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David Scott Lindsay
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HOUSING ASSISTANCE SUPPLY EXPERIMENT

A RAND NOTE

This Note was prepared for the Office of Policy Development and Research, U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, under Contract No. H-1789. Its views and conclusions do not necessarily reflect the opinions or policies of the sponsoring agency.

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PREFACE

This note was prepared for the Office of Policy Development and Research, U.S. Department of Housing and Urban Development. It reports an analysis of rent changes in St. Joseph County, Indiana, during the first three years of an experimental housing allowance program conducted there under Rand's supervision. Preliminary estimates from this study were used to adjust benefit levels for program participants in January 1980; the final estimates are reported here and compared with the preliminary ones.

The authors of this report worked on it at different times. As a resident consultant to Rand during the spring and summer of 1979, David Scott Lindsay formulated the general analytical model, assembled the data file, and generated the preliminary estimates of rent inflation that were used to revise program benefit levels. In October 1979, Lindsay left Rand to join the National Economic Research Associates in New York. Subsequently, Ira S. Lowry, principal investigator for the Housing Assistance Supply Experiment, became interested in Lindsay's findings concerning the allowance program's effect on rents, and reanalyzed the data to test those findings. As a result of reanalysis, the findings on program effects were considerably amplified, and all estimates of rent inflation were slightly revised, necessitating a redraft of the report. The current text and tables, though borrowing substantially from Lindsay's draft, reflect Lowry's reanalysis and interpretation.

Others at Rand contributed to the research and the preparation of the report. James P. Stucker's analysis of rent changes in Brown County, Wisconsin, the other experimental site for the allowance program, provided guidance for Lindsay's specification of the general rent-inflation model.* Daniel A. Relles contributed to model specification and helped with statistical computing. C. Lance Barnett, Wayne D.

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*James P. Stucker, *Rent Inflation in Brown County, Wisconsin: 1973-78*, The Rand Corporation, WN-10073-HUD, August 1978.

Perry, and C. Peter Rydell advised on analytical methods and exposition. Robert Young programmed file construction and ran many of the early statistical analyses. During the reanalysis, Relles worked directly with Lowry to devise diagnostics, respecify the model, improve the data set, and run the final statistical analyses. W. Eugene Rizor reviewed the programmatic sections of the note; Relles reviewed the model specification and statistical reporting; and Rydell reviewed the entire document. Donna Betancourt prepared the machine-formatted tables in this note; Gwen Shepherdson prepared the other tables and typescript. Jane Abelson edited the note and supervised its production.

This note was prepared pursuant to HUD Contract H-1789, Task 2.16.2.

SUMMARY

The experimental housing allowance program in St. Joseph County bases its payments to participants partly on the marketwide "standard cost of adequate housing." The schedule of standard costs (by size of dwelling) has been revised several times to compensate for inflation. This study was undertaken to assist the fourth such revision since the program began early in 1975.

The study's principal purpose was to estimate how much gross rents in St. Joseph County changed during the 45-month interval (November 1974 to July 1978) spanned by the Housing Assistance Supply Experiment's annual surveys of rental properties. A secondary purpose was to determine whether the allowance program itself was contributing significantly to rent inflation. If so, a compensatory increase in allowances might cause rents to rise further.

The data base consisted of 2,439 rent-change observations on 1,412 rental dwellings, each observation spanning the interval between successive interviews with the dwelling's occupants. Multiple regression techniques were used to estimate the influence of calendar time, dwelling size, property type and location, occupancy change, and occupancy by program participants on the annual rates of change in both gross and contract rents. The estimated parameters of this rent inflation model were applied to a detailed representation of the county's rental housing stock to estimate marketwide average rates of change.

RENT INFLATION, 1974-78

Between November 1974 and July 1978, gross rents in St. Joseph County increased by 23.2 percent, or at an average annual rate of 5.7 percent. About 70 percent of the observed increase is attributable to rising fuel prices, either paid directly by tenants or paid by landlords and added to contract rent. Because contract rent does not include all fuel costs, it rose less rapidly (4.4 percent annually) than did gross rent. Nonfuel operating costs also rose, with the result

that the average cash operating return on rental property appears to have decreased slightly.

Considering both the direct and collateral evidence, we conclude that marketwide rent increases in St. Joseph County were driven by the rising cost of supplying rental housing services, rather than by excess demand for such services. The amounts and timing of the rent increases and the apparent decline in cash operating return all support this conclusion.

The rate of increase in gross rents varied in different sectors of the market. It was greater for very small and very large dwellings than for dwellings with three or four rooms, which comprise the bulk of the rental stock. In general, gross rents rose more for low-rent dwellings, single-family houses, and rural dwellings than for their opposites. Tenant turnover was a common occasion for rent increases.

PROGRAM EFFECTS

Since April 1975, the St. Joseph County Housing Allowance Office has distributed cash payments to low-income families to help them with their housing expenses. In September 1978, about 17 percent of all renters in the county were enrolled in the program, and about 12 percent were then receiving monthly payments totaling $185,000, or 6 percent of the countywide rent bill. Allowance-stimulated demand for housing could have caused some of the observed rent inflation.

Rents of dwellings occupied by program participants did increase more than other rents, by about 2.0 percentage points (in central South Bend, 2.6 percentage points) annually over the 3.75-year period of observation. However, this participation premium does not seem to be cumulative. Rather, when a tenant joins the program, or when a participant moves into a dwelling formerly occupied by nonparticipants, a one-time surcharge of 3 to 4 percent is imposed. Thereafter, the rate of rent increase is approximately "normal."

Only part of the participation premium is a price increase. About a third of all renters who enroll in the program arrange repairs for their dwellings in order to qualify for payments. Such repaired

dwellings have larger average rent increases than initially acceptable dwellings. In those cases, part of the rent increase is payment for improved housing.

Spillover effects on nonparticipants' dwellings are evident only in central South Bend, where participants are numerous. Controlling on participation status, we find that gross rents on most types of dwellings increased faster in central South Bend than elsewhere in the county during 1974-75, when the allowance program began enrollment. However, the differential subsequently decreased or reversed; by 1978, the rates of rent increase were generally lower in central South Bend than elsewhere. Over the 3.75-year period, the average gross rent in central South Bend increased at about the same rate as in the rest of the county.

We conclude that raising allowance entitlements to compensate for past rent inflation is unlikely to cause further rent inflation. Collateral evidence indicates that allowances do not generate much extra housing demand through their income effects. Direct evidence from this study indicates that although participants' landlords impose small initial surcharges (partly to pay for program-required repairs), the rate of rent increase subsequently returns to "normal." In the program's first year, there seem to have been some spillover effects on nonparticipants' rents, but only in central South Bend, and not for long.

PRELIMINARY AND REVISED ESTIMATES OF RENT INFLATION

Preliminary estimates of rent inflation from this study, available in October 1979, were used by Rand's Field and Program Operations Group (FPOG) and the St. Joseph County Housing Allowance Office (HAO) in their revision of the HAO's schedule of the standard cost of adequate housing, which was approved by HUD and became effective in January 1980.

Subsequent reanalysis indicates that the preliminary figures slightly underestimated the annual marketwide inflation rate. Cumulative inflation since the first schedule of standard costs was compiled was further underestimated by the FPOG-HAO team because of a technical error in dating the initial schedule. Whereas the approved schedule

revision reflects an estimated rent increase of 36.8 percent over 60 months, we now think that a more appropriate figure would be 41.0 percent over 63 months. Had the latter figures been used in schedule revisions, payments in January 1980 would have been increased by an average of 3.5 percent. This underadjustment can be corrected by the HAO in the course of its next schedule revision.

CONTENTS

TABLES

I. INTRODUCTION

The experimental housing allowance program operated since December 1974 by the St. Joseph County Housing Allowance Office (HAO) offers monthly cash payments to low-income households so that they can afford adequate housing.* A participant's allowance entitlement reflects household size and income and "the standard cost of adequate housing." The initial schedule of standard costs, varying with household size, was based on a survey of the local housing market conducted by Rand in August 1974.

Since then, contract rents and home operating expenses have risen sharply. To compensate for those price increases, the HAO has periodically revised the schedule of standard costs from which allowance entitlements are calculated. Rand has participated in these revisions by analyzing market data gathered in annual household surveys and by working with HAO staff to develop equitable recommendations for schedule changes, which must be approved by the funding agency, the U.S. Department of Housing and Urban Development (HUD).

The main text of this note reports an analysis of rent inflation in St. Joseph County tnat provided the empirical basis for the fourth such schedule revision.** Appendix A reproduces a supplementary analysis and recommendations that were submitted to HUD. We have separated the recommendations from the rent-inflation analysis for several reasons:

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*Identical allowance programs are operated in Brown County, Wisconsin, and St. Joseph County, Indiana, as part of the Housing Assistance Supply Experiment (HASE). The experiment is designed to test the effect of a fullscale (open enrollment) program on the housing market in which it operates. Both renters and homeowners are eligible to participate. For details of program design and operating history, see *Sixth Annual Report of the Housing Assistance Supply Experiment*, The Rand Corporation, R-2544-HUD, May 1980.

**The schedule promulgated in December 1974 (when enrollment began) was revised in September 1976, September 1977, and January 1979; the revision recommended in Appendix A of this report became effective in January 1980.

- The rent-inflation analysis is based on records of four annual surveys of renter households in St. Joseph County which provide data spanning the period November 1974 through July 1978. The data were assembled and analyzed by one of the present authors (Lindsay) during the summer of 1979; findings were reported to the HAO and Rand's Field and Program Operations Group (FPOG), who collaborated on the recommendations that were submitted to HUD in October 1979.
- Because the final market survey was conducted in 1978, the recommendations for schedule revision necessarily go beyond those data. In fact, the HAO and FPOG jointly devised a method for estimating rent inflation in the program's remaining years without the aid of marketwide surveys. They used this occasion to test the method for the period during which survey data were available, and to extend the estimates through November 1979.
- Following the submission of those recommendations, certain anomalies in the survey-based rent-inflation findings led to reanalysis of the data. The reanalysis yielded additional information about the causes of the observed rent inflation, but also gave slightly higher estimates of the 1974-78 inflation rates than were used by the HAO-FPOG team to prepare their recommendations. The main text of this document reports the results of the reanalysis, while Appendix A is based on the initial analysis. Practically speaking, the differences are trivial; and it seemed inappropriate to retrospectively change the recommendations in order to achieve consistency.

The remainder of this introduction explains how housing costs enter the allowance entitlement formula, how the initial schedule of standard costs was derived, and how the schedule was subsequently revised. Section II explains the methods and data we used to estimate rent inflation for the period covered by our household surveys,

November 1974 through July 1978. Section III reports the principal findings from the survey data and interprets them in the light of collateral evidence. Section IV examines whether the allowance program itself might be responsible for some part of the observed marketwide rent increase; if so, increasing the benefits to participants might induce further rent inflation, an undesirable outcome. Section V summarizes the empirical findings and our interpretation of them.

HOUSING ALLOWANCE PAYMENT FORMULA

Households entitled to assistance under the experimental program include all those whose incomes are inadequate to support a specified standard of housing consumption, so long as they actually occupy housing that meets the standard. Participants may be renters or homeowners, and the quality of their housing is evaluated annually by the HAO.

The assistance formula postulates that any household, whatever its size or composition, can pay 25 percent of its adjusted gross income for housing. The difference between that amount and the standard cost of adequate housing in St. Joseph County is paid monthly by the HAO to all enrolled households whose housing meets program standards. The formula for a household consisting of n persons is

$$A_n = R^*_n - .25Y,$$

where A = the amount of the monthly allowance payment,

R^* = the monthly standard cost of adequate housing, including fuel and utilities,

Y = adjusted gross income per month, the adjustments reflecting exemptions and deductions specified by statute or program regulations.

As can be seen from the formula, an increase or decrease in R^* has a dollar-for-dollar effect on the amount of the allowances for all participants, regardless of their incomes. It also affects the income limit ($4R^*$) for participation in the program.

Note also that the amount of the allowance payment does not in general depend on the participant's actual housing expenditure, except that program regulations prohibit payments exceeding that expenditure. A household that finds certifiable housing costing less than R^* receives exactly the same payment as an otherwise similar household spending more than R^*. That arrangement is intended both to allow each household to adapt its housing consumption to its particular preferences and to encourage households to search the markets for bargains.

The standard cost of adequate housing (R^*) is thus a critical program parameter, affecting both the amounts paid to participants and the potential size of the program. In concept, it is the rent at which "specified packages of housing services can be supplied by the private market on a continuing basis, in quantities that meet the program's objectives of enabling all assisted households to secure adequate housing."*

The specifications for the "packages of housing services" are, of course, those adopted by the HAO for certification of participants' housing. Program standards include space requirements that vary with household size, requirements for structural soundness, light, ventilation, safety, sanitation, and the availability of equipment and utility services.**

ESTIMATING THE STANDARD COST OF ADEQUATE HOUSING

Before enrollment began in the St. Joseph County program, Rand estimated the standard cost of adequate dwellings of different sizes.

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*Ira S. Lowry, Barbara M. Woodfill, and Tiina Repnau, *Program Standards for Site I*, The Rand Corporation, WN-8574-HUD, January 1974, pp. 4-5. The concept is explained in David B. Lewis and Ira S. Lowry, *Estimating the Standard Cost of Adequate Housing*, The Rand Corporation, WN-8105-HUD, February 1973. That document also proposes the method for estimating such standard costs that was followed in both experimental sites.

**The standards are similar to those of national model housing codes. They are detailed in Iao Katagiri and G. Thomas Kingsley, eds., *The Housing Allowance Office Handbook*, The Rand Corporation, N-1491-HUD, July 1980, Chap. 12.

The estimates were based on evidence from a sample-selection screening survey conducted as part of the Supply Experiment.*

The survey was conducted in July, August, and September of 1974. It was addressed to the occupants of some 10,000 dwellings in St. Joseph County. Those households were interviewed briefly to obtain information on household size, composition, and income; size and quality of dwelling; tenure of occupants; and housing costs.

The questions on housing quality were chosen to test whether the unit would meet program standards. The question on housing costs for renters elicited their contract rent, their use of specified fuels and utility services, and whether those fuels and utility services were included in contract rent. Because the interviews were short and the accounting complex, individuals were not asked to estimate their fuel and utility costs. Rather, estimates of those costs were obtained from the information provided about usage and responsibility for payments.**

About 2,950 renters provided enough information for us to determine dwelling size and quality and to estimate gross rent (contract rent plus tenant-paid utilities). For each size of dwelling, those that met the quality standard were ordered as to monthly gross rent; and the median and lower quartile rents were determined. Inasmuch as the market was manifestly able to supply housing of adequate quality within that range of gross rents, that range was accepted as a first approximation to the

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*For details, see Ira S. Lowry, Barbara M. Woodfill, and Marsha A. Dade, *Program Standards for Site II*, The Rand Corporation, WN-8974-HUD, February 1975.

**The procedure for making these estimates is documented in David M. de Ferranti and Ira S. Lowry et al., *Screening Survey Audit Report for Site I*, The Rand Corporation, WN-8684-HUD, November 1974, Appendix C. From information provided by fuel and utility suppliers, consumption norms were established for households and dwellings of various sizes. The normal consumption was then multiplied by the applicable rates to estimate utility costs for each household. To estimate gross rent for a given household, the estimated cost of utilities paid directly by the tenant was added to the contract rent reported in the survey.

standard cost of adequate housing, applicable to renters and homeowners alike.*

Table 1.1 shows the development of the recommended schedule of values for R^*, beginning with a first approximation, the specification of lower and upper bounds for R^* for each size of dwelling. The bounds are the lower quartile and median gross rents for dwellings exceeding quality standard C.** In other words, it was judged that housing allowances should enable a family to select from at least the lowest-priced fourth of all existing certifiable dwellings, and that the choice need not encompass more than the lowest-priced half of all such dwellings. Setting limits exactly at the quartile and median values was an arbitrary decision, but the limits seem reasonably consistent with program purposes.

The weak association in St. Joseph County between measured housing quality and rent*** led us to consider a second approximation, the median value for *all* dwellings. For those with one and two bedrooms (the most common sizes), the median rents for all dwellings and for all standard dwellings were nearly identical. For all other sizes, the median for all dwellings was significantly lower than the median for all standard dwellings. Thus, this second approximation fell within the bounds established by the first approximation.

Nearly all other data reviewed indicate that the marginal cost of extra rooms should decline steadily. The second approximation was therefore smoothed and the values rounded. The recommended schedule of

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*Although homeowners provided estimates of the market value of their homes and an account of the utilities used, monthly housing costs could not be estimated directly. Given market equilibrium, the true cost of a specified bundle of housing services ought to be the same for homeowners and renters, even though the explicit payments to others may differ.

**Standard C is one of three alternative sets of requirements for judging housing adequacy; it was used to set R^* in both sites. For details, see Lowry, Woodfill, and Repnau, *Program Standards for Site I*; and Lowry, Woodfill, and Dade, *Program Standards for Site II*.

***In Brown County, we found that the proportion of dwellings passing Standard C rose quite regularly with rent.

Table 1.1

DERIVATION OF RECOMMENDED VALUES FOR R^*: SEPTEMBER 1974

Number of Bedrooms	Monthly Amount ($)			
	First Approximation		Second Approximation	R^* (recommended values)
	Lower Bound	Upper Bound		
0	87	116	106	100
1	100	118	117	125
2	119	144	142	145
3	144	171	164	160
4	140	181	172	170

SOURCE: Ira S. Lowry, Barbara M. Woodfill, and Marsha A. Dade, *Program Standards for Site II*, The Rand Corporation, WN-8974-HUD, February 1975, Table 9.

values for R^* shown in the last column of Table 1.1 reflects both of these operations. HUD approved the schedule in November 1974.

In Table 1.2, the original schedule of values for R^* in St. Joseph County is compared with other measures of housing cost. The schedule is close to the median gross rent in St. Joseph County for each size of unsubsidized rental dwelling, differing at most by $8 per month. For dwellings with zero or one bedroom, the proposed values for St. Joseph County were identical to those approved for Brown County a year earlier; for larger dwellings, the proposed St. Joseph County values were distinctly lower than those for Brown County, with a maximum difference of $20 for four-bedroom dwellings.

REVISING THE STANDARD COST OF ADEQUATE HOUSING

The schedule of standard costs described above has since been revised three times to compensate for the effects of inflation. In the first revision, other small adjustments were made to correct apparent

Table 1.2

COMPARISON OF APPROVED VALUES FOR R^* WITH OTHER MEASURES OF HOUSING COST, 1974

Number of Bedrooms	Monthly Amount ($)			
	St. Joseph County			Brown County
	R^* (approved)[a]	Median Rent, All Units[b]	Sec. 23 Schedule[c]	R^* (approved)[d]
0	100	106	107	100
1	125	117	121	125
2	145	142	142	155
3	160	164	163	170
4	170	172	178	190

SOURCE: Ira S. Lowry, Barbara M. Woodfill, and Marsha A. Dade, *Program Standards for Site II*, The Rand Corporation, WN-8974-HUD, February 1975, Table 10.

[a] Approved by HUD for South Bend in November 1974.

[b] All unsubsidized rental dwellings in St. Joseph County, third quarter, 1974.

[c] Schedule adopted for South Bend in 1973.

[d] Schedule approved by HUD for Brown County, Wisconsin, based on market data for September 1973.

inequities in the original schedule. Table 1.3 compares the revised R^* values adopted on each occasion.

The first adjustment, effective in September 1976, added $15 to the R^* value for each dwelling size, included a $5 "realignment" of the values for efficiency apartments (no separate bedroom) and one-bedroom dwellings. The inflation allowances were based on an analysis by the staff of the St. Joseph County HAO of fuel and utility rate increases between August 1974 (the date of the screening survey) and July 1976.*

*That analysis accompanied a letter from Charles E. Nelson (Rand) to Martin D. Levine (HUD) dated 29 July 1976. It was not published as a formal document.

Table 1.3

ADJUSTMENTS TO THE STANDARD COST OF ADEQUATE HOUSING: DECEMBER 1974-JANUARY 1979

Occupancy Standard		Standard Monthly Cost ($)[a]				
		Dec 1974				
Number of Persons	Number of Bedrooms	Initial Schedule	Realigned Schedule[b]	Sep 1976	Sep 1977	Jan 1979
1	0	100	105	115	120	130
2	1	125	130	140	150	160
3-4	2	145	145	160	175	190
5-6	3	160	160	175	185	195
7+	4	170	170	185	190	205

SOURCE: FPOG Policy Clarification Memoranda Nos. 158, 193, and 218.

NOTE: The effective date of each schedule is shown in the table; the measurement dates were several months earlier: August 1974, July 1976, August 1977, and October 1978, respectively.

[a]Estimated monthly cost of shelter and utilities for a dwelling of the indicated size that meets specified quality standards.

