with incomes over $8,000	
Estimated subsidy amount	Estimates of subsidy amount given to households during enrollment interview	
Under $40	Captures the effect of subsidy amount for households with subsidies $40-80 (continuous)	$10-40
$40-80	Captures the difference in the effect of subsidy amount for households with subsidies under $40 and those with subsidies $40-80 (continuous)	$40-80
Over $80	Captures the difference in the effect of subsidy amount for households with subsidies $40-80 and those with subsidies over $80 (continuous)	$80-120
Unconstrained household	= 1 if household is in Unconstrained allowance plan = 0 otherwise	0-1
Percent of Rent household	= 1 if household is in Percent of Rent allowance plan = otherwise	0-1

In addition, three special demographic descriptors were included relating to participation in other transfer programs, household mobility,[1] and the household's expressed satisfaction with its dwelling unit and neighborhood. Households that were already participating in government transfer programs might be more willing to enroll in another program unless they felt that their current benefits would be jeopardized.[2] Likewise, households that were dissatisfied with their current housing or were more willing to move might also be expected to be more likely to accept the allowance offer. Information on all of these demographic descriptors was collected as part of the Baseline Interview, conducted before households were approached for enrollment.

Differences in the Experimental offers are captured in two ways. First, the "estimated allowance payment" variable refers to the estimated payment that the household was told it would receive if it participated in the allowance program. (This variable is entered as a spline, like the income variable discussed above.) In addition, dummy variables for Percent of Rent offers and the Unconstrained offer are used to contrast acceptance

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(footnote continued from preceding page)

$$R = \alpha_0 + \alpha_1 D_1 + \alpha_2 D_2 + \alpha_3 D_3$$

means

$$R = \begin{cases} \alpha_0 + \alpha_1 Y & \text{if } Y \leq \$3,000 \\ \alpha_0 - \alpha_2(3,000) + (\alpha_1 + \alpha_2)Y & \text{if } \$3,000 \leq Y \leq \$8,000 \\ \alpha_0 - \alpha_2(3,000) - (\alpha_3(8,000) + (\alpha_1 + \alpha_2 + \alpha_3)Y & \text{if } Y \geq \$8,000 . \end{cases}$$

[1]The specific variable used as a proxy for mobility was the number of times the household had moved in the previous three years. This variable is strongly correlated with subsequent mobility during the experiment (see MacMillan, 1978).

[2]In fact, as was explained to households, only Food Stamp benefits were affected by receipt of housing allowances. All other major programs agreed to waive housing allowances in computing household income for eligibility or benefit calculations. Estimation with separate variables for Food Stamps and other transfers showed no difference in response between households receiving Food Stamps and those receiving other transfer payments.

rates for these plans with that of the Housing Gap plans, once payment amount has been taken into account. Coefficients for these dummies should, therefore, reflect differences in acceptance associated with payment formulas or housing requirements.[1]

Table 3-3 shows an estimate of the probability that a household in the Housing Gap, Percent of Rent, or Unconstrained group accepted the enrollment offer, as a function of the variables listed in Table 3-2. The estimation procedure used in Table 3-3 is logit analysis. Under the logistic specifications, the probability that a household accepted the enrollment offer is written as

(1) $$\pi_A = F(x'\beta)$$

where

π_A = the probability of accepting the offer

x' = a vector of independent variables

β = a set of unknown coefficients, and

F = the unit logistic distribution
$(\ln(F/1-F) = x'\beta$

The advantage of this and other similar specifications is that they take account of the fact that the dependent variable is a dichotomy (accept/not accept).[2] The logistic coefficients (β) may be estimated by maximum likelihood. The coefficients themselves are not particularly transparent.

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[1] Separate equations for each group were also estimated. A chi-square test showed that it was possible to combine equations for Housing Gap, Percent of Rent, and Unconstrained households without significant loss of explanatory power if dummy variables were used to distinguish allowance plans. That is, the hypothesis that demographic and payment amount effects were the same for all three groups was not rejected, as shown below

		Separate	Pooled	Difference
-2 Log Likelihood (Degrees of Freedom)	Pittsburgh	1748.1795 (31)	1767.9105 (17)	19.7310 (14)
	Phoenix	1269.6473 (33)	1283.3790 (18)	13.7317 (15)

The test level for the difference is given by $\chi^2_{.10}$ (14, 15) = (21.064, 22.307).

[2] See Appendix IX for a fuller description of the logistic specification.

Table 3-3

LOGIT ESTIMATION OF THE PROBABILITY OF ACCEPTING THE ENROLLMENT OFFER

	PITTSBURGH				PHOENIX			
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	EFFECT ACROSS USUAL RANGE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	EFFECT ACROSS USUAL RANGE
Constant	-1.310	-2.80**	NA	NA	-0.024	-0 08	NA	NA
Elderly household	-0 280	-1.69†	-0.048	-0 048	0.153	0.70	0.020	0.020
Young household	0.369	2.15*	0 064	0 064	0 138	0 82	0.018	0 018
Black household	0.402	3 17**	0 069	0.069	-0 778	-3.02**	-0.101	-0.101
Spanish American household	NA	NA	NA	NA	-0.663	-4.10**	-0.086	-0 086
Large household	0 476	3 20**	0.082	0.082	-0.006	-0.03	-0 001	-0.001
Single parent household	0.144	0.97	0 025	0.025	0 298	1.68†	0 039	0 039
Prior mobility	0.248	4.06**	0.043	0.129	0 168	3 55**	0.022	0 066
Dissatisfaction with unit or neighborhood	0 248	2.63**	0.043	0 043	0.138	1.08	0.018	0.018
Participation in other transfer programs	0.085	0.68	0 015	0 015	0 135	0 95	0.018	0.018
Income (in thousands)								
Under $3,000	0.335	2.19*	0.060	0 120	-0 076	-5 69**	-0.010	-0.020
$3,000-8,000[a]	-0.122	2.87**	-0.021	-0.105	-0.003	-0 08	0 000	-0 002
Over $8,000[a]	-0.058	-0.21	-0.010	-0.020	-0 069	-1.17	-0 009	-0 018
Estimated subsidy amount								
Under $40	0.042	6.52**	0.007	0 210	0.051	5 72**	0 007	0.210
$40-80[a]	0.018	2 87**	0.003	0 124	0 008	1 17	0 001	0.042
Over $80[a]	-0.009	-1.84†	-0.002	0 062	0 004	0 98	0 002	0 021
Unconstrained household	0 011	0.05	0.002	0.002	0 472	1.49	0.061	0.061
Percent of Rent household	0.506	4 31**	0.087	0 087	0 343	2 45*	0.045	0.045
Likelihood Ratio (Significance)	239.90**				145.41**			
Sample Size	1896				1664			
Mean of Dependent Variable	0 778				0 846			
Coefficient of Determination	0 119				0 102			

SAMPLE- Housing Gap, Percent of Rent and Unconstrained households that completed the enrollment interview, excluding households with incomes over $16,000.

DATA SOURCES: Baseline Interview, Household Events List.

a. These were estimated as splines. The coefficients shown in the Table are the estimated coefficients applicable in the range stated. Estimated differences from the coefficient for the previous interval are

	PITTSBURGH		PHOENIX	
	Coefficient	t-statistic	Coefficient	t-statistic
Income (000s)				
Δ 3,000-8,000	-0.457	-2.63**	0 072	1 66†
Δ Over 8,000	0.064	0 72	-0 066	-0.74
Est. Subsidy				
Δ $40-80	-0.025	-2 21*	-0.043	-3.11**
Δ Over 80	-0.026	-2.91**	-0.003	-0.36

† t-statistic significant at the 0.10 level (two-tailed).
* t-statistic significant at the 0.05 level (two-tailed).
** t-statistic significant at the 0 01 level (two-tailed).

Their meaning is commonly indicated by taking the partial derivative of the probability of accepting with respect to each independent variable (the change in the probability of accepting associated with a unit change in the independent variable, holding other variables constant). Under the logistic specification, this derivative is given by

$$\frac{\partial \Pi_A}{\partial x_i} = \pi_A(1-\pi_A)\beta_i \cdot \quad (2)$$

Notice that the effect of x_i changes depending on the level of π_A. In particular as π_A becomes very small or very large, the effect of x_i becomes small, regardless of the value of β_i. This reflects the fact that π_A is bounded by zero and one. At large (small) values of π_A, no variable can increase (decrease) π_A by very much. As is customary, derivatives presented in this report are evaluated at the mean value of π_A indicated in the logit table.[1]

The figures presented in Table 3-3 show the estimated logit coefficient and t-statistic for each variable, as well as the partial derivative. Because the units in which the independent variables are measured vary, the final column in Table 3-3 indicates the effect of each variable across its usual range. This is calculated as the product of the partial derivative estimate of the effect of a one-unit change multiplied by the number of units in the usual range. (The usual ranges used to compute these values are shown in Table 3-2.)

In terms of program variations, the results of the logistic analysis essentially repeat the pattern of Table 3-1. Even when payment amounts and demographic characteristics are taken into account, Percent of Rent households were significantly more likely to accept the enrollment offer than Housing Gap households at both sites. The indicated difference was about 9 percentage points in Pittsburgh and 5 percentage points in Phoenix. In Pittsburgh the partial derivative for the Unconstrained dummy variable is small (.002) and the difference between Unconstrained and Housing Gap households is not significant. In Phoenix, the coefficient for the

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[1] The partial derivative is a linear approximation to the effect of a change in the independent variables. Where large changes are involved, these are sometimes calculated exactly, using as a base the logistic function at the mean of π_A.

Unconstrained dummy variable is larger than that for the Percent of Rent variable and the partial derivative shows that Unconstrained households had a probability of accepting that was about 6 percentage points higher than that of Housing Gap households. However, as in Pittsburgh, the difference is not significant. In sum, while the Percent of Rent offer was clearly somewhat more attractive than the Housing Gap offer, it is still unclear whether this reflected the housing requirements or the difference in payment formulas.

These differences in acceptance rates among the different program types were apparently concentrated among higher income households. As described in Chapter 2, the Housing Gap payment formulas included a group of low payment plans with income eligibility limits about 20 percent lower than those used for the rest of the allowance plans tested. Acceptance logits were re-estimated allowing for differences in program acceptance rates for households above and below this low eligibility limit.[1] The results showed small and insignificant differences in acceptance rates among the different program types for households with incomes below the low eligibility limit (which made up about two-thirds of the households offered enrollment). Estimated differences for the higher income households, on the other hand, were larger and significant at both sites.[2]

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[1]Separate estimation for the two income groups did not yield significantly higher likelihoods than estimation with a dummy variable and interaction for differences in program type effects.

		Separate	Pooled	Difference
-2 Log Likelihood (Degrees of Freedom)	Pittsburgh	1726.995 (33)	1733.049 (19)	6.054 (14)
	Phoenix	1268.869 (35)	1277.550 (20)	8.681 (15)

Test levels are given by $\chi^2_{.10}$ (14, 15) = (21.064, 22.307)

[2]The estimated partial derivatives and t-statistics for differences in acceptance rates for Percent of Rent and Unconstrained households as compared with Housing Gap households are

	Pittsburgh		Phoenix	
For Households Eligible for Low Payment Plan	Partial Derivative	t-Statistic	Partial Derivative	t-Statistic
Percent of Rent	0.034	1.31	0.029	1.32
Unconstrained	-0.047	0.89	0.014	0.33

(footnote continued on next page)

The estimated payment amount had a significant and positive relationship to acceptance for households in the lowest payment group at both sites. As the estimated payment amount increased, however, its marginal effect decreased at both sites. That is, the increase in the probability of accepting with a dollar increase in payment amount was larger at lower values of payments. Indeed, in both sites increases in payments beyond $80 had almost no estimated effect on acceptance rates. This may simply reflect the very high acceptance rates among households offered large payments.[1] Table 2-5 in Chapter 2, for example, showed that acceptance rates were generally from around 90 to 100 percent for households with estimated payments of $70 or more. Thus there may, in effect, have been little room for further increases once payments reached the $80 level.

In terms of demographic effects, Table 3-3 shows that although a number of household characteristics were related to the probability of accepting the enrollment offer in each site, the effects were generally modest. Only prior mobility and income had an estimated effect of more than 10 percentage points over their normal range. In addition, the patterns of demographic effects across the two sites are not consistent.[2] In Pittsburgh, younger households were more likely to accept than older households, black

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(footnote continued from preceding page)

For Households Not Eligible for Low Payment Plans	Pittsburgh Partial Derivative	Pittsburgh t-Statistic	Phoenix Partial Derivative	Phoenix t-Statistic
Percent of Rent	0.160	5.03**	0.086	2.38
Unconstrained	0.060	0.82	0.144	1.67†

It should be noted that these differences appear to reflect interactions between program acceptance and income group rather than between program acceptance and payment. Estimates allowing for interaction between program effects and low payment level showed no significant interaction.

[1] As noted earlier, the logistic specification in theory takes account of this, since the implied effect in participation rates for a given logistic coefficient becomes small at high levels of π_A.

[2] A test for homogeneity of demographic effects in the two sites showed a significant loss of explanatory power if observations for the two sites were combined, even when differences in the effects of program variations were allowed for. This held true for several specifications of program variations.

households than nonminority households, and large households than smaller households. The probability of accepting increased with the number of moves prior to the experiment and was also higher for households that were dissatisfied with their units or neighborhoods than for satisfied households. The number of moves prior to the experiment was also positively related to the probability of accepting the offer in Phoenix. Other effects were inconsistent, however. Black and Spanish American households were less likely to accept than nonminority households in Phoenix, whereas black households in Pittsburgh were more likely to accept. Age, household size, and dissatisfaction, although significant in Pittsburgh, had smaller and statistically insignificant effects in Phoenix. Contrary to expectations, participation in other transfer programs did not have a significant effect at either site.

Income effects were also opposite at the two sites. Among households in the lowest income group in Pittsburgh, the probability of accepting the enrollment offer increased significantly as income increased. In Phoenix, the relationship was significant and negative. At both sites, the effect of income changed significantly for households with incomes between $3,000 and $8,000. For this group, the effect of income was small and negative in Pittsburgh and close to zero in Phoenix. It is difficult to know how to interpret these differences, though it appears that for households with incomes over $3,000 the probability of accepting enrollment was effectively the same regardless of income.[1]

It should be noted that these demographic effects are estimated taking payment amount into effect. Given the significant effect of payment amount (at least in the zero to $80 range), the payment formula itself may have substantial effects on the demographic composition of participants.

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[1]The correlation between income and subsidy amount for Housing Gap households makes the analysis of income effects particularly difficult. Also, as noted above, income eligibility limits were lower for Housing Gap plans that had lower payment levels (because households that qualified for a zero payment amount under a given plan were not eligible, and some households that would have received benefits under higher payment plans did not qualify for payments under the lower payment plans). In order to see if the relationship between payment level and income eligibility levels was responsible for the nonlinear income effects observed, the equation was re-estimated separately for households above and below the lowest income limits. Income effects remained nonlinear, however. Other demographic terms were not materially affected either.

This can be illustrated by comparing acceptance rates by income level for Housing Gap and Percent of Rent households. The amount of the allowance payment decreased for Housing Gap households as their income increased, holding other factors constant. For Percent of Rent households, income had no direct relation to payment amount. Differences in enrollment rates caused by payment variations may thus lead to demographic differences in participation. Table 3-4 illustrates this point by showing the enrollment rates for Housing Gap and Percent of Rent households by income level, not controlling for payment amount. Acceptance rates decreased with income for Housing Gap households, since higher income households were, on average, eligible for lower subsidies. For Percent of Rent households, in contrast, where payment was not strongly related to income, little variation in enrollment rates by income level is observed.[1]

Overall, there are few strong patterns in acceptance. Payment amount, as expected, was significantly and positively related to acceptance. Higher payments produced higher rates of acceptance, at least up to payment levels of $80. Above this level, acceptance rates were generally around 90 percent or more. In addition, there were significant, if modest, differences in acceptance rates among the different program offers associated with either the housing requirements or the payment formula (as opposed to payment level). While demographic differences are apparent in each site, they also are generally modest in size and show no strong consistent pattern across the two sites.

The next sections further investigate both the reasons for which households rejected the offer and the role of payment formulas and housing requirements.

3.2 REASONS FOR DECLINING THE ENROLLMENT OFFER

A sample of households that declined the enrollment offer was interviewed and questioned about reasons for turning down the housing allowance program. Results indicate that the decision to enroll was a fairly complex one and that a number of different factors were important to households in considering the allowance offer. Table 3-5 shows the reasons for declining

[1] Rent and income are positively correlated, so that higher income households in the Percent of Rent plans may have tended to receive higher payments. The increase in mean rental expenditures associated with differences in household income is, however, relatively small.

Table 3-4

ACCEPTANCE RATES FOR HOUSING GAP AND
PERCENT OF RENT HOUSEHOLDS BY INCOME LEVEL

	PITTSBURGH		PHOENIX	
	NUMBER IN GROUP	ACCEPTANCE RATE	NUMBER IN GROUP	ACCEPTANCE RATE
HOUSING GAP HOUSEHOLDS				
Income level				
$4,000 or less	469	78%	344	86%
$4,001-$8,000	474	74	373	85
More than $8,000	139	63	173	71
PERCENT OF RENT HOUSEHOLDS				
Income level				
$4,000 or less	344	81	242	86
$4,000-$8,000	373	83	310	87
More than $8,000	101	81	123	89

SAMPLE: Housing Gap and Percent of Rent households that completed the enrollment interview.

DATA SOURCES: Baseline Interview, Household Events List.

Table 3-5

REASONS FOR DECLINING
THE ENROLLMENT OFFER

REASON FOR NOT ENROLLING[a]	PITTSBURGH		PHOENIX	
	PERCENTAGE GIVING REASON	PERCENTAGE GIVING REASON AS THEIR ONLY REASON FOR NOT ENROLLING	PERCENTAGE GIVING REASON	PERCENTAGE GIVING REASON AS THEIR ONLY REASON FOR NOT ENROLLING
(Number of cases)	(170)	(170)	(168)	(168)
Requirements, bother, paperwork	50%	12%	49%	5%
Objected to participating in a transfer program	41	12	47	12
Benefits from other programs would be reduced	8	1	5	1
Thought they were ineligible	14	1	24	4
The payment was too small	18	1	26	1
Didn't want to move	14	2	14	1
Personal reasons	18	4	18	1
Didn't understand the offer	12	1	11	2
Mean number of reasons given	1.8		1.9	

SAMPLE: Sample of households that declined the enrollment offer.
DATA SOURCE: Terminee Interview.
a. A household could give more than one reason.

enrollment given by the survey respondents. Households were allowed to give up to six different reasons for failing to enroll, so the table presents responses in two different ways. The first column for each site shows the percentage of all respondents that gave a particular reason at least once. The second column shows the percentage of respondents giving a particular reason as their only reason for not enrolling.

The requirements of the program, including paperwork and the general bother of participating, was the reason most frequently given for turning down the enrollment offer. About half of the households at both sites mentioned this as a reason for not enrolling. Objections to participating in a government program was second in frequency. Over 40 percent of the households at both sites mentioned that they did not enroll because they did not want to accept charity or otherwise objected to the idea of accepting money from the government. A number of other reasons were cited, but none accounts for more than about a quarter of the households that rejected the offer at either site. Twenty-four percent of the respondents in Phoenix felt that they would have been ineligible for the program and 26 percent mentioned that the payment was too small to make participation worthwhile. Eighteen percent of the respondents in Pittsburgh mentioned that the payment was too small and 18 percent cited personal reasons for not enrolling. Concerns that benefits from other programs might be reduced, an unwillingness to move, and a lack of understanding of the program offer were also mentioned, but less frequently than the other reasons.

The second column for each site in Table 3-5 shows that only about one-third of the households gave only one reason for turning down the offer, and no more than 12 percent of the households at either site cited any particular reason as the only reason they did not enroll. In Pittsburgh, program requirements and bother and objections to participating in government programs were given with equal frequency by respondents as their only reason for not enrolling. In Phoenix, objections to government programs was the most frequently given single reason for declining the enrollment offer. Thus, households appear to have had a variety of reasons for turning down the enrollment offer, with no single reason clearly predominating. The bother and paperwork of participating and general objections to accepting money from government programs were the most frequently mentioned reasons, but most households also cited some other reason as well.

The previous section suggested that both the payment formula used and the presence of housing requirements may have had an effect on households' decisions to enroll. Table 3-6 presents further evidence on this issue by showing reasons for declining enrollment separately for Housing Gap and Percent of Rent households.[1]

The table suggests that the housing requirements may have been an important factor in the enrollment decision for Housing Gap households, especially in Pittsburgh. Although program requirements were cited frequently as a reason for turning down the enrollment offer by both groups, a significantly higher percentage of Housing Gap than Percent of Rent households gave this reason in Pittsburgh.[2] Housing Gap households in Pittsburgh were also significantly more likely than Percent of Rent households to say that they turned down enrollment because the payment was too small. This may reflect the difference in the payment formula for the two groups, or it may reflect a decision on the part of Housing Gap households that the payment offered was not enough to compensate them for the cost of meeting the housing requirements. The only indication of possible objections to housing requirements in Phoenix is the fact that Housing Gap households were significantly more likely than Percent of Rent households to cite unwillingness to move as a reason for turning down the program. Overall, differences in the reasons cited by the two groups are suggestive but not conclusive regarding the importance of the housing requirements.

Some further evidence is available by comparing reasons given for rejecting the allowance offer with household perceptions of whether their current units would meet requirements. Housing Gap households in the survey sample were asked a series of questions about their perceptions of the housing requirements for their treatment group. Households were asked if they remembered being told about the requirement, if they understood it, and whether they felt the unit in which they were living at the

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[1] Unconstrained households are not shown because so few were included in the sample.

[2] Unfortunately, respondents' answers were not specific enough to distinguish objections to housing requirements from objections to other program requirements such as monthly reports, periodic interviews, and housing evaluations not related to requirements.

Table 3-6

REASONS FOR DECLINING THE ENROLLMENT OFFER
FOR HOUSING GAP AND PERCENT OF RENT HOUSEHOLDS

REASON FOR NOT ENROLLING[a]	PITTSBURGH PERCENTAGE GIVING REASON[b]		PHOENIX PERCENTAGE GIVING REASON[b]	
	HOUSING GAP HOUSEHOLDS	PERCENT OF RENT HOUSEHOLDS	HOUSING GAP HOUSEHOLDS	PERCENT OF RENT HOUSEHOLDS
(Number of cases)	(98)	(65)	(115)	(42)
Requirements, bother, paperwork	57%*	40%	48%	52%
Objected to participating in a transfer program	43	38	42	55
Benefits from other programs would be reduced	6	11	4	10
Thought they were ineligible	15	12	25	21
The payment was too small	26**	9	27	21
Didn't want to move	16	12	17*	5
Personal reasons	16	20	21	12
Didn't understand the offer	10	12	9	14

SAMPLE: Sample of households that declined the enrollment offer.
DATA SOURCE: Terminee Interview.
a. A household could give more than one reason.
b. Unconstrained households are not shown because only 6 Unconstrained households in Pittsburgh and 11 in Phoenix were included in the sample.

Test for significance of the difference between Housing Gap and Percent of Rent households:

† t-statistic significant at the 0.10 level (two-tailed).
* t-statistic significant at the 0.05 level (two-tailed).
** t-statistic significant at the 0.01 level (two-tailed).

time of the interview would have met the requirement. Table 3-7 presents the responses to these questions. Only 17 to 23 percent of the Housing Gap households declining enrollment at the two sites felt that they would have failed the housing requirements. In Pittsburgh, 55 percent of the respondents said they did not remember or understand the requirements and 28 percent felt they would have passed the requirements in the unit in which they were living at the time of the interview. Phoenix households were less likely to say they did not understand the requirements and more likely to feel that they would have passed. Forty-nine percent of the Housing Gap households declining the enrollment offer in Phoenix were living in units which they felt would have passed the program's housing requirements. These results indicate that if the housing requirements had an effect on the decision to enroll for Housing Gap households, it seems likely to have resulted from the households' general feeling about the requirements rather than from a conviction that their unit would fail to pass.[1]

Table 3-8 supports this conclusion by showing the reasons for not enrolling given by Housing Gap households that did not remember or understand the requirements, households that felt they would have passed, and households that felt they would have failed. The reasons given do not bear any systematic relationship to the households' perceptions about housing requirements. Contrary to what might be expected, households that felt they would have met the housing requirement were most likely to cite program requirements as a reason for not enrolling at both sites, suggesting that the problem of meeting requirements was not a major factor for these households. Households that felt they would not have met the requirements were more likely to mention that they did not want to move, which seems reasonable. Households not expecting to meet the requirements were less likely than other households to say that they found the payment too small, however. Overall, these results suggest that households were not considering the likelihood that they would have to move as offsetting the benefits to be gained from participating at the time they considered enrolling.

Section 3-1 showed that payment amount and some household demographic characteristics were related to accepting the enrollment offer. The reasons

[1]This is further confirmed by the fact that differences in acceptance among the different program types were confined to the upper third of the income distribution, as indicated in the previous section.

Table 3-7

PERCEPTIONS ABOUT COMPLIANCE WITH HOUSING REQUIREMENTS AMONG HOUSING GAP HOUSEHOLDS THAT DECLINED THE ENROLLMENT OFFER

PERCEPTIONS ABOUT COMPLIANCE WITH HOUSING REQUIREMENTS	PITTSBURGH		PHOENIX	
	NUMBER OF HOUSEHOLDS	PERCENTAGE GIVING RESPONSE	NUMBER OF HOUSEHOLDS	PERCENTAGE GIVING RESPONSE
Didn't remember being told about the requirement	12	12%	11	10%
Didn't understand the requirement	42	43	22	19
Felt they would have met the requirement	27	28	56	49
Felt they would not have met the requirement	17	17	26	23
Total	98	100	115	100

SAMPLE: Sample of Housing Gap households that declined the enrollment offer.

DATA SOURCE: Terminee Interview.

Table 3-8

MAJOR REASONS FOR DECLINING THE ENROLLMENT OFFER
BY PERCEPTIONS ABOUT COMPLIANCE WITH HOUSING
REQUIREMENTS FOR HOUSING GAP HOUSEHOLDS

REASON FOR NOT ENROLLING	PITTSBURGH — PERCENTAGE GIVING REASON AMONG:			PHOENIX — PERCENTAGE GIVING REASON AMONG:		
	HOUSEHOLDS THAT DIDN'T REMEMBER OR UNDERSTAND THE REQUIREMENT	HOUSEHOLDS THAT FELT THEY WOULD HAVE MET THE REQUIREMENT	HOUSEHOLDS THAT FELT THEY WOULD NOT HAVE MET THE REQUIREMENT	HOUSEHOLDS THAT DIDN'T REMEMBER OR UNDERSTAND THE REQUIREMENT	HOUSEHOLDS THAT FELT THEY WOULD HAVE MET THE REQUIREMENT	HOUSEHOLDS THAT FELT THEY WOULD NOT HAVE MET THE REQUIREMENT
(Number of cases)	(54)	(27)	(17)	(33)	(56)	(26)
Requirements, bother, paperwork	57%	67%	41%	45%	55%	35%
Objected to participating in a transfer program	43	59	18	42	43	38
The payment was too small	20	37	24	27	29	23
Didn't want to move	11	19	29	9	14	31
Personal reasons	24	4	12	24	14	31

SAMPLE: Sample of Housing Gap households that declined the enrollment offer.
DATA SOURCE: Terminee Interview.

given by different demographic groups for deciding not to enroll may give some indication of why these demographic differences occurred. For example, elderly households may have found the requirements more burdensome or have had more difficulty in understanding the offer. Households with a history of several moves in the previous three years may have had fewer objections to moving and may, therefore, have been less apprehensive about the housing requirements.

Table 3-9 shows the reasons for not enrolling given by households stratified by age, race or ethnicity, participation in other transfer programs, mobility in the three years prior to the experiment, and subsidy amount. The table does give some evidence that certain reasons were more important for some groups than others.

Elderly households in Pittsburgh were less likely than younger households to feel that the payment amount was too small and more likely to cite personal reasons for not enrolling. In Phoenix, elderly households were less likely to think they were ineligible than were younger households but were more likely to say they did not understand the program and more likely to cite personal reasons. Several other reasons varied significantly in frequency across age but not in a consistent direction. Reasons for declining enrollment did not vary significantly by race of household head in Pittsburgh. There was one significant variation in Phoenix--minority households were somewhat more likely than nonminority households to cite unwillingness to move as a reason for not enrolling.

Households already participating in transfer programs in Pittsburgh were more likely than other households to express a concern over losing benefits from other programs and also more likely to say they were unwilling to move. In Phoenix, households participating in other programs were less likely than other households to cite general objections to government programs and more likely to mention personal reasons or an unwillingness to move as reasons for not enrolling.

Prior mobility had little relationship to reasons for not enrolling. The percentage of households saying that they did not want to move declined as prior mobility increased, but the differences were not large enough to be significant. In Pittsburgh, the percentage of households that thought they were ineligible varied across number of prior moves, but not in a consistent direction.

Table 3-9

REASONS FOR DECLINING THE ENROLLMENT OFFER
BY DEMOGRAPHIC GROUP AND SUBSIDY AMOUNT

REASONS FOR NOT ENROLLING[a]	AGE OF HEAD			RACE/ETHNICITY OF HEAD			PARTICIPATION IN OTHER TRANSPROGRAMS		MOBILITY IN THE THREE YEARS PRIOR TO ENROLLMENT			SUBSIDY AMOUNT		
	30 OR YOUNGER	31-61	61 OR OLDER	BLACK	SPANISH AMERICAN	NON-MINORITY	NON-PARTICIPANT	PARTICIPANT	NO MOVES	ONE MOVE	TWO OR MORE MOVES	$10	$11-35	$36 OR MORE
						PITTSBURGH								
(Number of cases)	(23)	(61)	(86)	(22)		(148)	(112)	(58)	(110)	(42)	(18)	(33)	(46)	(39)
Requirements, bother, paperwork	57%	43%	53%	68%		47%	54%	41%	52%	48%	44%	64%	48%	33%
Objected to participating in a transfer program	52	38	41	32		43	46	33	42	36	50	39	46	36
Benefits from other programs would be reduced	0	15	5*	14		7	3	17**	8	7	6	3	4	8
Thought they were ineligible	13	18	12	19		14	15	12	13	24	0*	18	9	18
The payment was too small	30	23	12*	5		20	20	16	15	26	22	42	24	5**
Didn't want to move	0	16	16	23		13	10	22*	16	12	6	9	11	26†
Personal reasons	4	10	28**	27		17	18	19	21	12	17	6	13	18
Didn't understand the offer	9	10	14	18		11	12	10	12	12	11	6	7	18
						PHOENIX								
(Number of cases)	(47)	(73)	(48)	(11)	(54)	(103)	(125)	(43)	(63)	(43)	(61)	(33)	(28)	(71)
Requirements, bother, paperwork	45%	47%	56%	55%	37%	54%	49%	49%	46%	56%	48%	64%	57%	38%*
Objected to participating in a transfer program	60	40	46†	18	46	50	54	26**	41	56	48	37	57	46
Benefits from other programs would be reduced	2	3	10†	0	4	6	3	9	5	9	2	3	7	3
Thought they were ineligible	19	36	12**	9	30	23	23	28	27	23	23	24	18	25
The payment was too small	23	30	23	45	24	25	27	23	22	35	25	48	25	20**
Didn't want to move	9	12	23	26	19	10*	10	26*	19	14	10	3	7	27*
Personal reasons	0	19	33*	36	11	19	9	44**	24	14	13	12	18	24*
Didn't understand the offer	13	5	19†	18	11	11	11	12	11	14	8	12	25	7*

SAMPLE Sample of households that declined the enrollment offer
DATA SOURCE Terminee Interview
a A household could give more than one reason.
† Chi-square significant at 0.10 level.
* Chi-square significant at 0.05 level.
** Chi-square significant at 0.01 level.

Subsidy amount was related to several reasons for not enrolling. Households were less likely to cite the bother of program requirements as their subsidy amount increased. As would be expected, they were also less likely to say that the payment amount was too small to make enrolling worthwhile at higher subsidy amounts. On the other hand, higher subsidy households were more likely to mention that they did not want to move.

In general, these results suggest that the decision to enroll involved a number of different factors for different demographic groups, and that patterns often varied across the sites. Groups that were less concerned about one item were frequently more concerned about other items. The lack of strong and consistent demographic variations in the probability of accepting the enrollment offer probably reflects the variety of issues involved.

3.3 THE IMPORTANCE OF PAYMENT FORMULAS AND HOUSING REQUIREMENTS

The previous sections have indicated that the estimated allowance payment was an important factor in determining acceptance. There are two ways in which households may have reacted to the subsidy in deciding whether to enroll. Households may have based their decisions simply on the amount of the subsidy which they were offered during the enrollment interview. This is the amount which has been found to be important in the previous analyses. There is also a possibility that households considered the payment formula used to calculate their subsidy amount in deciding whether to enroll.

The payment formula indicates the potential for payment change as the household's circumstances change. For Percent of Rent households, the percentage rebate used in the payment formula indicates the amount by which the payment would increase if the household's rent increased. As described in Chapter 2, several different values of this coefficient were tested. If households were basing their enrollment decision on the potential for larger payments offered by the payment formula, then enrollment rates should be higher for plans with a higher percentage rebate in rent. For Housing Gap households, payments were based on an estimate of the gap between the cost of standard housing and a fraction of the household's income. Some allowance plans were more generous than others for households of the same size and income, however, and differences could reflect different effects of anticipated changes in income and household size.

In order to test the possible effect of payment formula, the logit equation for the probability of accepting the enrollment offer shown in Table 3-3 was re-estimated adding a series of dummy variables to represent the different values of coefficients in the payment formulas. Definitions of these variables are shown in Table 3-10.

Table 3-11 presents results for the dummy variables indicating payment formula coefficients. Coefficients and significance levels for the other variables were quite similar to those shown in Table 3-3.[1] As the table shows, only one of the ten payment formula variables was significant at either site. In addition, a chi-square test indicated that adding the variables to the equation did not significantly increase its explanatory power.[2]

Households appear to have based their enrollment decision on the amount of the payment as it was presented to them in the interview, not on the payment formula used for calculation. This result is not unexpected. The payment formulas used were fairly complex, and it is not surprising that households did not try to decide whether to accept the enrollment offer based on potential future effects of the payment formula parameters on their payment amounts.

Initial Housing Position for Housing Gap Households

If households did consider the problems of meeting the housing requirements in deciding whether to accept the enrollment offer, it seems reasonable to expect that Housing Gap households that felt their unit was likely to meet the requirements would be more likely to accept the enrollment offer. However, this type of decision would have required that households have a fairly strong feeling about their chances of passing the requirement. Section 3.2 indicated that many of the households that turned down the offer were confused, or at least unconcerned, about the nature of the requirements. The analysis which follows examines the extent to which households with a

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[1] See Appendix X for complete results.

[2] Note that these results are for the significance of the payment formula dummies in addition to the estimated payment amount. In a logit estimation of acceptance for Housing Gap households which included payment coefficients but not the estimated payment amount (Kennedy, et al., 1977, Tables 4-6a and 4-6b), the variable representing dC* level was positive and significant at both sites (the equation included only households in groups with b = .25).

Table 3-10

VARIABLES USED TO ESTIMATE
THE EFFECT OF PAYMENT FORMULA
ON THE DECISION TO ENROLL

VARIABLE	DEFINITION
PERCENT OF RENT LEVEL	
0.2	= 1 if household was in allowance plan with a = 0.2 = 0 otherwise
0.3	= 1 if household was in allowance plan with a = 0.3 = 0 otherwise
0.4	Excluded group (represented by dummy for Percent of Rent group)
0.5	= 1 if household was in allowance plan with a = 0.5 = 0 otherwise
0.6	= 1 if household was in allowance plan with a = 0.6 = 0 otherwise
HOUSING GAP LEVEL	
C* high	= 1 if household was in allowance plans using 1.2 C*, b = 0.25 = 0 otherwise
C*	Excluded group
C* low	= 1 if household was in allowance plans using 0.8 C*, b = 0.25 = 0 otherwise
b high	= 1 if household was in allowance plans using b = 0.35 = 0 otherwise
b low	= 1 if household was in allowance plans using b = 0.15 = 0 otherwise

Table 3-11

LOGIT ESTIMATION OF THE EFFECT OF PAYMENT FORMULA ON THE DECISION TO ENROLL

PAYMENT LEVEL	PITTSBURGH COEFFICIENT	PITTSBURGH t-STATISTIC	PITTSBURGH PARTIAL DERIVATIVE	PITTSBURGH EFFECT ACROSS USUAL RANGE	PHOENIX COEFFICIENT	PHOENIX t-STATISTIC	PHOENIX PARTIAL DERIVATIVE	PHOENIX EFFECT ACROSS USUAL RANGE
Percent of Rent Level								
0.2	0.150	0.56	0.026	0.024	-0.329	-0.92	-0.043	-0.043
0.3	0.007	0.03	0.001	0 001	-0.189	-0.54	-0.025	-0.025
0.5	-0.125	-0.47	-0.022	-0.022	-0.192	-0.53	-0.025	-0.025
0.6	-0.423	-1.06	-0.073	-0.073	-0.890	-1.88†	-0.116	-0.116
Housing Gap Level								
C* high	-0.047	-0.22	-0.008	-0.008	0.359	1.38	0.047	0.047
C low	0.087	0.45	0.015	0.015	-0.157	-0.79	-0.021	-0.021
b high	-0.027	-0.09	-0.005	-0.005	0.418	1.04	0.054	0.054
b low	0.065	0.24	0.011	0.011	0.364	1.24	0.047	0.047
Likelihood Ratio (Significance)			242.02**				154.26**	
Sample Size			1,896				1,664	
Mean of Dependent Variable			0.778				0.846	
Coefficient of Determination			0.121				0.108	

SAMPLE: Housing Gap, Percent of Rent and Unconstrained households that completed the enrollment interview, excluding households with incomes over $16,000.

DATA SOURCES: Baseline Interview, Household Events List.

\+ t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

NOTE: The complete logit equation is shown in Appendix X.

higher probability of passing the housing requirements were more likely to accept the enrollment offer.

Analysis of households that did enroll shows that households were least likely to be living in units that already met the Minimum Standards requirement and most likely to be living in units which already met the Minimum Rent Low requirement.[1] If households were basing their enrollment decision on an accurate evaluation of the chances that they already met their housing requirements, then acceptance rates should be highest for households in the Minimum Rent Low requirement group and lowest for households in the Minimum Standards group.

This hypothesis was tested by including variables to indicate the type of requirement in a logit estimation of the probability of accepting the enrollment offer for Housing Gap households. Table 3-12 shows the definition of the variables used and their estimated coefficients. As Table 3-12 shows, the probability of enrolling did not differ significantly for households in the Minimum Standards, Minimum Rent Low, or Minimum Rent High groups.[2]

Another variable that is strongly related to the probability that a household already met requirements is based on their Baseline rents. These can be used to provide a rough measure of how far the households was from meeting requirements. For Minimum Rent households, this Baseline distance is defined as the difference between a household's Baseline rent and its required minimum rent amount. For Minimum Standards households, the Baseline distance from meeting requirements has been calculated as the difference between a household's Baseline rent and the estimated cost of modest standard housing for a household of that size (the C* schedule used in the payment formula). Neither of these measures is exact, but both are strongly related to the probability that enrolled households in fact already met requirements.

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[1] See Chapter 4.

[2] The table shows only the coefficients for the two housing requirement variables. Coefficients for the other variables were similar to those in Table 3-3. See Appendix X for the complete equation.

Table 3-12

THE EFFECT OF TYPE OF HOUSING REQUIREMENT ON THE DECISION TO ENROLL FOR HOUSING GAP HOUSEHOLDS

VARIABLE	DEFINITION
Minimum Standards Requirement	= 1 if household is in the Minimum Standards group = 0 otherwise
Minimum Rent Requirement	= -1 if household is in the Minimum Rent Low group = 1 if household is in the Minimum Rent High group = 0 otherwise

LOGIT ESTIMATION OF EFFECT OF TYPE OF HOUSING REQUIREMENT ON DECISION TO ENROLL

	PITTSBURGH				PHOENIX			
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	EFFECT ACROSS USUAL RANGE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	EFFECT ACROSS USUAL RANGE
Difference in acceptance between:								
A Minimum Standards and a Minimum Rent requirement	-0.214	-1.44	-0.041	-0.041	0.164	1.12	0.024	0.024
A Minimum Rent High and a Minimum Rent Low requirement	0.038	0.39	0.007	0.014	-0.062	-0.53	-0.009	-0.018

SAMPLE: Housing Gap households that completed the enrollment interview, excluding households with incomes over $16,000.

DATA SOURCES: Baseline Interview, Household Events List.

NOTE: The complete logit equation is shown in Appendix X.

Again, estimates of the probability of accepting the enrollment offer including Baseline distance, shown in Table 3-13, do not suggest that acceptance was related to whether households met the housing requirements. Distance from meeting the requirements was not significant at either site.[1]

As a final test of the hypothesis that households already meeting the requirements were more likely to accept the enrollment offer, a logit estimation of the probability of meeting each requirement at enrollment was performed including only households enrolled in the experiment. If households' acceptance decisions were in fact related to whether or not they actually met requirements, then households enrolled in allowance plans that involved a given requirement should be more likely than other households to meet that requirement. Households enrolled in the Minimum Standards plans would be more likely to meet Minimum Standards requirements and households enrolled in the Minimum Rent plans would be more likely to meet the Minimum Rent requirements. In fact, logit estimation of the probability that enrolled households met the various requirements showed no significant relationship between being enrolled in an allowance plan and meeting its requirements at enrollment.[2] This again supports the conclusion that the probability that a household already met the housing requirements was not related to its probability of accepting the enrollment offer.

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[1] Results are shown only for the distance variables; the coefficients for the other variables are similar to those in Table 3-3. See Appendix X for the complete equation. A variable which treated meeting requirements as a dichotomous rather than a continuous variable was also tested but failed to be significant.

[2] The relevant logit coefficients and t-statistics were:

	Pittsburgh		Phoenix	
	Logit Coefficient	t-Statistic	Logit Coefficient	t-Statistic
Minimum Standards	0.058	0.26	-0.206	-0.95
Minimum Rent Low	-0.059	-0.26	0.053	0.26
Minimum Rent High	0.021	0.09	-0.023	-0.10

Table 3-13

THE EFFECT OF DISTANCE FROM MEETING REQUIREMENTS ON THE DECISION TO ENROLL FOR HOUSING GAP HOUSEHOLDS

VARIABLE	DEFINITION
Distance from meeting requirements[a]	= For Minimum Rent households: Minimum Rent level for household − Rent at Baseline Interview = For Minimum Standards households: Estimated cost of modest standard housing for household of a given size − Rent at Baseline Interview

LOGIT ESTIMATION OF EFFECT OF DISTANCE FROM MEETING REQUIREMENTS ON DECISION TO ENROLL

	PITTSBURGH				PHOENIX			
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	EFFECT ACROSS USUAL RANGE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	EFFECT ACROSS USUAL RANGE
Distance from meeting requirements	0.003	1.23	0.001	0.100	0.001	0.30	0.000	0.009

SAMPLE: Housing Gap households that completed the enrollment interview, excluding households with incomes over $16,000.

DATA SOURCES: Baseline Interview, Houshold Events List.

NOTE: The complete logit equation is shown in Appendix X.

a. To avoid negative values, the variable has been re-scaled by adding 1,000 to all values.

3.4 SUMMARY

Most households that completed the enrollment interview and were offered a chance to enroll in the program decided to accept the allowance offer. Acceptance rates were over 75 percent at both sites. As would be expected, the probability that a household decided to accept the enrollment offer was positively related to the amount of the allowance payment. The effect of increases in payments was smaller for higher payment levels. Indeed, for households offered payments over $80, further increases in the payment offered had almost no effect on acceptance. (The acceptance rate for this group was already about 90 percent, however.)

There is no consistent pattern of demographic effects at the two sites. This lack of strong demographic patterns in enrollment appears to reflect the number of different factors involved in the decision. Objections to program requirements and paperwork and objections to accepting money from government programs were the reasons most frequently given by households for not enrolling in the program, but they were rarely the household's only reason for not enrolling. Although reasons for not enrolling varied across demographic groups, patterns were complex, with one reason offsetting another for a given group. Acceptance rates also varied somewhat across the major housing allowance plans offered. Overall, acceptance rates for the Percent of Rent allowance offers were estimated to be from five to nine points higher than those for the Housing Gap offers.

The reasons for not enrolling given by Percent of Rent and Housing Gap households do not clearly indicate whether payment formula or housing requirements was the most important factor in differences between the two groups. There is no evidence that households considered the payment formulas in any detail in deciding whether to enroll; payment formula parameters had no effect on the decision to enroll over and above their relationship to the initial subsidy amount offered. Likewise, while there is some indirect evidence that housing requirements did play a role in reducing acceptance rates for the Housing Gap plan, this effect seems to be more in terms of general objections to requirements than any consideration of whether or not the household itself would find it difficult to meet requirements. The difference in acceptance between the Housing Gap and Percent of Rent offers was concentrated among high income households, which were more likely to

meet requirements. Furthermore, most households that rejected the enrollment offer appear either to have failed to understand the exact nature of the requirements or to have felt that their unit would pass the requirements. Nor is there any evidence that acceptance by Housing Gap households was related to the probability that they already met the requirements.

This apparent lack of concern with the details of the payment formulas and housing requirements seems quite reasonable. Faced with a new program, households may well have decided to accept or reject the offer on very general grounds, reserving the option to drop out later if the details of the program made it less appealing than it appeared in prospect.

REFERENCES

Kennedy, Stephen D., T. Krishna Kumar, and Glen Weisbrod, Report on Participation Under a Housing Gap Form of Housing Allowance, Cambridge, Mass., Abt Associates Inc., May 1977 (revised June 1980).

MacMillan, Jean, Mobility in the Housing Allowance Demand Experiment, Cambridge, Mass., Abt Associates Inc., June 1978 (revised June 1980).

CHAPTER 4

MEETING REQUIREMENTS AFTER ENROLLMENT

The analysis of Chapter 3 found relatively modest differences in acceptance rates among the different program offers. The amount of the allowance payment offered to households did affect acceptance, but only at low or moderate payment levels. Differences in housing requirements and payment formulas (apart from the immediate payment amount) also appear to have had some effect on acceptance rates. However, these effects were neither large nor systematic. They do not seem to have resulted in any strong differences among demographic groups in accepting different programs. Nor were they apparently related to whether households in fact met the various housing requirements.

The major difference in program participation rates arose after enrollment. Eligible households in the Percent of Rent and Unconstrained plans that accepted the enrollment offer qualified for payments and became participants when they enrolled. Households enrolled in the Housing Gap plans, on the other hand, still had to meet the housing requirements before they could qualify for payments and become participants. Meeting these requirements posed a major barrier to program participation. Because of them, overall participation rates in the Housing Gap plans were only about half those of the Percent of Rent and Unconstrained plans.

This chapter analyzes the participation of Housing Gap households after enrollment. Section 4.1 discusses the factors that would be expected to influence participation. This discussion suggests that the participation rates of Housing Gap households are in fact quite reasonable given the allowance offer, the requirements themselves, and the households' pre-enrollment housing situation. The speculations of Section 4.1 are supported by the results of a more detailed analysis of participation in Section 4.2. Section 4.3 then develops the implications of the findings in terms of differences in participation among demographic groups. Finally, Section 4.4 briefly summarizes the major results of the chapter.

4.1 DETERMINANTS OF PARTICIPATION AMONG HOUSING GAP HOUSEHOLDS

This section presents the model of subsequent participation among Housing Gap households used in this chapter. The presentation is deliberately heuristic and is intended to convey only the major issues behind the empirical specification. A more formal model is presented in Appendix XVII.

Households enrolled in the Housing Gap plans could, of course, change their minds about enrollment and drop out of the experiment for a variety of reasons. Apart from this, however, participation would be expected to revolve around the housing requirements and allowance payment. Most obviously, households that already met requirements when they enrolled qualified for payments immediately. Other households only became participants if they later met requirements in their enrollment units or moved to other units that did meet requirements.

As shown in Table 4-1, households that already met requirements at enrollment comprised a substantial proportion of participants in all of the Housing Gap programs tested. Indeed, only one-fifth to one-half of the participants in the various Minimum Rent plans were households that met requirements after enrolling in the experiment. In contrast, about two-thirds of the Minimum Standards participants in each site met requirements after enrollment. These differences mostly reflect differences in the proportion of households that already met requirements when they enrolled rather than differences in the participation rates of households that did not already meet requirements at enrollment.

The average allowance payment offered to households that did not already meet requirements at enrollment was almost $70 in Pittsburgh and almost $90 in Phoenix. Despite this, only 34 percent of these households in Pittsburgh and 42 percent in Phoenix later met requirements. Thus, most households never became participants unless they had already met the requirements before they enrolled. The rest of this section discusses why so many households never participated, despite the offer of apparently generous allowance payments.

The basic idea behind the participation function estimated in this chapter can be most easily explained by starting with a Minimum Rent requirement. Some Minimum Rent households that did not meet requirements at enrollment

Table 4-1

INITIAL PAYMENT STATUS AND SUBSEQUENT PARTICIPATION

	PITTSBURGH				PHOENIX			
	ALL HOUSING GAP HOUSEHOLDS	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM HIGH RENT REQUIREMENT	ALL HOUSING GAP HOUSEHOLDS	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
Percentage of enrolled households that received a full payment at enrollment	33%	15%	64%	35%	29%	19%	53%	27%
(Number of cases)	(592)	(268)	(156)	(168)	(662)	(307)	(167)	(188)
Subsequent participation rate for households that received a full payment at enrollment	100	100	100	100	100	100	100	100
(Number of cases)	(197)	(39)	(100)	(58)	(195)	(57)	(88)	(50)
Subsequent participation rate for households that did not receive a full payment at enrollment	34	30	48	35	42	44	46	37
(Number of cases)	(395)	(229)	(56)	(110)	(467)	(250)	(79)	(138)
Subsequent participation rate for all enrolled households	56	40	81	58	59	54	74	54
(Number of cases)	(592)	(268)	(156)	(168)	(662)	(307)	(167)	(188)
Percentage of all participants that received a full payment at enrollment	60	36	79	60	50	34	71	50
(Number of cases)	(331)	(107)	(127)	(97)	(391)	(166)	(124)	(101)

SAMPLE: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCE: payments file.

would, of course, have met the requirements normally over time in the absence of an allowance offer. The probability that a household would have met the Minimum Rent requirement in the absence of any allowance offer is simply the probability that its normal expenditures, R_N, would have equalled or exceeded the required level at some point during the experiment. Thus,

(1) $$\pi_N = \text{Prob}(R_N \geq R_M)$$

where

π_N = the normal (nonexperimental) probability that the household would have met the Minimum Rent requirements

R_M = the expenditure level necessary to meet the housing requirements, and

R_N = the household's normal housing expenditures.

For households that would have met requirements anyway, the allowance program posed no special burdens beyond those associated with transfer programs in general. As already discussed in Chapter 3, households did not necessarily find participation to be without drawbacks, even apart from the housing requirements. They may have been reluctant to accept money from the government, found the various reporting requirements onerous, or have had other objections.[1] Thus, for households that would normally have met requirements after enrollment, the probability of participating is simply given by:

(2) $$\pi_{EN} = \text{Prob}(C_P < S)$$

where

π_{EN} = the probability of participating for households that would have met requirements normally

C_P = general participation "costs" and

S = the allowance amount offered.

[1] On the other hand, some households may have actually enjoyed participation. Site office staff, for example, believed that some households required regular assistance with the monthly reporting forms because of the opportunity this afforded for social contact.

The households analyzed in this chapter had, of course, already accepted the enrollment offer. In view of this, it is possible that, within the sample of enrolled households, all households that would have met requirements normally participated (that is, that C_P was always less than the payment offered for households that accepted the enrollment offer).[1]

There is at least one important caveat to this possibility, which applies as well to all of the participation rates discussed in this chapter. Meeting requirements takes time, and in some cases considerable time. If a household became ineligible, for example, before it met requirements, then it might not have participated simply because it did not have time to participate. While this factor could have reduced the observed participation rate in the Demand Experiment, it would also reduce the participation rate (in terms of the currently eligible population) in an operating program. At any instant in time, some households newly eligible for an operating program would not be participants simply because they had not yet had time to apply for the program and meet requirements. This factor is discussed further in Chapter 5. For the moment, it is sufficient to point out that the participation rates analyzed here are affected by such turnover in the eligible population and may be regarded as relating to the participation rate in an ongoing program expressed in terms of currently eligible households.

Households that would not normally have met Minimum Rent requirements had to increase their housing expenditures in order to receive their allowance payments. Ignoring for the moment any transaction costs involved in arranging to meet requirements, these households should have been willing to participate if the allowance offer was generous enough to cover the additional spending required (plus any general participation costs)--that is, if

$$S > \left(R_M - R_N\right) + C_P \tag{3}$$

[1] This is, of course, not necessarily true. The acceptance decision could have been revised in the light of actual experience with the program's requirements. In addition, actual payments may have been different from the estimates provided during the enrollment interview and may also have changed over time due to changes in household size and income.

where

S = the allowance payment offered

R_M = the housing expenditure level necessary to meet requirements

R_N = the household's normal housing expenditures and

C_P = general participation costs.

In fact the allowance payment may not have had to cover the entire increase in housing expenditures necessary to meet requirements. The household may also be partially compensated for its increased expenditures by obtaining better housing. However, if in the absence of the allowance offer the household would not have chosen to spend the required amount on housing, it would be expected to value the improvements in its housing at less than their cost. Thus, Equation (3) may be modified to the requirement that

$$(3') \qquad S > R_M - R_N - V_M + C_P$$

where V_M is the value to the household of the improved housing obtained at expenditures R_M.[1]

Based on Equation (3'), the participation rate for households that would not have met requirements normally is given by[2]

$$(4) \qquad \pi_E = \text{Prob}\left[S > (R_M - R_N) - V_M + C_P\right]$$

where

π_E = the participation rate

S = the allowance payment offered

R_M = the expenditure level necessary to meet the housing requirements

R_N = the household's normal housing expenditures

V_M = the value to the household of the improvements in housing obtained under expenditures R_M, and

C_P = general participation costs.

---

[1] V_M will generally be some function of R_M and R_N with $V_M < (R_M - R_N)$.

[2] It may be noted in passing that in theory any compensation for C_P should be added to household income in specifying R_N and V_M.

If $(S - C_P)$ is positive (if all enrolled households would participate in the absence of housing requirements), Equation (4) also applies to households that would normally meet requirements.[1] Thus for Minimum Rent households, the participation rate is simply given by the proportion of households whose normal expenditures lay above some point below the required levels.[2]

Minimum Standards households faced a somewhat different situation. Like Minimum Rent households, these households had to be willing to spend whatever amount was necessary to obtain a unit that met the requirements. In addition, however, the Minimum Standards requirement specified that the unit had to have certain specific features. For a given expenditure level, this would generally require the household to give up some other features that it would prefer (unless, given that rent, it would itself normally select a unit that met Minimum Standards). This in effect reduces the value of the unit obtained to the household (the V_M term in Equation (4)) and may even make it negative. Thus, recognizing that (for a given value of R_M) V_M is generally lower for Minimum Standards households than for Minimum Rent households, Equation (4) may be used for both sorts of requirements.

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[1] Equations (2) and (4) give

(i) $$\pi_{EN} = \text{Prob}[S > C_P]$$

(ii) $$\pi_E = \text{Prob}[S > (R_M - R_N) - V_M + C_P] \ .$$

In general, Equation (4) will not apply to households that would normally meet requirements (for which $R_N > R_M$ and $V_M = 0$) since this would imply C_P for these households was reduced by $(R_N - R_M)$. If, however, $S > C_P$ for all households, then π_{EN} is one and also equals the probability that $(S > C_P - \alpha)$, where α is any positive number. In this case, then, the π_{EN} formulation will also apply to π_E since for $R_N > R_M$.

(iii) $$\pi_E = \text{Prob}[S > (R_M - R_N) + C_P] = 1 = \pi_{EN}$$

[2] Equation (4) may be rewritten as the probability that $(R_N > R_M - (S + V_M - C_P))$. Since V_M is nonnegative, if $S - C_P$ is always positive, this amounts to saying that a household participates if R_N is above some point less than R_M.

The model of Equation (4) ignores transaction costs. Households that would not normally meet the requirements had to arrange either to meet requirements in their enrollment units or to move to new units. Either of these could involve some costs to the household. There is considerable evidence that moving is difficult, not only because of the effort and cost involved in finding and moving to a new unit, but also, in some cases at least, because of the psychological loss involved in giving up a unit (and possibly neighborhood) in which they have lived for some time, may have many friends and relatives, and generally know their way around (MacMillan, 1978). Nor is the alternative of arranging to meet requirements in place without cost to the household. For Minimum Standards households, upgrading their enrollment units could involve either negotiations with their landlords for improvements (possibly in exchange for increased rents), or the households themselves directly arranging for the necessary repairs.[1] Likewise, while arranging to meet Minimum Rent requirements in place seems simple enough to accomplish, it appears that in fact Minimum Rent households that later met requirements in their enrollment unit may all have done so as part of the normal process of changes in rent.[2] The option of arranging to pay a slightly higher rent in order to qualify for payments simply may not have seemed appropriate to most households.

In either case, these "transaction costs" are likely to have been much lower for households that would have moved anyway in the absence of the allowance offer. For these households, the additional effort involved in moving to a unit that met requirements only involved finding a unit that met the requirements.[3] Alternatively, households that changed their minds about

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[1] There is some evidence that most of the additional upgrading induced by the allowance offer was in fact directly paid for (or carried out by) the households themselves. See Merrill and Joseph (1979), Chapter 2, Section 2.3.

[2] See Merrill and Joseph (1979), Chapter 3.

[3] These assertions should be qualified. It is possible, of course, that a household that was trapped in its unit by financial necessity could have welcomed the opportunity afforded by the allowance to move to a better unit. This is related to a moderately subtle caveat for all of the preceding discussion. The normal behavior used to distinguish households that would or would not have met the requirements in the absence of the allowance offer should theoretically be defined in terms of normal behavior if they were given the allowance payment with no housing requirements. The apparent response to changes in income is, however, small enough that this distinction may be ignored in practice. See Appendix VIII for details.

moving in order to upgrade their enrollment unit would be spared the normal costs associated with moving. Thus Equation (4) should be modified by the addition of

$$C_T = C_T(M); \quad C_T(1) < C_T(0) \tag{5}$$

where

C_T = the transaction costs involved in meeting requirements, and

M = a dummy variable that is one if the household would normally move.

Incorporating these terms into Equation (4) yields

$$\pi_E = \text{Prob}\left[S > (R_M - R_N) - V_M + C_T + C_P\right] \tag{6}$$

where

π_E = the participation rate

S = the allowance payment offered

R_M = the expenditure level necessary to meet the housing requirements

R_N = the household's normal housing expenditures

V_M = the value to the household of the improvements in housing obtained under expenditures R_M (given the housing requirements)

C_T = additional transaction costs involved in meeting requirements, and

C_P = general participation costs.

The participation rate is a function of the allowance payment offered (S); the increase in expenditures necessary to meet requirements ($R_M - R_N$), modified by the value to the household of any housing improvements obtained in meeting requirements (V_M); transaction costs (C_T); and the general costs of participation (C_P).

The rest of this section offers a preliminary assessment of the importance of the various elements of Equation (6), based primarily on tabular comparisons. This lays groundwork for the more complete analysis of Section 4.2.

None of the independent variables in Equation (6) is observed directly. This is obviously true of the terms in transaction costs and general participation costs (C_T and C_P), as well as the value of housing obtained (V_M). It is also true of the increases in housing expenditures needed to meet requirements ($R_M - R_N$), since the household's normal rent is not known. Even the amount of the allowance payment offered, though known for any particular point in time, cannot be characterized with certainty, since payments changed with changes in income and household size. One reasonable approximation for at least the first three terms of Equation (6) would be to use the net cash payment at enrollment

$$S - (R_M - R_N) \cong S_0 - (R_M - R_0) \tag{7}$$

where

S_0 = the payment offer at enrollment (minus $10)[1]

R_M = the expenditures necessary to meet requirements, and

R_0 = expenditures at enrollment.[2]

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[1]The payment is reduced by $10 to reflect the fact that households received a $10 payment each month if they met reporting requirements. Thus the additional payment that the household would obtain by meeting requirements was $10 less than the payment offer at enrollment.

[2]The use of enrollment rents as a proxy for normal spending (R_N) should, if anything, underestimate R_N. Households that did not meet requirements had lower average rents than households that did meet requirements and thus lower average rents than the enrolled population as a whole. The usual phenomenon of regression towards the mean would suggest that normal rents for these households would be somewhat higher than R_0. In fact, there is a fairly strong serial correlation in rental expenditures over time, so that this effect is at least mitigated.

In addition, the formulation in Equation (7) does not take account of inflation. Using hedonic indices, Merrill (1977) estimated annual rates of inflation for housing prices in the two sites over the two years of the experiment to be about 7 percent in Pittsburgh and 5 percent in Phoenix (Merrill, 1977, Table 4-16). For Minimum Standards households, both R_M and R_N may increase at the same rate so that the approximation of Equation (2) would tend to overestimate the true net payment. For Minimum Rent households, inflation would be expected to increase the dollar value of R_N. In this case, Equation (2) will underestimate the true net payment. Both payments and Minimum Rent requirement levels were adjusted at the end of the first year to take account of inflation. However, there was still a one-year lag between enrollment and the adjustment. Thus there may still be some tendency for Equation (2) to overestimate net payments for Minimum Standards and underestimate them for Minimum Rent.

For Minimum Standards households, the average level of spending necessary to meet requirements may be at least roughly estimated by the average rents paid by households that did meet the requirements at enrollment. For Minimum Rent requirements, on the other hand, the necessary expenditure levels would seem to be defined by the requirement itself. In fact, however, this does not seem to be the case. Minimum Rent households were rarely able to meet the requirements exactly. Comparison of the actual expenditures of Minimum Rent and Control households that met requirements after enrollment show that both groups exceeded the Minimum Rent requirements by about the same amount. This suggests that a better estimate of necessary expenditure levels for Minimum Rent households as well is the average rent paid by Control households that met the requirement at enrollment.[1]

Under Equation (6), the participation rate for households that did not meet requirements at enrollment should be equal to the proportion of households with positive net payments, except for transaction costs and general participation costs on the one hand and the value of housing improvements on the other. Table 4-2 compares these two rates, using the expected net payment defined by Equation (7). Based on this calculation, the proportion of Minimum Rent households that participated is somewhat greater than the proportion with positive expected net payments. For Minimum Standards households, on the other hand, participation rates are well below the proportion of households with positive expected net payments and closer to the proportion with expected net payments greater than $20 per month. This difference between the two requirements does not seem unreasonable. As discussed earlier, meeting Minimum Standards requirements involved more than simply agreeing to spend a certain amount on housing. Households also had to live in units that met a fairly extensive list of requirements. This might both involve giving up some features that the household would prefer (or spending even more to obtain them) and expending more time and effort

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[1] This is discussed further in Appendix VIII. It should be pointed out that the hypothesis that households cannot reasonably meet the Minimum Rent requirements exactly, or in some cases, even come within a fairly large range above them, is critical to the success of the model. As Appendix VIII shows, if this is not the case, then the model of Equation (6) is demonstrably inadequate to explain the participation rates actually observed.

Table 4-2

PERCENTAGE OF HOUSEHOLDS WITH POSITIVE EXPECTED NET PAYMENTS[a]

HOUSING GAP HOUSEHOLDS THAT DID NOT RECEIVE A FULL PAYMENT AT ENROLLMENT	PITTSBURGH		PHOENIX	
	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT REQUIREMENT	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT REQUIREMENT
Proportion that participated	30%	40%	44%	40%
Proportion with positive expected net payments	57	37	59	35
Proportion with expected net payments greater than $20/month	40	17	40	23
(Number of cases)	(229)	(166)	(250)	(217)

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial Household Report Form, payments file.

a. Expected net payments at enrollment are defined as the difference between the allowance payment offered at enrollment and the expected increase in rent needed to meet requirements. The expected increase in rent needed to meet requirements is estimated by the mean rent of Control households that met the requirements at enrollment, controlling for household size and site.

to find a unit that met the requirements.[1]

The tabulations in Table 4-2 also suggest that for Minimum Rent households, at least, the other terms in Equation (6) had reasonably small values on average. The fact that participation rates under Minimum Rent exceeded the proportion of households with positive net payments suggests that among

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[1]It should be noted that this calculation is crude and probably misestimates the true proportion of households with expected positive net payments. To see this, recognize that the net payment calculated in Equation (7) is calculated with error (as discussed in the text). Thus,

$$y = \chi + \varepsilon$$

where

y = the true net payment

χ = the measured net payment

ε = the error of measurement.

Consider, for example, the case in which χ and ε have independent normal distributions

$$\chi \sim N(\mu, \sigma_x)$$
$$\varepsilon \sim N(0, \sigma_\varepsilon)$$
$$y \sim N\left(\mu, \sqrt{\sigma_x^2 + \sigma_\varepsilon^2}\right).$$

The true proportion of households with positive net payments ($y > 0$) is given by

$$\pi_T = 1 - F\left(\frac{-\mu}{\sqrt{\sigma_x^2 + \sigma_\varepsilon^2}}\right)$$

where F is the unit normal distribution. The measured proportion $\hat{\pi}$, has expected value π_m where

$$\pi_m = E(\hat{\pi}) = 1 - F\left(\frac{-\mu}{\sigma_x}\right).$$

If μ is negative (i.e., π_m is less than 0.5), then it is clear that

$$\pi_T > \pi_m,$$

since $\sigma_x^2 + \sigma_\varepsilon^2$ is greater than σ_x^2. Likewise, if π_m is greater than 0.5, π_T is less than π_m. Thus, given the values in Table 4-2, the estimated proportion with positive net payments may be overestimated for Minimum Standards and underestimated for Minimum Rent.