[b]The realignment was approved in September 1976, but all inflation adjustments after December 1974 are based on the realigned schedule.

Following the screening survey, Rand began an annual cycle of surveys addressed to a marketwide panel of about 2,000 residential properties. These surveys included annual attempts to interview the occupants of some 2,800 rented dwellings; because of vacancies, changes in property use, and nonresponse by occupants, these attempts typically succeeded for about 1,500 dwellings. The completed interviews provided detailed information about dwelling characteristics, contract rent, and related housing expenses for the same dwellings at different times, so were an excellent source of data for analyzing the intervening changes in housing costs.

By mid-1977, records were available from the first two such surveys, conducted in 1974-75 and 1976, respectively. We analyzed rent changes during that interval and projected the estimated inflation rates for each size of dwelling through August 1977.* From those estimates and projections, the HAO and FPOG developed their recommendations for a second schedule revision, approved by HUD for implementation in September 1977.

This second revision increased R^* values by $10 to $15 over the September 1976 amounts. However, the recommendations did not rely on the 1976 schedule as a benchmark; instead, they were based on our estimates of the total inflation in housing costs, August 1974 to August 1977. As compared with the realigned initial schedule, the inflation factors varied from 12 to 21 percent; the largest increases were for medium-sized dwellings.

The schedule was revised for the third time in January 1979. The supporting analysis was prepared by the HAO, and reflected only changes in fuel and utility rates between September 1977 and October 1978.** The R^* values were again increased by $10 to $15, bringing the cumulative change since August 1974 to between 21 and 31 percent, depending on dwelling size.

In 1979, the records of all four annual surveys of renters were available for analysis, and the end of Rand's oversight of the HAOs was approaching. Moreover, prices generally were still rising rapidly. Consequently, Rand undertook a final analysis of rent changes in St. Joseph County, based on all the household survey data that will ever be available. We also worked out with the Brown County HAO a method for subsequent revisions of the standard cost of adequate housing

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*James P. Stucker, *Rent Inflation in St. Joseph County, Indiana: 1974-77*, The Rand Corporation, N-1116-HUD, November 1979 (first issued as WN-9734-HUD, September 1977).

**The analysis accompanied a letter from Charles E. Nelson (Rand) to Howard Hammerman (HUD) dated 16 November 1978. It was not published as a formal document.

that (a) would not be limited to fuel and utility rate changes, but (b) could be done without survey data.*

Our analysis of rent changes based on the four annual survey cycles is presented in Secs. II through IV of this report. In Sec. V, we estimate the total increase in the standard cost of adequate housing from November 1974 through July 1978, the end of our survey data. Appendix A describes the application of the "posttransition" method of analysis to St. Joseph County, extending the estimates of rent inflation through November 1979; and it recommends a new schedule reflecting those estimates. The new schedule was approved by HUD and became effective in January 1980.

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*Daniel J. Alesch, P. F. Ernst, G. T. Kingsley, and L. Larson, "Proposed Methods for Post-Transition Updates for Standard Housing Expenses and the Standard Cost of Adequate Housing--Brown County Housing Allowance Program," 12 April 1979, submitted to HUD by Charles E. Nelson's letter to Roy Santos, 7 May 1979.

II. MODELING RENT INFLATION

To estimate the amount of rent inflation that has occurred in St. Joseph County, we use data from four annual surveys addressed to the occupants of rented dwellings throughout the county. Each dwelling in our sample was surveyed in 1975 and resurveyed (if feasible) in 1976, 1977, and 1978. By comparing the rents reported at different dates for the same dwelling, we obtain a measure of the time-rate of rent increase for that dwelling. Averaging such measures across classes of dwellings and across periods of time yields estimates of marketwide rent inflation for the entire period covered by our surveys (November 1974 through July 1978).

This method of estimating marketwide rent inflation should be distinguished from another method that is sometimes used, comparison of average rents observed in successive but independent samples of dwellings. Because our comparisons are all between observations on a given dwelling at different times, our marketwide estimates are not biased by changes in the housing stock such as the addition of new, more expensive dwellings or the removal of old, less expensive dwellings.

For individual dwellings in our sample, deterioration, capital improvements, or changes in operating policies sometimes will have altered the flow of housing services for which rent is the payment, so the observed rent change is not necessarily purely a price change. General market conditions in St. Joseph County suggest that, on average, the flow of services is declining slightly, so that the observed average rent change probably understates the average price change. For dwellings occupied by program participants, the reverse is probably true: Required repairs have slightly increased the flow of housing service. We judge that neither bias is large enough to alter the conclusions drawn from our analysis of rent changes.

The statistical method we used to estimate rent changes is actually considerably more complex (and more efficient) than is indicated by the

description above. All inflation rates reported in Sec. III were estimated from a 22-parameter exponential growth model fitted by regression to a data set of 2,439 observations of rent histories covering various parts of the interval November 1974 through July 1978. The parameters express the influence of the following variables on the annual rate of increase in rents:

- Interval of calendar time (three periods).
- Property type (number of units on the property, initial rent level, and urban or rural location).
- Number of rooms in the dwelling.
- Whether or not the dwelling was located in central South Bend (where program participants are most numerous).
- Whether or not the dwelling's occupants changed during an observation interval.
- Whether or not a program participant occupied the dwelling during an observation interval.

The estimated parameters were then applied to the observed characteristics of the sampled properties, cross-stratified by property type and dwelling size, to estimate average inflation rates for each stratum in each time period. For marketwide averaging, the stratum values were weighted according to the incidence of each class of dwelling in the county's rental stock. Finally, observations were averaged across the three periods to obtain inflation estimates for 1974-78.

The last three variables listed above were not essential to the derivation of stratum or marketwide estimates of rent inflation, but are helpful in testing specific hypotheses about the causes of rent inflation (e.g., Did the program itself contribute to inflation?). Those issues are addressed in Sec. IV. Here, we provide the technical specifications of the rent inflation model and describe the data set. Section III reports the basic results, estimates of inflation rates for each time period, dwelling size, and property type, and presents collateral evidence as to the causes of rent inflation. Appendix B provides full detail on the parameter estimates obtained by regression.

THE MODEL

Formally, if a price P increases at a constant rate i_t for m_t years during each period $t = 1, 2, 3$, the price at the end of the period P_m can be expressed in terms of the initial price P_0 as

$$P_m = (1 + i_1)^{m_1}(1 + i_2)^{m_2}(1 + i_3)^{m_3}P_0, \tag{1}$$

where $m = m_1 + m_2 + m_3$. To estimate i_1, i_2, i_3, the rates of inflation for each period, Eq. (1) can be transformed into a linear multiple regression model. First, taking the natural logarithm of Eq. (1) yields

$$\ln P_m = m_1 \ln(1 + i_1) + m_2 \ln(1 + i_2)$$

$$+ m_3 \ln(1 + i_3) + \ln P_0. \tag{2}$$

To simplify the notation, let

$$y \equiv \ln P_m - \ln P_0 \tag{2a}$$

and

$$a_t \equiv \ln(1 + i_t). \tag{2b}$$

Inspection of the data indicated that our population of dwellings was not homogeneous with respect to rent inflation. We used two devices to capture cross-sectional variation. First, we cross-stratified the sample of dwellings by property type and dwelling size, and estimated separate inflation rates for each class of dwellings thus defined. Second, we allowed each such rate to vary with the incidence of other characteristics in that class of dwellings. Thus, for the jth observation on dwellings of class c, the regression model is expressed as

$$y_{j,c} = a_{c,1}(m_{j,1}) + a_{c,2}(m_{j,2}) + a_{c,3}(m_{j,3}) + \nu_{j,c}, \tag{3}$$

where $y_{j,c}$ is the observed amount of inflation, $m_{j,t}$ is the time span of the observation during period t, $a_{c,t}$ is a parameter to be estimated, and $\nu_{j,c}$ is the stochastic disturbance term. It is assumed that the disturbance terms are independently and identically distributed with mean zero and constant finite variance.*

Double stratification of the housing-unit population into 11 strata of property type and 5 strata of unit size produces an 11×5 matrix (A_t) for each period, requiring the estimation of 165 parameters. However, if each element in the matrix is a linear combination of the property type α_p, dwelling size β_r, time period γ_t, participation in the allowance program δ_1, occupancy change δ_2, and location δ_3, only 22 parameters need be estimated. Specifically, each element in A_t is given by Eq. (4):

$$a_{c,t} = \alpha_p + \beta_r + \gamma_t + f_{1,c}\delta_1 + f_{2,c}\delta_2 + f_{3,c}\delta_3, \qquad (4)$$

where p indexes the type of property--1 through 11,

r indexes the unit size (number of rooms)--1-2, 3, 4, 5, 6+,

t indexes the time period--1, 2, 3, and

f is the stratum fraction of dwellings for which the corresponding indicator variable equals 1.

The type of property, dwelling size, and location variables identify potentially significant rental submarkets in St. Joseph County. The time-period variable captures the effects of changing market

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*Outlier adjustment involved a Huber trimming procedure. See P. J. Huber, "Robust Regression: Asymptotics, Conjectures and Monte Carlo," *Annals of Statistics*, Vol. 1, September 1973; and reviews and comments by Huber, R. V. Hogg, J. L. Gastwirth, and H. L. Harter in "Adaptive Robust Procedures: A Partial Review and Some Suggestions for Future Applications and Theory," *Journal of the American Statistical Association*, Vol. 69, No. 348, December 1974, pp. 909-927. Fitting the model with ordinary least squares produced an initial set of residuals. Observations were then weighted by the reciprocal of the absolute value of the residual if the residual exceeded two standard deviations; otherwise, the weight was simply two standard deviations. The model was then reestimated with the transformed data. Diagnostics on the residuals of the transformed data corroborated the assumptions with regard to the disturbance terms.

conditions, most specifically fuel price increases. Because tenant turnover is frequently the occasion for a "catch-up" rent increase, an indicator of occupancy change is included. Finally, including a program participation variable allows us to learn whether dwellings occupied by program participants experience a different rate of rent inflation than do other dwellings. Within each time period, rents are assumed to grow at a constant rate.

Combining Eqs. (3) and (4) yields the regression equation to be estimated:

$$\begin{aligned} y_{j,p,r} = {} & \alpha_p(m_{j,T}) + \beta_r(m_{j,T}) \\ & + \gamma_1(m_{j,1}) + \gamma_2(m_{j,2}) + \gamma_3(m_{j,3}) \\ & + \delta_1 H_j(m_{j,T}) + \delta_2 M_j(m_{j,T}) + \delta_3 L_j(m_{j,T}) \\ & + \nu_{j,p,r}. \end{aligned} \tag{5}$$

The dependent variable $(y_{j,p,r})$ is the change in the natural logarithm of rent. The $(m_{j,T})$ variables are the number of years spanned by the initial and subsequent price observations. The $(m_{j,t})$ variables are the number of years during each of the individual periods spanned by the initial and subsequent price observations. H, M, and L are indicator variables:

where $H = \begin{cases} 1 & \text{if the dwelling was currently occupied by an HAO client,} \\ 0 & \text{otherwise;} \end{cases}$

$M = \begin{cases} 1 & \text{if there was a change in tenant over the linked observation,} \\ 0 & \text{otherwise;} \end{cases}$

$L = \begin{cases} 1 & \text{if the dwelling was located in central South Bend,} \\ 0 & \text{otherwise.} \end{cases}$

Equation (5) completes the specification of the 22-parameter model to be estimated.*

*There are 22 parameters after constraints are imposed to remove collinearity. Three terms, γ_1, γ_2, and γ_3 yield the time effects. For

THE ESTIMATION PROCEDURE

After the model is fit, the change in the natural logarithm of rent of a dwelling of class c during period t is estimated by

$$\hat{a}_{c,t} = \hat{\alpha}_p + \hat{\beta}_r + \hat{\gamma}_t + f_{1,c}\hat{\delta}_1 + f_{2,c}\hat{\delta}_2 + f_{3,c}\hat{\delta}_3, \tag{6}$$

where $\hat{\alpha}_p$, $\hat{\beta}_r$, $\hat{\gamma}_t$, $\hat{\delta}_1$, $\hat{\delta}_2$, and $\hat{\delta}_3$ are the estimates of the parameters of Eq. (5), and the fs are the stratum fractions of dwellings for which M, L, and H, respectively, equal 1.

The annual rate of inflation for dwellings of class c during t is

$$G(\hat{a}_{c,t}) = exp(\hat{a}_{c,t}) - 1, \tag{7}$$

and the standard errors for the annual rates are approximated by geometric means:

$$G(\hat{s}_{\hat{a}_{c,t}}) = exp[\hat{a}_{c,t} + (\hat{s}_{\hat{a}_{c,t}}/2)] - exp[\hat{a}_{c,t} - (\hat{s}_{\hat{a}_{c,t}}/2)], \tag{8}$$

where $\hat{s}_{\hat{a}_{c,t}}$ = the standard error for $\hat{a}_{c,t}$.

Weighting the $\hat{a}_{c,t}$ by population estimates for that class of dwellings ($W_{p,r}$) yields the average predicted change in the natural logarithm of rent for dwellings of property type p, number of rooms r, and period t, respectively:

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the jth observation the set of $(m_{j,T})$ values systematically enter the jth row of the data matrix (X) in two places--once on the α_p and once on the β_r. As a result, $X'X$ is singular and noninvertible. Omitting a variable from each property type and unit size eliminates the collinearity and leaves the estimates of the $a_{c,t}$ unaffected. The omitted variables are property type 9 and dwelling size of 6+ rooms. The $(m_{j,T})$ also enter on indicator variables, but no linear combination of L, M, and H will produce a vector that is linearly dependent on the $(m_{j,T})$.

$$\hat{a}_{p,t} = \frac{\sum_{r}\left(W_{p,r}\right)\left(\hat{a}_{c,t}\right)}{\sum_{r}\left(W_{p,r}\right)} \tag{9a}$$

$$\hat{a}_{r,t} = \frac{\sum_{p}\left(W_{p,r}\right)\left(\hat{a}_{c,t}\right)}{\sum_{p}\left(W_{p,r}\right)} \tag{9b}$$

$$\hat{a}_{t} = \frac{\sum_{p,r}\left(W_{p,r}\right)\left(\hat{a}_{c,t}\right)}{\sum_{p,r}\left(W_{p,r}\right)} \tag{9c}$$

These estimated means and their standard errors are transformed into annual rates by Eqs. (7) and (8).

The method used to determine inflation rates and their standard errors for dwellings of class c, property type p, size r, and the entire population of dwellings during each period t is complete. The estimation procedure for these same parameters over all periods is discussed below.

The change in the natural logarithm of rent of a dwelling of class c over all periods is estimated by

$$\hat{y}_c = \hat{a}_{c,1}(m_1) + \hat{a}_{c,2}(m_2) + \hat{a}_{c,3}(m_3). \tag{10}$$

Weighting the $\hat{y}_c$ by the population of housing units of class c yields the average predicted change in the natural logarithm of rent on housing units of property type p, r, and all types in Eqs. (11a), (11b), and (11c), respectively.

$$\hat{y}_p = \frac{\sum_{r}\left(W_{p,r}\right)\hat{y}_c}{\sum_{r}\left(W_{p,r}\right)} \tag{11a}$$

$$\hat{y}_r = \frac{\sum_{p}\left(W_{p,r}\right)\hat{y}_c}{\sum_{p}\left(W_{p,r}\right)} \tag{11b}$$

$$\hat{y} = \frac{\sum_{p,r}\left(W_{p,r}\right)\hat{y}_c}{\sum_{p,r}\left(W_{p,r}\right)} \tag{11c}$$

Transforming the $\hat{y}$ by exponentiation yields the estimates of the annual inflation rate over 1975-78:

$$\hat{i} \equiv G(\hat{y}) = exp[\hat{y}/m_1 + m_2 + m_3)] - 1. \tag{12}$$

The standard errors of these transformed estimates $\hat{s}_{\hat{i}}$ are approximated with an appropriate transformation on $\hat{s}_{\hat{y}_p}$, $\hat{s}_{\hat{y}_r}$, and $\hat{s}_{\hat{y}}$. Namely,

$$\hat{s}_{\hat{i}} \equiv G(\hat{s}_{\hat{y}}) = exp[\hat{y} + (\hat{s}_{\hat{y}}/2)] - exp[\hat{y} - (\hat{s}_{\hat{y}}/2)]. \tag{13}$$

The specification of the 22-parameter model* has been presented and the estimation procedure detailed. We next review the data on which this model was estimated.

THE DATA

The annual household surveys conducted as part of the Supply Experiment are the best available sources of data for estimating changes over time in the price of housing services in St. Joseph County. These surveys report for each sampled dwelling the current monthly payment by the

*A closely related specification with 48 parameters was employed in James P. Stucker, *Rent Inflation in Brown County, Wisconsin: 1973-78*, The Rand Corporation, WN-10073-HUD, August 1978. Stucker assumed that the rate of inflation for each class of dwelling was a function solely of property type, number of rooms, and time period. Specifically, Stucker's counterpart to Eq. (4) would be $a_{c,t} = \alpha_{p,t} + \beta_{r,t}$; $c = 1, 2, \ldots, 55$; $p = 1, 2, \ldots, 11$; $r = 1, 2, \ldots, 5$; and $t = 1, 2, 3$. Stucker's results, other HASE literature, and the prespecification data analysis suggested, however, that location, occupancy change, and participation in the allowance program could be important variables in explaining the rate of increase in rent in St. Joseph County, and that time period effects could best be accounted for with separate variables.

occupant to his landlord (contract rent) and the occupant's average monthly expenditure during the preceding year for utilities not included in contract rent. The surveys are addressed to a stratified probability sample representing nearly the entire population of rental housing units in the county. The units selected as the permanent panel are resurveyed each year. Because their sampling histories are known, we can generalize findings to the market as a whole and to specific sectors of that market.

The Sample of Dwellings

The data base used here was constructed from the four household surveys fielded between 1974-75 and 1978 (waves 1 through 4). From these records, we obtained the desired data file by excluding records for dwellings

- o Owned by the occupant.
- o Not contained in the permanent panel.
- o Whose occupant was either related to, worked for, or received free or reduced rent from the landlord.
- o Whose occupant received a housing subsidy other than that from the allowance program.
- o That were mobile homes or rooming houses.

Records were also excluded if some of their data were either missing or inconsistent. The remaining records form a sample of 1,412 regular, full-rent, dwellings with 1,212, 1,064, 1,197, and 1,134 records for waves 1, 2, 3, and 4, respectively.

Table 2.1 displays the distributions by dwelling size and property type for dwellings in the analysis sample and also in the corresponding population of rented dwellings. The analysis file contains rent-change data on at least 200 dwellings of each coded size except 1-2 rooms; and contains over 100 dwellings for 6 of the 11 coded property types. (The number of rent-change observations is, on average, 1.7 times the number of dwellings in each category.) The different property types

Table 2.1

DISTRIBUTION OF ANALYSIS SAMPLE AND POPULATION
BY DWELLING SIZE AND PROPERTY TYPE

Code	Dwelling Characteristic	Dwellings in Analysis Sample[a]		Dwellings in Population[b]	
		Number	Percent	Number	Percent
	By Dwelling Size				
2	1-2 rooms	84	5.9	795	4.5
3	3 rooms	402	28.5	4,377	24.9
4	4 rooms	451	31.9	5,833	33.2
5	5 rooms	249	17.6	3,342	19.0
6	6+ rooms	226	16.0	3,225	18.4
	All sizes	1,412	100.0	17,572	100.0
	By Property Type				
	Low-rent Urban				
1	Single-family	63	4.5	1,028	5.9
2	2-4 units	265	18.8	3,168	18.0
3	5+ units	135	9.6	928	5.3
	Medium-rent Urban				
4	Single-family	176	12.5	2,321	13.2
5	2-4 units	260	18.4	2,213	12.6
6	5+ units	82	5.8	723	4.1
	High-rent Urban				
7	Single-family	108	7.6	2,645	15.1
8	2-4 units	68	4.8	733	4.2
9	5+ units	134	9.5	2,903	16.5
	Rural				
10	Low or medium rent	91	6.4	660	3.8
11	High rent	30	2.1	250	1.4
	All Types				
	Total	1,412	100.0	17,572	100.0

SOURCE: Tabulated by HASE staff from records of the rent-inflation analysis file and the wave 2 sampling records.

NOTE: Percentages may not add exactly to 100.0 because of rounding.

[a]Each sampled dwelling is represented in the analysis file by one or more linked records, each reporting rent change between two interview dates. The total number of such records is 2,439.

[b]Population of unsubsidized regular rental dwellings at the time of the wave 2 survey, estimated from sampling records and survey field reports. At that time, there were an estimated 20,495 dwellings on all types of rental properties in the county.

were unevenly sampled for the HASE panel; so it is unsurprising that the distribution by property type in this subsample does not match the population's distribution.

Table 2.2 shows how these dwellings are distributed by location and participation status. A total of 732 dwellings, 52 percent of the sample, were located in central South Bend; 242 dwellings, 17 percent of the sample, were occupied by program participants at some time between each dwelling's initial and final occupant interview.

Table 2.2

DISTRIBUTION OF ANALYSIS SAMPLE AND POPULATION BY LOCATION AND PARTICIPATION STATUS

Participation Status of Dwelling	Number of Dwellings		
	Central South Bend	Rest of County	Total
Dwellings in Sample[a]			
Ever occupied by participant	175	67	242
Never occupied by participant	557	613	1,170
Total	732	680	1,412
Corresponding Population[b]			
Ever occupied by participant	2,127	770	2,897
Never occupied by participant	6,665	8,010	14,675
Total	8,792	8,780	17,572

SOURCE: Tabulated by HASE staff from records of the rent-inflation analysis file and wave 2 sampling records.

[a]Each sampled dwelling is represented in the analysis file by one or more linked records, each reporting rent changes between two interview dates. The total number of such records is 2,439.

[b]Population of unsubsidized regular rental dwellings at the time of the wave 2 survey, estimated from sampling records and field reports. At that time, there were an estimated 20,495 dwellings on all types of rental properties in the county.

The Sample of Rent-Change Observations

Pairs of accepted records for these 1,412 dwellings were then linked over time so that each linked pair yielded an observation on the intervening change (if any) in gross rent for a specific dwelling, as well as the associated time span. Table 2.3 shows all possible linkages and enumerates their incidence in the file. Because each year some empaneled dwellings were vacant, because the occupants of other dwellings could not be contacted or refused to be interviewed, and because some completed interviews lacked essential data, relatively few dwellings had acceptable

Table 2.3

RECORD LINKAGES YIELDING RENT-CHANGE OBSERVATIONS: ANNUAL SURVEYS OF RENTAL DWELLINGS, 1975-78

Type of Linkage	Sources of Linked Record				Number of Pairwise Links[a]	
	Wave 1	Wave 2	Wave 3	Wave 4	Total	Selected
1	X	X			606	606
2	X		X		632	226
3	X			X	558	86
4		X	X		652	652
5		X		X	588	153
6			X	X	716	716
All types	1,212	1,604	1,197	1,134	3,752	2,439

SOURCE: Compiled by HASE staff from records of annual interviews with the occupants of 1,412 rented dwellings in St. Joseph County.

NOTE: See text for record-selection criteria.

[a]The total includes redundant links, e.g., wave 1 to wave 3 as well as wave 1 to wave 2, wave 2 to wave 3. In such cases, we selected only the latter two links.

records for all four annual surveys. Consequently, some linked records span a single year and others span several years.* When offered the choice between a multiyear link and its component shorter links, we chose the latter because they more nearly bracket the dates of actual rent changes. The selection process yielded 2,439 rent-change observations on 1,412 dwellings.**

Table 2.4 shows that about 12 percent of those observations pertain to dwellings occupied by participants during the observation interval; 44 percent to dwellings that changed occupants during that interval; and 54 percent to dwellings located in central South Bend. As might be expected from the locational distribution of dwellings ever occupied by participants, about three-fourths of the rent-change observations on dwellings currently occupied by participants are in central South Bend. Occupancy changes are common for all dwelling-status categories.

Allocating Rent Changes among Analysis Periods

For analysis, we allocated the total time span of each rent-change observation among three arbitrary periods by counting the number of months that fell into each period:

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*When recording the time span associated with a linked record, we used the beginning of the months preceding the actual interview dates. Because each year's fieldwork was spread over 6 to 9 months, two successive "annual" interviews could be separated by as few as 3 months or as many as 21 months.

**The formal analysis treats multiple observations on a given dwelling as though they were linearly independent. A test of the analysis file for serial correlation yields $\rho = -.271$. Serial correlation in a dependent variable does not bias regression coefficients, but may bias their standard errors either up or down. (Intuitively, a negative serial correlation would seem to yield overlarge standard errors, but we have not found an analytical proof.) We repeated the regression analysis on an alternative data set constructed by selecting only the longest linked record for each dwelling. Although the standard errors of the regression coefficients were larger (because of the smaller sample size), the estimates themselves were only trivially different from those reported in Sec. III.

Table 2.4

DISTRIBUTION OF RENT-CHANGE OBSERVATIONS
BY DWELLING STATUS

Observation Sample, by Dwelling Status	Percent of Observations with Indicated Dwelling Status		
	Participant -Occupied	Occupancy Change	Located in CSB[a]
All dwellings	12.5	44.2	54.0
Participant-occupied	100.0	39.1	74.3
Not participant-occupied	--	44.9	51.1
Occupancy change	11.0	100.0	54.4
No occupancy change	13.6	--	53.6
Located in CSB[a]	17.2	44.5	100.0
Not located in CSB[a]	6.9	43.7	--

SOURCE: Tabulated by HASE staff from records of the St. Joseph County rent-inflation file.

NOTE: Each sample element is an observation on the interval between two interviews of the dwelling's occupants. The full sample encompasses 1,412 dwellings with up to three observations per dwelling, for a total of 2,439 observations. Participation and occupancy statuses pertain to the specific period of observation.

[a]Central South Bend.

Period 1 = November 1974 - December 1975 = 1.17 years

Period 2 = January - December 1976 = 1.00 year

Period 3 = January 1977 - July 1978 = 1.58 years

Table 2.5 shows how many observations fell at least partly into each period, and the average duration of observation within that period. Measured in this way, about 15 percent of the rent-change information at our disposal pertains to Period 1, 39 percent to Period 2, and 46 percent to Period 3.*

*Calculated for "all dwellings" as the product in each period of the number and the average duration of observations.

Table 2.5

DISTRIBUTION AND AVERAGE DURATION OF RENT-CHANGE OBSERVATIONS BY ANALYSIS PERIOD

Observation Sample, by Dwelling Status	Analysis Period[a]			
	1	2	3	1-3
Number of Observations				
All dwellings	920	1,723	1,832	2,439
Participant-occupied	92	176	256	304
Not participant-occupied	828	1,547	1,576	2,135
Occupancy change	443	815	878	1,077
No occupancy change	477	908	954	1,362
Located in CSB[b]	515	945	975	1,316
Not located in CSB[b]	405	778	857	1,123
Average Duration of Observation (yrs.)				
All dwellings	.313	.446	.493	1.252
Participant-occupied	.251	.406	.601	1.258
Not participant-occupied	.321	.451	.477	1.249
Occupancy change	.342	.551	.568	1.461
No occupancy change	.290	.362	.433	1.085
Located in CSB[b]	.333	.450	.468	1.251
Not located in CSB[b]	.289	.441	.521	1.251

SOURCE: Tabulated by HASE staff from records of the St. Joseph County rent-inflation file.

NOTE: Each sample element is an observation on the interval between two interviews of the dwelling's occupants. The full sample encompasses 1,412 dwellings with up to three observations per dwelling; the average is 1.7. A single observation may span parts of two or more analysis periods, and portions of two or more observations may fall within a single analysis period. The analysis periods are not equal in duration.

[a]Period 1 = November 1974-December 1975; Period 2 = January-December 1976; Period 3 = January 1977-July 1978.

[b]Central South Bend.

Weighting the Sample

Equations (9) and (11) call for population weights corresponding to each of 55 classes of rental dwellings: 11 property types by 5 dwelling sizes. The parameters to be weighted were estimated on rent-change data drawn from four annual surveys, during which the population of dwellings marginally changed as to both physical characteristics and occupancy status.

The weights we chose are based on sampling and interview records for the second annual survey (wave 2). We estimated the countywide population of rental dwellings corresponding to the sample in each of the 55 classes, using standard procedures devised by HASE staff for this purpose.*

Altogether, there were about 20,500 dwellings on rental properties in 1976, when wave 2 was conducted. However, we used population weights based on a total of 17,572, as shown in Table 2.1. Like the analysis sample, this population excludes mobile homes, rooming houses, subsidized housing, and dwellings occupied by resident landlords.

Because survey data were used in conjunction with sampling histories to construct population estimates, those estimates and the weights derived from them are subject to sampling error. However, our estimates of standard errors for rent inflation rates reflect only the sampling errors of the parameter estimates; we judged that the weighting errors would be small in comparison and including them would have complicated our calculations considerably.

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*Daniel A. Relles, *Using Weights to Estimate Population Parameters from Survey Records*, The Rand Corporation, WN-10095-HUD, April 1978. The population estimates are linked back to a 1974 tax-office enumeration of all residential properties in the county. Within each of the 55 classes, we also estimated the proportion of dwellings that (a) were ever occupied by participants, (b) experienced an occupancy change, and (c) were located in central South Bend.

III. RENT INFLATION, 1974-78

Using the method and data described in Sec. II, we estimated annual inflation rates, 1974-78, for both gross and contract rent. Gross rent, the quantity we use to measure the standard cost of adequate housing, is more nearly comparable across dwellings because it includes all fuel and utility expenses by whomever paid. On the other hand, contract rents are more precise; our surveys recorded the tenant's exact monthly payment to his landlord at the date of the interview. To construct a dwelling's gross rent, we combined the *current* contract rent with the tenant's estimate of his *average* monthly payments for fuels and utility services that were billed directly to him.* Because of frequent rate changes and strong seasonal fluctuations in fuel consumption, those estimates must be imprecise as to both amount and currency.

INFLATION IN GROSS RENT

Table 3.1 reports our results for gross rent. The average annual rate of increase between November 1974 and July 1978 was about 5.7 percent, which compounds to 23.2 percent for 45 months. The annual rate was lowest (4.6 percent) for 1974-75, rose to 7.7 percent for 1976, and dropped to 5.3 percent for 1977-78.

Although the inflation rate varied with time, there is a consistent pattern of relative rates by size of dwelling. Rents rose most for very small and very large dwellings, least for those of intermediate size. Less consistent patterns are evident by property type. Generally, low rents increased faster than high rents; rents for single-family dwellings increased faster than those for multiple dwellings; and rural rents increased more rapidly than did urban rents.

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*A respondent who had trouble estimating a year-round monthly average was invited to estimate separate monthly averages for summer and winter; those two figures were subsequently averaged by Rand staff. Some respondents consulted records, others did not.

Table 3.1

GROSS RENT INFLATION BY DWELLING SIZE AND PROPERTY TYPE: ALL DWELLINGS, 1974-78

Code	Dwelling Characteristic	Annual Rate of Increase (%) in Gross Rent							
		Period 1		Period 2		Period 3		Periods 1-3	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
	By Dwelling Size								
2	1-2 rooms	5.53	1.11	8.68	1.09	6.19	1.02	6.64	0.94
3	3 rooms	4.18	0.75	7.29	0.70	4.84	0.59	5.28	0.45
4	4 rooms	4.15	0.75	7.26	0.69	4.81	0.57	5.25	0.43
5	5 rooms	4.65	0.80	7.77	0.78	5.31	0.68	5.75	0.55
6	6+ rooms	5.73	0.85	8.88	0.84	6.39	0.74	6.85	0.62
	By Property Type								
	Low-rent Urban								
1	Single-family	7.88	1.26	11.09	1.28	8.55	1.20	9.01	1.12
2	2-4 units	5.57	0.79	8.72	0.76	6.23	0.67	6.68	0.53
3	5+ units	4.87	0.94	8.00	0.93	5.53	0.84	5.97	0.74
	Medium-rent Urban								
4	Single-family	6.20	0.87	9.37	0.86	6.86	0.77	7.32	0.65
5	2-4 units	3.07	0.78	6.14	0.73	3.71	0.65	4.15	0.51
6	5+ units	3.81	1.21	6.90	1.17	4.46	1.08	4.90	1.03
	High-rent Urban								
7	Single-family	2.22	0.95	5.27	0.96	2.86	0.88	3.30	0.78
8	2-4units	3.83	1.23	6.93	1.23	4.48	1.14	4.93	1.08
9	5+ units	3.67	1.02	6.76	0.95	4.32	0.83	4.76	0.78
	Rural								
10	Low or medium rent	9.01	1.15	12.26	1.14	9.69	1.05	10.15	0.97
11	High rent	6.91	1.65	10.10	1.67	7.58	1.61	8.04	1.56
	All Sizes and Types								
	All dwellings	4.61	0.66	7.73	0.60	5.26	0.47	5.71	0.27

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: Period 1 = November 1974-December 1975; Period 2 = January-December 1976; Period 3 = January 1977-July 1978. See Appendix Table B.2 for regression parameters used to construct these estimates.

The range of sectoral variation within each time period is quite large: Some rates are three to four times other rates. As indicated by the small standard errors on the sectoral and period estimates, the differences are not plausibly due to sampling variability. They could reflect different submarket demand conditions; or different production functions, hence, different submarket supply conditions. These possibilities are briefly explored below.

INFLATION IN CONTRACT RENT

Our estimates of annualized inflation in contract rent are presented in Table 3.2. Neither the level nor the pattern of inflation in contract rent resembles that noted above for gross rent. Over the 45-month period, the average annual rate of increase for contract rent is 4.4 percent, versus 5.7 percent for gross rent; rather than peaking in 1976, the contract rent inflation rate climbs steadily. The inflation rate for contract rent decreases with size of dwelling, and is greatest for initially low rents. Gross rents, but not contract rents, increased faster for single-family and rural dwellings than for other types.

RENT INFLATION AND FUEL COSTS

Because the difference between gross and contract rent consists entirely of tenant-paid fuel and utility expenses, it is clear from Tables 3.1 and 3.2 that rising fuel and utility expenses were salient in gross rent inflation. Fuel costs in particular help to explain the sectoral variation in gross rent inflation rates: Low rents have a larger component of fuel costs than do high rents, hence should increase faster when fuel costs rise; single-family houses generally use more fuel than apartments in multiple dwellings, because of their larger size and greater exposure to the elements. The associations of low rents with

Table 3.2

CONTRACT RENT INFLATION BY DWELLING SIZE AND PROPERTY TYPE: ALL DWELLINGS, 1974-78

Code	Dwelling Characteristic	Annual Rate of Increase (%) in Gross Rent							
		Period 1		Period 2		Period 3		Periods 1-3	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
	By Dwelling Size								
2	1-2 rooms	5.08	1.02	6.32	0.99	7.46	0.95	6.41	0.86
3	3 rooms	3.30	0.69	4.52	0.63	5.64	0.55	4.61	0.41
4	4 rooms	2.85	0.68	4.06	0.62	5.17	0.52	4.15	0.39
5	5 rooms	3.14	0.73	4.35	0.69	5.47	0.63	4.44	0.50
6	6+ rooms	2.79	0.76	4.00	0.74	5.12	0.68	4.09	0.56
	By Property Type								
	Low-rent Urban								
1	Single-family	3.88	1.12	5.11	1.12	6.23	1.08	5.20	1.00
2	2-4 units	4.74	0.72	5.98	0.69	7.11	0.62	6.07	0.49
3	5+ units	4.35	0.86	5.58	0.84	6.72	0.78	5.67	0.68
	Medium-rent Urban								
4	Single-family	3.22	0.78	4.43	0.76	5.55	0.70	4.52	0.58
5	2-4 units	1.99	0.71	3.20	0.66	4.30	0.60	3.28	0.47
6	5+ units	2.55	1.10	3.76	1.04	4.87	1.00	3.85	0.94
	High-rent Urban								
7	Single-family	1.13	0.86	2.32	0.86	3.42	0.82	2.41	0.71
8	2-4 units	4.17	1.14	5.40	1.11	6.53	1.07	5.49	1.00
9	5+ units	2.86	0.93	4.07	0.86	5.19	0.77	4.16	0.71
	Rural								
10	Low or medium rent	4.53	1.02	5.76	0.99	6.89	0.94	5.85	0.86
11	High rent	2.31	1.46	3.51	1.45	4.62	1.44	3.60	1.38
	All Sizes and Types								
	All dwellings	3.11	0.60	4.32	0.54	5.44	0.44	4.41	0.24

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: Period 1 = November 1974-December 1975; Period 2 = January-December 1976; Period 3 = January 1977-July 1978. See Appendix Table B.11 for regression parameters used to construct these estimates.

small dwellings, and of higher fuel consumption with large dwellings, probably explains the U-shaped schedule of inflation rates by size of dwelling.*

If fuel costs are the salient factor in rent changes, one would hope to see them most clearly at work in the period analysis, since fuel price changes are lumpy. However, fuel oil, natural gas, and electricity price changes were not synchronized, and these fuels are used in different proportions by different dwellings. Moreover, gross rents as defined for this study reflect fuel price changes only with complex lags. If the landlord pays, say, for space heating, and the price of fuel oil rises, he may not pass on the extra cost as a contract rent increase until the tenant moves out or the current lease expires; if the tenant pays directly for space heating, a rise in the price of fuel oil will affect his average monthly expense only when his current supply of oil is depleted and replaced.

Over longer periods of analysis, such lags are less important. If we are willing to assume a fixed level of fuel consumption during a period of rising prices,** we can show that fuel price increases alone could account for 70 percent of the increase in gross rents, 1974-78. Details follow.

Periodically, the HAO in St. Joseph County compiles current rate schedules for fuels in St. Joseph County and estimates the average monthly fuel bills for dwellings of different sizes, assuming a standard mix of

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*The estimates in Table 3.1 by size of dwelling are *sectoral* estimates, reflecting the assortment of property types in each dwelling-size class. The partial derivatives of gross rent inflation with respect to dwelling size have a J-shape rather than a U-shape; see Appendix Table B.2. Also, see Appendix C, which compares this study's findings with an earlier analysis of rent changes in St. Joseph County.

**Analysis of actual fuel expenditures in Brown County, 1973-76, indicates *increased* consumption during a period in which the composite price of fuels rose by 63 percent. Probably, the reason was variation in weather. Most estimates of the shortrun price elasticity of fuel consumption are low, e.g., -.10 to -.15. See, for example, Martin L. Baughman and Paul L. Joskow, "Energy Consumption and Fuel Choice by Residential and Commercial Consumers in the United States," *Energy Systems and Policy*, Vol. I, No. 4, 1976, pp. 305-322.

fuels and a fixed level of consumption for each. Table 3.3 shows their estimates for four dates beginning with December 1974 and ending with October 1978. During that interval (47 months), the typical fuel bill increased by 72 percent; fuel costs in December 1974 were about 24 percent of the standard cost of adequate housing (gross rent), rising to about 30 percent in October 1978.

As noted earlier, gross rents increased by 23.2 percent over 45 months, November 1974 to July 1978. Rescaling the HAO's fuel cost index to this same interval yields a 45-month increase of 68 percent. Using base-year expenditure weights of .24 for fuel and .76 for nonfuel shares of gross rent, we can estimate x, the inflation rate for nonfuel items, by solving the following equation:

$$23.2 = (.24)(68.0) + (.76)x \qquad (14)$$
$$x = 9.1$$

In other words, the price of shelter (plus water, sewage, and trash collection charges, which are collectively small) rose by 9.1 percent over the 45-month interval, or by 2.3 percent annually. Of the total increase in average gross rent, 70 percent was due to fuel price increases and 30 percent to nonfuel price increases.*

These calculations strongly suggest that sectoral differences in gross rent inflation rates should be sought in sectoral differences in fuel consumption. That hypothesis will be examined more rigorously in subsequent reports on the causes and consequences of housing price changes in both experimental sites.

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*Substituting for x in Eq. (14) yields $23.2 = 16.3 + 6.9$.

Table 3.3

TYPICAL FUEL EXPENSES BY SIZE OF DWELLING:
ST. JOSEPH COUNTY, INDIANA, 1974-78

Number of Rooms	Typical Expense ($/mo.)				Percentage Change			
	Dec 1974	Sep 1975	Feb 1977	Oct 1978	Dec 1974-Sep 1975	Sep 1975-Feb 1977	Feb 1977-Oct 1978	Dec 1974-Oct 1978
1	22.79	27.82	33.03	39.89	22.1	18.7	20.8	75.0
2	27.23	33.03	39.27	47.35	21.3	18.9	20.6	73.9
3	31.76	38.24	45.51	54.80	20.4	19.0	20.4	72.5
4	36.11	43.45	51.75	62.26	20.3	19.1	20.3	72.4
5	40.55	48.66	57.99	69.70	20.0	19.2	20.2	71.9
6	44.99	53.87	64.23	77.15	19.7	19.2	20.1	71.5
7	49.43	59.08	70.47	84.62	19.5	19.3	20.1	71.2
8+	53.87	64.29	76.71	92.07	19.3	19.3	20.0	70.9
Average[a]	38.34	46.06	54.87	65.98	20.3	19.1	20.3	72.4

SOURCE: Unpublished analyses prepared by HAO staff from local rate schedules, using methods devised by Barbara M. Woodfill (Rand).