These conclusions could change, of course, if the $E(\varepsilon)$ were nonzero or ε and χ correlated.

enrolled households the average value of housing improvements obtained by meeting requirements may exceed the average costs of arranging to meet requirements (C_T) and of participation in general (C_p).[1]

In fact, households that moved were much more likely to meet requirements than those that stayed in their enrollment units. This may, however, reflect at least three different factors. First, since the households considered here all failed to meet requirements in their enrollment units, households that changed units would be expected to meet requirements more often than those that stayed in their enrollment units. Second, among Experimental households, households that moved may to some extent have been households that moved because they had decided to participate. Indeed, MacMillan (1978) estimates that among Housing Gap households that did not meet requirements at enrollment and moved during the first two years of the experiment, from 10 to 23 percent, depending on housing requirement and site, were induced to move by the allowance offer.[2] Third, households may in fact be more willing to respond to the allowance offer and change their housing in order to meet requirements if they were going to move anyway. Sorting these factors out requires the more elaborate estimation procedures of the next section.

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[1]Alternatively, this could reflect underestimation of the proportion of Minimum Rent households with positive net payments as noted at the end of the previous paragraph.

[2]MacMillan (1978) estimated the probability of moving for a Housing Gap household that did not meet requirements at enrollment (π_1) as a logistic function of a variety of individual characteristics (summarized as β_1) and an experimental effect (α). Under this model, the normal probability of moving in the absence of the allowance offer (π_1^N) is $[1 + \exp(-\beta_1)]^{-1}$, whereas the probability of moving with the allowance offer (π_1^E) is $[1 + \exp(-\beta_1-\alpha)]^{-1}$. As is well known, under the logistic specification, π_1^N, can be approximated by

$$\pi_1^N \simeq \pi_1^E - \pi_1^E (1-\pi_1^E)\alpha \qquad (1)$$

Thus, letting barred variables stand for expected mean values, the proportion of Experimental households that moved that were induced to move by the experimental offer is

$$\gamma = \frac{\bar{\pi}^E - \bar{\pi}^N}{\bar{\pi}^E} \simeq \frac{\overline{\pi_1^E(1-\pi_1^E)\alpha}}{\bar{\pi}^E} < (1-\bar{\pi}^E)\alpha \text{ for } \alpha > 0, \qquad (11)$$

(footnote continued on next page)

4.2 THE PROBABILITY OF PARTICIPATING FOR HOUSEHOLDS THAT DID NOT MEET REQUIREMENTS AT ENROLLMENT

The previous section suggested that the participation of households that did not meet requirements at enrollment would be expected to depend on the change in rent involved in meeting requirements, the payment offered, and the difficulty involved in arranging to meet requirements by moving or by changes in the household's enrollment unit. This section presents estimates of the probability of participating in terms of these factors. Special attention is paid to determining whether there are any demographic differences in participation that are not captured by the three factors listed above and to comparisons with the rate at which Control households met requirements in the absence of an allowance offer.

Under the model presented in Equation (6), a household should have participated if

$$N - S - (R_M - R_N) + V_M - C_T - C_P > 0 \qquad (8)$$

(footnote continued from preceding page)
where the inequality in (11) follows from the fact that $E(\pi_1^2)$ is greater than $(E(\pi_1))^2$. Thus an upper bound for the proportion of movers that were induced to move by the allowance is $(1-\pi^E)\alpha$. MacMillan's estimates for α (MacMillan, 1978, Appendix IX) are:

	Pittsburgh		Phoenix	
	Minimum Standards	Minimum Rent	Minimum Standards	Minimum Rent
$\hat{\alpha}$	0.408	0.360	0.226	0.682

(The Minimum Rent coefficients are weighted averages of MacMillan's estimates for the two Minimum Rent groups, using as weights the proportion of households not meeting requirements at enrollment from Table 4-1.)

The mobility rates for households that did not meet requirements at enrollment and were actively enrolled at the end of two years are:

	Pittsburgh		Phoenix	
	Minimum Standards	Minimum Rent	Minimum Standards	Minimum Rent
Mobility rate	0.45	0.35	0.58	0.67
	(155)	(126)	(137)	(136)

Applying MacMillan's estimates of α to the mobility rates above gives:

	Pittsburgh		Phoenix	
	Minimum Standards	Minimum Rent	Minimum Standards	Minimum Rent
$\hat{\gamma}$	0.22	0.23	0.10	0.23

where

N = the net value to the household of participating

S = the allowance payment offered

R_M = the expenditure level necessary to meet the housing requirements

R_N = the household's normal housing expenditures

V_M = the value to the household of the improvements in housing obtained under expenditures R_M (given the housing requirements)

C_T = additional transaction costs involved in meeting requirements, and

C_P = general participation costs.

None of the variables in Equation (8) is known with certainty. The empirical specification of Equation (8) used in this section began by replacing these variables with a stochastic specification based on observables, specifically

$$N = \alpha_0' + \alpha_1' R_R + \alpha_2' R_0 + \alpha_3' e_0 + \alpha_4' \hat{P}_M + \alpha_5' \ln \hat{P}_M + \alpha_6' S_0 - \delta \tag{9}$$

where

N = the net value to the household of participating

R_R = the required expenditure level (for Minimum Rent households) or the estimated cost of standard housing (for Minimum Standards households)

R_0 = the household's housing expenditures at enrollment

e_0 = the residual from a regression of enrollment housing expenditures on various household characteristics

$\hat{P}_M$ = the estimated probability that a household would normally move in the absence of the allowance offer

S_0 = the allowance payment at enrollment, and

δ = a stochastic term.

The probability that a household participates under this specification is simply the probability that δ is small enough to make the net value, N,

positive, given the values of the other variables. For purposes of estimation, δ was assumed to be distributed logistically, so that[1]

$$(10) \qquad \ln\left(\frac{\pi_E}{1-\pi_E}\right) = \alpha_0 + \alpha_1 R_R + \alpha_2 R_0 + \alpha_3 e_0 + \alpha_4 \hat{P}_M + \alpha_5 \ln\hat{P}_M + \alpha_6 S_0 .$$

The term in the required expenditure level (R_R) is used to represent R_M in Equation (8). As discussed in Section 4.1, the actual value of R_M is stochastic and for Minimum Rent households, lies above the required level R_R. The presumption, however, is that R_R and R_M are positively related, so that the expected sign for α_1 is negative.[2]

The terms in R_0, e_0, and $\hat{P}_M$ all relate to normal expenditures R_N. These arise as follows. Assume that a household's normal housing expenditures (given market prices) are a function of income and various other household characteristics, so that

$$(11) \qquad R_N = X\beta_N + \varepsilon_N$$

where

R_N = normal housing expenditures

X = a vector of household descriptors

β_N = a vector of unknown coefficients, and

ε_N = a stochastic term.

The stochastic term, ε_N, appears to be serially correlated[3] so that

---

[1] The relation in Equation (10) refers to a standardized logistic variable. Thus the coefficients of Equation (10) are related to those of Equation (9) by

$$\alpha_i = \frac{\alpha_i'}{k}, \quad k = \frac{\sqrt{3}}{\pi}\sigma$$

where σ is the standard deviation of δ.

[2] This point may require some elaboration. The normal probability that a household met the Minimum Rent requirements in the absence of any experimental offer was Prob($R_N > R_R$). This is, of course, equal to Prob($R_N > R_M$) for each of these households, by definition. To the extent that a household would not normally meet the requirements in the absence of the allowance offer, R_M must exceed R_R. For these households, R_M is the relevant variable. A household might well be willing to agree to housing expenditures of R_R, but not R_M. In this case, it would not participate since it finds no acceptable unit available in the range (R_R, R_M).

[3] See Friedman and Weinberg (1979) for evidence of this.

(12) $$\varepsilon_N^t = \rho^t \varepsilon_N^0 + \theta_N^0 .$$

Thus if changes in the household descriptors are ignored, normal household expenditures in later periods may be expressed in terms of initial expenditures (R_N^0) and the initial stochastic value (ε_N^0) by

$$R_N^0 = X^0 \beta_N + \varepsilon_N^0$$

$$R_N^t = X^0 \beta_N + \varepsilon_N^t$$

$$= X^0 \beta_N + \rho^t \varepsilon_N^0 + \theta_N^t$$

(13) $$R_N^t = R_N^0 - (1-\rho^t)\varepsilon_N^0 + \theta_N^t$$

Thus both R_0 and the residual at enrollment from Equation (11) may be used to predict R_N. Since R_0 is positively related to R_N^t and e_0 negatively related to R_N^t (given R_0), the expected signs for α_2 and α_3 are positive and negative, respectively. In practice, however, the explanatory power of estimates based on Equation (11) was low enough that the term in e_0 provided no significant improvement over estimates of participation based on R_0 alone. Thus this term was dropped from the final specification.

Normal expenditures, or more generally, the normal probability of meeting any of the requirements, should also be related to whether or not the household would normally move. Substantial changes in either unit features or rent are clearly less likely for households that do not move than for those that do. Since all the households analyzed in this section failed to meet requirements at enrollment, they would be expected to have a higher normal probability of meeting requirements if they would normally have moved. Thus the expected sign of α_4 is positive. The estimated normal probability

of moving is taken from estimates in MacMillan (1978), as detailed in Appendix II.[1]

As discussed in Section 2.1, the probability that a household would normally move may also affect its willingness to change its housing in response to the experimental offer. In particular, a household that would move anyway might be expected to be more willing to change its intended unit to meet the requirements than a household that would normally remain in its existing unit. This additional effect of the probability of moving is represented by the term $\ln\hat{P}_M$, which represents the expected cost to the household of having to move, given that it would not move normally.[2] In practice, this term was generally not significant and was dropped from the final estimations.[3]

The term in Equation (8) for the value to the household of housing improvements is not directly represented in Equation (10). Instead, it is assumed to be a function of R_M and R_N and thus represented indirectly by the terms relating to these variables.

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[1]The simple addition of a term in $\hat{P}_M$ to Equation (10) ignores the fact that the distribution of R_N is apparently different depending on whether or not households would normally move. (Indeed, the differences between these distributions is one of the determinants of the probability of moving; unfortunately, it is not the only or even the major determinant. See MacMillan (1978) and Friedman and Weinberg (1978), Appendix VII). Thus the distribution of R_N is a mixture of two distributions. Representing this by a term in $\hat{P}_M$ is clearly inadequate, at least in theory. A variety of alternative specifications involving interaction of $\hat{P}_M$ with initial expenditures, the difference between initial expenditures and required levels, and the payment amount were all tried with no significant improvement in the likelihood of the estimated equation.

[2]This is based on a logistic specification of the probability of moving. For details, see Appendix XVII.

[3]The term in $\ln\hat{P}_M$ in theory only arises if the household cannot more easily arrange to meet requirements in its original unit instead of moving. Merrill and Joseph (1979) find that, as might be expected, such in-place participation was generally confined to households that were relatively close to meeting requirements. Thus as an alternative specification to Equation (10), $\ln\hat{P}_M$ was entered only for households with values of $R_R - R_O$ greater than \$15 (based on Merrill and Joseph, 1979, Table 3-6). This specification again generally showed no significant effects for $\ln\hat{P}_M$.

The allowance payment offered to the household, S, in Equation (8) is again not known with certainty. The amount of the payment is, of course, known at any particular time, but may in prospect differ from this depending on expected changes in household size and income. This value is represented in Equations (9) and (10) by the payment offered at enrollment. In actual estimation, this payment amount was further decomposed into two variables in order to separate the effects of payment per se from its association with demographic variables.

As described in Chapter 2, Housing Gap households were offered payments calculated under the formula

(14) $$S = dC^* - bY$$

where

S = payment amount

C* = the estimated cost of modest, existing standard housing in each site, varied by site and household size

Y = household income, and

d,b = payment level parameters.

Thus, variations in payment amount depend on the variations in payment parameters (d and b) among the different allowance plans tested in the experiment and on differences in household size and income among households enrolled in the experiment. The two payment variables used in estimation essentially allocate variations in payment amounts between these two factors. The first variable (the "payment level" variable) is the payment that the household would receive if it were a household of size four with an income equal to the sample mean. Variations in the value of this variable reflect only variations in the payment parameters of the different allowance plans in which households were enrolled. The second variable (the "residual payment" variable) is simply the difference between the actual payment offered to the household and its "payment level." Thus, this variable reflects the effects of both payment parameter variation and variations in household size and income.

Finally, the separate items in R_0 and R_R could generally be reduced to a single measure of distance from meeting requirements $(R_R - R_0)$.[1] Thus, the final specification presented in this section is

$$(15) \qquad \ln\left(\frac{\pi_E}{1-\pi_E}\right) = \alpha_0 + \alpha_1(R_R - R_0) + \alpha_2\hat{P}_M + \alpha_3 S_1 + \alpha_4 S_2$$

where

π_E = the probability that a household participated

R_R = the required expenditure level (for Minimum Rent households) or the estimated cost of standard housing (for Minimum Standards households)

R_0 = the household's housing expenditures at enrollment

$\hat{P}_M$ = the estimated probability that a household would normally move in the absence of the allowance offer

S_1 = the payment level at enrollment (computed as the payment the household would have received as a household of size four with the sample mean income), and

S_2 = the residual payment (the difference between the actual payment offered at enrollment and S_1).

The coefficients of Equation (15) would not be expected to be the same for Minimum Rent and Minimum Standards requirements, both because the relationship between the normal probability of meeting requirements and rent is more tenuous for Minimum Standards and because, as discussed in Section 2.1, the payment amount needed to induce a household to meet Minimum Standards should be larger than that required under Minimum Rent for a given change in expenditures (reflected in the lower value of V_M for Minimum Standards households). If Equation (15) is properly specified, however, differences in participation under the two Minimum Rent levels should be captured by changes in the value of R_R. Thus coefficients for these two groups would be expected to be similar. In addition, with the exception of payment variables, the coefficients for variables in Equation (15) may both reflect effects on the normal probability that a household would have met requirements and further effects on its willingness to participate under a given payment offer.

[1] For test results, see Appendix XII.

The rest of this section presents empirical estimates of the probability that Housing Gap households that did not already meet requirements at enrollment subsequently participated. These estimates are presented first based on the sample of Housing Gap households alone, and second in comparison with the normal probability that households would meet the various requirements, as represented by Control households. These latter estimates are used to derive the participation rate among households that would not normally have met requirements.

Table 4-3 presents estimates of the probability of participating for Housing Gap households that did not meet requirements at enrollment. The table presents combined site estimates for Minimum Standards and separate site estimates for Minimum Rent. As expected, the Minimum Rent High and Minimum Rent Low requirements could be pooled at each site.[1] Estimates for Minimum Rent could not be pooled across the two sites, but the estimates for Minimum Standards participation were not significantly different between the sites and could be pooled.[2]

The estimated coefficients for Minimum Standards follow the expected pattern. The distance variable is significant and negative. The estimated effect of a $10 increase in the difference between a household's enrollment rent and the estimated cost of standard housing is approximately a three-point reduction in the probability of participating.[3] This is reasonably large given the overall participation rate for Minimum Standards households of 0.47 (see Table 4-1). The probability of moving is significantly and positively related to participation, and again reasonably large in relation to the

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[1]Details of tests for homogeneity reported in this chapter are presented in Appendix XII.

[2]Separate estimates for the two sites are presented in Appendix XIII. For test details see Appendix XII.

[3]The derivations in Table 4-3 are evaluated at the mean participation rate for all Housing Gap households. They are used here simply as a convenient characterization of the size of effects.

Table 4-3

LOGIT ESTIMATION OF THE PROBABILITY OF PARTICIPATING FOR HOUSING GAP HOUSEHOLDS THAT DID NOT RECEIVE A FULL PAYMENT AT ENROLLMENT

	MINIMUM STANDARDS REQUIREMENT (SITES COMBINED)			MINIMUM RENT REQUIREMENT					
				PITTSBURGH			PHOENIX		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]
Constant	-1.724	-5.48**	NA	0.626	1.04	NA	-1.480	2.45*	NA
Distance (units of $10)	-0.113	-5.17**	-0.026	-0.639	-5.31**	-0.149	-0.134	3.31**	-0.031
Probability of moving (units of .10)	0.067	1.84†	0.016	0.163	2.37*	0.038	0.135	4.19**	0.031
Payment level (units of $10)	0.222	6.27**	0.052	-0.042	-0.49	-0.010	0.118	2.02*	0.028
Residual payment (units of $10)	0.048	1.13	0.011	-0.022	-0.24	-0.005	0.067	1.37	0.010
Likelihood Ratio (Significance)		97.523**							
Sample Size		710							
Mean of Dependent Variable		0.370							
Coefficient of Determination		0.104							

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Household Events List, Initial Household Report Form, payments file.

a. Derivatives computed at sample mean.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

overall rate of participation. The difference in the probability of participating between a household with a zero probability of moving and one with an estimated probability of one is roughly 16 percentage points.[1,2]

As expected, the estimated coefficient of the "payment level" variable for Minimum Standards households is positive and significant. Indeed, it is significantly larger in absolute value than the coefficient for distance.[3] In terms of the specification of Equation (15), the allowance payment would be expected to have affected participation of Minimum Standards households in two ways. First it should have made households willing to increase their housing expenditures. Second, at any given level of expenditures it should also have made households more willing to select a unit that met requirements.

The estimated coefficient for the residual payment variable, on the other hand, is roughly one-fifth the size of the coefficient for payment level.[4]

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[1] This is computed using the approximation

$$\pi(\hat{P}_M=1) - \pi(\hat{P}_M=0) = 10\hat{\beta}(\hat{P}_M)\ (\bar{\pi})\ (1-\bar{\pi})$$

where $\hat{\beta}(\hat{P}_M)$ is the estimated coefficient for the probability of moving and $\bar{\pi}$ is the mean participation rate for all Housing Gap households that did not meet requirements at enrollment. This is a rough approximation, but probably not materially in error. Nor does it represent a substantial projection beyond the sample range. Estimated probabilities of moving ranged from .00 to .97 or more at each site.

[2] When participation effects were estimated separately at the two sites, the coefficient for the probability of moving was small and insignificant in Pittsburgh (though not significantly different from the estimated coefficient in Phoenix). This appears to reflect estimation error. There is some evidence that units that failed to meet the Minimum Standards requirement in Phoenix were in somewhat worse condition than in Pittsburgh (Bakeman et al., 1979, Table 2-6ff). This would suggest that Phoenix households might more often have had to move in order to meet requirements. In fact, however, the proportion of households that upgraded their enrollment unit to meet Minimum Standards was almost identical at the two sites (Merrill and Joseph, 1979, Chapter 2, Section 2.1, 2.4 and 2.5). Thus the higher participation rates observed for Minimum Standards households in Phoenix (Table 4-1) almost entirely reflect differences in the rates at which households moved and met requirements.

[3] The sum of the payment level and distance coefficients is 0.1092 with a standard deviation of 0.0419 (which yields a t-statistic of 2.61, significant at the .05 level).

[4] The difference between the two coefficients is 0.1745, with a standard deviation of 0.0374 (which yields a t-statistic of 4.66, significant at the 0.01 level).

Since the difference between the two variables is simply that residual payments are correlated with household size and income, this suggests that the estimated coefficient for residual payment may be picking up the effects of omitted demographic variables correlated with income and household size. In fact, addition of the demographic descriptors used in Chapter 3 did not significantly increase the likelihood value of the estimated logit for either Minimum Standards or Minimum Rent requirements.[1] Nor did it materially change the estimated coefficients for payment level and residual payment.[2]

It appears that the demographic effects associated with the descriptors of Chapter 3 are adequately characterized in terms of the rental distance from meeting requirements and the probability of moving. Why the coefficient on the residual payment variable should be so small remains a mystery.

The results for Minimum Rent requirements are less consistent. Estimated coefficients for Minimum Rent in Phoenix are not significantly different from those for Minimum Standards.[3] The estimates for Minimum Rent in

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[1] See Appendix XII for details.

[2] The coefficients for payment level and residual payment including and excluding demographic characteristics were (for separate site estimation):

	Pittsburgh		Phoenix	
	Included	Excluded	Included	Excluded
Minimum Standards				
Payment level	0.2413	0.2804	0.1293	0.1577
	(0.0594)	(0.0645)	(0.0465)	(0.0514)
Residual payment	-0.0990	0.0678	-0.0434	0.0309
	(0.1078)	(0.0739)	(0.0514)	(0.0491)
Minimum Rent				
Payment level	-0.0629	-0.0421	0.0778	0.1177
	(0.0863)	(0.0857)	(0.0655)	(0.0643)
Residual payment	-0.1618	-0.0212	0.0175	0.0669
	(0.1099)	(0.0902)	(0.0582)	(0.0519)

Most payment coefficients were slightly reduced when demographic variables were added, but the difference is large (though still not greater than one standard deviation) only for the residual payment coefficient for Minimum Rent.

[3] The major apparent differences are a larger coefficient for the probability of moving and the fact that the estimated effect for residual payment is closer to (and not significantly different from) the estimated effect for payment level. Despite these apparent differences, the hypothesis that the coefficients for Minimum Rent in Phoenix are the same as those for Minimum Standards is not rejected, as shown in Appendix XII.

Pittsburgh are very different, however. While distance is significant at both sites, its estimated effect is much larger for Minimum Rent households in Pittsburgh. Most important, while the payment level variable has a positive and significant effect for Minimum Rent in Phoenix, it has a negative and insignificant effect in Pittsburgh.

The lack of any payment effect for Minimum Rent households in Pittsburgh is somewhat puzzling. It is apparent in tabulations of participation rates by payment level and it persisted under a variety of specifications. Furthermore, as discussed later in this section, it does not indicate a lack of any effect in inducing households to meet requirements; indeed, the Minimum Rent offer in Pittsburgh induced about the same increase in the proportion of households that met requirements as Minimum Standards in both sites or Minimum Rent in Phoenix. Analysis of expenditure changes among participants (Friedman and Weinberg, 1979) shows something of the same pattern--expenditure changes above those that would have occurred normally were generally modest in Pittsburgh as compared with Phoenix.[1] It appears then that while Minimum Rent households in Pittsburgh were induced to meet the requirements by the allowance offer, they generally made only modest changes in their expenditures and were apparently insensitive to the amount of the allowance payment.

One partial explanation for this may be the initial situation of Minimum Rent households in Pittsburgh. Among households that did not meet the Minimum Rent requirements, those in Pittsburgh had rents at enrollment that were generally much closer to the required level than those in Phoenix. Indeed, the average difference between required levels and enrollment rents was roughly half as large in Pittsburgh as in Phoenix (Merrill and Joseph, 1979, pp. 56,

[1]This was true of Minimum Standards and Unconstrained households in Pittsburgh as well, however. See Friedman and Weinberg (1979), Chapter 5, Section 5.4.

A-121).[1] Because so many households were relatively close to meeting requirements, variations in payments above a modest amount may have made relatively little difference to most households. It must be admitted, however, that these speculations are both unproven and inadequate to account fully for the lack of payment effect for Minimum Rent households in Pittsburgh.[2]

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[1]The mean differences between the rent levels necessary to meet requirements and actual rents for Minimum Rent households that did not meet requirements at enrollment are shown below using first, required rent levels and second, the mean rents of Control households that met requirements at enrollment as measures of necessary rent levels.

	Pittsburgh	Phoenix
Distance from required levels	$25.45	$48.02
(standard deviation)	(18.04)	(34.95)
Distance from Control levels	57.73	79.66
(standard deviation)	(20.75)	(29.43)
Sample size	(176)	(221)

The relative lack of households at any considerable distance from Minimum Rent requirements in Pittsburgh is even more apparent in the distribution of the two distance measures.

	Distance from Requirement Level		Distance from Control Level	
	Pittsburgh	Phoenix	Pittsburgh	Phoenix
0-25	52%	31%	1%	0%
26-50	37	29	43	17
51-75	10	18	37	33
76+	1	22	20	50
Sample size	(176)	(221)	(176)	(221)

[2]As noted earlier, Friedman and Weinberg (1979) found a generally low level of expenditure change for all Housing Gap and Unconstrained households in Pittsburgh as compared with Phoenix. While it is true that Pittsburgh households were generally closer to meeting requirements, this is not adequate to explain the lack of response, as indicated by Friedman and Weinberg's simulation of expected expenditure changes, which were larger than estimated actual changes in Pittsburgh, but not Phoenix. (See Friedman and Weinberg, 1979, Table 5-24.)

As indicated at the beginning of this section, participation rates reflect both the fact that some households would normally meet requirements even in the absence of the allowance offer and the effect of the additional inducement to meet requirements provided by the allowance payment. Indeed, with the exception of the allowance payment variables, all of the coefficients reported in Table 4-3 could reflect both effects on household's normal probability of meeting requirements and effects on their response to the allowance offer. One way to sort out these two factors is to compare the rate at which households that did not meet requirements at enrollment subsequently met their requirements and participated with the rate at which similar Control households met the various requirements.[1] This in effect compares the participation rate of Housing Gap households with the estimated normal rate at which households would have met requirements in the absence of an allowance offer.

Three sets of estimates are presented, one for each type of requirement, based on the following specification:

$$(16) \qquad \pi = \gamma_0 + \gamma_1 D + \gamma_2 \hat{P}_M + Phx\ (\gamma_3 + \gamma_4 D + \gamma_5 \hat{P}_M) + \gamma_6 E + \gamma_7 S + \gamma_8 RS$$

where

π = the probability that a household met the requirement

D = distance from meeting requirements at enrollment ($R_R - R_0$)

$\hat{P}_M$ = probability of moving during the experiment

Phx = a dummy for Phoenix (allowing for difference of intercept, distance, and probability of moving coefficients in the two sites)

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[1] These comparisons are based on a slightly different definition of participation for Control and Housing Gap households. This reflects the fact that Housing Gap figures are based on payment records while Control figures are constructed from housing evaluations and reported rents. As discussed in Appendix III, the two measures are very closely related and differ only in a few instances.

E = a dummy for Housing Gap households (under the requirement analyzed)

S = the payment level at enrollment minus $10 (zero for Control households), and

RS = the residual payment minus $10 (zero for Control households).

The specification of Equation (16) was also estimated allowing for differences in the effects of distance and the probability of moving between Housing Gap and Control households. These proved to be generally insignificant. Thus it appears that the effects of distance and the normal probability of moving on the probability of participation estimated in Table 4-3 primarily reflect their effects on the normal probability of meeting requirements.[1] Likewise, as indicated in Equation (16), the sites could be pooled in each case, as long as allowance was made for differences in the normal probability of meeting requirements (as represented by the intercept and the terms in distance and the probability of moving.[2]

The results of the comparison are presented in Table 4-4. The results for Minimum Standards requirements parallel those of Table 4-3. There is a significant payment level effect somewhat greater than the absolute value of the estimated coefficient for distance. Again, the estimated coefficient for the residual payment variable is much smaller than that for payment level and insignificant. For the two Minimum Rent requirements, on the other hand, none of the allowance variables is significant. It appears that once the normal probability of meeting requirements is taken into account, payment

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[1] Tests for differences in the estimated effects of distance and the probability of moving were based on separate estimates for the two sites with the results reported in Appendix XII. The only case in which there was a significant difference was for Minimum Rent Low households in Phoenix. This reflects a significant and negative distance effect for Control households as compared with an insignificant distance effect for Housing Gap Minimum Rent Low households.

[2] Test results for pooling sites are given in Appendix XII. In addition to not rejecting the specification of Equation (16), differences in normal meeting between the sites beyond a shift term could also be dropped for Minimum Standards. A specification with only intercept differences is not reported here because of the significant difference in comparison with separate site estimates for Minimum Rent High and because the two pooled specifications (with and without interaction terms) are significantly different from each other (at the 0.10 level) for both Minimum Rent requirements.

Table 4-4

COMPARISON OF THE PARTICIPATION RATE FOR HOUSING GAP HOUSEHOLDS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS -- COMBINED SITES

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]
Constant	-1.303	-5 82**	NA	-0.935	-2.59**	NA	-0.607	2.15*	NA
Distance (units of $10)	-0.172	-5.12**	-0.034	-0.485	3.54**	-0.104	-0.506	5.62**	-0.090
Probability of moving (units of .10)	0.069	1.60	0.014	0.234	3.82**	0.050	0.178	3.43**	0.032
Phoenix households	0 563	1.77†	0.112	-0.637	-1.24	-0.137	-0 652	-1.47	-0 116
Distance in Phoenix (units of $10)	0.056	1.47	0.011	0.342	2.30*	0.073	0.298	3.04**	0 053
Probability of moving in Phoenix (units of 10)	-0.011	-0 21	-0.002	-0.081	1.06	-0.017	-0.059	-0.87	-0.010
Housing Gap households	-0.329	-1.04	-0.066	0.585	0 86	0.125	0.240	0 54	0.043
Payment level (units of $10)	0.186	4.89**	0.037	0.051	0.56	0 011	0 093	1.53	0 017
Residual payment (units of $10)	0.036	0.95	0.007	-0.016	-0 20	-0.003	0.080	1 41	0.014
Likelihood Ratio (Significance)		125.584**			57.050**			107.127**	
Sample Size		1046			478			797	
Mean of Dependent Variable		0.275			0 312			0.231	
Coefficient of Determination		0.102			0.096			0.124	

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment and Control households that did not meet housing requirements at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES Baseline Interview, Housing Evaluation Forms, Household Events List, Initial and monthly Household Report Forms, payments file.

a. Derivatives computed at sample mean.

† t-statistic significant at the 0.10 level (two-tailed)

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

effects are not significant for Minimum Rent households at either site.[1]

At the same time, the estimated coefficients for the experimental terms for the two Minimum Rent requirements, though individually insignificant, are not trivial in their overall effect on the rate of meeting requirements. This can be seen most easily by dropping the payment variables from Equation (16) and leaving only a dummy variable for Experimental households to capture the overall effect of the allowance offer. The results are presented in Table 4-5. Despite the apparent difference in both the size and the significance of the coefficients for the three different requirements in Table 4-4, the overall effect estimated in Table 4-5 is both significant and almost identical for all three requirements. Taking account of the normal probability of meeting requirements, the additional effect of the allowance offer is approximately the same for each requirement and each site.[2] The major difference among the requirements is the absence of any strong payment effect for Minimum Rent requirements.[3] This is important because it suggests that the logistic specification may hold across a wide range of normal probabilities for meeting requirements.[4]

The estimated effect of the allowance offer presented in Table 4-5 is much smaller than the overall participation rate. Thus, it is apparent that many of the households that met requirements after enrollment would have done so normally in the absence of the allowance offer. Table 4-6 shows the implied

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[1] See Appendix XIII for separate site estimates.

[2] See Appendix XIII for separate site estimates.

[3] This is confirmed by comparison of the log likelihoods of the equations estimated with payment terms with those estimated only with a dummy variable for Housing Gap households. The payment terms are significant only for Minimum Standards. See Appendix XII.

[4] Specifically, it suggests that the probability of participation under any requirement might be estimated as

$$\ln\left(\frac{\pi}{1-\pi}\right) = \beta_N + x\gamma$$

where

β_N = the logistic coefficient for the probability of meeting the requirement normally (i.e., $\ln(\pi_N/1-\pi_N)$),

x = a program dummy or payment offer.

(Note that although the payment effects for Minimum Rent in Table 4-4 are not significantly different from zero, they are also not significantly different from those estimated for Minimum Standards.)

Table 4-5

COMPARISON OF THE PARTICIPATION RATE FOR HOUSING GAP HOUSEHOLDS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS (WITHOUT PAYMENT VARIABLES)--COMBINED SITES

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]
Constant	-1.384	-6.41**	NA	-0.966	-2 58**	NA	-0.652	-2.29*	NA
Distance (units of $10)	-0 173	-5 36**	-0.034	-0.483	-3.49**	-0 104	-0.508	5.81**	-0.090
Probability of moving (units of 10)	0.065	1.51	0.013	0.235	3.70**	0.050	0 185	3 46	0.033
Phoenix households	0.673	2 08*	0.134	-0.577	1.10	-0.124	-0.629	-1 45	-0.112
Distance in Phoenix (units of $10)	0.058	1.50	0.012	0.342	2.29	0.073	0 303	3.17**	0.054
Probability of moving in Phoenix (units of .10)	-0 002	-0.03	-0.000	-0.085	-1.10	-0.018	-0 060	0 88	-0.011
Housing Gap households	0.875	6.44**	0.175	0.883	3.95**	0.189	0.925	5.40**	0.164
Likelihood Ratio (Significance)		102.911**			56.403**			104.369**	
Sample Size		1046			478			797	
Mean of Dependent Variable		0.275			0 312			0.231	
Coefficient of Determination		0.084			0.095			0.121	

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment and Control households that did not meet housing requirements at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Housing Evaluation Forms, Household Events List, Initial and monthly Household Report Forms, payments file

a Derivatives computed at sample mean.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

Table 4-6

PROPORTION OF PARTICIPANTS THAT WOULD HAVE MET REQUIREMENTS IN THE ABSENCE OF THE ALLOWANCE OFFER -- COMBINED SITES

	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
HOUSEHOLDS THAT DID NOT RECEIVE A FULL PAYMENT AT ENROLLMENT (number of cases)	(479)	(135)	(248)
1-a Participation rate	37%	47%	36%
1-b Estimated normal rate of meeting requirements	17	25	15
1-c Proportion of participants that would have met requirements normally	46	53	42
ALL ENROLLED HOUSEHOLDS (number of cases)	(575)	(323)	(356)
2-a Participation rate	47	78	56
2-b Proportion that received a full payment at enrollment	17	58	30
2-c Estimated proportion that would have met requirements normally after enrollment	14	10	10
2-d Total normal participation rate	31	68	40
2-e Percentage of all participants that would have met requirements normally	66	87	71
2-f Implied participation rate for households that would not have met requirements normally	24	29	25

SAMPLE: Enrolled Housing Gap households that did not recieve a full payment at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Household Events List, Initial Household Report Form, payments file.

NOTE Table items are defined as follows:

1-a	π_{EA}	2-a	π_E	2-e	$\pi_o + \frac{(1 - \pi_o)\hat{\pi}_{NA}}{\pi_E}$
1-b	$\hat{\pi}_{NA}$	2-b	π_o		
1-c	$\hat{\pi}_{NA} / \pi_{EA}$	2-c	$(1-\pi_o)\hat{\pi}_{NA}$	2-f	$\frac{\pi_{EA} - \hat{\pi}_{NA}}{1 - \hat{\pi}_{NA}}$
		2-d	$\pi_o + (1 - \pi_o)\hat{\pi}_{NA}$		

where:

π_{EA} = participation rate for households that did not receive a full payment at enrollment.

$\hat{\pi}_{NA} = \pi_{EA} - \hat{\delta}_{EA}(\pi_{EA})(1 - \pi_{EA})$

$\hat{\delta}_{EA}$ the estimated logistic coefficient for Housing Gap households from Table 4-5

π_E = participation rate for all enrolled households

π_o = the proportion of households that received a full payment at enrollment

proportion of participants not meeting requirements after enrollment that would have met them normally.[1] From 40 to 50 percent of these households are estimated to be households that would have met requirements without the allowance. In terms of all participants (including households that met requirements at enrollment) most were households that would have met the housing requirements normally. The proportion of participants that would have met requirements normally ranges from two-thirds for Minimum Standards requirements to almost 90 percent for Minimum Rent Low requirements. Indeed, the implied participation rate for households that would not have met requirements is only about 25 percent.

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[1] The estimated normal rate of meeting is based on the logistic approximation

$$\pi_N = [1 + \exp(-\beta_0)]^{-1}$$

$$\pi_E = [1 + \exp(-\beta_0 - \gamma)]^{-1}$$

$$\pi_N \cong \pi_E - \gamma\pi_E(1-\pi_E)$$

where

π_N = the normal probability of meeting requirements

π_E = the allowance household's probability of meeting requirements.

The figures in Table 4-6 are estimated using the mean value of π_E and the estimated allowance effect ($\hat{\gamma}$) from Table 4-5. For positive γ this will tend to understate the mean normal probability because β_0 is stochastic. Thus, even if γ is known exactly,

$$E(\pi_N) \cong E(\pi_E)(1-\gamma) + \gamma E(\pi_E^2)$$

$$= E(\pi_E)(1-\gamma) + \gamma[(E(\pi_E)]^2 + \delta\gamma$$

$$> E(\pi_E)(1-\gamma) + \gamma[E(\pi_E)]^2,$$

since the term δ is the variance of π_E in the population $[E(\pi_E^2) - (E(\pi_E)^2]$ and hence positive.

This has obvious implications for evaluating an allowance program. It appears that a housing allowance program will mostly serve households that would normally live in acceptable housing (as defined by the program rules). It will be relatively unsuccessful in reaching households in substandard housing. Households in acceptable housing may well be in need of assistance. As has been pointed out elsewhere, they generally are paying very large fractions of their income for rent, frequently more than 40 percent. This is also, however, frequently true of households that did not meet requirements, especially those that did not meet Minimum Standards.[1]

The estimates presented in Table 4-5 do suggest that participation rates could be increased by offering larger allowance payments, at least for Minimum Standards requirements. Unless these increased payments can be successfully targeted, however, the cost might be very large. The overall participation rate for households that would not normally meet requirements is given by

$$\bar{\pi} = \frac{\pi_E - \pi_N}{1 - \pi_N} \tag{17}$$

Where

$\bar{\pi}$ = the participation rate among households that would not normally meet requirements

π_E = the participation rate among Housing Gap households that did not meet requirements at enrollment, and

π_N = the normal rate of meeting requirements among households that did not meet requirements at enrollment.

[1] See Friedman and Weinberg (1979), Tables 2-7, 3-14 and 3-15.

Likewise, the overall proportion of participants that would have met requirements normally is given by

$$\rho = \frac{\pi_0 + \pi_N}{\pi_0 + (1-\pi_0)\ \pi_E} \tag{18}$$

where π_0 is the proportion of households that already met requirements at enrollment. Finally, the estimated effect of an increase in the payment level offered to all households under a Minimum Standards requirement in Table 4-4 is

$$\Delta\pi_E = 0.1855\ (\pi_E)(1-\pi_E)X \tag{19}$$

where X is the increase in payments (in $10 units).

Using the estimated values of π_E, π_N, and π_0 from Table 4-6 of 0.37, 0.17, and 0.17, respectively, the increase in payments necessary to achieve a 50 percent participation rate among households that would not normally meet requirements may be computed by [using Equation (17)]

$$0.50 = \frac{(0.37) - (0.17) + 0.1855\ (0.37)(0.63)X}{0.83} \tag{20}$$

$$X = 4.97$$

Thus achieving a 50 percent participation rate among households that would normally live in substandard housing would require an increase in average payments of approximately $50 per month. This would have almost doubled the payments offered in Pittsburgh and increased those in Phoenix by almost two-thirds.[1] Even in this case, with an overall participation rate (including households that already met requirements at enrollment) of 66 percent, almost half (47 percent) of participants would still be households that would have met requirements normally.[2]

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[1]The average payment offered to Housing Gap households at enrollment was $56 in Pittsburgh and $73 in Phoenix.

[2]It should be pointed out that there is no reason to believe that this pattern is not also true of all other housing programs as well. This is discussed further in Chapter 6.

4.3 DEMOGRAPHIC DIFFERENCES IN SUBSEQUENT PARTICIPATION

The analysis of participation in the previous section found no significant demographic differences in participation once the amount of the allowance payment and the normal probability of meeting requirements (represented by terms in the distance from meeting requirements at enrollment and the normal probability of moving) were taken into account. At the same time, the heavy concentration of participation among households that would normally have met requirements would itself be expected to result in substantial differences in participation among different demographic groups. Demographic groups that tend to live in the worst housing or to be relatively immobile will also tend to participate less. This may be offset if the allowance payment offered to these households is also larger. This section explores the overall differences in participation among different demographic groups, tracing these differences to differences in housing conditions, mobility, and payments.

Table 4-7 presents the results of a logit estimation of the probability of participating subsequent to enrollment as a function of a number of household demographic characteristics. The table shows the estimated relationship of each demographic characteristic to participation, taking the effect of other household characteristics into account. Several demographic differences in participation were apparent at both sites.

Minority households and large households were significantly less likely to participate and single-parent households were significantly more likely to participate than other households. Income had a significant positive relationship to participation. A test for a nonlinear income effect did not show a significant difference between the effect of income for households with incomes under $4,000 and those with incomes over $4,000, though the estimated coefficients suggest that the lower participation rates associated with lower income may be concentrated among very low income households.[1] There were also several demographic relationships that were

[1] A two-part spline of income at the $4,000 level was used rather than the three-part spline used elsewhere because there were too few enrolled Housing Gap households in the highest of the three income groups.

Table 4-7

LOGIT ESTIMATION OF THE RELATIONSHIP OF DEMOGRAPHIC CHARACTERISTICS TO THE PROBABILITY OF PARTICIPATING SUBSEQUENT TO ENROLLMENT FOR HOUSING GAP HOUSEHOLDS

	PITTSBURGH				PHOENIX			
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	EFFECT ACROSS USUAL RANGE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	EFFECT ACROSS USUAL RANGE
Constant	-0 279	-0 57	NA	NA	-0 432	-0 90	NA	NA
Elderly household	-0.335	-1 22	-0.083	-0 083	0 038	0 15	0 009	0 009
Young household	-0 010	-0 48	-0 025	-0 025	0 507	2.87**	0 122	0 122
Black household	-0 576	-2 81**	-0 142	-0 142	-0 970	-2 82**	-0 233	-0.233
Spanish American household	NA	NA	NA	NA	-0 661	-3 61**	-0 159	-0.159
Large household	-0.750	-2 95**	-0 185	-0 185	-0 803	-3 68**	-0 193	-0 193
Single parent household	0 514	2 67**	0 127	0 127	0.456	2 43*	0 110	0 110
Participation in other transfer programs	-0 471	-2 40*	-0 116	-0 116	-0 099	-0 64	-0 024	-0 024
Income (in thousands)								
Under $4,000	0 303	2 41*	0.070	0 210	0 271	2 33*	0 070	0 210
$4,000 and over[a]	0.042	0.37	0.010	0 062	0.038	0 604	0 009	0.055
Likelihood Ratio (Significance)	35 486**				65.710**			
Sample Size	572				649			
Mean of Dependent Variable	0 556				0 598			
Coefficient of Determination	0 045				0 075			

SAMPLE Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing

DATA SOURCES. Baseline Interview, Initial Household Report Form, payments file.

a. Income coefficients were estimated as splines The coefficients shown in the Table are the estimated coefficients applicable in the range stated Estimated differences from the coefficient for the previous interval are

	PITTSBURGH		PHOENIX	
	Coefficient	t-statistic	Coefficient	t-statistic
Income (000s)				
Δ $4,000 and over	-0.261	-1.34	-0 233	-1.55

different at the two sites. Young households were more likely to participate than households with heads over 30 in Phoenix but not in Pittsburgh. Households participating in other transfer programs were less likely to participate than other households in Pittsburgh but not in Phoenix.

The demographic differences indicated by the logit estimates may be more or less apparent in the overall participation rates for different demographic groups. In fact, the logit results generally correspond to the simple differences in participation rates among demographic groups shown in Table 2-14. Differences in participation by household size and race or ethnicity are apparent from a comparison of tabulated participation rates for these groups. The higher participation rate of single-parent households (almost always households with female heads) is also apparent from Table 2-14. Income differences are somewhat less obvious from a simple examination of participation rates. Table 2-14 does show an increase in participation as income increases up to a point, but it also shows a decrease in participation at the highest income levels. Differences in participation by age and receipt of transfer payments appear to be about equal at the two sites based on Table 2-14. However, controlling for other factors in the logit estimation appears to have reduced the age effect in Pittsburgh and the transfer program effect in Phoenix.

A number of different factors may explain the demographic differences observed in participation subsequent to enrollment. As discussed in previous sections, whether a household met the program requirements at enrollment, its distance from meeting the requirements, the amount of the allowance payment offered, and the household's normal probability of moving were all related to participation. Each of these factors may vary across demographic groups. If some demographic groups were less likely to be living in housing that met requirements or were further away from meeting the requirements at enrollment, then these groups would also be less likely to participate, other things being equal. Likewise, the allowance payment offered varied across demographic groups, because the Housing Gap payment formula varied payments based on household size and income. Finally, normal mobility is likely to have been quite different for different demographic groups.

Table 4-8 summarizes the relationship of demographic characteristics to each of the factors which affected participation. The table explains demographic differences in participation in terms of differences in compliance with requirements at enrollment, initial distance from meeting requirements, subsidy amount and normal probability of moving.[1] The table shows that a number of different factors usually contributed to overall demographic differences.

Elderly households were more likely to meet requirements at enrollment and, if they did not meet requirements, were likely to be closer to doing so. This might have been expected to lead to a higher participation rate, but, as the table shows, elderly households were also entitled to lower subsidy amounts (because of their generally small household size) and were less likely to move than younger households. Overall, the elderly were not significantly more or less likely to participate than other households.

Results are less consistent across sites for households with young heads of household. These households were more likely to move than older households at both sites. In Phoenix they were also more likely to meet requirements initially than the excluded group (households with heads 31 to 61). Overall, younger households were more likely to participate than other households in Phoenix but not in Pittsburgh.

Minority households appear to have been less likely to participate because of their poor initial housing. Black and Spanish American households were less likely to meet the housing requirements and were likely to be further away from meeting them at enrollment than nonminority households. Since

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[1] Sources of the results in Table 4-8 are shown in Appendix XI. Results for compliance with requirements at enrollment are based on a logit estimation of the probability of receiving a full payment at enrollment among all Housing Gap households, including all of the demographic characteristics. Results for distance from meeting requirements are based on a regression of initial distance from meeting on demographic characteristics for Housing Gap households that did not receive a full payment at enrollment. Results for payment amount are based on a regression of enrollment payment on demographic characteristics for Housing Gap households that did not receive a full payment at enrollment. Normal probability of moving results are taken from a logit estimation of the probability of moving among Control households.

Table 4-8

SUMMARY OF RELATIONSHIP OF DEMOGRAPHIC CHARACTERISTICS TO PARTICIPATION SUBSEQUENT TO ENROLLMENT FOR HOUSING GAP HOUSEHOLDS

DEMOGRAPHIC CHARACTERISTIC	RELATIONSHIP TO PROBABILITY OF RECEIVING A FULL PAYMENT AT ENROLLMENT	RELATIONSHIP TO DISTANCE FROM MEETING REQUIREMENTS AT ENROLLMENT (POSITIVE VALUES INDICATE SMALLER DISTANCES)	RELATIONSHIP TO SUBSIDY AMOUNT	RELATIONSHIP TO THE NORMAL PROBABILITY OF MOVING	OVERALL RELATIONSHIP TO THE PROBABILITY OF PARTICIPATING SUBSEQUENT TO ENROLLMENT
Elderly household	+[a]	+[a]	-	-	0
Young household	+[a]	0	0	+	+[a]
Black household	-	-	0	+[a]	-
Spanish American household	-[a]	-[a]	0	0	-[a]
Large household	-	-	+	0	-
Single parent household	+[a]	+[a]	0	+[a]	+
Participation in other transfer programs	-	-	+[a]	+[b]	-[b]
Income					
Lower Range	+	+[b]	-[b]	0	+
Higher Range[c]	0	-	-[a]	0	0

a. Phoenix only.
b. Pittsburgh only.
c. Refers to the difference in the effect of income from the lower range.
0 = No significant relationship.
+ = Significant positive relationship at the 0.10 level.
- = Significant negative relationship at the 0.10 level.

minority households were not on average entitled to lower allowance payments and were no less likely to move, poor initial housing appears to be the major factor involved.

Large households were also disadvantaged by their poor initial housing. Like minorities, households with five or more members were less likely to meet the requirements at enrollment and were further away from meeting them than smaller households. Even though larger households were entitled to larger payments, this apparently was not enough to compensate for initial housing position, and large households were less likely to participate than smaller households.

Participants in other transfer programs were also in poorer housing at the beginning of the experiment. Even though these households were entitled to higher payments than other households (in Pittsburgh) and were more likely to move (in Phoenix), their overall participation in Pittsburgh was lower than that of other households.

Single-parent households were apparently more likely to participate than other households for two reasons. They were more likely to be in better housing initially and they were also more likely to move over the course of the experiement. Thus they had a higher overall participation rate.

Results for income are somewhat inconsistent across sites and across income levels. Overall, participation was positively related to income and the relationship was not significantly different for households in the lower and higher income ranges. This relationship seems to have occurred because higher income households were more likely to meet the housing requirements at enrollment. In addition, distance from meeting the requirements for households that did not meet requirements at enrollment declined with income in Pittsburgh at the lowest income levels but had no significant relation to income in Phoenix.[1] As expected from the payment formula,

[1] As indicated, in the table, the coefficient for income in Pittsburgh was significantly lower at higher income levels. As a result, the net coefficient at these levels was not significantly different from zero.

income was negatively related to subsidy amount; it had no relationship to the normal probability of moving at either site. Thus the major factor involved in the positive income effect on overall participation appears to be the relationship between income and initial compliance with the housing requirements.

4.4 SUMMARY

The Housing Gap programs tested in the Demand Experiment had participation rates of only about half those observed in the Percent of Rent and Unconstrained plans. The reason for this sharp reduction in participation was the imposition of housing requirements. The effect of housing requirements was concentrated among households that would not normally have met the requirements. Participation rates for enrolled households that would not normally have met requirements were generally only 25 percent. Indeed, since only 78 percent of Housing Gap households accepted the enrollment offer to begin with, the overall participation rate for these households would be about 20 percent. As a result, participation rates in the Housing Gap program were markedly lower for households in poor housing (by the program's standards), for minorities, for large households, and for those with the lowest incomes.

These patterns could be somewhat mitigated, at least under a Minimum Standards requirement, by offering higher payments, but unless the payments could be effectively targeted, the cost could be prohibitive. Almost doubling payments would, for example, based on the estimates of this chapter, effectively double the participation rate among households that would not normally meet requirements. This would still, however, give an overall participation rate for these households of only 40 percent.[1]

In evaluating these results in terms of comparisons with other housing programs, it should be remembered that they represent the results of an

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[1] There is some indication that increased payments could be more effectively targeted towards households in the worst housing by concentrating them among the very poorest households. This would require that payments fall more sharply with increases in income than the 25 percent rate common to most of the Housing Gap plans and most housing programs.

open-enrollment program. A limited enrollment Housing Gap program could, like any other limited enrollment program, allocate its openings to achieve any desired mix of elderly and nonelderly, minority and nonminority, very poor and less poor households. This would still tend to leave households occupying the worst housing within each of these groups less likely to participate. However, this may also be true of every other housing program in the United States. All of these programs are designed to offer participants standard housing at reduced cost if they will agree to live in certain units or types of units. Absent direct evidence, it is not at all clear that these programs do not ultimately serve the same types of households as a housing allowance.

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CHAPTER 5

MEETING REQUIREMENTS AT TWO YEARS

Chapter 4 analyzed participation in terms of the proportion of all enrolled Housing Gap households that ever met requirements and received a full payment. The base population of Chapter 4 includes both households that remained actively enrolled in the experiment and eligible for payments for two years after enrolling and households that dropped out or became ineligible within one month after enrollment. It seems reasonable to suppose that a housing allowance would work quite differently for these two groups. Households that remained enrolled and eligible for very brief periods had little opportunity to respond to the allowance offer and, to the extent that they anticipated becoming ineligible or dropping out, little reason to undertake any major change in their housing. Households that remained eligible for long periods, on the other hand, had both more time and greater incentive to take advantage of the allowance offer. Seen in this light, the results of Chapter 4 could be more desirable than they appear. The heavy preponderance among participants of households that would have met requirements normally could reflect a large component of emergency assistance to temporarily eligible households with larger impacts on the housing of more permanently eligible households. This chapter addresses this possibility by analyzing participation rates among households that were still enrolled and eligible two years after enrollment.

As noted in the last section of Chapter 2, it seems likely that some eligible Housing Gap households that would have participated in an unconstrained program dropped out of the experimental sample because they were unwilling or unable to meet the housing requirements. Thus, the participation rates estimated in this section are undoubtedly upper bounds in the actual participation rate among all eligible households willing to participate in a transfer program. This also suggests that comparisons with Control households will tend to overestimate the impact of the allowance offer on the rate at which households met requirements. Again, the impacts estimated here should be regarded as upper bounds.[1]

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[1] These potential biases are evaluated further in Appendix VI. It appears that the bias in the estimated impact of the allowance offer may be small, but this has not been established with certainty.

Section 5.1 presents tabulations of participation rates at the end of two years. These suggest that separate analysis of households that did and did not already meet requirements when they enrolled is appropriate for analysis of participation at the end of two years, as it was for analysis of the cumulative participation rate analyzed in Chapter 4. Section 5.2 presents the results of a logit analysis of participation at the end of two years, parallel to that of Chapter 4. Finally, Section 5.3 summarizes the major findings of the chapter.

5.1 PARTICIPATION RATES AT THE END OF TWO YEARS

Table 5-1 presents participation rates among Housing Gap and Control households still enrolled and modally eligible at the end of two years.[1,2] As was noted in Chapter 2, the overall participation rates at two years are generally slightly higher than the cumulative rate for all enrolled households shown in Table 4-1. The differences between the two rates are not large, however. However, the impact of the allowance offer indicated by the difference between the rates at which Housing Gap and Control households met requirements does appear to be larger at two years. Thus, it appears that, as expected, more permanently eligible households did have a larger response to the allowance offer. Overall participation rates for these households were not larger than those for all enrolled households because the more permanently eligible households were also less likely to meet requirements normally.

Most households that met requirements at enrollment continued to do so at two years.[3] Indeed, among households still enrolled and eligible at the end of two

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[1] As was noted in Chapter 2, selection of households on the basis of modal eligibility is somewhat arbitrary. The Housing Gap plans tested in the Demand Experiment included plans with both higher and lower income eligibility limits. The modal limits were chosen to provide a single criterion for all households including Control households.

[2] The participation rate used for Experimental households is not the proportion of Housing Gap households that were receiving full payments at the end of two years, but the proportion that met the housing requirements. In theory, households that met the requirements might not be receiving full payments because they had not fulfilled reporting requirements. There were relatively few such households, however. (See Appendix III.) The proportion of households living in units which met the requirements has been used because it is directly comparable for Control and Experimental households.

[3] This is partly due to the program rules. Under the payment rules of the Demand Experiment, households that met requirements in a unit continued to qualify for payments as long as they remained in that unit. For details see Appendix III.

Table 5-1

PARTICIPATION RATES AT THE END OF TWO YEARS[a]

	MINIMUM STANDARDS HOUSEHOLDS		MINIMUM RENT LOW REQUIREMENT		MINIMUM RENT HIGH REQUIREMENT	
	Housing Gap households	Control households	Housing Gap households	Control households	Housing Gap households	Control households
PITTSBURGH						
Participation rate among enrolled households at the end of two years	44%	23%	83%	71%	52%	41%
(Number of cases)	(174)	(217)	(111)	(230)	(93)	(230)
Percentage of households that met requirements at enrollment	20	16	59	56	27	27
(Number of cases)	(174)	(217)	(110)	(230)	(93)	(230)
Participation rate among households that met requirements at enrollment	91	83	100	97	100	94
(Number of cases)	(34)	(35)	(65)	(128)	(25)	(62)
Participation rate among households that did not meet requirements at enrollment	32	12	58	38	34	21
(Number of cases)	(140)	(182)	(45)	(102)	(68)	(168)
Percentage of households participating at the end of two years that met requirements at enrollment	41	58	71	76	52	62
(Number of cases)	(71)	(50)	(91)	(163)	(48)	(94)
PHOENIX						
Participation rate among enrolled households at the end of two years	56	33	76	46	51	27
(Number of cases)	(154)	(237)	(87)	(239)	(101)	(238)
Percentage of households that met requirements at enrollment	19	16	45	39	19	18
(Number of cases)	(153)	(233)	(87)	(239)	(101)	(238)
Participation rate among households that met requirements at enrollment	86	82	97	90	95	88
(Number of cases)	(29)	(38)	(39)	(94)	(19)	(43)
Participation rate among households that did not meet requirements at enrollment	48	24	58	17	40	13
(Number of cases)	(124)	(195)	(48)	(145)	(82)	(195)
Percentage of households participating at the end of two years that met requirements at enrollment	29	40	58	77	35	60
(Number of cases)	(85)	(78)	(66)	(110)	(51)	(63)

SAMPLE Housing Gap and Control households active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal ($dC^a = 1.0C^b$, $b = .25$) Housing Gap treatment group and households living in their own homes or in subsidized housing

DATA SOURCES: Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

[a]Note that for Control households the "participation" rate refers to the rate at which Control households met each of the three requirements and has no relationship to their status in the experiment.

years the participation rates for Housing Gap households that met requirements at enrollment generally fell short of 100 percent by the loss of three or four households at most. Likewise, while Housing Gap households that already met the various requirements at enrollment continued to meet the requirements at a higher rate than similar Control households, the difference in the rates is not large. It also usually reflects a two or three household increase in the number of Housing Gap households that met requirements and is never statistically significant. Because of the small number of households involved, further analysis of households that already met requirements was generally impossible.

There are, however, more substantial differences in the participation rates of households that did not meet requirements at enrollment, both across the different requirements and between Housing Gap and Control households. The next section focuses on these households, using a specification parallel to that of Chapter 4.

5.2 PARTICIPATION AT THE END OF TWO YEARS AMONG HOUSEHOLDS THAT DID NOT MEET REQUIREMENTS AT ENROLLMENT

Participation among households still enrolled and eligible at the end of two years should in theory depend on the same sorts of factors as participation among all enrolled households. A household would be expected to participate if the allowance payment offered (S) was large enough to compensate it for the increase in expenditures necessary to meet requirements ($R_M - R_N$), modified by the value to the household of any housing improvements obtained (V_M), plus transaction costs involved in meeting requirements (C_T).[1] In symbols, a household should participate if

$$N = S - (R_M - R_N) + V_M - C_T > 0 \quad (1)$$

where

N = the net value to the household of the allowance offer

S = the allowance payment offered

R_M = the expenditure level necessary to meet the housing requirements

[1] The term for general participation costs (C_p) included in the specification of Equation (6) in Chapter 4 is not included here, since all households considered in this chapter were meeting reporting requirements and receiving at least $10 payments.

R_N = the household's normal housing expenditures

V_M = the value to the household of the improvements in housing obtained under expenditures R_M (given the housing requirements), and

C_T = additional transaction costs involved in meeting requirements.

The empirical specification replaces these unobserved variables with a stochastic specification

$$N = \alpha_0' + \alpha_1' R_R + \alpha_2' \hat{R}_N + \alpha_3' \hat{P}_M + \alpha_4' \ln\hat{P}_M + \alpha_5' S_1 + \alpha_6' S_2 - \delta \tag{2}$$

where

R_R = the required expenditure level at two years (for Minimum Rent households) or the estimated cost of standard housing at two years (for Minimum Standards households)

$\hat{R}_N$ = the household's estimated normal expenditures at the end of two years

$\hat{P}_M$ = the estimated probability that a household would normally move during the two years after enrollment in the absence of the allowance offer

S_1 = the payment level at two years (computed as the payment that the household would have received as a household of size four with the sample mean income)

S_2 = the residual payment at two years (the difference between the actual payment offered at two years and S_1), and

δ = a stochastic term, with mean zero and standard deviation, σ.

As in the specification of Chapter 4, the stochastic term, δ, is assumed to have a logistic distribution, so that the probability of participating (π_E) is given by[1]

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[1]The relation in Equation (3) refers to a standardized logistic variable. Thus the coefficients of Equation (3) are related to those of Equation (2) by

$$\alpha_i = \frac{\alpha_i'}{k}, \quad k = \frac{\sqrt{3}}{\pi}\sigma$$

where σ is the standard deviation of δ.

$$(3) \qquad \ln\left(\frac{\pi_E}{1-\pi_E}\right) = \alpha_0 + \alpha_1 R_R + \alpha_2 \hat{R}_N + \alpha_3 \hat{P}_M + \alpha_4 \ln\hat{P}_M + \alpha_5 S_1 + \alpha_6 S_2$$

This specification directly parallels that of Equation (10) in Chapter 4. The actual variables included are, however, somewhat different, reflecting measurement at the end of two years rather than at enrollment.

A household's rent level is likely to have changed over the two years after enrollment even in the absence of the experiment, if only because of inflation. Normal housing expenditures at the end of two years were estimated using the Control group and are based on the household's demographic characteristics, including income, as well as the residual from the regression of expenditures on these variables at enrollment.[1]

The expenditures necessary to meet requirements also rose during the course of the experiment. The cost of units that met the Minimum Standards requirements was higher, on average, at the end of the experiment than at the beginning. Likewise Minimum Rent levels were raised during the second year of the experiment to adjust for inflation. As in Chapter 4, the variable used to estimate the expenditure levels needed to meet requirements is the actual Minimum Rent requirement for Minimum Rent households and the estimated cost of standard housing for Minimum Standards households. Both of these levels were increased at the end of the first year to adjust for inflation.

In general, the probability of participating would be expected to increase with $\hat{R}_N$ and decrease with R_R. Indeed, as was the case in Chapter 4, these variables could generally be reduced to a single measure of distance from meeting requirements, $(R_R - \hat{R}_N)$.[2]

The terms in the normal probability of moving are the same terms used in Chapter 4. The probability of participating would be expected to increase with the normal probability of moving, both because the deviation of actual expenditures above predicted normal levels tended to be positive for households that moved, as compared with those that stayed in their enrollment unit, and because additional transaction costs involved in meeting requirements would be expected to

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[1] See Appendix XVI for details of the normal rent regressions.

[2] For test results, see Appendix XIV.

be smaller for households that would have moved normally. The term in the logarithm of the probability of moving was intended to estimate the expected cost of having to move to meet requirements for households that would not, in fact, have moved in the absence of the allowance offer. As in the analysis of Chapter 4, this term was generally insignificant and was dropped from the final specification.

The payment variables are exactly like those used in Chapter 4, except that they are computed at the end of two years. The payment level variable is computed for a given household size and income. Variations in this variable reflect variations in the payment formula parameters tested in the experiment. The residual payment variable is the difference between the payment level and the actual payment to which the household was entitled given its income and household size. Variations in this variable reflect both variations in payment parameters and variations in household size and income.

The final specification used, therefore, was

$$(4) \qquad \ln\left(\frac{\pi_E}{1-\pi_E}\right) = \alpha_0 + \alpha_1(R_R - \hat{R}_N) + \alpha_2\hat{P}_M + \alpha_3 S_1 + \alpha_4 S_2$$

where

π_E = the probability that a household participated

R_R = the required expenditure level at the end of two years (for Minimum Rent households) or the estimated cost of standard housing at the end of two years (for Minimum Standards households)

$\hat{R}_N$ = estimated normal expenditures at the end of two years

$\hat{P}_M$ = the estimated probability that a household would normally move in the absence of the allowance offer

S_1 = the payment level at two years (computed as the payment the household would have received as a household of size four with income equal to the sample mean income), and

S_2 = the residual payment at two years (the difference between the actual payment offered at two years and S_1).

Table 5-2 shows the results of a logit estimation of the probability of being a participant at the end of two years among households that did not meet requirements at enrollment. As expected, patterns are fairly similar to those shown in Table 4-3 for the probability of ever being a recipient among all enrolled households that did not meet requirements at enrollment. Effects are somewhat simpler at the end of two years, however. The results of Chapter 4 showed a markedly different response for Minimum Rent households in Pittsburgh. Whereas the Minimum Standards equations could be pooled for the two sites and were similar to the Minimum Rent estimates in Phoenix, Minimum Rent equations could not be pooled for the two sites. Likewise, participation among all enrolled Minimum Rent households in Pittsburgh was not significantly related to payment level, contrary to the results for the other Housing Gap groups. This anomaly disappears for participation at the end of two years. First, it is possible to pool both Minimum Rent and Minimum Standards households across the two sites.[1] Second, payment effects are more consistent for the two-year sample.

The effect of payment level was positive and significant for both Minimum Rent and Minimum Standards households. An increase of $10 in payment level is estimated to have increased a household's probability of being a participant after two years by about five percentage points for Minimum Standards households, the same effect as that estimated for the payment level variable in Chapter 4. Likewise, the probability of participating among Minimum Rent households increased by three percentage points for a $10 increase in payment level, the same effect as that estimated for all enrolled Minimum Rent households in Phoenix in Chapter 4. The residual payment (the difference between the actual payment and the payment level) was also positive and significant for Minimum Rent households. The unexplained absence of any effect for the residual payment variable, found in Chapter 4, was, however, maintained for Minimum Standards households at two years.

Distance from meeting the requirements was significant and negative at both sites. A household's estimated probability of being a participant at two years declined by four percentage points for Minimum Standards households and eleven percentage points for Minimum Rent households for a $10 increase in distance from meeting the requirements. The probability of moving during the experiment was positively

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[1] See Appendix XIV for test results.