NOTE: Expense data cover fuels used for illumination and appliances, cooking, water heating, and space heating. Consumption standards for each fuel and function are given in Ira S. Lowry, *Inflation in the Standard Cost of Adequate Housing: Site I, 1973-1976*, The Rand Corporation, N-1102-HUD, October 1979 (first issued as WN-9430-HUD, March 1976), Sec. III.

[a]Unweighted.

RENT INFLATION AND NONFUEL COSTS

Although fuel price increases are clearly the major cause of gross rent increases during the period covered by our household survey data, the calculations reported above left a residual 1.8 percent annual increase in gross rent unexplained. It is conceivable that this increase reflects excess market demand that enabled landlords to raise contract rents and increase their profits. If so, the excess demand could have been induced by the housing allowance program.

As yet, we are not prepared to present a full analysis of the causes and consequences of housing price inflation in either of our experimental sites. However, we can offer preliminary data that discredit the hypothesis of demand-driven rent increases. These data come from the survey of the owners of the rental properties whose occupants provided our rent-change data.

Table 3.4 compares landlords' revenues and expenses for 1974 and 1977. That time interval differs only slightly from the one for which rent-inflation rates were reported earlier in this section. The entries in the table describe only cash items, and exclude direct tenant payments for fuel, utilities, or repairs. Although landlords' expenses for repairs are included, those for capital improvements are excluded.

When cash operating expenses are subtracted from rental revenue, the residual is a cash operating return that is primarily a return on capital investment but may also recompense unpaid labor by the property owners; loosely speaking, it is "profit." If the demand for rental housing increases more than the cost of supplying it, profits should rise until additions to supply eliminate the market imbalance. Table 3.4 indicates the contrary. Although rental revenues did increase between 1974 and 1977, operating expenses increased faster.* As a result, the cash operating return actually decreased.

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*The observed revenue increase is less than is implied by the rate of inflation in contract rent (Table 3.2) because both vacancy losses and rent waivers (for employees or relatives) increased during this period.

Table 3.4

COMPARISON OF CASH REVENUE AND OPERATING EXPENSE FOR REGULAR RENTAL PROPERTIES IN ST. JOSEPH COUNTY, 1974 AND 1977

Item	1974		Average Change (%/yr.)	1977	
	Amount ($/unit)	Percent		Amount ($/unit)	Percent
Cash revenue[a]	957	100.0	3.3	1,055	100.0
Cash operating expense:[b]					
Management	23	2.4	16.1	36	3.4
Fuel, utilities	137	14.3	14.9	208	19.7
Maintenance replacement	220	23.0	7.9	276	26.2
Real estate tax	155	16.2	-6.9	125	11.8
Insurance	78	8.2	1.7	82	7.8
Cash operating return[c]	344	35.9	-1.6	328	31.1

SOURCE: Tabulated by HASE staff from weighted records of the integrated property file (1 October 1980).

NOTE: Entries are based on records for 509 regular rental properties with complete data for both 1974 and 1977. Regular rental properties exclude mobile home parks, farms, and rooming houses. The property weights used in this tabulation are preliminary.

[a]Cash revenue from residential rents plus a small amount of commercial rent. Excludes waived rent, vacancy losses, and uncollectibles.

[b]Excludes tenant cash payments for utilities and repairs and all non-cash items such as unpaid labor by landlords or employee or tenant labor compensated by rent waivers. Excludes capital improvements and debt service.

[c]Return on capital and compensation for unpaid labor by landlord.

We think that result is inconsistent with a scenario of demand-driven inflation in the price of housing services. It is much more consistent with a scenario of "cost-push" inflation: rising factor costs that cause landlords to seek compensatory rent increases. Table 3.4 tells us that landlords are falling behind, perhaps because of consumer resistance, perhaps because of a typical lag between the cost increase and its recognition by the landlord.

RENT INFLATION AND OCCUPANCY CHANGE

When demand is shifting or factor costs are changing, landlords do not adjust rents daily or even monthly. Their policies no doubt vary, but it is generally believed that landlords prefer to postpone rent changes until their current tenants move. The human reasons for such a preference are obvious; but because durations of occupancy vary considerably, such a policy could result in considerable price variation within a housing market.

From the tenant's perspective, that policy leads to what may be called "length-of-stay discounts" on the market rents of their dwellings. Hedonic index estimation for both Brown and St. Joseph counties indicates that such discounts existed at the time of our baseline surveys (1974 and 1975, respectively). In both cases, each year of occupancy typically reduced monthly rent by about $4.40, up to a limit of about $15, or 11 percent of the average monthly gross rent.*

The years after baseline saw more rapid price changes in general than did the years before, which may have affected landlords' willingness to wait for tenant turnover to raise rents, and also the amount of the implicit discounts while they waited. However, our analysis of the 1974-78 rent inflation file does show that change of occupancy is still a preferred occasion for rent increases. Controlling on other dwelling characteristics, we find that a change of occupancy between the initial

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*C. Lance Barnett, *Using Hedonic Indexes to Measure Housing Quantity*, The Rand Corporation, R-2450-HUD, October 1979, p. 30; Charles W. Noland, *Assessing Hedonic Indexes for Housing*, The Rand Corporation, N-1305-HUD, May 1980, Table 2. The discounts cited are for St. Joseph County; they are slightly higher in Brown County.

and terminal rent observation on a dwelling added 2.8 percent per year to its gross rent and 3.6 percent to its contract rent.*

About 60 percent of the rented dwellings in St. Joseph County are vacated annually, which implies roughly that the overall annual gross rent inflation rate of 5.7 percent is composed of an average 6.8 percent annual increase for dwellings with an occupancy change and 4.0 percent for those with no occupancy change.**

CONCLUSION

Analysis of 2,439 rent-change observations on 1,412 rental dwellings in St. Joseph County, spanning the period November 1974 through July 1978, leads to the conclusion that the marketwide increase in gross rent over that period was about 23.2 percent, or 5.7 percent annually.

About 70 percent of that rent increase is attributable to rising fuel prices. Some fuel costs are paid by landlords; their cost increases may be passed on to tenants in the form of higher contract rents. Other fuel costs are paid directly by tenants; their cost increases reflect only in gross rent. Because gross rents include all fuel costs, they rose faster than contract rents (5.7 versus 4.4 percent annually).

Nonfuel operating expenses for rental properties also increased. Data covering a slightly different interval indicate that the cash

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*These figures are antilogarithms of the "MOVE" coefficients in Appendix Tables B.2 and B.11.

**$5.7 = .6(x + 2.8) + .4(x)$. More precisely, 60 is the turnover rate per 100 dwellings, not the number of different dwellings that had an occupancy change. See C. Peter Rydell, *Vacancy Duration and Housing Market Condition*, The Rand Corporation, N-1135-HUD, October 1979 (first issued as WN-10074-HUD, January 1978), for an analysis of turnover patterns.

Direct estimation from the rent-inflation file yields a 6.9 percent annual rate of gross rent increase for dwellings with occupancy changes during an observation interval, versus 4.9 percent for those without occupancy change. However, the estimates are not comparable because of differences in the average duration of observations for the two subsamples (see Table 2.5).

operating expense for the average rental property in St. Joseph County, 1974-77, increased by more than did its rental revenue. Consequently, landlords' profits decreased. We interpret this result as evidence against a scenario of demand-driven rent increases and for a scenario of cost-push inflation.

There is considerable variance between dwellings in the rate of rent increase observed in our sample. Part of the variance is associated with dwelling characteristics that imply different rates of factor-cost increase and perhaps differential shifts of submarket demand. But a substantial part reflects simply the irregularity of timing in rent adjustments when market conditions are changing. The gross rent inflation rate for dwellings with an occupancy change was 6.8 percent, versus 4.0 percent for those without an occupancy change.

IV. PROGRAM EFFECTS

The HAO's policy of adjusting allowance schedules to compensate for inflation in the standard cost of adequate housing is subject to an important qualification: If the allowance program itself is causing housing prices to increase, such compensatory action might intensify the problem and could therefore be undesirable. This section examines the evidence from both our rent-inflation analysis file and other sources that bear on the issue of program-caused price increases.

Briefly, we find that rents for participant-occupied dwellings did increase faster than rents for other dwellings in St. Joseph County, but these rent increases do not seem to have propagated beyond central South Bend nor were they large enough or common enough to perceptibly affect marketwide or even submarket averages. Moreover, part of the participants' rent increases were payments for housing repairs and improvements, rather than pure price increases.

HOW THE PROGRAM MIGHT AFFECT HOUSING PRICES

Because of the structure of the allowance program, any effect it could have on housing prices would have to operate through either of two market channels:

- With more money to spend for housing, participants might bid up the prices (contract rents) of desirable dwellings--those that met HAO standards of quality, and especially those that also had other desirable attributes. In this scenario, no change need occur in the flow of housing services from the existing stock of dwellings; excess demand in a competitive market would redistribute dwellings between participants and nonparticipants and would cause price increases reflecting in larger profits for landlords.

Presumably, the increased profitability of these sought-after dwellings would in time encourage landlords to repair or remodel dwellings to serve that segment of the market, and the increased supply would drive prices down until a new, normal-profit equilibrium was reached.

- The HAO's housing standards, relayed by enrollees to their current or prospective landlords, might lead to a substantial volume of housing repairs and improvements, as both landlords and tenants sought to qualify sub-standard dwellings for occupancy by program participants. Either by prearrangement with tenants or unilateral action by landlords, rents might be raised to reflect the greater market value of the improved dwellings. *Such rent changes would not contribute to price increases; rather, they would be payments for (desirable) quality increases.* However, it is conceivable that widespread repair activity generated by the allowance program might strain the capacity of the local home improvement industry and lead at least temporarily to higher prices for scarce labor or materials.

The scale of the program in St. Joseph County lends plausibility to both scenarios. In September 1978, about 17 percent of all renters in the county were enrolled in the program and about 12 percent were then receiving payments. Allowance payments to renters in that month totaled $185,000, about 6 percent of the countywide rent bill ($3.04 million). Over half of all enrollees lived in dwellings that failed their initial HAO evaluations, so had either to repair those dwellings or move in order to qualify for payments.

However, analysis of enrollees' responses both to the allowance and the housing requirements casts considerable doubt on both scenarios. Participants have only modestly increased their housing expenditures, their behavior reflecting a generally low income

elasticity of housing demand.* One estimate based on three years of program data is that renters in St. Joseph County increase their expenditures by 9.4 percent as a result of participation, despite average income supplements of about 31 percent.** This estimate implies a countywide increase in rent expenditures of about 1.2 percent.

Although about 5,200 dwellings (both rented and owner-occupied) had been repaired by September 1978 by enrollees seeking to qualify for payments, most of the work was done by the occupants of the dwellings, their friends, or their landlords; cash outlays for paid labor and materials were typically small, averaging about $80 per repaired owner-occupied home and $35 per repaired rental dwelling.*** In addition, homeowners appear to have increased their voluntary repair activity while in the program, and they used contractors more for this purpose than for initial repairs. However, for the year beginning July 1975, we estimate that the total volume of contractor-performed repairs to participants' dwellings in St. Joseph County was $758,000, about 3 percent of the countywide volume of contract repairs.†

In short, the collateral evidence does not suggest much pressure from the allowance program on housing prices either directly or by way of pressure on repair costs. As Sec. III concludes, purely exogenous cost increases, especially those for electricity, natural gas, and fuel oil, absorbed all of the observed increase in rental revenues during the period covered by our data. Our preliminary estimates, using baseline property accounts and factor-price indexes that are specific to St. Joseph County rental housing, indicate that the average cash operating return has decreased since the program began.

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*John Mulford, *Income Elasticity of Housing Demand*, The Rand Corporation, R-2449-HUD, July 1979.

**John E. Mulford, George D. Weiner, and James L. McDowell, *How Allowance Recipients Adjust Housing Consumption*, The Rand Corporation, N-1456-HUD, August 1980, p. 42.

***James L. McDowell, *Housing Allowances and Housing Improvement: Early Findings*, The Rand Corporation, N-1198-HUD, September 1979, Table 2.6.

†Michael G. Shanley and Charles M. Hotchkiss, *The Role of Market Intermediaries in a Housing Allowance Program*, The Rand Corporation, forthcoming.

DID THE PROGRAM INCREASE HOUSING PRICES FOR PARTICIPANTS?

The most likely place to look for program effects on housing prices is among the set of dwellings occupied by program participants. With this possibility in mind, we flagged 242 dwellings in our sample that were occupied by someone enrolled in the allowance program at the time of at least one occupant interview. These dwellings yielded 452 rent-change observations, including 304 for periods of participant occupancy.* Participant status indicators for each dwelling were included in the regression analysis of observed rent changes.

The parameter estimates reported in Appendix Table B.2 indicate that (controlling on time period, property type and location, dwelling size, and occupancy change) the gross rents of dwellings currently occupied by participants rose faster (by 2.1 percentage points annually) than did other gross rents.** We will call this extra rent increase the "participation premium."

The participation premium measures the mathematically expected effect on rents of a randomly chosen dwelling's having been occupied by a program participant. However, participants did not occupy a randomly chosen set of dwellings; they tended to live in particular neighborhoods and to avoid high-rent dwellings. They also may have moved more or less often than nonparticipants did.

To estimate the actual differences in rent histories between participants' and other dwellings, we divided the sample into those two groups and estimated the rent-inflation model (without the participation variable) separately for each group. The regression parameters (see Appendix Tables B.5, B.6, and B.25) were then used to estimate average inflation rates by dwelling size and property type with the results reported in

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*That is, a program participant occupied the dwelling at the time of at least one of the two interviews that define a rent-change observation period. We do not know for what portion of that period the participant occupied the dwelling.

**From Table B.2, $[exp(.0204)] - 1 = .0206$ with $t = 3.1$. The comparable coefficient for contract rent implies an annual premium of 2.33 percent for participants' dwellings (see Appendix Table B.11).

Table 4.1 for participants and Table 4.2 for nonparticipants. Comparing the grand means of those two tables yields a participation premium of 2.0 percentage points, insignificantly lower than the premium as measured by the participation coefficient in the combined data set (2.1 percentage points). Thus, it appears that on average, participants chose dwellings whose characteristics were otherwise no more or less favorable to rent increases than those chosen by nonparticipants.

The estimates from the split sample also indicate that the participation premium concentrates in the early part of the program. Comparing period means from Tables 4.1 and 4.2, we see the following average annual percentage changes in gross rent:

	St. Joseph County		
	Participants	Nonparticipants	Difference
Period 1	7.4	4.3	3.1
Period 2	9.5	7.4	2.1
Period 3	6.3	5.3	1.0
Periods 1-3	7.5	5.5	2.0

Because the sample of participants' dwellings is small, none of the period differences is statistically significant; however, the regularity of the trend reinforces the evidence, suggesting that the participation premium is a start-up effect that will vanish in subsequent program years.*

Comparing participant and nonparticipant inflation rates by dwelling size and property type is also hampered by large standard errors, and cross-period consistency is not tested by our model.** It appears that the participation effect was greatest for small dwellings, but there is no strong pattern by rent-level or type of property (compare Tables 4.1 and 4.2).

The participation premium is not a pure price increase. About a third of all renters who enroll in the program arrange to repair their enrollment dwellings in order to qualify for payments, and other analyses

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*See pp. 53-58 for additional evidence.

**Only the participation and occupancy-change statuses of a dwelling were allowed to vary with time in our model.

Table 4.1

GROSS RENT INFLATION BY DWELLING SIZE AND PROPERTY TYPE: PARTICIPANTS' DWELLINGS, 1974-78

Code	Dwelling Characteristic	Annual Rate of Increase (%) in Gross Rent							
		Period 1		Period 2		Period 3		Periods 1-3	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
	By Dwelling Size								
2	1-2 rooms	16.01	5.23	18.32	4.68	14.83	4.47	16.12	4.40
3	3 rooms	8.52	2.86	10.68	2.30	7.42	1.84	8.62	1.53
4	4 rooms	7.00	2.68	9.13	2.12	5.91	1.66	7.10	1.28
5	5 rooms	6.07	2.94	8.18	2.70	4.99	2.23	6.17	1.96
6	6+ rooms	7.36	2.79	9.50	2.67	6.27	2.21	7.46	1.85
	By Property Type								
	Low-rent Urban								
1	Single-family	7.38	3.94	9.51	3.66	6.29	3.15	7.48	3.10
2	2-4 units	10.19	2.92	12.38	2.32	9.07	1.91	10.29	1.58
3	5+ units	5.40	3.30	7.50	3.06	4.33	2.41	5.50	2.33
	Medium-rent Urban								
4	Single-family	9.72	2.98	11.90	2.62	8.60	2.29	9.82	1.93
5	2-4 units	6.01	2.78	8.11	2.46	4.93	2.01	6.10	1.68
6	5+ units	8.15	4.88	10.30	4.38	7.05	4.20	8.25	4.12
	High-rent Urban								
7	Single-family	2.59	2.82	4.63	2.78	1.54	2.35	2.68	2.04
8	2-4 units	6.55	3.69	8.67	3.51	5.47	3.10	6.65	2.94
9	5+ units	12.49	4.88	14.73	4.73	11.35	4.28	12.60	4.23
	Rural								
10	Low or medium rent	8.43	5.09	10.59	4.87	7.33	4.22	8.53	4.34
11	High rent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Sizes and Types								
	All dwellings	7.37	2.44	9.51	1.96	6.28	1.39	7.47	0.85

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: Period 1 = November 1974-December 1975; Period 2 = January-December 1976; Period 3 = January 1977-July 1978. See Appendix Table B.5 for regression parameters used to construct these estimates.

Table 4.2

GROSS RENT INFLATION BY DWELLING SIZE AND PROPERTY TYPE: NONPARTICIPANTS' DWELLINGS, 1974-78

Code	Dwelling Characteristic	Annual Rate of Increase (%) in Gross Rent							
		Period 1		Period 2		Period 3		Periods 1-3	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
	By Dwelling Size								
2	1-2 rooms	4.99	1.12	8.13	1.12	5.99	1.05	6.24	0.95
3	3 rooms	3.76	0.77	6.87	0.73	4.76	0.63	5.01	0.47
4	4 rooms	3.76	0.78	6.87	0.73	4.76	0.61	5.00	0.46
5	5 rooms	4.64	0.83	7.78	0.81	5.64	0.72	5.89	0.57
6	6+ rooms	5.47	0.89	8.63	0.88	6.48	0.79	6.73	0.66
	By Property Type								
	Low-rent Urban								
1	Single-family	8.26	1.34	11.51	1.37	9.30	1.30	9.56	1.21
2	2-4 units	4.83	0.82	7.97	0.81	5.83	0.72	6.08	0.56
3	5+ units	4.95	0.98	8.09	0.98	5.95	0.90	6.20	0.78
	Medium-rent Urban								
4	Single-family	5.64	0.91	8.80	0.91	6.65	0.82	6.90	0.69
5	2-4 units	2.69	0.81	5.77	0.77	3.68	0.69	3.92	0.54
6	5+ units	3.27	1.24	6.37	1.20	4.26	1.11	4.51	1.05
	High-rent Urban								
7	Single-family	2.38	1.02	5.45	1.03	3.36	0.96	3.61	0.85
8	2-4 units	3.30	1.32	6.40	1.31	4.29	1.23	4.54	1.17
9	5+ units	3.19	1.04	6.28	0.98	4.18	0.85	4.42	0.79
	Rural								
10	Low or medium rent	8.95	1.17	12.22	1.17	9.99	1.09	10.25	0.99
11	High rent	6.81	1.64	10.01	1.66	7.83	1.60	8.09	1.54
	All Sizes and Types								
	All dwellings	4.29	0.68	7.42	0.63	5.29	0.51	5.54	0.29

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: Period 1 = November 1974-December 1975; Period 2 = January-December 1976; Period 3 = January 1977-July 1978. See Appendix Table B.6 for regression parameters used to construct these estimates.

have shown that the repaired dwellings had larger average rent increases than did initially acceptable dwellings.* However, the participation premium reported above is also unlikely to be purely a payment for additional housing services, given what we know about the nature and cost of repairs.

DID PROGRAM-INDUCED PRICE INCREASES AFFECT MARKET PRICES?

The evidence that rent inflation was greater for participants' dwellings than for others raises the question whether those increases spilled over into a broader market. Such a spillover could take two forms:

- In the marketwide accounting for rent increases, the higher rates for participants' dwellings are averaged with lower rates for other dwellings. The average is consequently higher than it would be, absent any program effect.
- The example of successful price increases for participants' dwellings might influence landlords to raise rents for other dwellings more than they would have done, absent the program.

The participation premium was, of course, averaged into our estimates of marketwide rent increases. However, comparing the inflation rates reported for all dwellings in Table 3.1 with those reported for nonparticipants' dwellings in Table 4.2 assures us that the effect is practically negligible. Marketwide, the average annual increase was 5.7 percent for all dwellings, versus 5.5 percent for nonparticipants' dwellings.**

The evidence that the participation premium diminished over time is logically consistent with two alternative scenarios: (a) the premium diminished because landlords discovered that few participants were willing to pay it, given their option of moving, or (b) the premium was

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*See *Fourth Annual Report of the Housing Assistance Supply Experiment*, The Rand Corporation, R-2302-HUD, May 1978, Table 5.12.

**Alternatively, we could estimate the average rate of rent increase for all (including participant-occupied) dwellings, absent the participation premium of 2.1 percentage points. That calculation yields a "background" inflation rate of 5.4 percent annually.

propagated throughout the market, raising the general level of rents. Given the small magnitudes involved, it is difficult to find a test that would discriminate between these scenarios. The best test that we could devise was to compare price changes in central South Bend (where participants are numerous) with price changes in the rest of the county (where participants are few). That test is described below.

DID PROGRAM-INDUCED PRICE INCREASES AFFECT SUBMARKET PRICES?

Most students of metropolitan housing markets believe that those markets are divided into essentially noncompeting submarkets, within each of which the mutual adjustments of supply and demand proceed independently. If so, a program-induced price increase that vanishes in marketwide accounting might nonetheless be salient in a particular submarket.

Analysis of St. Joseph County's housing market from various perspectives leads us to the conclusion that its most strongly bounded submarket is central South Bend, the shaded area in the figure below. Although baseline rents for comparable dwellings do not much differ between central South Bend and the rest of St. Joseph County, and hedonic index estimation does not yield distinctively different price coefficients for housing attributes, vacancy rates are much higher and property values are much lower than elsewhere in the county.* Moreover, central South Bend houses 85 percent of the county's black population and about half of all program participants. About a fourth of the rented dwellings in central South Bend were at one time occupied by participants, versus a tenth elsewhere in the county (see Table 2.2). If program effects spill over from participants' dwellings to other dwellings, such effects are more likely to be visible in central South Bend than elsewhere.

Despite the greater density of participation in central South Bend, rents for most types of dwellings rose less there than in the rest of the county. Appendix Table B.2, which controls on property type and

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*C. Peter Rydell, *Shortrun Response of Housing Markets to Demand Shifts*, The Rand Corporation, R-2453-HUD, September 1979, Table 1; and Noland, *Assessing Hedonic Indexes for Housing*.

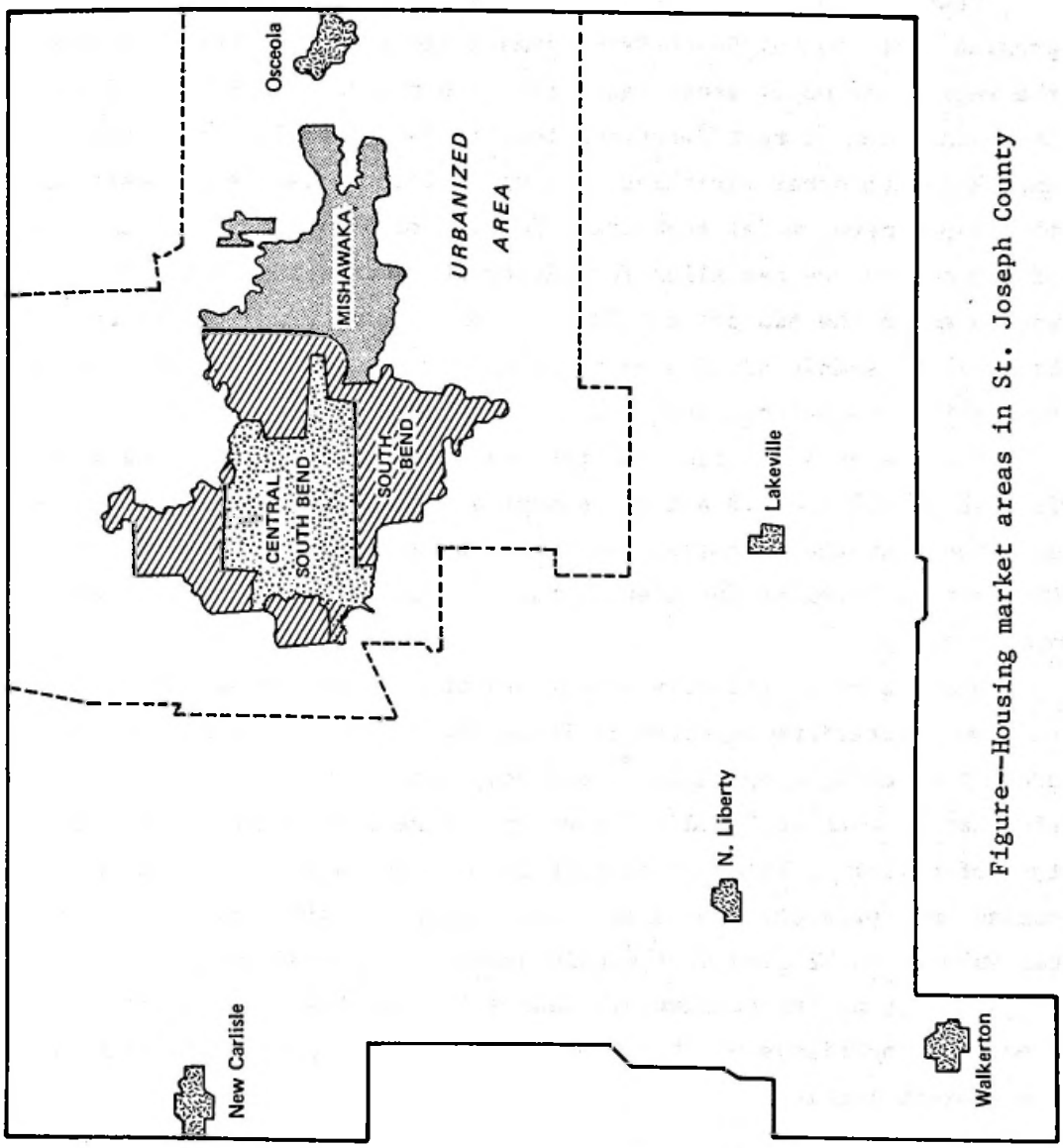

Figure--Housing market areas in St. Joseph County

dwelling size, as well as on participation status and occupancy change, indicates that location in central South Bend typically reduced a dwelling's average annual rate of gross rent increase by 0.6 percentage points, or by about 10 percent of the countywide average rate.

However, the structure of that analysis implicitly rejects the premise that central South Bend forms a distinct submarket; although the regression model whose parameters are reported in Table B.2 allows location to enter rent determination, it does not allow location to interact with other variables. By splitting the sample and estimating the 22-parameter model separately for central South Bend and the rest of the county, we can allow for different interactions among independent variables in the two areas. That approach is particularly attractive because the sample divides nearly evenly; we have 1,316 observations for central South Bend and 1,123 for the rest of the county.

Regression statistics for the two subsamples are reported in Appendix Tables B.7 and B.8 and are compared in Table B.26. The comparison confirms that the time-trends of rent change differ in the two areas (90-percent level of confidence) but is equivocal with respect to other parameters.

Because of potentially different interactions among variables in the two regressions reported in Tables B.7 and B.8, their coefficients are not directly comparable.* However, the coefficients of each regression can be used to "predict" the rate of rent increase for a particular type of dwelling, holding constant all variables except location. Comparing such predicted rates of rent increase should indicate whether the two submarkets behaved differently during the period in question; and if so, what the differences were. Tables 4.3 and 4.4 allow imprecise but adequate comparisons of this type, revealing two patterns pertinent to the present inquiry.**

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*Table B.26 compares *standardized* coefficients which are, for each case, essentially deviations from complementary averages. See Appendix B for an explanation of these test statistics and the reasons we chose them.

**The construction of those tables parallels the construction of Tables 4.1 and 4.2, discussed earlier. The entries, even for individual dwelling sizes or property types, reflect different mixes of dwellings

Table 4.3

GROSS RENT INFLATION BY DWELLING SIZE AND PROPERTY TYPE: DWELLINGS IN CENTRAL SOUTH BEND, 1974-78

Code	Dwelling Characteristic	Annual Rate of Increase (%) in Gross Rent							
		Period 1		Period 2		Period 3		Periods 1-3	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
	By Dwelling Size								
2	1-2 rooms	6.65	1.54	9.02	1.56	5.98	1.45	6.99	1.33
3	3 rooms	4.74	1.02	7.08	0.95	4.10	0.83	5.08	0.60
4	4 rooms	4.31	1.03	6.63	1.00	3.66	0.86	4.65	0.64
5	5 rooms	5.46	1.10	7.81	1.08	4.81	0.94	5.81	0.75
6	6+ rooms	5.83	1.16	8.19	1.17	5.18	1.05	6.18	0.86
	By Property Type								
	Low-rent Urban								
1	Single-family	8.23	1.76	10.64	1.79	7.56	1.67	8.58	1.57
2	2-4 units	5.97	1.04	8.33	1.00	5.31	0.87	6.32	0.65
3	5+ units	6.31	1.29	8.68	1.30	5.65	1.17	6.65	1.02
	Medium-rent Urban								
4	Single-family	6.27	1.23	8.64	1.22	5.61	1.08	6.61	0.92
5	2-4 units	3.60	1.03	5.91	0.99	2.96	0.86	3.94	0.65
6	5+ units	5.05	1.68	7.39	1.65	4.40	1.53	5.39	1.45
	High-rent Urban								
7	Single-family	2.84	1.31	5.13	1.34	2.21	1.23	3.18	1.08
8	2-4 units	4.25	1.71	6.58	1.70	3.61	1.59	4.59	1.50
9	5+ units	5.24	2.01	7.59	1.96	4.59	1.87	5.59	1.80
	Rural								
10	Low or medium rent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	High rent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Sizes and Types								
	All dwellings	5.09	0.89	7.44	0.85	4.44	0.69	5.44	0.37

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: Period 1 = November 1974-December 1975; Period 2 = January-December 1976; Period 3 = January 1977-July 1978. See Appendix Table B.7 for regression parameters used to construct these estimates.

Table 4.4

GROSS RENT INFLATION BY DWELLING SIZE AND PROPERTY TYPE: DWELLINGS IN THE REMAINDER OF ST. JOSEPH COUNTY, 1974-78

Code	Dwelling Characteristic	Annual Rate of Increase (%) in Gross Rent							
		Period 1		Period 2		Period 3		Periods 1-3	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
	By Dwelling Size								
2	1-2 rooms	3.83	1.58	8.41	1.53	6.51	1.43	6.17	1.33
3	3 rooms	2.95	1.11	7.49	1.03	5.60	0.84	5.27	0.68
4	4 rooms	3.10	1.08	7.65	0.95	5.76	0.75	5.42	0.58
5	5 rooms	3.18	1.17	7.72	1.11	5.83	0.98	5.50	0.81
6	6+ rooms	5.46	1.24	10.10	1.21	8.17	1.06	7.83	0.90
	By Property Type								
	Low-rent Urban								
1	Single-family	6.97	1.80	11.69	1.82	9.73	1.71	9.38	1.60
2	2-4 units	5.21	1.29	9.85	1.28	7.92	1.14	7.58	0.99
3	5+ units	2.75	1.37	7.27	1.34	5.39	1.19	5.06	1.08
	Medium-rent Urban								
4	Single-family	5.80	1.23	10.46	1.21	8.52	1.09	8.18	0.91
5	2-4 units	2.22	1.20	6.73	1.12	4.85	1.01	4.52	0.84
6	5+ units	1.37	1.70	5.84	1.60	3.98	1.48	3.65	1.42
	High-rent Urban								
7	Single-family	1.14	1.36	5.59	1.38	3.74	1.28	3.41	1.13
8	2-4 units	2.87	1.76	7.40	1.76	5.51	1.62	5.18	1.55
9	5+ units	1.94	1.26	6.43	1.14	4.56	0.93	4.23	0.84
	Rural								
10	Low or medium rent	7.73	1.29	12.48	1.25	10.51	1.09	10.16	0.94
11	High rent	5.81	1.69	10.48	1.69	8.54	1.61	8.19	1.48
	All Sizes and Types								
	All dwellings	3.44	0.98	7.99	0.86	6.10	0.65	5.76	0.40

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: Period 1 = November 1974-December 1975; Period 2 = January-December 1976; Period 3 = January 1977-July 1978. See Appendix Table B.8 for regression parameters used to construct these estimates.

First, for all dwelling sizes and all property types, there is a time-trend in the relative rates of rent increase in the two submarkets. The aggregate comparison of annual percentage changes, shown below, is characteristic of its detailed components:

	Central South Bend	Rest of County	Difference
Period 1	5.09	3.44	1.65
Period 2	7.44	7.99	- .55
Period 3	4.44	6.10	-1.66
Periods 1-3	5.44	5.76	- .32

Thus, when we allow for independent processes of rent determination in the two submarkets, we find that rents in central South Bend rose faster than elsewhere in the county during the first program year, but less rapidly thereafter. By Period 3, the rates of rent increase were generally lower in central South Bend than elsewhere.

Second, the initial disparity in rent-increase rates was generally least for single-family houses (property types 1, 4, and 7), most for apartments in large buildings (property types 3, 6, and 9). For the former, the central South Bend rates had dropped well below rates elsewhere by Period 3; for the latter, the corresponding rates converged, but did not cross.* There are no discernible patterns of relative rates either by rent level or dwelling size.

From the comparisons discussed above, we conclude that there was a central South Bend "location premium" during the first program year that subsequently diminished or reversed, depending on property type. Given the heavy concentration of program participants in central South

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as well as different parameter estimates for the two submarkets. However, we have also constructed rent-increase predictions for an assortment of strictly comparable standard cases (e.g., a 4-room dwelling on a low-rent, 2-4-unit property continuously occupied by a nonparticipant household) without obtaining any different messages than come from the simpler comparisons possible with Tables 4.3 and 4.4.

*The specification of the 22-parameter model forces rent changes for all types of dwellings in each submarket to follow the same general time-path, though at levels specific to each property and dwelling size.

Bend, one might suppose that this location premium was simply a proxy for the participation premium reported earlier, whose behavior was similar. To test this possibility, we respecified the 22-parameter model to show participation effects separately for each period, then fitted the respecified model to data for central South Bend. The regression statistics are reported in Appendix Table B.20; the salient coefficients, transformed to annual percentage changes in gross rent, are compared below to corresponding coefficients from Table B.7, the 22-parameter model fitted to central South Bend data.

	Central South Bend	
Standard Case[a]	22-Parameter Model (Table B.7)	24-Parameter Model (Table B.20)
Nonparticipant:		
Period 1	7.0	6.7
Period 2	9.4	9.3
Period 3	6.3	6.5
Participant:		
Period 1	2.6	4.2
Period 2		2.6
Period 3		1.6

[a]High-rent dwelling of 6+ rooms on a property with 5+ units, no change of occupancy. For the comparisons shown here, other standard cases would differ only by a model-specific constant k added to each column entry before exponentiation.

The figures above show that in central South Bend the participation premium was indeed largest during the first program year, declining sharply thereafter. They also show that part of the apparent trend in the location premium (22-parameter model) is actually due to participation: Note the flattening of the time-series for nonparticipants in the 24-parameter model. However, comparing the nonparticipant coefficients of the 24-parameter model fitted to central South Bend (Table B.20) with corresponding coefficients for the same model fitted to the rest of St. Joseph County (Table B.21) still signals a declining location premium when participation effects are controlled by period:

	24-Parameter Model		
Standard Case[a]	Central South Bend	Rest of County	Difference
Nonparticipants:			
Period 1	6.7	3.4	3.3
Period 2	9.3	7.4	1.9
Period 3	6.5	5.8	.7

[a]High-rent dwelling of 6+ rooms on a property with 5+ dwellings, no change of occupancy. For the comparisons shown here, other standard cases would differ only by a location-specific constant Z added to each column entry before exponentiation.

IS THE PARTICIPATION PREMIUM CUMULATIVE?

The text table on p. 44 indicates that dwellings currently occupied by participants experienced larger rent increases in every period than did other dwellings, although the differential diminished over time. One interpretation of that finding is that for someone participating in the program through all three periods, the participation premium would be cumulatively large--nearly 9 percentage points over a 3.75-year period.*

However, that interpretation assumes that the "participant-occupied dwellings" in our sample were first occupied by participants during Period 1 and that participants stayed in those dwellings through Period 3. The upper panel of Table 4.5 shows differently. Of 304 observations on participant-occupied dwellings, 230 were the first observation of that dwelling while a participant lived there. In Period 1, such "first observations" are the only type entering the parameter estimates; but three-fifths of all first observations occur either in Period 2 (comprising 54 percent of all Period 2 observations) or Period 3 (comprising 42 percent of all Period 3 observations).**

*$(1.075)^{3.75} - (1.055)^{3.75} = .089 = 8.9\%$

**These calculations are inexact, since the influence of an observation on period-specific parameters depends on the number of months of that observation that fall in each period.

Table 4.5

DISTRIBUTION OF RENT-CHANGE OBSERVATIONS BY PERIOD AND ORDER OF OBSERVATION: DWELLINGS CURRENTLY AND EVER OCCUPIED BY PARTICIPANTS

Order of Observation	Number of Observations Falling Partly or Entirely in the Indicated Period			
	1	2	3	1-3
Dwellings Currently Occupied by Participants				
All observations	92	176	256	304
First observations	92	62	76	230
Subsequent observations	--	114	180	74
Dwellings Ever Occupied by Participants				
All observations	147	289	352	452
First observations	147	61	34	242
Subsequent observations	--	228	318	210

SOURCE: Tabulated by HASE staff from records of the rent-inflation analysis file.

NOTE: Because rent-change observations are not synchronized, they often overlap two or more analysis periods. In this accounting, "first observations" on a given dwelling are assigned to the periods in which they begin. Portions of first observations that overlap subsequent periods are counted together with higher-order observations on the same dwellings as "subsequent observations." Because the entries for Periods 2 and 3 thus double-count observations, they do not sum to the totals in the last column.

Given the still heavy but diminishing load of first observations in Periods 2 and 3, a more plausible interpretation of the participation premium is that it is a surcharge imposed when a dwelling is first occupied by a participant, not an annual event.* If so, the countywide premium of 3.1 percent estimated for Period 1 (see p. 44) would be the total program effect on that dwelling's rents; for central South Bend, the corresponding figure is 4.2 percent (see p. 54).

An additional test seems to confirm the second interpretation, that the participation premium is an initial rather than a repeated surcharge. Our sample of dwellings contains 242 that were *ever* occupied by participants, and we have a total of 452 rent-change observations on those dwellings: 304 for intervals of participant occupancy and 148 for intervals during which the occupants were nonparticipants. The lower panel of Table 4.5 shows how the observations on these dwellings are distributed by period and order of observation. As compared with 76 percent of the observations on dwellings *currently* occupied by participants (upper panel of the table), only 54 percent of the ever-occupied cases are first observations on the dwelling of interest, and three-fifths of the first observations began in Period 1. In Period 2, first observations comprise only 27 percent of the total; in Period 3, only 11 percent.

Dividing the total sample of rent-change observations into those pertaining to dwellings *ever* occupied by participants (452 cases) and those pertaining to dwellings *never* occupied by participants (1,987 cases), we fitted the 22-parameter rent-inflation model separately to each subsample (see Appendix Tables B.9, B.10, and B.27). Then, we estimated the annual average change in gross rents for corresponding populations by the usual technique, with the following results:

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*That is, the initial surcharge becomes part of the base rent, which increases thereafter at the market rate for that type of dwelling.

	St. Joseph County		
	Dwellings Ever Occupied by Participants	Dwellings Never Occupied by Participants	Difference
Period 1	8.0	3.9	4.1
Period 2	8.0	7.8	.2
Period 3	5.2	5.4	-.2
Periods 1-3	6.8	5.5	1.3

Note that a substantial participation premium is evident for Period 1, when only first observations enter the parameter estimates; but the premium disappears in subsequent periods when first observations are only a small fraction of all observations. In short, the participation premium appears to be an initial, not a recurring surcharge.

The fact that the Period 1 premium on dwellings *ever* occupied by participants is larger than the corresponding premium on dwellings *currently* occupied by participants (4.1 vs. 3.1 percentage points) suggests that some of the rent increases we have attributed to the program actually precede a dwelling's occupancy by participants. A plausible interpretation (that cannot be confirmed without more chronological detail than is available) is that some of those who enrolled in the program did so because their rents had been increased. Whether such rent increases were random events or were prompted by the announcement of the allowance program cannot be deduced from these data.