Table 5-2

LOGIT ESTIMATION OF THE PROBABILITY OF PARTICIPATING AT THE END OF TWO YEARS FOR HOUSING GAP HOUSEHOLDS THAT DID NOT MEET REQUIREMENTS AT ENROLLMENT--COMBINED SITES

	MINIMUM STANDARDS HOUSEHOLDS			MINIMUM RENT HOUSEHOLDS		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-1.185	-4.65**	NA	-0.967	1.49	NA
Distance (units of $10)	-0.162	-4.18**	-0.039	-0.433	-7.25**	-0.105
Probability of moving (units of 0.10)	0.014	2.54**	0.034	0.084	1.60	0.020
Payment level (units of $10)	0.204	4.27**	0.050	0.119	2.07*	0.029
Residual payment (units of $10)	0.032	0.58	0.008	0.214	4.97**	0.052
Phoenix households	0.613	2.38*	0.150			
Likelihood ratio (Significance)	95.354**					
Sample size	425					
Mean of dependent variable	0.421					
Coefficient of determination	0.165					

SAMPLE: Housing Gap households that did not meet the requirements of their treatment group at enrollment and were active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1.0C*, b = .25) Housing Gap treatment group and households living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

Table 5-3

COMPARISON OF THE PARTICIPATION RATES OF HOUSING GAP HOUSEHOLDS AT THE END OF TWO YEARS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS--COMBINED SITES

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-1.770	-6.92**	NA	-1 328	-4 23**	NA	-1.102	-4.07**	NA
Distance (units of $10)	-0.154	-4.97**	-0.030	-0.469	-5.26**	-0 010	-0.340	-6.29**	-0.058
Probability of moving (units of 0.10)	0.098	2.57*	0 019	0.181	3.41**	0 040	0.117	2 63**	0 020
Phoenix households	0.927	4.24**	0.183	-0.144	-0 46	-0.032	0.037	0.13	0.006
Experimental households	0 064	0.15	0.013	-0.477	-0.64	-0.106	-0 005	-0.009	-0 001
Payment level (units of $10)	0.189	4.02**	0.037	0.231	2.38**	0.052	0.141	1.921	0.024
Residual payment (units of $10)	0.025	0.43	0.005	0.258	3.26**	0.006	0.168	3 08**	0 029
Likelihood ratio (significance)		90 583**			82.022**			77 145	
Sample size		551			298			453	
Mean of dependent variable		0.270			0.336			0.221	
Coefficient of determination		0.141			0.216			0 161	

SAMPLE: Housing Gap households that did not meet the requirements of their treatment group at enrollment and Control households that did not meet each of the three requirements at enrollment that were active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* - 1.0C*, b = .25) Housing Gap treatment group and households living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

† t-statistic significant at the 0 10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

related to a household's probability of meeting the requirements, but it was significant only for Minimum Standards households.

In addition, the probability of being a participant at two years was higher for both types of requirements in Phoenix than in Pittsburgh. Overall, Phoenix households were estimated to have a probability of participating 15 percentage points higher than that of similar Pittsburgh households.

Thus, the factors that influenced long term participation among households that remained active and eligible over two years are much the same as those that influenced short term participation rates. If anything, patterns are somewhat clearer and more consistent for the estimation of long term participation.[1]

Participation rates at two years may also be analyzed, as in Chapter 4, by comparing participation rates among Housing Gap households with the rates at which Control households met the housing requirements. The results of this comparison are presented in Table 5-3. Comparisons were estimated separately for each requirement. In each case it was possible to pool observations for the two sites without significant loss of explanatory power.[2]

Effects for distance and probability of moving are significant and in the expected direction for all three requirements. These variables appear to be related to the normal probability of meeting the requirements among Control households as well as to the probability of meeting the requirements among Experimental households.[3] In addition, the size of the effects for

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[1] An exception to this is the effect of demographic variables. Unlike the results reported in Chapter 4, adding demographic variables to the equation in Table 5-2 does increase its explanatory power. However, none of the demographic terms is significant except for income, which has a positive relationship to the probability of participating. Separate tests for the three requirements suggest that the effects are concentrated in the Minimum Rent rather than the Minimum Standards group. Separate tests for the two sites show that demographic variables added significant explanatory power only in Phoenix, not in Pittsburgh.

[2] See Appendix XIV for test results.

[3] Terms allowing the effect of distance and the probability of moving to vary for Housing Gap and Control households were also tested, but were found to be insignificant except for Minimum Rent Low households in Pittsburgh. See Appendix XIV for test results.

these variables are very similar to those estimated in Chapter 4 for Pittsburgh (see Table 4-4).

Table 5-3 also shows a significant and positive effect for payment level in all three comparisons. For households active over two years, the level of payment offered appears to have had an effect on inducing them to meet requirements over and above their normal probability of doing so. This is in contrast to results in Chapter 4 that showed an effect of payment level only for Minimum Standards households in comparison with Control households. Residual payment also had a significant and positive effect for Minimum Rent households, but not for the Minimum Standards group.

The overall effect of the allowance offer on the rate at which households met requirements may be indicated by suppressing the payment variables in Table 5-3. The estimated coefficients for the Housing Gap dummy variable are shown in Table 5-4.[1] As expected, all are significant and large--from roughly one-third to three-quarters larger than similar coefficients estimated for the cumulative participation of all enrolled households in Chapter 4. Furthermore, while the estimated logit coefficients for the three requirements are not as obviously similar as those in Chapter 4, none is significantly different from another.

Indeed, with the exception of the coefficients for the residual payment variable under Minimum Standards, the coefficients for experimental and payment effects in Table 5-3 are not significantly different between the different requirements.[2] The fact that the residual payment coefficient for Minimum Standards is so much lower than the payment level coefficient suggests that there are household size or income effects on participation under this requirement not accounted for by the distance and probability of moving variables. Apart from this, however, the overall similarity of the estimates under the different requirements suggests that, at least for households that did not meet requirements at enrollment, the participation rate for any requirement could be specified in the form,

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[1]The full results are presented in Appendix XV.

[2]Significance here was assessed in terms of pairwise comparisons assuming independence across the three requirements. Since the same Control households are used in each estimate, this is not strictly acceptable.

Table 5-4

ESTIMATED LOGIT COEFFICIENTS FOR THE OVERALL EFFECT OF THE ALLOWANCE OFFER ON THE RATE AT WHICH HOUSEHOLDS MET REQUIREMENTS--COMBINED SITES

	COEFFICIENT	STANDARD DEVIATION	t-STATISTIC
Minimum Standards requirement	1.284	0.198	6.48**
Minimum Rent Low requirement	1.601	0.308	5.20**
Minimum Rent High requirement	1.170	0.247	4.74**

SAMPLE: Housing Gap households that did not meet the requirements of their treatment group at enrollment and Control households that did not meet each of the three requirements at enrollment that were active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1.0C*, b = .25) Housing Gap treatment group and households living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

NOTE: Complete logit results are shown in Appendix XV.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

(5) $$\ln\left(\frac{\pi}{1-\pi}\right) = \ln\left(\frac{\pi_N}{1-\pi_N}\right) + \gamma S$$

where

π = the probability of participating under any requirement

π_N = the probability of meeting the requirement normally, in the absence of the experiment

S = the allowance payment offered.

Furthermore, while the relatively small samples of households that did already meet requirements at enrollment and the high probability that these households would continue to meet requirements normally make analysis of program effects for this group difficult, the estimated overall effect for households that did not meet requirements at enrollment in Table 5-4 is not obviously inconsistent with the tabulations for households that did meet requirements at enrollment in Table 5-1.[1] Thus, the specification of Equation (5) might apply to the overall participation rate for all households.

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[1]The table below shows the average proportion of Controls and Experimentals meeting requirements at enrollment that continued to meet them at the end of two years (from Table 5-1). The figure for Experimental households is then compared with the estimated rate for such households obtained from the Control rate and the overall effect estimated in Table 5-4, i.e.,

$$\hat{\pi}_E = \left[1 + \exp\left(\ln\left(\frac{\bar{\pi}_C}{1-\bar{\pi}_C}\right) + \hat{E}\right)\right]^{-1}$$

where

$\hat{\pi}_E$ = estimated participation rate among households that met requirements at enrollment

$\bar{\pi}_C$ = the proportion of Control households meeting requirements at enrollment that met them at two years

$\hat{E}$ = the estimated overall effect from Table 5-4.

	$\bar{\pi}_C$	$\bar{\pi}_E$	$\hat{\pi}_E$
Minimum Standards	.82	.89	.94
(N)	(73)	(63)	(NA)
Minimum Rent Low	.94	.99	.99
(N)	(222)	(104)	(NA)
Minimum Rent High	.92	.98	.97
(N)	(105)	(44)	(NA)

The estimated rates $\hat{\pi}_E$ appear to be quite similar to the observed means $\bar{\pi}_E$. This is hardly conclusive, since a wide range of logistic coefficients will produce similar values of $\hat{\pi}_E$, given the high levels of $\bar{\pi}_C$. Still, it does suggest that further analysis could develop a nicely unified set of estimates.

If the effect of the allowance offer was greater for households that remained active for two years, then the participation rate of households that would not have met the requirements normally should be higher for this group than for all enrollees. Table 5-5 shows the estimated normal rate of meeting requirements among households active at the end of two years. Results are shown for all households still actively enrolled and eligible after two years and shown separately for households that did and did not meet the requirements at enrollment.[1]

In general, the group of participants still active at the end of two years contains a higher proportion of households that would not normally have met the requirements than the group of households that ever participated (as shown in Table 4-6). The differences are not dramatic, however. The proportion of participants that would have met the requirements normally in the absence of the allowance offer is estimated to range from 59 percent for Minimum Standards households to 75 percent for Minimum Rent Low households. Similar figures for all enrolled households in Table 4-6 ranged from 66 percent to 87 percent. Likewise the implied participation rate for households that would not normally have met requirements was 28 percent for Minimum Standards households, 27 percent for Minimum Rent High households and 50

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[1]The numbers in Table 5-5 parallel those of Table 4-6, with two exceptions. First, because of the large size of the estimated logistic coefficients, the first derivative approximation to the effect of the allowance offers used in Table 4-11, was not used here. Instead, the normal rate at which Housing Gap households would have met requirements was approximated by

(i) $$\pi_N = \frac{e^X}{1 + e^X}$$

(ii) $$X = \ln\left(\frac{\pi_E}{1 - \pi_E}\right) - \hat{\beta}_E$$

where π_E is the observed rate at which Housing Gap households met requirements X and $\hat{\beta}_E$ is the estimated coefficient for Housing Gap households in Table 5-4. Thus the normal rate was estimated as the logistic function of the logit value implicit in the actual rate at which Housing Gap households met requirements, minus the estimated effect on the logit value of the Housing Gap offer.

The second difference has to do with households that met requirements at enrollment. As indicated in Section 5.1, these households could not be analyzed using the logistic specification of this section. Instead, their normal rate of meeting requirements is taken as the rate for Control households shown in Table 5-1.

Table 5-5

PROPORTION OF PARTICIPANTS AT TWO YEARS THAT WOULD HAVE MET REQUIREMENTS IN THE ABSENCE OF THE ALLOWANCE OFFER--COMBINED SITES

	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
HOUSEHOLDS THAT DID NOT MEET REQUIREMENTS AT ENROLLMENT (Number of cases)	(264)	(93)	(150)
1-a Participation rate	40%	58%	37%
1-b Estimated normal rate of meeting requirements	16	22	15
1-c Proportion of participants that would have met requirements normally	40	38	41
ALL ENROLLED HOUSEHOLDS (Number of cases)	(328)	(198)	(194)
2-a Participation rate	49%	80%	51%
2-b Proportion that met requirements at enrollment	19	53	23
Estimated proportion that would have met requirements normally after enrollment			
2-c Households that met requirements at enrollment	16	50	21
2-d Households that did not meet requirements at enrollment	13	10	12
2-e Total normal participation rate	29	60	33
2-f Percentage of all participants that would have met requirements normally	59	75	65
2-g Implied participation rate for households that would not have met requirements normally	28	50	27

SAMPLE Housing Gap households active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1 OC*, b = 25) Housing Gap treatment group and households living in their own homes or in subsidized housing

DATA SOURCES: Initial and Monthly Household Report Forms, Housing Evaluation Forms, payments file.

NOTE Table items are defined as follows

1-a π_{EA}

1-b $\hat{\pi}_{NA}$

1-c $\hat{\pi}_{NA}/\pi_{EA}$

2-a π_E

2-b π_o

2-c $\hat{\pi}_{NE}\pi_o$

2-d $(1-\pi_o)\pi_{NA}$

2-e $\hat{\pi}_{NE}\pi_o + (1-\pi_o)\hat{\pi}_{NA}$

2-f $\frac{2\text{-}c}{2\text{-}a}$

2-g $\frac{(2\text{-}a) - (2\text{-}c)}{1 - (2\text{-}e)}$

where

π_{EA} = participation rate at two years for Housing Gap households that did not meet requirements at enrollment

$\hat{\pi}_{NA} = e^X/1 + e^X$ where $X = \ln(\pi_{EA}/1-\pi_{EA}) - \hat{\beta}_{EA}$

$\hat{\beta}_{EA}$ = the estimated logistic coefficient for Housing Gap households from Table 5-4

π_E = participation rate at two years for all Housing Gap households

π_o = the proportion of Housing Gap households that met requirements at enrollment

$\hat{\pi}_{NE}$ = the proportion of Control households that met requirements at enrollment and continued to meet them at two years (from Table 5-1). Figures are combined site averages (0 82 for the Minimum Standards requirement, 0 94 for the Minimum Rent Low requirement, 0 92 for the Minimum Rent High Requirement).

percent for Minimum Rent Low households at two years. These rates are only marginally higher than the 24 and 25 percent rates estimated for all enrolled Minimum Standards and Minimum Rent High households in Chapter 4. (The difference is more marked for Minimum Rent Low households--50 percent at two years as compared with 29 percent for all enrolled households.)

5.3 SUMMARY

The allowance offer did have a larger effect for households that remained enrolled and eligible for two years, than for all enrolled households. At the same time, the basic patterns found for all enrolled households were maintained. Subsequent participation rates among households that did not meet requirements at enrollment were still relatively low, going above 50 percent only for the Minimum Rent Low requirements. Distance from the expenditure level necessary to meet requirements and the probability of moving had effects similar to those found for all enrolled households and again appeared to act primarily through their effect on the household's normal probability of meeting requirements. The estimated logit coefficients for the overall effect of the allowance offer in inducing households to meet requirements were again similar across all three requirements. Indeed the major difference from the patterns of Chapter 4 was a greater consistency of the results. The anomalous pattern for Minimum Rent households in Pittsburgh disappeared and payment level had a significant effect on the probability of meeting requirements for all three types of requirements. Most important, despite the larger effect of the allowance offer in inducing households to meet requirements most households that would not normally have met requirements in the absence of the allowance offer still did not participate. Households that would have met requirements normally continue to comprise more than half of all participants. As in Chapter 4, households in the worst housing were still the least likely to participate.

CHAPTER 6

TECHNICAL SUMMARY

This report has analyzed participation in the Housing Allowance Demand Experiment both in terms of the absolute participation rates observed and the relative participation rates among different program offers and different demographic groups. The Demand Experiment offered the opportunity to participate in a housing allowance program to samples of eligible households in two sites, Allegheny County, Pennsylvania (Pittsburgh) and Maricopa County, Arizona (Phoenix). Participation rates observed in the experiment can be used to estimate potential participation in similar ongoing open-enrollment programs in which all eligible households are allowed to participate. They may also reflect on patterns of participation among different demographic groups in limited enrollment programs.

The level and pattern of program participation are central to the evaluation of any program. Consider first an open-enrollment program. Total program costs will obviously depend on the overall participation rate and the extent to which relative participation rates vary with the cost of serving different households. Equally important, participation rates directly measure the basic ability of the program to reach its target population. Households that never participate in a program are not served, whether well or poorly, by the program. Thus examination of participation must be a first step towards evaluating program effectiveness.

The implications of less than total participation frequently depend, however, on who participates. Many programs, for example, extend income eligibility limits beyond their target population in order to provide for a gradual reduction in benefits if household income increases. For such programs a finding of limited participation among higher income eligibles might be of little concern and even viewed as a positive feature. If the program does reach its original target population, the loss of higher income households may in effect simply reduce total program costs without materially changing the intended benefits. A finding of low participation among the poorest eligibles, on the other hand, would clearly indicate that the program had failed in its purpose, strongly suggesting a need for

alternative or supplemental efforts. More generally, failure to reach specific groups such as the elderly, minorities, households with limited education, or the handicapped may suggest a need for special program services to meet the special disadvantages of these groups.

Program participation may also directly affect the nature of program benefits. Households eligible for various subsidy programs such as Public Housing, Food Stamps, or Medicare/Medicaid may be regarded as falling into two groups. One group consists of households that would, in the absence of the program, purchase about as much housing, food, or medical care as they do with the program, though often at considerable sacrifice. For these households, the effect of the program is primarily financial; it frees resources that they would have had to spend on these things for purchases of other goods or services. The second group consists of households that would, in the absence of the program, purchase much less housing, food, or medical care than they obtain through the program. These households may still receive considerable financial relief from the program, but they also experience a considerable improvement in their housing, food, or medical care.[1] The extent to which a program's effects are primarily financial as opposed to achieving substantive changes in housing, food consumption, and medical care depends on the mix of these two groups in the eligible population and their relative participation rates.

Limited enrollment programs may have much more opportunity to select their participants. Even if the program has relatively less appeal for the very poor, for example, it may still be able to select only very poor applicants for enrollment. Additional outreach efforts may be required to obtain enough applicants, however, and the program's actual flexibility in selecting applicants may be limited by law or regulation. More important some selections may be quite difficult to make. A housing program that wished to target its services to households that would otherwise live in substandard housing as opposed to households needing purely financial

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[1] Specifically, they spend more for these services, either directly or indirectly through the program. Whether this increased spending in fact results in better housing, improved nutrition, and improved health care is a separate issue. For analysis of this topic in terms of housing change in the Demand Experiment, see Kennedy and Merrill (1979) and Friedman and Weinberg (1978, 1979).

relief must in effect select as participants households that would live in substandard housing without the program. This raises obvious issues of equity. It may be difficult to argue that one household should be offered low-cost housing while another household is denied support simply because it has managed by dint of considerable sacrifice and careful shopping to obtain decent housing. Targets may have to be set in terms of acceptable criteria for overall need rather than directly in terms of living in substandard housing.

In addition, it is not always possible to guess accurately about what kind of housing a household will occupy in the absence of assistance. A household that is now in standard housing may be faced with sudden loss of income or heavy non-housing expenses due to death, separation, illness, unemployment or retirement that will drive it into substandard housing without assistance or unusual sacrifice of other needs. Likewise, households that are now in substandard housing may experience changes in their circumstances that would normally allow them to obtain decent housing from their own resources. Even a limited enrollment program may be unable to undo the participation patterns that would be present if the program were available to all eligible households.[1]

The results of the Demand Experiment suggest that achieving a minimum level of housing services for a substantial proportion of the eligible population may be more difficult than it might seem. Specifically, it appears that without substantially larger payments than those offered in the Demand Experiment, a housing allowance program must either fail to reach most households in the worst housing or adopt such low standards that most low-income households would meet the standards in any case. Likewise, while programs with low standards will have high participation

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[1]Another example of such problems is in manpower programs. Such programs have from time to time been severely criticized on the grounds that they largely select enrollees that are relatively skilled or easy to place in jobs, essentially enrolling people that would have found similar jobs to those provided by the program without any assistance. Similar issues would arise in housing programs to the extent that local authorities tend to select applicants that are generally regarded as "good tenants" (people that would be more likely to be able to find decent housing in the private market).

rates, most of the payments made will be used to provide financial relief rather than achieving substantial changes in participant housing. Conversely, payments can be funnelled into housing change, but only at the cost of low participation rates, especially among households in the worst housing. In addition, while there is no direct evidence as yet for other housing programs, it appears that these same trade-offs may apply to them as well. Finally, it is possible that these trade-offs could be ameliorated if methods can be found to characterize housing need more accurately and target assistance more tightly.

The Demand Experiment tested three major types of housing allowance programs--Housing Gap, Unconstrained, and Percent of Rent. Housing Gap plans offered participants payments designed to make up all or part of the gap between the estimated costs of modest, existing standard housing in each site and the fraction of its income that a household could reasonably be expected to afford for housing. Households could only receive these payments if they lived in or moved to housing that met certain program requirements. The Housing Gap plans are in many ways similar to the Section 8 (existing) Leased Housing Program and have a generic similarity to other housing programs such as Public Housing or Section 236, both of which offer participants housing that meets certain standards at below market rents.

The other two types of allowance tested did not impose housing requirements. Percent of Rent plans offered households rebates equal to a fixed fraction of their monthly rent. Payments were tied directly to the household's housing expenditures, but no other requirements were imposed. Households were free to spend as much or as little for housing as they wished and could occupy any rental unit in the two counties. The Unconstrained plan offered households payments based on the same formula used for the Housing Gap plans, but without imposing any housing requirements. This plan was, in effect, a welfare or income maintenance program.

The major differences in participation among the different programs revolved around the imposition of housing requirements. These both substantially reduced overall participation rates and materially affected the demographic composition of participating households.

Participation rates for Percent of Rent and Unconstrained households were generally high, ranging from 78 to 90 percent depending on the site, as shown in Table 6-1.[1] Participation rates in these programs were, as expected, positively associated with the amount of the payment offered. However, the effect of higher payment offers on participation fell off sharply with higher payment levels. Taking account of demographic characteristics, the difference in the probability of participating between households offered payments of $20 per month and those offered payments of $40 per month was estimated to be about 14 percentage points in both sites. In contrast, the estimated difference between households offered payments of $40 per month and those offered payments of $60 per month was only six percentage points in Pittsburgh and two percentage points in Phoenix. Neither site showed any increase in participation with increases in payments above $80 per month.[2]

While participation in the Percent of Rent and Unconstrained programs was significantly different for different demographic groups, the differences were frequently modest and generally inconsistent across the two sites. It appears that the reasons for rejecting participation in these programs were both varied and idiosyncratic, with demographic patterns arising more by chance than through any strong causal links.

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[1]Participation figures for Percent of Rent and Unconstrained households are based on initial acceptance of the enrollment offer. These figures may overestimate participation rates for similar ongoing programs for two reasons. First, household acceptance of the program offer was based on the verbal descriptions of program outreach workers. Households may well have changed their mind about participating in the program after enrolling. Evidence based on analysis of dropouts in the first six months of the program suggests that such reversals in household acceptance decisions did occur. In particular, it appears that the difference in acceptance rates between the two sites may reflect differences in such delayed decisions, so that the participation rate for an actual program might fall towards the lower end of the rates observed for the Demand Experiment--about 75 to 80 percent. (See Section 2.6 of Chapter 2 and Appendix V.)

Second, participation rates estimated in the Demand Experiment are based on households that completed the initial enrollment interview. All of these households had received a brief but complete description of how the program operated, including an estimate of the allowance payment that they would receive if they participated. This represents a very extensive outreach effort. To the extent that households eligible for an ongoing program are less aware of the program's existence and benefits, participation rates in such a program might be much lower than those observed in the experiment.

[2]See Table 3-3.

Table 6-1

PARTICIPATION RATES FOR PERCENT OF
RENT AND UNCONSTRAINED HOUSEHOLDS

	PITTSBURGH	PHOENIX	COMBINED SITES
Percent of Rent households			
Participation rate	82%	87%	84%
(Number of cases)	(821)	(678)	(1,499)
Unconstrained households	78	90	83
Participation rate	(120)	(89)	(209)
(Number of cases)			

SOURCE: Table 2-1.

Objections to program reporting requirements and reluctance to accept money from the government were the reasons most frequently given by households for not accepting the enrollment offer. These were rarely the only reason given, however.

Participation under the Housing Gap plans was about half as large as under the Percent of Rent or Unconstrained plans. This clearly reflected the housing requirements imposed under the Housing Gap plans. Housing Gap households, like Percent of Rent and Unconstrained households, had to decide whether to accept the enrollment offer. For Percent of Rent and Unconstrained households, this was the only decision involved in participation. Once households in these groups accepted the enrollment offer and were certified as eligible and enrolled in the experiment, they immediately qualified for payments and began to participate in the programs. Enrolled Housing Gap households still had to meet housing requirements in order to qualify for payments. This additional step accounted for almost all of the reduction in participation rates for the Housing Gap plans.

As shown in Table 6-2, acceptance rates for the Housing Gap plans were only slightly lower than those for Percent of Rent and Unconstrained households--78 percent for Housing Gap in the two sites combined as compared with 84 percent for Percent of Rent and 83 for Unconstrained households. Furthermore, this difference in acceptance rates was concentrated in the upper third of the income distribution of households offered enrollment. Apart from this difference, acceptance of the Housing Gap offers followed the same pattern as that for Percent of Rent and Unconstrained households. There were no other significant differences among the different program types, either in estimated demographic effects or in the estimated effects of the allowance payment offered.[1]

There is some evidence that the lower acceptance rate among Housing Gap households did reflect a response to the Housing Gap housing requirements. At the same time, this response was very general and apparently completely unrelated to whether the household actually met or thought that it met the housing requirements. Acceptance rates were almost identical for the

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[1] See Section 3.1 of Chapter 3.

Table 6-2

PARTICIPATION RATES FOR HOUSING GAP HOUSEHOLDS

	ALL HOUSING GAP HOUSEHOLDS	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
PITTSBURGH				
Overall participation rate	41%	30%	60%	42%
Acceptance rate (Number of cases)	74 (1086)	75 (489)	74 (287)	73 (310)
Subsequent participation rate (Number of cases)	56 (592)	40 (268)	81 (156)	58 (168)
PHOENIX				
Overall participation rate	49	45	61	44
Acceptance rate (Number of cases)	83 (1007)	84 (470)	82 (258)	81 (279)
Subsequent participation rate (Number of cases)	59 (662)	54 (307)	74 (167)	54 (188)
COMBINED SIZES				
Overall participation rate	45	37	61	43
Acceptance rate (Number of cases)	78 (2093)	79 (959)	78 (545)	77 (589)
Subsequent participation rate (Number of cases)	58 (1254)	47 (575)	78 (323)	56 (356)

SOURCES: Tables 2-3 and 2-4.

three different requirements tested, despite large variations in the proportions of households that met the different requirements. Nor were Housing Gap households that accepted the enrollment offer any more likely to meet requirements than other households.[1] Less than a quarter of the Housing Gap households that turned down the enrollment offer felt that they would have failed to meet requirements. While a larger proportion of these households said that they rejected the allowance offer because they did not want to move, a smaller proportion cited program requirements (including both housing requirements and other program requirements) as a reason for rejecting the allowance offer.[2]

Whether households would normally meet housing requirements was, however, strongly related to their subsequent participation, as shown in Table 6-3. As a result, a large majority of participants under each program either already met the requirements when they enrolled or would have met them normally after enrollment. Only 38 percent of the households that did not meet requirements at enrollment subsequently met requirements and participated in the allowance programs. While the participation rate of households that did not already meet requirements at enrollment varied somewhat by requirement and site, it was never as high as 50 percent. Comparisons with Control households indicate that from 15 to 25 percent of the Housing Gap households that did not meet requirements would have met them normally, in the absence of the allowance offer. As a result, the estimated participation rate among households that would not have met requirements normally was only 24 to 29 percent, and these households made up only a relatively small fraction of recipients, ranging from 13 percent of participants under the Minimum Rent Low plans to 34 percent under the Minimum Standards plan.

The association between participation and a household's normal probability of meeting the housing requirements also had important implications for the demographic characteristics of participants. Households that would not normally have met the housing requirements were generally less likely to

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[1] See Section 3.3 of Chapter 3.

[2] See Section 3.2 of Chapter 3.

Table 6-3

PARTICIPATION RATES AMONG HOUSING GAP HOUSEHOLDS
THAT NORMALLY WOULD NOT HAVE MET REQUIREMENTS

	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
MEETING REQUIREMENTS AT ENROLLMENT			
Percentage of enrolled households that did not meet requirements at enrollment	83%	42%	70%
(Number of cases)	(575)	(323)	(356)
Participation rate for households that did not meet requirements at enrollment	37	47	36
(Number of cases)	(479)	(135)	(248)
Percentage of participants that did not meet requirements at enrollment	65	25	45
(Number of cases)	(273)	(251)	(198)
MEETING REQUIREMENTS NORMALLY			
Estimated percentage of enrolled households that normally would not have met requirements	69	32	60
Estimated participation rate for households that normally would not have met requirements	24	29	25
Estimated percentage of participants that normally would not have met requirements	34	13	29
OVERALL PARTICIPATION RATE			
Participation rate for all enrolled households	47	78	56
(Number of cases)	(575)	(323)	(356)

SOURCES: Tables 4-1 and 4-6.

participate. As a result, participation rates were significantly lower for minorities, for large households, and for the very poor.[1]

The strong association between participation and a household's normal probability of meeting requirements also has important implications for the program's impact on housing. Most obviously, the failure of the program to reach even half of the households that would not normally have met requirements means that most of the eligible population in substandard housing (as defined by the program's requirements) were not served. Likewise, the fact that most households that did participate would have met requirements normally means that most of the program's benefits for recipients were financial relief rather than improved housing.

Participants that would have met requirements normally in the absence of any allowance offer were effectively unconstrained by the housing requirements. They would be expected to have treated the allowance payment like any other addition to income, with correspondingly modest changes in their housing. Analysis of housing change among Housing Gap participants by Friedman and Weinberg (1979) confirms this. Households that already met requirements at enrollment, for example, generally devoted little or none of their allowance payment to additional housing expenditures. Since two-thirds to seven-eighths of participants would have met requirements normally, as indicated in Table 6-3, it appears that an allowance program will have little effect on the housing of most of its participants.

Despite this fact, other analyses have shown that the programs with housing requirements did lead to larger housing changes than the Unconstrained or Percent of Rent programs. These changes were, however, purchased at the price of lower participation and were highly specific to the requirements used. Friedman and Weinberg (1979) find, for example, that Unconstrained households showed no significant increase above normal levels in the rate at which they met Minimum Standards requirements. Likewise, while Unconstrained households were more likely to meet Minimum Rent requirements than similar Control households, the estimated impact was much smaller than that for Minimum Rent households. These effects were highly specific to the

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[1] See Section 4.3 of Chapter 4.

requirements used. Under alternative standards that were both more or less stringent than the Minimum Standards, for example, there was no significant difference in the impact of the Minimum Standards and Unconstrained programs.

The same pattern was apparent in the housing changes of participants (as opposed to all enrolled households). Participants in the Housing Gap programs showed significantly larger increases in expenditures than Unconstrained households only under Minimum Rent High requirements--that is, only when requirements were relatively stringent and specifically related to rent levels. Indeed, in terms of a general index of housing services, derived from the estimated average market value of units as a function of unit and location characteristics,[1] Friedman and Weinberg found no significant difference between the changes for Housing Gap and Unconstrained households. Given the relatively low participation rates among Housing Gap households, this means that an Unconstrained program would produce larger changes for the entire enrolled population, though at a correspondingly higher cost.[2]

Thus, it appears that in contrast with the Unconstrained plan, the Housing Gap plan obtained larger housing changes only in terms of the specific requirements imposed. The Unconstrained plan reached a much larger proportion of households at accordingly larger total program costs and subsidized larger numbers of households in substandard housing.

The trade-off between the housing quality achieved by participants, the impact of the allowance program on housing, and its effectiveness in reaching households in the worst housing is apparent in Table 6-3. The 78 percent participation rate under the Minimum Rent Low requirement was achieved largely because the requirement was low enough that 68 percent of households would have met it normally. As a result, however, only 13 percent of the participants were households that were induced to

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[1] This is an hedonic index of housing services, estimated by Merrill (1977).

[2] Indeed, probably at a higher than proportional increase in total cost, since the very poor and very large households excluded under the Housing Gap plans tended to be eligible for larger payments.

meet requirements by the allowance program. Conversely, the lowest participation rate was the 47 percent rate observed for the Minimum Standards requirement. This low rate followed directly from the fact that only 31 percent of enrolled households would have met this requirement normally. As a result, the proportion of recipients induced to meet requirements by the program was over two and one half times as large as under the Minimum Rent Low requirement, though still only 34 percent of participants.

As indicated in Table 6-3, the participation rate among households that would not normally meet requirements was the same or lower under the more stringent Minimum Standards requirements as under the Minimum Rent Low requirements. The analysis of Chapters 3 and 4 found that an individual household's probability of participating was a simple function of its normal probability of meeting requirements, as determined by its distance from meeting requirements and its normal probability of moving, plus an experimental effect.[1] Households in the worst housing were least likely to meet requirements normally and hence least likely to participate. As program requirements are made more stringent, these households became even less likely to participate.

Thus, the greater impact or impact per dollar of the Housing Gap programs and the restriction of subsidies to standard units (as defined by the program) was accomplished in two ways. First, households that were relatively close to meeting requirements were induced to meet them at much higher rates than an unconstrained payment alone would have accomplished. Second, households that were relatively far from meeting requirements were effectively excluded from the program. A Housing Gap form of allowance program can achieve high quality levels for its participants, but only at the cost of progressively excluding eligible households in the worst housing.

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[1]The estimated relationship between participation and a household's normal probability of meeting requirements was remarkably stable. There was little evidence of any marked interaction between the logistic coefficients for the experimental effect and the terms in the household's normal probability of meeting requirements. Likewise, the estimated logistic coefficient was remarkably stable across the three requirements despite substantial variations in the content of the requirements and the average normal rate of meeting them.

For Minimum Standards requirements, at least, these patterns were somewhat mitigated by higher allowance payments. As would be expected, higher payments increased participation among households that would not normally have met requirements. Unless higher payments could be effectively targeted to this group, however, the costs involved might be prohibitive. The average allowance payment offered to enrolled households was $56 per month in Pittsburgh and $73 per month in Phoenix. Achieving even a 50 percent participation rate among Minimum Standards households that would not normally have met requirements was estimated to have required increasing this payment offer by almost $50 per month. The estimated overall participation rate at these payment levels would have been 66 percent, with slightly more than half of the participants induced to meet requirements by the allowance offer.[1]

Not all enrolled households remained enrolled and eligible for the entire two years of the experiment. Households that remained enrolled and eligible for two years after enrollment might be expected to have been more willing and able to change their housing in response to the allowance offer than households that were only enrolled and eligible for a few months. The analysis of Chapter 5 showed that this was indeed the case. The difference was generally not large, however. Even among households that remained enrolled and eligible for two years, participation rates for households that would not normally have met requirements were never higher than 50 percent. Nor did these households ever constitute as much as half of the participating population. (See Table 6-4.)[2] Again, however, results suggested that substantial increases in payment could mitigate this pattern.

These findings raise important questions for other housing programs as well. Every housing program for low-income households essentially offers households a payment (often in the form of below-cost rents) if the household will agree to occupy housing that meets certain standards. In new

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[1] See Section 4.2 of Chapter 4.

[2] There is some evidence that these estimates overstate the effect of the allowance offer for Minimum Standards households due to differences in attrition between Housing Gap and Control households. The bias may not be large, however. (See Appendix VI.)

Table 6-4

PARTICIPATION RATE OF HOUSING GAP HOUSEHOLDS THAT NORMALLY WOULD NOT HAVE MET REQUIREMENTS AND THAT REMAINED ENROLLED AND ELIGIBLE FOR TWO YEARS AFTER ENROLLMENT

	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
Estimated percentage of enrolled households that normally would not have met requirements	71%	40%	67%
Estimated participation rate for households that normally would not have met requirements	28	50	27
Estimated percentage of participants that normally would not have met requirements	41	25	35

SOURCE: Table 5-5.

construction programs, such as Public Housing or Section 236, these standards are very specific, involving at best a selection from among units specifically constructed or rehabilitated for the program. In Section 8, the standards are more like those used in the Demand Experiment. All of the programs offer the same type of choice, however. These programs may, therefore, face the same sorts of trade-offs as those found above for housing allowances. Alternatively, if they do not, the reasons for such a difference should suggest useful modifications of the allowance mechanism.[1]

[1]While it would no doubt be difficult to amass a large enough sample of new applicants in conjunction with an appropriate control group to investigate these issues directly in other programs, the issues involved seem important enough to warrant serious consideration.

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APPENDIX I

DESIGN OF THE DEMAND EXPERIMENT

This appendix presents a brief overview of the Demand Experiment's purpose, data collection procedures, experimental design, and sample allocation.

I.1 PURPOSE OF THE DEMAND EXPERIMENT

The Demand Experiment is one of three experiments established by the U.S. Department of Housing and Urban Development (HUD) as part of the Experimental Housing Allowance Program.[1] The purpose of these experiments is to test and refine the concept of housing allowances.

Under a housing allowance program, money is given directly to individual low-income households to assist them in obtaining adequate housing. The allowance may be linked to housing either by making the amount of the allowance depend on the amount of rent paid or by requiring that households meet certain housing requirements in order to receive the allowance payment. The initiative in using the allowance and the burden of meeting housing requirements are therefore placed upon households rather than upon developers, landlords, or the government.

The housing allowance experiments are intended to assess the desirability, feasibility, and appropriate structure of a housing allowance program. Housing allowances could be less expensive than some other kinds of housing programs. Allowances permit fuller utilization of existing sound housing because they are not tied to new construction. Housing allowances may also be more equitable. The amount of the allowance can be adjusted to changes in income without forcing the household to change units. Households may also, if they desire, use their own resources (either by paying higher rent or by searching carefully) to obtain better housing than is required to qualify for the allowance. As long as program requirements are met, housing allowances offer households considerable choice in selecting housing most appropriate to their needs--for example, where they live (opportunity to locate near schools, near work, near friends

[1] The other two experiments are the Housing Allowance Supply Experiment and the Administrative Agency Experiment.

or relatives, or to break out of racial and socioeconomic segregation) or the type of unit they live in (single-family or multifamily). Finally, housing allowances may be less costly to administer. Program requirements need not involve every detail of participant housing. The burden of obtaining housing that meets essential requirements is shifted from program administrators to participants.

These potential advantages have not gone unquestioned. Critics of the housing allowance concept have suggested that low-income households may lack the expertise necessary to make effective use of allowances; that the increased supply of housing needed for special groups such as the elderly will not be provided without direct intervention; and that an increase in the demand for housing without direct support for the construction of new units could lead to a substantial inflation of housing costs.[1]

If housing allowances prove desirable, they could be implemented through a wide range of possible allowance formulas, housing requirements, nonfinancial support (such as counseling), and administrative practices. The choice of program structure could substantially affect both the program's costs and impact.

The Demand Experiment addresses issues of feasibility, desirability, and appropriate structure by measuring how individual households (as opposed to the housing market or administrative agencies) react to various allowance formulas and housing standards requirements. The analysis and reports are designed to answer six policy questions:

1. Participation

   Who participates in a housing allowance program? How does the form of the allowance affect the extent of participation for various households?

2. Housing Improvements

   Do households that receive housing allowances improve the quality of their housing? At what cost? How do households

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[1] The issue of inflation is being addressed directly as part of the Housing Allowance Supply Experiment.

that receive a housing allowance seek to improve their housing--by moving, by rehabilitation? With what success?

3. Locational Choice

For participants who move, how does their locational choice compare with existing residential patterns? Are there non-financial barriers to the effective use of a housing allowance?

4. Administrative Issues

What administrative issues and costs are involved in the implementation of a housing allowance program?

5. Form of Allowance

How do the different forms of housing allowance compare in terms of participation, housing quality achieved, locational choice, costs (including administrative costs), and equity?

6. Comparison with Other Programs

How do housing allowances compare with other housing programs and with income maintenance in terms of participation, housing quality achieved, locational choice, costs (including administrative costs), and equity?

The Demand Experiment tests alternative housing allowance programs to provide information on these policy issues. While the experiment is focused on household behavior, it also offers data on program administration to supplement information gained through the Administrative Agency Experiment. Finally, the Demand Experiment gathers direct information on participants and housing conditions for a sample of households in conventional HUD-assisted housing programs at the two experimental sites for comparison with allowance recipients.

I.2 DATA COLLECTION

The Demand Experiment was conducted at two sites--Allegheny County, Pennsylvania (Pittsburgh), and Maricopa County, Arizona (Phoenix). HUD selected these two sites from among 31 Standard Metropolitan Statistical Areas (SMSAs) on the basis of their growth rates, rental

vacancy rates, degree of racial concentration and housing costs. Pittsburgh and Phoenix were chosen to provide contrasts between an older, more slowly growing Eastern metropolitan area and a newer, relatively rapidly growing Western metropolitan area. In addition, Pittsburgh has a substantial black minority and Phoenix a substantial Spanish American minority population.

Most of the information on participating households was collected from:

Baseline Interviews, conducted by an independent survey operation before households were offered enrollment;

Initial Household Report Forms and monthly Household Report Forms, completed by participating households during and after enrollment, which provided operating and analytic data on household size and income and on housing expenditures.

Supplements to the Household Report Forms, completed annually by participating households after enrollment, which provide data on assets, income from assets, actual taxes paid, income from self-employment, and extraordinary medical expenses;

Payments and status data on each household maintained by the site offices;

Housing Evaluation Forms, completed by site office evaluators at least once each year for every dwelling unit occupied by participants, which provide information on housing quality;

Periodic Interviews, conducted approximately six, twelve, and twenty-four months after enrollment by an independent survey operation; and

Exit Interviews, conducted by an independent survey operation for a sample of households that declined the enrollment offer or dropped out of the program.

Surveys and housing evaluations were also administered to a sample of participants in other housing programs: Public Housing, Section 23/8 Leased Housing, and Section 236 Interest Subsidy Housing.

Since households were enrolled throughout the first ten months of operations, the operational phase of the experiment extended over nearly four years in total. Analysis will be based on data collected from households during their first two years after enrollment in the experiment. The experimental programs were continued for a third year

in order to avoid confusion between participants' reactions to the experimental offers and their adjustment to the phaseout of the experiment. During their last year in the experiment eligible and interested households were aided in entering other housing programs.

I.3 ALLOWANCE PLANS USED IN THE DEMAND EXPERIMENT

The Demand Experiment tested a number of combinations of payment formulas and housing requirements and several variations within each of these combinations. These variations allow some possible program designs to be tested directly. More importantly, they allow estimation of key responses such as participation rates and changes in participant housing in terms of basic program parameters such as the level of allowances; the level and type of housing requirements; the minimum fraction of its own income that a household can be expected to contribute toward housing; and the way in which allowances vary with household income and rent. These response estimates can be used to address the policy questions for a larger set of candidate program plans, beyond the plans directly tested.[1]

Payment Formulas

Two payment formulas were used in the Demand Experiment--Housing Gap and Percent of Rent.

Under the Housing Gap formula, payments to households constitute the difference between a basic payment level, C, and some reasonable fraction of family income. The payment formula is:

$$P = C - bY$$

where P is the payment amount, C is the basic payment level, "b" is the rate at which the allowance is reduced as income increases, and Y is

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[1]The basic design and analysis approach, as approved by the HUD Office of Policy Development and Research, is presented in Abt Associates Inc., Experimental Design and Analysis Plan of the Demand Experiment, Cambridge, Mass., August 1973, and in Abt Associates Inc., Summary Evaluation Design, Cambridge, Mass., June 1973. Details of the operating rules of the Demand Experiment are contained in Abt Associates Inc., Site Operating Procedures Handbook, Cambridge, Mass., April 1973.

the net family income.[1] The basic payment level, C, varies with household size, and is proportional to C*, the estimated cost of modest existing standard housing at each site.[2] Thus, payment under the Housing Gap formula can be interpreted as making up the difference between the cost of decent housing and the amount of its own income that a household should be expected to pay for housing.[3]

Under the Percent of Rent formula, the payment is a percentage of the household's rent. The payment formula is:

$$P = aR$$

where R is rent and "a" is the fraction of rent paid by the allowance. In the Demand Experiment the value of "a" remained constant once a household had been enrolled.[4]

Housing Requirements

The Percent of Rent payment formula is tied directly to rent: a household's allowance payment is proportional to the total rent. Under the Housing Gap formula, however, specific housing requirements are needed to tie the allowance to housing. Two types of housing requirement were used: Minimum Standards and Minimum Rent.

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[1] In addition, whatever the payment calculated by the formula, the actual payment cannot exceed the rent paid.

[2] The housing cost parameter, C*, was established from estimates given by a panel of qualified housing experts in Pittsburgh and Phoenix. For more detailed discussion regarding the derivation of C*, refer to Abt Associates Inc., Working Paper on Early Findings, Cambridge, Mass., January 1975, Appendix II.

[3] As long as their housing met certain requirements (discussed below), Housing Gap households could spend more or less than C* for housing, as they desired, and hence contribute more or less than "b" of their own income. This is in contrast to other housing programs, such as Section 8 (Existing).

[4] Five values of "a" were used in the Demand Experiment. Once a family had been assigned its "a" value, the value generally stayed constant in order to aid experimental analysis. In a national Percent of Rent program, "a" would probably vary with income and/or rent. Even in the experiment, if a family's income rose beyond a certain point, the value of "a" dropped rapidly to zero. Similarly, the payment under Percent of Rent could not exceed C* (the maximum payment under the modal Housing Gap plan), which effectively limited the rents subsidized to less than C*/a.

Under the Minimum Standards requirement, participants received the allowance payment only if they occupied dwellings that met certain physical and occupancy standards. Participants occupying units that did not meet these standards either had to move or arrange to improve their current units to meet the standards. Participants already living in housing that met standards could use the allowance to pay for better housing or to reduce their rent burden (the fraction of income spent on rent) in their present units.

If housing quality is broadly defined to include all residential services, and if rent levels are highly correlated with the level of services, then a straightforward housing requirement (one that is relatively inexpensive to administer) would be that recipients spend some minimum amount on rent. Minimum Rent was considered as an alternative to Minimum Standards in the Demand Experiment, in order to observe differences in response and cost and to assess the relative merits of the two types of requirements. Although the design of the experiment used a fixed minimum rent for each household size, a direct cash assistance program could employ more flexible structures. For example, some features of the Percent of Rent formula could be combined with the Minimum Rent requirement. Instead of receiving a zero allowance if their rent is less than the Minimum Rent, households might be paid a fraction of their allowance depending on the fraction of Minimum Rent paid.

Allowance Plans Tested

The three combinations of payment formulas and housing requirements used in the Demand Experiment were Housing Gap Minimum Standards, Housing Gap Minimum Rent, and Percent of Rent. A total of 17 allowance plans were tested.

The twelve Housing Gap allowance plans are shown in Table I-1. The first nine plans include three variations in the basic payment level, C (1.2C*, C*, and 0.8C*) and three variations in housing requirements (Minimum Standards, Minimum Rent Low (0.7C*), and Minimum Rent High (0.9C*)). The value of "b"--the rate at which the allowance is reduced as income increases--is 0.25 for each of these plans. The next two

plans have the same level of C (C*) and use the Minimum Standards Housing Requirement, but use different values of "b". In the tenth plan the value of "b" is 0.15, and in the eleventh plan, 0.35. Finally, the twelfth plan is unconstrained, that is, it has no housing requirement. This unconstrained plan allows a direct comparison with a general income-transfer program.

Eligible households that did not meet the housing requirement were still able to enroll. They received full payments whenever they met the requirements during the three years of the experiment. Even before meeting the housing requirements, such households received a cooperation payment of $10 per month as long as they completed all reporting and interview requirements.

Within the Housing Gap design, the average effects of changes in the allowance level or housing requirements can be estimated for all the major responses. In addition, interactions between the allowance level and the housing requirement can be assessed. Responses to variations in the allowance/income schedule (changes in "b") can be estimated for the basic combination of the Minimum Standards housing requirement and payments level of C*.

The Percent of Rent allowance plans consist of five variations in "a" (the proportion of rent paid to the household), as shown in Table I-1.[1] A demand function for housing is estimated primarily from the Percent of Rent observations. Demand functions describe the way in which the amount people will spend on housing is related to their income, the relative price of housing and other goods, and various demographic characteristics. Such functions may be used to simulate response to a variety of possible rent subsidy programs not directly tested within the Demand Experiment. Together with estimates of supply response, they may also be used to simulate the change in market prices and housing expenditures over time due to shifts in housing demand or costs.

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[1] Designation of multiple plans for the same "a" value reflects an early assignment convention and does not indicate that the households in these plans were treated differently for either payment purposes or analysis.

Table I-1
ALLOWANCE PLANS TESTED

HOUSING GAP (P = C - bY, where C is a multiple of C*)

b VALUE	C LEVEL	HOUSING REQUIREMENTS			
		Minimum Standards	Minimum Rent Low = 0.7C*	Minimum Rent High = 0.9C*	No Requirement
b = 0.15	C*	Plan 10			
b = 0.25	1.2C*	Plan 1	Plan 4	Plan 7	
	C*	Plan 2	Plan 5	Plan 8	Plan 12
	0.8C*	Plan 3	Plan 6	Plan 9	
b = 0.35	C*	Plan 11			

Symbols: b = Rate at which the allowance decreases as the income increases.
C* = Basic payment level (varied by family size and also by site)

PERCENT OF RENT (P = aR)

a = 0.6	a = 0.5	a = 0.4	a = 0.3	a = 0.2
Plan 13	Plans 14 - 16	Plans 17 - 19	Plans 20 - 22	Plan 23

CONTROL:

With Housing Information	Without Housing Information
Plan 24	Plan 25

Control Groups

In addition to the various allowance plans, control groups were necessary in order to establish a reference level for responses, since a number of uncontrolled factors could also induce changes in family behavior during the course of the experiment. Control households received a cooperation payment of $10 per month. They reported the same information as families that received allowance payments, including household composition and income; they permitted housing evaluations; and they completed the Baseline Interview and the three Periodic Interviews. (Control families were paid an additional $25 fee for each Periodic Interview.)

Two control groups were used in the Demand Experiment. Members of one group (Plan 24) were offered a Housing Information Program when they joined the experiment and were paid $10 for each of five sessions attended. (This program was also offered to households enrolled in the experimental allowance plans but they were not paid for their attendance.) The other control group (Plan 25) was not offered the Housing Information Program.

All the households in the various allowance plans had to meet a basic income eligibility requirement. This limit was approximately the income level at which the household would receive no payment under the Housing Gap formula:

$$\text{Income Eligibility Limit} = \frac{C^*}{0.25}$$

In addition, households in plans with lower payment levels (Plans 3, 6, 9 and 11) had to have incomes low enough at enrollment to receive payment under these plans. Finally, only households with incomes in the lower third of the eligible population were eligible for enrollment in Plan 13, and only those in the upper two-thirds were eligible for Plan 23.

I.4 FINAL SAMPLE

Final analysis of the impact of the housing allowance will be based on the first two years of experimental data. Thus, the key sample size

Table I-2

SAMPLE SIZE AFTER TWO YEARS

HOUSING GAP (P = C - bY, where C is a multiple of C*)

b VALUE	C LEVEL	HOUSING REQUIREMENTS			
		Minimum Standards	Minimum Rent Low = 0.7C*	Minimum Rent High = 0.9C*	No Requirement
b = 0.15	C*	Plan 10 PIT = 45 PHX = 36			
b = 0.25	1.2C*	Plan 1 PIT = 33 PHX = 30	Plan 4 PIT = 34 PHX = 24	Plan 7 PIT = 30 PHX = 30	
	C*	Plan 2 PIT = 42 PHX = 35	Plan 5 PIT = 50 PHX = 39	Plan 8 PIT = 44 PHX = 44	Plan 12 PIT = 63 PHX = 40
	0.8C*	Plan 3 PIT = 43 PHX = 39	Plan 6 PIT = 44 PHX = 35	Plan 9 PIT = 43 PHX = 35	
b = 0.35	C*	Plan 11 PIT = 41 PHX = 34			

Total Housing Gap. 512 households in Pittsburgh, 421 households in Phoenix.

Symbols: **b** = Rate at which the allowance decreases as the income increases.
C* = Basic payment level (varied by family size and also by site)

PERCENT OF RENT (P = aR)

a = 0.6	a = 0.5	a = 0.4	a = 0.3	a = 0.2
Plan 13 PIT = 28 PHX = 21	Plans 14 - 16 PIT = 109 PHX = 81	Plans 17 - 19 PIT = 113 PHX = 66	Plans 20 - 22 PIT = 92 PHX = 84	Plan 23 PIT = 65 PHX = 46

Total Percent of Rent. 407 households in Pittsburgh, 298 households in Phoenix.

CONTROLS.

With Housing Information	Without Housing Information
Plan 24 PIT = 159 PHX = 137	Plan 25 PIT = 162 PHX = 145

Total Controls 321 households in Pittsburgh, 282 households in Phoenix

NOTE This sample includes households that were active, although not necessarily receiving payments, after two years of enrollment, households whose enrollment income was above the eligibility limits or that moved into subsidized housing or their own homes are excluded. While data on the excluded households may be useful for special analyses, particular analyses may also require the use of a still more restricted sample than the one shown here

for this report and the other reports in this series is the number of households in the experiment at the end of the first two years. The two-year sample size is shown in Table I-2, and comprises households that were still active, in the sense that they were continuing to fulfill reporting requirements. The sample size for a particular analysis may be smaller. For example, analysis of the housing expenditures of movers uses only those households that moved during the first two years after enrollment.

APPENDIX II

SAMPLE AND VARIABLE DEFINITIONS

II.1 SAMPLES USED IN THE ANALYSIS

Four major samples were used in the analysis of participation--households that completed the enrollment interview, eligible households that enrolled in the experiment, households that did not enroll and were selected for a terminee survey and enrolled, eligible households that were still eligible and active in the experiment at the end of two years. Table II-1 shows the number of households in the four groups at each site. Each group is discussed in more detail below.

Households that Completed the Enrollment Interview

This is the sample of households used for the analysis of acceptance of the enrollment offer in Chapter 3. These households were contacted for enrollment and were willing to hear the complete presentation on the housing allowance experiment before deciding whether they wished to enroll. All households in the group were given an estimate of the amount of subsidy they would receive if they became participants. Multivariate analyses of acceptance impose additional restrictions--the sample for these analyses is limited to households with annual incomes under $16,000 (to eliminate extreme values for the income variable) and also excludes households with missing information on any of the variables used in the analysis.[1]

Enrolled Eligible Households

This is the sample used for the analysis of participation subsequent to enrollment in Chapter 4. This group includes all households enrolled in the experiment, with the exception of households found to be living in

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[1] The income figures involved are taken from the Baseline Interview. Apparently overincome households were eliminated from the Demand Experiment sample as part of the earlier Screening Interview, but no additional households were eliminated due to income figures reported at Baseline, so that there were some extreme income values in the sample.

Table II-1

MAJOR SAMPLES USED IN THE ANALYSIS

	PITTSBURGH	PHOENIX
Households that completed the enrollment interview and received a subsidy estimate		
Housing Gap households	1086	1007
Percent of Rent households	821	678
Unconstrained households	120	89
Control households	863	750
Total	2890	2524
Enrolled households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing		
Housing Gap households	592	662
Percent of Rent households	484	476
Unconstrained households	73	70
Control households	431	521
Total	1580	1729
Sample of households that declined the enrollment offer and completed the Terminee Interview		
Housing Gap households	98	115
Percent of Rent households	65	42
Unconstrained households	6	11
Total	169	168
Households active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal Housing Gap treatment group and households living in their own homes or in subsidized housing		
Housing Gap households	378	342

DATA SOURCES: Baseline Interview, Household Events List, Initial and monthly Household Report Forms, payments file.

their own homes or in subsidized housing at enrollment and those found to have incomes over the program's eligibility limits after they had been enrolled.[1] All of these households in the Percent of Rent and Unconstrained groups became program participants. For the Housing Gap groups, some enrolled eligible households did not meet the housing requirements and therefore never became full participants. For multivariate analyses of participation subsequent to enrollment for Housing Gap households, households with missing information on any of the relevant variables have been excluded.

Households in the Terminee Survey Sample

A random sample of Experimental households that chose not to enroll were interviewed and asked about their reasons for turning down the program. This group forms the basis for the analysis of reasons for declining enrollment in Chapter 3.

Enrolled Eligible Households Active and Eligible at the End of Two Years

This group of household is used for the analysis of long term participation in Chapter 5. It includes all households that were eligible at enrollment and continued to be active in the experiment and modally eligible at the end of two years. Active households are households that continued to reside in the program area and to fulfill reporting requirements. Note that the sample of active Experimental households includes Housing Gap households that were not in compliance with housing requirements and were therefore not receiving full payments, but continued to fulfill reporting requirements and receive $10 per month.

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[1] During the enrollment process, two months were allowed after completion of the Initial Household Report Form to obtain third-party verification of participant-declared income. Because the timing of subsequent analytic reports rested on the date at which enrollment was completed for all households, an accelerated enrollment process was adopted in January 1974. Under this process, households were enrolled, if necessary, without prior verification if their Initial Household Report Form income was less than $500 above the eligibility limits. Some of the households enrolled were later determined to have incomes over the eligibility limits upon completion of verification.

Modally eligible households are households that, based on their household size and income at the end of two years, were entitled to a payment of not less than $10 under the modal Housing Gap payment formula (d = 1.0C*, b = .25). Households with missing information for any relevant variables are excluded from the multivariate analyses in Chapter 5.

II.2 DATA SOURCES

The data sources used in this report are described below.

Baseline Interview

Baseline Interviews[1] were administered to all households before offers to enroll in the program and were completed between March 1973 and January 1974. Data were collected in the following general categories: housing expenditures and consumption; location and housing search; neighborhood and housing preferences and satisfaction; maintenance and upgrading; household composition; household assets, income, and expenses; and participation in other government programs. The interviews provide measures of the household's position prior to the experiment.

Exit Interview for Non-Participants

These interviews were administered to a sample of households that rejected the offer to enroll in the program and were completed between February and April 1974. Data were collected in the following general areas: reasons for not enrolling; attitudes toward program requirements; attitudes toward the subsidy; and effects of experimental requirements on enrollment.

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[1] This interview, as well as the Exit Interview for Non-Participants, and the Periodic Interviews, were designed by Abt Associates Inc., and administered in the field by the National Opinion Research Center.

Periodic Interviews

Periodic Interviews were administered to all enrolled households approximately six months, one year, and two years after enrollment. Subject areas included housing expenditures and consumption; location and housing search; preferences and satisfaction; maintenance and upgrading; and participation in other government programs.

Housing Evaluation Forms

Housing Evaluation Forms were used to collect detailed information on the characteristics of the units occupied by households in the Demand Experiment. The first Housing Evaluation Form was completed at enrollment, subsequent forms were completed at the time of each periodic interview.[1] Data from the Housing Evaluation forms have been used to determine whether Control households ever met the Minimum Standards requirement in the analysis of the normal probability of meeting requirements.

Initial and Monthly Household Report Forms

When interviewers were sent to households to explain the Experimental Housing Allowance Program and to make the enrollment offer, they also helped the household complete the Initial Household Report Forms. All households that accepted the enrollment offer were required to fill in these forms prior to enrollment. Initial Household Report Forms were completed between April 1973 and February 1974. Detailed information was collected on each household's composition, housing expenditures (rent, utilities, furnishings, and so forth), and asset holdings (savings bonds, stocks, and so forth), as of the time of the interview. Income data were collected for each of the previous 12 months for each type of income (e.g., wages, social security, welfare) for each household member 18 years of age or over. Household expenses (e.g., alimony, child care,

[1] Housing evaluations were also conducted for Minimum Standards households whenever the household requested an evaluation to see if it met requirements and for all households whenever the household moved to a new unit.

medical) were also collected for the 12 most current months. Data from the Initial Household Report Forms were used operationally to determine whether initial household composition and income eligibility requirements had been met. Analytically, these data have been used to describe the household's demographic characteristics and income just prior to participation in the program. After enrollment, households were required to submit a Household Report Form each month.

The Household Events List

The Household Events List was the data source used to track households through the stages of enrollment. Operationally, these data were used to monitor the enrollment effort. The following steps in the enrollment process are recorded in the Household Events List: when the site office received the name and address of the household; when the contact letter was sent out; when the enrollment interview was completed; when a subsidy estimate was given; when the enrollment agreement was signed; when the Initial Household Report Form was completed; when verification was completed; and when the official enrollment letter was sent to the household. Reasons for not successfully completing enrollment were also recorded. Analytically, these data have been used in the derivation of the enrollment outcome variable.

Payments Data

After each monthly payment cycle, the household's current payment status, reasons for the status (if other than Full Payments status), payment period number, payment amount, and the intermediate variables used to calculate the payment were extracted from the payments system. These data were the source of participation response measures for analyses of participation decisions after enrollment.

II.3 VARIABLES USED IN THE ANALYSIS

Data on the demographic characteristics of households in the Experiment are available from two different sources. Information on all households that completed the enrollment interview is available from the Baseline

Interview. This information has been used in the analysis of acceptance of the enrollment offer. For households that enrolled in the experiment, more accurate information on household size, composition, and income is available from the Initial Household Report Form. This information has been used in the analysis of subsequent participation among enrolled Housing Gap households.

Elderly Household

Age is calculated from the date of birth of the person determined to be the head of the household according to census definitions. This variable has a value of one if the household head is 62 or older and zero otherwise. Information comes from the Baseline Interview for households that completed the enrollment interview and from the Initial Household Report Form for enrolled households.

Young Household

Age of household head is determined in the same way as for elderly households. This variable has a value of one if the head of the household is under 30 years old and zero otherwise.

Black Household

Households have been classified as white, black or Spanish American based on observations by the Baseline Interviewer. This variable has a value of one if the head of the household was classified as black and zero otherwise.

Spanish American Household

This variable has a value of one if the household head was identified as Spanish American and a value of zero otherwise. The variable is valid only in Phoenix, since there were no Spanish American households in the Pittsburgh sample. Classification of a household as Spanish American is based on the observation of the Baseline Interviewer for households that completed the enrollment interview. Enrolled households were classified as Spanish American based on their surname according to census conventions.

Large Household

This variable is based on household size information collected on the Baseline Interview for households that completed the enrollment interview and on the Initial Household Report Form for enrolled households. It has a value of one if the household has five or more members and a value of zero otherwise. All persons in the household have been counted with the exception of roomers and boarders.

Single Parent Household

This variable identifies households in which the household head was single and which included children under 18 years of age. Information comes from the Baseline Interview for households that completed the enrollment interview and from the Initial Household Report Form for enrolled households. The variable has a value of one if the household is headed by a single person and includes children and a value of zero otherwise.

Prior Mobility

This variable is equal to the number of moves the household reported having made in the three years before the Baseline Interview. It is continuous and ranges from zero to seven.

Dissatisfaction

In the Baseline Interview, households were asked about satisfaction with their present unit and neighborhood. Both were measured on a four point scale:

Very Satisfied

Somewhat Satisfied

Somewhat Dissatisfied

Very Dissatisfied.

Households in the first two categories were grouped together as being satisfied, and households in the last two categories as being dissatisfied. Households were further categorized by whether they were dissatisfied with either their unit or their neighborhood at enrollment or satisfied with

both. This latter categorization maximizes the size of the dissatisfied group. It was chosen because satisfaction levels were high and an inclusive definition was necessary if the dissatisfied group was to be large enough for analysis.

Participation in Other Transfer Programs

This variable identifies households that were receiving benefits from other transfer programs including Food Stamps, Aid to Families with Dependent Children, Old Age Assistance, Aid to the Blind, Aid to the Disabled, General Assistance and any other forms of public assistance. The variable is based on responses to the Baseline Interview for all households. The variable has a value of one for all households that received any form of assistance during the twelve months prior to the interview and a value of zero otherwise.

Income

The income variable used in this report is an analytic definition of household income, which measures disposable income. The definition of income, referred to as "Net Income for Analysis," is an estimate of the annual income received by all household members 18 years of age or older. It is the sum of earned income and other income, net of taxes and alimony paid. Table II-2 shows how this definition of income compares with the definition used in determining eligibility in the experiment and the definition used by the census.

For households that completed the enrollment interview, income was based on information from the Baseline Interview. For enrollees, it was based on the Initial Household Report Form. The coding used for the income variable is a spline coding, which allows for nonlinear effects. (See discussion in Chapter 3).

Subsidy

For households that completed the enrollment interview, subsidy amount represents the amount of the estimate households were given of what their subsidy would be if they enrolled in the program (and for Housing Gap households, if they met the housing requirements).

Table II-2

COMPONENTS INCLUDED IN THE DEFINITION OF NET INCOME FOR ANALYSIS AND COMPARISON WITH CENSUS AND PROGRAM ELIGIBILITY DEFINITIONS

COMPONENTS	NET INCOME FOR ELIGIBILITY	NET INCOME FOR ANALYSIS	CENSUS (GROSS INCOME)
I. GROSS INCOME			
A. Earned Income			
1 Wages and Salaries	X	X	X
2. Net Business Income	X	X	X
B Income-Conditioned Transfers			
1. Aid for Dependent Children	X	X	X
2. General Assistance	X	X	X
3. Other Welfare	X	X	X
4. Food Stamps Subsidy	-	X*	-
C. Other Transfers			
1. Supplemental Security Income (Old Age Assistance, Aid to the Blind, Aid to the Disabled)	X	X	X
2. Social Security	X	X	X
3 Unemployment Compensation	X	X	X
4. Workmen's Compensation	X	X	X
5 Government Pensions	X	X	X
6. Private Pensions	X	X	X
7. Veterans Pensions	X	X	X
D. Other Income			
1. Education Grants	X	X	X
2. Regular Cash Payments	X	X	X
3 Other Regular Income	X	X	X
4. Alimony Received	X	X	X
5 Asset Income	X*	X*	X*
6. Income from Roomers and Boarders	-	-	X
II GROSS EXPENSES			
A. Taxes			
1. Federal Tax Withheld	X*	X*	-
2. State Tax Withheld	X*	X*	-
3 FICA Tax Withheld	X*	X*	-
B. Work-Conditioned Expenses			
1. Child Care Expenses	X	-	-
2. Care of Sick at Home	X	-	-
3. Work Related Expenses	X*	-	-
C Other Expenses			
1. Alimony Paid Out	X	X	-
2. Major Medical Expenses	X	-	-

*The amounts of these income and expense items are derived using data reported by the household. All other amounts are included in the income variables exactly as reported by the household.