CONCLUSIONS

Although we do not think that final conclusions about program effects on housing prices should be based solely on the rent-change data analyzed in this section, we believe that those data provide strong enough evidence to guide decisions about compensatory changes in the standard cost of adequate housing. Considering all the evidence discussed above, we conclude that:

- Early enrollees in the allowance program experienced above-average rent increases, especially in central South Bend where enrollment was concentrated. There, the initial participation

premium may have been as large as 4.1 percentage points, but that figure includes payments for increased housing services as well as price increases.

- The program effect may have extended beyond dwellings actually occupied by participants. Rents in central South Bend rose slightly more in Period 1 than did rents elsewhere in the county, the difference varying with other factors (property characteristics, participation status, occupancy change) that affected rent increases.
- Both the participation and location premiums for central South Bend dwindled rapidly as enrollment progressed. By the middle of Period 3, about 2.5 years after renter enrollment began, the countywide participation premium was about 1.0 percentage point (1.6 percentage points in central South Bend); and the central South Bend location premium had essentially disappeared.
- Outside central South Bend, the participation premium was never large; its 3-period average is 1.0 percentage point. We attribute this result to the low incidence (10 percent) of participants in the rest of the county's rental market. If, as in central South Bend, the spillover effects in the rest of the county were proportional to the participant premium, they were vanishingly small.
- For a given dwelling (and therefore for its occupants), the participation premium was apparently a one-time surcharge, not an annual extra rent increase. An April 1975 enrollee who stayed both in the program and in the same dwelling through July 1978 would be paying 3 to 5 percent more rent at the end of that time than if the dwelling had been continuously occupied by a nonparticipant.

V. CONCLUSIONS

The experimental housing allowance program in St. Joseph County bases its payments to participants partly on the marketwide "standard cost of adequate housing," which was initially estimated from screening survey data collected in August 1974. The schedule of standard costs (by size of dwelling) has since been revised several times to compensate for inflation. This study was undertaken to assist the fourth such revision.

The study's principal objective was to estimate how much gross rents in St. Joseph County changed during the 45-month interval (November 1974 to July 1978) spanned by HASE's annual surveys of rental properties. A secondary purpose was to determine whether the allowance program itself was contributing significantly to rent inflation. Preliminary analysis of rent changes for a panel of 1,412 rental dwellings yielded estimates of annual and 45-month rates of rent inflation for the entire rental stock, by size of dwelling and by property type. These estimates guided the HASE Field and Program Operations Group and the St. Joseph County HAO's recommendations for a new schedule of standard costs, effective January 1980.

Subsequent reanalysis of the data yielded slightly higher estimates of rent changes, but the differences are too small to be programmatically important. Secs. III and IV reported the findings of this reanalysis. They are summarized here and compared with the preliminary findings.

RENT INFLATION, 1974-78

Analysis of 2,439 rent-change observations on 1,412 rental dwellings in St. Joseph County, spanning the period November 1974 through July 1978, leads to the following conclusions:

- During that interval, gross rents increased marketwide at an average annual rate of 5.7 percent. The increase was greater in 1976 (7.7 percent) than in either 1974-75 or 1977-78 (4.6 and 5.3 percent, respectively).

- The rate of increase was greatest for very small and very large dwellings (6.6 and 6.8 percent, respectively) and least (5.3 percent) for dwellings with 3 or 4 rooms, which comprise the bulk of the rental stock. In general, rents rose more for low-rent dwellings, single-family houses, and rural dwellings than for their complements.
- Tenant turnover was a common occasion for rent increases. For dwellings whose tenants changed during an observation interval, the gross rent inflation rate was 6.8 percent, versus 4.0 percent for those without turnover.
- About 70 percent of the observed increase in gross rents is attributable to rising fuel prices, either paid directly by tenants or paid by landlords and added to contract rent. Because contract rent does not include all fuel costs, it rose less rapidly than did gross rent (4.4 vs. 5.7 percent annually).
- Nonfuel operating costs also rose, with the result that the average cash operating return on rental property appears to have decreased slightly.

Considering both the direct and collateral evidence, we conclude that marketwide rent increases in St. Joseph County were driven by the rising cost of supplying rental housing services, rather than by excess demand for such services. The amounts and timing of the rent increases and the apparent decline in cash operating return all support this conclusion.

PROGRAM EFFECTS

Since April 1975, the St. Joseph County Housing Allowance Office has distributed cash payments to low-income families to help them with their housing expenses. In September 1978, about 17 percent of all renters in the county were enrolled in the program, and about 12 percent were then receiving monthly payments totaling $185,000, or 6 percent of the countywide monthly rent bill. Allowance-stimulated demand for housing could have caused some of the observed rent

inflation. If so, a compensatory increase in allowances might cause rents to rise further. Our study examined these possibilities, with the following findings:

- Rents of dwellings occupied by participants did increase more than other rents, by about 2.0 percentage points (in central South Bend, 2.6 percentage points) annually over the 3.75-year period. However, this "participation premium" does not seem to be cumulative. Rather, when a tenant joins the program, or when a participant moves into a dwelling formerly occupied by nonparticipants, a one-time surcharge of 3.1 to 4.1 percent is imposed. Thereafter, the rate of rent increase is approximately "normal."
- Only part of the participation premium is a price increase. About a third of all renters who enroll in the program arrange repairs for their dwellings in order to qualify for payments. Other analyses have shown that such repaired dwellings had larger average rent increases than did initially acceptable dwellings. In those cases, part of the rent increase was payment for improved housing.
- Spillover effects on nonparticipants' dwellings are evident in central South Bend, where participants are numerous. Controlling on participation status as well as on other dwelling characteristics, we found that rents for most property types increased faster in central South Bend than elsewhere in the county during the first program year, 1974-75. However, such differentials diminished or reversed in subsequent years. Over the 3.75-year period, the average rent in central South Bend increased at about the same rate as in the rest of the county.
- Outside of central South Bend, the participation premium is hard to measure reliably because of the low frequency of participants' dwellings, but appears to be about 1.0 percent

annually over the 3.75-year period. Spillover effects, if any, could not be measured.

We conclude that raising allowance entitlements to compensate for past rent inflation is unlikely to cause further rent inflation. Collateral evidence indicates that allowances do not generate much extra housing demand through their income effects. Direct evidence from this study indicates that although participants' landlords impose small initial surcharges (partly to pay for program-required repairs), the rate of rent increase subsequently returns to "normal." In the program's first year, there seem to have been some spillover effects on nonparticipants' rents, but only in central South Bend, and not for long.

Averaging participants' rent increases in with other rent increases does bias our estimate of "background" rent inflation, but not enough to be practically important. Marketwide, the average annual increase was 5.7 percent, versus 5.5 percent for nonparticipants' dwellings.

Finally, there are some hints in the data that an appreciable number of participants joined the program following an unusually large rent increase, rather than the increase following their enrollment. We cannot tell from the data whether those unusually large increases were random events or were prompted by the announcement of a housing allowance program.

PRELIMINARY AND REVISED ESTIMATES OF RENT INFLATION

As explained in the introduction to this section, preliminary estimates of gross rent inflation by dwelling size were used by FPOG and the HAO in forming recommendations for a new schedule of the standard cost of adequate housing. Table 5.1 compares those preliminary estimates with the revised estimates reported in Sec. II, which are based on reanalysis of the same data.

The preliminary and revised estimates for dwellings with one or two rooms are statistically indistinguishable. For larger dwellings,

Table 5.1

PRELIMINARY AND REVISED ESTIMATES OF GROSS RENT INFLATION BY DWELLING SIZE: ALL DWELLINGS, 1974-78

Number of Rooms	Annual Rate of Increase (%) in Gross Rent				45-Month Increase (%)
	Nov 1974 -Dec 1975	Jan-Dec 1976	Jan 1977 -Jul 1978	Nov 1974 -Jul 1978	
Preliminary Estimate					
1-2	5.26	8.60	6.58	6.70	27.53
3	3.50	6.79	4.80	4.92	19.73
4	3.45	6.74	4.75	4.87	19.52
5	3.95	7.25	5.25	5.37	21.67
6+	4.92	8.25	6.24	6.36	26.01
All sizes	3.91	7.21	5.22	5.33	21.50
Revised Estimate					
1-2	5.53	8.68	6.19	6.64	27.26
3	4.18	7.29	4.84	5.28	21.28
4	4.15	7.26	4.81	5.25	21.15
5	4.65	7.77	5.31	5.75	23.33
6+	5.73	8.88	6.39	6.85	28.20
All sizes	4.61	7.73	5.26	5.71	23.15

SOURCE: Estimated by HASE staff from records of the St. Joseph County rent-inflation file.

NOTE: The FPOG-HAO recommendations reproduced in Appendix C were based on the preliminary estimates for a 43-month interval (November 1974-May 1978). Subsequent reanalysis of the data yielded the revised estimates shown in the lower panel.

we now think that the preliminary figures underestimated the average annual inflation rate by about 0.4 percentage points. The underestimates are largest in Period 1, smaller in Period 2, and negligible in Period 3.

The estimates changed for several reasons. Reviewing the preliminary analysis, we identified various assumptions and tactical decisions made under deadline pressure that could be improved upon; and also some minor errors in computational algorithms, always a

hazard in machine data processing. Specifically, the reanalysis differed in the following respects:

- The participation status of a dwelling was redefined so that it could vary over time. Initially, all observations pertaining to a dwelling *ever* occupied by participants were counted as observations on "participants' dwellings." In the reanalysis, only observations during which the dwelling was *currently* occupied by participants were so counted. (In fact, both the preliminary and revised analyses tested both specifications, but reported only the ones indicated.*) This change was influential in diagnosing program effects, but insignificant in marketwide estimates of gross rent inflation.
- A computational error was discovered in the outlier adjustment routine described in Sec. II. Correction of this error changed all of the estimates slightly, slightly increasing the marketwide average rates for Periods 1 and 2 and reducing the rate for Period 3. The 3-period annual average was unaffected.
- Observation intervals were redefined. These are the intervals between two interviews with the occupants of a given dwelling. In the preliminary analysis, the entire months in which the initial and terminal interviews occurred were both counted in the interval associated with an observed rent change. On average, that procedure overstates the interval by one month, though the overstatement varies with actual interview dates. In the reanalysis, the observation interval was defined as running from the beginning of the month preceding the first interview to the beginning of the month preceding the second interview, these usually being the dates of the respondent's last preceding contract rent payments. This change shortened the average observation interval by 6.2 percent and therefore

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*The reanalysis reported here does include a few tables on "ever-occupied" dwellings. See pp. 54-58 and Appendix Tables B.9, B.10, and B.27.

increased the associated rate of rent change by about 0.3 percentage points. Terminating each observation sooner decreased the average duration of observations by 4 percent in Period 2 and 11 percent in Period 3. Period 1 was unaffected.

- The base for population estimates was expanded. In the preliminary analysis, inflation parameters estimated by regression were applied to a 1976 population of rental dwellings which excluded, among other categories, those that were vacant at the time of the second survey wave (about 12 percent of all rented dwellings) because their participation status was indeterminate. In the reanalysis, we imputed participation status to these dwellings and included them in our population estimates. The main effect was to alter the relative weights of the property-type-by-size-of-dwelling strata in estimating the marketwide inflation rate. The rate itself did not change significantly.

The most systematic effects were those associated with redefining observation intervals, which account for most of the increase in the average annual inflation rate. This redefinition, together with the reprogramming of the outlier adjustment, also shifted inflation from later to earlier periods. As Table 5.1 shows, the Period 1 annual average for all dwelling sizes increased by 0.7 percentage points; the Period 2 average, by 0.5 percentage points; and the Period 3 average, by 0.1 percentage point.

The programmatic implications are slight. As is explained in Appendix A, the FPOG-HAO analysts used only 43 months of our 45-month average inflation rates by size of dwelling. Had they also used the revised inflation rate estimates, the recommended schedule of standard costs would have been unchanged for dwellings of one or two rooms, and about 1.6 percent larger for other dwellings. Over all dwelling sizes, the FPOG-HAO estimate of the 43-month gross rent increase was 20.5 percent; using the revised estimates, it would have been 22.1 percent. On the other hand, we have noted that our marketwide figure

includes a small program effect; if only nonparticipant data were used to measure background inflation, the revised estimates would yield a 43-month gross rent increase of 21.4 percent, or 0.9 percentage points greater than the FPOG-HAO estimate.

Actually, the FPOG-HAO analysis incorporates another underestimate of at least equal size. The reference date for the initial schedule of standard costs was August 1974, when the screening survey was conducted. The analysis reported here is based on annual survey data spanning the period November 1974 through July 1978. The authors of Appendix A calculated a 43-month rate of rent increase for each size of dwelling (see Table A.4) running from November 1974 (the beginning of the annual surveys) through May 1978 (a convenient date for switching to an estimating method that was not dependent on survey data). Table A.5 combines that 43-month increase with a subsequent 18-month increase derived by the postsurvey method to obtain an estimate of the total change in the standard cost of adequate housing between November 1974 and November 1979.

To calculate inflation-compensated values for the standard cost of adequate housing in December 1979, the authors of Appendix A applied the 61-month inflation factors described above to the initial schedule of standard costs. In so doing, they failed to allow for inflation between August and November 1974.*

Table 5.2 shows the inflation factors for August 1974 through November 1979 that now seem most appropriate to us, and compares them with the factors actually used in Appendix A to calculate the new schedule of standard costs. Our revised factors (a) use the higher inflation rates presented in the lower panel of Table 5.1, and (b) are calculated on the basis of 46 rather than 43 months, to include August-October

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*Given the complex chronologies of both standard cost schedules and survey fieldwork, the oversight is understandable. Appendix A was reviewed by one of the authors of this report (Lowry) before it was submitted to HUD, and he also missed the significance of the starting date in Table A.5.

Table 5.2

PRELIMINARY AND REVISED ESTIMATES OF INFLATION IN THE STANDARD COST OF ADEQUATE HOUSING: 1974-79

Number of Rooms	Survey-Based Estimate		Postsurvey Estimate (Jun 1978 -Nov 1979)	Combined Estimates		
	Preliminary (Nov 1974 -May 1978)	Revised (Aug 1974 -May 1978)		Preliminary (Nov 1974 -Nov 1979)	Revised (Aug 1974 -Nov 1979)	Difference (Col. 4- Col. 5)
1-2	26.19	27.75	17.06	47.72	49.95	-2.23
3	18.80	21.61	12.44	33.58	36.74	-3.16
4	18.60	21.47	12.31	33.20	36.42	-3.22
5	20.64	23.72	13.61	37.06	40.56	-3.50
6+	24.74	28.67	16.17	44.91	49.48	-4.57
All sizes	20.50	24.27	13.50	36.77	41.05	-4.28

SOURCE: Table 5.1 and Appendix Table A.5.

NOTE: Preliminary figures are those used in Appendix A to form recommendations for a new schedule of the standard cost of adequate housing for December 1979. Revised figures are those that now seem appropriate, for reasons explained in the text. The combined estimates are the product of either the preliminary or revised figures (as labeled) with the same postsurvey estimate.

1974 and exclude June-July 1978, and (c) accept the FPOG-HAO estimates for June 1978-November 1979.

Had the revised factors been used to determine the standard cost of adequate housing in December 1979, payments to program participants would have increased by about 3.0 percent.* Given the variety of other judgments that entered the recommendations presented in Appendix A, the underestimate of inflation is not programmatically important. In any case, it need have only transient effects on allowance payments. It can be corrected by the HAO in the course of the next schedule revision.

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*Holding clients' incomes constant, each dollar increase in the standard cost of adequate housing adds one dollar to each client's allowance entitlement. In September 1979, the average allowance entitlement was $79 monthly. The recommended increase brought the average for that population to $99 monthly. Had the revised inflation factors been used to calculate the recommended increase, the average entitlement would have been $102, an increase of about 3.0 percent.

Appendix A

A REVISED SCHEDULE FOR THE STANDARD COST OF ADEQUATE HOUSING IN ST. JOSEPH COUNTY, INDIANA: ANALYSIS AND RECOMMENDATIONS*

INTRODUCTION

This paper recommends adjustments to the Standard Cost of Adequate Housing (R^*) schedule for the St. Joseph County housing allowance program to be effective 1 December 1979.** It also describes the data and methods used in developing the recommendations.

The initial R^* schedule for St. Joseph County was based on the HASE screener survey. The schedule has been adjusted three times since then. Only the second adjustment (effective September 1977) relied on additional HASE survey data: data on gross rent inflation from survey wave 1 to wave 2. The most recent adjustment that yielded the current schedule (effective January 1979) was based on HAO staff analysis of changes in fuel and utility costs only.

For this analysis, data from all HASE surveys (waves 1 through 4) were used to estimate inflation in gross rents from November 1974 (the base date of the initial schedule) through May 1978 (midpoint of wave 4 data collection). A method similar to that proposed for postexperimental R^* schedule adjustments for the Brown County housing allowance program***

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*This appendix was prepared by G. Thomas Kingsley, manager of HASE's Field and Program Operations Group, and Timothy M. Corcoran, deputy director of the St. Joseph County HAO. Its rent-inflation estimates are based on a preliminary analysis of survey data that yielded slightly different results than are reported in the main text of this note. See Sec. V for discussion.

**The recommendations presented here were submitted to HUD on 4 October and 16 November 1979, were approved by HUD on 4 December 1979, and became effective 1 January 1980, a month later than had been planned.

***Alesch, Ernst, Kingsley, and Larson, "Proposed Methods for Post-Transition Updates for Standard Housing Expenses and the Standard Cost of Adequate Housing."

was then used to estimate inflation in gross rents from May 1978 through November 1979. (We call it the "HAO method" in this paper.)

Before describing our analysis of rent inflation, however, we consider the case for realigning the 1974 base schedule.

PROPOSED REALIGNMENT OF THE 1974 R^* SCHEDULE

Since this is the last R^* analysis for St. Joseph County to be performed by Rand, we wanted to assure ourselves that we would leave the program with the most reasonable and defensible schedule possible. Accordingly, we reviewed our earlier studies to see if there was any justification for questioning our prior recommendations.

In this review, we found some evidence to suggest problems in the comparability of the approved 1974 R^* schedules in the two HASE sites. First, the R^* values in the 1974 schedule for Brown County were generally higher than the median rents for standard units in that site, whereas the St. Joseph County schedule fell below the comparable medians for three out of five dwelling sizes (see Table A.1). Second, a comparison of the 1974 (realigned) schedules with the rents paid by clients during the first year of program operation in each site showed client rents averaging more than R^* in both sites, with a somewhat wider gap between the St. Joseph County figures (see Table A.2).

Although these are crude indicators, we believe they are sufficient to justify an adjustment to the 1974 schedule for St. Joseph County. In our original studies, we pointed out that the empirical base for determining R^* was more solid in Brown County than in St. Joseph County.* In Brown County, housing quality increased with rent in a fairly orderly relationship. We were able to establish an R^* schedule with confidence that the values chosen were appropriate to the target levels of housing quality.**

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*Lowry, Woodfill, and Repnau, *Program Standards for Site I;* Lowry, Woodfill, and Dade, *Program Standards for Site II.*

**See Lowry, Woodfill, and Repnau, *Program Standards for Site I*, pp. 4-6.

Table A.1

COMPARISON OF 1974 (REALIGNED) R^* SCHEDULES WITH MEDIAN RENTS: BROWN AND ST. JOSEPH COUNTIES

Occupancy Standard		Approved R^* ($)		Median Gross Rent ($)		Ratio of Realigned R^* to Median Rent	
No. of Persons	No. of Bedrooms	Initial Schedule	Realigned Schedule	All Units	Standard Units	All	Standard
Brown County							
1	0	100	110	91	101	1.21	1.09
2	1	125	130	123	127	1.06	1.02
3-4	2	155	155	150	155	1.03	1.00
5-6	3	170	170	160	168	1.06	1.01
7+	4	190	180	146	146	1.23	1.23
Average[a]						1.12	1.07
St. Joseph County							
1	0	100	105	106	116	.99	.91
2	1	125	130	117	118	1.11	1.10
3-4	2	145	145	142	144	1.02	1.01
5-6	3	160	160	164	171	.98	.94
7+	4	170	170	172	181	.99	.94
Average[a]						1.02	.98

SOURCE: For Brown County, Ira S. Lowry, Barbara M. Woodfill, and Tiina Repnau, *Program Standards for Site I*, WN-8574-HUD, January 1974; Ira S. Lowry, *Inflation in the Standard Cost of Adequate Housing: Site I, 1973-1976*, N-1102-HUD, October 1979 (first issued as WN-9430-HUD, March 1976). For St. Joseph County, Ira S. Lowry, Barbara M. Woodfill, and Marsha A. Dade, *Program Standards for Site II*, WN-8974-HUD, February 1975; James P. Stucker, *Rent Inflation in St. Joseph County, Indiana: 1974-77*, N-1116-HUD, November 1979 (first issued as WN-9734-HUD, September 1977). All are publications of The Rand Corporation.