For enrolled households, payment amount is calculated from the Initial Household Report Form, according to the payment formula for the treatment group to which a household was assigned. This variable represents the payment to which an eligible household was entitled if all program requirements were met. For Housing Gap households that had not met requirements, it provides a measure of the full amount of the payment the household could receive once the requirements were met. A spline coding is used for both forms of subsidy to allow for nonlinear effects of subsidy amount (See Chapter 3).

Payment Level

This variable is defined only for enrolled Housing Gap households. It represents the payment to which a household with four members and the mean income for enrolled households would have been entitled. Variation in the variable is thus based entirely on payment parameter differences, and takes no account of variations in household size or income. The values for payment level for each Housing Gap allowance plan are shown below:

Values for Payment Level

Allowance Plan*	Pittsburgh	Phoenix
1	$87.25	$120.50
2	59.25	84.50
3	31.25	48.50
4	87.25	120.50
5	59.25	84.50
6	31.25	48.50
7	87.25	120.50
8	59.25	84.50
9	31.25	48.50
10	91.55	122.70
11	26.95	43.30

*See Table I-1

Residual Payment at Enrollment

This variable represents the difference between the actual allowance payment to which a household was entitled at enrollment and the payment level for the allowance plan to which the household was assigned (see discussion above). Thus, residual payment captures household size and income level variations in payment amount which are not taken into account in payment level.

Residual Payment at Two Years

This variable is calculated in the same way as residual payment payment at enrollment. However, it is based on the amount of the payment to which the household was entitled according to the household's size and income at the end of two years, rather than the payment at enrollment.

Percent of Rent Level

A series of dummy variables were used to capture the effect of the different parameters used in the Percent of Rent payment formula (see Table I-1). Four dummy variables were used for the five different payment levels (the excluded group were households entitled to a rent rebate of .4).

Housing Gap Level

This series of dummy variables identifies the different payment parameters used for the Housing Gap allowance plans. Four dummy variables were used to represent the five different payment levels. (Households in the "modal" group were excluded, that is, households in plans using 1.0C* and b = .25. See Table 3-10).

Minimum Standards Requirement

This variable is equal to one if a household is in the Minimum Standards group and equal to zero otherwise.

The Minimum Standards requirement for Housing Gap households has two separate components--a series of physical requirements for the dwelling unit and an occupancy standard. Physical requirements were developed from elements of the American Public Health Association/Public Health Service, Recommended Housing Maintenance and Occupancy Ordinance (revised 1971). The requirements, listed below, were grouped into 15 components made up of related items.

1. COMPLETE PLUMBING

   Private toilet facilities, a shower or tub with hot and cold running water, and a washbasin with hot and cold running water must be present and in working condition.

2. COMPLETE KITCHEN FACILITIES

   A cooking stove or range, refrigerator, and kitchen sink with hot and cold running water must be present and in working condition.

3. LIVING ROOM, BATHROOM, KITCHEN PRESENCE

   A living room, bathroom, and kitchen must be present. (This represents the dwelling unit "core," which corresponds to an efficiency unit.)

4. LIGHT FIXTURES

   A ceiling or wall-type fixture must be present and working in the bathroom and kitchen.

5. ELECTRICAL

   At least one electric outlet must be present and operable in both the living room and kitchen. A working wall switch, pull-chain light switch, or additional electrical outlet must be present in the living room.[1]

6. HEATING EQUIPMENT

   Units with no heating equipment; with unvented room heaters which burn gas, oil, or kerosene; or which are heated mainly with portable electric room heaters will be unacceptable.

7. ADEQUATE EXITS

   There must be at least two exits from the dwelling unit leading to safe and open space at ground level (for multifamily building only).

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[1]This housing standard is applied to bedrooms in determining the number of adequate bedrooms for the program occupancy standard.

Effective November, 1973 (retroactive to program inception) this requirement was modified to permit override on a case-by-case basis where it appears that fire safety is met despite lack of a second exit.

8. ROOM STRUCTURE

Ceiling structure or wall structure for all rooms must not be in condition requiring replacement (such as severe buckling or leaning).

9. ROOM SURFACE

Ceiling surface or wall surface for all rooms must not be in condition requiring replacement (such as surface material that is loose, containing large holes, or severely damaged).

10. CEILING HEIGHT

Living room, bathroom, and kitchen ceilings must be 7 feet (or higher) in at least one-half of the room area.[1]

11. FLOOR STRUCTURE

Floor structure for all rooms must not be in condition requiring replacement (such as severe buckling or noticeable movement under walking stress).

12. FLOOR SURFACE

Floor surface for all rooms must not be in condition requiring replacement (such as large holes or missing parts).

13. ROOF STRUCTURE

The roof structure must be firm.

14. EXTERIOR WALLS

The exterior wall structure or exterior wall surface must not need replacement. (For structure, this would include such conditions as severe leaning, buckling or sagging and, for surface, conditions such as excessive cracks or holes.)

15. LIGHT/VENTILATION

The unit must have a 10 percent ratio of window area to floor area and at least one operable window in the living room, bathroom, and kitchen or the equivalent in the case of properly vented kitchens and/or bathrooms.[1]

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[1]This housing standard is applied to bedrooms in determining the number of adequate bedrooms for the program occupancy standard.

The occupancy requirement sets a maximum of two persons for every adequate bedroom, regardless of age. An adequate bedroom is a room that can be completely closed off from other rooms and meets the program housing standards of ceiling height, light/ventilation, and electrical service. In addition, the room must meet the housing standards for the condition of room structure, room surface, floor structure, and floor surface. If the dwelling unit contains four or more adequate bedrooms, it is judged to meet occupancy standards. A studio or efficiency apartment is counted as a bedroom.

Roomers and boarders are added to household size when determining whether a household meets occupancy standards, as all the rooms in the dwelling unit are taken into account.

Minimum Rent Requirement

This variable differentiates the two levels of Minimum Rent--High and Low--from other groups. It is equal to plus one if the household is in the Minimum Rent High group, minus one if a household is in the Minimum Rent Low group and zero otherwise.

Distance From Meeting Requirements (Analysis of Acceptance)

This variable represents the distance between the rent the household was paying at the time of the Baseline Interview and the estimated rent level necessary to meet housing requirements. (The variable is defined only for Housing Gap households.) For Minimum Rent households, the required rent is simply the amount of the Minimum Rent requirement (based on the household size reported in the Baseline Interview). For Minimum Standards households, the required rent level is set at the estimated cost of a modest existing standard unit in each site as a function of household size (the C* schedule used in the Housing Gap payment formula).

Distance From Meeting Requirements (Enrolled Households)

This variable is calculated in the same way as the previous variable, but it is based on household size and rent level information obtained from the

Initial Household Report Form rather than from Baseline Interview data. It has been calculated for Control households as well as for the Housing Gap group. For Control households, three separate distance measures were computed, one for each type of requirement. For Housing Gap households, only the distance from the requirement to which the household was actually assigned has been calculated.

Distance From Meeting Requirements (Households Active and Eligible After Two Years)

This variable is calculated in a somewhat different way than the other distance variables. The rent level required is defined in the same way, but it is based on data at the end of two years. (Required rent levels were increased during the period to adjust for the effect of inflation. Also, household size might have changed.) The distance variable is calculated as the difference between required rent level and the predicted normal rent of the household at the end of two years. Predicted normal rent is based on a regression of rent at the end of two years among Control households on a series of demographic variables. (The results of the equation are shown in Appendix XVI.) This equation was then used to predict the rent that an Experimental household would normally have been paying by the end of the experiment and this predicted normal rent was used in the calculation of distance from meeting the requirements.

Probability Of Moving

A household's normal probability of moving, without the influence of the experiment, is based on a logit estimation of the probability of moving over two years among Control households. The logit equation included a number of household demographic characteristics as well as mobility history (See MacMillan, 1978 for a more complete discussion of the variables used to predict mobility). The results of estimating the equation for Control households are shown in Table II-3. This equation was used to calculate a predicted probability of moving for Experimental households.

Table II-3

LOGIT ESTIMATION OF THE PROBABILITY OF MOVING FOR CONTROL HOUSEHOLDS

INDEPENDENT VARIABLE	PITTSBURGH COEFFICIENT	PITTSBURGH t-STATISTIC	PITTSBURGH PARTIAL DERIVATIVE[a]	PHOENIX COEFFICIENT	PHOENIX t-STATISTIC	PHOENIX PARTIAL DERIVATIVE[a]
Constant	0.628	0.54	NA	0.709	0.61	NA
LIFE CYCLE FACTORS						
Age of household head (in decades)	-0.351	-3.09**	-0.080	-0.272	-2.69**	-0.068
Number of children	-0.108	-1.12	-0.025	0.063	0.69	0.016
OTHER HOUSEHOLD CHARACTERISTICS						
Female head of household	0.160	0.71	0.036	0.456	1.62	0.114
Black head of household	-0.196	-0.61	-0.044	1.069	1.96*	0.267
Spanish American head of household	NA	NA	NA	-0.907	-2.45*	-0.227
Years of education of household head	-0.062	-1.14	-0.014	-0.013	-0.24	-0.003
Per capita income of household (in thousands)	-0.302	-1.07	-0.068	0.281	1.27	0.070
Number of moves in three years prior to the experiment	0.660	4.77**	0.150	0.412	3.04**	0.103
HOUSING AND NEIGHBORHOOD FACTORS						
Perceived crowding	0.210	0.71	0.048	0.375	1.23	0.094
Living in a unit with basic facilities	0.321	1.20	0.073	0.043	0.18	0.011
SOCIAL BONDS						
Positive feelings toward neighbors	0.057	0.74	0.013	-0.145	-1.84†	-0.036
Length of residence in enrollment unit (in years)	0.022	0.80	0.005	-0.134	-2.08*	-0.034
DISSATISFACTION						
Dissatisfaction with unit or neighborhood at enrollment	0.317	1.15	0.072	0.013	0.04	0.003
PREDISPOSITION TO MOVE						
Would move with an increase in money available for rent	0.306	1.18	0.069	0.957	3.17**	0.239
VARIABLES ADDED FOR THE PARTICIPATION ANALYSIS						
Initial Position regarding housing requirements[b]						
Dummy 1	-0.503	-0.78	-0.114	-1.247	-1.62	-0.312
Dummy 2	0.369	0.59	0.084	-1.006	-1.34	-0.252
Dummy 3	-1.105	-1.88†	-0.251	0.243	0.31	0.061
Dummy 4	-7.390	-2.18*	-1.676	-1.763	-2.46**	-0.441
Dummy 5	-0.459	-1.36	-0.104	-0.815	-1.68†	-0.204
Residual of predicted rent at enrollment[c]	-0.002	-0.26	-0.000	0.004	0.50	0.001
Good deal on enrollment unit (in dollars)[d]	0.014	1.82†	0.003	0.003	0.40	0.001
Likelihood Ratio (Significance)		81.050**			82.656**	
Sample Size		(276)			(241)	
Mean of Dependent Variable		0.348			0.510	
Coefficient of Determination		0.227			0.247	

SAMPLE: Control households active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits, those living in their own homes or in subsidized housing, and those that moved between the Baseline Interview and enrollment.

DATA SOURCES: Initial and monthly Household Report Forms, Initial Housing Evaluation Form, Baseline and Periodic Interviews, and payments file.

a. Derivatives computed at sample mean.

b. This set of dummies controls for whether the household met the housing requirements used for the Housing Gap group at enrollment. The variables are defined as follows:

PASS MINIMUM STANDARDS

MINIMUM RENT	MINIMUM RENT LOW: PASS	MINIMUM RENT LOW: FAIL
PASS	Dummy 2 = 1	
FAIL	Dummy 3 = 1	Dummy 4 = 1

FAIL MINIMUM STANDARDS

MINIMUM RENT	MINIMUM RENT LOW: PASS	MINIMUM RENT LOW: FAIL
PASS	Dummy 1 = 1	
FAIL	Dummy 5 = 1	Excluded Group

c. This is the difference between a household's actual rent at enrollment and a predicted rent based on household demographic characteristics.

d. See Merrill, 1977.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

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MacMillan, Jean, Mobility in the Housing Allowance Demand Experiment, Cambridge, Mass., Abt Associates Inc., June 1978 (revised June 1980).

Merrill, Sally R., Hedonic Indices as a Measure of Housing Quality, Cambridge, Mass., Abt Associates Inc., December 1977 (revised June 1980).

APPENDIX III

THE DEFINITION OF VARIABLES FOR MEETING REQUIREMENTS AND PARTICIPATION

This appendix discusses the variables used to define participating and meeting housing requirements among Housing Gap and Control households. It is intended primarily for readers who want to use the Demand Experiment data. In theory, for households actively enrolled in the experiment meeting requirements and participating might appear to be synonomous. In fact, there can be discrepancies between the two due to payment rules and errors in data collection, coding, and computer entry. Furthermore, completely comparable measures cannot be constructed for Housing Gap and Control households. The discrepancies involved are, however, generally small.

The following two sections discuss in turn the definition of participation used in Chapter 4 for all enrolled households and the definition used in Chapter 5 for households still enrolled and eligible at the end of two years.

III.1 PARTICIPATION AMONG ALL ENROLLED HOUSEHOLDS

For reasons discussed further in Appendix VII, the participation rate for all enrolled Housing Gap households was defined as the proportion of those households that ever received a full allowance payment. The participation variable for these households is taken directly from the monthly payments file. Households were recorded as having ever received a full payment if the payments records showed that they had in any month during the first two years after enrollment been recorded as meeting the housing requirements for their allowance plan and had in fact received an allowance payment.[1] This payments-based definition of participation corresponds directly to the information provided by the program to households about whether they had met the housing requirements.

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[1] It was possible for a household to meet requirements but never receive a full payment because it did not submit the rent receipts and monthly income reports required by the experiment or refused to complete a periodic interview or allow a housing evaluation.

In addition to the payment based variable, which exists only for Housing Gap households, it is also possible to define an analytic measure of whether a household met requirements. This measure is available for both Control and Housing Gap households, and is based on reported rental expenditures from the monthly Household Report Forms submitted by each household and on periodic Housing Evaluation Forms. The Housing Evaluation Forms were completed by program office housing evaluators at enrollment, at approximately 6, 12 and 24 months after enrollment, and whenever a household moved.

Two issues are involved: First, due either to payments staff errors or errors in coding and entering data, the analytic and payment records may disagree for Housing Gap households. This is evident, for example, in the difference between the payments records on initial full payments and the analytic records on meeting requirements, shown in Table II-1. As shown there, the discrepancies are few, especially with regard to overall rates. It may be noted that participation rates for Housing Gap households that did not receive a full payment at enrollment in Chapters 2 and 4 are based on payments status at enrollment, while the comparisons with Control households in Chapter 4 are based on the analytic records at enrollment.

The second problem is the frequency of the analytic data. The central analytic files of the Demand Experiment are organized around five cross-sections--pre-enrollment, enrollment, and six, twelve, and twenty-four months after enrollment. While other data are available, these cross-sections provide the only points at which data from interviews, monthly reports, and housing evaluations can all be linked together. As a result, analytic measures of whether Control households ever met requirements are based on information at these cross-sections. In contrast, payments records for Housing Gap households are based on monthly records.

Since payments records are used for Housing Gap households and analytic records for Control households, comparisons of the two groups in Chapter 4 could be biased. It is not clear what could be done to remove this problem completely. On one hand, lack of a comparable measure means that Control households may misestimate the normal rate of meeting

Table III-1

COMPARISON OF PAYMENTS AND ANALYTIC RECORDS AT ENROLLMENT

	MINIMUM STANDARDS HOUSEHOLDS	MINIMUM RENT LOW HOUSEHOLDS	MINIMUM RENT HIGH HOUSEHOLDS	ALL HOUSING GAP HOUSEHOLDS
	PITTSBURGH			
(Number of cases)	(266)	(154)	(167)	(587)
Payments Definition Percentage that received a full payment at enrollment	15%	64%	35%	33%
Analytic Definition Percentage that met requirements at enrollment	18	63	31	34
Percentage of households for which the two measures disagree	5	1	6	4
	PHOENIX			
(Number of cases)	(302)	(166)	(188)	(656)
Payments Definition Percentage that received a full payment at enrollment	19%	53%	27%	30%
Analytic Definition Percentage that met requirements at enrollment	19	54	27	30
Percentage of households for which the two measures disagree	1	6	4	3
Overall percentage of households for which the two measures disagree	3	4	5	4

SAMPLE: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial Housing Evaluation Form, Initial Household Report Form, payments file.

requirements. On the other hand, the actual incentives created by the allowance offer are reflected in the payments records. Fortunately, there is in fact relatively little discrepancy between the two definitions. Table III-2 shows, for Housing Gap households not receiving full payments at enrollment, the proportion that subsequently met requirements based on payments data and on analytic data. As can be seen from the table, using the analytic definition for Housing Gap households would have resulted in participation rates that were two points higher for Minimum Standards, three to five points lower for Minimum Rent High, and six to seven points higher for Minimum Rent Low requirements.

III.2 PARTICIPATION AT TWO YEARS

The emphasis of the analysis of participation among households that were still eligible and enrolled at the end of two years was more on comparisons with Control households than on absolute participation rates. As a result, the same measure was used for both Housing Gap and Control households. Under the payments rules of the Demand Experiment, a household qualified for payments if it had ever met requirements in its current unit.[1] Thus, under the analytic definition of meeting requirements, a household met requirements if its unit met requirements at the end of two years or had met them at some previous cross-section.

Since the same definition is used for both Housing Gap and Control households in this case, the question is whether a substantial proportion of Housing Gap households were receiving full payments, but were classified by the analytic measure as not meeting requirements. Table III-3 shows the proportion of households active and eligible at two years that might have been dropped from the sample due to this discrepancy. The proportions are small, so that dropping these households would not have

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[1] Households could meet requirements in a unit and then fail to meet them in the same unit due to changes in household size (as for example, due to the birth of children), changes in requirements (due to the adjustment of Minimum Rent requirements to take account of inflation) or measurement error. Given the relatively short duration of the Demand Experiment, households were not forced to meet requirements again in the same unit (if they moved, however, they did not have to meet requirements in order to continue to qualify for payments).

Table III-2

COMPARISON OF PAYMENTS AND ANALYTIC RECORDS OF PARTICIPATION FOR HOUSEHOLDS THAT DID NOT RECEIVE A FULL PAYMENT AT ENROLLMENT

	MINIMUM STANDARDS HOUSEHOLDS	MINIMUM RENT LOW HOUSEHOLDS	MINIMUM RENT HIGH HOUSEHOLDS	ALL HOUSING GAP HOUSEHOLDS
	PITTSBURGH			
(Number of cases)	(229)	(56)	(110)	(395)
Payment Definition Percentage that ever received a full payment	30%	48%	35%	34%
Analytic Definition Percentage that met requirements at any cross-section	32	54	30	35
Percentage of households for which the two measures disagree	4	9	7	6
	PHOENIX			
(Number of cases)	(250)	(79)	(138)	(467)
Payments Definition Percentage that ever received a full payment	44%	46%	37%	42%
Analytic Definition Percentage that met requirements at any cross-section	46	53	34	44
Percentage of households for which the two measures disagree	13	8	6	10
Overall percentage of households for which the two measures disagree	9	8	6	8

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Housing Evaluation Forms, Initial and monthly Household Report Forms, payments file.

Table III-3

COMPARISON OF PAYMENTS AND ANALYTIC RECORDS OF PARTICIPATION AT TWO YEARS

	PERCENTAGE OF HOUSEHOLDS FAILING TO MEET REQUIREMENTS UNDER THE ANALYTIC DEFINITION THAT WERE RECEIVING FULL PAYMENTS AT TWO YEARS	
	PITTSBURGH	PHOENIX
MINIMUM STANDARDS		
All households (Number of cases)	3% (77)	2% (81)
Households that did not meet requirements at enrollment (Number of cases)	4 (47)	4 (57)
MINIMUM RENT LOW		
All households (Number of cases)	0 (88)	0 (64)
Households that did not meet requirements at enrollment (Number of cases)	0 (24)	0 (27)
MINIMUM RENT HIGH		
All households (Number of cases)	4 (46)	4 (52)
Households that did not meet requirements at enrollment (Number of cases)	9 (23)	6 (35)

SAMPLE: Housing Gap households active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal ($dC^* = 1.0C^*$, $b = .25$) Housing Gap treatment group and households living in their own homes or in subsidized housing.

DATA SOURCES: Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

materially increased the participation rate among Housing Gap households. (Nor, of course, would there have been any way to make a comparable adjustment to Control data.)

One other point should be noted in this connection. Because of the "grandfather clause" in the program requirements, the proportion of households that actually met current requirements at the end of two years is sometimes substantially lower than the proportion that met requirements under the program rules. For information, Table III-4 shows the proportion of Housing Gap and Control households still enrolled and eligible at the end of two years that met the analytic definition of current requirements at that time. Significant differences are apparent for households that did not meet requirements at enrollment and are generally not very different from differences based on the program requirements measure of Chapter 5.[1]

[1]The differences under the program requirements measure of Chapter 5, (Table 5-1) and the current requirements measure of Table III-4 are shown below (for households that did not meet requirements at enrollment.

Difference Between Housing Gap and Control Rates of Meeting Requirements

	Pittsburgh			Phoenix		
	Minimum Standards	Minimum Rent Low	Minimum Rent High	Minimum Standards	Minimum Rent Low	Minimum Rent High
Program (Table 5-1)	20%	20%	13%	24%	41%	27%
Current (Table III-4)	13%	19%	10%	20%	41%	26%

Table III-4

PERCENTAGE OF HOUSEHOLDS THAT MET CURRENT REQUIREMENTS AT TWO YEARS

	PITTSBURGH			PHOENIX		
	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
All Households						
Housing Gap households	25%	77%	48%	46%	72%	47%
(Number of cases)	(178)	(114)	(98)	(155)	(89)	(101)
Control households	14	65	36	28	43	24
(Number of cases)	(221)	(232)	(232)	(238)	(239)	(239)
Difference	11	12	12	18	29	23
(t-statistic)	(2.79**)	(2.28*)	(2.08*)	(3.77**)	(4.74**)	(4.19**)
Households that Met Requirements at Enrollment						
Housing Gap households	43	96	100	73	92	89
(Number of cases)	(35)	(67)	(27)	(30)	(40)	(19)
Control households	51	91	85	68	85	81
(Number of cases)	(35)	(128)	(62)	(38)	(94)	(43)
Difference	-8	5	15	5	7	8
(t-statistic)	(0.67)	(1.29)	(3.96**)	(0.45)	(1.10)	(1.04)
Households that Did Not Meet Requirements at Enrollment						
Housing Gap households	20	51	28	40	56	37
(Number of cases)	(142)	(45)	(71)	(124)	(48)	(82)
Control households	7	32	18	20	15	11
(Number of cases)	(184)	(102)	(168)	(196)	(144)	(195)
Difference	13	19	10	20	41	26
(t-statistic)	(3.58**)	(3.92**)	(1.74†)	(3.92**)	(5.63**)	(5.12**)

SAMPLE Housing Gap and Control households active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1.0C*, b = .25) Housing Gap treatment group and households living in their own homes or in subsidized housing.

DATA SOURCES Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

APPENDIX IV

THE PARTICIPATION PROCESS IN THE DEMAND EXPERIMENT

This is the first of four appendices concerning the samples used in this report. The purpose of these appendices is to discuss ways in which the participation rates estimated from experimental data might differ from the absolute or relative rates that would be observed in a similar operating program. This appendix describes the process by which households became participants in the various Demand Experiment programs. Subsequent appendices discuss the effects of attrition at six months and two years after enrollment and issues arising from population dynamics.

In a typical housing assistance program, eligible households may learn about the program from a variety of sources. They may see or hear public service announcements or advertisements sponsored by the housing agency, they may learn about the program through word of mouth from friends or relatives, or they may be referred to the program from another social service agency.[1] A number of eligible households may never hear about the program, and still others may hear about it but decide not to apply. Households that apply to the program may or may not be selected to be enrolled and, once enrolled, may or may not meet the program requirements and begin to receive benefits.

Application and enrollment in the Demand Experiment were quite different from this. The outreach process used in the experiment was structured to provide equal access to all potentially eligible households within certain geographic areas. First, a sample of dwelling units was drawn at each site.[2] Households

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[1] These were in fact the three major sources from which households learned about the housing allowance program in the Administrative Agency Experiment. Word of mouth was the most important source, referral was second, and media announcements were third. See MacMillan and Hamilton (1977).

[2] The sample was drawn from lists of all units within Allegheny and Maricopa counties excepting those in Census tracts with median (1970) incomes of over $12,000, blocks with fewer than 10 percent rental units or less than five rental units in number, blocks with only Public Housing or Section 23 units, and blocks scheduled for demolition.

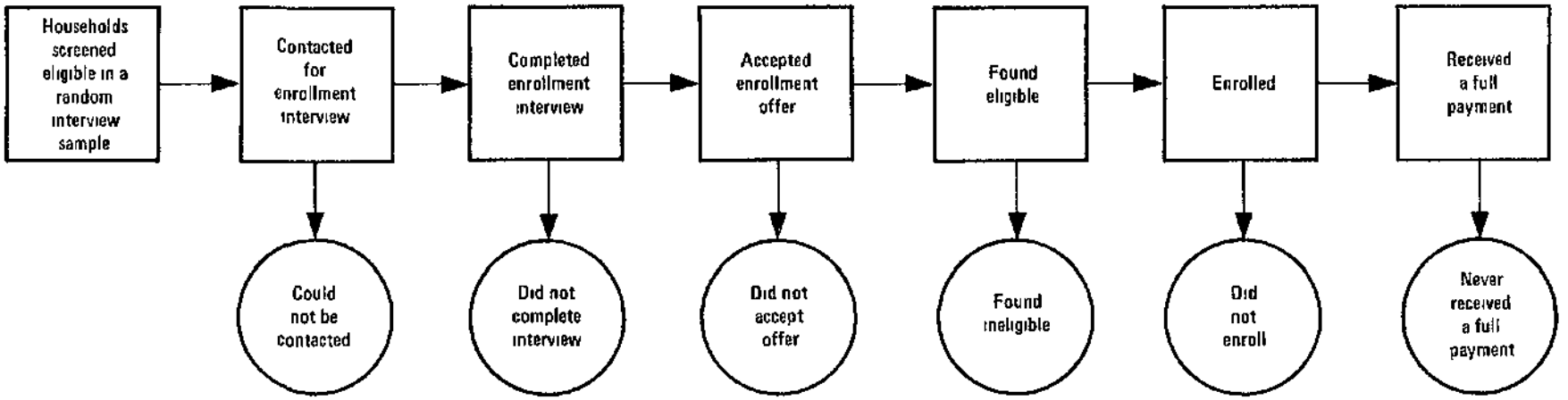
in these units were briefly interviewed in a Screening Interview to determine whether they were likely to be eligible for the experimental program. Households that were apparently eligible were then re-interviewed (the Baseline Interview) to obtain information on their pre-experimental situation. At no time during either the Screening or Baseline Interviews were households told about the experiment or offered enrollment. Thus, households that did not complete these interviews represent a pure interviewing loss.

Households that completed both the Screening and Baseline Interviews were randomly assigned to the various experimental housing allowance plans and offered enrollment. This was the first time that households were told about the Experimental Housing Allowance Program. Households that accepted the offer and applied for the program completed a detailed report on their income, assets, rent, and household size. This information was reviewed and the reported income verified to determine actual household eligibility. Eligible households were then enrolled in the experiment.

Not all of the households that enrolled in the experiment became allowance recipients. In a number of the allowance plans, households were required to live in units which met certain requirements before they could receive an allowance payment. Enrolled households that already met these requirements or that were assigned to allowance plans that did not have housing requirements could begin to receive payments immediately after enrollment. Other households had to move to new units or upgrade their current units in order to meet the housing requirements and become program participants.

Participation in the Demand Experiment thus involved a number of stages as shown in Figure IV-1--being selected from the listing of units, completing the pre-enrollment interviews and being determined to be apparently eligible; being contacted for enrollment; completing the enrollment interview; deciding to accept the enrollment offer; being determined to be actually eligible; enrolling; and becoming a recipient. As discussed in Chapter 2, however, the analysis of program participation combines these stages into two major participation decisions--first accepting the enrollment offer and second, once enrolled, actually participating in the program and receiving an al-

Figure IV-I
THE PARTICIPATION PROCESS IN THE DEMAND EXPERIMENT



lowance payment. The analysis of acceptance is based on households that got far enough in the enrollment process to receive a complete description of the program offer. The analysis of subsequent participation is based on enrolled households. Participants are defined as all enrolled households that ever received an allowance payment over the two years of the experiment. The overall participation rate is the product of the acceptance rate and the subsequent participation rate.

This definition of participation raises three major issues--first, the selection of households that completed the enrollment interview as the base population for analysis; second, the treatment of households found to be ineligible after accepting the enrollment offer; and third, the decision to define a participant as any household that ever received a full allowance payment. This last issue in fact involves two different issues--the role of attrition (discussed in Appendices V and VI) and the effect of population turnover on participation rates (discussed in Appendix VII).

IV.1 SELECTION OF HOUSEHOLDS THAT COMPLETED THE ENROLLMENT INTERVIEW

The first issue in the definition of participation is the selection of households that completed the initial enrollment interview as the base population for analysis. There are two different types of issues concerning this selection. First, the selection itself restricts the sample to households that at least knew about the program. This may represent a much more extensive outreach than is likely to be achieved in any operating program--at least in the first few years. In this case, the participation rates presented in this report would overestimate the actual rates for the entire eligible population in an ongoing program. Second, the analysis ignores any households that turned down the program offers before they completed the enrollment interview. This may again overestimate acceptance rates and also miss some program or demographic differences in acceptance. The rest of this section discusses each of these issues in turn. The results are not conclusive. It seems possible, however, that the overstatement of absolute rates may not be large, and it is clear that errors in estimating relative acceptance rates among programs are small.

With regard to the first issue, two pieces of evidence are available from the other parts of the Experimental Housing Allowance Program--the Administrative Agency Experiment and the Supply Experiment. The Administrative Agency Experiment comprised eight limited enrollment demonstration programs in eight different sites. Analysis by MacMillan of a special survey of eligible households in one site (Jacksonville, Florida) revealed that after two years of program operations only 21 percent of the population interviewed knew about the program, and of these, only 32 percent had applied (MacMillan, 1977, pp. C-13 and C-27).[1] This would suggest that the participation rates estimated from Demand Experiment data are indeed much higher than those that would be found in an operating program.

At the same time, the Jacksonville program was a relatively small, limited enrollment program. While outreach efforts included some paid newspaper advertisements, use of public service radio and television announcements, and outdoor advertising, as well as direct mailings to renters and presentations to community groups, most of this activity was concentrated in a relatively short period of about six months before the survey (MacMillan, 1977, p. C-11). Furthermore, Jacksonville was the only one of the eight Administrative Agency Experiment sites that seriously failed to meet its overall enrollment target in its first enrollment period. Thus the Jacksonville situation may represent a worst case. Indeed, preliminary data from the Supply Experiment suggest that outreach efforts can reach a much larger proportion of the eligible population.

The Supply Experiment involves an open enrollment housing allowance program in two sites, Brown County, Wisconsin (Green Bay) and St. Joseph County, Indiana (South Bend).[2] All eligible households in these counties can enroll. Outreach efforts to date have included extensive use of television and radio

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[1]The surveys were conducted starting in March 1975. The Jacksonville program was publicized and accepted applications during two periods--March through September 1973 and September 1974 through April 1975. Thus, the surveys began towards the end of the second enrollment period and about two years after operations began (MacMillan, 1977, p. C-7).

[2]The Supply Experiment was designed and conducted by the Rand Corporation.

commercials, newspaper ads, mailings, and brochures, as well as presentations to relevant organizations (Ellickson and Kanouse, 1978, pp. 52, 59). The results appear to be widespread knowledge of the program's existence, at least. Baseline Surveys of households in the two counties, conducted after early publicity efforts, showed that 25 percent of the households surveyed had heard of the allowance program in Brown County and 34 percent in St. Joseph County. Less than a year later, in a second survey in each site, 80 percent of the households surveyed in Brown County and 87 percent of those in St. Joseph County said that they had heard of the program (Ellickson and Kanouse, p. 67).[1]

These figures suggest that outreach efforts can reach the vast majority of the population. However, these early tabulations are subject to a number of caveats and are not directly comparable to the results of the Jacksonville survey. First, the tabulations for the Supply Experiment do not investigate the accuracy of household knowledge at the end of the first year. They reflect only the percentage of respondents that answered "yes" when asked if they had ever heard of the housing allowance program.[2] The Jacksonville study, on the other hand, classified households as having heard of the allowance program only if they supplied some key detail in describing the program.

An apparently comparable measure is reported by Ellickson and Kanouse only for Baseline respondents in St. Joseph County. Of the 34 percent of respondents that said they had heard of the allowance program, only half gave some accurate details about the program (Ellickson and Kanouse, p. 65).

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[1]Sample sizes for the surveys are large--over 2,000 renters and 500 homeowners in each site (Ellickson and Kanouse, pp. 6-7).

[2]Ellickson and Kanouse (pp. 14-15) point out that these can include people who answered "yes" incorrectly (in order to appear informed or to please the interviewer, for example), people who confused the allowance program with other programs, and people who knew nothing about the program except its name, as well as people who have some accurate conception of what the program does.

Thus the 87 percent recognition rate at the end of the first year may substantially overstate actual program awareness.[1]

In addition, the preliminary analysis of results from the Supply Experiment does not specifically discuss the responses of eligible households as opposed to those of the entire population. Finally, the surveys from which these data are taken include repeated surveys of households in a specific set of units, with considerable overlap between surveys. Thus some learning might be the result of the surveys rather than program outreach.

In conclusion, while the preliminary tabulations from the Supply Experiment clearly suggest that the Jacksonville results need not be typical, it is not yet clear just how effective outreach can be in reaching potentially eligible households. Ineffective outreach can obviously produce participation rates far lower than those estimated in the Demand Experiment. Further analysis of the Supply Experiment will be necessary to see whether substantial outreach efforts (but still within the reach of an operating program) can come close to the very high level of awareness implicit in this analysis of the Demand Experiment.

The other set of issues involved in the selection of households that completed the initial enrollment interview as the base for analysis revolves around the extent to which households that did not get this far in the enrollment process were in fact rejecting the allowance offer. To the extent that this is true, suppression of earlier stages in the enrollment process may bias the analysis of acceptance both in terms of estimated absolute rates and in terms of differences in rates among different demographic groups and program offers.

As indicated in the introduction to this appendix, households were only approached for enrollment after they had completed two preliminary interviews (the Screening Interview to select apparently eligible households, and a Baseline Interview to collect preprogram information on households'

[1] Ellickson and Kanouse are clearly aware of this problem and have developed procedures for grading household knowledge of the allowance program. At the time of their report, however, these had only been applied to Baseline respondents in St. Joseph County.

demographic characteristics and housing situations). These interviews themselves involved some sample attrition (about 20 percent in both sites), as shown in Table IV-1. Since these interviews never mentioned any housing allowance program, however, such interviewing losses are not relevant to participation.

The Screening and Baseline Interviews were conducted by the National Opinion Research Corporation, under subcontract to Abt Associates. A variety of procedures were used to obtain as representative a sample as possible, including repeated callbacks made at different times of day (and over several days), and the completion rates for the interviews are high. Nevertheless, it is, of course, quite possible that households completing the interviews are not a random sample of the eligible population in the two sites. There is no reason to believe that this selection is in any way related to response to an allowance program, however. Thus, for purposes of analyzing responses to the experimental program (as opposed to representing Pittsburgh and Phoenix), the sample can be regarded as effectively random.[1]

In addition, however, not all households that completed the Screening and Baseline Interviews completed the initial enrollment interview as well. Figure IV-2 shows the percentage of households that passed through each stage in the participation process. As shown there, 10 to 20 percent of households assigned to the experiment could not be contacted either because they literally could not be found or because they would not agree to an appointment for an interview. These households may reasonably be regarded as similar to households that refused the Screening or Baseline

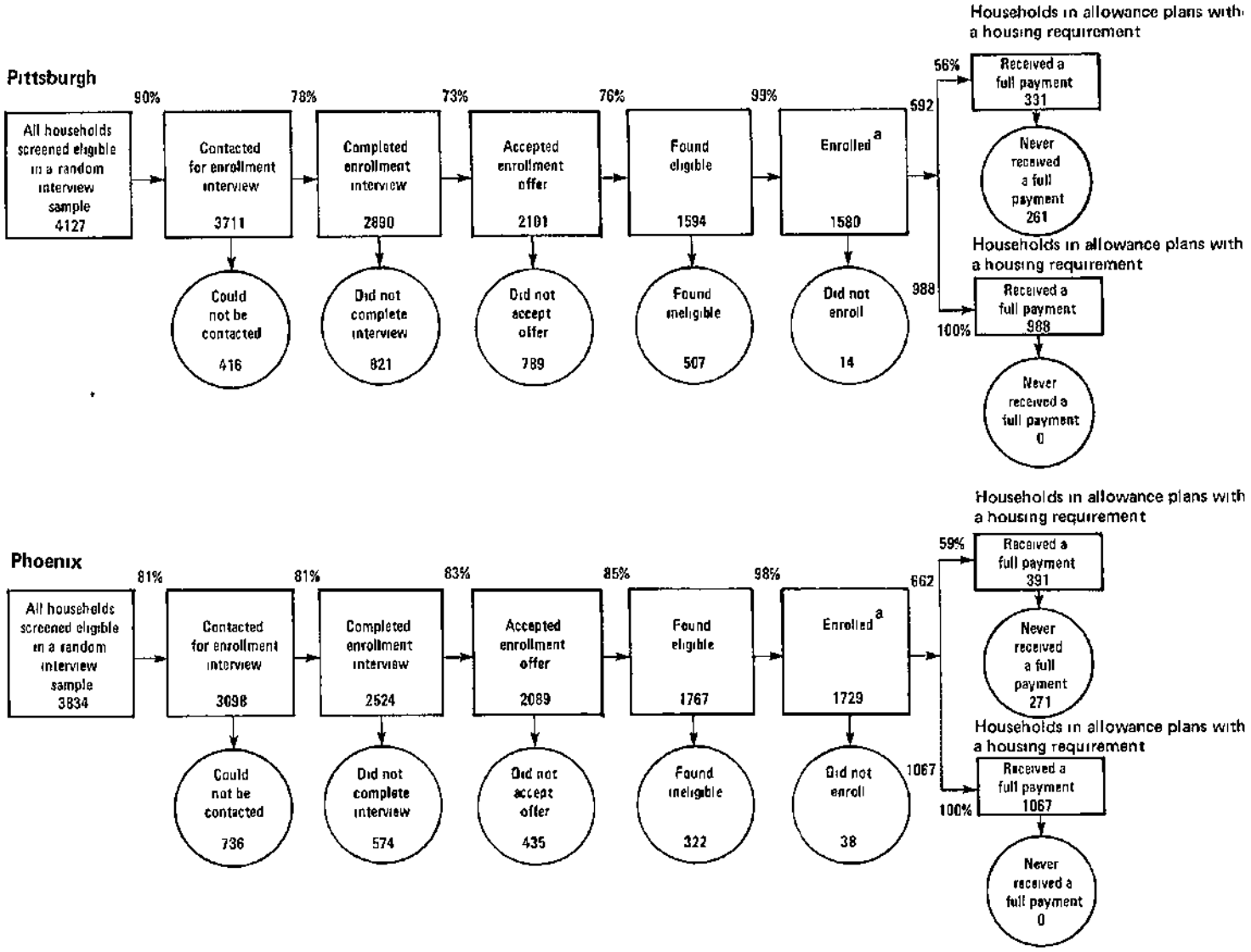
[1] In fact, the distribution of a variety of demographic characteristics in the sample that actually enrolled was not materially different from that estimated for the entire eligible population based on Census data. (See Abt Associates, 1975, pp. 34-38.)

Table IV-1

COMPLETION RATES FOR SCREENING
AND BASELINE INTERVIEWS

	PITTSBURGH	PHOENIX
Screening Interview	83.4%	82.3%
Baseline Interview	84.1	83.0

Figure IV-2
PARTICIPATION RATES IN THE DEMAND EXPERIMENT



[a]Excludes households that were found to be ineligible after enrollment (households living in their own homes or in subsidized housing and households with enrollment incomes over the eligibility limits)

Interviews. Since these households were not told about the program, they should not be considered in an analysis of program participation.[1]

In addition, another 20 percent of households broke off the enrollment interview before they received a complete description of the program (including an estimate of the payment they would receive if they participated as well as a description of reporting requirements and, where applicable, housing requirements). Since this initial description took about ten minutes, these households have in this report been regarded as simply refusing to have an interview. In fact, of course, they may have been refusing an interview, regarding themselves as probably ineligible, or rejecting the program out of hand. Thus, this sample loss could actually in whole or in part be a decision not to accept the enrollment offer, with the implication that actual acceptance rates could be as low as 0.78 or 0.81 times the rates estimated based on households that completed the enrollment interview.

There is no direct information about why households refused to complete the enrollment interview. Two sorts of indirect evidence are available, however. First, in reporting the results of the enrollment interview attempt, enrollers were instructed to classify incomplete interviews as either "break-offs" or "turndowns", depending on whether the enroller had explained a substantial part of the program.[2] Thus households that

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[1] Enrollment interviews were conducted by site office staff and were completely separate from the data gathering interviews conducted by NORC. Attempts to reach households were, however, modeled on NORC procedures and involved both letters and, where possible, phone calls over several days and times of day. The letters did mention a "housing program" (a "housing study" in the case of Control households), but provided no further details. It, therefore, seems reasonable to regard these failures to reach households as unconnected with the program.

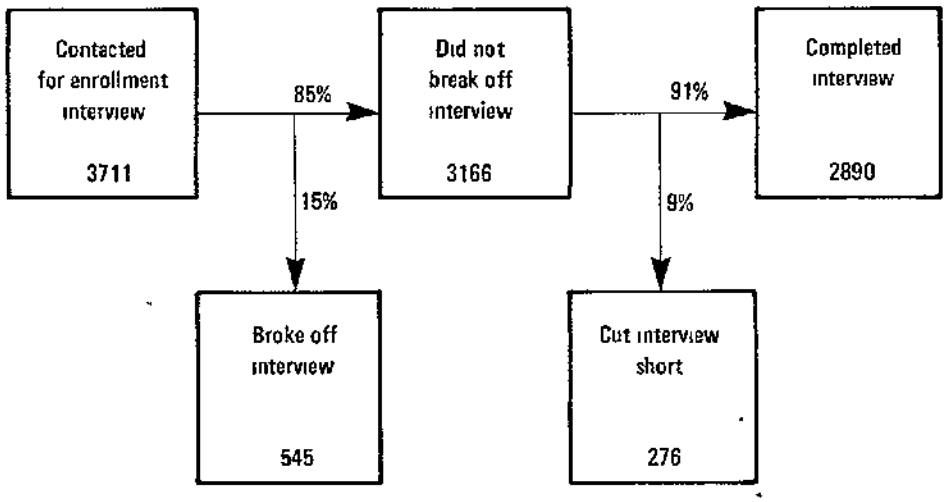
[2] The exact instructions were as follows:

"The term "break-off" will be used to denote a household which refuses to speak to the Enroller or interrupts the Enroller during the interview before the Enrollment Agreement is signed and before the Enroller has explained a substantial part of the program. If the Enroller has outlined the major parts of the program and the household is not interested, it is called a turn-down. A turn-down can occur prior to the signing of the Enrollment Agreement (if the Enroller has had an opportunity to explain the program) or any time prior to receipt of the acceptance letter by the household." (Abt Associates, 1973)

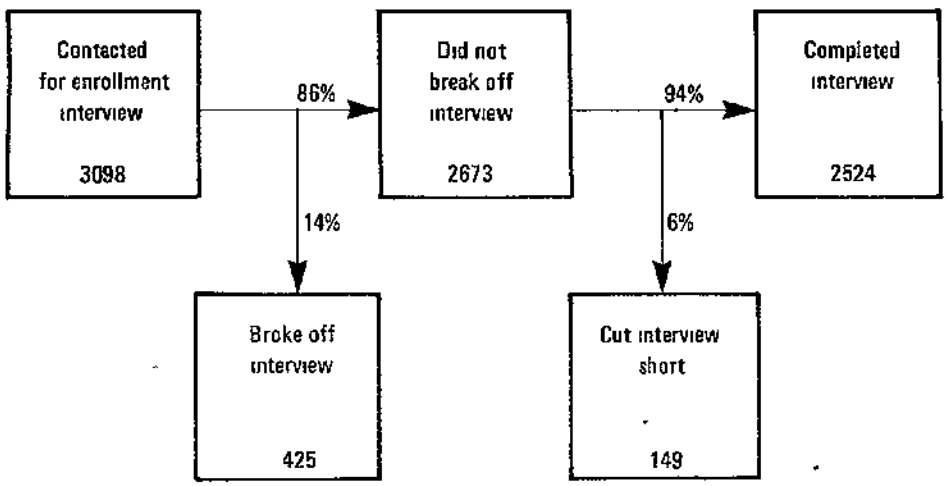
did not receive a payment estimate can be divided into households that in the enroller's opinion refused to hear about the program and those that had listened to at least a partial description of the program offer. It seems possible that even if households in the first category were in fact refusing to have an interview, households in the second could well have been rejecting the enrollment offer. Figure IV-3 shows the "break-off" and subsequent interview completion rates in each site. As shown in the figure, 91 percent of the households that did not break off the interview in Pittsburgh and 94 percent of those in Phoenix went on to complete the enrollment interview. Thus, if in fact households that broke off the interview were only rejecting the interview and not the program, acceptance rates based on completed interviews would be off by at most a factor of 1.10 in Pittsburgh (1/.91) and 1.06 in Phoenix (1/.94).

Figure IV-3
DETAILS OF COMPLETION OF THE ENROLLMENT INTERVIEW

Pittsburgh



Phoenix



Another source of evidence about the nature of incomplete interviews may be obtained by examining the extent to which completion rates differed among the Experimental programs or between households assigned to Experimental programs and Control households. Table IV-2 presents the results of a logit estimation of the probability of completing the initial enrollment interview (i.e., becoming part of the base population for the analysis of acceptance) for households assigned to one of the Experimental or Control plans.[1] The variables are similar to those used in the analysis of acceptance in Chapter 3 except that payment estimate is, of course, omitted.[2] The results do suggest that some response to program offers was involved in determining the rate at which assigned households completed the initial enrollment interview. The dummy variables contrasting Experimental and Control households are significant for Percent of Rent offers in both sites and Housing Gap offers in Phoenix.[3] At the same time the differences in completion rates are small, especially among the three experimental groups.

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[1]The exact sample used in Table IV-2 is all households whose names were sent to the sites for enrollment in the experiment, minus households that would not have qualified for a $10 payment under the modal Housing Gap payment plan (P = C* - .25Y; see Appendix I), and households excluded because they lived in subsidized housing or blocks scheduled for demolition.

[2]In addition, some variables used in Chapter 3 are more finely broken out in Table IV-2--specifically unit and neighborhood dissatisfaction are separated and participation in Food Stamps and Welfare are identified separately.

[3]In addition, there are significant differences among the Experimental groups in Pittsburgh, but not Phoenix, as shown below.

Difference in Coefficients	Pittsburgh		Phoenix	
	Logit Coefficient (standard error)	t-statistic	Logit Coefficient (standard error)	t-statistic
Percent of Rent vs. Housing Gap	0.2277 (0.1045)	2.18*	0.0466 (0.1018)	0.23
Unconstrained vs. Housing Gap	-0.1259 (0.2069)	0.61	-0.2123 (0.2205)	0.96
Unconstrained vs. Percent of Rent	-0.3535 (0.2112)	1.71†	-0.2590 (0.2251)	1.15

Table IV-2

LOGIT ESTIMATION OF THE PROBABILITY OF COMPLETING THE ENROLLMENT INTERVIEW

	PITTSBURGH			PHOENIX		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	0.542	1.89†	NA	0.613	5.07**	NA
Elderly household	-0.457	-3.61**	-0.091	-0.168	-1.33	-0.036
Younger household	0.286	2.33*	0.057	-0.159	-1.61	-0.034
Black household	0.215	2.12*	0.043	0.122	0.78	0.026
Spanish American household	NA	NA	NA	-0.251	-2.83**	-0.053
Large household	0.251	1.80†	0.050	0.130	1.26	0.028
Single parent household	0.303	2.70**	0.060	0.452	4.47**	0.096
Prior mobility	0.051	1.33	0.010	0.013	0.68	0.003
Dissatisfaction with unit	0.160	1.99*	0.032	0.095	1.23	0.020
Dissatisfaction with neighborhood	0.099	1.09	0.020	-0.099	-1.08	-0.021
Participation in Food Stamps	0.459	4.22**	0.091	0.255	3.04**	0.054
Participation in Welfare	-0.050	-0.41	-0.010	0.161	1.86†	0.034
Income (in thousands)	0.009	0.08	0.002	-0.016	-1.91†	-0.003
Income squared	0.005	0.41	0.001	0.001	0.32	0.000
Housing Gap household	-0.013	-0.14	-0.003	0.290	3.23**	0.061
Unconstrained household	-0.139	-0.67	-0.028	0.077	0.35	0.016
Percent of Rent household	0.214	2.01*	0.043	0.336	3.36**	0.071
Likelihood Ratio (Significance)		217.826**			75.238**	
Mean of Dependent Variable		0.727			0.694	
Coefficient of Determination		0.064			0.021	
Sample Size		(2919)			(2944)	

SAMPLE All households selected to be contacted for the Enrollment Interview, excluding households with incomes over modal eligibility limits at the time of the Baseline Interview and those found to be ineligible (living in subsidized housing or in blocks scheduled for demolition) before they were contacted for enrollment.

DATA SOURCES Baseline Interview, Household Events List.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

Likewise the sign pattern of significant demographic effects parallels the results for the analysis of acceptance in Chapter 3. Thus it appears that even if basing the analysis of acceptance on households that completed the enrollment interview did ignore some response to the allowance offer, it did not materially change the pattern of results across programs or demographic groups.[1]

IV.2 TREATMENT OF ELIGIBILITY IN ACCEPTANCE

As indicated at the beginning of this appendix, all households approached for enrollment were apparently eligible based on information collected during the Screening and Baseline Interviews. However, not all of these households were in fact eligible. Before households were actually enrolled, their eligibility was redetermined based on much more detailed information on income and household size and composition, obtained from households after they had accepted the enrollment offer and, in the case of income, verified with the income source.[2]

One approach to dealing with ineligible households would be to remove them from the analysis altogether. The problem with this approach is that

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[1] Similar estimates to those of Table IV-2 were obtained for each of the substages in completion described above--being contacted for enrollment, not breaking off the enrollment interview, and, finally, completing the enrollment interview. Some significant differences were found in at least one site at each stage. Thus it appears that the alternative to using households that completed the initial enrollment interview was to use all assigned households. This was felt to be likely to include more noise than added information on the acceptance decision.

[2] Towards the end of the enrollment period, some households were enrolled in the experiment before their income verification was complete. This was done because it was less expensive to make allowance payments to a small number of ineligible households (which, at least under Housing Gap plans, would in any case only receive $10 payments) than to delay the start of the experimental analysis period while waiting for verification to be completed. Once verification was completed for these households, ineligible households, though allowed to continue in the program if they wished, were removed from the analytic sample. Thus, for the purposes of this report, "enrolled households" always refers to households that were enrolled and eligible at enrollment.

it would bias estimated acceptance rates. This arises because eligibility was determined after households had decided whether or not to accept the enrollment offer. Removal of households found to be ineligible would in effect remove ineligible households that accepted the offer while leaving in ineligible households that turned down the offer before their eligibility could be determined. Thus, removing such households would necessarily underestimate acceptance rates.

Virtually every household that accepted the enrollment offer and was determined to be eligible in fact enrolled in the experiment. Thus in terms of the household decisions of eligible households, there is no difference between acceptance and enrollment. Figure IV-4 shows the details of the enrollment process for households that accepted the enrollment offer. As shown there, except for households found to be ineligible, of those that accepted the enrollment offer, 99 percent in Pittsburgh and 98 percent in Phoenix went on to enroll. Thus, for eligible households, participation rates may be properly calculated as the product of the acceptance and subsequent participation rates.

At the same time, ineligible households are included in the acceptance sample. Thus some demographic and program effects found in Chapter 3 could reflect the responses of ineligible households. This could, for example, be the source of the somewhat lower acceptance rates found for Housing Gap households. As noted in Chapter 3, lower acceptance rates were only apparent in the upper third of the sample income distribution, based on Baseline income. (Housing Gap households that rejected the enrollment offer did not cite suspected ineligibility as a reason more often than Percent of Rent households.)[1]

The next three appendices discuss issues arising from sample attrition and population dynamics.

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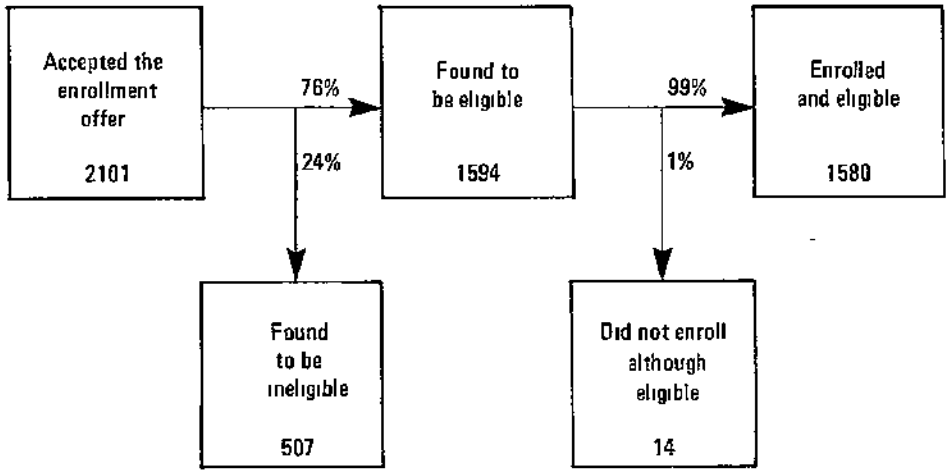
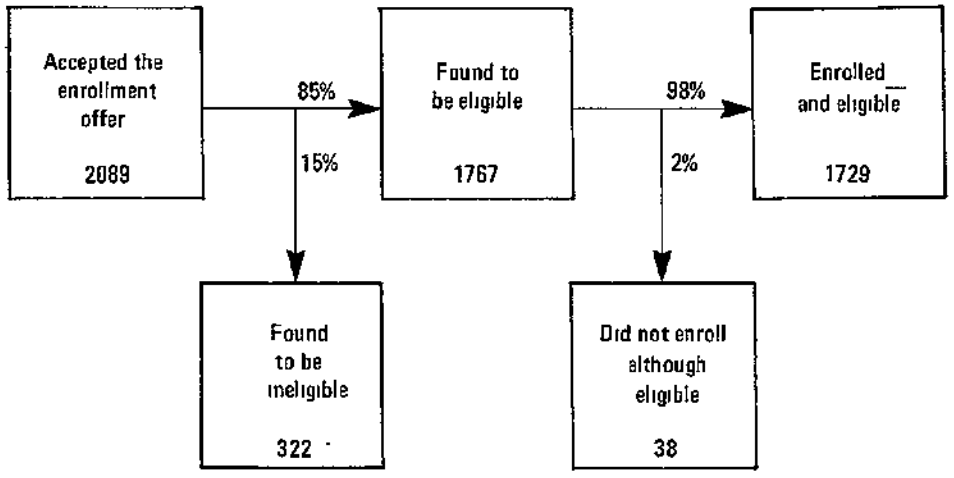
[1]It would be possible to attempt to correct for this problem by incorporating terms in the probability of being ineligible in the acceptance logits. Unless variables can be found which are known to influence the probability of being eligible but not the probability of accepting the offer, techniques for doing this are extremely reliant on distributional specifications.

Figure IV-4
DETAILS OF THE ENROLLMENT PROCESS FOR HOUSEHOLDS THAT ACCEPTED THE ENROLLMENT OFFER[a]

Pittsburgh



Phoenix



[a]As indicated in the text, eligibility review of some households was completed after enrollment In addition, income limits for Control households were higher than those for the Experimental plans. The analysis of this report does not include such Control households, and they are not included in the figure for "Enrolled and Eligible" households above

Figures for households actually enrolled regardless of subsequent eligibility determination are shown below

	ACCEPTED		ELIGIBLE		ENROLLED
Pittsburgh	2101	$\xrightarrow{84\%}$	1774	$\xrightarrow{99\%}$	1760
Phoenix	2089	$\xrightarrow{90\%}$	1879	$\xrightarrow{98\%}$	1841

REFERENCES

Abt Associates Inc., Site Operating Procedures Handbook, Cambridge, Mass., 1973.

_____, Second Annual Report of the Housing Allowance Demand Experiment, Cambridge, Mass., February 1975.

Ellickson, Phyllis L. and David E. Kanouse, "Public Perceptions of Housing Allowances: The First Two Years," (RAND/WN-9817-HUD), Santa Monica, California, The Rand Corporation, January 1978.

MacMillan, Jean, "Awareness and Decision in the Application Process" in MacMillan, Jean and William L. Hamilton, Outreach: Generating Applications in the Administration Agency Experiment, Cambridge, Mass., Abt Associates Inc., 1977.

APPENDIX V

ATTRITION IN THE FIRST SIX MONTHS AFTER ENROLLMENT

The results of Chapters 2 and 3 suggest that households' decisions to accept or reject the enrollment offer were based on a very general picture of the program offers. In particular, there is little evidence of any strong or consistent reactions to differences in payment formulas beyond the immediate payment estimate provided by the enroller or to the housing requirements for Housing Gap households. This seems perfectly reasonable behavior. Faced with an offer about which little was known, households may well have decided to ignore details and see how the program actually worked before finally making up their minds. This raises the issue of how often households changed their minds after enrolling and by extension how different acceptance rates would be likely to be in an ongoing program. In an ongoing program, households' impressions of a program, based on their own past experience or the experiences of friends and relatives, may be much clearer than the verbal descriptions provided in the enrollment interview. This appendix examines household behavior during the first six months after enrollment to see if there is in fact evidence that many households changed their minds about their decision to enroll.

Table V-1 shows the proportion of households that were still actively enrolled in the experiment six months after enrollment. Actively enrolled means that the household was still meeting the experimental reporting requirements. While six month retention rates are high, some households did drop out of the experiment in the first six months, more often in Phoenix than in Pittsburgh. Indeed, the proportion of households completing the initial enrollment interview that both accepted the offer and remained enrolled for at least six months (the product of the acceptance and retention rates) is very similar, both in pattern and level, across the two sites. Thus, the acceptance rate for Percent of Rent and Unconstrained households might be reduced by a factor of 0.95 in Pittsburgh and 0.84 in Phoenix, giving an overall adjusted acceptance rate for these households of roughly 75 percent.

Table V-1

RETENTION RATE AT SIX MONTHS AFTER ENROLLMENT

	HOUSING GAP HOUSEHOLDS	PERCENT OF RENT HOUSEHOLDS	UNCONSTRAINED HOUSEHOLDS	CONTROL HOUSEHOLDS
ACCEPTANCE RATE				
Pittsburgh	74% (1,086)	82% (821)	78% (120)	61% (863)
Phoenix	83 (1,007)	87 (678)	90 (89)	78 (750)
SIX-MONTH RETENTION RATE[a]				
Pittsburgh	89 (592)	95 (484)	100 (73)	93 (431)
Phoenix	80 (662)	85 (476)	84 (70)	81 (521)
PRODUCT OF ACCEPTANCE AND RETENTION RATES				
Pittsburgh	66	78	78	57
Phoenix	66	74	76	63

SAMPLE: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Household Events List and payments file.

a. Percentage of enrolled households still actively enrolled at the end of six months.

NOTE: Number of cases in parentheses.

The six-month retention rates for Housing Gap households are somewhat lower than those for Percent of Rent and Unconstrained households. This is to be expected. The analysis of acceptance in Chapter 3 suggested that while acceptance of the enrollment offer was modestly lower among Housing Gap households, it was not related to whether the households actually met (or thought that they met) the housing requirements. Some of the attrition among Housing Gap households in the first six months would be expected to reflect responses to the housing requirements. This is only mildly confirmed by the six-month retention rates among Housing Gap households that already met requirements at enrollment as compared with all Housing Gap households. Six-month retention rates for these households were 93 percent in Pittsburgh and 81 percent in Phoenix -- somewhat closer to the retention rates for Percent of Rent households.[1]

These numbers suggest that there were in fact some reversals of the acceptance decision early in the program. The discussion of Chapter 2 and Appendix VII also suggests that a distinction might be made between permanent reversals of the acceptance decision based on households' experience with the program and turnover in the eligible and interested population (reversals due to changes in household circumstances that may change again later or be matched by opposite changes in the circumstances of households that rejected the enrollment offer). The import of this distinction is that attrition due to turnover could in theory be offset by reversals (had they been allowed) in the decisions of households that rejected the enrollment offer. In this case, acceptance rates should not

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[1] Six-month retention rates for households that already met requirements at enrollment are

	Pittsburgh				Phoenix			
	HG	MS	MRL	MRH	HG	MS	MLR	MRH
Retention Rate	93%	94%	95%	90%	81%	88%	78%	78%
(Number of cases)	(198)	(49)	(97)	(52)	(196)	(56)	(90)	(50)

Evidence presented later in this appendix suggests that the fact that these rates are still lower than those for Percent of Rent and Unconstrained households largely reflects chance occurence of ineligibility.

be reduced by the retention rate.[1]

There are three sorts of evidence available for sorting out which of these factors was predominant during the first six months. First, some of the sample attrition during the first six months was known to result from changes in the household's situation rather than revision of its enrollment decision. Some households, for example, bought their own homes or moved out of the county. While these decisions involved giving up eligibility for the allowance program, they also involved considerations that might well overwhelm any relatively fine issues concerning participation in housing allowances. Table V-2 shows retention rates of enrolled households excluding such "involuntary" attrition.[2] As can be seen from the table, most attrition in the first six months after enrollment did not fall into the involuntary category. The retention rates net of involuntary attrition shown in Table V-2 are only modestly higher than those of Table V-1, and the overall acceptance-cum-retention rate pattern is again very similar in the two sites.

The retention rates for all Housing Gap households shown in Table V-2 are again lower than those for Percent of Rent and Unconstrained households. Retention rates for Housing Gap households that already met requirements at enrollment, however, were very similar to those of Percent of Rent and Unconstrained households -- 96 percent in Pittsburgh and 91 percent

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[1] As discussed in Chapter 2, turnover will still reduce participation rates if households take enough time to apply or participate after becoming eligible.

[2] Analysis of voluntary and involuntary attrition is based on work by Glen Weisbrod. The specific items categorized as involuntary that occurred during the first six months were attrition due to moves to owned home or subsidized housing, moves out of the counties in which the experiment was conducted, ineligible household composition, institutionalization, and death. It may be noted that moves out of Allegheny and Maricopa counties are unlikely to be short distance moves. In addition, moves out of county were an important source of attrition only in Maricopa County (Phoenix), where there are no nearby population centers outside the county.

Table V-2

RETENTION RATE AT SIX MONTHS AFTER ENROLLMENT
NET OF INVOLUNTARY ATTRITION

	HOUSING GAP HOUSEHOLDS	PERCENT OF RENT HOUSEHOLDS	UNCONSTRAINED HOUSEHOLDS	CONTROL HOUSEHOLDS
ACCEPTANCE RATE				
Pittsburgh	74% (1,086)	82% (821)	78% (120)	61% (863)
Phoenix	83 (1,007)	87 (678)	90 (89)	78 (750)
SIX-MONTH RETENTION RATE				
Pittsbugh	90 (573)	97 (469)	100 (73)	95 (419)
Phoenix	82 (602)	90 (438)	86 (66)	83 (470)
PRODUCT OF ACCEPTANCE AND RETENTION RATES				
Pittsburgh	67	80	78	58
Phoenix	68	78	77	65

SAMPLE: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing, and households that dropped out of the program for reasons classified as involuntary (moved to own home, subsidized housing, or out of county; ineligible household composition; institutionalization; or death).

DATA SOURCES: Household Events List and payments file.

NOTE: Number of cases in parentheses.

in Phoenix.[1]

Not all forms of ineligibility were necessarily known in assigning reasons for attrition. Households that simply stopped reporting and refused to explain why they wanted to drop out or households that moved to an unknown address could also have become ineligible or had other changes in their circumstances that made them less willing to participate. If sample attrition in the first six months simply reflected some ongoing turnover process, then it might be expected that this process would have continued at the same rate for the next 18 months.[2] In this case, retention rates during the last year and a half of the program would more or less replicate the experience of the first six months, so that

$$(1) \qquad R(6 \text{ months to } 2 \text{ years}) = [R(6 \text{ months})]^3$$

where R is the retention rate.

Table V-3 compares retention rates net of involuntary attrition for the first six and second 18 months of the program. Retention rates after six months are generally close to or above the retention rates for the first six months, let alone the cube of those rates. This suggests that reversals of household decisions rather than turnover factors not captured by the known reasons for attrition were the most important source of attrition in the first six months.

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[1] This suggests, as noted earlier, that the difference in retention rates for all enrolled households was largely due to random factors affecting eligibility. Details of retention rates net of involuntary attrition are shown below.

	Pittsburgh				Phoenix			
	HG	MS	MRL	MRH	HG	MS	MRL	MRH
Retention Rate Net of Involuntary Attrition	96%	98%	96%	94%	91%	92%	89%	90%
(Number of cases)	(192)	(47)	(95)	(50)	(170)	(52)	(76)	(42)

[2] This is certainly not necessarily true. Expected turnover rates could be lower for households that remained eligible longer.

Table V-3

COMPARISON OF RETENTION RATES NET OF INVOLUNTARY ATTRITION FOR THE FIRST SIX AND SECOND EIGHTEEN MONTHS OF THE PROGRAM

	HOUSING GAP HOUSEHOLDS	PERCENT OF RENT HOUSEHOLDS	UNCONSTRAINED HOUSEHOLDS	CONTROL HOUSEHOLDS
		PITTSBURGH		
First six months	90%	97%	100%	95%
(First six months)[3]	73	91	100	80
Next eighteen months	94	95	94	91
		PHOENIX		
First six months	82	90	86	83
(First six months)[3]	55	73	64	57
Next eighteen months	98	95	95	94

SAMPLE: For the first six months: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing, and households that dropped out of the program for reasons classified as involuntary in the first six months. For the next eighteen months: Households actively enrolled at six months, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing, and households that dropped out of the program for reasons classified as involuntary in the next eighteen months.

DATA SOURCES: Household Events List and payments file.

One potential source of changes in eligibility not accounted for by involuntary attrition is changes in income or household size. If these were an important factor in attrition not coincident with, for example, moves to owned housing or moves out of county, they would be expected to show up in a difference in the proportion of Experimental households that were ineligible at the end of six months as compared with Control households. Experimental households that became ineligible on the basis of income or household size had their allowance payments reduced to $10 (the level for Control households), whereas payments to Control households were unaffected. If there was any considerable attrition due to changes in income eligibility, it should be concentrated among Experimental households.

Table V-4 compares the proportion of Experimental and Control households still enrolled at the end of six months that were ineligible under the modal Housing Gap limits. The only significant difference is in Pittsburgh. Thus it is possible that the already small Pittsburgh attrition rate noted in Table V-1 reflected turnover in income eligibility.

Table V-4

PERCENTAGE OF HOUSEHOLDS WITH ANNUAL INCOMES
GREATER THAN THE MODAL HOUSING GAP ELIGIBILITY LIMITS
AT SIX MONTHS AFTER ENROLLMENT

	HOUSEHOLDS IN MODAL HOUSING GAP PLANS	HOUSEHOLDS IN MODAL PERCENT OF RENT PLANS	UNCONSTRAINED HOUSEHOLDS	CONTROL HOUSEHOLDS
		PITTSBURGH		
Percentage Ineligible	9%	14%	5%	21%
(Number of cases)	(155)	(340)	(73)	(395)
Difference from Control households	12**	-7†	-16**	NA
(t-statistic)	(3.33)	(2.37)	(3.17)	
		PHOENIX		
Percentage Ineligible	7%	12%	9%	10%
(Number of cases)	(151)	(300)	(57)	(389)
Difference from Control households	-3	2	-1	NA
(t-statistic)	(1.10)	(0.83)	(0.23)	

SAMPLE: Households actively enrolled at six months, and assigned to plans with initial eligibility limits equal to the modal Housing Gap limits, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial and monthly Household Report Forms, and payments file.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

APPENDIX VI

ATTRITION IN THE FIRST TWO YEARS AFTER ENROLLMENT

This appendix has two parts. The first part simply presents basic figures on attrition rates during the first two years after enrollment, parallel to those presented in Appendix V for the first six months after enrollment. These figures address the possibility, raised in Section 2.6 of Chapter 2, that participation rates based on households that were still actively enrolled and eligible at the end of two years may overestimate participation among the entire eligible population at two years. The second part focuses on the issue of bias in comparisons of the rates at which Housing Gap and Control Households met requirements at the end of two years.

VI.1 ATTRITION OVER TWO YEARS

The analysis of subsequent participation in Chapter 5 is based on households that were still actively enrolled and eligible two years after enrollment. As discussed in Chapter 2, if some eligible households that were still eligible at the end of two years dropped out of the experiment because they were unwilling to meet the housing requirements, then participation rates based on households still enrolled will, of course, overestimate participation among all households that were still eligible at the end of two years. This section examines attrition over the two years of the experiment to develop some idea of the potential magnitude of this overstatement.

Table VI-1 shows the retention rates for Experimental and Control households during the first two years after enrollment. The first row for each site shows retention rates for all enrolled households. The second shows retention rates net of households that were known to have dropped out for reasons that made them ineligible.[1] Retention rates net of such involun-

[1] As in Appendix V, the reasons were moves to their own homes, to subsidized housing, or out of the counties in which the experiment was run or becoming ineligible due to changes in household composition, institutionalization, or death.

Table VI-1

PERCENTAGE OF ALL ENROLLED HOUSEHOLDS AND ALL ENROLLED HOUSEHOLDS THAT DID NOT DROP OUT INVOLUNTARILY STILL ACTIVELY ENROLLED AT THE END OF TWO YEARS

	HOUSING GAP HOUSEHOLDS	PERCENT OF RENT HOUSEHOLDS	UNCONSTRAINED HOUSEHOLDS	CONTROL HOUSEHOLDS
		PITTSBURGH		
Retention rate for all enrolled households	74%	82%	85%	74%
(Number of cases)	(592)	(484)	(73)	(431)
Retention rate for households that did not drop out involuntarily[a]	84	92	94	87
(Number of cases)	(521)	(433)	(66)	(370)
		PHOENIX		
Retention rate for all enrolled households	57	62	57	54
(Number of cases)	(662)	(476)	(70)	(521)
Retention rate for households that did not drop out involuntarily[a]	76	83	78	74
(Number of cases)	(495)	(358)	(51)	(379)

SAMPLE: Enrolled households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Payments file, Initial and monthly Household Report Forms.

a. Households were classified as involuntarily drop-outs if they were known to have moved to their own home, to subsidized housing, or outside of the county or if they became ineligible due to changes in household composition, institutionalization, or death.

tary attrition are reasonably high and not very different among the different allowance types. Nevertheless, they do suggest that participation rates among Housing Gap households are overestimates. If, as indicated by Table VI-1, only 84 or 76 percent of Housing Gap households that remained eligible were still enrolled at the end of two years, then the participation rates of Chapter 5 should be reduced by the same factor (0.84 in Pittsburgh and 0.76 in Phoenix).

Table VI-2 presents retention rates for Housing Gap households by type of requirement. Except for Minimum Rent Low in Pittsburgh, retention rates do not vary substantially among the different requirements. Thus the relative participation rates under the various requirements may not be misstated. Nor does it appear that the degree of overstatement would vary appreciably by whether or not households already met requirements at enrollment, as indicated by Table VI-3. The only appreciable (and significant) difference in retention rates is for Minimum Standards households in Pittsburgh.

This sort of reasoning assumes, however, that involuntary attrition identifies all households that did become ineligible or at least that the retention rate (net of involuntary attrition) was the same for households that became ineligible for other reasons as for those that remained eligible. This might well be true for Control households, since eligibility changes made no difference in payments to these households. It seems less likely to be the case for Housing Gap or Unconstrained households, where payments were determined by income and household size. (Percent of Rent payments also declined if household income became large enough, but the limits for continuing eligibility were much higher than the enrollment limits.)

This surmise is confirmed by Table VI-4, which shows the proportions of households actively enrolled at the end of two years with annual incomes below the modal Housing Gap eligibility limits.[1] Housing Gap households

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[1] Modal limits are defined by the income that would result in a $10 payment under the modal Housing Gap formula ($S = C^* - .25Y$, where S is the payment, C^* is the estimated cost of modest existing standard housing for each household size, and Y is monthly income).

Table VI-2

RETENTION RATES BY TYPE OF REQUIREMENT

	ALL HOUSING GAP HOUSEHOLDS	MINIMUM STANDARDS REQUIREMENTS	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
	PITTSBURGH			
Retention rate for all enrolled households	74%	74%	81%	67%
(Number of cases)	(592)	(268)	(156)	(168)
Retention rate for households that did not drop out involuntarily[a]	84	83	91	78
(Number of cases)	(521)	(239)	(138)	(144)
	PHOENIX			
Retention rate for all enrolled households	57	56	58	58
(Number of cases)	(662)	(307)	(167)	(188)
Retention rate for households that did not drop out involuntarily[a]	76	77	78	74
(Number of cases)	(495)	(224)	(124)	(147)

SAMPLE: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibilty limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Payments file, Initial and monthly Household Report Forms.

a. Households were classified as involuntary drop-outs if they were known to have moved to their own home, to subsidized housing, or outside of the county or if they became ineligible due to changes in household composition, institutionalization, or death.

Table VI-3

RETENTION RATES NET OF INVOLUNTARY ATTRITION BY INITIAL HOUSING STATUS

	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
	PITTSBURGH		
Households that met requirements at enrollment	96%	93%	75%
(Number of cases)	(45)	(83)	(44)
Households that did not meet requirements at enrollment	80	89	80
(Number of cases)	(193)	(53)	(99)
t-statistic	2.59**	0.79	0.66
	PHOENIX		
Households that met requirements at enrollment	75	74	72
(Number of cases)	(44)	(62)	(32)
Households that did not meet requirements at enrollment	78	82	75
(Number of cases)	(176)	(61)	(115)
t-statistic	0.42	1.08	0.34

SAMPLE: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing, and households that dropped out of the program for reasons classified as involuntary (moved to own home, subsidized housing, or out of county; ineligible household composition, institutionalization, or death).

DATA SOURCES: Payments file, Initial and monthly Household Report Forms.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

Table VI-4

PERCENTAGE OF HOUSEHOLDS ACTIVE AT THE END OF TWO YEARS
WITH INCOMES BELOW THE MODAL ELIGIBILITY LIMITS

	HOUSING GAP HOUSEHOLDS	PERCENT OF RENT HOUSEHOLDS	UNCONSTRAINED HOUSEHOLDS	CONTROL HOUSEHOLDS
	PITTSBURGH			
Percentage below the modal eligibility limits	89%	76%	92%	73%
(Number of cases)	(433)	(394)	(62)	(320)
Difference from Control households	16**	3	19**	NA
(t-statistic)	(5.88)	(0.90)	(3.23)	NA
	PHOENIX			
Percentage below the modal eligibility limits	94	88	95	88
(Number of cases)	(373)	(297)	(39)	(278)
Difference from Control households	6*	0	7	NA
(t-statistic)	(2.50)	(0)	(1.29)	NA

SAMPLE: Households active at two years after enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.
DATA SOURCES: Payments file, Initial and monthly Household Report Forms.
† t-statistic significant at the 0.10 level (two-tailed).
* t-statistic significant at the 0.05 level (two-tailed).
** t-statistic significant at the 0.01 level (two-tailed).

have a significantly higher proportion of eligible households, suggesting that, as expected, Housing Gap households that became ineligible were more likely to drop out than similar Control households. Some idea of the possible magnitude of this effect may be obtained by assuming that the retention of Control households was unaffected by changes in income eligibility. In this case, the proportion of eligible households in the population of enrolled households can be estimated by the proportion of Control households that were eligible at two years. Since

$$\pi_E = \alpha\pi_E^E + (1-\alpha)\ \pi_E^I \qquad (1)$$

where

π_E = the retention rate for all Housing Gap households

π_E^E = the retention rate for Housing Gap households that remained eligible

π_E^I = the retention rate for Housing Gap households that became ineligible, and

α = the proportion of Housing Gap households that remained eligible.

The expected proportion of eligible households in the retained Housing Gap sample, α_E, is given by

$$\alpha_E = \frac{\alpha\pi_E^E}{\pi_E} \qquad (2)$$

so that the retention rate for Housing Gap households that remained eligible (π_E^E) may be estimated by

$$\hat{\pi}_E^E = \frac{\hat{\pi}_E\ \hat{\alpha}_E}{\hat{\alpha}} \qquad (3)$$

where

$\hat{\pi}_E^E$ = the estimated retention rate for Housing Gap households that remained eligible

$\hat{\pi}_E$ = the observed retention rate for all Housing Gap households (net of involuntary attrition)

$\hat{\alpha}_E$ = the observed proportion of Housing Gap households enrolled at two years that were eligible, and

$\hat{\alpha}$ = the observed proportion of Control households enrolled at two years that were eligible.

Applying this estimator to the retention rates of Table VI-I, gives values for $\hat{\pi}_E^E$ of 1.02 in Pittsburgh and 0.81 in Phoenix. Thus it seems possible that all of the attrition among Housing Gap households in Pittsburgh was in fact due to ineligibility of one form or another, while estimated participation rates in Phoenix still appear to be subject to reduction by a factor of 0.81.[1]

This reasoning is hardly conclusive.[2] Still, it at least suggests the possibility that the degree of overestimation involved in estimating participation rates on the basis of households still enrolled and eligible at the end of two years may not be large.

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[1]It is true that the Housing Gap plans included some plans with enrollment income limits below the modal limits used for the enrolled Control households considered in this report. This was not, however, the source of the difference in eligibility shown above. Considering only the modal Housing Gap plans gives 86 percent eligible in Pittsburgh (N = 131) and 95 percent eligible in Phoenix (N = 117), both significantly different from the Control figure in Table VI-4 and almost the same as the figure for all Housing Gap households.

[2]An obvious alternative hypothesis is that Housing Gap and Unconstrained households reduced their incomes (labor force participation) in response to the Housing Gap tax rate. Likewise, if Control households that became ineligible were in fact more likely to drop out, $\hat{\alpha}$ in Equation (3) would underestimate α so that $\hat{\pi}_E^E$ would overstate π_E^E.

VI.2 BIAS IN COMPARISONS OF HOUSING GAP AND CONTROL HOUSEHOLDS

To the extent that participation rates among Housing Gap households still enrolled and eligible at the end of two years overestimate the actual participation rate among all households that were still eligible at two years after enrollment, they would also be expected to overstate the impact of the allowance offer on meeting requirements as measured by comparisons of Housing Gap and Control households. As shown below, there is clear evidence that this did occur for Minimum Standards households. Estimating the extent of the bias introduced, however, is more difficult than it might appear to be at first glance.

Housing Gap households that did not meet requirements received the same $10 monthly payment as Control households. They might, therefore, be expected to remain in the experiment at the same rate as similar Control households. Indeed, since Control households were enrolled in a housing study while Housing Gap households were enrolled in a program, Housing Gap households that never participated in the program might drop out more often than similar Control households. Housing Gap households that met requirements, on the other hand, would be expected to be more likely to remain in the experiment than similar Control households, since they received their full allowance payments. Such differential attrition patterns, if they exist, would bias comparisons of Housing Gap and Control households at the end of two years. The rate at which Control households met requirements would underestimate the actual extent of normal meeting among Housing Gap households.[1]

The strong correlation between meeting requirements at enrollment and meeting requirements at subsequent periods provides a ready test for differential attrition. If Housing Gap households that met requirements at any time were more likely to remain in the experiment than similar Control households, then Housing Gap households that met requirements

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[1] These problems can also arise in connection with the cumulative participation of all enrolled households, but they are much less likely to be important, as noted later in this appendix.

at enrollment should also have been more likely to remain in the experiment. Table VI-5 shows the retention rates for enrolled Housing Gap and Control households in terms of the sample used in Chapter 5--that is, a household is retained if it is still actively enrolled and modally eligible at the end of two years. Housing Gap households generally had somewhat higher retention rates than similar Control households. For Minimum Rent households, this difference applied equally regardless of whether the households met requirement at enrollment. There is, however, a marked difference in relative retention rates for Minimum Standards households, especially in Pittsburgh.

The critical number in Table VI-5 is the difference of the difference between Housing Gap and Control households that appears at the lower right corner of each set of comparisons. This measures differential attrition between Housing Gap and Control households with respect to whether or not households met requirements at enrollment. As shown in Table VI-5, differential attrition was large only for Minimum Standards households (and significant only in Pittsburgh). This suggests comparisons of Minimum Standards and Control households will be biased due to differential attrition.[1]

The problem of estimating the actual extent of this bias is reasonably complicated. The rest of this section provides a brief formal statement of the issues involved and then develops results for two simple models.

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[1] It may be noted that this result is inconsistent with the suggestion of the previous section that retention was almost 100 percent among Housing Gap households in Pittsburgh. While the evidence of the previous section was based on all Housing Gap households, it also applies to Minimum Standards households alone. The proportions of Minimum Standards households enrolled at two years that were modally eligible were 0.90 in Pittsburgh (N = 197) and 0.94 in Phoenix (N = 169).. Following the reasoning of the previous section, these would give implied retention rates for eligible Minimum Standards households of 102 percent in Pittsburgh and 82 percent in Phoenix.

Table VI-5

RETENTION RATES BY INITIAL HOUSING STATUS FOR HOUSING GAP AND CONTROL HOUSEHOLDS[a]

	PITTSBURGH			PHOENIX		
	HOUSING GAP HOUSEHOLDS	CONTROL HOUSEHOLDS	DIFFERENCE (t-STATISTIC)	HOUSING GAP HOUSEHOLDS	CONTROL HOUSEHOLDS	DIFFERENCE (t-STATISTIC)
MINIMUM STANDARDS REQUIREMENT						
Households that met the requirement at enrollment	71%	40%	31%**	54%	38%	16%*
(Number of cases)	(49)	(87)	(3 52)	(56)	(108)	(1 96)
Households that did not meet the requirement at enrollment	65	58	7	52	50	2
(Number of cases)	(217)	(338)	(1.60)	(246)	(397)	(0 48)
Difference	6	-18	24* (2.57)[b]	2	-12	14 (1.54)[b]
MINIMUM RENT LOW REQUIREMENT						
Households that met the requirement at enrollment	68	48	20**	43	38	5
(Number of cases)	(97)	(268)	(3 38)	(90)	(255)	(0.83)
Households that did not meet the requirement at enrollment	79	64	15*	63	56	7
(Number of cases)	(57)	(160)	(2.08)	(76)	(264)	(1.07)
Difference	-11	-16	5 (0.58)	-20	-18	-2 (0 23)
MINIMUM RENT HIGH REQUIREMENT						
Households that met the requirement at enrollment	48	45	3	42	31	11
(Number of cases)	(52)	(138)	(0.37)	(50)	(142)	(1.42)
Households that did not meet the requirement at enrollment	59	58	1	61	53	8
(Number of cases)	(115)	(290)	(0.18)	(138)	(377)	(1.61)
Difference	-11	-13	2 (0.21)[b]	-19	-22	3 (0.32)[b]

SAMPLE Enrolled Housing Gap and Control households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing

DATA SOURCES: Payments file, Initial and monthly Household Report Forms, Initial Housing Evaluation Form.

† t-statistic significant at the 0 10 level (two-tailed)

* t-statistic significant at the 0 05 level (two-tailed)

** t-statistic significant at the 0 01 level (two-tailed)

a For this table, retained households are defined as households active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal ($dC^* = 1.0C^*$, $b = .25$) Housing Gap treatment group and households living in their own homes or in subsidized housing.

b. The estimate of the variance used in calculating the (approximate) t-statistic for the difference in differences was

$$\frac{\sum_i P_i(1-P_i)}{N_i}$$

where P_i = the observed proportion, and

N_i = the sample size for the ith cell

The discussion above suggested that the major source of the expected difference in attrition between Housing Gap and Control households was the payments made to Housing Gap households. Thus, if the probability that a Control household is retained is given by [1,2]

$$(4) \qquad R_c = \text{Prob}\ (\xi < \$10) = G\ (\$10)$$

where

R_c = the retention rate

ξ = the monetized net cost of remaining in the experiment, and

G = the distribution function for ξ,

then the probability of retention for Housing Gap households would be given by

$$(5) \qquad R_\xi = G(V)$$

where V is the value of the allowance payment to the household.

The value of the allowance payment is, however, correlated with the household's probability of meeting requirements, so that under this model the retention of Housing Gap households is correlated with the household's probability of meeting requirements. Specifically, households that never meet requirements only receive a $10 payment, so that V is $10 for these households.[3] For households that would normally meet requirements, on the other hand, the allowance payment is essentially an unconstrained

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[1]The model of attrition posed in this section is focused solely on the issue of differential attrition and is not intended to represent a complete model of attrition.

[2]The formal statement of the attrition problem presented in this section is based on the general formalization developed by Heckman (1976). See also Hausman and Wise (1977).

[3]A more reasonable model might also allow for some disappointment with the program that would lead such households to drop out more often than similar Control households.

income transfer, so that V equals the amount of the payment (S). Finally, for households induced to meet requirements, V should lie somewhere above the $10 that they would receive if they did not meet requirements and below the full value of the allowance payment.

Assume that there is some measure of distance from meeting requirements δ, such that

(6) $$\pi_N = P(\delta < 0) = F(0)$$

$$\pi_E = P(\delta < S) = F(S)$$

where

π_N = the probability of meeting requirements normally

π_E = the probability that a household participates when offered a payment, S

S = the allowance payment offered, and

F = the distribution function for δ.

This essentially specifies that the value of meeting requirements for households that would not meet them normally is given by $(S - \delta)$. Thus the distribution of V is given by

(7) V = \$10 with probability 1-F(S)

$S-\delta$ with probability density $f(\delta)$, $0 < \delta < S$

S with probability F(0).

Since V is correlated with δ, the distribution of δ in the retained sample will be different from its distribution in the overall population. Specifically, if $h(\delta)$ is the expected density function for a household in the retained sample,

(8) $$h(\delta|S) = \frac{f(\delta)\ G(\$10)}{R_E}, \quad \delta \geq S$$

$$\frac{f(\delta)\ G(S-\delta)}{R_E}\ ,\ 0 \leq \delta \leq S$$

$$\frac{f(\delta)\ G(S)}{R_E}\ ,\ \delta \leq 0$$

where R_E is the overall retention rate, given a payment offer of S. It should be apparent from Equation (8) that the distribution of δ in the retained population will have a smaller mean and a higher value of π_N. Furthermore, this bias will vary with the amount of the allowance payment, S.

This model could in theory be incorporated into the estimation of Chapter 5,[1] though there are fairly severe problems with the specification of δ. As it stands, however, the model is still incomplete. The model posed above essentially relates attrition to a single point in time. Thus, the usual application would specify Equation (8) in terms of the distribution of δ at two years after enrollment. This requires either an unusual foresight and disregard for the intervening period or that the values of δ be fixed for each household. Neither assumption seems reasonable for housing requirements given the normal turnover exhibited by Control households and the apparent myopia of the acceptance decision. Thus the formulation of Equation (8) would have to be extended to include such dynamic considerations.[2] This has not been done here. Instead, the two extreme assumptions of complete myopia and complete absorption with a point two years after enrollment are examined in the context of a single representation of Equation (8).

Complete myopia is the easiest case to describe. Imagine that households start with their position at enrollment. In the next "period" they may or may not meet requirements and remain enrolled or drop out accordingly. This process repeats in successive periods. Notice that attrition is never directly based on the household's position at the end of two years. Rather, the distribution of meeting requirements at the end of two years

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[1] See, e.g., Heckman (1976), and Hausman and Wise (1977).

[2] For a discussion of this issue, see Kennedy (1978).

is affected because of the correlation between the household's requirements status in intermediate periods and its status at the end of two years. But the same is true of its status at enrollment. Selections in intermediate periods affect the proportion of the retained population that met requirements at enrollment through the same correlation process that led them to effect the proportion of retained households that met requirements at two years. Thus a simple measure of the bias introduced at the end of two years is the bias introduced at enrollment. This may be estimated by comparing the rate at which households in the two-year sample met requirements with the rate at which all households met requirements.[1]

Table VI-6 compares the proportions of households that met requirements at enrollment for all enrolled households and for enrolled households retained in the sample for Chapter 5. Since this table is merely the converse of Table VI-5, as expected, the Minimum Standards households are the only households with a significant difference from Control households in terms of the difference between the proportion of households that met requirements at enrollment in the two samples.

Even for Minimum Standards, however, the comparisons in Chapter 5 already correct for most of the bias because they take account of position at enrollment. If there had been no difference in attrition between Minimum Standards and Control households in Pittsburgh, for example, the proportion of households that met requirements at enrollment would have been 0.13 instead of 0.20 (that is, the initial difference between Housing Gap and Control rates of meeting requirements at enrollment would have been maintained). Even using the Control rate of 83 percent for the probability that households meeting requirements at enrollment continued to meet them at two years, as shown in Table 5-1, this would reduce the overall participation rate for Housing Gap households at two years by six points. Only

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[1] For an example dealing with continuous variables see Kennedy (1978). It should be noted that the model sketched above is somewhat sensitive to the time lags of decisions and requires more explicit attention to the proper definition of a "period."

Table VI-6

PERCENTAGE OF HOUSEHOLDS THAT MET REQUIREMENTS AT ENROLLMENT FOR ALL ENROLLED HOUSEHOLDS AND HOUSEHOLDS ACTIVE AND BELOW MODAL ELIGIBILITY LIMITS AT THE END OF TWO YEARS

	PITTSBURGH			PHOENIX		
	HOUSING GAP HOUSEHOLDS	CONTROL HOUSEHOLDS	DIFFERENCE	HOUSING GAP HOUSEHOLDS	CONTROL HOUSEHOLDS	DIFFERENCE
MINIMUM STANDARDS REQUIREMENT						
Enrolled households	18%	20%	-2%	19%	21%	-2%
(Number of cases)	(266)	(425)		(302)	(505)	
Households active and below modal eligibility limits at the end of two years	20	15	5	19	17	2
(Number of cases)	(177)	(230)		(158)	(240)	
Difference	-2	-5**	7**	0	-4*	4*
(t-statistic)[a]	1 16	2 80	2 82	0 00	(2 20)	2 20
MINIMUM RENT LOW REQUIREMENT						
Enrolled households	63	63	0	54	49	5
(Number of cases)	(154)	(428)		(166)	(519)	
Households active and below modal eligibility limits at the end of two years	59	56	3	45	40	5
(Number of cases)	(111)	(230)		(87)	(243)	
Difference	-4	-7**	3	-9*	-9**	0
(t-statistic)[a]	(1 51)	(3.24)	(0 88)	(2 55)	(4 03)	(0 00)
MINIMUM RENT HIGH REQUIREMENT						
Enrolled households	31	32	1	27	27	0
(Number of cases)	(167)	(428)		(188)	(519)	
Households active and below modal eligibility limits at the end of two years	27	27	0	20	18	2
	(93)	(230)		(105)	(243)	
Difference	-4	-5*	1	-7*	-9**	2
(t-statistic)[a]	(1 37)	(2 40)	(0 24)	(2.23)	(4 53)	(0 54)

SAMPLES Enrolled Housing Gap and Control households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing

Housing Gap and Control households active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1 0C*, b = 25) Housing Gap treatment group and households living in their own homes or in subsidized housing

DATA SOURCES Payments file, Initial and monthly Household Report Forms, Initial Housing Evaluation Form

† t-statistic significant at the 0 10 level (two-tailed)

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0 01 level (two-tailed)

a The t-statistic is the t-statistic for the difference between the percentages meeting requirements for those still active at two years and those no longer active It may also be computed as

$$\frac{\pi_A - \pi_R}{\sqrt{\pi_A\left(1-\pi_A\right)\left(\frac{1}{N_R} - \frac{1}{N_A}\right)}}$$

where the subscripts A and R refer to all enrolled households and households still active at two years, respectively The (approximate) t-statistic for the difference of differences was calculated using the sum of the estimated variances for each difference

a two-point drop remains to be accounted for by bias in the rates at which Housing Gap households met requirements given their initial status. Thus, for example, even if the entire two-point drop was imposed on the participation rate among households that did not already meet requirements at enrollment, the rate would only be reduced from 32 percent to 29 percent (as compared with a 12 percent rate for similar Control households).

Alternatively, consider the case in which retention is based solely on the household's requirements status at the end of two years. To simplify the example further, assume all behavior is based on normal requirements status.[1] In this case the retention rate among households that did and did not meet requirements at enrollment is given by

$$\rho_{ME} = \pi_{ME}\,\alpha_M + (1-\pi_{ME})\,\alpha_N \tag{9}$$

$$\rho_{\overline{ME}} = \pi_{\overline{ME}}\,\alpha_M + (1-\pi_{\overline{ME}})\,\alpha_N$$

where

ρ = the difference in retention rates between Housing Gap and Control households

π = the probability that a household met requirements at the end of two years

α_M = the difference in Housing Gap and Control retention rates for households that would normally have met requirements

α_N = the difference in Housing Gap and Control retention rates for households that would not normally have met requirements

ME = subscript indicating that the household met requirements at enrollment, and

$\overline{ME}$ = subscript indicating that the household did not meet requirements at enrollment.

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[1] This is a worst case assumption. It is equivalent to assuming that the value of the allowance payment in Equation (7) is $10 for households that were induced to meet requirements.

Equation (9) can be solved to give

$$(10) \qquad \frac{\alpha_M}{\alpha_N} = 1 + \frac{\rho_{\overline{ME}} - \rho_{ME}}{\rho_{ME}\pi_{\overline{ME}} - \rho_{\overline{ME}}\pi_{ME}}$$

which can be estimated using Control rates for $\pi_{\overline{ME}}$ and π_{ME}.

In terms of bias, the observed participation rate ($\tilde{\pi}$) for any group of Housing Gap households is related to the true rate (π) by

$$(11) \qquad \tilde{\pi} = \frac{\alpha_M \pi}{\alpha_M \pi + \alpha_N (1-\pi)}$$

$$(12) \qquad \pi = \frac{\tilde{\pi}}{\frac{\alpha_M}{\alpha_M}(1-\tilde{\pi}) + \tilde{\pi}} .$$

Applying these equations to the figures for Minimum Standards in Pittsburgh would give participation rates of 45 percent for households that met requirements at enrollment and four percent for households that did not meet requirements at enrollment, well below the rates for comparable Controls.

These numbers are not, of course, intended to be taken seriously. The model posed is extreme beyond belief. They are only intended to indicate that alternative assumptions would derive much larger biases than those found under the complete myopia model. The myopia model, on the other hand, suggests that the bias involved in the results of Chapter 5 could be trivially small. Absent more careful specification and estimation, the caveat of possible bias remains.

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APPENDIX VII

POPULATION DYNAMICS AND PROGRAM PARTICIPATION

This appendix explores a simple model of population dynamics.[1] The first section presents the model, indicates its implications for program participation, and uses it to justify the interpretation of the participation rates estimated in Chapters 4 and 5. The second section discusses the very severe limitations of the model posed, but suggests that the combined results of Chapters 4 and 5 still are likely to provide a reasonably good bound on both participation rates and the impact of the allowance offer on the rate at which households met the housing requirements.

VII.1 POPULATION DYNAMICS

There is ample evidence that many poor households do not remain poor forever. Household income fluctuates for a variety of reasons, including changes in employment, wages, and marital status. If households require some time to decide to apply for a program or meet its requirements, then the fact that the eligible population is not fixed will permanently reduce the program's participation rate. This can be taken account of in analyzing a cohort of the eligible population, such as that enrolled in the Demand Experiment, by observing the cumulative participation rate for the cohort.

To see this, assume that the probability that a household eligible at time t will be eligible at time (t + 1) is (1 - r) for all households. In other words, 100r percent of the eligible population ceases to be eligible each period. Further assume that the size of the total population is fixed, so that households that cease to be eligible are always replaced by the same

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[1] As mentioned in the main text, the potential importance of population dynamics was pointed out to us by analysis at the Rand Corporation in connection with their analysis of the Supply Experiment. While the models presented in this appendix were developed for this report, they are straight forward given the basic idea provided by Rand.

number of newly eligible households. In this case, households eligible in any one period will have been eligible for various lengths of time. Indeed, under the assumption that the total population is fixed, the expected distribution of times eligible will eventually approach the steady state of distribution.[1]

$$(1) \qquad \begin{cases} f(t) = r\,(1 - r)^{t} \\ F(t) = 1 - (1 - r)^{t+1} \end{cases}$$

where

$f(t)$ = the proportion of the population that has been eligible for t periods (t = 0 represents newly eligible households)

$F(t)$ = the proportion of the population that has been eligible for t periods or less, and

r = the turnover rate for the eligible population (the proportion of eligibles in one period that are not eligible in the next).

Now assume that eligible households take time to decide to apply for a program and meet its requirements. Say, for example, that the time needed to participate is the same for all households (α) and that all households eventually decide to participate if they remain eligible long enough. In this case, the proportion of the currently eligible population that will be

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[1] This may be seen as follows. Let $f_0(t)$ be any initial frequency function for times eligible. Since the total population size is fixed, $f_0(0)$ must equal r. (Since 100r percent of the households have just ceased to be eligible, the percentage of newly eligible households must also be 100r.) Now consider the frequency function at some later period, T. Since r is independent of past states, this function must be given by

$$f_T(t) = \begin{cases} (1 - r)^{t - T}\, f_0(t - T) \text{ for } T < t \\ (1 - r)^{t}\, r \text{ for } T \geq t \end{cases}$$

That is, at time T the proportion of households that have been eligible for exactly T periods is $(1 - r)^{T}$ times the proportion that was newly eligible T periods earlier ($f_0(0)$). Likewise, the proportion of households at time T that have been eligible for T + k periods must be $(1 - r)^{T}$ times the proportion that had already been eligible for k periods at t_0 (T periods earlier). On the other hand, the proportion that have been eligible for T - 1 periods at time T must be $(1 - r)^{T-1}$ times the newly eligible households at time 1, and so forth.

As T becomes large, $f_T(t)$ approaches $(1-r)^{t}r$.

participants in any given period is simply equal to the proportion that have been eligible for at least α periods. Thus,

$$\pi = 1 - F(\alpha - 1) = (1 - r)^{\alpha} \tag{2}$$

where

π = the expected current participation rate, and

α = the time required to participate once eligible.

More generally, assume that the time required to participate, α, is stochastic with a frequency function $h(\alpha)$ and let the probability that an individual household will be willing to participate itself vary with α. In this case, the probability that a household with required time, α, participates is simply its probability of being willing to participate, $\pi(\alpha)$, times the probability that it will remain eligible for at least periods $[1-F(\alpha-1)]$. The expected proportion of all currently eligible households that currently participate in the program is given by

$$\pi = \sum_{\alpha=0}^{\infty} \pi(\alpha)[1-F(\alpha-1)]h(\alpha)$$

$$\pi = \sum_{\alpha=0}^{\infty} (1-r)^{\alpha}\Pi(\alpha)h(\alpha)$$

where

π = the expected current participation rate

α = the time required to participate

$h(\alpha)$ = the frequency function for α, and

$\pi(\alpha)$ = the probability of participating for households with a required time of α.

Thus, the current participation rate (π) depends not only on the ultimate willingness of households to participate, $\pi(\alpha)$, but also on the time required to participate, α, and the turnover rate of the population, r.

The participation rate defined in Chapter 4 was designed to take account of the effects of population turnover, at least in terms of the simple model posed above. The Demand Experiment enrolled a cohort of the

eligible population. Households that became ineligible were not replaced, so that there is no opportunity to observe the current participation rate defined by Equation (3) directly.[1] Under the model posed above, however, the cumulative participation rate defined in Chapter 4, will, over time, approach the current rate of Equation (3).

Any cohort of eligible households selected in a given period will have an expected distribution of remaining times eligible. Under the dynamic posed above, the probability that a household remains eligible for exactly t periods is the probability that it remains eligible for t periods $(1-r)^t$, times the probability that it becomes ineligible by the next period, r. Thus

$$g(t) = r(1-r)^t = f(t) \tag{4}$$

$$G(\alpha) = 1 - \sum_{o}^{\alpha-1} g(t) = 1-F(\alpha-1)$$

where

$g(t)$ = the expected proportion of households that remain eligible for exactly t periods, and

$G(\alpha)$ = the proportion of households that remain eligible for at least α periods.

The probability that an individual household with required time, α, will participate is given by its probability of being willing to participate, $\pi(\alpha)$, times the probability that it will remain eligible for at least periods, $G(\alpha)$. Thus, the overall cumulative participation rate of the cohort after T periods is

$$\Pi_T^C = \sum_{\alpha=0}^{T} h(\alpha)\pi(\alpha)G(\alpha) \tag{5}$$

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[1] There is an exception. Enrolled households that became ineligible could, if they wished, remain enrolled, receiving the same $10 payment as Control households for completing reporting requirements. These households could later receive allowance payments if they once again became eligible. No attempt has been made here to take account of, or even estimate the extent of, this phenomenon.

$$= \sum_{a=0}^{T} h(\alpha)\pi(\alpha)\,[1-F(\alpha-1)]$$

$$= \sum_{\alpha=0}^{T} h(\alpha)\pi(\alpha)\,(1-r)^{\alpha}$$

In the limit,

$$\lim_{T\to\infty} \Pi_T^C = \sum_{a=0}^{\infty} h(\alpha)\pi(\alpha)\,[1-F(\alpha-1)] \tag{6}$$

which is the current participation rate defined by Equation (3).[1]

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[1] It may be noted that the relation between the current participation rate and the cumulative cohort participation rate does not apparently rely on the Markov assumption that the probability of being eligible in period t depends only on the state in period t-1. Assume any population turnover process that maintains a fixed total eligible population and approaches a steady state distribution of times eligible, F(t), and select a cohort of eligible households at time T. Let G (x,t) be the probability that a household that has been eligible for t periods at T_0 will remain eligible for at least x periods more. Now consider the distribution of all eligible households at time T + a. Since the total population size is assumed to be fixed, for $t \geq a$

$$f_a(t) = G_0(a;t-a)\,f_0(t-a) \tag{i}$$

But since the distribution F(t) is fixed,

$$f_a(t) = f_0(t) \tag{ii}$$

Thus,

$$G(a;t+a) = \frac{f_0(t-a)}{f_0(t-a)} \tag{iii}$$

Now consider the overall probability that a household in the cohort will remain eligible for x periods more. This is, evidently

$$G(x) = \sum_{t=0}^{\infty} G(x,t)\; f_0(t) \tag{iv}$$

or, equivalently,

$$G(x) = \sum_{t=x}^{\infty} G(x,t-x)\,f_0(t-x) \tag{v}$$

Substituting (iii) into (v) gives

$$G(x) \sum_{t=x}^{\infty} f_0(t) = 1-F(x-1)$$

which was the basis for the equality of $\lim \Pi_T^C$ and π. (The generality of this, of course, depends on the class of processes that approach stable distributions, F(t), with fixed population size.)

Alternatively, as in Chapter 5, consider the current cohort participation rate among households still eligible after T years. This is evidently given by

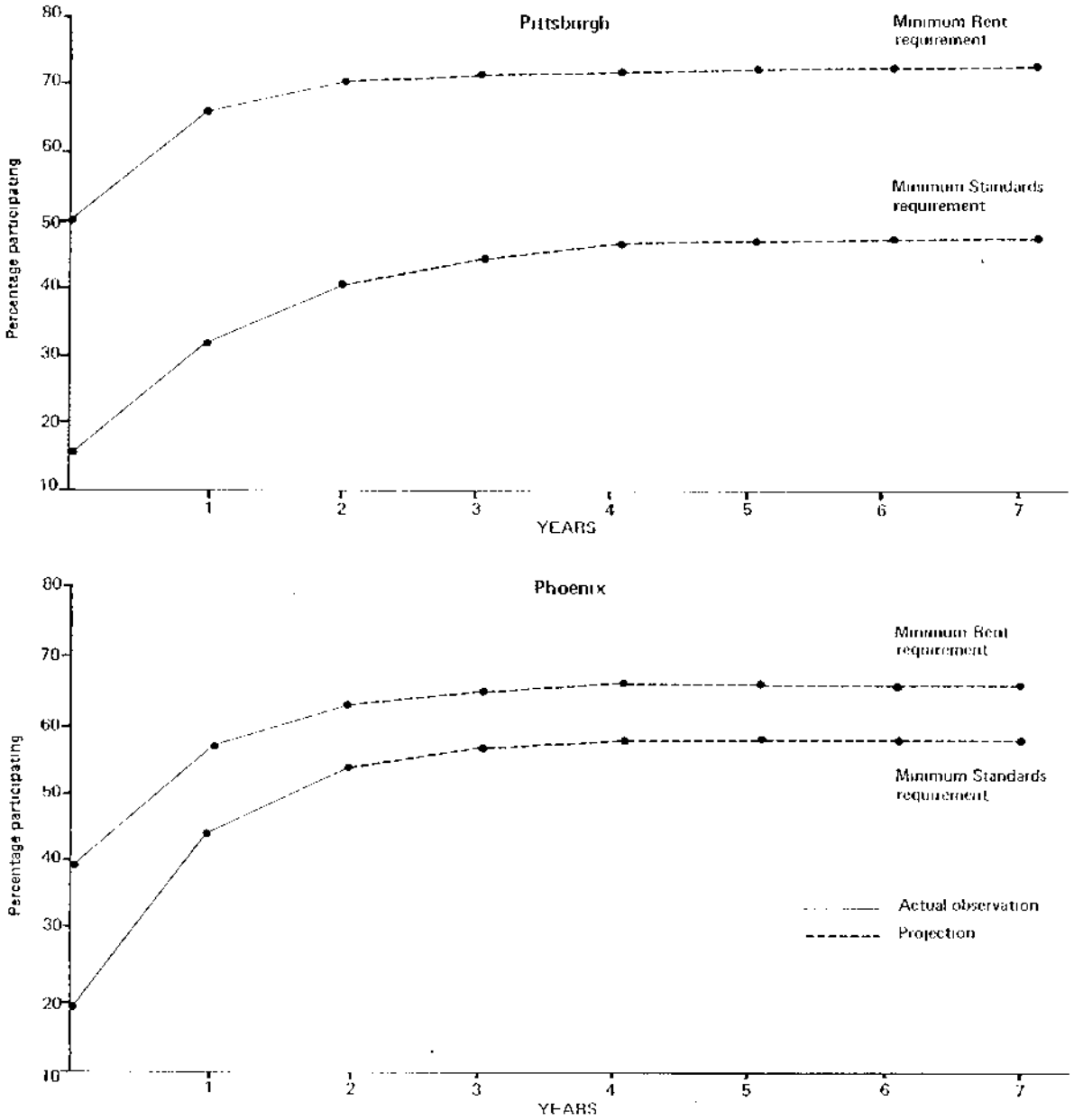
$$\Pi_T^{cc} = \sum_{\alpha=0}^{T} h(\alpha)\pi(\alpha) \tag{7}$$

Thus in the limit this rate will give the overall proportion of households that would participate if all households remained eligible forever.

The model posed above need not be restricted to turnover in the eligible population alone. It can also apply to turnover in the eligible and interested population. Thus, for example, say that households' circumstances change over time in ways that, while leaving them eligible, change the amount of the allowance payment they would receive, make meeting reporting requirements more or less difficult, or otherwise make the program offer more or less appealing. In this case, the eligible and interested population may turn over more rapidly than the eligible population alone. If households that accepted the enrollment offer represent the eligible and interested population at enrollment, then the cumulative participation rate of this cohort will represent the participation rate of the eligible and interested population. Multiplying this rate by the acceptance rate then gives the participation rate for the eligible population.

The equation of the cumulative cohort participation rate and the current program rate is asymptotic, while the data analyzed in this report only extend to the first two years after enrollment. Examination of the build-up of participation rates (shown in Figure VII-1), suggests, however, that this truncation of the cumulative cohort rate may not have materially altered results. The rate of increase in the cumulative participation rate dropped sharply from the first to the second year for both Minimum Standards and Minimum Rent requirements in both sites. As a result, the projected rates in future years are only slightly higher than the rates at the end of the first two years.

Figure VII-I
BUILD-UP OF PARTICIPATION OVER TWO YEARS AND PROJECTION TO FUTURE YEARS[a]



SAMPLE Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing

DATA SOURCE Payments file

[a]Solid lines show actual observations. Dashed lines follow the projection

$$P_T = P_2 + (P_2 - P_1)\ C \sum_{t=0}^{T-2} C^t$$

where

P_T = the cumulative participation rate at the end of T years, and

$$C = \frac{P_2 - P_1}{P_1 - P_0}$$

The projected rates shown in Figure VII-1 are based on a simple extrapolation of the first two years. The specific extrapolation used was

(8) $$\frac{\Delta\pi t}{\Delta\pi_{t-1}} = C$$

$$\Delta\pi_t = C^t \Delta\pi_0$$

$$\pi_T = \pi_2 + \Delta\pi_2 C \sum_{t=0}^{T-2} C^t$$

where $(\Delta\pi 2/\Delta\pi_1)$ is used to estimate "C" and

π_t = the cumulative participation rate at the end of t years

$\Delta\pi_t = \pi_t - \pi_{t-1}$.

In terms of the model of Equation (5),

(9) $$\Delta\pi_t = h(t)\pi(t)(1 - r)^t$$

so that the assumption of Equation (8) becomes

(10) $$\frac{h(t)\pi(t)(1 - r)}{h(t - 1)\pi(t - 1)} = C$$

where C is some constant. This assumption is innocuous enough; indeed, the projections of Figure VII-1 look much like a free-hand extension of a smooth curve through the observed points. At the same time, the projection is still arbitrary and seems to have no especially compelling theoretical basis.

Table VII-1 presents more detail along the lines of Figure VII-1, showing the actual rates through the first two years and the asymptotic projected value. In addition, the last column shows the maximum possible rate that could have been obtained if all households that were still actively enrolled in the experiment at the end of two years eventually participated. These maximum possible rates, while no doubt extreme, are almost always well above the two year rate and the asymptotic projection. Thus, while the sharp change in

Table VII-1

BUILDUP OF PARTICIPATION

	CUMULATIVE PARTICIPATION RATE AT:				
	ENROLLMENT	ONE YEAR	TWO YEARS	PROJECTED MAXIMUM RATE [a]	MAXIMUM POSSIBLE RATE [b]
			COMBINED SITES		
Minimum Standards requirement	17%	39%	47%	52%	76%
Minimum Rent requirement	44	61	66	68	86
Minimum Rent Low requirement	58	72	78	82	90
Minimum Rent High requirement	30	51	56	58	81
			PITTSBURGH		
Minimum Standards requirement	15	32	40	47	79
Minimum Rent requirement	49	65	69	70	90
Minimum Rent Low requirement	64	76	81	85	95
Minimum Rent High requirement	35	54	58	59	85
			PHOENIX		
Minimum Standards requirement	19	45	54	59	74
Minimum Rent requirement	39	57	63	66	82
Minimum Rent Low requirement	53	67	74	81	86
Minimum Rent High requirement	27	48	54	56	89

SAMPLE: Enrolled Housing Gap and Control households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Payments file, Initial and monthly Household Report Forms, Housing Evaluation Forms.

a. Computed as $P_2 + \frac{(P_2 - P_1)C}{1 - C}$

where P_i = the cumulative participation rate at the end of i years

$C = \frac{P_2 - P_1}{P_1 - P_0}$

(see text for explanation).

b. Computed as $P_2 + R$, where R is the proportion of the enrolled population that had never participated and was still actively enrolled in the experiment at the end of two years.

slope between the first and second years suggests that there would have been little future increase in the cumulative participation rate, large increases cannot be entirely ruled out.[1]

VII.2 LIMITATIONS

This section discusses some of the limitations of the simple dynamic model posed above. The discussion suggests that the measure of participation used in Chapter 4 may in theory overestimate program participation rates and underestimate both the impact of the program on meeting requirements and the proportion of participants induced to meet requirements by the allowance offer.[2] Some evidence based on the behavior of Control households, however, suggests that the bias involved may not in fact be large.

One obvious drawback to the simple dynamic posed above is that it makes no provision for turnover in the households that would normally meet requirements (or be induced to meet requirements by the allowance offer) within the eligible population. Thus, under this model, the fact that some Control households that did not meet requirements at enrollment later met the requirements must be attributed to a shift in the normal propensity to meet requirements, concurrent with the allowance offer.

A variety of alternative models may be posed. Most become quite cumbersome, so that this section will simply indicate the intuitive effect of such turnover without posing any formal model.

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[1] One obvious specification that would lead to large accumulations after two years is as follows. Imagine that the allowance offer has two sorts of effects. First, some households are induced to change their housing. This produces the relatively sharp increase in participation in the first year. Other households are not induced to change their housing, but as they come to meet requirements normally are then induced not to change their housing again to units that would not meet requirements. If, in addition, the turnover rate is not fixed, but tends to be lower for households that have been eligible for longer periods, future accumulations could be large, despite the pattern of the first two years.

[2] As indicated in Appendix VI, the participation measure used in Chapter 5, on the other hand, while still likely to overestimate participation rates, should, if anything, overestimate program impact in meeting requirements. Thus, the two measures should at least bracket the actual effect of the program.

The cumulative cohort participation rate defined in Equation (5) and used in the analysis of Chapter 4, accumulates all households that ever met requirements. If there is turnover in the population that met requirements normally, this cumulative rate would, of course, overstate the rate at which households normally met requirements. Thus the participation rate for Housing Gap households and the normal rate of meeting requirements for Control households could be overstated. The impact of the allowance offer on meeting requirements could still be correctly estimated if this overstatement applied equally to both Housing Gap and Control households.[1] At the same time, it seems quite possible that the allowance offer would increase the probability that households that already met requirements or would normally meet requirements would then continue to meet the requirements. In this case, the overall participation rate for Housing Gap households would be less overstated, since the assumption that once such households met requirements they would always continue to do so would be more closely approximated by the actual probability of continuing to meet requirements. Now, however, the estimated impact of the allowance offer would necessarily be biased below the true impact, since the rate of meeting requirements among Control households would still be expected to overestimate the actual normal rate of meeting requirements.

Some idea of the potential importance of this problem may be obtained by comparing the cumulative rate of meeting requirements for Control households that were still enrolled and eligible at the end of two years with the rate at which these households actually met requirements at that time. The accumulation of households that met requirements normally cannot pose a serious problem for estimates of either the participation rate of Housing Gap households or the impact of the allowance offer on the rate at which households met requirements unless there is a material difference in the two definitions for Control households that remained enrolled and eligible.

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[1]The estimated proportion of participants that were induced to meet requirements would still, however, be expected to be an underestimate due to the spurious enlargement of the denominator.

Table VII-2 compares the two measures for both Control and Housing Gap households that were still enrolled and eligible at the end of two years. Differences are generally small and approximately the same for Housing Gap and Control households. Thus it would appear, based on this evidence, that the accumulation of households that would have ceased to meet requirements may have increased estimated participation rates by only about five percentage points and not materially biased comparisons of the rates at which Housing Gap and Control households met requirements.

This is further confirmed by comparisons using only households that did not meet requirements at enrollment, shown in Table VII-3. Differences between the two measures are still generally small (though larger in comparison to the size of the rates at which households met requirements) and if anything larger for Housing Gap than for Control households.

A second problem with the interpretation of the participation rates estimated in Chapter 4 has to do with the failure to exclude some ineligibles. Many of the households that became ineligible for the Demand Experiment program did so for reasons that automatically excluded them from the sample. These included especially moves out of the counties in which the Demand Experiment was conducted and, more rarely, death, institutionalization, and ineligible household composition. Income ineligibility did not, however, automatically exclude households from the sample. While Housing Gap households that became ineligible due to increased income might be expected to drop out of the program, there was no requirement that they do so. Furthermore, there is no compelling reason why Control households that became ineligible would drop out of the sample or even notice the fact.

This is confirmed in part by Table VII-4, which shows the proportion of Control households and households in Housing Gap plans with eligibility limits at or below the modal limits, still enrolled at the end of two years, that had annual incomes at the end of two years that were above the modal limits.[1]

[1] Some Housing Gap plans had higher income limits and, as expected, more households with incomes above the modal limits at two years.

Table VII-2

COMPARISON OF CUMULATIVE AND CROSS-SECTIONAL MEASURES AT THE END OF TWO YEARS

	PITTSBURGH				PHOENIX			
	PERCENTAGE THAT EVER MET REQUIRE-MENTS	PERCENTAGE THAT MET REQUIRE-MENTS AT TWO YEARS	DIFFER-ENCE	SAMPLE SIZE	PERCENTAGE THAT EVER MET REQUIRE-MENTS	PERCENTAGE THAT MET REQUIRE-MENTS AT TWO YEARS	DIFFER-ENCE	SAMPLE SIZE
MINIMUM STANDARDS REQUIREMENT								
Control households	27%	23%	4%	(217)	38%	33%	5%	(237)
Housing Gap households	48	44	5	(174)	63	56	7	(154)
MINIMUM RENT LOW REQUIREMENT								
Control households	73	71	2	(230)	53	46	7	(239)
Housing Gap households	83	83	0	(111)	80	76	4	(87)
MINIMUM RENT HIGH REQUIREMENT								
Control households	43	41	2	(230)	32	27	5	(238)
Housing Gap households	54	52	2	(93)	54	51	3	(101)

SAMPLE: Housing Gap and Control households active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal ($dC^* = 1.0C^*$, $b = .25$) Housing Gap treatment group and households living in their own homes or in subsidized housing.

DATA SOURCES: Payments file, Initial and monthly Household Report Forms, Housing Evaluation Forms.

Table VII-3

COMPARISON OF CUMULATIVE AND CROSS-SECTIONAL MEASURES AT THE END OF TWO YEARS FOR HOUSEHOLDS THAT DID NOT MEET REQUIREMENTS AT ENROLLMENT

	PITTSBURGH				PHOENIX			
	PERCENTAGE THAT EVER MET REQUIRE-MENTS	PERCENTAGE THAT MET REQUIRE-MENTS AT TWO YEARS	DIFFER-ENCE	SAMPLE SIZE	PERCENTAGE THAT EVER MET REQUIRE-MENTS	PERCENTAGE THAT MET REQUIRE-MENTS AT TWO YEARS	DIFFER-ENCE	SAMPLE SIZE
MINIMUM STANDARDS REQUIREMENT								
Control households	13%	12%	1%	(182)	26%	24%	2%	(195)
Housing Gap households	36	32	4	(140)	54	48	6	(124)
MINIMUM RENT LOW REQUIREMENT								
Control households	38	38	0	(102)	22	17	5	(145)
Housing Gap households	58	58	0	(45)	65	58	7	(48)
MINIMUM RENT HIGH REQUIREMENT								
Control households	23	21	2	(168)	16	13	3	(195)
Housing Gap households	37	34	3	(68)	44	40	4	(82)

SAMPLE: Housing Gap households and Control households active at two years after enrollment that did not meet requirements at enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal ($dC^* = 1.0C^*$, $b = .25$) Housing Gap treatment group and households living in their own homes or in subsidized housing.

DATA SOURCES: Payments file, Initial and monthly Household Report Forms, Housing Evaluation Forms.

Table VII-4

PERCENTAGE OF HOUSEHOLDS ACTIVE AT THE END OF TWO YEARS WITH INCOMES ABOVE THE MODAL ELIGIBILITY LIMITS[a]

	PITTSBURGH	PHOENIX
HOUSING GAP HOUSEHOLDS[b]	10%	5%
(Number of cases)	(294)	(259)
CONTROL HOUSEHOLDS	28	12
(Number of cases)	(320)	(278)

SAMPLE: Households active at two years after enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Payments file, Initial and monthly Household Report Forms.

a. Modal limits are given by the income at which a household would have received a $10 payment under the modal Housing Gap payment formula, that is:

$$Y \geq 4\ (C^* - 10)$$

where

Y = annual income, and
C* = the estimated cost of standard housing used to calculate payments at two years

b. Housing Gap households include only those households in plans with eligibility limits at or below the modal limits (Plans numbered 2, 3, 5, 6, 8, 9, 11 in Appendix I).

From 5 to 10 percent of the Housing Gap households enrolled at the end of two years had incomes above the modal limits, as compared with from 12 to 28 percent of Control households enrolled at the end of two years.[1]

This raises the possibility that some of the Housing Gap and Control households that met requirements after enrollment did so after they had in fact become ineligible on the basis of income. Since Control households that became income ineligible were, based on Table VII-4, apparently less likely to drop out of the sample than Housing Gap households, comparisions of Housing Gap and Control households might underestimate the effect of the allowance offer on the rate at which eligible households met requirements.

It would be possible, given the data available in the Demand Experiment, to construct a file of monthly household incomes and thus examine the eligibility of each household when it first met requirements.[2] Information on meeting requirements for Control households is, however, only available at the few cross-sections defined by household interviews and housing inspections (at enrollment and six, twelve and twenty-four months after enrollment).[3]

Table VII-5 compares the rate at which all enrolled Housing Gap and Control households ever met requirements using this cross-sectional information, first based simply on whether the household met requirements at any cross-section (the measure used in this report) and second counting a household as meeting requirements at a cross-section only if it was also still modally eligible at that cross-section.

Taking account of income eligibility reduces the rate at which households met requirements by at most four percentage points. While the reduction is somewhat larger for Control households, the difference from the reduction for Housing Gap households is never more than two percentage points. Thus, failure to exclude income ineligible households from the cumulative participation rate among all enrolled households has little or no effect on the

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[1]The limits used in Table VII-4 are higher than the limits at enrollment, reflecting the adjustment in the estimated cost of standard housing (the C* schedule used in the Housing Gap payment formula) at the end of the first year after enrollment.

[2]This file is being constructed, but was not available when the work in this report was completed.

[3]See Appendix III.

Table VII-5

COMPARISON OF THE RATE AT WHICH HOUSEHOLDS EVER MET REQUIREMENTS
BASED ON CROSS-SECTIONAL DATA WITH AND WITHOUT CONTROLLING FOR INCOME ELIGIBILITY

	PITTSBURGH				PHOENIX			
	PERCENTAGE THAT EVER MET REQUIRE-MENTS	PERCENTAGE THAT EVER MET WHILE ELIGIBLE	DIFFER-ENCE	SAMPLE SIZE	PERCENTAGE THAT EVER MET REQUIRE-MENTS	PERCENTAGE THAT EVER MET WHILE ELIGIBLE	DIFFER-ENCE	SAMPLE SIZE
MINIMUM STANDARDS REQUIREMENT								
Control households	33%	30%	3%	(431)	42%	38%	4%	(521)
Housing Gap households	42	41	1	(268)	56	54	2	(307)
MINIMUM RENT LOW REQUIREMENT								
Control households	76	74	2	(431)	60	60	0	(521)
Housing Gap households	83	83	0	(156)	77	76	1	(167)
MINIMUM RENT HIGH REQUIREMENT								
Control households	47	44	3	(431)	39	38	1	(521)
Housing Gap households	51	49	2	(168)	51	51	0	(188)

SAMPLE: Enrolled Housing Gap and Control households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Payments file, Initial and monthly Household Report Forms, Housing Evaluation Forms.

actual rates observed in the Demand Experiment. Furthermore, the same pattern is apparent considering only households that did not meet requirements at enrollment, as shown in Table VII-6.

It appears then, that the most obvious shortcomings of the simple dynamic model posed in Section VII.1 may not have been empirically significant. While a more complete dynamic specification would be desirable, the interpretation of the cumulative participation rate offered by Section VII.1, may in fact be reasonably accurate. If the two problems discussed above act cumulatively, overall participation rates might, based on the evidence presented here, be overstated by as much as 10 percentage points and comparisons of Housing Gap and Control households underestimate the impact of the allowance offer by two or three percentage points.

Table VII-6

FOR HOUSEHOLDS THAT DID NOT MEET REQUIREMENTS AT ENROLLMENT:
COMPARISON OF THE RATE AT WHICH HOUSEHOLDS EVER MET REQUIREMENTS
BASED ON CROSS-SECTIONAL DATA, WITH AND WITHOUT CONTROLLING FOR INCOME ELIGIBILITY

	PITTSBURGH				PHOENIX			
	PERCENTAGE THAT EVER MET REQUIRE-MENTS	PERCENTAGE THAT EVER MET WHILE ELIGIBLE	DIFFER-ENCE	SAMPLE SIZE	PERCENTAGE THAT EVER MET REQUIRE-MENTS	PERCENTAGE THAT EVER MET WHILE ELIGIBLE	DIFFER-ENCE	SAMPLE SIZE
MINIMUM STANDARDS REQUIREMENT								
Control households	16%	13%	3%	(338)	26%	21%	5%	(397)
Housing Gap households	29	28	1	(217)	46	43	3	(246)
MINIMUM RENT LOW REQUIREMENT								
Control households	36	31	5	(160)	22	21	1	(264)
Housing Gap households	56	54	2	(57)	50	49	1	(76)
MINIMUM RENT HIGH REQUIREMENT								
Control households	22	18	4	(290)	16	15	1	(377)
Housing Gap households	29	27	2	(115)	33	33	0	(138)

SAMPLE: Enrolled Housing Gap and Control households that did not meet requirements at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Payments file, Initial and monthly Household Report Forms, Housing Evaluation Forms.

APPENDIX VIII

EXPECTED RENT LEVELS NECESSARY TO MEET MINIMUM STANDARDS AND MINIMUM RENT REQUIREMENTS

This appendix discusses the rent levels that households should have expected to pay in order to meet the Minimum Rent or Minimum Standards requirements. The first section shows that this issue is critical to the model of participation in Chapter 4. In particular, if Minimum Rent households could all expect to meet requirements at rents very close to the required levels, the model of Chapter 4 is apparently inadequate. The second section then presents evidence on the rent levels that were, in fact, necessary to meet requirements.

VIII.1 EXPECTED RENT LEVELS AND PARTICIPATION

The model of participation developed in Section 4.1 of Chapter 4 (Equation (8)) stated that households should have participated if

(1) $$S > R_M - R_N - V_M + C_T + C_P$$

where

S = the allowance payment

R_N = the household's normal expenditures

R_M = the expenditures necessary to meet the housing requirements

V_M = the value to the household of the improvements in its housing obtained under expenditures R_M (given the housing requirements)

C_T = additional transaction costs involved in meeting requirements, and

C_P = general participation costs.

One conceptually simple test of the overall adequacy of this model is to see whether the proportion of households that participated in fact corresponds to the proportion for which Equation (1) was true. If this is the case, then it is possible to argue that the model of Equation (1) captures the major determinants of participation.[1]

As was discussed in Chapter 4, none of the independent variables in Equation (1) is observed directly. This is obviously true of the terms in transaction costs and general participation costs (C_T and C_P), as well as the value of housing obtained (V_M). It is also true of the increases in housing expenditures needed to meet requirements ($R_M - R_N$), since the household's normal rent is not known. Even the amount of the allowance payment offered cannot be characterized with certainty, since payments changed with changes in income and household size. One reasonable approximation for at least the first three terms of Equation (1) would be to use the net cash payment at enrollment,

$$S - (R_M - R_N) \simeq S_0 - (R_M - R_0) \quad (2)$$

where

S_0 = the payment offer at enrollment (minus \$10)[2]

R_M = the expenditures necessary to meet requirements, and

R_0 = expenditures at enrollment.

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[1]This does not claim that these terms are well modeled, only that the model at least conceptually includes all important factors. Other factors could, of course, still influence participation, but they would at least have to have a mean effect of zero at the mean values of the terms in Equation (1).

[2]The payment is reduced by \$10 to reflect the fact that households received a \$10 payment each month if they met reporting requirements. Thus the additional payment that the household would obtain by meeting requirements was its allowance payment minus \$10.

The use of enrollment rents as a proxy for normal spending (R_N) should, if anything, underestimate R_N. Households that did not meet requirements had lower average rents than households that did meet requirements and thus lower average rents than the enrolled population as a whole. The usual phenomenon of regression towards the mean would suggest that even if mean normal rents for the entire population did not change over time, the mean normal rent for households that did not meet requirements initially would increase. In fact, there is a fairly strong serial correlation in rental expenditures over time, so that this effect is at least mitigated.

In addition, the formulation in Equation (2) does not take account of inflation.[1] For Minimum Standards households, both R_M and R_N may increase at the same rate so that the approximation of Equation (2) would tend to overestimate the true net payment.[2] For Minimum Rent households, inflation would be expected to increase the dollar value of R_N. In this case, Equation (2) will underestimate the true net payment.[3] Both payments and Minimum Rent requirement levels were adjusted at the end of the first year to take account of inflation. However, there was still a one-year lag between enrollment and the adjustment. Thus there may still be some tendency for Equation (2) to overestimate net payments for Minimum Standards and underestimate them for Minimum Rent.

The critical issue in Equation (2) is the value used for R_M. Chapter 4 proposed as a reasonable estimate for each requirement the expenditure levels of Control households that met that requirement at enrollment. This may seem high for Minimum Rent households. Minimum Rent households that were constrained by the Minimum Rent requirement to spend more for housing than they wanted to would be expected to economize on rents as much as possible, spending as close to the required level as they could. Control households that

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[1] Using hedonic indices, Merrill (1977) estimated annual rates of inflation for housing prices in the two sites over the two years of the experiment to be about 7 percent in Pittsburgh and 5 percent in Phoenix.

[2] $S_O - (R_M - R_O) > S_O - (1 + p)\ (R_M - R_O)$.

[3] $S_O - (R_M - R_O) < S_O - (R_M - (1 + p)R_O)$.

met Minimum Rent requirements, on the other hand, would be expected to include households with desired spending levels above the required levels. If a household that wanted to economize on rent could find a unit very close to the required level, the average expenditures of Control households that met the requirements without an allowance offer could substantially overstate the expenditure level necessary to meet requirements. Indeed, the same arguments could be made for Minimum Standards, though in this case there is no especially convincing alternative to the expenditure of Control households.

The rest of this section examines participation rates among Housing Gap households that did not meet requirements at enrollment based on alternative measures of R_M. For Minimum Standards households, the only measure used for R_M is expenditures of Control households that met Minimum Standards requirements at enrollment. Two different measures are used for Minimum Rent households. The first measure is simply the Minimum Rent requirement. This assumes that Minimum Rent households could reasonably expect to be able to find acceptable units that met requirements with rents at or very close to the required level. The second measure is based on the expenditures of Control households that already met the Minimum Rent requirements at enrollment. This measure essentially assumes, given the incomes of enrolled households, both that relatively few Control households that met Minimum Rent requirements had desired expenditures substantially above the required levels and that Minimum Rent households were not able to economize effectively on rents in meeting the requirements.