NOTE: Initial R^* schedules were based on market surveys of actual rents conducted in Brown County in September 1973 and St. Joseph County in September 1974. For Brown County, R^* was realigned in April 1976; for St. Joseph County, in November 1976.

[a]Unweighted average of calculated ratios.

Table A.2

COMPARISON OF 1974 (REALIGNED) R^* SCHEDULES WITH FIRST CERTIFIED RENTS FOR YEAR-1 RECIPIENTS: BROWN AND ST. JOSEPH COUNTIES

Occupancy Standard		Average First Certified Rent, Year 1[a]		Ratio of Realigned R^* to First Certified Rent[b]	
Number of Persons	Number of Bedrooms	Brown County	St. Joseph County	Brown County	St. Joseph County
1	0	116	115	.95	.91
2	1	149	150	.87	.87
3-4	2	168	169	.92	.86
5-6	3	198	191	.86	.84
7+	4+	201	198	.90	.86
Average[c]				.90	.87

SOURCE: Table A.1 and tabulations by HAO staffs of recipient records for July 1974-June 1975 in Brown County and April 1975-March 1976 in St. Joseph County.

[a]Recipients are grouped by number of persons, not number of bedrooms.

[b]Ratio of realigned R^* to average first certified rent, not average of individual ratios.

[c]Unweighted average of calculated ratios.

In St. Joseph County, the relationship between quality and rent was erratic; more judgment was required in setting the initial schedule. It is possible, therefore, that the initial schedule in St. Joseph County, and its first realignment, were set too low.

In designing a further realignment at this point, we considered several factors. First, we thought that the ratios described above for the St. Joseph County schedule should more closely approximate those for the firmer Brown County schedule. Second, we thought there should continue to be a reasonable and equitable spacing between R^* levels for different size classes. Third, we wanted to be conservative about the amounts proposed because we lacked thorough data relating to these issues; thus, when there was room for judgment, we chose R^* values that would commit the program to a smaller outlay of funds.

Table A.3

PROPOSED REALIGNMENT OF R^* SCHEDULE FOR ST. JOSEPH COUNTY

Occupancy Standard		Realigned R^* (in 1974 $)		Ratio of Current Proposal to:		
Number of Persons	Number of Bedrooms	Nov 1974	Current Proposal	Median Rent, Standard Units	First Certified Rent	Brown County R^*
1	0	105	105	.91	.91	.95
2	1	130	130	1.10	.87	1.00
3-4	2	145	150	1.04	.89	.97
5-6	3	160	170	.99	.89	1.00
7+	4+	170	180	.99	.91	1.00
Average[a]				1.01	.89	.98

SOURCE: Tables A.1 and A.2

[a]Unweighted average of calculated ratios.

The proposed realignment, shown in Table A.3, was developed by balancing these factors. It proved impossible to use any one as the sole guide. For example, had we simply determined the St. Joseph County schedule for all size classes by assuming the Brown County ratios of R^* to first certified rents, we would have defied reasonable bounds in regard to the other two factors, ratios to median rents and fiscal conservatism.

INFLATION ESTIMATES, NOVEMBER 1974 THROUGH MAY 1978

The method we used to analyze waves 1 through 4 survey data in St. Joseph County was similar to that used for the comparable Brown County analysis.* Results are summarized in Table A.4. For units of all sizes, inflation in gross rents in calendar 1975 was 3.91 percent. The rate increased to 7.21 percent in calendar 1976, then declined to 5.22 percent for the 1977-78 period. Gross rent inflation over the entire 43-month period ranged from 18.60 percent (4-room units) to

*Stucker, *Rent Inflation in Brown County*.

Table A.4

MARKETWIDE ESTIMATES OF GROSS RENT INFLATION:
ST. JOSEPH COUNTY, NOVEMBER 1974-May 1978

Number of Rooms	Annual Inflation Rates(%)				43-Month Increase[a] (%)
	1975	1976	1977-78	1975-78 Average	
1-2	5.26	8.60	6.58	6.70	26.19
3	3.50	6.79	4.80	4.92	18.80
4	3.45	6.74	4.75	4.87	18.60
5	3.95	7.25	5.25	5.37	20.64
6+	4.92	8.25	6.24	6.36	24.74
All sizes	3.91	7.21	5.22	5.33	20.50

SOURCE: Estimated by HASE staff from records of the survey of renters for St. Joseph County, waves 1-4 [Ed. Note: Estimates are from a preliminary analysis; see Sec. V, especially Table 5.1, for final estimates].

[a]The 43-month equivalent rate is a weighted average computed in the following manner: 14 months of the 1975 estimate (to include the last 2 months of 1974); 12 months of the 1976 estimate; 17 months of the combined 1977-78 rate (to include the first 5 months of 1978).

26.19 percent (1- and 2-room units). The rate for all sizes was 20.50 percent.

TESTING THE HAO METHOD FOR WAVES 1 THROUGH 4

The method proposed for postexperimental schedule adjustments in Brown County entailed: (1) applying the change in the U.S. Bureau of Labor Statistics' (BLS) residential rent index for the north central region to HASE survey base data for contract rent to estimate inflation in contract rent; and (2) applying HAO estimates of increases in total residential fuel and utility costs to HASE data for tenant-paid fuel and utility cost (the remaining component of gross rent) to estimate inflation in that component.

When this method was applied to the period covered by the HASE surveys in Brown County, resulting estimates of gross rent inflation closely approximated those measured by the surveys. The method does not predict as well for St. Joseph County, but we judge that it predicts well enough to serve as the basis for postexperimental schedule adjustments there. For reasons described in the Brown County proposal, it should have more credibility than any other available method short of additional market surveys. The steps are as follows:

- Mean contract rent for rental units of all sizes in St. Joseph County was $108 per month in March 1975 (midpoint of wave 1). By May 1978 (midpoint of wave 4), the mean had increased to $133. The BLS residential rent index increased from 86.6 in March 1975 to 101.9 in April 1978. Applying the derived annual rate of increase (5.42 percent) over the full March 1975-May 1978 period yields an estimate of the May 1978 mean contract rent of $128.
- Tenant-paid fuel and utility costs averaged $27 per month at wave 1 and $34 at wave 4. By the HAO method, total fuel and utility costs for a typical household increased from $59.38 in January 1975 to $79.97 in January 1978, an average annual increase of 10.43 percent. Applying this rate only to the wave 1 base for tenant-paid fuel and utility costs yields a May 1978 estimate of $37.
- The implied estimate for the mean gross rent in May 1978 ($165) is quite close to the actual as measured by the HASE wave 4 survey ($167), even though the proposed method underestimates the measured change in contract rent and overestimates the change in tenant-paid fuel and utility costs.

INFLATION ESTIMATES, JUNE 1978 THROUGH NOVEMBER 1979

We could have estimated November 1979 adjustments to the R^* schedule simply by applying the last measured inflation rates from survey data (1977-78) through November 1979. There is evidence, however, that

gross rent inflation rates since May 1978 have been higher than they were over the previous year.*

- The BLS residential rent index for the north central region increased from 101.9 in April 1978 to 110.9 in June 1979, an annual rate of increase of 7.52 percent. Starting with St. Joseph County's mean contract rent of $133 in May 1978 as measured by survey wave 4, the application of this rate over the subsequent 18-month period yields a November 1979 estimate of $148.28.
- HAO estimates of total fuel and utility cost for the typical St. Joseph County household increased from $79.97 in January 1978 to $98.13 in August 1979, an annual rate of increase of 13.8 percent. Starting with St. Joseph County's mean for tenant-paid fuel and utility costs from wave 4 ($34 in May 1978), the application of this rate yields an estimate of $41.28 in November 1979.
- These estimates imply an increase in mean gross rent from $167 in May 1978 to $189.56 in November 1979, a total increase of 13.5 percent (8.81 percent annual rate). To calculate rates over the same period for units of different sizes, we assume that the ratio of the annual rate for each size category to the overall rate (8.81 percent) is the same as the comparable ratio calculated from the 1975-78 average annual rates in Table A.4.**

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*The BLS index used in this analysis is the residential rent component of the consumer price index for all urban consumers in the north central region, as reported in U.S. Department of Labor, Bureau of Labor Statistics, *CPI Detailed Report*, U.S. Government Printing Office, Washington, D.C., various dates. Most recent HAO estimates of fuel and utility costs are from Roger Chrastil and Timothy Corcoran, *Fuel and Utility Costs in St. Joseph County, August 1979*, St. Joseph County Housing Allowance Office, August 1979. Estimates for earlier dates are from previous submissions to HUD.

**In our recent analysis for the Brown County program, we used a different method to estimate inflation by unit size. We applied a single BLS index to inflate contract rents in all size categories, but applied separate fuel and utility inflation factors (from HAO studies)

- As shown in Table A.5, these rates are then applied to the vector of rates for the previous 43 months to establish the complete 61-month equivalent rates (November 1974 through November 1979). The annual rates over the full period range from 5.80 percent (for 4-room units) to 7.98 percent (1- and 2-room units). The annual rate for all sizes is 6.35 percent.

PROPOSED ADJUSTMENTS TO THE *R** SCHEDULE

To adjust the *R** schedule, we apply the full 61-month inflation rates to the proposed realigned 1974 schedule; Table A.6 shows the results. As in past submissions, resulting values are rounded to the nearest $5 in the proposed 1979 schedule.

Table A.7 compares the proposed *R** values for December 1979 with the current values, promulgated in January 1979. For each unit size, the table also separates the proposed *R** increase into its components, inflation and schedule realignment.

ESTIMATED INCREASE IN OUTLAYS FOR ALLOWANCE PAYMENTS

In Table A.8, we show that the proposed schedule adjustments would increase outlays for allowance payments in December 1979 by about $116,840. We estimate that checks mailed the last of November will amount to $471,400; therefore, this increment would represent a 25-percent increase. As shown in the table, a significant part of the increase ($10,035 or 9 percent) is due to our proposed realignment of the 1974 *R** schedule. The remaining $106,805 is justified by our estimates of rent inflation since 1974.

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to tenant-paid fuel and utility costs in the various size categories. That method did not work well in St. Joseph County because of extreme variation in the ratios of tenant-paid fuel and utility costs to all fuel and utility costs in units of different sizes. In early 1978, the tenant-paid component represented about 6 percent of the total for 1- and 2-room units. The ratio increased with unit size, reaching 91 percent for units with 7 or more rooms. Fuel and utility costs have been increasing more rapidly than shelter costs of late. In these circumstances, the application of the Brown County method would have biased estimates of gross rent inflation upward for larger units and downward for smaller units.

Table A.5

MARKETWIDE ESTIMATES OF GROSS RENT INFLATION:
ST. JOSEPH COUNTY, NOVEMBER 1974-NOVEMBER 1979

Number of Rooms	43-Month Increase (Nov 74-May 78)	18-Month Increase (Jun 78-Nov 79)	61-Month Increase (Nov 74-Nov 79)	
			Total	Annual Rate
1-2	26.19	17.06	47.72	7.98
3	18.80	12.44	33.58	5.86
4	18.60	12.31	33.20	5.80
5	20.64	13.61	37.06	6.40
6+	24.74	16.17	44.91	7.57
All sizes	20.50	13.50	36.77	6.35

SOURCE: See text.

Table A.6

ADJUSTING R^* SCHEDULE FOR INFLATION, 1974-79:
ST. JOSEPH COUNTY

Occupancy Standard		Proposed R^* Realignment (1974 $)	Marketwide Inflation, 1974-1979		Proposed R^* Schedule (Dec 1979)
Number of Persons	Number of Rooms[a]		Percent	Amount ($)	
1	1-2	105	47.7[b]	50	155
2	3	130	35.7[b]	46	175
3-4	4	150	33.2	50	200
5-6	5	170	37.1	63	235
7+	6	180	44.9	81	260

SOURCE: Tables A.3, A.4, and A.5.

[a]Marketwide inflation rates were computed by number of rooms rather than number of bedrooms. However, HAO occupancy standards can be expressed equivalently in rooms or bedrooms.

[b]Inflation rates for units with 1-2 rooms and those with 3 rooms are weighted according to incidence in St. Joseph County (15 and 85 percent, respectively).

Table A.7

COMPARISON OF PROPOSED AND CURRENT R^* SCHEDULES:
ST. JOSEPH COUNTY

Occupancy Standard		R^* Schedule ($)		Ratio, Proposed to Current	Components of Proposed Increase ($)		
Number of Persons	Number of Rooms	Current (Jan 79)	Proposed (Dec 79)		Inflation only[a]	Due to Realignment[b]	Total
1	1-2	130	155	1.19	25	--	25
2	3	160	175	1.09	15	--	15
3-4	4	190	200	1.05	5	5	10
5-6	5	195	235	1.20	25	15	40
7+	6	205	260	1.27	40	15	55
Average				1.16			

SOURCE: Iao Katagiri and G. Thomas Kingsley, eds., *The Housing Allowance Office Handbook*, The Rand Corporation, N-1491-HUD, July 1980, and Tables A.3 and A.6.

NOTE: Current R^* schedule was effective 1 January 1979. It reflects only utility price increases after September 1977. Proposed schedule is based on reestimates of inflation for the entire period, November 1974 to December 1979.

[a]Effect of inflation, based on November 1976 realigned schedule.

[b]Proposed realignment in 1979 dollars.

Table A.8

EFFECT OF PROPOSED R^* INCREASE ON MONTHLY ALLOWANCE DISBURSEMENTS: ST. JOSEPH COUNTY

Number of Persons	Recipient Households (Sep 79)	Proposed Increase per Household ($)	Estimated Increase in Monthly Disbursement ($)		
			Without Realignment	Due to Realignment	Total
1	2,877	25	71,925	--	71,925
2	1,416	15	21,240	--	21,240
3-4	1,137	10	5,685	5,685	11,370
5-6	243	40	6,075	3,645	9,720
7+	47	55	1,880	705	2,585
Total	5,720	20	106,805	10,035	116,840

SOURCE: Tables A.6 and A.7. Participation estimates are based on the recipient population as of 30 September 1979.

NOTE: Entries in this table were revised in October 1980 to correct errors in the original.

After an R^* adjustment, the average allowance payment declines month by month as client incomes increase and R^*, for a time, remains fixed. However, the $116,840 gap between monthly payments based on the proposed adjustment and the payment levels that would have occurred without it is likely to remain relatively constant in subsequent months, assuming no dramatic changes in the number of recipients. Thus, the adjustment will probably cause an increase of about $1,402,000 in allowance payments over the coming year.

Appendix B

PARAMETER ESTIMATES FOR THE RENT-INFLATION MODEL

The general model specified in Sec. II was estimated twice on the entire sample of rent-change observations, once for gross rent changes, and once for contract rent changes. Each version was also estimated on each of eight subsamples of rent-change observations. Finally, the model was respecified to distinguish participation effects by period (augmented model) and then estimated on two of the subsamples.

This appendix systematically reports the estimated regression coefficients and auxiliary statistics for each case. Table B.1 provides a crosswalk between the notation used in Sec. II and the mnemonic labels of the statistical tables that follow. Tables B.2 through B.23 each report parameter estimates for a particular case. For the general model's eight paired subsamples, Tables B.24 through B.31 compare the estimated coefficients of each independent variable.

As explained in Sec. III, the estimated parameters of each case were applied to a representation of the population of rental dwellings in St. Joseph County in order to estimate composition-weighted average rates of rent change by period, size of dwelling, and type of property. The salient cases are fully reported in the main text (Tables 3.1, 3.2, 4.1 through 4.4). Corresponding tables were generated for the remaining cases, but are omitted because they do little to amplify the findings.

REGRESSION VARIABLES FOR THE FULL SAMPLE

The full sample consists of 1,412 dwellings, for which 2,439 rent-change observations were available. Those observations cover different intervals between November 1974 and July 1978; the interval covered by each observation is partitioned among three arbitrary periods, the subinterval falling in each period serving as the value of the period variable. The total interval of observation also serves as a weight on each of 19 binary (0,1) dwelling status variables. In effect, the logarithmic transformation of the observed rent change was regressed on 22

exposure-weighted indicator variables. The regression coefficients are identified in Table B.1 by the symbols used to represent them in Sec. II and by the exposure weights and indicator variables with which they are associated. Tables B.2 (gross rent) and B.11 (contract rent) report the regression coefficients that were estimated on each variable.

Because the 11 property-type indicators and 5 dwelling-size indicators each form closed sets whose elements are complements, one indicator was arbitrarily omitted from each set: property type PS09, and dwelling size RMS6.

REGRESSION VARIABLES FOR THE SUBSAMPLES

The general model was also estimated on eight subsamples of rent-change observations. The parameter estimates for the gross rent model are reported in Tables B.3 through B.10; for the contract rent model, in Tables B.12 through B.19.

Essentially the same set of independent variables was entered in each case. However, splitting the sample according to the value of an independent variable made that variable redundant, so it was deleted from the model. Thus, in the occupancy status subsamples, MOVE is deleted; in the participation status subsamples, PART is deleted; and in the location subsamples, CSB is deleted. Results for subsamples of dwellings *ever* occupied by participants, as opposed to those *never* occupied by participants, are reported in Tables B.9 and B.18 and Tables B.10 and B.19, respectively. In the former subsample, a dwelling may or may not be *currently* occupied by a participant, so the indicator of current participation status (PART) remains in the model.

It also turned out that some subsamples lacked the full array of property types, so the null variables were also omitted from that subsample regression. Thus, Table B.7 lacks a coefficient for PS09 (the standard case), but also lacks coefficients for PS10 and PS11 because rural properties were not present in the central South Bend sample.

REGRESSION VARIABLES FOR THE 24-PARAMETER MODEL

To help diagnose program effects, we respecified the general model given in Sec. II so that it would indicate participation effects

separately for Periods 1, 2, and 3. We estimated this augmented model on subsamples of dwellings in central South Bend versus those elsewnere in the county. The estimated coefficients for both gross and contract rent, by location, are presented in Tables B.20 through B.23.

INTERPRETING THE COEFFICIENTS

As reported, each coefficient is the natural logarithm of the associated variable's contribution to a dwelling's annualized rent-inflation rate. For easier reading, the coefficients are reported in fixed-point decimal notation rather than the more precise floating-point notation; however, all internal computations, including significance tests, used the more precise values.

Coefficients can be transformed by exponentiation to annual rates of rent increase as follows:

$$\textit{Annual percentage change} = 100\{[\exp(\textit{coefficient})]-1\}$$

When combining the effects of variables, the coefficients should be added before transformation.

The coefficients of M1, M2, and M3 represent the period inflation rates for an arbitrary standard case--an urban, high-rent dwelling of six or more rooms, on a property with five or more units, located outside central South Bend; the dwelling is occupied by nonparticipants, and did not change occupants during the observation interval. To conduct "excursions" from this standard case, one simply adds to M1, M2, and M3 the coefficients of selected indicator variables.

Testing the statistical significance of individual coefficients associated with closed sets of indicator variables is awkward because the benchmark for the usual test procedure is not a value of zero but the implicit coefficient of an arbitrarily omitted variable whose estimate is also imprecise. Thus, in our model, the usual test of the significance of RMS2's coefficient depends partly on the value and variance of the implicit RMS6 coefficient.

To avoid that arbitrary dependence, we chose a different test of statistical significance whose benchmark is the average of the

complementary set of coefficients. Thus, the coefficient of RMS2 was compared with the average coefficient for RMS3 through RMS6, an estimate whose precision depends jointly on the variances and covariances of those four variables. In this comparison, coefficients other than those associated with RMS were identically averaged (set by set) for both the test and benchmark cases.

The second column ("standardized coefficient") of each table differences the test and benchmark coefficients, and the third estimates the standard error of that difference. Since the differences are linear in the regression coefficients, the standard error is easily derived from the covariance matrix of the regression coefficients. The last column of each table reports the value of t, a test of statistical significance. Standardized coefficients that are greater than zero at the 95- and 99-percent level of confidence are indicated by $|t| > 1.645$ and $|t| > 2.326$, respectively.

The auxiliary statistics at the head of each table report the predicted mean value of rent change for the population corresponding to the sample analyzed, the standard error of that mean, and the proportion of total variance explained by regression (R^2). Adjoining these statistics is a standard analysis of variance that includes the sample size and an F test of the statistical significance of the regression parameters taken together. For the smallest subsample $(DF = 18, 286)$, the 95- and 99-percent levels of confidence are indicated by $F > 1.9$ and $F > 2.6$, respectively.

We should note that all test statistics are biased upward by the outlier adjustment procedure described in a footnote to Sec. II. They are probably biased downward by the negative serial correlation $(\rho = -.271)$ between rent-change observations for successive time periods. Our data set contains, on average, 1.7 observations per dwelling, and these observations were formally treated as though they were statistically independent.