Table VIII-1 presents the proportion of Minimum Rent households with positive net payments, using required expenditures to estimate R_M in Equation (2). Based on this measure, the allowance payment offered was more than enough to cover the required increase in housing expenditures for most households that did not meet requirements at enrollment. Participation rates were much lower. The proportion of Minimum Rent households with allowance offers large enough to cover the cost of meeting requirements was two-thirds larger than the proportion that actually participated in both sites. Indeed, the proportion of Minimum Rent households that would have had $20 or more per month of the allowance left over after paying for increased expenditures was larger than the proportion that actually participated. Thus it appears that the

Table VIII-1

PERCENTAGE OF MINIMUM RENT HOUSEHOLDS
WITH POSITIVE NET PAYMENTS AT ENROLLMENT
(Based on Required Levels)[a]

	PITTSBURGH	PHOENIX
Percentage that participated	40%	40%
Percentage with positive net payments	72	65
Percentage with net payments greater than $20 per month	50	47
Number of cases	(166)	(217)

SAMPLE: Enrolled Minimum Rent households that did not receive a full payment at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial Household Report Forms and payments file.

a. Net payments at enrollment are defined as the difference between the allowance payment offered at enrollment and the increase in rent needed to meet requirements. The increase in rent needed is defined as the difference between enrollment rent and required rent for Minimum Rent households, controlling for site and household size.

transaction costs and general participation cost factors of Equation (1) were on average reasonably important in influencing participation.[1]

Unfortunately, examination of two-year data suggests that these factors do not account for the difference between participation rates and the proportion of households with positive net payments either. Table VIII-2 shows the distribution of net payment values at the end of two years for households that were still enrolled in the experiment but had never met requirements. Over half of the households that had not participated by the end of two years had positive net payment offers at that time, and over a third had net payment offers of $20 or more. Most of the nonparticipants still enrolled in the experiment at the end of two years could apparently have met requirements at no additional cost to themselves, and indeed with reduced out-of-pocket costs for housing, while also obtaining better housing.

Since all the households reported in Table VIII-2 remained actively enrolled in the experiment, accepting $10 payments and meeting all program requirements other than the housing requirements, this seems to suggest a very substantial role for transaction costs. The second half of Table VIII-2 shows the distribution of net payments for households that never met requirements and also moved during the experiment. Sample sizes are small, but most of these households also had offers with substantial positive net payment values. Since these households all accepted $10 payments, met reporting requirements, and moved during the two years of the experiment, it appears that the factors in Equation (1) do not completely account for the relatively low participation rates observed.

Parallel results are presented in Tables VIII-3 and VIII-4 using the average rents of Control households that met requirements to estimate R_M for each requirement. Now the proportion of Minimum Rent households that participated is slightly larger than the proportion with positive net payments in both sites. However, the proportion of Minimum Standards households that participated is lower than the proportion with positive net payments and both groups show some nonparticipating households at the end of two years with positive

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[1] Recall that the other term, V_M, is generally expected to have been positive.

Table VIII-2

DISTRIBUTION OF NET PAYMENTS AT THE END OF TWO YEARS
AMONG MINIMUM RENT HOUSEHOLDS THAT NEVER RECEIVED A FULL PAYMENT
(Based on Required Levels)[a]

	PITTSBURGH	PHOENIX
ALL HOUSEHOLDS		
Net Payment		
Greater than $40	20%	27%
Greater than $20	32	41
Greater than 0	62	53
(Number of cases)	(65)	(66)
HOUSEHOLDS THAT MOVED DURING THE EXPERIMENT		
Net Payment		
Greater than $40	20%	42%
Greater than $20	40	50
Greater than 0	80	71
(Number of cases)	(10)	(24)

SAMPLE: Minimum Rent households active at two years after enrollment that never received a full payment, excluding those with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial and monthly Household Report Forms and payments file.

a. Net payments at the end of two years are defined as the difference between the allowance payment offered at the end of two years and the increase in rent needed to meet requirements. The increase in rent needed is defined as the difference between actual rent and required rent for Minimum Rent households at the end of two years, controlling for site and household size.

Table VIII-3

PERCENTAGE OF HOUSEHOLDS WITH POSITIVE NET PAYMENTS AT ENROLLMENT
(Based on Rent Levels for Control Households)[a]

HOUSING GAP HOUSEHOLDS THAT DID NOT RECEIVE A FULL PAYMENT AT ENROLLMENT	PITTSBURGH		PHOENIX	
	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT REQUIREMENT	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT REQUIREMENT
Proportion that participated	30%	40%	44%	40%
Proportion with positive expected net payments	57	37	59	35
Proportion with expected net payments greater than $20/month	40	17	40	23
(Number of cases)	(229)	(166)	(250)	(217)

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial Household Report Form, payments file.

a. Expected net payments at enrollment are defined as the difference between the allowance payment offered at enrollment and the expected increase in rent needed to meet requirements. The expected increase in rent needed to meet requirements is estimated by the mean rent of Control households that met the requirements at enrollment, controlling for household size and site.

Table VIII-4

DISTRIBUTION OF NET PAYMENTS AT THE END OF TWO YEARS
AMONG HOUSING GAP HOUSEHOLDS THAT NEVER RECEIVED A FULL PAYMENT
(Based on Rent Levels for Control Households)[a]

	PITTSBURGH		PHOENIX	
	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT REQUIREMENT	MINIMUM STANDARDS REQUIREMENT	MINIMUM RENT REQUIREMENT
ALL HOUSEHOLDS				
Net Payment				
Greater than $40	19%	5%	27%	11%
Greater than $20	37	22	46	21
Greater than 0	58	25	63	33
(Number of cases)	(101)	(65)	(59)	(66)
HOUSEHOLDS THAT MOVED DURING THE EXPERIMENT				
Net Payment				
Greater than $40	25%	10%	38%	25%
Greater than $20	53	40	52	42
Greater than 0	72	40	76	54
(Number of cases)	(36)	(10)	(21)	(22)

SAMPLE: Housing Gap households active at two years after enrollment that never received a full payment, excluding those with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial and monthly Household Report Forms and payments file.

a. Net payments at the end of two years are defined as the difference between the allowance payments offered at the end of two years and the increase in rent needed to meet requirements. The increase in rent needed to meet each requirement is estimated by the mean rent of Control households that met that requirement at the end of two years, controlling for household size and site.

net payments. However, under the model of expected rent implicit in using the average rents of Control households to estimate R_M, these facts are consistent with the participation model of Chapter 4.

First, in terms of the results of Table VIII-3 for Minimum Standards, meeting Minimum Standards involved more than simply increased expenditures. Households had to find units that met a fairly extensive list of detailed requirements. This might require some effort, especially in the areas of the city with which enrollees were familiar, and might also force them to give up other unit features which they desired. Thus, the fact that participation rates for Minimum Standards households were closer to the proportion with net payment offers of more than $20 per month may reflect both costs of finding a Minimum Standards unit and the possibility that from the household's point of view the housing obtained was not materially better (and may even have been worse) than the housing they started with. Second, in terms of net payments at two years, the costs of meeting Minimum Standards, including the rental expenditures required, may vary from household to household. This could explain why some households with apparently large net payment offers at the end of two years still had not participated. The estimated net payment reflects the average rental costs of Minimum Standards housing. Individual households may find rents and other costs to be higher or lower than this. Thus, the fact that some households did not accept offers with a large average net payment may not be surprising.

These considerations would also apply to the distribution of net payments at two years for Minimum Rent requirements. If Minimum Rent households could not necessarily have obtained acceptable units that met the Minimum Rent requirements at rents close to the required levels, then it is not at all implausible for some Minimum Rent households to reject an allowance payment of, for example, $60 a month, while moving to a unit that was within $20 of meeting the Minimum Rent requirements. Such households may simply not have been able to find a unit that met their needs as well as the Minimum Rent level for less than $60 more in rent. Thus under the measure of net payments based on rent levels of Control households that met requirements, the observed participation rates seem much more consonant with the model of Equation (1).

This argument may be further supported by noting that households that met the Minimum Rent requirements may not in fact have obtained better housing commensurate with their increased housing expenditures. Thus the V_M term in Equation (1) (which is omitted from the net payment calculation) may be small not only because the household values housing improvements at less than cost but also because the improvements obtained are themselves less than the increase in expenditures would suggest.

It appears that different units of similar overall quality command very different rents within a given metropolitan area. Units that meet Minimum Rent requirements will tend to be higher priced as well as higher quality units. Thus to some extent, households moving to units that meet the Minimum Rent requirements may be expected to improve their housing by less than they increase their expenditures. The average value of this overpayment may be estimated by comparing the costs of units that met the Minimum Rent requirements with the market-wide average cost of units with similar locational and dwelling unit characteristics. Any initial "good deal" enjoyed by households may be estimated in the same way. The difference in the two is the prospective pure change in expenditures without any improvement in housing involved in meeting the Minimum Rent requirements.[1]

Some idea of the magnitude of this effect may be obtained by comparing the difference between the estimated good deal at the end of two years for households that never met requirements and the average deal at two years for households that met requirements with the overall expected change in expenditures at enrollment. One minus this ratio gives the real change in housing as a proportion of total expenditure increases. Median values are presented in Table VIII-5. As shown there, Minimum Standards households that never met requirements could generally have expected improvements in housing commensurate with expenditure changes.[2] Minimum Rent households that never met re-

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[1]The estimated cost of units as a function of dwelling unit and locational characteristics is taken from hedonic indices estimated by Merrill (1977). For a discussion of the issues involved in this estimate including the problem of distinguishing the effects of omitted variables in the hedonic regression from true price differences, see Kennedy and Merrill (1979).

[2]As pointed out earlier, however, these improvements might not be valued by the household at their market value.

Table VIII-5

MEDIAN RATIO OF THE EXPECTED CHANGE IN HOUSING TO EXPECTED EXPENDITURE CHANGE FOR HOUSEHOLDS THAT NEVER RECEIVED A FULL PAYMENT

	PITTSBURGH		PHOENIX	
	MINIMUM STANDARDS	MINIMUM RENT	MINIMUM STANDARDS	MINIMUM RENT
Value[a]	0.92	0.43	0.90	0.62
N	(104)	(71)	(58)	(65)

SAMPLE: All enrolled households, eligible at enrollment and still enrolled at the end of two years that never received a full payment.

a. The median ratio is defined as:

$$1 - \text{Median} \left(\frac{DLM - DL_i}{ER - R_{Oi}} \right)$$

where

DLM = the average estimated overpayment at two years by households that met requirements after enrollment;

DL_i = the i^{th} household's estimated actual overpayment at two years;

ER = the average housing expenditures at enrollment of Control households that met requirements at enrollment; and

R_{Oi} = the i^{th} household's actual housing expenditures at enrollment.

quirements, on the other hand, might have expected improvements in housing from one-third to one-half smaller than their increased expenditures.

Thus it appears that the participation model of Chapter 4 may be adequate to explain observed participation rates if Minimum Rent households were in fact unable on average to expect to obtain acceptable units that met the Minimum Rent requirements at rents much below those of similar Control households. This issue is examined in the next section.

VIII.2 COMPARISON OF THE RENT LEVELS FOR CONTROL AND MINIMUM RENT HOUSEHOLDS THAT MET REQUIREMENTS AFTER ENROLLMENT

Control households that met the Minimum Rent requirement normally would be expected to display rents ranging well above the required levels. This simply reflects the fact that rent levels varied considerably for the population as a whole. Truncating this distribution by selecting households with rents above a given level will still leave a considerable variation in rents, unless the truncation point is very high. The same thing would be expected for Minimum Rent households that met requirements normally. Minimum Rent households that were induced to meet requirements by the allowance offer, on the other hand, might be expected to display rents very close to the required level. These households were generally constrained by the Minimum Rent requirements to spend more on rent than they normally would have.[1] Thus, they should in theory have wanted to economize on rents as much as possible by meeting the requirements as closely as possible.

At the same time, it is not at all clear that this incentive to economize on rents should be expected to reduce actual expenditures to any considerable degree. Casual observation suggests that similar units in similar locations rent for widely differing amounts within a given metropolitan area. Analysis of rents paid by households in the Demand Experiment confirms both the

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[1] Some households may be induced to meet requirements by the allowance payment alone--that is, the allowance payment may increase the household's income enough that it would then want to spend more than the required level. Given the apparently low rental response to changes in income, such households are neither likely to constitute a large group, nor likely to have changed their spending by any large amount. (See Friedman and Weinberg, 1978 and 1979.)

fact of price heterogeneity and household responses to change in the incentive to shop carefully.[1] But, households should have as much incentive to avoid paying more than necessary for a given type of unit as they would have to avoid paying more than necessary to meet a Minimum Rent requirement. Thus, although households do apparently make some effort to avoid paying more than necessary for a given unit, the fact of considerable remaining price heterogeneity indicates that there are limits to these efforts. Households do not search to the point that rents for similar units in similar locations are equalized.

This is not unreasonable. A household may have fairly specific requirements which limit the number of acceptable units available at any given time. Searching among alternative units not only involves effort, but also takes time. Even if a household decides to continue searching, it may move to a more acceptable unit in the meantime. These same considerations would also apply to a household that attempted to meet the Minimum Rent requirements. The household had to meet its own needs as well as the program requirements. Moreover, if its current unit did not meet the Minimum Rent requirements, it could not begin to receive an allowance payments until it moved.

In fact, comparison of rent distributions for Control and Minimum Rent households that met Minimum Rent requirements after enrollment suggests that the actual degree of economizing on rents by households that were induced to meet the requirements was small. These comparisons are complicated by two factors. First, both the Minimum Rent requirement and the allowance payments were raised after the first year of the experiment to adjust for inflation. However, households that had already met the Minimum Rent requirement under the old level continued to qualify for payments (also under the old level) as long as they did not move. (Households that moved had to qualify under the new requirement level.)[2] The comparisons between Control and Minimum Rent households presented here take account of this by considering only households whose rents exceeded the required level at a given point in time.

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[1] See Kennedy and Merrill (1979).

[2] This was done to avoid unnecessary hardship on households that had already arranged to meet requirements at the original level. For further discussion, see Appendix III.

All households considered had rents below the original Minimum Rent requirement at enrollment. Comparisons are then made, first, between Minimum Rent and Control households with rents in excess of the original requirement level at the end of the first year after enrollment and, second, between Minimum Rent and Control households with rents in excess of the revised requirement level at the end of the second year after enrollment.

The second factor that complicates the comparison is that there is no way to identify exactly which Minimum Rent households were induced to meet requirements (and thus had an additional incentive to economize on rents) and which simply met the requirements normally (and thus would be expected to display rents similar to those displayed by Control households that met the requirements). The discussion in Chapter 4 (Table 4-6) indicated that roughly half of the Minimum Rent households in the two sites that met requirements after enrollment would have met them normally. Thus differences between Control and Minimum Rent households may underestimate by a factor of one-half any difference between Control households and Minimum Rent households that were induced to meet requirements. Still, any substantial economizing would be expected to show up in observed comparisons.

The tables that follow test two hypotheses. The first is the hypothesis that Minimum Rent households that met requirements after enrollment were on the average closer to meeting requirements than similar Control households. This is done by comparing the mean values of the differences between the required and actual rent for each group. The second hypothesis is that a larger proportion of Minimum Rent households had rents closer to the required levels than similar Control households. This hypothesis is first tested defining "close" as being within $10 of the required level, and then tested defining "close" as being within $20 of the required level.

Table VIII-6 summarizes the results of these comparisons for the two Minimum Rent levels at the two time periods (one year and two years after enrollment). An entry of "Y" by a hypothesis means that the computed difference between Minimum Rent and Control households is in the hypothesized direction; an "N" indicates that it is contrary to the hypothesized direction. (Significant differences, where they occur, are indicated by crosses or asterisks.)

Table VIII-6

THE DIFFERENCE BETWEEN ACTUAL AND REQUIRED RENTAL EXPENDITURES--
COMPARISON OF COMPUTED DIFFERENCE IN DISTRIBUTIONAL PARAMETERS
WITH PREDICTED DIFFERENCES UNDER THE HYPOTHESIS THAT
MINIMUM RENT HOUSEHOLDS SUCCESSFULLY ECONOMIZE ON RENT

	ONE YEAR		TWO YEARS	
	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT	MINIMUM RENT LOW REQUIREMENT	MINIMUM RENT HIGH REQUIREMENT
MEAN				
Pittsburgh	Y†	0	0	N(*)
Phoenix	0	N	Y	Y
Combined sites	Y	N	0	N
PROPORTION WITHIN $10				
Pittsburgh	Y**	Y	0	N
Phoenix	Y	0	0	0
Combined sites	Y	0	0	N
PROPORTION WITHIN $20				
Pittsburgh	Y	0	Y	N(*)
Phoenix	0	0	Y	N
Combined sites	Y	0	Y	N(*)

Y = direction agrees with hypothesis.
N = direction disagrees with hypothesis.
0 = negligible difference (less than $1 for the means or 5 percentage points for the percentages).

† significant at the 0.10 level (one-tailed).
* significant at the 0.05 level (one-tailed).
** significant at the 0.01 level (one-tailed).
(*) significant at the 0.05 level in direction contrary to hypothesis.

A "0" entry corresponds to a negligible difference. The definition of negligible is deliberately conservative. For mean values, it is a difference of less than one dollar. Since the Control mean was generally $20 or more, this would indicate a truly modest degree of economizing. Likewise, for comparisons of the percentages of households that had rents close to the required levels, a negligible difference is defined as a difference of less than five percentage points. Given that roughly half of the Minimum Rent households were induced to meet the requirements, a negligible difference here means that less than an additional ten percent of these households were able to find units close to the required levels.

As the table indicates, it would be as easy to make a case that Minimum Rent households economized less as that they economized more. Non-negligible differences are almost evenly balanced between agreement and disagreement with the hypothesized directions. Few differences are significant. Among those that are, evidence of significantly lower overpayment by Minimum Rent Low households at the end of the first year after enrollment may be balanced against evidence of significantly higher overpayment by Minimum Rent High households at the end of the second year after enrollment. Examination of numerical values for differences, presented in Tables VIII-7 through VIII-10 confirms these conclusions. Except for the two sets of (contradictory) significant differences indicated in Table VIII-6, most differences are small.

Thus, there is no evidence that Minimum Rent households were in fact able to economize to any substantial degree in meeting requirements in comparison with Control households. The use of the average rents paid by Control households as a proxy for R_M in Section VIII.1 is not apparently in substantial error.

Table VIII-7

COMPARISON OF ACTUAL EXPENDITURES AND REQUIRED RENT LEVELS FOR CONTROL AND MINIMUM RENT LOW HOUSEHOLDS THAT MET MINIMUM RENT LOW REQUIREMENTS AT THE END OF ONE YEAR

	MEAN	STANDARD DEVIATION	PERCENTAGE WITH A DIFFERENCE OF LESS THAN $10	PERCENTAGE WITH A DIFFERENCE OF LESS THAN $20	PERCENTAGE WITH A DIFFERENCE OF $40 OR MORE	NUMBER OF CASES
			PITTSBURGH			
Control households	22.93	18.25	25	57	18	(28)
Minimum Rent households	15.50	20.46	59	77	14	(22)
Difference	7.43	-2.21	-34	-20	4	
Significance test	1.34†[a]	NA[b]	2.45*[a]	1.50†[a]	0.41[a]	
			PHOENIX			
Control households	27.69	21.50	14	49	26	(35)
Minimum Rent households	26.82	23.85	25	50	29	(28)
Difference	0.87	-2.25	-11	-1	-3	
Significance test	0.15[a]	NA[b]	1.07[a]	0.11[a]	NA[a]	
			COMBINED SITES			
Control households	25.57	20.16	19	52	22	(63)
Minimum Rent households	21.84	22.91	40	62	22	(50)
Difference	3.73	-2.75	-21	-10	0	
Significance test	0.92[a]	NA[b]	2.45**[a]	1.04[a]	0.03[a]	

SAMPLE: Minimum Rent Low and Control households active at one year after enrollment that met the Minimum Rent Low requirement at the end of one year but not at enrollment, excluding those with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial and monthly Household Report Forms, and payments file.

a. t-test (one-tailed)

b. F test (one-tailed)

† Significant at the 0.10 level.

* Significant at the 0.05 level.

** Significant at the 0.01 level.

Table VIII-8

COMPARISON OF ACTUAL EXPENDITURES AND REQUIRED RENT LEVELS FOR CONTROL AND MINIMUM RENT HIGH HOUSEHOLDS THAT MET MINIMUM RENT HIGH REQUIREMENTS AT THE END OF ONE YEAR

	MEAN	STANDARD DEVIATION	PERCENTAGE WITH A DIFFERENCE OF LESS THAN $10	PERCENTAGE WITH A DIFFERENCE OF LESS THAN $20	PERCENTAGE WITH A DIFFERENCE OF $40 OR MORE	NUMBER OF CASES
			PITTSBURGH			
Control households	19.00	19.60	42	64	12	(33)
Minimum Rent households	18.96	21.31	52	65	22	(23)
Difference	0.04	-1.71	-10	-1	-10	
Significance test	0.01[a]	NA[b]	0.72[a]	0.12[a]	NA[a]	
			PHOENIX			
Control households	24.03	16.19	21	38	14	(29)
Minimum Rent households	26.52	25.73	21	42	18	(33)
Difference	-2.49	-9.54	0	-4	-4	
Significance test	NA[a]	NA[b]	0.05[a]	0.36[a]	NA[a]	
			COMBINED SITES			
Control households	21.36	18.11	32	52	13	(62)
Minimum Rent households	23.41	24.10	34	52	20	(56)
Difference	-2.05	-5.99	-2	0	-7	
Significance test	NA[a]	NA[b]	0.18[a]	0.02[a]	NA[a]	

SAMPLE: Minimum Rent High and Control households active at one year after enrollment that met the Minimum Rent High requirement at the end of one year but not at enrollment, excluding those with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial and monthly Household Report Forms, and payments file.

a. t-test (one-tailed).

b. F test (one-tailed).

† Significant at the 0.10 level.

* Significant at the 0.05 level.

** Significant at the 0.01 level.

Table VIII-9

COMPARISON OF ACTUAL EXPENDITURES AND REQUIRED RENT LEVELS FOR CONTROL AND MINIMUM RENT LOW HOUSEHOLDS THAT MET MINIMUM RENT LOW REQUIREMENTS AT THE END OF TWO YEARS

	MEAN	STANDARD DEVIATION	PERCENTAGE WITH A DIFFERENCE OF LESS THAN $10	PERCENTAGE WITH A DIFFERENCE OF LESS THAN $20	PERCENTAGE WITH A DIFFERENCE OF $40 OR MORE	NUMBER OF CASES
			PITTSBURGH			
Control households	24.00	18.54	32	45	28	(40)
Minimum Rent households	24.91	22.35	30	52	26	(23)
Difference	-0.91	-3.81	2	-7	2	
Significance test	NA[a]	NA[a]	NA[a]	0.55[a]	0.12[a]	
			PHOENIX			
Control households	39.48	31.74	10	24	41	(29)
Minimum Rent households	36.39	25.49	13	36	45	(31)
Difference	3.09	6.25	-3	-12	-4	
Significance test	0.42[a]	1.55[b]	0.32[a]	0.97[a]	NA[a]	
			COMBINED SITES			
Control households	30.51	25.41	23	36	33	(69)
Minimum Rent households	31.50	24.66	20	43	37	(54)
Difference	-0.99	1.25	3	-7	-4	
Significance test	NA[a]	1.10[b]	NA[a]	0.72[a]	NA	

SAMPLE: Minimum Rent Low and Control households active at two years after enrollment that met the Minimum Rent Low requirement at the end of two years but not at enrollment, excluding those with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial and monthly Household Report Forms, and payments file.

a. t-test (one-tailed).

b. F test (one-tailed).

† Significant at the 0.10 level.

* Significant at the 0.05 level.

** Significant at the 0.01 level.

Table VIII-10

COMPARISON OF ACTUAL EXPENDITURES AND REQUIRED RENT LEVELS FOR CONTROL AND MINIMUM RENT HIGH HOUSEHOLDS THAT MET MINIMUM RENT HIGH REQUIREMENTS AT THE END OF TWO YEARS

	MEAN	STANDARD DEVIATION	PERCENTAGE WITH A DIFFERENCE OF LESS THAN $10	PERCENTAGE WITH A DIFFERENCE OF LESS THAN $20	PERCENTAGE WITH A DIFFERENCE OF $40 OR MORE	NUMBER OF CASES
			PITTSBURGH			
Control households	16.61	16.18	42	76	8	(38)
Minimum Rent households	28.32	24.10	35	48	35	(23)
Difference	-11.91	-7.92	7	28	-27	
Significance test	NA[a]	NA[b]	NA[a]	NA[a]	NA[a]	
			PHOENIX			
Control households	30.12	27.45	28	56	32	(25)
Minimum Rent households	25.20	20.41	27	50	20	(30)
Difference	4.92	7.04	1	6	12	
Significance test	0.77[a]	1.81[b]	NA[a]	NA[a]	1.02[a]	
			COMBINED SITES			
Control households	21.97	22.19	36	68	18	(63)
Minimum Rent households	26.64	21.93	30	49	26	(53)
Difference	-4.67	0.26	6	19	-8	
Significance test	NA[a]	1.02[b]	NA[a]	NA[a]	NA[a]	

SAMPLE: Minimum Rent High and Control households active at two years after enrollment that met the Minimum Rent High requirement at the end of two years but not at enrollment, excluding those with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Initial and monthly Household Report Forms, and payments file.

a. t-test (one-tailed).

b. F test (one-tailed).

† Significant at the 0.10 level.

* Significant at the 0.05 level.

** Significant at the 0.01 level.

VIII.3 SOME FURTHER TABLES ON PARTICIPATION AND PAYMENT AMOUNT AMONG MINIMUM STANDARDS HOUSEHOLDS

The following tables for Housing Gap Minimum Standards households present some added tabulations of participation by payment level and net cash value.[1] The payment levels refer to the 1.2C* (High), C* (Medium), and 0.8C* (Low) plans shown in Table I-1 of Appendix I.

[1] Net cash value is the payment amount minus the increase in housing expenditures needed to meet the Housing Gap requirements.

Table VIII-11

PARTICIPATION OF HOUSING GAP MINIMUM STANDARDS HOUSEHOLDS BY PAYMENT LEVEL

PAYMENT LEVEL	PERCENT ACCEPTING OFFER TO ENROLL	AVERAGE PAYMENT	PERCENT ENROLLED HOUSEHOLDS THAT MET REQUIREMENTS WITHIN TWO YEARS	AVERAGE PAYMENT
		PITTSBURGH		
High	80.3% (71)	$56 (71)	47.5% (40)	$76 (40)
Medium	70.6 (102)	40 (102)	51.7 (58)	53 (58)
Low	72.8 (114)	37 (111)	19.6 (56)	41 (56)
		PHOENIX		
High	94.8% (58)	$86 (58)	62.8% (43)	$96 (43)
Medium	80.4 (107)	68 (107)	52.1 (71)	67 (71)
Low	74.0 (104)	46 (104)	45.0 (60)	55 (60)

SAMPLE: All Housing Gap households that completed the enrollment interview and received a subsidy estimate and were assigned to plans with the Minimum Standards housing requirement, excluding plans with contribution rates other than 0.25.

DATA SOURCES: Household Events List, payments file.

Table VIII-12

SUBSEQUENT PARTICIPATION BY NET CASH VALUE
FOR HOUSING GAP MINIMUM STANDARDS HOUSEHOLDS
THAT DID NOT MEET REQUIREMENTS AT ENROLLMENT

NET CASH VALUE	PERCENT THAT BECAME RECIPIENTS			
	PITTSBURGH		PHOENIX	
	%	(N)	%	(N)
$41 or more	44.7	(114)	54.1	(109)
$21 to $40	24.6	(57)	45.2	(31)
$1 to $20	6.3	(32)	42.4	(33)
$-19 to $0	5.9	(17)	37.5	(32)
$-20 or less	0	(9)	22.2	(45)

SAMPLE: All enrolled Housing Gap Minimum Standards households that did not already meet the Minimum Standards requirements when they enrolled.
DATA SOURCES: Payments file.

REFERENCES

Friedman, Joseph and Daniel H. Weinberg, The Demand for Rental Housing: Evidence From a Percent of Rent Housing Allowance, Cambridge, Mass., Abt Associates Inc., September 1978 (revised June 1980).

_____, Housing Consumption Under a Constrained Income Transfer: Evidence From a Housing Gap Housing Allowance, Cambridge, Mass., Abt Associates Inc., April 1979 (revised June 1980).

Kennedy, Stephen D. and Sally R. Merrill, "The Use of Hedonic Indices to Distinguish Changes in Housing and Housing Expenditures: Evidence From the Housing Allowance Demand Experiment," paper presented at the Research Conference on the Housing Choices of Low-Income Families, Washington, D.C., March 1979.

Merrill, Sally R., Hedonic Indices as a Measure of Housing Quality, Cambridge, Mass., Abt Associates Inc., December 1977 (revised June 1980).

APPENDIX IX

INTERPRETATION OF THE LOGISTIC SPECIFICATION AND ESTIMATED LOGISTIC COEFFICIENTS

Although the logistic specification is by now fairly well known, it may not be familiar to all readers. This appendix provides a brief review of its basic motivation and properties.[1] The model may seem complicated to readers unfamiliar with it, though in fact its intuitive basis is very similar to that of ordinary regressions.

Consider any variable, d, that takes on only two values (for convenience, zero and one). Such variables can often be reasonably regarded as manifestations of some underlying continuous variable, y, where

$$(1) \qquad d = \begin{cases} 1 \text{ if } y \geq 0 \\ 0 \text{ if } y < 0 \end{cases}$$

That is, d assumes the value 1 whenever y crosses the threshold value of zero. (The zero is clearly arbitrary; if the threshold value is c, then it can be set at zero by considering the continuous variable, y-c). Now assume further that the variable y can itself be written as a function of some set of variables, X, and a stochastic term, written for convenience as $-\varepsilon$, so that

$$(2) \qquad y = x'\beta - \varepsilon$$

In this case, the probability of observing d = 1 given x, $\pi(x)$, is simply

$$(3) \qquad \pi(x) = \text{Prob } (y \geq 0 \mid x) = \text{Prob } (\varepsilon < x'\beta) = F(x'\beta)$$

---

[1] For further discussion, see, for example, McFadden (1974).

where F is the distribution function of ε. If the form of F is known, then the coefficients, β, of Equation (3) may be estimated by maximum likelihood. Given some form of F, the log likelihood, L, of any sequence of observations for d is simply

$$(4) \qquad L(d) = \sum_{i=a} \ln F(x_i'\beta) + \sum_{i\neq a} \ln(1-F(x_i'\beta))$$

where A is the set of observations with d equal to one. The logistic specification simply assumes that F is logistic--that is, that

$$(5) \qquad F(\varepsilon) = [1 + \exp(\frac{-\varepsilon+\mu}{k})]^{-1}$$

where

μ = the mean of ε

$k = \sqrt{3}/\pi$ times the standard deviation of ε

thus in this case

$$(6) \qquad \pi(x_i) = (F(x_i'\beta)\ [1 + \exp(\frac{-x_i'\beta+\mu}{k})]^{-1}$$

In fact, of course, the parameters of F are rarely known. However, if the variables, x, include a constant term, the mean of ε may, as usual, be assumed to be zero, so that estimated coefficients estimate (β/k) instead of β.

Empirical estimation using maximum likelihood produces estimates of β/k, as well as estimates of the variance-covariance matrix of the estimators. The estimates of β/k are asymptotically normally distributed, so that the significance of the individual coefficients may be tested in terms of the usual t-statistic. In addition, the significance of the coefficients as a whole may be tested in terms of twice the change in log-likelihood, which has a chi-square distribution.[1]

---

[1]The log of the square of the ratio of the likelihood achieved under the estimated model to the likelihood achieved under the constraints that some or all parameters are zero is asymptotically χ^2 with (k-r) degrees of freedom, where k is the number of parameters and r the number of unrestricted parameters. (McFadden, 1974).

The relative importance of the estimated logistic coefficients is not always immediately apparent. The coefficients themselves do not directly state the impact of the variable on the probability being investigated. What is of interest is the change in probability, but the change in probability implied by a given coefficient varies with the initial probability level. Thus a coefficient of 1.0 implies a 6 percentage point increase in probability at a base probability of 0.9 and a 23 percentage point increase at a base probability of 0.5. In this report, the change in probability implied by the logistic coefficient is generally evaluated at the mean probability for the population. Thus values indicate the impact of a unit increase in the relevant independent variable from the mean.

In addition, the impact on probability is frequently not evaluated exactly, but approximated in terms of the first derivative

$$(7) \qquad \frac{\Delta\pi}{\Delta x_i} \sim \frac{\partial\pi}{\partial x_i} = \pi(1-\pi)\beta_i .$$

Table IX-1 shows the value of the actual change in probability and the first derivative approximation for various values of p and various levels of β_i. The first row shows the actual change in probability for a unit increase in x_i above the mean value of x_i. The second row shows the actual change in probability for a unit increase in x_i from half a unit below the mean to half a unit above the mean.[1] The third row shows the first derivative approximation. As the table shows, the approximation to a unit increase is good for logit coefficients of one or less, while the approximation to a unit change around the mean is reasonably good for all values in the table.

Alternatively, where large coefficients suggest a large error in the first derivative approximation, effects are sometimes estimated by

$$(8) \qquad \bar{\pi} = [1 + \exp(-y)]^{-1}$$

$$\Delta\pi = [1 + \exp(-y-\Delta x_i\beta_i)]^{-1} - \bar{\pi}$$

where

$\bar{\pi}$ = the mean value of π in the sample

---

[1] This is especially appropriate for dummy variables with a mean of .5, for example.

Table IX-1

COMPARISON OF ACTUAL AND FIRST DERIVATIVE APPROXIMATION TO THE CHANGE IN PROBABILITY FOR A UNIT CHANGE IN AN INDEPENDENT VARIABLE UNDER VARIOUS VALUES OF THE LOGISTIC COEFFICIENT

		VALUE OF PROBABILITY				
β_1	π $x_0'\beta$	0.1 -2.20	0.25 -1.10	0.50 0	0.75 1.10	0.90 2.20
.25	$\Delta\pi$(increase)	.02	.05	.06	.04	.02
	$\Delta\pi$(deviation)	.02	.05	.06	.05	.02
	$\partial\pi/\partial x$	.02	.05	.06	.05	.02
.50	$\Delta\pi$(increase)	.05	.10	.12	.08	.04
	$\Delta\pi$(deviation)	.05	.09	.12	.09	.05
	$\partial\pi/\partial x$	.05	.09	.13	.09	.05
.75	$\Delta\pi$(increase)	.09	.16	.18	.11	.05
	$\Delta\pi$(deviation)	.07	.14	.19	.14	.07
	$\partial\Pi/\partial x$	.07	.14	.19	.14	.07
1.0	$\Delta\pi$(increase)	.13	.23	.23	.14	.06
	$\Delta\pi$(deviation)	.09	.19	.24	.19	.09
	$\partial\pi/\partial x$	.09	.19	.25	.19	.09
1.5	$\Delta\pi$(increase)	.23	.35	.32	.18	.08
	$\Delta\pi$(deviation)	.14	.28	.36	.28	.14
	$\partial\pi/\partial x$	.14	.28	.38	.28	.14
2.0	$\Delta\pi$(increase)	.35	.46	.38	.21	.09
	$\Delta\pi$(deviation)	.19	.37	.46	.37	.19
	$\partial\pi/\partial x$	.18	.38	.50	.38	.18

NOTE: $\Delta\pi(\text{increase}) = \pi(x_0+1) - \pi(x_0)$

$\Delta\pi(\text{deviation}) = \pi(x_0+.5) - \pi(x_0-.5)$

$\pi(x) = [1 + \exp(-x'\beta)]^{-1}$

It should be noted that both of these formulations relate to changes in individual probabilities. In particular, they do not claim to represent the change in the mean value of π associated with a change in x_i. This is most easily seen in terms of the first derivative approximation of Equation (7). Consider, for example, the effect of some treatment on the mean value of π. Say that the treatment has a logistic coefficient of, α, so that (setting k equal to one for convenience)

$$
\begin{aligned}
\pi_i(d \mid \text{ no treatment}) &= [1 + \exp(-x_i' \beta)]^{-1} \\
\pi_i(d \mid \text{ treatment}) &= [1 + \exp(-x_i' \beta - \alpha)]^{-1} \\
\Delta\pi_i &\simeq \pi_i(1-\pi_i)\alpha
\end{aligned}
\tag{9}
$$

The effect of the treatment varies with the value of π_i. In particular

$$
\begin{aligned}
\Delta E(\pi_i) &\simeq E[\pi_i(1-\pi_i)\alpha] \\
&= [E(\pi_i) - E(\pi_i^2)]\alpha \\
&< [E(\pi_i) - (E(\pi_i))^2]\alpha
\end{aligned}
$$

since $E(\pi_i^2)$ is greater than $(E(\pi_i))^2$. Thus evaluating the effect of a treatment at the mean value of π_i using the derivative approximation will overstate the effect on the mean value of π_i. (No clear direction can be established for the formulation of Equation (8)).

REFERENCES

McFadden, D., "Conditional Logit Analysis of Qualitative Choice Behavior," in Frontiers in Econometric Research, New York, Academic Press, 1974.

APPENDIX X

LOGIT RESULTS REFERENCED IN CHAPTER 3

Table X-1

LOGIT ESTIMATION OF THE PROBABILITY OF
ACCEPTING THE ENROLLMENT OFFER
INCLUDING PAYMENT FORMULA VARIABLES (SUPPORTING TABLE 3-11)

	PITTSBURGH			PHOENIX		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-1 316	-2.72**	NA	0.014	0 04	NA
Elderly household	-0 286	-1 71	-0 049	0.154	0 71	0 020
Young household	0 367	2 31*	0 063	0 125	0 77	0 016
Black household	0 398	3 04**	0 068	-0 770	-2 98**	-0 100
Spanish American household	NA	NA	NA	-0.680	-4 32**	-0 088
Large household	0 473	2 96**	0 082	0 018	0 11	0 002
Single parent household	0 135	0 88	0.024	0 324	1 81†	0.042
Prior mobility	0 249	4.15**	0 043	0 173	3 68**	0.023
Dissatisfaction with unit or neighborhood	0 242	2 68**	0 042	0 134	1 14	0 017
Participation in other transfer programs	0 078	0.62	0.013	0 170	1.02	0.022
Income (in thousands)						
Under $3,000	0 316	2 06*	0.050	-0 093	-5 07**	-0.010
Δ $3,000-$8,000[a]	-0 437	-2 49*	-0 080	0.085	1 94†	0.010
Δ Over $8,000[a]	0 063	0.70	0.010	-0.063	-0.75	-0.010
Estimated subsidy amount						
Under $40	0.044	6 47**	0.008	0 050	5 74**	0 006
Δ $40-$80[a]	-0 024	-2 11*	-0 004	-0 043	-3 11**	-0 006
Δ Over $80[a]	-0 029	-3 11**	-0 005	-0 004	-0 47	-0.001
Unconstrained household	0.022	0.08	0 004	0 518	1.52	0.067
Percent of Rent household	0 537	2 27*	0.093	0 617	1 90†	0 080
Percent of Rent Level						
.2	0 150	0 56	0 026	-0 329	-0 92	-0 043
3	0 007	0 03	0.001	-0.189	-0 54	-0 025
5	-0.125	-0.47	-0.022	-0.192	-0 53	-0 025
6	-0 423	-1 06	-0.073	-0 890	-1.88†	-0 116
Housing Gap Level						
C^a high	-0 047	-0.22	-0 008	0 359	1.38	0 047
C^a low	0 087	0.45	0 015	-0 157	-0.79	-0.021
b high	-0.027	-0.09	-0.005	0 418	1.04	0.054
b low	0.065	0.24	0 011	0.364	1.24	0.047
Likelihood Ratio (Significance)		242.025**			154 265**	
Sample Size		1896			1664	
Mean of Dependent Variable		0 778			0.846	
Coefficient of Determination		0.121			0.108	

SAMPLE. Housing Gap, Unconstrained and Percent of Rent households that completed the enrollment interview, excluding households with incomes over $16,000.

DATA SOURCES Baseline Interview, Household Events List

a Coefficients reported are for splines Thus, the coefficient that applies to the variable in any range is the coefficient for the lowest range plus the subsequent "Δ" coefficients

† t-statistic significant at the 0 10 level (two-tailed)

* t-statistic significant at the 0 05 level (two-tailed)

** t-statistic significant at the 0.01 level (two-tailed).

TABLE X-2

LOGIT ESTIMATION OF THE PROBABILITY OF
ACCEPTING THE ENROLLMENT OFFER
INCLUDING HOUSING REQUIREMENT VARIABLES (SUPPORTING TABLE 3-12)

	PITTSBURGH			PHOENIX		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-1 202	-1 90[-]	NA	-1.109	-1 33	NA
Elderly household	-0 635	-2.75[**]	-0 122	0 294	1.09	0.043
Young household	-0.097	0.47	0 019	0 217	1 02	0 032
Black household	0.540	2.82[**]	0 103	-0.834	-2.51[*]	-0 121
Spanish American household	NA	NA	NA	-0 655	-3.35[**]	-0.095
Large household	0 554	2 95[**]	0 106	0 058	0 24	0.008
Single parent household	-0.029	-0.14	-0 005	0.620	2 81[**]	0 090
Prior mobility	0 338	4 45[**]	0 065	0 187	3 10[**]	0 027
Dissatisfaction with unit or neighborhood	0 274	1 98[*]	0 052	0 113	0 67	0 016
Participation in other transfer programs	0.172	1.05	0 033	0.233	1.10	0 034
Income (in thousands)						
Under $3000	0 416	2 00[*]	0 080	0 191	0 70	0.030
Δ $3,000-$8,000[a]	-0 647	-2.72[**]	-0 120	-0.200	-0 66	-0 030
Δ Over $8,000[a]	0 232	2.04[*]	0.040	-0 095	-0.81	-0 010
Estimated subsidy amount						
Under $40	0.046	5.42[**]	0 009	0 062	5.36[**]	0 009
Δ $40-$80[a]	-0 031	-2.16[*]	-0 006	-0 066	-3 58[**]	-0 010
Δ Over $80[a]	-0 026	-2.28[*]	-0.005	0 009	0.84	0 001
Difference in acceptance between.						
A Minimum Standards and a Minimum Rent requirement	-0.214	-1.44	-0.041	0 164	1.12	0 024
A Minimum Rent High and a Minimum Rent Low requirement	0 038	0 39	0.007	-0 062	-0 53	-0 009
Likelihood Ratio (Significance)		179 318			103 098	
Sample Size		1012			944	
Mean of Dependent Variable		0.742			0 824	
Coefficient of Determination		0 155			0 117	

SAMPLE Housing Gap households that completed the enrollment interview, excluding households with incomes over $16,000

DATA SOURCES Baseline Interview, Household Events List.

a. Coefficients reported are for splines Thus, the coefficient that applies to the variable in any range is the coefficient for the lowest range plus the subsequent "Δ" coefficients.

[-] t-statistic significant at the 0 10 level (two-tailed)

[*] t-statistic significant at the 0 05 level (two-tailed)

[**] t-statistic significant at the 0.01 level (two-tailed).

Table X-3

LOGIT ESTIMATION OF THE PROBABILITY OF ACCEPTING THE ENROLLMENT OFFER INCLUDING DISTANCE FROM MEETING REQUIREMENTS (SUPPORTING TABLE 3-13)

	PITTSBURGH			PHOENIX		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-3 924	1.68†	NA	-1 877	-0 88	NA
Elderly household	-0.588	-2.45*	-0.110	0 432	1.50	0.063
Young household	0.181	0.83	0.034	0.246	1.13	0.036
Black household	0.593	3.09**	0.111	-0.930	-2.71**	-0.136
Spanish American household	NA	NA	NA	-0.631	-2.84**	-0.093
Large household	0.567	2.58**	0.106	0.072	0.27	0.011
Single parent household	-0.019	-0.09	-0.004	0.606	2.50*	0.089
Prior mobility	0.319	3.88**	0.060	0.190	2.78**	0.028
Dissatisfaction with unit or neighborhood	0 231	1.71†	0 043	0.084	0.44	0.012
Participation in other transfer programs	0.231	1.34	0.043	0.264	1.14	0.039
Income (in thousands)						
Under $3000	0.394	1.87†	0.070	0.238	0.79	0.030
Δ $3,000-$8,000[a]	-0.529	-2.61**	-0.120	-0.253	-0.77	-0.040
Δ Over $8,000[a]	0.215	1.75†	0.040	-0.092	-0.74	-0.010
Estimated subsidy amount						
Under $40	0.042	4.73**	0.008	0.066	5.34**	0.010
Δ $40-$80[a]	-0.025	-1.69†	-0.005	-0.073	-3.73**	-0.011
Δ Over $80[a]	-0.026	-2.23*	-0.005	0.014	1.20	0.002
Distance from meeting requirements	0.003	1.23	0.001	0 001	0.30	0 00'
Likelihood Ratio (%ignificance)		162.477			98.565	
Sample Size		946			851	
Mean of Dependent Variable		0.752			0.821	
Coefficient of Determination		0.153			0.123	

SAMPLE Housing Gap households that completed the enrollment interview, excluding households with incomes over $16,000.

DATA SOURCES- Baseline Interview, Household Events List.

a. Coefficients reported are for splines. Thus, the coefficient that applies to the variable in any range is the coefficient for the lowest range plus the subsequent "Δ" coefficients.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0 05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

APPENDIX XI

COMPLETE RESULTS SUMMARIZED IN TABLE 4-8

Table XI-1

LOGIT ESTIMATION OF THE PROBABILITY OF RECEIVING
A FULL PAYMENT AT ENROLLMENT (SUPPORTING TABLE 4-8)

	PITTSBURGH			PHOENIX		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-1.188	-2.20*	NA	-2.253	-3.88**	NA
Elderly household	-0.217	-0.75	-0.048	0.525	1.86	0.110
Young household	-0.333	-1.53	-0.074	0.352	1.75	0.074
Black household	-0.593	-2.66**	-0.132	-1.571	-2.69**	-0.329
Spanish American household	NA	NA	NA	-0.796	-3.95**	-0.167
Large household	-1.395	-4.73**	-0.309	1.599	-5.46**	-0.335
Single parent household	0.256	1.11	0.057	0.647	3.06**	0.136
Participation in other transfer programs	-0.397	-1.97*	-0.088	-0.764	-3.52**	-0.160
Income (in thousands)						
Under $4,000	0.319	2.32*	0.070	0.419	2.77**	0.090
Δ $4,000 and over[a]	-0.118	-0.56	-0.030	-0.262	-1.40	-0.050
Likelihood Ratio (Significance)		43.740			121.255	
Sample Size		572			649	
Mean of Dependent Variable		0.332			0.299	
Coefficient of Determination		0.060			0.153	

SAMPLE: Enrolled Housing Gap households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Initial Household Report Form, payments file.

a. Coefficients reported are for splines Thus, the coefficient that applies to the variable in any range is the coefficient for the lowest range plus the subsequent "Δ" coefficients.

† t-statistic significant at the 0 10 level (two-tailed).

* t-statistic significant at the 0 05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

Table XI-2

REGRESSION OF DISTANCE FROM MEETING REQUIREMENTS
AT ENROLLMENT ON DEMOGRAPHIC CHARACTERISTICS (SUPPORTING TABLE 4-8)

	PITTSBURGH		PHOENIX	
	COEFFICIENT	t-STATISTIC	COEFFICIENT	t-STATISTIC
Constant	-46.005	NA	-54.662	NA
Elderly household	3.751	0.91	11.472	2.07*
Young household	0.206	0.07	0.039	0.0
Black household	-7.028	-2.50*	-19.643	-2.97**
Spanish American household	NA	NA	-23.659	-6.06**
Large household	-9.945	-2.72**	-36.514	-7.92**
Single parent household	4.098	1.32	12.541	2.77**
Participation in other transfer programs	-5.191	-1.73†	-7.885	-2.00*
Income (in thousands)				
Under $4,000	6.27	3.06**	2.72	1.02
Δ $4,000 and over[a]	-10.55	3.62**	0.13	0.04
R^2	0.110		0.299	
F-statistic	5.682		20.726	
Sample Size	376		447	

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Initial Household Report Form, payments file.

a. Coefficients reported are for splines. Thus, the coefficient that applies to the variable in any range is the coefficient for the lowest range plus the subsequent "Δ" coefficients.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

Table XI-3

REGRESSION OF PAYMENT AMOUNT AT ENROLLMENT
ON DEMOGRAPHIC CHARACTERISTICS (SUPPORTING TABLE 4-8)

	PITTSBURGH		PHOENIX	
	COEFFICIENT	t-STATISTIC	COEFFICIENT	t-STATISTIC
Constant	85.585	NA	91.135	NA
Elderly household	-17.072	-4.39**	-27.761	-6.44**
Young household	2.178	0.79	1.891	0.60
Black household	2.441	0.93	-6.659	-1.31
Spanish American household	NA	NA	-1.146	0.38
Large household	20.430	5.97**	33.933	9.51**
Single parent household	1.890	0.65	-3.219	-0.92
Participation in other transfer programs	0.536	0.19	8.328	2.72**
Income (in thousands)				
Under $4,000	-8.45	-4.39**	-2.52	-1.21
Δ $4,000 and over[a]	1.13	0.41	-7.50	2.89
R^2	0.225		0.377	
F-statistic	13.495		29.813	
Sample Size	379		452	

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Initial Household Report Form, payments file.

a. Coefficients reported are for splines. Thus, the coefficient that applies to the variable in any range is the coefficient for the lowest range plus the subsequent "Δ" coefficients.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

Table XI-4

LOGIT ESTIMATION OF THE PROBABILITY OF MOVING FOR CONTROL HOUSEHOLDS (SUPPORTING TABLE 4-6)

	PITTSBURGH			PHOENIX		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-1.541	-1.43	NA	-1.351	-1.84	NA
Elderly household	-1.068	-2.86**	-0.247	-0.827	-2.73**	-0.206
Young household	0.973	4.14**	0.225	0.922	4.68**	0.229
Black household	-0.163	-0.70	-0.038	1.001	2.74**	0.249
Spanish American household	NA	NA	NA	-0.355	-1.55	-0.088
Large household	-0.082	0.29	0.019	-0.259	-1.11	-0.065
Single parent household	-0.032	-0.12	-0.008	0.623	3.01**	0.155
Participation in other transfer programs	0.653	2.69**	0.151	0.196	0.89	0.049
Income (in thousands)						
Under $3000	0.200	0.54	0.050	0.384	1.44	0.100
Δ $3,000-$8,000[a]	-0.283	-0.68	-0.070	-0.390	-1.30	-0.100
Δ Over $8,000[a]	0.913	1.14	0.210	0.046	0.22	0.010
Likelihood Ratio (Significance)		59.081			67.254	
Sample Size		417			516	
Mean of Dependent Variable		0.362			0.533	
Coefficient of Determination		0.108			0.943	

SAMPLE: Enrolled Control households, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline and Periodic Interviews, Initial and monthly Household Report Forms, payments file.

a. Coefficients reported are for splines. Thus, the coefficient that applies to the variable in any range is the coefficient for the lowest range plus the subsequent "Δ" coefficients

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

APPENDIX XII

DETAILS OF TESTS FOR HOMOGENEITY
REFERENCED IN CHAPTER 4

This appendix presents the details of the various tests for homogeneity referenced in Chapter 4. Two basic types of specifications are tested in Chapter 4. The first is estimated using only Housing Gap households that did not meet requirements at enrollment.

(1) $$\ln\left(\frac{\pi_E}{1-\pi_E}\right) = \alpha_0 + \alpha_1(R_R - R_0) + \alpha_2\hat{P}_M + \alpha_3 S_1 + \alpha_4 S_2$$

$$+ \text{(Interaction with MS, MRL, MRH)}$$

$$+ \text{(Interaction with Phx)}$$

where

π_E = the probability of participating

R_R = the required expenditure levels (for Minimum-Rent households) or the estimated cost of standard housing (for Minimum Standards households).

R_0 = enrollment housing expenditures

$\hat{P}_M$ = the estimated normal probability of moving

S_1 = the payment level (set equal to the payment that the household would have received as a household of size four with the sample mean income)

S_2 = the residual payment (the difference between the actual payment offered at enrollment and S_1)

MS = a dummy for the Minimum Standards requirement

MRL = a dummy for the Minimum Rent Low requirement

MRH = a dummy for the Minimum Rent High requirement

MR = a dummy for the Minimum Rent requirements

Phx = a site dummy (1 if Phoenix, 0 if Pittsburgh)

For this specification, the tests reported below generally deal with pooling by requirement or site (the interaction terms indicated). There is also a test for the restriction that the coefficients of R_R and R_O be equal and opposite in sign). Tests presented below involving this specification are designated (HG) in the heading.

The second specification was estimated separately for each housing requirement (Minimum Standards, Minimum Rent Low, and Minimum Rent High). In each case, equations are estimated using households that did not meet requirements at enrollment from among Housing Gap and Control households. The specification used was generally of the form

$$(2) \qquad \ln\left(\frac{\pi_E}{1-\pi_E}\right) = \gamma_0 + \gamma_1(R_R - R_O) + \gamma_2\hat{P}_M + \gamma_3(S_1 - 10) + \gamma_4(S_2 - 10)$$

$$+ \text{(interaction in E)} + \text{(interaction in Phx)}$$

where the terms are defined as in Equation (1), except that

π_E = the probability of meeting requirements (based on a comparable measure for Housing Gap and Control households)[1]

E = a dummy for Housing Gap households

Tests reported for this specification generally concern interactions in the Housing Gap and site dummies. There is also a test for the restriction that the coefficients of R_R and R_O be equal and opposite in sign. Tests for this specification are designated in the heading (CN).

Test results are reported in the order in which they are mentioned in Chapter 4. In each case, the alternative specifications are indicated by referencing one of the two Equations above and then indicating interactions. Thus,

$$(3) \qquad A = (1) + Phx(C, R_R - R_O, \hat{P}_M)$$

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[1] See Appendix III for details on the measures used.

indicates an equation of the form

$$\pi_E = \alpha_0 + \alpha_1(R_R - R_0) + \alpha_2\hat{P}_M + \alpha_3 S_1 + \alpha_4 S_2 + \alpha_0' Phx + \alpha_1' Phx\,(R_R - R_0) + \alpha_2' Phx\,\hat{P}_M \tag{4}$$

Full interactions with the entire variable set in the basic equation are indicated by, for example, Phx(1)

1. Test of the Restriction that the Sum of the Coefficients for R_R and R_0 is Zero (HG)

$$A = (1) + MR(1) + \alpha_5 R_0 + \alpha_5' MRR_0$$

$$B = (1) + MR(1)$$

		Pittsburgh	Phoenix
-2 Log Likelihood (D of F)[1]	A	370.161 (11)	457.217 (11)
	B	372.225 (9)	460.410 (9)
Difference (D of F)		2.064 (2)	3.193 (2)

The test level for the differences is given by $\chi^2_{.10}(2) = 4.605$.

[1] (D of F) indicates the number of variables in the equation in addition to the constant term.

2. Test of the Restriction that the Sum of the Coefficients for the R_N and R_O is Zero (CN)

$$A = (2) + E(C, R_R - R_O, \hat{P}_M) + \alpha_5 R_O + E\alpha_5 R_O$$

$$B = (2) + E(C, R_R - R_O, \hat{P}_M)$$

		Pittsburgh	Phoenix
Minimum Standards			
-2 Log Likelihood (D of F)	A	457.396 (9)	633.525 (9)
	B	457.856 (7)	636.600 (7)
Difference (D of F)		0.460 (2)	3.075 (2)
Minimum Rent Low			
-2 Log Likelihood (D of F)	A	222.392 (9)	294.202 (9)
	B	225.111 (7)	295.439 (7)
Difference (D of F)		2.719 (2)	1.237 (2)
Minimum Rent High			
-2 Log Likelihood (D of F)	A	351.002 (9)	393.491 (9)
	B	354.905 (7)	394.354 (7)
Difference (D of F)		3.903 (2)	0.863 (2)

Test levels for the difference are given by $\chi^2_{.10}(2) = 4.605$[1]

[1] It may be noted that under a specification without experimental interaction for $R_R - R_O$ and $\hat{P}_M$, the difference in log likelihood is significant as the 10 percent level for Minimum Rent High in Pittsburgh.

3. Homogeneity of Coefficients for the Two Minimum Rent Levels (HG)

Unless the distributional form is mis-specified, the two Minimum Rent levels should have the same coefficients. Tests of homogeneity did not reject this hypothesis, as indicated below:

A: (1) + MRL(1) + MRH(1) (Separate Minimum Rent)

B: (1) + MR(1) (Pooled Minimum Rent)

		Pittsburgh	Phoenix
-2 Log Likelihood (D of F)	A	366.935 (17)	448.703 (17)
	B	370.161 (11)	457.217 (11)
Difference (D of F)		3.226 (6)	8.514 (6)

The test level for the difference is given by $\chi^2_{.10}(6) = 10.645$.

4. Homogeneity of Sites for Minimum Standards and Minimum Rent (HG)

Separate estimates for the two sites are presented in Appendix XIII. The estimates for Minimum Standards at the two sites look quite similar. Test results for homogeneity of Minimum Standards across the two sites are:

A: (1) + MR(1) + Phx(1) + PhxMR(1) (Sites Separate)

B: (1) + MR(1) + PhxMR(1) (Pooled MS, Separate MR)

	(A)	(B)	Difference
-2 Log Likelihood (D of F)	832.635 (19)	838.513 (14)	5.878 (5)

The test level is $\chi^2_{.10}(5) = 9.236$.

Estimates for Minimum Rent are quite different at the two sites. Further pooling Minimum Rent yields

B: (1) + MR(1) + PhxMR(1) (Pooled MS, Separate MR)

C: (1) + MR(1) (Pooled MS and MR)

	(B)	(C)	Difference
-2 Log Likelihood	838.513	853.542	15.029*
(D of F)	(14)	(9)	(5)

The test level is given by $\chi^2_{.10}(5) = 9.236$.

5. Test for Demographic Effects on the Probability of Participation (HG)

These tests were based on estimates using the variables of Equation (1) stratified by Minimum Standards and Minimum Rent, with and without demographic variables. The demographic variables tested were those of Chapter 3, consisting of dummy variables for households whose heads were older, younger, or black (or in Phoenix, Spanish Americans), for large households, for single parent households, for households with income from other transfer programs, and for households that were dissatisfied with their housing. Tests for significance did not reject the hypothesis that these variables (and the residual payment) had no effect on participation, as shown below.

A: (1) + MR(1) + D (With Demographic Variables and Residual Payments)

B: (1) + MR(1) (Without Demographic Variables)

C: (1) + MR(1) Without S_2 and MRS_2 (Without Demographic Variables or Residual Payments)

	A	B	C
Pittsburgh			
-2 Log Likelihood	357.110	372.225	372.809
(D of F)	(19)	(9)	(7)
Difference from (A)		15.115	15.699
(D of F)		(10)	(12)
Phoenix			
-2 Log Likelihood	443.591	460.410	462.131
(D of F)	(20)	(9)	(7)
Difference from (A)		16.819	18.540
		(11)	(13)

Test levels are given by $\chi^2_{.10}(10, 11, 12, 13) = (15.987, 17.275, 18.549, 19.812)$.

6. Test of Homogeneity of Minimum Standards in Pittsburgh, Minimum Standards in Phoenix, and Minimum Rent in Phoenix (HG)

A: (1) + MR(1) + Phx(1) + PhxMR(1) (Sites Separate)

B: (1) + MR(1) + PhxMR(1) (Pooled MS, Not MR)

C: (1) + (1-Phx)MR(1) (Pooled Except for MR in Pittsburgh)

	A	B	C
-2 Log Likelihood	832.635	838.513	843.538
(D of F)	(19)	(14)	(9)
Difference from C	10.903	5.025	
(D of F)	(10)	(5)	

Test levels are given by $\chi^2_{.10}(5, 10) = (9.236, 15.987)$.

7. Tests for Homogeneity of Distance and Normal Probability of Moving Coefficients Between Housing Gap and Control Households (CN)

Tests for differences in the estimated effects of distance and the probability of moving were based on separate estimates for the two sites with the following results:

A: (2) + $E(C, R_R - R_0, \hat{P}M)$

B: (2) + E

	Pittsburgh			Phoenix		
	A	B	Difference	A	B	Difference
Minimum Standards	457.856	461.413	3.557	636.600	637.564	0.964
(D of F)	(7)	(5)	(2)	(7)	(5)	(2)
Minimum Rent Low	225.111	229.482	4.371	295.439	303.894	8.455*
(D of F)	(7)	(5)	(2)	(7)	(5)	(2)
Minimum Rent High	354.905	355.596	0.691	394.354	396.432	2.078
(D of F)	(7)	(5)	(2)	(7)	(5)	(2)

The only case in which there was a significant difference was for Minimum Rent Low households in Phoenix. This reflects a significant and negative distance effect for Control households as compared with an insignificant distance effect for Housing Gap Minimum Rent Low households.

8. Tests for Pooling Sites in Housing Gap and Control Comparisons (CN)

Three specifications were compared:

A: (1) + E + Phx(1) + Phx(E) (Sites Separate)

B: (1) + E + Phx (Sites Pooled, Different Intercepts)

C: (1) + E + Phx + Phx(R_R-R_O,P_M) (Sites Pooled, Different Intercepts and Different Distance and Probability of Moving Effects.)

Results are given below. In addition to not rejecting the specifications (C) differences in normal meeting between the sites beyond a shift term could also be dropped for Minimum Standards (B).

	A	B	C
Minimum Standards			
-2 log likelihood	1098.978	1107.392	1105.544
(D of F)	(11)	(6)	(8)
Difference from (A)		8.414	6.566
(D of F)		(5)	(3)
Minimum Rent Low			
-2 log likelihood	533.376	541.789	536.116
(D of F)	(11)	(6)	(8)
Difference from (A)		8.413	2.740
(D of F)		(5)	(3)
Minimum Rent High			
-2 log likelihood	752.028	763.590	754.144
(D of F)	(11)	(6)	(8)
Difference from (A)		11.562*	2.116
(D of F)		(5)	(3)

Test levels are given by $\chi^2_{.10}(5, 3) = (9.236, 6.251)$

The specification with only intercept differences was not used because of the significant difference in comparison with separate site estimates for Minimum Rent High and because the two pooled specifications (with and without site interaction terms) are themselves significantly different from each other (at the 0.10 level) for both Minimum Rent requirements.

9. Tests for Dropping Payment Variables from Housing Gap and Control Comparisons (CN)

Tests of the hypothesis that the coefficients of S_1 and S_2 in Equation (2) are zero. The hypothesis was rejected only for Minimum Standards in both sites.

A: (2)

B: (2) without terms in S_1, S_2

	Pittsburgh			Phoenix		
	A	B	Difference	A	B	Difference
Minimum Standards	461.413	479.851	18.437**	637.564	647.780	10.216**
(D of F)	(5)	(3)	(2)	(5)	(3)	(2)
Minimum Rent Low	229.482	230.694	1.212	303.894	305.177	1.283
(D of F)	(5)	(3)	(2)	(5)	(3)	(2)
Minimum Rent High	355.596	355.614	0.018	396.432	399.252	2.820
(D of F)	(5)	(3)	(2)	(5)	(3)	(2)

Test levels are given by $\chi^2_{.10}(2) = 4.605$.

APPENDIX XIII

LOGIT RESULTS REFERENCED IN CHAPTER 4

Table XIII-1

LOGIT ESTIMATION OF THE PROBABILITY OF PARTICIPATING FOR HOUSING GAP HOUSEHOLDS THAT DID NOT RECEIVE A FULL PAYMENT AT ENROLLMENT--PITTSBURGH

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]
Constant	-1.738	-3.31**	NA	0.625	1.02	NA
Distance (units of $10)	-0.167	-3.46**	-0.037	-0.638	-5.75**	-0.142
Probability of moving (units of .10)	-0.011	-0.19	-0.002	0.163	1.85†	0.036
Payment level (units of $10)	-0.280	4.36**	0.062	-0.042	-0.49	0.009
Residual payment (units of $10)	-0.068	0.92	0.015	-0.021	-0.24	-0.005
Likelihood Ratio (Significance)		51.693**				
Sample Size		333				
Mean of Dependent Variable		0.333				
Coefficient of Determination		0.122				

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Household Events List, Initial Household Report Form, payments file.

a. Derivatives computed at sample mean.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

Table XIII-2

LOGIT ESTIMATION OF THE PROBABILITY OF PARTICIPATING FOR HOUSING GAP HOUSEHOLDS THAT DID NOT RECEIVE A FULL PAYMENT AT ENROLLMENT--PHOENIX

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]
Constant	-1.208	-2.30*	NA	-1.481	2.38*	NA
Distance (units of $10)	-0.118	4.01**	-0.029	-0.134	2.94**	-0.032
Probability of moving (units of .10)	0.094	1.84†	0.023	0.135	3.14**	0.032
Payment level (units of of $10)	0.158	3.07**	0.038	0.118	1.83†	0.028
Residual payment (units of $10)	0.031	0.63	0.007	0.067	1.29	0.016
Likelihood Ratio (Significance)	47.998**					
Sample Size	377					
Mean of Dependent Variable	0.403					
Coefficient of Determination	0.094					

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Household Events List, Initial Household Report Form, payments file.

a. Derivatives computed at sample mean.
† t-statistic significant at the 0.10 level (two-tailed).
* t-statistic significant at the 0.05 level (two-tailed).
** t-statistic significant at the 0.01 level (two-tailed).

Table XIII-3

COMPARISON OF THE PARTICIPATION RATE FOR HOUSING GAP HOUSEHOLDS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS--PITTSBURGH

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]
Constant	-1.477	-5.72**	NA	-0.907	2 45*	NA	-0.566	2 03*	NA
Distance (units of $10)	-0 187	-5.34**	-0.032	-0.472	-3 30**	-0.111	-0 501	6 42**	-0.094
Probability of moving (units of .10)	0.079	1.69†	0.013	0.233	3 59**	0.055	0 182	3 48**	0.034
Housing Gap households	-0 515	-0.98	-0.088	1.706	1 71†	0.399	0.569	0 84	0 107
Payment level (units of $10)	0.284	4.05	0.049	-0 186	-1 14	-0.043	0 014	0 12	0.003
Residual payment (units of $10)	0 052	0.60	0.009	-0.115	-0 70	-0.027	-0 004	-0 04	-0 001
Likelihood Ratio (Significance)		58.430**			25.495**			48.131**	
Sample Size		496			193			358	
Mean of Dependent Variable		0.218			0.373			0.251	
Coefficient of Determination		0.112			0 100			0 119	

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment and Control households that did not meet housing requirements at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES. Baseline Interview, Housing Evaluation Forms, Household Events List, Initial and monthly Household Report Forms, payments file

a Derivatives computed at sample mean.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0 05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed)

Table XIII-4

COMPARISON OF THE PARTICIPATION RATE FOR HOUSING GAP HOUSEHOLDS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS--PHOENIX

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]
Constant	-0.636	2 47*	NA	-1 600	-3.91**	NA	-1.306	-5 16**	NA
Distance (units of $10)	-0.112	-5.36**	-0 025	-0.146	-2 48*	-0.029	-0 213	-5 57**	-0.036
Probability of moving (units of .10)	0.054	1.58	0.012	0.154	3 02**	0.030	0 120	3 33**	0 020
Housing Gap households	-0 439	-0.95	-0.097	-0 003	-0.00	-0.001	0 328	0.599	0.055
Payment level (units of $10)	0.163	3 08**	0.036	0.1406	1.10	0 028	0.101	1 53	0.017
Residual payment (units of $10)	0 039	0 83	0.009	0.028	0 29	0.006	0 113	1.61	0 019
Likelihood Ratio (Significance)		57.889**			28.663**			59.573**	
Sample Size		550			285			439	
Mean of Dependent Variable		0 327			0.270			0.214	
Coefficient of Determination		0 083			0.086			0 131	

SAMPLE. Enrolled Housing Gap households that did not receive a full payment at enrollment and Control households that did not meet housing requirements at enrollment, excluding households with enrollment incomes over the eligilibity limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Housing Evaluation Forms, Household Events List, Initial and monthly Household Report Forms, payments file.

a. Derivatives computed at sample mean.

† t-statistic significant at the 0.10 level (two-tailed)

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0 01 level (two-tailed)

Table XIII-5

COMPARISON OF THE PARTICIPATION RATE FOR HOUSING GAP HOUSEHOLDS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS (WITHOUT PAYMENT VARIABLES)--PITTSBURGH

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]
Constant	-1.448	-5.85**	NA	-0.886	-2.38**	NA	-0.565	-1.88†	NA
Distance (units of $10)	-0.177	-5.03**	-0.030	-0.469	-3.47**	-0.110	-0.501	-5.57**	-0.094
Probability of moving (units of .10)	0.067	1.46	0.011	0.228	3.46	0.053	0.182	3.37**	0.034
Housing Gap households	1.011	4.62**	0.172	0.619	1.71†	0.145	0.625	2.23**	0.118
Likelihood Ratio (Significance)		39.991**			24.283**			48.113**	
Sample Size		496			193			358	
Mean of Dependent Variable		0.218			0.373			0.251	
Coefficient of Determination		0.077			0.095			0.119	

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment and Control households that did not meet housing requirements at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES. Baseline Interview, Housing Evaluation Forms, Household Events List, Initial and monthly Household Report Forms, payments file.

a. Derivatives computed at sample mean.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

Table XIII-6

COMPARISON OF THE PARTICIPATION RATE FOR HOUSING GAP HOUSEHOLDS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS (WITHOUT PAYMENT VARIABLES)--PHOENIX

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE[a]
Constant	-0.672	-2.61**	NA	-1.609	-4.10**	NA	-1.379	-3.80**	NA
Distance (units of $10)	-0.114	-5.65**	-0.025	-0.143	-2 50*	-0.028	-0.209	-5.44**	-0.035
Probability of moving (units of .10)	0.062	1.88†	0.014	0.154	3 17**	0.030	0.129	2.87**	0.022
Housing Gap households	0.778	4.08**	0.171	1.082	3.45**	0.213	1.176	4.68	0.198
Likelihood Ratio (Significance)		47.673**			27.380**			56.753	
Sample Size		550			285			439	
Mean of Dependent Variable		0.327			0.270			0.214	
Coefficient of Determination		0.069			0.082			0.124	

SAMPLE: Enrolled Housing Gap households that did not receive a full payment at enrollment and Control households that did not meet housing requirements at enrollment, excluding households with enrollment incomes over the eligibility limits and those living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Housing Evaluation Form, Household Events List, Initial and monthly Household Report Forms, payments file.

a. Derivative computed at sample mean.
† t-statistic significant at the 0.10 level (two-tailed).
* t-statistic significant at the 0.05 level (two-tailed).
** t-statistic significant at the 0.01 level (two-tailed).

APPENDIX XIV

DETAILS OF TESTS FOR HOMOGENEITY
REFERENCED IN CHAPTER 5

This appendix presents the details of the various tests for homogeneity referenced in Chapter 5. It follows the same format as that used in Appendix XII to present test results for Chapter 4. Two basic types of specifications are tested in Chapter 5. The first is estimated using only Housing Gap households that did not meet requirements at enrollment.

$$(1) \qquad \ln \frac{\pi_E}{1-\pi_E} = \alpha_0 + \alpha_1 (R_R - \hat{R}_N) + \alpha_2 \hat{P}_M + \alpha_3 S_1 + \alpha_4 S_2$$

$$+ \text{(Interaction with MS, MRL, MRH)}$$

$$+ \text{(Interaction with Phx)}$$

where

π_E = the probability of meeting requirements at the end of two years

R_R = the required expenditure levels (for Minimum Rent households) or the estimated cost of standard housing (for Minimum Standards households).

$\hat{R}_N$ = estimated normal housing expenditures

$\hat{P}_M$ = the estimated normal probability of moving

S_1 = the payment level (set equal to the payment that the household would have received as a household of size four with the sample mean income)

S_2 = the residual payment (the difference between the actual payment offered at enrollment and S_1)

MS = a dummy for the Minimum Standards requirement.

MRL = a dummy for the Minimum Rent Low requirement

MRH = a dummy for the Minimum Rent High requirement

MR = a dummy for the Minimum Rent requirements

Phx = a site dummy (1 if Phoenix, 0 if Pittsburgh)

For this specification, the tests reported below generally deal with pooling by requirement or site (the interaction terms indicated). There is also a test for the restriction that the coefficients of R_R and $\hat{R}_N$ be equal and opposite in sign. Tests presented below involving this specification are designated (HG) in the heading.

The second specification was estimated separately for each housing requirement (Minimum Standards, Minimum Rent Low, and Minimum Rent High). In each case, equations are estimated using households that did not meet requirements at enrollment from among Housing Gap and Control households. The specification used was generally of the form

$$(2) \qquad \ln \frac{\pi_E}{1-\pi_E} = \gamma_0 + \gamma_1(R_R - \hat{R}_N) + \gamma_2 \hat{P}_M + \gamma_3(S_1 - 10) + \gamma_4(S_2 - 10) + (\text{interaction in E}) + (\text{interaction in Phx})$$

where the terms are defined as in Equation (1), except that

E = a dummy for Housing Gap households

Tests reported for this specification generally concern interactions in the Housing Gap and site dummies. There is also a test for the restriction that the coefficients of R_R and $\hat{R}_N$ be equal and opposite in sign. Tests for this specification are designed in the heading (CN).

Test results are reported in the order in which they are mentioned in Chapter 5. In each case, the alternative specifications are indicated by referencing one of the two Equations above and then indicating interactions. Thus,

$$(3) \qquad A = (1) + \text{Phx}(C, R_R - \hat{R}_N, P_M)$$

indicates an equation of the form

$$(4) \qquad \pi_E = \alpha_0 + \alpha_1(R_R - \hat{R}_N) + \alpha_2 \hat{P}_M + \alpha_3 S_1 + \alpha_4 S_2 + \alpha'_0 \text{Phx} + \alpha'_1 \text{Phx}\,(R_R - \hat{R}_N) + \alpha'_2 \text{Phx}\,\hat{P}_M$$

Full interactions with the entire variable set in the basic equation are indicated by, for example, Phx(1)

1. Test of the Restriction that the Sum of the Coefficients for R_R and R_N is Zero (HG)

$$A = (1) + MR(1) + \alpha_5 \hat{R}_N + \alpha_5' MR\hat{R}_N + \alpha_6 L_N \hat{P}_M + \alpha_6' MRL_N \hat{P}_M$$

$$B = (1) + MR(1) + \alpha_6 L_N \hat{P}_M + \alpha_6' MRL_N \hat{P}_M$$

		Pittsburgh	Phoenix
-2 Log Likelihood (D of F)[1]	A	233.160 (13)	228.512 (13)
	B	237.502 (11)	229.937 (11)
Difference (D of F)		4.342 (2)	1.425 (2)

The test level for the differences is given by $X^2_{.10}(2) = 4.605$.

2. Test of the Restriction that the Sum of the Coefficients for the R_R and $\hat{R}_N$ is Zero (CN)

$$A = (2) + E(C, R_R - \hat{R}_N, \hat{P}_M) + \alpha_5 \hat{R}_N + E\alpha_5' \hat{R}_N + \alpha_6 L_N \hat{P}_M$$

$$B = (2) + E(C. R_R - \hat{R}_N, \hat{P}_M) + \alpha_6 L_N \hat{P}_M$$

[1] (D of F) indicates the number of variables in the equation in addition to the constant term.

		Pittsburgh	Phoenix
Minimum Standards			
-2 Log Likelihood (D of F)	A	234.452 (10)	303.370 (10)
	B	236.959 (8)	304.992 (8)
Difference (D of F)		2.507 (2)	1.622 (2)
Minimum Rent Low			
-2 Log Likelihood (D of F)	A	139.512 (10)	138.404 (10)
	B	140.862 (8)	139.981 (8)
Difference (D of F)		1.350 (2)	1.577 (2)
Minimum Rent High			
-2 Log Likelihood (D of F)	A	212.800 (10)	175.926 (10)
	B	214.126 (8)	179.747 (8)
Difference (D of F)		1.326 (2)	3.821 (2)

Test levels for the differences are given by $X^2_{.10}(2) = 4.605$.

3. Homogeneity of Sites for Minimum Standards and Minimum Rent (HG)

Test results for homogeneity of Minimum Standards across the two sites are:

A: (1) + MR(1) + Phx(1) + PhxMR(1) (Sites Separate)

B: (1) + MR(1) + Phx (Pooled Sites with Site Dummy)

	(A)	(B)	Difference
-2 Log Likelihood (D of F)	475.147 (19)	483.214 (10)	8.068 (9)

The test level is $X^2_{.10}(9) = 14.684$

4. Test for Demographic Effects on the Probability of Participation (HG)

These tests were based on estimates using the variables of Equation (1) stratified by Minimum Standards and Minimum Rent, with and without demographic variables. The demographic variables tested were those of Chapter 3, consisting of dummy variables for households whose heads were older, younger, or black (or in Phoenix, Spanish Americans), for large households, for single parent households, for households with income from other transfer programs, and for households that were dissatisfied with their housing. Tests for significance rejected the hypothesis that these variables had no effect on participation, as shown below. The only significant variable in each case was income, which had estimated logistic coefficients of

	Pittsburgh	Phoenix	Combined Sites
Income (000's)	0.1082	0.5841*	0.3462*
(Std.dev)	(0.2514)	(0.2391)	(0.1598)
Income Spline(000's)	-0.1168	-0.1734	-0.0554
(Std.dev)	(0.3521)	(0.2805)	(0.1973)

A: (1) + MR(1) + D (With Demographic Variables)

B: (1) + MR(1) (Without Demographic Variables)

	A	B	Difference
Pittsburgh			
-2 Log Likelihood	236.599	245.043	8.444
(D of F)	(19)	(9)	(10)
Phoenix			
-2 Log Likelihood	206.584	230.104	23.519**
(D of F)	(20)	(9)	(11)
Pooled Sites			
-2 Log Likelihood	465.876	483.214	17.339*
(D of F)	(21)	(10)	(11)
Differences Between Pooled and Separate Sites			
-2 Log Likelihood	22.693	8.067	
(D of F)	(19)	(9)	

Test levels are given by $X^2_{.10}(9,10,11,19) = (14.684, 15.987, 17.275, 27.204)$.

5. Tests for Homogeneity of Distance and Normal Probability of Moving Coefficients Between Housing Gap and Control Households (CN)

Tests for differences in the estimated effects of distance and the probability of moving were based on separate estimates for the two sites with the following results:

A: (2) + $E(C, R_R - \hat{R}_N, \hat{PM})$

B: (2) + E

	Pittsburgh			Phoenix		
	A	B	Difference	A	B	Difference
Minimum Standards (D of F)	237.608 (7)	238.561 (5)	0.953 (2)	305.440 (7)	306.472 (5)	1.032 (2)
Minimum Rent Low (D of F)	140.882 (7)	147.726 (5)	6.843* (2)	140.104 (7)	141.422 (5)	1.318 (2)
Minimum Rent High (D of F)	214.342 (7)	215.088 (5)	0.746 (2)	180.577 (7)	182.720 (5)	2.143 (2)

The only case in which there was a significant difference was for Minimum Rent Low households in Pittsburgh. Test level is given $X^2_{.10}(2) = 4.605$.

6. Tests for Pooling Sites in Housing Gap and Control Comparisons (CN)

Two specifications were compared:

A: (1) + E + Phx(1) + Phx(E) (Sites Separate)

B: (1) + E + Phx (Sites Pooled, Different Intercepts)

Results are given below.

	A	B	Difference
Minimum Standards			
-2 Log Likelihood	545.033	552.625	7.592
(D of F)	(11)	(6)	(5)
Minimum Rent Low			
-2 Log Likelihood	289.148	298.258	9.110
(D of F)	(11)	(6)	(5)
Minimum Rent High			
-2 Log Likelihood	397.808	401.093	3.285
(D of F)	(11)	(6)	(5)

Test level is given by $X^2_{.10}(5) = (9,236)$

9. Tests for Dropping Payment Variables from Housing Gap and Control Comparisons (CN)

The hypothesis that the coefficients of S_1 and S_2 in Equation (2) are zero was rejected for Minimum Standards and Minimum Rent Low in both sites and for Minimum Rent High in Phoenix.

A: (2)

B: (2) without terms in S_1, S_2

	Pittsburgh			Phoenix		
	A	B	Difference	A	B	Difference
Minimum Standards	238.561	254.007	15.446**	306.472	311.213	4.741*
(D of F)	(5)	(3)	(2)	(5)	(3)	(2)
Minimum Rent Low	147.726	153.634	5.908*	141.422	148.146	6.724*
(D of F)	(5)	(3)	(2)	(5)	(3)	(2)
Minimum Rent High	215.088	215.266	0.178	182.720	191.053	8.333*
(D of F)	(5)	(3)	(2)	(5)	(3)	(2)

Test levels are given by $X^2_{.10}(2) = 4.605$.

APPENDIX XV

LOGIT RESULTS REFERENCED IN CHAPTER 5

Table XV-1

COMPARISON OF THE PARTICIPATION RATES OF HOUSING GAP HOUSEHOLDS AT THE END OF TWO YEARS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS (WITHOUT PAYMENT VARIABLES)--COMBINED SITES

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	1 955	-7 90**	NA	-1 571	-5.18**	NA	-1 305	-4 87**	NA
Distance (units of $10)	-0 156	-5 42**	-0 031	-0.375	-4 75**	-0.084	-0 295	-5 69**	-0 051
Probability of moving (units of 0 10)	0.110	3 09**	0.022	0 207	4 13**	0 046	0 123	2 79**	0 021
Phoenix households	1 147	5.22**	0 226	-0 093	-0 30	-0 021	0 147	0.55	0 025
Experimental households	1.284	6 48**	0.253	1.601	5.20**	0.357	1 170	4.74**	0 201
Likelihood Ratio (Significance)		76 110**			71 180**			66 109**	
Sample Size		551			298			453	
Mean of Dependent Variable		0.270			0.336			0 221	
Coefficient of Determination		0 118			0 187			0.138	

SAMPLE Housing Gap households that did not meet the requirements of their treatment group at enrollment and Control households that did not meet each of the three requirements at enrollment that were active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1.0C*, b = .25) Housing Gap treatment group and households living in their own homes or in subsidized housing.

DATA SOURCES Baseline Interview, Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0 05 level (two-tailed)

** t-statistic significant at the 0.01 level (two-tailed)

Table XV-2

LOGIT ESTIMATION OF THE PROBABILITY OF PARTICIPATING AT THE END OF TWO YEARS FOR HOUSING GAP HOUSEHOLDS THAT DID NOT MEET REQUIREMENTS AT ENROLLMENT--PITTSBURGH

	MINIMUM STANDARDS HOUSEHOLDS			MINIMUM RENT HOUSEHOLDS		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-1.977	-2.99**	NA	-0.038	0.06	NA
Distance (units of $10)	-0.209	-2.27*	-0.049	-0.625	-4.64**	-0.148
Probability of moving (units of 0.10)	0.128	1.58	0.030	0.013	0.13	0.003
Payment level (units of $10)	0.302	4.01**	0.071	-0.031	-0.31	-0.007
Residual payment (units of $10)	-0.008	-0.08	-0.002	0.265	2.63**	0.063
Likelihood Ratio (Significance)	43.684**					
Sample Size	217					
Mean of Dependent Variable	0.382					
Coefficient of Determination	0.151					

SAMPLE: Housing Gap households that did not meet the requirements of their treatment group at enrollment and were active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1.0C*, b = .25) Housing Gap treatment group and households living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

Table XV-3

LOGIT ESTIMATION OF THE PROBABILITY OF PARTICIPATING AT THE END OF TWO YEARS FOR HOUSING GAP HOUSEHOLDS THAT DID NOT MEET REQUIREMENTS AT ENROLLMENT--PHOENIX

	MINIMUM STANDARDS HOUSEHOLDS			MINIMUM RENT HOUSEHOLDS		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-1.026	-1.48	NA	-1.101	1.53	NA
Distance (units of $10)	-0.148	-2.37*	-0.037	-0.407	-4.53**	-0.101
Probability of moving (units of 0.10)	0.171	2.42*	0.043	0.120	1.63	0.030
Payment level (units of ($10)	0.138	2.07*	0.034	0.198	2.38*	0.049
Residual payment (units of $10)	0.029	0.40	0.007	0.202	3.91**	0.050
Likelihood Ratio (Significance)	57.014**					
Sample Size	208					
Mean of Dependent Variable	0.462					
Coefficient of Determination	0.199					

SAMPLE: Housing Gap households that did not meet the requirements of their treatment group at enrollment and were active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1.0C*, b = .25) Housing Gap treatment group and households living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

Table XV-4

COMPARISON OF THE PARTICIPATION RATES OF HOUSING GAP HOUSEHOLDS AT THE END OF TWO YEARS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS--PITTSBURGH

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-1 714	-4 49**	NA	-1.522	-3 48**	NA	-0 912	-2 75**	NA
Distance (units of $10)	-0.232	-3 58**	-0 038	-0.651	-3 62**	-0 159	-0 402	-3.95**	-0 076
Probability of moving (units of 0 10)	0.067	1.03	0 011	0 248	3 00**	0.060	0 125	1.88†	0.024
Experimental households	-0 004	-0 01	-0 001	0.480	0 41	0.117	0 360	1.16	0.068
Payment level (units of $10)	0 303	3 89**	0.050	-0 096	-0 55	-0.024	0 052	0.62	0.010
Residual payment (units of $10)	0 009	0 08	0 002	0.388	2 05*	0 095	0 025	0 19	0.005
Likelihood Ratio (Significance)		45 249**			32 223**			21 601**	
Sample Size		276			132			209	
Mean of Dependent Variable		0 210			0 424			0 254	
Coefficient of Determination		0 159			0 179			0 091	

SAMPLE Housing Gap households that did not meet the requirements of their treatment group at enrollment and Control households that did not meet each of the three requirements at enrollment that were active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1 0C*, b = 25) Housing Gap treatment group and households living in their own homes or in subsidized housing

DATA SOURCES Baseline Interview, Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

† t-statistic significant at the 0.10 level (two-tailed)

* t-statistic significant at the 0 05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed)

Table XV-5

COMPARISON OF THE PARTICIPATION RATES OF HOUSING GAP HOUSEHOLDS AT THE END OF TWO YEARS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS--PHOENIX

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-0 834	-2 31*	NA	-1 385	-2 76**	NA	-1 239	-2 48*	NA
Distance (units of $10)	-0 140	-4 01**	-0 031	-0 444	-4 22**	-0 086	-0 334	-4 79**	-0 052
Probability of moving (units of 0 10)	0 110	2 26*	0 024	0 141	1 93†	0 027	0 119	1 90†	0 018
Experimental households	-0 105	0 16	-0 023	-1 107	-0 74	-0 216	0 351	0 92	0 055
Payment level (units of $10)	0 153	2 29*	0 034	0 366	2 19*	0 071	0 129	2 84**	0 020
Residual payment (units of $10)	0 044	0 65	0 010	0 221	2 26*	0 043	0 103	2 72**	0 028
Likelihood Ratio (Significance)		42 679**			50 569**			56 402**	
Sample Size		275			166			244	
Mean of Dependent Variable		0 331			0 265			0 193	
Coefficient of Determination		0 122			0 263			0 236	

SAMPLE Housing Gap households that did not meet the requirements of their treatment group at enrollment and Control households that did not meet each of the three requirements at enrollment that were active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1 0C*, b = 25) Housing Gap treatment group and households living in their own homes or in subsidized housing

DATA SOURCES: Baseline Interview, Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file

† t-statistic significant at the 0 10 level (two-tailed)

* t-statistic significant at the 0 05 level (two-tailed)

** t-statistic significant at the 0 01 level (two-tailed)

Table XV-6

COMPARISON OF THE PARTICIPATION RATES OF HOUSING GAP HOUSEHOLDS AT THE END OF TWO YEARS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS (WITHOUT PAYMENT VARIABLES) — PITTSBURGH

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-1 743	-4 53**	NA	-1 693	-3 60**	NA	-0 916	-2 49*	NA
Distance (units of $10)	-0 203	-2.98**	-0 034	-0.543	-3.18**	-0 133	-0 403	-3 75**	-0 076
Probability of moving (units of 0 10)	0 060	0 97	0 010	0 283	3 20**	0.069	0.126	1.84+	0.024
Experimental households	1 480	4 48**	0.246	1.070	2 87**	0.261	0 626	1 80	0 118
Likelihood Ratio (Significance)	29 803**			26 315**			21 424		
Sample Size	276			132			209		
Mean of Dependent Variable	0 240			0 424			0 254		
Coefficient of Determination	0 105			0.146			0 091		

SAMPLE Housing Gap households that did not meet the requirements of their treatment group at enrollment and Control households that did not meet each of the three requirements at enrollment that were active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1 0C*, b = 25) Housing Gap treatment group and households living in their own homes or in subsidized housing

DATA SOURCES: Baseline Interview, Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

+ t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0 01 level (two-tailed)

Table XV-7

COMPARISON OF THE PARTICIPATION RATES OF HOUSING GAP HOUSEHOLDS AT THE END OF TWO YEARS WITH THE RATE AT WHICH CONTROL HOUSEHOLDS MET REQUIREMENTS (WITHOUT PAYMENT VARIABLES)--PHOENIX

	MINIMUM STANDARDS REQUIREMENT			MINIMUM RENT LOW REQUIREMENT			MINIMUM RENT HIGH REQUIREMENT		
	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE	COEFFICIENT	t-STATISTIC	PARTIAL DERIVATIVE
Constant	-0.929	-2.64**	NA	-1 601	-3.24**	NA	-1.498	-3.02**	NA
Distance (units of $10)	-0 145	-4.28**	-0.032	-0.365	-3.78**	-0 071	-0 274	-4.46**	-0.043
Probability of moving (units of 0.10)	0.132	2.82**	0.029	0 157	2.27*	0.031	0.125	2.03*	0.020
Experimental households	1 153	4.13**	0.255	2.311	5.44*	0 450	1.729	4.85**	0 269
Likelihood Ratio (Significance)		37.938**			43 844**			48 069**	
Sample Size		275			166			244	
Mean of Dependent Variable		0.331			0.265			0 193	
Coefficient of Determination		0.109			0.228			0.201	

SAMPLE: Housing Gap households that did not meet the requirements of their treatment group at enrollment and Control households that did not meet each of the three requirements at enrollment that were active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal (dC* = 1 0C*, b = .25) Housing Gap treatment group and households living in their own homes or in subsidized housing

DATA SOURCES: Baseline Interview, Initial and monthly Household Report Forms, Housing Evaluation Forms, payments file.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0 05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

APPENDIX XVI

REGRESSION PREDICTING NORMAL RENT AT TWO YEARS AFTER ENROLLMENT

Table XVI-1

REGRESSION OF RENT AT TWO YEARS ON
HOUSEHOLD CHARACTERISTICS FOR CONTROL HOUSEHOLDS

	PITTSBURGH		PHOENIX	
	COEFFICIENT	t-STATISTIC	COEFFICIENT	t-STATISTIC
Constant	92.382	NA	118.678	NA
Elderly household	-10.204	2.03*	-31.625	4.56**
Young household	6.577	1.80†	6.565	1.26
Black household	-12.125	3.14**	-21.944	2.82**
Spanish American household	NA	NA	-14.721	2.76**
Large household	11.833	2.40*	12.556	2.34*
Single parent household	7.673	2.02*	12.579	2.38*
Participation in other transfer programs	-11.574	3.10**	-19.329	3.95**
Income (in thousands)				
Under $4,000	8.19	2.51*	5.97	1.51
Δ $4,000 and over[a]	-5.71	1.37	-0.67	0.14
Residual of predicted rent at enrollment	0.712	13.69**	0.671	10.97**
R^2	0.573		0.578	
F-statistic	31.353		30.835	
Sample Size	220		236	
Mean of Dependent Variable	118.127		131.258	

SAMPLE: Control households active at two years after enrollment, excluding those with enrollment incomes over the eligibility limits for their treatment group and those with incomes at two years over the eligibility limits for the modal ($dC^* = 1.0C^*$, $b = .25$) Housing Gap treatment group and households living in their own homes or in subsidized housing.

DATA SOURCES: Baseline Interview, Initial and monthly Household Report Forms.

a. Coefficients reported are for splines. Thus, the coefficient that applies to the variable in any range is the coefficient for the lowest range plus the subsequent "Δ" coefficients.

† t-statistic significant at the 0.10 level (two-tailed).

* t-statistic significant at the 0.05 level (two-tailed).

** t-statistic significant at the 0.01 level (two-tailed).

APPENDIX XVII

THE THEORY OF PARTICIPATION

This appendix presents the formal model of participation that underlies the discussion of Chapter 4. It is a modified version of material previously presented in Kennedy et al. (1977) and is included here to complete the exposition of this report. The model is economic and is intended for technical readers.

Households eligible for a government transfer program may not participate for a variety of reasons--they may not know that they are eligible; they may not wish to announce that they are eligible (i.e., poor); they may not find the benefit worth the bother of program reporting requirements; they may feel that others need assistance more than they do; they may simply not like government programs. Participation in a housing allowance program is subject to all these factors.

Certain forms of housing allowance involve an added disincentive to participation--the household must meet a minimum housing requirement in order to qualify for payments. This requirement may be expressed either in terms of a minimum set of physical features or in terms of a Minimum Rent level. In either case, households may be forced to spend part or all of their payment, and in some cases more of their own income as well, on housing. In addition, physical standards for the unit may require households to purchase a different type of housing from that which they would normally want, even if they were to spend the same amount of money.[1] Such requirements are central to the idea of a housing allowance, since they channel the program's payments into acceptable housing.

The extent of participation obviously affects the potential total costs and impact of a program. In addition, who participates directly determines who benefits from the program, and thus whether or not the distribution of program benefits is equitable. Who participates may also determine the kinds of benefits realized by the program. Thus, for example, if eligible households only participate when they already meet the housing requirements, the

[1] These considerations apply to existing rental housing programs as well. In existing programs households must contribute some of their own resources to rent and generally are offered only a limited range of possible units if they wish to participate.

program may not have a substantial impact on housing. Payments may be used primarily to help pay for participants' existing housing rather than to purchase better housing. The analysis of participation is concerned not only with predicting such effects, but with how changes in program payment schedules or housing requirements can be used to change program costs, program equity, and the kind of benefits realized.

This appendix develops a formal model of participation in a housing allowance program. The focus is on the role of the housing requirement and payment level in determining household participation.

In the model of participation presented here, individual decisions to participate are characterized in terms of the minimum payment at which a given household will participate (S*) and the way in which this payment varies with changes in household income, prices, and the housing requirement. The participation rate for any group of individuals is determined by the proportion of households whose minimum payment falls below the payment offered to them. This rate will depend on the distribution of the individual minimum payments and will vary with the group's income, with prices, and with the housing requirement.

The first four sections develop a model of individual household participation, based on demand theory. Section XVII.1 briefly summarizes the basic propositions of demand theory. Section XVII.2 presents a graphical analysis of Minimum Rent requirements. Sections XVII.3 and XVII.4 extend this analysis to consider first the effects of changes in housing costs over time and across geographic areas and second, the effect of a Minimum Standards requirement.

The model presented has three important limitations. First, no explicit account is made of the disincentives to participation common to all transfer programs. Second, the model explicitly assumes that all households are in equilibrium, that there is no uncertainty, and that there are no costs involved in finding housing or moving. Third, the model takes only indirect account of the household's initial level of housing. This curtails certain applications. Section XVII.5 discusses these three limitations, suggests methods for correcting them, and in some cases, tests for assessing their empirical importance. Section XVII.6 develops a model of participation rates (the aggregate participation of groups of households) based on the model of

individual behavior including a set of empirical predictions which can be used to test the model.

The formal model of participation presented here is unabashedly economic. Thus it concentrates on government policy tools such as payment schedules and housing requirements and on their interaction with household income and the local price of housing. It offers correspondingly less insight into the psychological or sociological determinants of participation. As with most economic models, the effects of demographic variables other than income are largely unexplained and unexplored except in the most casual way. This both reduces the predictive power of the model and limits insight into nonfinancial policy changes in program procedure or support that could affect the participation of various groups. The discussion of Section XVII.5 develops more inclusive notions that at least provide the outlines of a more general approach.

XVII.1 REVIEW OF DEMAND THEORY

The theory of participation developed in this appendix is an extension of demand theory. This section reviews four well-known theorems from demand theory to provide the basis for later discussion.

Each household is assumed to have a twice differentiable preference ordering defined by $U(x)$, where "x" is a vector of commodities and $U(x^1) > U(x^0)$ implies that x^1 is preferred to x^0. Each commodity (x_i) is defined so that $(\partial U/\partial x_i)$, its marginal utility, is nonnegative. The preference ordering, $U(x)$, is assumed to be strictly quasi-concave.[1]

Faced with a set of prices (p) and income (Y), the household selects its preferred commodity bundle from among those that it can afford. If information and transactions are cost-less, the household's demand functions, $x(p, Y)$, will be determined by

[1] A function with positive gradient is strictly quasi-concave if its level curves are strictly concave from above. In essence, the strict quasi-concavity of U asserts that for any pair of commodities, increasingly more of the first commodity is required to compensate the household for reductions in the second commodity, holding other commodity levels constant.

(1) $$\underset{\{x\}}{\text{Max}}\ U(x) \text{ s.t. } p'x \leq Y,\ x \geq 0$$

where

x = the vector of commodities

p = the vector of prices

Y = money income.

It can be shown (Arrow and Entloven, 1961) that:

Theorem 1 (Utility Maximization). Under the assumptions stated, the solution, $x(p, Y)$, to Equation (1) exists and is determined by

(2) $$\begin{cases} U_x - \lambda p \leq 0 \\ \{x_i \delta_{ij}\}(U_x - \lambda p) = 0 \\ \lambda(p'x - Y) = 0 \\ \lambda \geq 0 \end{cases}$$

where λ is the Lagrange multiplier for Equation (1).[1]

Assuming that the individual is not sated (some $U_i > 0$) and ignoring zero commodities, the conditions in Equation (2) become:

(3) $$\begin{cases} U_x - \lambda p = 0 \\ p'x - Y = 0 \\ \lambda > 0. \end{cases}$$

---

[1]The notation used here and throughout this appendix is that for

$$Z = f(x)$$

then

$$Z_x = \left(\frac{\partial Z}{\partial x_i}\right)$$

$$Z_{xx} = \left(\frac{\partial^2 Z}{\partial x_i \partial x_j}\right),$$

and so forth. The gradient, Z_x, is always taken to be a column vector. Where it is not clear for a partial derivative what other variables are held constant, the other variables are indicated by a subscript. Thus for

$$Z = f(x, Y)$$

$$Z_{x|Y} = \left(\frac{\partial Z}{\partial x_i}\right).$$

The point at which a function is evaluated is indicated, if necessary, by a superscript, e.g., Z^o, Z_x^o, or $Z_{x|Y}^o$.

The major proposition of demand theory can be developed by exploiting a dual problem to Equation (1):

$$\text{(4)} \qquad \underset{\{x\}}{\text{Min}}\ Y = p'x \text{ s.t. } U(x) \geq \bar{U}.$$

It can be shown (McFadden and Winter, 1969) that

$$\text{(5)} \qquad \begin{cases} x(p, \bar{U}) = x(p, Y(p, \bar{U})) \\ \lambda(p, \bar{U}) = \lambda(p, Y(p, \bar{U})). \end{cases}$$

This and other considerations yield:

> Theorem 2 (The Fundamental Theorem of Demand Theory).[1] A differentiable function, $x(p, Y)$ is defined as a local demand function at x^o, if $x(p, Y)$ is the solution to
>
> $$\underset{\{x\}}{\text{Max}}\ U(x) \text{ s.t. } p'x \leq Y$$
>
> for some twice differentiable, quasi-concave function U in some neighborhood of x^o.
>
> Any differentiable function $x(p, Y)$ is a local demand function if and only if
>
> $$p'x = Y$$
>
> $$p'\frac{\partial x}{\partial Y} = 1$$
>
> $$\left(\frac{\partial x}{\partial p} + \frac{\partial x}{\partial Y}x'\right) = B$$
>
> where B is symmetric, negative semi-definite and
>
> $Y'BY = 0$ if and only if Y is proportional to p.

Two other concepts will prove useful. First, the utility level achieved in Equation (1) can be expressed in terms of the constraint parameters, prices and income, as follows:

---

[1] That all demand functions have these properties can be developed from Equations (4) and (5) (McFadden and Winter, 1969). That all sets with these properties are demand functions (locally) can also be shown (Kennedy, 1972).

Theorem 3 (Indirect Utility Function).[1] The indirect utility function defined by

$$\phi(p, Y) - \underset{\{x\}}{\text{Max}}\ U(x) \text{ s.t. } p'x \leq Y \tag{6}$$

has the properties

$$\begin{aligned} \phi p &= -\lambda x(p, Y) \\ \phi Y &= \lambda \end{aligned} \tag{7}$$

where λ is the Lagrange multiplier in Equation (1).

Second, the concept of indirect utility can be applied to a subset of commodities to yield Hicks' Composite Commodity Theorem. Consider

$$\underset{\{x_1\}}{\text{Max}}\ U(x_1, x_2) \text{ s.t. } \frac{p_1'x_1}{a} \leq E$$

where x_1 is a vector of the first "r" commodities. This defines $x_1^*(p_1/a, E, x_2)$. But now Equation (1) can be rewritten

$$\underset{\{E,x_2\}}{\text{Max}}\ U(E, x_2) \text{ s.t. } aE + p_2'x_2 \leq Y.$$

If the prices, p_1, change only proportionally, then (p_1/a) is constant, and the composite commodity, E, is defined by

$$E = \sum_i^r \frac{p_{ij}x_{ij}}{\Sigma p_{ij}} .$$

---

[1] Equations (7) follow from application of the Envelope Theorem to Equation (1). The Envelope Theorem asserts that given the problem

$$\underset{\{x\}}{\text{Max}}\ Z(x, a) \text{ s.t. } g(x, a) = 0$$

with solution $x^*(U)$ and given the Lagrangian:

$$L = Z(x, a) - \lambda g(x, a),$$

then

$$\frac{\partial Z^*}{\partial a} = \frac{\partial L^*}{\partial a}\bigg|_{x,Y} = \frac{\partial Z}{\partial a}\bigg|^{x^*} - \lambda \frac{\partial g}{\partial a}\bigg|^{x^*} .$$

This yields:

Theorem 4 (Composite Commodity Theorem). Define a composite commodity, E, and its price $\bar{p}$, by

$$\bar{p} = \sum_{i}^{r} p_i$$

$$E = \sum_{i}^{r} \frac{p_i x_i}{\bar{p}} .$$

Then the functions $E(\bar{p}, p_2, Y)$ and $x_2(\bar{p}, p_2, Y)$ are solutions to the problem

$$\underset{\{E,x_2\}}{\text{Max}}\ U(E, x_2) \text{ s.t. } \bar{p}E + p_2'x_2 \leq Y.$$

The importance of this theorem is that there is no need to define an ultimate commodity set. Complex bundles of goods, such as housing, can be treated as a single commodity as long as the relative prices of the individual components do not change. The single commodity is, however, housing expenditures (or normalized expenditures). Its composition (the relative proportion of the x_1 components) will generally change as the overall price of the composite, other prices, or income change.[1]

---

[1] It is worth noting that the Composite Commodity Theorem does not depend on the linear form of the budget constraint. In general, if the cost of x_1 can be written

$$C(x_1) = \theta f(x_1)$$

where θ is a shift parameter, then the composite, E, can be defined by

$$E = \frac{C(x_1)}{C(\bar{x}_1)}$$

$$\bar{p} = C(\bar{x}_1) = \theta f(\bar{x}_1)$$

where $\bar{x}_1$ is any fixed point.

This is an important consideration for housing where the cost of different bundles of components (number of rooms, quality of structure, and so forth) may not be a linear function of component levels. For a further discussion, see Merrill, 1977, Appendix I.

XVII.2 PARTICIPATION UNDER A MINIMUM RENT REQUIREMENT (CONSTANT PRICES)

Under a Minimum Rent requirement, eligible households are offered a payment, (S), if they meet the condition

$$p_1' x_1 \geq r \tag{8}$$

where x_1 is some subset of the commodities (specifically, the housing bundle). The subset x_1 may be more or less inclusive. In the Demand Experiment, for example, x_1 includes utilities other than telephones, but not furnishings.[1] The household will accept the offer if it can reach a higher level of utility by accepting, if the payment (S) is greater than the minimum payment needed to compensate it for meeting the Minimum Rent requirement in Equation (8). The rest of this section examines the value of this minimum payment (A*).

Much of the analysis of minimum rent can be carried out graphically. Figure XVII-1 presents the usual household indifference map across housing and nonhousing goods (H and Z, respectively), with level curves U_0, U_1, and so forth. The household budget constraint is represented by the line, ($pH + Z = Y$), where "p" is the relative price of housing, and income (Y) is expressed in terms of the nonhousing good. The household chooses the point (H_0, Z_0), the highest indifference level within the budget constraint.[2]

A housing allowance offer shifts the budget line as shown in Figure XVII-2. If the household spends more than the minimum rent on housing (buys more housing than $E = R/p$), income is increased by the amount of the allowance payment and the budget line is shifted up. As drawn in Figure XVII-2, the allowance offered is just large enough to compensate the household for meeting

[1] This can be a serious operational problem. A widespread program with a Minimum Rent requirement could be met by collusion to set artificially high rents or by the creation of units with nonhousing consumption included in rent (e.g., well-stocked freezers).

[2] As long as the cost functions for the housing and nonhousing subsets only shift proportionally, the composite commodity theorem cited in Section XVII.1 allows analysis in terms of two goods. Thus the graphical analysis is completely general under these conditions. It cannot, however, take account of nonproportional shifts in prices or of minimum standards.

Figure XVII-1
CHOICE BETWEEN HOUSING AND NONHOUSING EXPENDITURES
BEFORE HOUSING ALLOWANCE OFFER

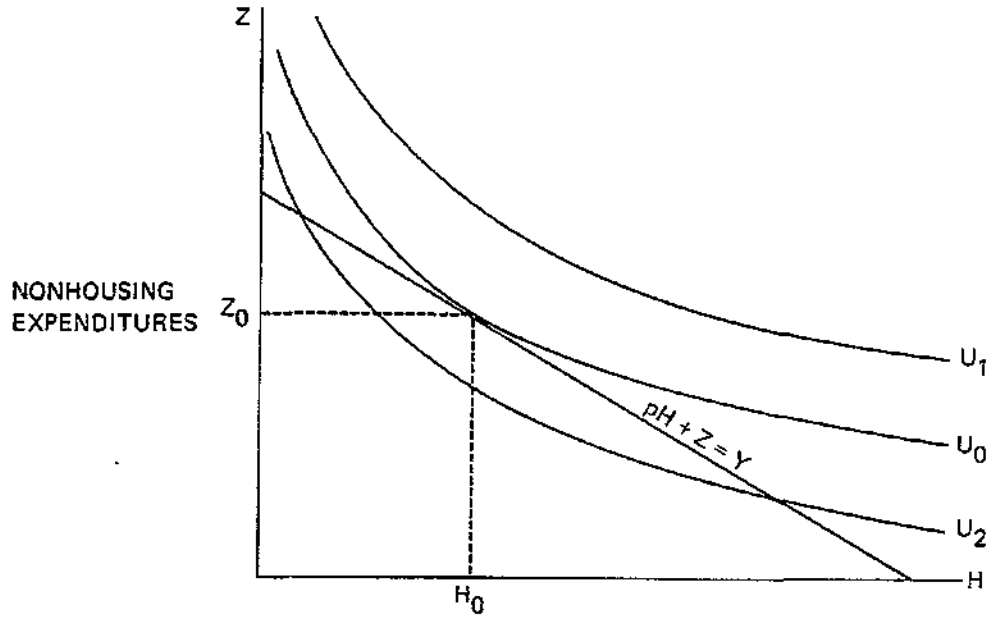
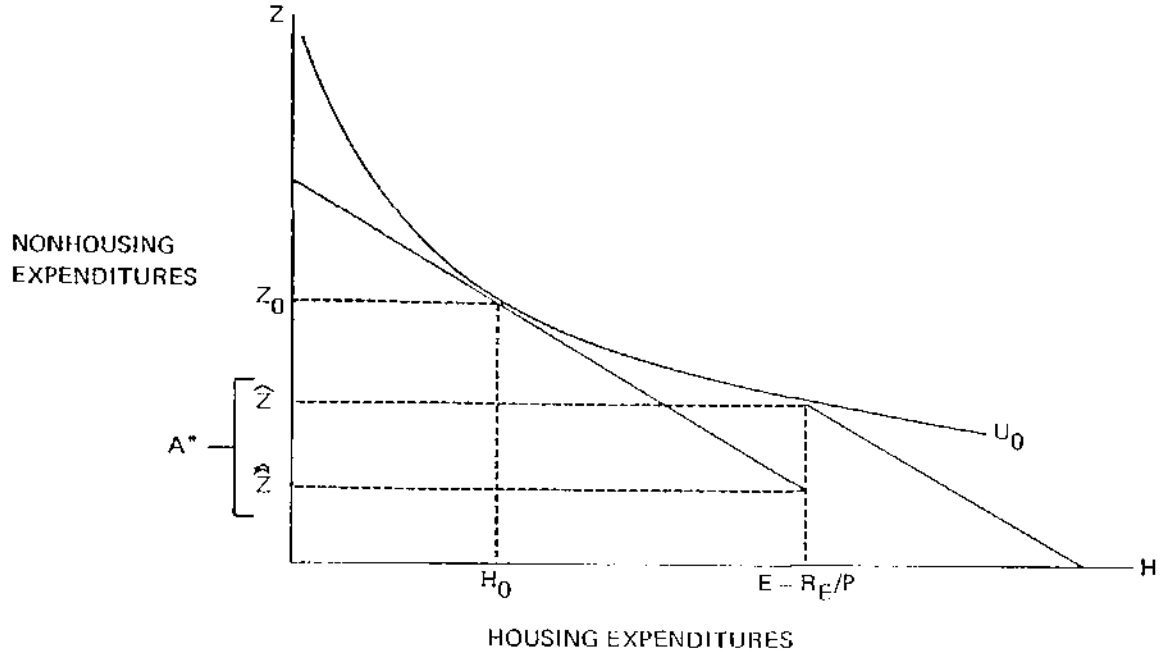


Figure XVII-2
MINIMUM PAYMENT REQUIRED FOR PARTICIPATION WITH A
MINIMUM RENT HOUSING REQUIREMENT OF R_E



the Minimum Rent requirement; the point $(E, \hat{Z})$ is on the same indifference curve as (H_0, Z_0).[1]

The difference between $\hat{\hat{Z}}$, the level of nonhousing goods that the household can afford with its own income while purchasing E, and $\hat{Z}$, the level indifferent to its original position, is A*, the minimum payment at which the household will participate. As long as the indifference curve is strictly concave, A* will be positive, but less than $(Z_0 - \hat{\hat{Z}})$, the payment that would allow the household to maintain its original level of nonhousing consumption, Z_0, while meeting the housing requirement. Thus

$$0 < A^* < p(E - H_0), \text{ if } E > H_0. \tag{9}$$

The effect of a change in the housing requirement is shown in Figure XVII-3. As E is increased from E_0 to E_1, the distance between the budget line and the indifference curve U_0 increases, and increases at an increasing rate. Thus

$$\frac{\partial A^*}{\partial E} > 0, \quad \frac{\partial^2 A^*}{\partial E^2} > 0. \tag{10}$$

The effects on A* of changes in income is illustrated in Figure XVII-4. An increase in income shifts the budget line up. As drawn in Figure XVII-4, the effect is to reduce A*. That is

$$\frac{\partial A^*}{\partial Y} < 0. \tag{11}$$

This depends on the assumption that housing is a normal good (expenditures on housing increase as income increases). Intuitively, if housing is normal and income increases enough, the household will reach the required expenditure level, and A* will fall to zero.

The rest of this section develops the basic analytic framework for the Minimum Rent requirement and establishes the following theorem.

---

[1] This analysis abstracts from a host of issues. It assumes perfect rationality, no moving or search costs, and no other disincentives to participation. The importance of these assumptions is discussed in Section XVII.5.

Figure XVII-3

THE EFFECT OF CHANGE IN HOUSING REQUIREMENTS ON THE MINIMUM PAYMENT REQUIRED FOR PARTICIPATION

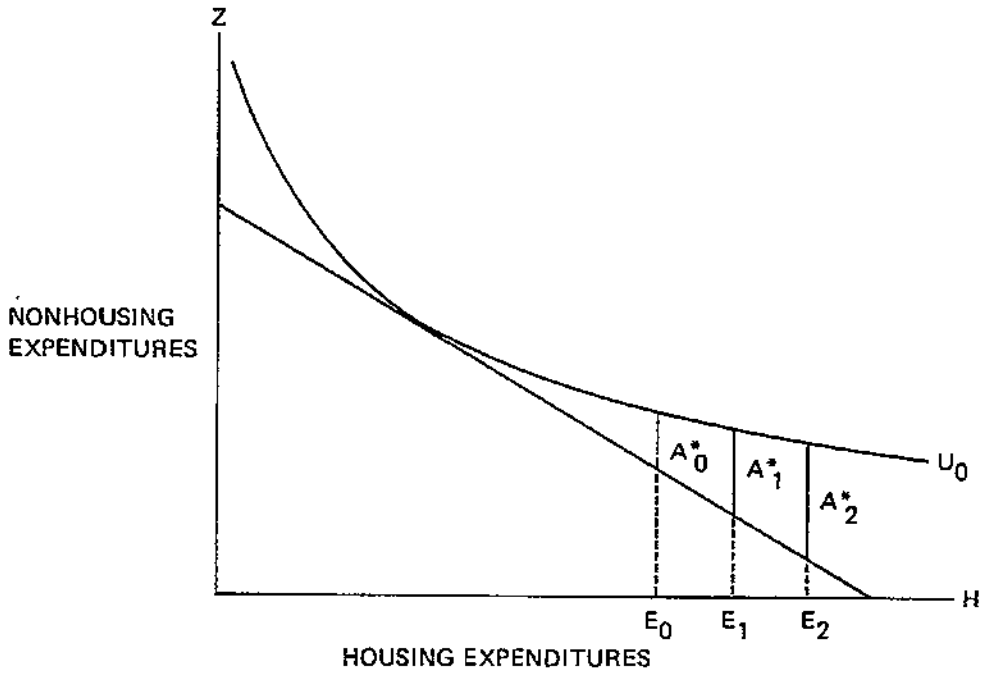
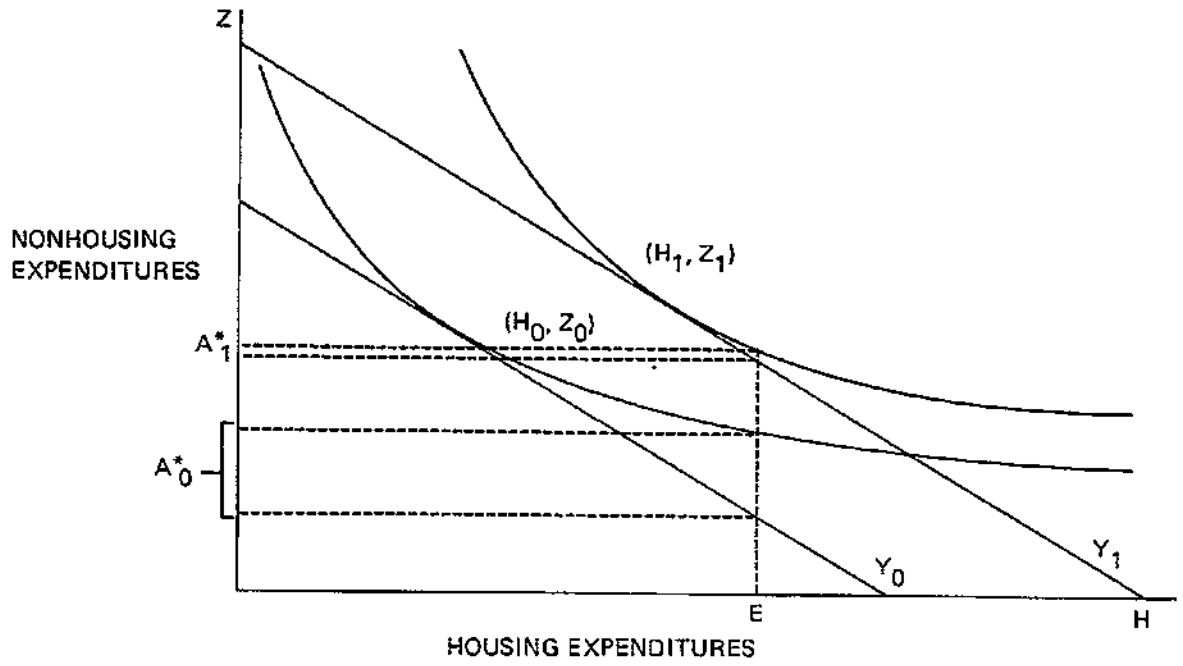


Figure XVII-4

THE EFFECT OF CHANGE IN INCOME ON THE MINIMUM PAYMENT REQUIRED FOR PARTICIPATION



Theorem 5 (Minimum Rent with Constant Prices). Under a Minimum Rent requirement, $p_1'x_1 > r$, the minimum payment required to compensate an individual for meeting the requirement is defined by

$$A^* = A^*(r, p_1, p_2, Y)$$

where

r = the Minimum Rent requirement

p_1 = the vector of housing component prices

p_2 = the vector of nonhousing commodity prices

Y = money income.

For any given set of prices, A^* has the properties when $r > p_1'x_1^o$:

a. $r - p_1'x_1^o > A^* > 0$

b. $1 > A_r^* > 0$

c. $-1 < A_Y^* < 0$ everywhere and $A_{rY}^* < 0$ everywhere if and only if $p_1'(\partial x_1/\partial Y) > 0$ everywhere, that is, if the composite commodity formed of elements included in rent is a normal good

d. $A_{rr}^* > 0$

e. $A_{YY}^* > 0$ everywhere if $p_1'(\partial x_1/\partial Y) > 0$ and $p_1'(\partial^2 x_1/\partial Y^2) < 0$ everywhere (sufficient condition). This condition will be met, for example, if the income elasticity of the composite commodity, x_1, is less than one and constant or declining as income increases.

The rest of this section proves Theorem 5.

Consider the minimum income necessary to remain at the initial utility level, $\phi(p, Y)$, while meeting the Minimum Rent requirement of Equation (8)

$$\text{(12)} \qquad \underset{\{x\}}{\text{Min}}\ \hat{Y} = p_1'x_1 + p_2'x_2 \text{ s.t. } U(x_1, x_2) > \phi(p, Y),\ p_1'x_1 \geq r$$

then the minimum payment, A^*, is defined by

$$\text{(13)} \qquad A^* = \hat{Y} - Y.$$

Since $\hat{Y}$ is a minimum, A^* will be positive if the Minimum Rent requirement is binding (if $p_1'x_1^o < r$).

From Equation (12), A^* is a function of (r, p_1, p_2, Y). Applying the Envelope Theorem and substituting into Equation (13), the derivatives are

$$
(14)\qquad \begin{cases} A^*_r = \gamma \\ A^*_{p_1} = (1-\gamma)\hat{x}_1 + \hat{\mu}\phi_{p_1} = (1-\gamma)\hat{x}_1 - \hat{\mu}\lambda^o x^o_1 \\ A^*_{p_2} = \hat{x}_2 + \hat{\mu}\phi_{p_2} = \hat{x}_2 - \hat{\mu}\lambda^o x^o_2 \\ A^*_y = \hat{\mu}\phi_y - 1 = \hat{\mu}\lambda^o - 1 \end{cases}
$$

where γ and $\hat{\mu}$ are the Lagrange multipliers for the constraints $(p_1'x_1 - r \geq 0)$ and $(U - \phi \geq 0)$, respectively.[1]

The First Order Conditions (FOC) for Equation (12) are

$$
(15)\qquad \begin{cases} (1-\gamma)p_1 - \mu U x_1 = 0 \\ p_2 - \mu U x_2 = 0 \\ U(x_1, x_2) - \phi(p, Y) = 0 \\ \gamma(p_1'x_1 - r) = 0 \\ \gamma \geq 0 \\ \mu > 0. \end{cases}
$$

But these are the FOC for the Expenditure Dual defined by Equation (4) with $\hat{p}_1 = (1-\gamma)p_1$. Hence γ is defined by

$$
(16)\qquad p_1'x_1[(1-\gamma)p_1, p_2, \phi(p, Y)] = r
$$

and

$$
(17)\qquad \begin{cases} (\hat{x}_1, \hat{x}_2) = x(\hat{p}_1, p_2, \phi(p, Y)) \\ \hat{\lambda} = (\hat{\mu})^{-1} = \lambda(\hat{p}_1, p_2, \phi(p, Y)) \\ \hat{p}_1 = (1-\gamma)p_1 \end{cases}
$$

where $\hat{p}_1$ is the level of prices that will support expenditure "r." Notice that the support prices, $\hat{p}_1$, are simply a proportional shift of the initial

---

[1]The right-most expressions in Equation (14) follow from application of Theorem 3.

housing price vector. Thus, when initial prices are fixed, the x_1 and x_2 bundles can be regarded as two composite commodities and the Minimum Rent requirement as requiring a fixed level of the housing bundle. This yields strong propositions on the signs of the A* derivatives.

By the FOC, Y is positive unless the household already meets the constraint (unless $p_1'x_1^o \geq r$). Hence

$$A_r^* > 0 \text{ for } p_1'x_1^o < r. \tag{18}$$

The expression for A_y^* involves $(\lambda^o/\hat{\lambda} - 1)$. The size of $(\lambda^o/\hat{\lambda})$ is established by

$$\lambda(p, U) = \lambda(p, Y(p, U)) \text{ (from Equation (5))}$$

$$\left.\frac{\partial\lambda}{\partial p}\right|_u = \left.\frac{\partial\lambda}{\partial p}\right|_Y + \frac{\partial\lambda}{\partial Y}\left(\frac{\partial Y}{\partial p}\right) = \left.\frac{\partial\lambda}{\partial p}\right|_y + \frac{\partial\lambda}{\partial Y}x.$$

But

$$\lambda = \frac{\partial U}{\partial Y}$$

$$\left.\frac{\partial\lambda}{\partial p}\right|_y = \frac{\partial U}{\partial p\partial Y} = \frac{\partial}{\partial Y}(-\lambda x) = -\frac{\partial\lambda}{\partial Y}x - \lambda\frac{\partial x}{\partial Y}.$$

Hence

$$\left.\frac{\partial\lambda}{\partial p}\right|_u = -\lambda\frac{\partial x}{\partial Y} \tag{19}$$

$$\lambda(\hat{p}_1, U_0) = \lambda^o \exp -\int_p^{\hat{p}} \left(\frac{\partial x}{\partial Y}\right)' dp$$

where dp is some path connecting p_1 and $\hat{p}$. (Notice that $\partial x/\partial Y$ is evaluated along the indifference surface and is a function of prices and the indifference level.)

Since $\hat{p} < p_1$, $\lambda/\hat{\lambda} < 1$ if $(\partial x_1/\partial Y)$ is everywhere positive (if the elements of the housing bundle are everywhere superior). Indeed, since $\hat{p}$ is proportional to p, the path, dp, can be written (dp = pdt), and

$$\lambda(\hat{p}, U^o) = \lambda^o \exp\left(-\int_1^{(1-\gamma)} p_1' \frac{\partial x}{\partial Y} dt\right) = \lambda^o \exp\int_{(1-\gamma)}^{1} p_1' \frac{\partial x_1}{\partial Y} dt. \tag{20}$$

Thus $(\lambda^{o}/\hat{\lambda})$ is less than one if the composite housing commodity is everywhere normal. Empirically, this seems a reasonable assumption for an inclusive enough definition of x_1. Thus

$$(21) \qquad A^{*}_{Y} = \frac{\lambda^{o}}{\hat{\lambda}} - 1 < 0 \text{ if } \begin{cases} p_1' \dfrac{\partial x_1}{\partial Y} \text{ everywhere } > 0 \\ p_1' x_1^{o} < r. \end{cases}$$

This is intuitively reasonable in the large. If the housing bundle is a normal good, then as income increases, housing expenditures will increase and eventually reach the Minimum Rent requirement.

The second derivatives of A* with respect to Minimum Rent requirement and income follow. From Equation (11)

$$(22) \qquad \begin{cases} A^{*}_{rr} = \dfrac{\partial \gamma}{\partial r} \\ A^{*}_{ry} = \dfrac{\partial \gamma}{\partial Y} \\ A^{*}_{yy} = \dfrac{\partial (\lambda^{o}/\hat{\lambda})}{\partial Y} . \end{cases}$$

From Equation (16) the value of γ is defined by

$$p_1' x_1[(1 - \gamma)p_1, p_2, \phi(p, Y)] = r.$$

Hence

$$(23) \qquad A^{*}_{rr} = \frac{\partial \gamma}{\partial r} = -\left[p_1'\left(\frac{\partial \hat{x}_1}{\partial p_1}\bigg|_u\right)p_1\right]^{-1} > 0^{1}$$

and

$$A^{*}_{ry} = \frac{\partial \gamma}{\partial Y} = \left[p_1'\left(\frac{\partial x_1}{\partial p_1}\bigg|_u\right)p_1\right]^{-1}\left(p_1' \frac{\partial \hat{x}_1}{\partial \phi}\right)\frac{\partial \phi}{\partial Y}$$

$$(24) \qquad = \left[p_1'\left(\frac{\partial \hat{x}_1}{\partial p_1}\bigg|_u\right)p_1\right]^{-1} p_1' \frac{\partial \hat{x}_1}{\partial Y} \frac{\hat{\lambda}}{\lambda^{o}} < 0,$$

if the composite housing commodity is superior (that is, if $p_1' \dfrac{\partial \hat{x}_1}{\partial Y} > 0$).

---

[1] By Theorem 2, the submatrix $(\partial \hat{x}_1/\partial p_1|_u)$ must be negative definite since if $Y'(\partial \hat{x}_1/\partial p_1|_u)Y = 0$, then $(Y', 0)$ is orthogonal to $(\partial \hat{x}/\partial p|_u)$ which violates Theorem 2.

Finally,

$$A^*_{YY} = \frac{\partial}{\partial Y}\left(\frac{\lambda^o}{\hat{\lambda}}\right) = \frac{\partial}{\partial Y} \exp \int_{p^o}^{\hat{p}} \frac{\partial x'}{\partial Y}\, dp$$

$$= (\lambda^o/\hat{\lambda}) \left[\left(p_1' \frac{\partial x_1}{\partial Y}\right)\left(-\frac{\partial Y}{\partial Y}\right) + \int_{p^o}^{\hat{p}} \frac{\partial^2 x}{\partial Y^2} \frac{\lambda^o}{\lambda}\, dp\right]. \tag{25}$$

From Equation (24), $\partial Y/\partial Y$ is negative. Thus A^*_{YY} will be positive if $((\partial^2 x'/\partial Y^2)p_1)$ is negative (since $\hat{p} < p_0$). This appears to be a reasonable condition. If the income elasticity of the housing bundle is less than one, the condition is met if the elasticity is constant or declining as income increases (if the reduction in the proportion of income spent on housing is constant or increasing), as shown below. If ξ is the elasticity of a good, "x," then

$$\xi = \frac{\partial x}{\partial Y} \cdot \frac{Y}{x}$$

$$\frac{\partial \xi}{\partial Y} = \frac{\partial^2 x}{\partial Y^2} \cdot \frac{Y}{x} - \left(\frac{\partial x}{\partial Y}\right)^2 \frac{Y}{x^2} + \frac{\partial x}{\partial Y} \frac{1}{x} = \frac{\partial^2 x}{\partial Y^2} \frac{Y}{x} - \frac{1}{Y}(\xi^2 - \xi)$$

which is $\gtrless 0$, as

$$\frac{\partial^2 x}{\partial Y^2} \gtrless \frac{x}{Y^2}(\xi^2 - \xi).$$

If $\xi < 1$, then $(\xi^2 - \xi) < 0$ and $\partial\xi/\partial Y \leq 0$ implies $\partial^2 x/\partial Y^2 < 0$.

Thus

$$A^*_{YY} > 0 \text{ if } \left(p_1' \frac{\partial^2 x_1}{\partial Y^2} < 0\right) \tag{26}$$

which is satisfied if the income elasticity of demand for the composite housing bundle is less than one and constant or declining with income.

XVII.3 PRICE CHANGES AND PARTICIPATION UNDER A MINIMUM RENT REQUIREMENT

Housing is not a single, homogeneous good. The cost of equivalent housing may vary substantially from one area to another and even within areas. In addition the relative cost as well as need for various features (construction materials, air conditioning, central heating, yard space) may vary substantially. This raises important issues of how payments should be varied to take account of price differences, and for a Minimum Rent condition, how the Minimum Rent level should be adjusted to maintain some real level of housing.

These questions are not really answerable in terms of individual behavior (nor indeed without clear specification of government objectives). Most feasible policies must necessarily be based on and evaluated in terms of indices derived from aggregate behavior. This section, therefore, is confined to discussion of one special case in which the prices of housing and nonhousing goods are each adjusted proportionally.

If the housing and nonhousing price vectors only change proportionally, then the housing and nonhousing bundles form two composite commodities. In this case, the Minimum Rent requirement may be thought of as setting a level for the composite housing bundle, while allowing individuals to choose the exact composition of the bundle. This subsection explores the implications of a policy of adjusting the Minimum Rent requirement to offset (proportional) increases in the price of housing and maintain the "real" housing requirement implicit in the Minimum Rent to give the following theorem:

> Theorem 6 (Proportional Price Changes). If the component prices of the housing bundle change proportionally and if the Minimum Rent level is adjusted to reflect changes in the price of housing by
>
> $$\frac{dr}{r} = \frac{dp_1}{p_1}$$
>
> and if the composite commodity, housing, is a superior good, then
>
> a. $A^*_{p_1} > 0$
>
> b. $A^*_{rp_1} > 0$
>
> c. $A^*_{yp_1} < 0$
>
> d. $A^*_{p_1p_1} > 0.$

Define x_1 and x_2 as composite commodities. Under an adjusted Minimum Rent policy, the Minimum Rent condition becomes

$$\hat{x}_1 \geq e \tag{27}$$

and Equation (12) is written

$$\text{Min } \hat{Y} = p_1\hat{x}_1 + p_2\hat{x}_2 \text{ s.t. } U(\hat{x}_1, \hat{x}_2) \geq \phi(p, Y), \ \hat{x}_1 \geq e \tag{28}$$

and Equations (14) become

$$\begin{cases} A^*_c = p_1\gamma \\ A^*_{p_1} = \hat{x}_1 - (\lambda^o/\hat{\lambda})x_1^o \\ A^*_{p_2} = \hat{x}_2 - (\lambda^o/\hat{\lambda})x_2^o \\ A^*_y = (\lambda^o/\hat{\lambda}) - 1 \end{cases} \tag{29}$$

where $(p_1\gamma)$ is the Lagrange multiplier for the condition $(\hat{x}_1 \geq e)$, defined by

$$x_1[p_1(1 - \gamma), p_2, \phi(p, Y)] = e. \tag{30}$$

The derivatives A^*_c and A^*_y are as before except that since $r = p_1e$, $A^*_e = p_1A^*_r$, and x_1 and x_2 are now scalars.

The quantity, $\hat{x}_1$, is simply e, the real constraint level, so that $\hat{x}_1$ is greater than x_1^o if the constraint is binding. In this case, since there are only two commodities, $\hat{x}_2$ must also be less than $\hat{x}_1$, since x_1 and x_2 must be compensated substitutes (see Theorem 2). Since $\lambda^o/\hat{\lambda}$ is also less than one,

$$\begin{cases} A^*_{p_1} > 0 \\ A^*_{p_2} \text{ is of indeterminate sign.} \end{cases} \tag{31}$$

The indeterminateness of $A^*_{p_2}$ reflects the usual double action of price changes; increases in p_2 both shift consumption towards housing, which

would reduce A* (holding real income constant) and reduce real income.[1] In the case of changes in p_1, these two effects act in the same direction.

The second derivatives with respect to price are

$$
(32)\qquad
\begin{cases}
A^*_{ep_1} = \dfrac{\partial(p_1 Y)}{\partial p_1} & A^*_{ep_2} = \dfrac{\partial(p_1 Y)}{\partial p_2} \\[2ex]
A^*_{yp_1} = \dfrac{\partial(\lambda^\circ/\hat{\lambda})}{\partial p_1} & A^*_{yp_2} = \dfrac{\partial(\lambda^\circ/\hat{\lambda})}{\partial p_2} \\[2ex]
A^*_{p_1p_2} = -\dfrac{\partial(\lambda^\circ/\hat{\lambda})}{\partial p_1} x_1^\circ - \left(\dfrac{\lambda^\circ}{\hat{\lambda}}\right)\dfrac{\partial x_1^\circ}{\partial p_1} & \\[2ex]
A^*_{p_1p_2} = -\dfrac{\partial(\lambda^\circ/\hat{\lambda})}{\partial p_2} x_1^\circ - \left(\dfrac{\lambda^\circ}{\hat{\lambda}}\right)\dfrac{\partial x_1^\circ}{\partial p_2} & \\[2ex]
A^*_{p_2p_2} = \dfrac{\partial \hat{x}_2}{\partial p_1}\left(\dfrac{\partial p_1 Y}{\partial p_2}\right) + \dfrac{\partial \hat{x}_2}{\partial p_2} - \dfrac{\partial(\lambda^\circ/\hat{\lambda})}{\partial p_2} x_2^\circ - \left(\dfrac{\lambda^\circ}{\lambda}\right)\dfrac{\partial x_2^\circ}{\partial p_2}\,. &
\end{cases}
$$

---

[1] While it is true that the income compensated sign of $A^*_{p_2}$ is clearly negative ($A^*_{p_2}(\text{comp}) = \hat{x}_2 - x_2^\circ$), no simple conditions on the demand functions will yield a clear sign for the uncompensated derivative, even though in the immediate neighborhood of $e = x_1^\circ$, the sign is determined by the gross complementarity or substitutability of x_1 and x_2. When the housing requirement is not binding, $\hat{p}_1 = p_1$ and $A^*_{p_2} = 0$. As "e" is increased, $\hat{p}_1$ falls. But along the indifference curve

$$
\left.\frac{\partial A^*_{p_2}}{\partial \hat{p}_1}\right|_u = \left.\frac{\partial \hat{x}_2}{\partial \hat{p}_1}\right|_u - \frac{\partial \hat{x}_1}{\partial Y}\cdot\frac{\lambda^\circ}{\hat{\lambda}}\, x_2^\circ
$$

where $(\partial \hat{x}_1/\partial Y)$ is $(\partial x_1/\partial Y)$ evaluated at $\hat{p}_1$. Recalling that the compensated price derivatives are symmetric

$$
\left.\frac{\partial A^*_{p_2}}{\partial \hat{p}_1}\right|_u = \left.\frac{\partial \hat{x}_1}{\partial p_2}\right|_y - \frac{\partial \hat{x}_1}{\partial Y}\left(\frac{\lambda^\circ}{\hat{\lambda}}\, x_2^\circ - \hat{x}_2\right)
$$

$$
= \left.\frac{\partial \hat{x}_1}{\partial p_2}\right|_y + \frac{\partial \hat{x}_1}{\partial Y} A^*_{p_2}\,.
$$

If x_1 and x_2 are everywhere gross complements (i.e., $\left.\partial \hat{x}_1/\partial p_2\right|_Y < 0$), then this derivative will be negative at $\hat{p}_1 = p_1$. Thus as "e" is increased ($\hat{p}_1$ falls), $A^*_{p_2}$ will be initially positive and the sign of $\left(\partial A^*_{p_2}/\partial \hat{p}_1|_u\right)$ is unclear. Similarly if x_1 and x_2 are gross substitutes, $A^*_{p_2}$ will again start with the opposite sign in the neighborhood of $e = x_1^\circ$.

By Equation (30)

$$(33)\qquad \left\{ \begin{aligned} \frac{\partial(p_1\gamma)}{\partial p_1} &= \left(\frac{\partial \hat{x}_1}{\partial \hat{p}_1}\bigg|_u\right)^{-1}\left[\left(\frac{\partial \hat{x}_1}{\partial \hat{p}_1}\bigg|_u\right) - \frac{\partial \hat{x}_1}{\partial Y}\ \frac{\lambda^o}{\hat{\lambda}}\ x_1^o\right] \\ &= 1 - \left(\frac{\hat{x}_1}{\hat{p}_1}\bigg|_u\right)^{-1}\left(\frac{\lambda^o}{\hat{\lambda}}\right)\frac{\partial \hat{x}_1}{\partial Y}\ x_1^o > 0 \text{ if } \frac{\partial \hat{x}_1}{\partial Y} > 0 \end{aligned} \right.$$

Likewise,

$$(34)\qquad \left\{ \begin{aligned} \frac{\partial(p_1\gamma)}{\partial p_2} &= \left(\frac{\partial \hat{x}_1}{\partial p_1}\bigg|_u\right)^{-1}\left[\left(\frac{\partial \hat{x}_1}{\partial \hat{p}_2}\bigg|_u\right) - \frac{\partial \hat{x}_1}{\partial Y}\ \frac{\lambda^o}{\hat{\lambda}}\ x_2^o\right] \\ &= \left(\frac{\partial x_1}{\partial p_1}\bigg|_u\right)^{-1}\left[\frac{\partial \hat{x}_1}{\partial p_2}\bigg|_y - \frac{\partial \hat{x}_1}{\partial Y}\left(\frac{\lambda^o}{\hat{\lambda}}\ x_2^o - \hat{x}_2\right)\right] \\ &= \left(\frac{\partial x_1}{\partial p_1}\bigg|_u\right)^{-1}\left[\frac{\partial x_1}{\partial p_2}\bigg|_y + \frac{\partial \hat{x}_1}{\partial Y}\ A^*_{p_2}\right] \end{aligned} \right.$$

which shares the indeterminacy in sign of $A^*_{p_2}$.

By Equation (21)

$$A^*_{yp_1} = \frac{\partial(\lambda^o/\hat{\lambda})}{\partial p_1} = \frac{\lambda^o}{\hat{\lambda}}\left[\frac{\partial \hat{x}_1}{\partial Y}\left(1 - \frac{\partial(p_1\gamma)}{\partial p_1}\right) - \frac{\partial x_1^o}{\partial Y}\right].$$

But by Equation (33), $(1 - \partial p_1\gamma/\partial p_1)$ is negative if $\partial x_1/\partial Y$ is everywhere positive, so that

$$(35)\qquad \left.\begin{aligned} A^*_{yp_1} &> 0 \\ A^*_{p_1p_1} &> 0 \end{aligned}\right\} \text{ if } \frac{\partial x_1}{\partial Y} \text{ is everywhere positive,}$$

while the sign patterns of derivatives with respect to p_2 are indeterminate. It is also interesting to consider proportional changes in p_1 without adjusting the Minimum Rent requirement. From Equation (14)

$$p_1'A^*_{p_1} = (1 - \gamma)r - \frac{\lambda^o}{\hat{\lambda}}\ p_1'x_1^o.$$

Since $r > p_1'x_1^o$, the critical factor is the relative size of $(1 - \gamma)$ and $(\lambda^o/\hat{\lambda})$, both of which are less than one. Unfortunately $(1 - \gamma)$ is smaller

than $(\lambda^o/\hat{\lambda})$. From Equations (23) and (19)

$$\frac{\partial(1-\gamma)}{\partial r} = \left[p_1'\left(\frac{\partial \hat{x}_1}{\partial p_1}\bigg|_u\right)p_1\right]^{-1} < 0$$

$$\frac{\partial(\lambda^o/\hat{\lambda})}{\partial r} = \left(\frac{\lambda^o}{\hat{\lambda}}\right)\left(\frac{\partial x_1'}{\partial Y}\, p_1\right)\left[p_1'\left(\frac{\partial \hat{x}_1}{\partial p_1}\bigg|_u\right)p_1\right]^{-1} < 0 \tag{36}$$

$$\frac{\partial(1-\gamma)}{\partial r} > \frac{\partial(\lambda^o/\hat{\lambda})}{\partial r} \quad \text{if } 1 < \left(\frac{\lambda^o}{\hat{\lambda}}\right)\left(\frac{\partial x_1'}{\partial Y}\, p_1\right).$$

But $(\lambda^o/\hat{\lambda})$ is less than one and if $(\partial x_2/\partial Y)$ is positive, $((\partial x_1'/\partial Y)p_1)$ is also less than one.

The quantity $(1-\gamma)r$ is the expenditure on housing valued at the support prices, $\hat{p}_1 = (1-\gamma)p_1$. Thus a sufficient condition for $p_1'A^*_{p_1} > 0$ is that the compensated price elasticity be larger than one in absolute value.

The effect of general price changes are impossible to predict without detailed definition of the form of the utility function. This is true even under general adjustment policies. Consider, for example, the policy that sets the Minimum Rent level by

$$\frac{dr}{r} = \frac{(dp_1)'x_1^o}{p_1'x_1^o}. \tag{37}$$

This policy includes adjustment of Equation (27) as a special case under $dp_1 = p_1$. Under such a policy,

$$A^*_{p_1} + A^*_r dr = (1-\gamma)\hat{x}_1 - \left(\frac{\lambda^o}{\hat{\lambda}} - \gamma\frac{r}{p_1'x_1^o}\right)x_1^o. \tag{38}$$

The coefficient of $\hat{x}_1$ is greater than the coefficient of x_1^o since

$$(1-\gamma) - \left(\frac{\lambda^o}{\hat{\lambda}} - \gamma\frac{r}{p_1'x_1^o}\right) = 1 + \gamma\left(\frac{r}{p_1'x_1^o} - 1\right) - \frac{\lambda^o}{\hat{\lambda}} > 0.$$

However, the sign pattern of $(\hat{x}_1 - x_1^o)$ is not generally known and hence $dp_1'(A^*_{p_1} + A^*_r dr)$ may have any sign.[1]

The real issue is not the general sign pattern of $A^*_{p_1}$ but the adjustment mechanism for "r." This is most immediately apparent in considering how the Minimum Rent requirement should vary across cities. Clearly a fixed dollar requirement will result in very different real housing requirements as p_1 varies. On the other hand, even a plausible adjustment mechanism such as that posed above in Equation (37) has obvious defects. In particular, if $\hat{x}_1 \neq x_1$, there will be sets of price changes that leave the index unchanged while substantially changing $p_1'\hat{x}_1$ and thus the effect of the Minimum Rent requirement, and similarly there will be sets of price changes that will change the index without affecting the value of $p_1'\hat{x}_1$.

These issues appear, however, to be better pursued in the context of aggregate models than in terms of individual behavior and will not be explored further in this appendix.

---

[1] Further conditions can be placed on the demand functions. If, for example, every component of the housing bundle is a compensated substitute for every component of x_2, then since

$$\left(\frac{\partial x_1}{\partial p_1}\bigg|_u\right)p_1 + \left(\frac{\partial x_1}{\partial p_2}\bigg|_u\right)p_2 = 0$$

by Theorem 2:

$$\left(\frac{\partial x_1}{\partial p_1}\bigg|_u\right)p_1 = -\left(\frac{\partial x_1}{\partial p_2}\bigg|_u\right)p_2 < 0$$

since

$$\frac{\partial \hat{x}_1}{\partial r} = \left(\frac{\partial x_1}{\partial p_1}\bigg|_u\right)\left(-p_1\right)\left(\frac{\partial Y}{\partial r}\right)$$

in this case, $\partial\hat{x}_1/\partial r > 0$ and $(\hat{x}_1 - x_1^o) > 0$. This will occur if the utility function can be written as $U[f(x_1), g(x_2)]$. But such additional assumptions seem unwarranted.

XVII.4 PARTICIPATION UNDER A MINIMUM STANDARDS HOUSING REQUIREMENT

Under a Minimum Standards housing requirement, eligible households are offered a payment, S, if they meet the condition

$$x_1 \geq e, \tag{39}$$

where x_1 is some subset of commodities (specifically a set of housing characteristics such as floor space, number of rooms, or the ratio of window area to floor area). As with minimum rent, the household will accept the offer if it can reach a higher level of utility by accepting--if the payment, S, is greater than the minimum payment needed to compensate it for meeting the Minimum Standards requirements. The rest of this section examines the value of this minimum payment (A*).

This section has two parts. The first establishes properties of the minimum payment (A*) function for Minimum Standards. The second compares Minimum Standards and Minimum Rent requirements.

Properties of a Minimum Standards Requirement

The principle ambiguity in establishing results for Minimum Standards arises from the fact that it is impossible to say which of the requirements will in fact be binding. In particular, as will be shown below, the fact that initial consumption is greater or less than the requirement for some single item does not imply anything about whether or not that requirement is binding. Thus for example a household may start with more rooms per person than is required by the standard. Faced with a requirement for higher quality rooms, it may well want to reduce the number of rooms below the standard. On the other hand, if size and quality were complementary, a household that failed to meet either requirement initially might, for example, elect to exceed the size requirement, given the quality requirement. These effects are matters of taste and stand apart from the apparent fact that high levels of certain features may only be available in combination with high levels of other features.

Although this ambiguity prevents completely general results, the following theorem covers a wide range of situations.

Theorem 7 (Minimum Standards). Let A^* be the minimum payment necessary to compensate a household for meeting a Minimum Standards condition ($x_1 \geq e$), then

$$A^* = A^*(e, p_1, p_2, Y)$$

where

e = the Minimum Standards

p_1 = the market prices of the constrained set

p_2 = the market prices of all other commodities

Y = money income

and if $e_i > x_i^o$ for some i,

a. $p_1'(e - x_1^o) > A^* > 0$

b. $A_e^* \geq 0$ with some positive element

c. $e_i > x_i^o$ is neither sufficient nor necessary for $A_{e_i}^* > 0$

d. A_{ee}^* is positive semi-definite and can be written as a positive definite matrix for elements that are binding[1] with zero entries for all other elements.

If, in addition, $\partial x_1/\partial Y > 0$ everywhere[2] for every element of the constraint, then

e. $-1 < A_Y^* < 0$

f. $A_{p_i}^* > 0$ if $e_i > x_i^o$ (sufficient)

g. $p'A_p^* > 0$ if $p_1'e > p_1'x_1^o$ (sufficient)

h. $A_{YY}^* > 0$ if $\partial^2 x_1/\partial Y^2 < 0$[2]

i. $\tilde{p}_1'(Ap_1p_1)\tilde{p}_1 > 0$ where $\tilde{p}_1$ and Ap_1p_1 are restricted to the subset for which the constraint is binding.[1]

The major thrusts of Theorem 7 are most easily seen in terms of proportional changes in the Minimum Standards requirements and the price of the housing items included in the list of requirements. For such shifts:

---

[1] As will be shown below, the relation of e_i and x_i^o does not imply anything about whether the i^{th} constraint is binding.

[2] Conditions on wealth derivatives are sufficient.

$$
(40)\qquad \begin{cases} \dfrac{\partial A^*}{\partial e} = e' A^*_e > 0 \text{ if } e \not< x_1^o \\ \dfrac{\partial A^*}{\partial Y} < 0 \text{ if } \dfrac{\partial x_1}{\partial Y} > 0 \text{ everywhere} \\ \dfrac{\partial A^*}{\partial p_1} = p_1' A^*_{p_1} > 0 \text{ if } \dfrac{\partial x_1}{\partial Y} > 0 \text{ everywhere and } p_1' e > p_1' x_1^o. \end{cases}
$$

These results are intuitively plausible. In essence, they say that a household will require a larger payment to agree to meet more stringent requirements and that if none of the components of x_1 is inferior, that is, if the household meets the requirements (or gets closer to meeting them) as income increases, then the amount of the required payment will decrease with income and increase with an increase in the market price of the required items.

As with Minimum Rent, A* is defined by

$$
(41)\qquad A^* = \hat{Y} - Y
$$

where

$$
(42)\qquad \hat{Y} = \underset{\{x\}}{\text{Min}}\ p_1' x_1 + p_2' x_2 \text{ s.t. } U(x_1, x_2) \geq \phi(p, Y),\ x_1 \geq e.
$$

Thus

$$
(43)\qquad \begin{cases} A^*_e = \beta \\ A^*_{p_1} = \hat{x}_1 - \hat{\eta}\lambda^o x_1^o \\ A^*_{p_2} = \hat{x}_2 - \hat{\eta}\lambda^o x_2^o \\ A^*_Y = \hat{\eta}\lambda^o - 1 \end{cases}
$$

where β is the vector of Lagrange multipliers for the condition $(x_1 \geq e)$, and $\hat{\eta}$ is the Lagrange multiplier for $(U \geq \phi)$.

The FOC for Equation (42) are

$$(44)\qquad \begin{cases} (p_1 - \beta) - \hat{\eta}U_{x_1} = 0 \\ p_2 - \hat{\eta}U_{x_2} = 0 \\ \hat{\eta}[U(x_1, x_2) - \phi] = 0 \\ \{\beta_i \delta_{ij}\}[x_i - e] = 0 \\ (\beta, \hat{\eta}) \geq 0. \end{cases}$$

These are the FOC for the Expenditure Dual, Equation (4), with $\hat{p}_1 = (p_1 - \beta)$. By Equations (44), each β_i is positive if $\hat{x}_{1i} = e_i$ and zero if $\hat{x}_{1i} > e_i$. Hence

$$(45)\qquad A_e^* = \beta \geq 0.$$

Note, however, that there is no necessary relation between whether a constraint is binding (and hence has $A_{e_i}^* > 0$) and whether it was initially met. The intuition of this is straightforward. Even though a requirement, say on x_i, is not met initially, if x_i is strongly complementary with other components whose levels must also be increased, the constraint may not bind once the other levels have been reached. Similarly, if the level of x_i originally exceeded the requirement, but x_i is a substitute for other components that must be increased, the constraint on x_i may become binding.

One interesting point is that if $(x_1 = e)$ gives some $\beta_i < 0$, the required A* will be reduced by allowing x_{1i} to exceed e_i. Thus, the efficiency of a housing allowance over direct construction may not only come from allowing the household to choose those features of the unit with which the government is not concerned, but also from allowing the household to exceed the government's requirements.

These facts may be proved as follows. If the Minimum Standards requirement is set at initial consumption $(e = x_i^o)$, then $\beta^o = 0$. The change in β necessary to support a change in x_1 exactly equal to de is given by

$$x_1[p_1 - \beta,\ p_2,\ \phi(p,\ Y)] = e$$

$$\frac{\partial \beta}{\partial e} = -\left(\frac{\partial x_1}{\partial p_1}\bigg|_u\right)^{-1}. \tag{46}$$

The only restriction on $(\partial\beta/\partial e)$ is that it be positive definite. This can be seen as follows. By Theorem 2, the only restriction on $(\partial x/\partial p|_u)$ is that it be negative semi-definite of rank $(n - 1)$, with $p'(\partial x/\partial p|_u) = 0$. It is obvious that the submatrix $(\partial x_1/\partial p_1|_u)$ must be negative definite (and hence $(\partial\beta/\partial e)$ be positive definite). Conversely, let $(\partial\beta/\partial e)$ be any positive definite matrix, and thus $(\partial x_1/\partial p_1|_u)$ any negative definite matrix. Extend $(\partial x_1/\partial p_1|_u)$ to a negative definite matrix, M, of rank $(n - 1)$. Then define

$$g = -\frac{M\tilde{p}}{p_n}$$

$$b = \left(\frac{1}{p_n}\right)^2 \tilde{p}'M\tilde{p} \tag{47}$$

$$\tilde{p} = (p_1, \ldots, p_{n-1}).$$

Then it is evident that

$$Z = \begin{pmatrix} M, & g \\ g', & b \end{pmatrix} \tag{48}$$

satisfies the conditions on $(\partial x/\partial p|_u)$.[1]

---

[1]The price vector, "p," is orthogonal to Z by construction. That Z is negative semi-definite can be seen as follows. Say that

$$Y'ZY > 0.$$

From Equation (47)

$$Y'ZY = \tilde{Y}'A\tilde{Y} - \frac{2\tilde{Y}'M\tilde{p}}{p_n} Y_n + \left(\frac{Y_n}{p_n}\right)^2 \tilde{p}'M\tilde{p}$$

where the first and last terms on the r.h.s. are negative by the negative definiteness of M. But then as Y_n goes to zero, $Y'ZY$ must become negative, hence by continuity, there is some Y_n^* such that

$$Z\begin{pmatrix} \tilde{Y} \\ Y_n^* \end{pmatrix} = 0.$$

But this implies

$$\tilde{Y} = \alpha\tilde{p}.$$

(footnote continued on next page)

Since the only restriction on $(\partial\beta/\partial e)$ is that it be positive definite, it is clear that there may exist a strictly positive change, de, such that

$$d\beta = \left(\frac{\partial\beta}{\partial e}\right)de$$

has some negative elements.[1] But this means that some elements of the requirement $(e = x_1^o + de)$ will not be binding even though $(e > x_1^o)$. Similarly, there must also be positive definite matrices that map a vector with negative elements into the positive orthant (for example, the inverse of one that maps a strictly positive vector into one with some negative elements). Thus we can also have $(\beta = d\beta > 0)$, every element of the constraint binding, even though some elements were original exceeded (i.e., $e = x_1^o + de$ has some elements less than x_{1i}^o).

Applying Equation (19) to A_y^* yields

$$A_y^* = -1 + (\lambda^o/\hat{\lambda}) = -1 + \exp\int_p^{\hat{p}_1} \frac{\partial x_1'}{\partial Y}\,dp. \tag{49}$$

Since

$$p_1 - \hat{p}_1 = \beta \geq 0,$$

then

$$A_y^* < 0 \text{ if } \frac{\partial x_1}{\partial Y} > 0 \text{ everywhere,} \tag{50}$$

that is, if every element of the Minimum Standards set is everywhere normal. This is a strong condition, since it applies to each component of x_1. It is obviously not necessary. It is not unreasonable in the large, however, to

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(footnote continued from previous page)
Thus

$$Y'ZY = (\tilde{p}'M\tilde{p})\left(\alpha^2 - 2\alpha\frac{Y_n}{p_n} + \left(\frac{Y_n}{p_n}\right)^2\right)$$

$$= (\tilde{p}'M\tilde{p})\left(\alpha - \frac{Y_n}{p_n}\right)^2 < 0$$

by a negative definite.

[1] Say that there is no such vector, de. Then every column of $(\partial\beta/\partial e)$ must be semi-positive, which is clearly not the case for every positive definite matrix.

assume that the requirements reflect "middle-class" tastes and generally are ones that will be met more closely as income increases.[1]

If the normality condition of Equation (50) is met, it also follows that

$$A^*_{p_i} > 0 \text{ for } e_i > x_i^o. \tag{51}$$

The condition $e_i > x_i^o$ is important, however. As discussed above, this is not equivalent to e_i being binding. It is not inconceivable that some element, x_i^o, is greater than e_i and is reduced to the minimum as other elements are increased.

The equalities in the derivatives are eliminated for proportional shifts. If $e \not\leq x_1^o$, then A* is positive and some element of β is positive. Thus proportional shifts in "e" always increase A*

$$e'A^*_e = e'\beta > 0. \tag{52}$$

Similarly, if the superiority condition is met, proportional shifts in p_1 increase A* if the cost of "e" is not less than initial housing expenditures (in effect, if "e" does not represent a lower level of the composite housing good defined by p_1)

$$\begin{aligned} p_1'A^*_{p_1} &= p_1'\hat{x}_1 - (\lambda^o/\hat{\lambda})(p_1'x_1^o) \\ &\geq p_1'e - (\lambda^o/\hat{\lambda})(p_1'x_1^o) > 0 \text{ for } p_1'e \geq p_1'x_1^o. \end{aligned} \tag{53}$$

As with Minimum Rent the sign pattern of $A^*_{p_2}$ is indeterminate without specifying the size of the substitution effect between x_1 and x_2.

---

[1] It would be desirable to find some price path for the integral in Equation (49) that would yield intuitively understandable conditions on the housing bundle as a whole. None is apparent, however. Proportional shifts in prices give terms in $(\partial x/\partial Y)'(p_0 - \hat{p}_1)$, where $(p_0 - \hat{p}_1)$ are not the prices supporting $(\partial x/\partial Y)$. Proportional expansion of "e" gives terms in $(\partial x/\partial Y)'(\partial \hat{x}_1/\partial \hat{p}_1|_u)^{-1}(e - x_1^o)$. It should be clear, however, from the discussion concerning $(\partial\beta/\partial e)$, following Equation (46), that this term may have any sign as long as $\partial x/\partial Y$ and $e - x_1^o$ are not proportional.

Given $\partial x/\partial Y$ and $e - x_1^o$ not proportional, select the orthonormal rotation Q that rotates them until the i^{th} element of each has the same or opposite sign as appropriate. Then set λ_i as large as necessary and $Q'(\lambda_i\delta_{ij})Q$ will be a $(\partial x_1/\partial p_1|_u)$ that gives the desired sign.

Ignoring the terms in p_2 (which are of indeterminate sign), the matrix of second order partials is given by

$$(54)\qquad \begin{cases} A^*_{ee} = \dfrac{\partial \beta}{\partial e}; \quad A^*_{e_{p_1}} = \dfrac{\partial \beta}{\partial p_1}; \quad A^*_{eY} = \dfrac{\partial \beta}{\partial Y} \\ A^*_{p_1 p_1} = \left(\dfrac{\partial x_1}{\partial p_1}\right) - x_1^o \left(\dfrac{\partial(\lambda^o/\hat{\lambda})}{\partial p_1}\right)' - \left(\dfrac{\lambda^o}{\hat{\lambda}}\right)\left(\left.\dfrac{\partial x_1}{\partial p_1}\right|_y\right); \\ A^*_{YY} = \dfrac{\partial(\lambda^o/\hat{\lambda})}{\partial Y}. \end{cases}$$

The terms of $d\beta$ are zero for components where $e_1 < \hat{x}_1$. For the other components, $d\beta$ is defined by[1]

$$(55)\qquad \hat{x}_1(p_1 - \beta, p_2, \phi(p - Y)) = e$$

$$(56)\qquad \begin{cases} \dfrac{\partial \beta}{\partial e} = -\left(\left.\dfrac{\partial \hat{x}_1}{\partial p_1}\right|_u\right)^{-1} \\ \dfrac{\partial \beta}{\partial p_1} = I - \left(\left.\dfrac{\partial \hat{x}_1}{\partial p_1}\right|_u\right)^{-1} \dfrac{\partial \hat{x}_1}{\partial Y}\left(\dfrac{\lambda^o}{\hat{\lambda}}\right) x_1^{o\prime} \\ \dfrac{\partial \beta}{\partial Y} = \left(\left.\dfrac{\partial x_1}{\partial p_1}\right|_u\right)^{-1} \dfrac{\partial \hat{x}_1}{\partial Y}\left(\dfrac{\lambda^o}{\hat{\lambda}}\right). \end{cases}$$

Thus $(\partial\beta/\partial e)$ is a positive semi-definite matrix so that

$$(57)\qquad \begin{cases} A^*_{e_1 e_i} \geq 0, \; A^*_{e_i e_j} \text{ of indeterminate sign} \\ e' A^*_{ee}\, e > 0. \end{cases}$$

---

[1] For components where e_1 is just binding, these expressions apply only to changes that increase β (e.g., nonnegative changes in "e").

The sign patterns of $(\partial\beta/\partial p_1)$ and $(\partial\beta/\partial Y)$ are indeterminate, even for proportional shifts (see the footnote following Equation (50)).

The term $(\partial(\lambda^o/\hat{\lambda})/\partial Y)$ is given, following Equation (25), by

$$(58)\qquad \begin{cases} A^*_{yy} = \dfrac{\partial}{\partial Y}\left(\lambda^o/\hat{\lambda}\right) \\ A^*_{yy} = \dfrac{\lambda^o}{\hat{\lambda}}\left[\left(\displaystyle\int_{p_1}^{\hat{p}_1} \frac{\partial^2 x_1'}{\partial Y}\, dp\right) + \frac{\partial \hat{x}_1'}{\partial Y}\,\frac{\partial \hat{p}_1}{\partial Y}\right]. \end{cases}$$

But

$$(59)\qquad \frac{\partial \hat{p}_1}{\partial Y} = \begin{cases} -\dfrac{\partial\beta}{\partial Y} \text{ for } \hat{x}_1 = e \\ 0 \text{ for } \hat{x}_1 > e \end{cases}$$

and

$$(60)\qquad -\frac{\partial \hat{x}_1'}{\partial Y}\,\frac{\partial\beta}{\partial Y} = -\left(\frac{\partial \hat{x}_1}{\partial Y}\right)'\left(\left.\frac{\partial \hat{x}_1}{\partial p_1}\right|_u\right)^{-1}\frac{\partial x_1}{\partial Y}\left(\frac{\lambda^o}{\hat{\lambda}}\right) > 0$$

since $(\partial \hat{x}_1/\partial p_1|_u)$ is negative definite. Thus

$$(61)\qquad A^*_{yy} > 0 \text{ if } \frac{\partial^2 x_1}{\partial Y^2} < 0 \text{ everywhere.}$$

Again, this is a strong condition, since it relates to each component.

The sign pattern on the price derivatives is unclear. If some of the $\hat{x}_{1i}$ exceed e_1, then β_i will not change for these components. Changes in p_{1i} for elements where $\hat{x}_{1i} > e_i$ are like changes in the prices of the unconstrained subset, and no sign can be established. Proportional changes in the prices of the effectively constrained subset do have a clear effect, however.

For $\hat{x}_i = e$, $\hat{p}_1 = (p_1 - \beta)$ and

$$(62)\qquad \begin{cases} \dfrac{\partial \hat{p}_1}{\partial p_1} = I - \dfrac{\partial\beta}{\partial p_1} \\ \qquad = \left(\left.\dfrac{\partial \hat{x}_1}{\partial p_1}\right|_u\right)^{-1}\dfrac{\partial \hat{x}_1}{\partial Y}\left(\dfrac{\lambda^o}{\hat{\lambda}}\right)x_1^{o\prime} \end{cases}$$

by Equation (56). Thus

$$
(63)\qquad
\left\{
\begin{aligned}
A^*_{p_1p_1} &= \left(\frac{\partial \hat{x}_1}{\partial p_1}\bigg|_u\right)\left(\frac{\partial \hat{p}_1}{\partial p_1}\right) - x_1^o\left(\frac{\lambda^o}{\hat{\lambda}}\right)\left[\frac{\partial \hat{x}_1'}{\partial Y}\left(\frac{\partial \hat{p}_1}{\partial p_1}\right) - \frac{\partial x_1^{o\prime}}{\partial Y}\right] \\
&\quad - \frac{\lambda^o}{\hat{\lambda}}\left(\frac{\partial x_1^o}{\partial p_1}\bigg|_u\right) = \frac{\partial \hat{x}_1}{\partial Y}\frac{\lambda^o}{\hat{\lambda}}x_1^{o\prime} \\
&\quad - x_1^o\left(\frac{\lambda^o}{\hat{\lambda}}\right)^2\left[\frac{\partial \hat{x}_1}{\partial Y}\left(\frac{\partial \hat{x}_1}{\partial p_1}\bigg|_u\right)^{-1}\frac{\partial x_1}{\partial Y}\right]x_1^{o\prime} \\
&\quad + \frac{\lambda^o}{\hat{\lambda}}\left(x_1^o\frac{\partial x_1^{o\prime}}{\partial Y} + \frac{\partial x_1^o}{\partial Y}x_1^{o\prime}\right) - \frac{\lambda^o}{\hat{\lambda}}\left(\frac{\partial x_1^o}{\partial p_1}\bigg|_u\right)
\end{aligned}
\right.
$$

and proportional shifts in these prices alone yield

$$
(64)\qquad p_1'A^*_{p_1p_1}p_1 > 0
$$

since $\partial x_1/\partial Y > 0$ lag assumption, and $(\partial x_1/\partial p_1|_u)$ is negative definite.

Comparison of Minimum Standards and Minimum Rent

It is clear from Section XVII.3 that a Minimum Rent requirement will never be exceeded unless the household exceeds it initially, that is

$$
(65)\qquad p_1'\hat{x}_1(r) = \text{Max}[r,\ p_1'x_1^o].
$$

By Equation (12), $\hat{x}_1$ is a minimum cost position. Hence if a given Minimum Standards requirement, "e," is not met by $\hat{x}_1$, an additional payment will be required to compensate the household for moving to "e." Thus

$$
(66)\qquad A^*(r = p_1'e) \leq A^*(e).
$$

In addition, the discussion above showed that

$$
(67)\qquad \hat{x}_1(e) \geq e
$$

so that

$$
(68)\qquad p_1'\hat{x}_1(e) \geq r = p_1'e,
$$

that is, expenditures under a Minimum Standards requirement may exceed the level required to just purchase the minimum bundle. It should also be clear, however, that this expenditure level would not necessarily lead the household to purchase "e" without the constraint. Thus

$$A^*(r = p_1'\hat{x}_1(e)) \leq A^*(e). \tag{69}$$

This establishes:

Theorem 8 (Comparison of Minimum Standards and Minimum Rent). Under the Minimum Rent requirement:

$$r - p_1'e$$

$$A^*(r) \leq A^*(e)$$

$$p_1'\hat{x}_1(r) = r \leq p_1'\hat{x}_1(e)$$

$$A^*(r) < A^*(e) \text{ if } r < p_1'\hat{x}_1(e).$$

Further

$$A^*(r = p_1'\hat{x}_1(e)) \leq A^*(e).$$

Comparisons cannot, of course, be established for derivatives under the two types of requirements. The relative effect of changes in income, prices, or requirement level will depend on whether the household, given expenditures, moves closer to or farther from the Minimum Standards vector.

XVII.5 SOME UNFINISHED BUSINESS: EXTENTIONS OF THE MODEL OF INDIVIDUAL BEHAVIOR

The preceeding sections have developed a more or less detailed theory of discrete choice in a timeless, frictionless world with perfect information and complete certainty, in which there are no disincentives to participation other than the housing requirements attached to the payment. The theory is detailed, though at times inconclusive, with respect to the effects of payment levels, housing requirements, prices, and household income. It allows for the existence of, but does not investigate, differences in taste due to other demographic factors such as household size. Nor does it yet really investigate the link between participation and other behavior.

This section briefly discusses these issues and indicates possible extensions of the model to deal with them.

Search and Moving Costs

One of the most striking misspecifications in the model of individual behavior presented in previous sections is the assumption that adjustments, and in particular moving or rehabilitation, cost nothing in themselves. In fact, finding and moving to a new dwelling unit may involve considerable costs in terms of time, money, and psychic dislocation. The existence of such transaction costs complicates the model of individual behavior in several ways.

Most obviously, the minimum payment necessary to compensate an individual for meeting housing requirements now is defined by

(69) $$S^* = A^* + M^*$$

where

A^* = the indifference payment defined in previous sections

M^* = compensation for moving.

Notice that M^* is zero for households that already meet requirements, or would normally have moved and met them (and hence do not have to be compensated for changing their housing). Further, one would expect that M^* would be different depending on whether or not requirements could readily be met by rehabilitation of the household's current unit as opposed to moving. In addition, to the extent that the costs of moving are costs of moving alone, as opposed to the costs of searching for a unit with particular characteristics, then any household that would have moved anyway will not need to be compensated for these pure moving costs. Further, moving costs may be incurred again at the end of the experiment if households expect to have to readjust their housing once the allowance payments end. Finally, M^* is a capital cost incurred in order to receive payments; if S^* is computed in monthly payments, then M^* is defined by

(70)
$$\sum_{1}^{T} \frac{M^*}{(1+r)^t} = C_M + \frac{C_T}{(1+r)^T}$$

$$M^* = \frac{r(1+r)^T}{(1+r)^T - 1} C_M + \frac{r}{(1+r)^T - 1} C_T$$

where

C_M = the cost of moving

C_T = the expected cost of moving at termination (possibly zero)

r = the individual discount rate

T = the number of months the individual will receive payments.

Thus M* increases over time as the household's remaining months in the program decrease.

On the other hand, to the extent that the moving costs reflected in M* are not monetary, they are income to the recipient,[1] and so will be at least partially offset by a reduction in A*. Thus the appropriate specification of Equation (69) is[2]

$$S^* = A^*(Y + \hat{M}^*) + M^* \tag{71}$$

where

$A^*(Y + \hat{M}^*)$ = the indifference compensation required at income $Y + \hat{M}^*$

$\hat{M}^*$ = the discounted nonmonetary moving costs (if they are positive)

M^* = discounted moving costs.

The purely financial costs of moving may not be large. The periodic interviews asked households that had moved how much it cost them to move.[3] While some households reported large costs, the vast majority (well over 90 percent in Phoenix and from 73 to 88 percent in Pittsburgh) reported costs of not more than $100 (see Table XVII-1). Using the formula given in Equation (70) and assuming a discount rate of 7 percent, 30 months remaining in the program and that the household does expect to have to move again at the

---

[1]Compensation for nonfinancial components of M* is not real income in the sense of making the household better off. On the other hand, having accepted the compensation, M*, the household then has to decide where to spend it.

[2]Note that since $-1 < A^*_Y < 0$, nonmonetary moving costs will only be partially offset.

[3]The exact question was: "Altogether, about how much did it cost you to move? Include things like wages lost because of moving, paying for someone to help you, or paying for a moving van."

Table XVII-1

HOUSEHOLD ESTIMATE OF THE COST OF MOVING

	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	PERCENTAGE ≤ $100	SAMPLE SIZE
			PITTSBURGH			
First Periodic Interview	$52	$53	0	$300	88%	(285)
Second Periodic Interview	58	63	0	500	85	(218)
Third Periodic Interview	85	109	0	1300	73	(301)
			PHOENIX			
First Periodic Interview	$16	$45	0	$800	98%	(603)
Second Periodic Interview	25	118	0	200	96	(409)
Third Periodic Interview	32	76	0	800	93	(495)

SAMPLE: Households that reported having moved since the previous interview.

DATA SOURCES: First, Second and Third Periodic Interviews.

end of the experiment, a hundred dollar cost for each move would require monthly payments of only nine dollars. These figures are admittedly only for households that did move. More importantly they do not include either psychic costs, search time, or the loss of lower rent levels associated with long tenure in one unit.[1]

In addition to these direct effects, the existence of substantial moving costs would suggest that individuals may not be in equilibrium when they receive the experimental offer. Thus on the one hand, the compensating payment (A*) may be different from that implied by equilibrium (a source of noise in estimating the relation between A* and income, prices, and so forth), and on the other hand, to the extent that the household is about to move anyway, the term M* would not enter.[2]

Furthermore, adjustment costs suggest that households will attempt to match their housing to some long run position, that the relevant independent variables are some sort of "permanent" income, household size, etcetera.[3]

In summary, the transaction costs associated with finding and moving to a new unit may mean that households will behave differently depending on whether

---

[1]Preliminary estimates of hedonic indices for the two sites estimate that households that have lived in the same unit for five to ten years pay almost 14 percent less rent in Pittsburgh and over 17 percent less rent in Phoenix than new tenants in comparable units. See Merrill (1976, p. 52).

It should be noted, however, that these reductions may not in fact reflect a tenure discount. If households with "good deals" tend to hold onto them, then proportionately more long-tenure households would have rents below market value and hence show a negative coefficient for tenure in hedonic regressions.

[2]Note that disequilibrium affects whether or not a household is willing to take up the offer in terms of moving. Once the household decides to move, the offer must still be better than the equilibrium position (as it would be if in combination with the disequilibrium position it leads a household to move).

[3]This is not the only reason why current income, in particular, may not be an appropriate variable. Considerations of smoothing lifetime consumption and uncertainty about future income also enter, complicated by less than perfect capital markets. No modeling of this is proposed. Various proxies such as average income or estimated (instrumentally) permanent income may be desirable, however.

or not they either do not have to move to meet program requirements or would have moved anyway.

It may be noted in passing that the theory of participation provides an obvious basis for a theory of mobility. The cost to a household of being out of equilibrium is defined by A*. Thus moving decisions in general could be characterized in terms of the present discounted value of moving costs and the cost of being out of equilibrium, $A_t^*(E = R_t)$. As will be shown in a later subsection, this implies, for example, that only under special restrictions can the cost of disequilibrium and hence mobility decisions be characterized in terms of the stream of $(R_t^* - R_t^A)$ or (R_t^*/R_t^A) when R_t^* are desired expenditures (in a frictionless world) and R_t^A are actual expenditures.

Shopping Behavior

One potentially important problem related to moving involves the effects of program offers on shopping behavior. It is apparent that information in rental markets is imperfect enough to allow at least some variation in housing prices. How much a household pays for a given type of unit is, therefore, dependent in part on luck and on the household's efforts in shopping for good deals.[1] Any housing requirement reduces the set of acceptable units and hence may change the average price that must be paid by tenants that move to find such units. This is most evident in the case of Minimum Rent requirements, which clearly eliminate good deals from among types of units with average rents near the Minimum Rent level, but it may apply to other requirements as well.

As a result, as noted in Chapter 4, the change in housing obtained in meeting some housing requirement may be less than proportional to the change in expenditures, making the program offer less attractive.[2]

Uncertainty

In general, individuals may be uncertain about the choices available to them, mistaken in their understanding of the choices, uncertain about their preferences with respect to the choices, and unable, having decided on a

[1] See Kennedy and Merrill (1979).

[2] For comparisons of real housing changes with changes in housing expenditures, see Kennedy and Merrill (1979) and Friedman and Weinberg (1978 and 1979).

course of action, perfectly to control or predict the actual outcome of the action. These phenomena are not well understood, and are not likely to be well modeled within the course of this analysis. The following paragraphs indicate standard ad hoc characterizations of the problems they present and suggest the nature of their impact on the analysis.

The first two uncertainties simply say that the observed variables characterizing an individual's situation will differ from the variables on which the individual makes decisions. Such errors in variable problems are well established in social science and dealt with in fairly standard, if ad hoc, ways. Indeed, as long as the problem involved is to predict behavior, given values of the erroneously measured observed variables, there is no problem at all; estimated effects may have a larger variance of estimate when based on erroneously measured independent variables, but are unbiased.

The real problem arises in inferring the effects of other variables. Thus, for example, if policy makers, as seems likely, are interested in the normal or average income composition of participants, it may be desirable to analyze participation in terms of normal (average, permanent) income over several years, incorporating the relationship of the true variables to this measure rather than, for example, income at enrollment. Similarly, to the extent that individuals' understanding of their situation improves over time, participation may change over time.

Uncertain preferences may be formally treated by assuming that the individual acts as if his preferences of the moment are certain. In this case, the random change in preferences over time can be treated formally in the same way as random differences in preferences across individuals. This is not unreasonable with regard to a notion of errors in judgment about tastes. It is unsatisfactory in that it does not attempt to structure individual uncertainty (by, for example, assuming that an individual is more uncertain about "distant" alternatives than near ones) and thus allow the individual to respond to his uncertainty.

Random outcomes of actions are another source of error in postulated relationships. Little comment is necessary. Unless there is reason to believe that the relation has some systematic component, little can be done unless intentions can be identified.

Other Disincentives to Participation

Participation in a housing allowance program is subject to a variety of factors common to all transfer programs, though differing in content from program to program. These may include the bother of reporting requirements, dislike of dependence, a feeling that others need assistance more than they do, lack of awareness of the program, and so forth. Participation in the Housing Allowance Demand Experiment had its own special features, including, for example, an extensive outreach program in which eligible households were contacted in person and unusual (in programs) reporting requirements such as monthly reports on income, rent, and household composition. Thus the minimum payment for participation now becomes

$$S^* = A^*(Y + \hat{M}^* + T^*) + M^* + T^* \tag{72}$$

where

A^* = the indifference compensation required at income $Y + M^* + T^*$

$\hat{M}^*$ = the discounted nonmonetary moving costs

M^* = the discounted total moving costs

T^* = the compensation to overcome other factors.

Notice that T^*, like $\hat{M}^*$, is partially offset by the reduction in A^* due to the income effect of T^*. Put another way, if T^* is large enough, it may effectively swamp the more systematic A^*.

Two issues arise with respect to T^*. First, to what extent can it be identified and thus separated from M^* and A^*? Second, to what extent can it be modified by changes in program procedures and, in particular, by dropping the special experimentally induced program reporting requirements?

With respect to the first issue, three groups may offer some partial information on T^*. Control households had to meet all program requirements except the housing requirements. Thus their participation may provide some information on T^*. Unfortunately, Control households, unlike Experimental households, were asked to enroll not only on the basis of the payment they received ($10 per month plus $25 for each of three interviews) but also on the basis of helping in a study of housing. In addition, although all participants were promised anonymity, Experimental households may have had to announce their participation in order to show that they could afford units. Thus the participation behavior of Control households may be different from that of Experimental households.

A second possible source of information on T* is Percent of Rent households. These households were offered a payment equal to some fraction of their rent, and were not required to meet any housing requirements. Thus their participation should reflect T* alone. The problem in estimating participation behavior for Percent of Rent households is that the payment they received depended not only on their pre-program rent but also on their ultimate rental expenditures given the payment. Thus estimates of T* in terms of demographic variables for these households will reflect not only differences in T* but also different propensities to move and change expenditures. Furthermore, to the extent that Percent of Rent payments do proceed from induced changes in housing expenditures, they are not strictly equivalent to a payment not tied to housing.

A third possible source of information about T* is Housing Gap households that remained in the experiment, meeting all requirements except the housing requirements. These households, like Control households, received $10 per month if they meet all reporting requirements. After two years, it may be reasonable to assume that they were no longer interested in participating in the program but did accept a modified Control offer.

The problem of sorting out the effects of individual program requirements, and especially the experimental-specific reporting requirements, on T* is more difficult. All households faced the same reporting requirements. Households were asked to rate the bothersomeness of various specific requirements. To the extent that these ratings can be interpreted as proxies for elements of T*, they may allow dollar valuation of individual requirements.

The problems involved in sorting out experimental and normal program factors in T* discussed in the previous paragraph, raise a more general issue concerning the extent to which experimental participation rates can be used to forecast participation in a normal program. Aware of the numerous peculiarities of the experimental outreach and enrollment procedures, the design of the Demand Experiment carefully disavows ability to forecast absolute levels of participation. Forecasts of absolute participation rates under alternative programs should probably be based on reasonably careful analysis of results from the Administrative Agency Experiment and Supply Experiment as well as the Demand Experiment.

Implications For Other Behavior

The conceptual framework of the participation model applies to other forms of behavior as well. In particular, there is a strong formal link between participation and initial housing position on the one hand and the response of participants in terms of changes in housing position on the other. This subsection briefly describes these links and some of the difficulties involved in exploiting them analytically. It appears, in general, that while these linkages among different behaviors do exist in theory and thus provide a potentially powerful analytic specification, their application in practice may be well beyond the range of theoretical development in the near future.

In terms of initial position, the individuals' demand function

(73) $$H = E(p, Y)$$

is defined by

(74) $$A^*(E, p, Y) = 0$$

where

H = the vector of housing consumption
E = the vector of housing requirements
p = the vector of commodity prices
Y = income.

This is not surprising, since both the demand function and A* are defined by and define the individual's preference ordering over commodities (up to a monotonic transformation). In terms of the response of participation, at least two groups may be distinguished in terms of whether or not households are in fact constrained by the housing requirements. If the household would meet the requirements in any case, then it will in theory follow its normal behavioral path, that is

(75) $$\hat{H} = H(Y + S, p) \text{ if } A^*(Y + S) \not> 0.$$

Other households are forced off their normal behavior

(76) $$\hat{H} = E > H((Y + S), p) \text{ if } A^*(Y + S) > 0.$$

These groups may be further divided by whether or not the household must move to participate, and indeed, if it does not have to move, whether the returns to moving exceed M*.

Despite these formal links, however, explicit connections between demand functions and A* are difficult to develop. The expressions for the derivatives of A* developed in previous sections of this report are not readily interpretable in terms of demand functions, nor are there apparently simple conditions to translate A*(E, p, Y) into A*(E, H(p, Y)).[1]

XVII.6 AGGREGATE BEHAVIOR

The previous sections have discussed individual household response to a housing allowance. This section develops a model of aggregate behavior based on the distribution of individual responses. It thus lays the foundation for empirical estimation and the application of the theory of individual behavior to the design of alternative programs. The section has two parts. The first part develops a general model connecting individual and aggregate behavior. The second discusses some key assumptions necessary to allow inferences about aggregate behavior from the information on individual behavior developed in Sections XVII.2 through XVII.4 above.

Aggregate Behavior

This subsection first considers a model based solely on the pure compensation costs (A*) discussed in Sections XVII.2 through XVII.4 and then briefly examines the complications introduced by notions of moving costs and general bother costs discussed in Section XVII.5. Consider a group of individuals with the same income, household size, and other demographic characteristics facing a common set of prices. If tastes vary across individuals (as evidenced, for example, by varying levels of expenditure on housing by otherwise similar households), then the A* level for each household, the minimum payment at which the household will agree to participate in a program with a given housing requirement, will also vary.

Let it be assumed that the distribution of A* can be derived from the distribution of $\hat{U}$ by

$$F(S;\ E,\ Y,\ p,\ D) = \text{Prob}(A^* < S \mid E,\ Y,\ p,\ D) \tag{77}$$

---

[1] Exact conditions have not yet been established, but they are restrictive. A* as a function of E and H(p, Y), for example, requires that the ratio of $\partial H/\partial p$ and $\partial H/\partial Y$ be constant along an indifference curve. Similarly, $A^*(E - H_0)$ requires, among other things, that the compensated demand curves are linear in prices.

where

E = the housing requirement

Y = household income

p = the vector of prices

D = a vector of demographic characteristics

and the probability is the size of the subset of U for which:

(78) $A^*(E, Y, p) < S$

relative to the size of the admissible set, given D.[1] The distribution of Equation (77) is conditional on a given income, price, and so forth for every household. Thus, for example in

(79) $$\pi(S; E, Y, p, D) = \int_{-\infty}^{S} f(A^*; E, Y, p, D)dA^*.$$

π is the participation rate for a group of households with identical incomes and demographic characteristics, facing a common set of prices, and each offered the same dollar payment, S, subject to the same housing requirement, E.

The distribution of f(A*) is not empirically convenient. A* is necessarily nonnegative. Furthermore, every household that meets the housing requirements will have A* equal to zero. Thus, the distribution of A* as presently defined cannot be described by any continuously differentiable distribution. A* can, however, be redefined so that it does not accumulate at zero.

Consider first a Minimum Rent requirement. Households accumulate at (A* = 0) because they are allowed to exceed to Minimum Rent level. But A* could be more generally defined in terms of the compensation necessary to induce a household to spend more or less on housing than it desires, that is, in terms of the requirement.

(80) $$p_1'x_1 = r.$$

A* will, however, still be nonnegative, since the household will, by definition, be worse off out of equilibrium. Likewise, the signs of derivatives are reversed when $(p_1'x_1^o > r)$; increasing "r," for example, brings such a household closer to equilibrium and reduces the compensation required.

[1] Note that the distribution of U, the preference ordering, may include a stochastic distribution of U associated with each individual. Thus individual behavior may also be stochastic.

The obvious redefinition of A* for a Minimum Rent condition is, therefore:

$\hat{A}^*$ = the minimum payment necessary to compensate a household for spending $r = p_1'x_1$

$$A^* = \begin{cases} \hat{A}^* \text{ if } r \geq p_1'x_1^o \\ -\hat{A}^* \text{ if } r \leq p_1'x_1^o. \end{cases} \tag{81}$$

All of the theorems of Sections XVII.2 and XVII.3 hold for A* as defined by Equation (81).

The A* distribution for a Minimum Standards requirement can be similarly redefined. Unlike Minimum Rent, however, the Minimum Standards requirement cannot be posed in terms of $(x_1 = e)$. Households that do not meet a Minimum Rent requirement will never exceed the requirement, so that

$$A^*(p_1'x_1 = r) = A^*(p_1'x_1 \geq r),\ p_1x_1^o \geq r. \tag{82}$$

As was discussed in Section XVII.4, however, it is possible that

$$A^*(x_1 = e) > A^*(x_1 \geq e) \tag{83}$$

even if $(x_1^o < e)$.[1] Thus an equality requirement would shift the A* distribution for Minimum Standards. The appropriate redefinition of A* for Minimum Standards is given by

$$A^* = \begin{cases} A^* \text{ necessary to compensate } x_1 \geq e \text{ if } x_1^o \not> e \\ -A^* \text{ necessary to compensate } x_1 \leq e \text{ if } x_1^o \geq e. \end{cases} \tag{84}$$

These redefinitions spread A* so that its distribution can be continuously differentiable, though still bounded.[2]

Estimation of Equation (79) can yield not only estimates of participation rates but also at least partial information on the change in housing that will result from the program and net benefits in terms of the income equivalence of the offer.

Participation rates for the population as a whole and marginal rates for

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[1] See the discussion following Equation (45).

[2] In fact, many empirically tractable forms will be unbounded. This sort of misspecification is common, however, and may not be serious.

various subgroups follow from

$$\pi^* = \int_{(p,Y,D)} \int \pi\left[S(p, Y, D), E, Y, p, D\right] g(p, Y, D) \tag{85}$$

where π^* is the participation rate for the population as a whole. Responses of participating households depend critically upon whether or not they are in fact constrained by the housing requirement, that is

$$\hat{x}_1 = \begin{cases} x_1(Y + S) \text{ if } x_1(Y + S) \text{ satisfies } E \\ x_1(E) \text{ if } x_1(Y + S) \text{ does not satisfy } E \end{cases} \tag{86}$$

But households for which $x_1(Y + S)$ satisfies E will also have $A^*(Y + S)$ nonpositive. Thus the proportion of participants that will exceed the requirement (for whom the requirements are not binding) is given by

$$m = \frac{\pi^*(S = 0;\ Y = Y + S,\ D,\ E,\ p)}{\pi^*(S;\ Y,\ D,\ E,\ p)} \tag{87}$$

where the arguments of π^* are distributions as in Equation (84).

The net benefit for any individual from participating is given by $\hat{S}$, where $\hat{S}$ is defined by

$$\begin{aligned} &\hat{S} = S \text{ if } A^*(Y + S) \leq 0 \\ &A^*(Y + \hat{S}) = S - \hat{S}, \text{ if } A^*(Y + S) > 0. \end{aligned} \tag{88}$$

Thus $\hat{S}$ is the excess of S over A^* after A^* has been adjusted to take account of the additional real income from the payment (net of compensation for meeting the housing requirement). Thus, lower and upper bounds on the mean value of $\hat{S}$ for any group of participants are given by

$$\begin{aligned} \underline{B} &= E(S) - E(A^*(Y)) \\ \overline{B} &= E(S) - E(A^*(Y + S)). \end{aligned} \tag{89}$$

These can be further refined by noting that B is equal to S where $A^*(Y + S)$ is less than or equal to zero. Thus closer approximations will be provided by

$$\underline{B}^* = E(S) - E[A^*(Y) \,|\, \text{for } A^*(Y + S) > 0]$$

(90)

$$\bar{B}^* = E(S) - E[A^*(Y + S) \,|\, \text{for } A^*(Y + S) > 0].$$

Section XVII.4 suggested that the participation decision could not be reasonably characterized simply in terms of pure compensation for disequilibrium (A*) and that there were also both general variations in the propensity to participate in any program and variations in transactions (moving or rehabilitation) costs. As discussed below, these factors may seriously undermine the aggregate model presented above and suggest that prior information on the probability of meeting requirements in the absence of the experimental program and the probability of moving may be desirable for an adequate specification of the participation decision.

Consider first the compensation required to participate in any program over and above the additional compensation required to induce the household to meet the housing requirements. This was symbolized by T* in Section XVII.4 and S* rewritten

$$S^* = A^*(Y + T^*) + T^*. \tag{91}$$

Equation (91) cannot, however, apply if A* is redefined as above; negative values of A* are definitional and would not affect positive values of T*. Indeed, even under the original definition of A*, negative values of T* will not enter the argument of A*, since the payment to participate is not actually made. Thus, if T* and A* are independently distributed, the appropriate expression for the participation rate would be

$$\int_{-\infty}^{0} [g(T^*) \int_{-\infty}^{S-T^*} f(A^*;Y)dA^*]dT^* + \int_{-\infty}^{S} [g(T^*) \int_{-\infty}^{S-T^*} f(A^*;Y + T^*)dA^*]dT^*. \tag{92}$$

This is a reasonably cumbersome expression. It suggests that the model might be profitably expressed in terms of the probability of participating if the household would meet the requirements in the absence of the experiment ($A^*(Y) \leq 0$) and the probability of participating if the household

would not meet requirement.[1] In any case, unless T* is relatively small, direct estimation of the participation model will not necessarily provide estimates of the proportion of participants as would normally meet the housing requirements in the absence of the experiment.

Transactions costs present a more complicated problem. Most obviously, they only arise when A* is positive, and then only when the household would move. Thus, the effects on the distribution of A* of changes in housing requirements, prices, or income are confounded with changes in the probability of moving and of having to move to meet requirement. More generally, to the extent that transactions costs lead households to maintain nonequilibrium positions in the absence of the experiment, they further confuse the appropriate value of A*.

The next section discusses further assumptions concerning the nature of the connection between $g(U)$ and $f(S^*)$ which allow inferences concerning aggregate behavior to be drawn from individual behavior.

Connections Between Aggregate and Individual Behavior

Having redefined S* to obtain a more convenient distribution, further assumptions must be made before the results for individuals can be used to establish results for aggregate behavior. Consider, for example, the problem of predicting:

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[1] The probability of participating for households that would meet requirements in the absence of the experiment is simply the probability that T* is less than S. For other households, the distribution of A* + T* may be expressed in several different ways. For example, if T* is redefined by

$$S^* = A^*(Y) + \hat{T}^*$$

then the distribution of $\hat{T}^*$ will vary when A* is positive and T* is positive, since then

$$\frac{\partial S^*}{\partial T^*} = A^*_Y + 1 = \lambda/\hat{\lambda} < 1.$$

Thus the variance of $\hat{T}^*$ will, if T* is independent of A*, be smaller than the variance of T* and since $A^*_{YY} > 0$ will tend to increase as income increases.

$$(93) \qquad \frac{\partial \pi}{\partial \theta} = f(S;\ E,\ Y,\ p,\ D)\frac{\partial S}{\partial \theta} + \int_{-\infty}^{S} \frac{\partial f(S^*;\ E,\ Y,\ p,\ D)}{\partial \theta}$$

where θ is some relevant variable. The individual theory of Sections XVII.2 through XVII.4 gives only limited information about the last term of Equation (93). If tastes vary with θ in an unknown way, then the distribution of S^* will shift in an unknown way. Thus the first critical assumption necessary to infer aggregate from individual behavior is

> Assumption 1 (Independence of Tastes). The distribution of preference orderings for a given demographic group, D, is independent of prices, housing requirements, and income.

Prices, housing requirements, and income are specified because these are the variables for which individual behavior was established. Notice also that the validity of the assumption may depend on the exact set of characteristics included in the set of demographic descriptors, D.

For income, this assumption requires, among other things, that all preference orderings be separable in terms of income-related elements such as work-leisure decisions and consumption decisions, so that different work-leisure decisions do not systematically change the preference ordering over consumption goods.[1]

If, in addition, higher income households have fundamentally different tastes due to upbringing, education or whatever, these must, of course, be explicitly controlled for. Such problems are probably less severe within the restricted income range relevant to housing allowances but might most obviously arise with respect to racial or ethnic background, size of household, and sex of head of household.

A similar issue arises with respect to the level of housing requirements. The level of housing requirement is a control variable and so is independent of tastes except that it is often varied with household size and hence may be correlated with tastes in this way.

These issues simply guide the appropriate choice of elements for inclusion in the set of demographic descriptors, D.

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[1] There is no requirement that the allocation of expenditures be independent, only that the preference ordering be independent. Hence the leisure and consumption branches do not need to be homothetic.

Even if tastes are independent of θ (given the value of D), individual theory only provides information about the mean value of $f(S^*)$ and not about other moments. The distribution of $f(S^*)$ is assumed to arise from some underlying distribution of tastes. If tastes are independent of θ, then

$$\mu = \int_u S^*(u, \theta) g(u) du$$

$$\frac{\partial \mu}{\partial \theta} = \int \frac{\partial S^*}{\partial \theta} g(u) du. \tag{94}$$

Thus the change in the mean value of S^* is the mean of the individual changes in S^*. Results for derivatives of S^* will carry over to the value of S^*.

On the other hand, the change in the variance of S^* is given by

$$\sigma^2 = \int_u (S^* - \mu)^2 g(u) du$$

$$\frac{\partial \sigma^2}{\partial \theta} = 2 \int_u (S^* - \mu) \left(\frac{\partial S^*}{\partial \theta} - \frac{\partial \mu}{\partial \theta}\right) g(u) \tag{95}$$

and depend on the covariance across tastes of S^* and $\partial S^*/\partial \theta$. Thus no inference about higher order moments is possible without some information on the distribution of tastes.

Relatively strong inferences can be made from individual to aggregate behavior if distributions are fixed except for the first moment, this is, if

> Assumption 2 (Dominance of Mean Effects). The distribution of $(S^* - \mu)$ is fixed.

Most obviously, since the effect of any variable on the mean of S^* is the mean of the individual effects, all the theorems of Sections XVII.2 through XVII.4 apply to the mean, and thus under Assumption 2, directly to aggregate behavior.

While such assumptions provide formal connection between the deterministic models of the previous sections and stochastic behavior, whether individual or aggregate, it should be clear that the connection is relatively unexplored

and incomplete. The connection between deterministic and stochastic behavior proposed here seems relatively vulnerable on at least three grounds.

First, in purely formal terms, the reasoning slides too readily from notions based on a countable number of individual preference orderings to a continuous distribution of preference orderings. Thus, for example, the content of Assumption 2 is not clear, especially in connection with specific distributions. Say, for example, that $f(S^*)$ is any two parameter distribution, for example the normal or logistic distribution. Then

$$\pi = \int_{-\infty}^{\frac{S-\mu}{\sigma}} h(t) \tag{96}$$

where $h(t)$ is the unit normal (or logistic) distribution, and

$$\left.\frac{\partial \pi}{\partial \theta}\right|_S = -\left(\frac{1}{\sigma}\right) h\left(\frac{S-\mu}{\sigma}\right)\left[\frac{\partial \mu}{\partial \theta} + \left(\frac{S-\mu}{\sigma}\right)\frac{\partial \sigma}{\partial \theta}\right]. \tag{97}$$

Thus the sign of $(\partial \pi/\partial \theta)$ will be determined by $(\partial \sigma/\partial \theta)$ as well as $(\partial \mu/\partial \theta)$ and for extreme values of S, dominated by $(\partial \sigma/\partial \theta)$. On the other hand, this result seems counter-intuitive. If, under Equation (77), the S^* associated with every preference ordering increases, for example, the proportion of preference orderings for which $(S^* < S)$ cannot increase. This would apparently imply that under the conditions of Equation (96), $(\partial \sigma/\partial \theta)$ must be zero.

It may be worthwhile to consider the implications of such reasoning for estimating demand functions. Say that there is some distribution of preference orderings $f(u)$, and say that for every admissible preference ordering some good, "x," is superior $(\partial x/\partial Y > 0)$. Then clearly if preference orderings are distributed independently of income, the mean value of "x" is also superior, and the variance may change in an unknown way as income changes. On the other hand, the proportion of individuals consuming "x" in excess of some fixed level, $\bar{x}$, cannot decrease as income increases. But by Equation (97) if we also assume that "x" is normally distributed, the variance must be constant and the regression of "x" on income homoskedastic with respect to income.

It is difficult to know how seriously to take this conclusion. The reasoning proceeds from intuition based on a countable number of individuals to continuous distributions. It does suggest that the connection between g(u) and f(S*) should be investigated more closely.

In addition, the model itself is unduly restrictive on at least two grounds. First, all uncertainty is loaded onto stochastic preferences. There is no uncertainty about the objective elements of choice. While at some level of generality there may be no meaningful distinction between uncertain objective facts and uncertain preferences, this restriction is of special concern given the model's second failure--the lack of any real investigation of individual choice in the face of uncertainty. The individual is assumed to act on each moment's tastes (or perhaps the mean of his/her tastes) without regard to their volatility.

These weaknesses are not only important for modeling participation. The major intellectual drive behind the models developed here is an attempt to integrate the participation decision with other elements of demand theory, most notably, the demand for housing. Yet as the model stands, there are few explicit links between the two. This is partly no doubt due to the usual problems of linking utility and demand functions in the large, but it also may rest on the lack of explicit mechanisms connecting individual and aggregate behavior.

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