Our rent-change observations had large variances, traceable in some cases to physical modifications in the dwellings or a landlord's strategy for either keeping a desirable tenant or evicting an undesirable one. However, much of the variance is associated with the

arbitrariness of the observation intervals surrounding a specific rent increase or reduction. The various regressions on the full sample and subsamples explain from 10 to 40 percent of the variance in the annualized rate of rent change, not a large enough fraction to make the model a good predictor for individual dwellings.

However, all of the equations and about half of the coefficients in each are statistically significant at 95 percent or better, reflecting the large size of the data base. The predicted mean values for annualized rent-inflation rates, used in revising the standard cost of adequate housing for program purposes, are quite reliable; their standard errors are typically about 5.0 percent of the estimated mean.

COMPARING SUBSAMPLE REGRESSIONS

The split-sample regressions were undertaken primarily to reveal salient interaction effects among variables in the general model--e.g., interaction between the location and participation status of a dwelling, or between location and time. Tables B.24 through B.31 compare the regression coefficients obtained for each of the four subsample pairs.

The first two columns of each table report the marginal influence of the indicated variable on rent change in the respective subsamples. These entries are taken from the second columns of the appropriate tables of parameter estimates, and their interpretation is given above. The remaining columns report a standard test of the statistical significance of the difference between the entries in columns 1 and 2, based on the size of the difference and the variance of both estimators. Most of the differences are not statistically significant, indicating no evidence of interaction effects.

GROSS AND CONTRACT RENT CHANGE

Although this appendix reports in parallel on parameter estimates for gross and contract rent change, the main text makes little use of the contract rent parameter estimates. The essential reason is that when the model is used to estimate population average rent changes, compositional effects become important. Gross rent includes all fuel

and utility expenses by whomever paid; contract rent includes only those paid by the landlord. The proportion of housing expense included in contract rent varies with property type, so contract-rent inflation rates are not comparable across property types.

However, because contract rent is a single, explicit monthly payment by a tenant to his landlord, its reported values reflect fewer errors than do those for gross rent, some of whose components are intrinsically ambiguous. We have included the contract rent regressions here for the use of any reader who wishes to exploit that virtue, or whose benchmark for comparison (e.g., the rent index published by the Bureau of Labor Statistics) reflects contract rather than gross rent.

Table B.1

LIST OF VARIABLES AND PARAMETERS FOR THE GENERAL RENT-INFLATION MODEL

Parameter to be Estimated[a]	Variable: Exposure Weight[b]	Variable: Dwelling Status[c]	Variable Description
			Years of Exposure
γ_1	M1	--	Exposure during Period 1
γ_2	M2	--	Exposure during Period 2
γ_3	M3	--	Exposure during Period 3
			History and Location[d]
δ_1	MT[e]	PART[e]	Occupied by participant
δ_2	MT	MOVE	Occupancy changed
δ_3	MT	CSB	Located in central South Bend
			Property Type[d]
α_1	MT	PS01	Urban low-rent single-family
α_2	MT	PS02	Urban low-rent 2-4 units
α_3	MT	PS03	Urban low-rent 5+ units
α_4	MT	PS04	Urban medium-rent single-family
α_5	MT	PS05	Urban medium-rent 2-4 units
α_6	MT	PS06	Urban medium-rent 5+ units
α_7	MT	PS07	Urban high-rent single-family
α_8	MT	PS08	Urban high-rent 2-4 units
α_9	MT	PS09	Urban high-rent 5+ units
α_{10}	MT	PS10	Rural low or medium-rent
α_{11}	MT	PS11	Rural high-rent
			Dwelling Size[d]
β_1	MT	RMS2	1-2 rooms
β_2	MT	RMS3	3 rooms
β_3	MT	RMS4	4 rooms
β_4	MT	RMS5	5 rooms
β_5	MT	RMS6	6+ rooms

[a] These symbols appear in Eq. (5) of Sec. II.

[b] In Eq. (5), the weights are written as $m_{j,t}$.

[c] In Eq. (6), the history and location variables are written as H_j, M_j, L_j. The period, property type and location variables appear only as subscripts.

[d] 1 if condition met; zero otherwise. Participation and occupancy status refer to the specific observation interval. Other values are fixed for all observations on a given dwelling.

[e] In the 24-parameter model, MT·PART is replaced by M1·PART, M2·PART, and M3·PART.

Table B.2

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: GROSS RENT, ALL DWELLINGS

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	20
Predicted mean	5.71 Pct	DF (error):	2,419
Standard error	.27 Pct	Total (sample size):	2,439
R-squared:	.30	F Ratio:	51.7

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0507	-0.0178	0.0077	-2.3140
M2	0.0801	0.0263	0.0081	3.2542
M3	0.0569	-0.0084	0.0062	-1.3655
PART	0.0204	0.0204	0.0066	3.0671
MOVE	0.0272	0.0272	0.0045	6.0717
CSB	-0.0063	-0.0063	0.0048	-1.2975
PS01	0.0393	0.0332	0.0106	3.1242
PS02	0.0181	0.0098	0.0062	1.5722
PS03	0.0131	0.0043	0.0083	0.5205
PS04	0.0190	0.0108	0.0068	1.5880
PS05	-0.0100	-0.0211	0.0058	-3.6224
PS06	0.0015	-0.0084	0.0103	-0.8143
PS07	-0.0265	-0.0392	0.0083	-4.6947
PS08	-0.0121	-0.0234	0.0109	-2.1472
PS09	(a)	-0.0101	0.0080	-1.2657
PS10	0.0457	0.0401	0.0095	4.2202
PS11	0.0128	0.0040	0.0153	0.2602
RMS2	-0.0206	-0.0006	0.0098	-0.0608
RMS3	-0.0310	-0.0136	0.0054	-2.5281
RMS4	-0.0299	-0.0122	0.0050	-2.4366
RMS5	-0.0191	0.0013	0.0062	0.2086
RMS6	(a)	0.0252	0.0071	3.5251

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.3

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: GROSS RENT, DWELLINGS WITH OCCUPANCY CHANGES

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean	6.92 Pct	DF (error):	1,058
Standard error	.41 Pct	Total (sample size):	1,077
R-squared:	.38	F Ratio:	34.4

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0623	-0.0213	0.0139	-1.5356
M2	0.0810	0.0068	0.0148	0.4590
M3	0.0861	0.0145	0.0105	1.3807
PART	0.0205	0.0205	0.0104	1.9767
MOVE	(a)	0.0	0.0	0.0
CSB	-0.0019	-0.0019	0.0071	-0.2726
PS01	0.0677	0.0508	0.0171	2.9716
PS02	0.0337	0.0135	0.0090	1.4962
PS03	0.0298	0.0092	0.0116	0.7930
PS04	0.0380	0.0182	0.0109	1.6762
PS05	-0.0045	-0.0285	0.0081	-3.5062
PS06	0.0110	-0.0115	0.0147	-0.7803
PS07	-0.0367	-0.0639	0.0129	-4.9542
PS08	0.0168	-0.0051	0.0177	-0.2906
PS09	(a)	-0.0236	0.0117	-2.0119
PS10	0.0753	0.0592	0.0139	4.2503
PS11	0.0048	-0.0183	0.0219	-0.8376
RMS2	-0.0151	0.0054	0.0134	0.4010
RMS3	-0.0313	-0.0149	0.0076	-1.9687
RMS4	-0.0359	-0.0206	0.0072	-2.8679
RMS5	-0.0146	0.0060	0.0092	0.6503
RMS6	(a)	0.0242	0.0113	2.1419

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.4

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: GROSS RENT, DWELLINGS WITHOUT OCCUPANCY CHANGES

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean	4.92 Pct	DF (error):	1,343
Standard error	.35 Pct	Total (sample size):	1,362
R-squared:	.20	F Ratio:	17.9

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0716	-0.0133	0.0087	-1.5238
M2	0.1065	0.0391	0.0089	4.3789
M3	0.0633	-0.0258	0.0073	-3.5567
PART	0.0181	0.0181	0.0084	2.1460
MOVE	(a)	0.0	0.0	0.0
CSB	-0.0161	-0.0161	0.0067	-2.4152
PS01	0.0079	0.0143	0.0130	1.0968
PS02	-0.0017	0.0038	0.0088	0.4292
PS03	-0.0148	-0.0107	0.0125	-0.8570
PS04	-0.0038	0.0015	0.0085	0.1734
PS05	-0.0080	-0.0032	0.0089	-0.3576
PS06	-0.0098	-0.0052	0.0151	-0.3464
PS07	-0.0160	-0.0120	0.0108	-1.1104
PS08	-0.0393	-0.0376	0.0133	-2.8246
PS09	(a)	0.0056	0.0109	0.5124
PS10	-0.0008	0.0047	0.0131	0.3629
PS11	0.0302	0.0388	0.0218	1.7792
RMS2	-0.0364	-0.0194	0.0155	-1.2538
RMS3	-0.0301	-0.0115	0.0082	-1.3904
RMS4	-0.0165	0.0055	0.0073	0.7559
RMS5	-0.0216	-0.0008	0.0086	-0.0962
RMS6	(a)	0.0261	0.0092	2.8375

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.5

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: GROSS RENT, DWELLINGS CURRENTLY OCCUPIED BY PARTICIPANTS

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	18
Predicted mean	7.47 Pct	DF (error):	286
Standard error	.85 Pct	Total (sample size):	304
R-squared:	.37	F Ratio:	9.4

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.1752	-0.0047	0.0281	-0.1682
M2	0.1948	0.0248	0.0265	0.9353
M3	0.1649	-0.0201	0.0187	-1.0710
PART	(a)	0.0	0.0	0.0
MOVE	0.0316	0.0316	0.0142	2.2195
CSB	-0.0146	-0.0146	0.0177	-0.8222
PS01	-0.0570	-0.0026	0.0306	-0.0861
PS02	-0.0275	0.0298	0.0189	1.5768
PS03	-0.0831	-0.0313	0.0263	-1.1926
PS04	-0.0443	0.0113	0.0212	0.5338
PS05	-0.0697	-0.0166	0.0194	-0.8568
PS06	-0.0566	-0.0022	0.0378	-0.0571
PS07	-0.1332	-0.0864	0.0247	-3.4971
PS08	-0.0889	-0.0377	0.0313	-1.2063
PS09	(a)	0.0601	0.0334	1.8003
PS10	-0.0405	0.0156	0.0429	0.3629
PS11	(a)	0.0601	0.0334	1.8003
RMS2	0.0121	0.0547	0.0404	1.3552
RMS3	-0.0565	-0.0310	0.0184	-1.6866
RMS4	-0.0586	-0.0336	0.0166	-2.0218
RMS5	-0.0555	-0.0298	0.0226	-1.3172
RMS6	(a)	0.0396	0.0235	1.6852

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.6

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: GROSS RENT, DWELLINGS CURRENTLY OCCUPIED BY NONPARTICIPANTS

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	5.54 Pct	DF (error):	2,116
Standard error:	.29 Pct	Total (sample size):	2,135
R-squared:	.29	F Ratio:	46.3

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0432	-0.0195	0.0080	-2.4457
M2	0.0727	0.0248	0.0085	2.9189
M3	0.0527	-0.0052	0.0066	-0.7947
PART	(a)	0.0	0.0	0.0
MOVE	0.0265	0.0265	0.0048	5.5704
CSB	-0.0070	-0.0070	0.0050	-1.3999
PS01	0.0495	0.0389	0.0113	3.4326
PS02	0.0192	0.0056	0.0066	0.8509
PS03	0.0211	0.0077	0.0087	0.8844
PS04	0.0215	0.0082	0.0073	1.1240
PS05	-0.0067	-0.0229	0.0061	-3.7488
PS06	0.0051	-0.0099	0.0107	-0.9243
PS07	-0.0146	-0.0316	0.0090	-3.5225
PS08	-0.0082	-0.0245	0.0118	-2.0827
PS09	(a)	-0.0155	0.0081	-1.9112
PS10	0.0503	0.0398	0.0097	4.1072
PS11	0.0178	0.0041	0.0151	0.2729
RMS2	-0.0210	-0.0039	0.0100	-0.3911
RMS3	-0.0279	-0.0125	0.0056	-2.2212
RMS4	-0.0260	-0.0102	0.0053	-1.9326
RMS5	-0.0144	0.0043	0.0064	0.6741
RMS6	(a)	0.0223	0.0075	2.9713

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.7

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: GROSS RENT, DWELLINGS IN CENTRAL SOUTH BEND

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	17
Predicted mean:	5.44 Pct	DF (error):	1,299
Standard error:	.37 Pct	Total (sample size):	1,316
R-squared:	.26	F Ratio:	27.3

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0676	-0.0079	0.0106	-0.7489
M2	0.0896	0.0251	0.0114	2.2082
M3	0.0614	-0.0172	0.0088	-1.9490
PART	0.0252	0.0252	0.0081	3.1234
MOVE	0.0331	0.0331	0.0064	5.1977
CSB	(a)	0.0	0.0	0.0
PS01	0.0245	0.0356	0.0156	2.2863
PS02	-0.0006	0.0079	0.0088	0.9026
PS03	0.0067	0.0160	0.0123	1.3042
PS04	-0.0069	0.0010	0.0107	0.0927
PS05	-0.0277	-0.0218	0.0087	-2.5093
PS06	-0.0029	0.0055	0.0153	0.3568
PS07	-0.0463	-0.0424	0.0125	-3.4012
PS08	-0.0330	-0.0277	0.0160	-1.7330
PS09	(a)	0.0086	0.0139	0.6209
PS10	(a)	0.0086	0.0139	0.6209
PS11	(a)	0.0086	0.0139	0.6209
RMS2	-0.0223	0.0002	0.0139	0.0165
RMS3	-0.0380	-0.0194	0.0075	-2.5957
RMS4	-0.0364	-0.0174	0.0074	-2.3409
RMS5	-0.0157	0.0084	0.0087	0.9718
RMS6	(a)	0.0281	0.0101	2.7893

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.8

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: GROSS RENT, DWELLINGS ELSEWHERE IN ST. JOSEPH COUNTY

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	5.76 Pct	DF (error):	1,104
Standard error:	.40 Pct	Total (sample size):	1,123
R-squared:	.36	F Ratio:	32.1

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0313	-0.0343	0.0113	-3.0379
M2	0.0744	0.0304	0.0114	2.6624
M3	0.0567	0.0039	0.0086	0.4473
PART	0.0096	0.0096	0.0124	0.7712
MOVE	0.0204	0.0204	0.0063	3.2416
CSB	(a)	0.0	0.0	0.0
PS01	0.0445	0.0318	0.0149	2.1358
PS02	0.0310	0.0170	0.0102	1.6643
PS03	0.0057	-0.0109	0.0117	-0.9387
PS04	0.0365	0.0230	0.0093	2.4567
PS05	-0.0012	-0.0185	0.0088	-2.0872
PS06	-0.0065	-0.0243	0.0142	-1.7116
PS07	-0.0146	-0.0333	0.0118	-2.8115
PS08	-0.0014	-0.0188	0.0153	-1.2223
PS09	(a)	-0.0172	0.0088	-1.9557
PS10	0.0531	0.0413	0.0092	4.4999
PS11	0.0247	0.0100	0.0151	0.6609
RMS2	-0.0174	-0.0006	0.0136	-0.0448
RMS3	-0.0219	-0.0063	0.0078	-0.8053
RMS4	-0.0236	-0.0083	0.0067	-1.2392
RMS5	-0.0216	-0.0059	0.0089	-0.6637
RMS6	(a)	0.0211	0.0102	2.0741

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.9

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: GROSS RENT, DWELLINGS EVER OCCUPIED BY PARTICIPANTS

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	6.82 Pct	DF (error):	433
Standard error:	.70 Pct	Total (sample size):	452
R-squared:	.32	F Ratio:	10.5

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.1415	0.0130	0.0198	0.6545
M2	0.1413	0.0127	0.0198	0.6389
M3	0.1158	-0.0256	0.0156	-1.6466
PART	0.0232	0.0232	0.0134	1.7336
MOVE	0.0372	0.0372	0.0119	3.1373
CSB	-0.0056	-0.0056	0.0148	-0.3778
PS01	-0.0365	0.0090	0.0247	0.3653
PS02	-0.0334	0.0125	0.0165	0.7597
PS03	-0.0702	-0.0280	0.0224	-1.2505
PS04	-0.0328	0.0132	0.0191	0.6892
PS05	-0.0621	-0.0190	0.0159	-1.1982
PS06	-0.0403	0.0049	0.0341	0.1437
PS07	-0.1230	-0.0861	0.0216	-3.9937
PS08	-0.0784	-0.0370	0.0266	-1.3895
PS09	(a)	0.0492	0.0290	1.6948
PS10	-0.0156	0.0321	0.0371	0.8644
PS11	(a)	0.0492	0.0290	1.6948
RMS2	0.0139	0.0488	0.0340	1.4339
RMS3	-0.0466	-0.0268	0.0155	-1.7285
RMS4	-0.0522	-0.0339	0.0143	-2.3762
RMS5	-0.0407	-0.0195	0.0185	-1.0523
RMS6	(a)	0.0314	0.0197	1.5978

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.10

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: GROSS RENT, DWELLINGS NEVER OCCUPIED BY PARTICIPANTS

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	6.11 Pct	DF (error):	1,058
Standard error:	.40 Pct	Total (sample size):	1,077
R-squared:	.32	F Ratio:	26.2

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0400	-0.0251	0.0083	-3.0141
M2	0.0764	0.0294	0.0088	3.3311
M3	0.0539	-0.0043	0.0067	-0.6386
PART	(a)	0.0	0.0	0.0
MOVE	0.0252	0.0252	0.0049	5.1969
CSB	-0.0076	-0.0076	0.0051	-1.4820
PS01	0.0506	0.0391	0.0119	3.2937
PS02	0.0222	0.0078	0.0067	1.1606
PS03	0.0230	0.0087	0.0089	0.9781
PS04	0.0213	0.0068	0.0073	0.9256
PS05	-0.0063	-0.0235	0.0063	-3.7488
PS06	0.0057	-0.0104	0.0107	-0.9637
PS07	-0.0118	-0.0296	0.0092	-3.2206
PS08	-0.0072	-0.0246	0.0121	-2.0287
PS09	(a)	-0.0166	0.0081	-2.0434
PS10	0.0507	0.0392	0.0097	4.0286
PS11	0.0180	0.0032	0.0151	0.2103
RMS2	-0.0234	-0.0055	0.0101	-0.5440
RMS3	-0.0299	-0.0135	0.0058	-2.3475
RMS4	-0.0266	-0.0095	0.0054	-1.7612
RMS5	-0.0153	0.0047	0.0066	0.7113
RMS6	(a)	0.0238	0.0077	3.1017

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.11

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: CONTRACT RENT, ALL DWELLINGS

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	20
Predicted mean:	4.41 Pct	DF (error):	2,419
Standard error:	.24 Pct	Total (sample size):	2,439
R-squared:	.25	F Ratio:	39.4

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0223	-0.0170	0.0071	-2.4016
M2	0.0340	0.0005	0.0074	0.0714
M3	0.0447	0.0165	0.0057	2.8952
PART	0.0230	0.0230	0.0061	3.7625
MOVE	0.0351	0.0351	0.0041	8.5032
CSB	-0.0054	-0.0054	0.0045	-1.2179
PS01	0.0145	0.0142	0.0098	1.4496
PS02	0.0165	0.0164	0.0057	2.8679
PS03	0.0128	0.0124	0.0077	1.6225
PS04	0.0027	0.0012	0.0063	0.1934
PS05	-0.0133	-0.0164	0.0054	-3.0483
PS06	-0.0041	-0.0062	0.0095	-0.6499
PS07	-0.0212	-0.0250	0.0077	-3.2523
PS08	0.0071	0.0060	0.0100	0.6018
PS09	(a)	-0.0017	0.0073	-0.2329
PS10	0.0156	0.0155	0.0088	1.7627
PS11	-0.0134	-0.0164	0.0141	-1.1680
RMS2	0.0015	0.0089	0.0090	0.9857
RMS3	-0.0132	-0.0094	0.0050	-1.8944
RMS4	-0.0129	-0.0091	0.0046	-1.9717
RMS5	-0.0035	0.0026	0.0057	0.4591
RMS6	(a)	0.0070	0.0066	1.0691

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.12

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: CONTRACT RENT, DWELLINGS WITH OCCUPANCY CHANGES

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	6.11 Pct	DF (error):	1,058
Standard error:	.40 Pct	Total (sample size):	1,077
R-squared:	.32	F Ratio:	26.2

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0470	-0.0287	0.0137	-2.0936
M2	0.0651	-0.0016	0.0147	-0.1058
M3	0.0863	0.0303	0.0104	2.9173
PART	0.0326	0.0326	0.0103	3.1681
MOVE	(a)	0.0	0.0	0.0
CSB	-0.0068	-0.0068	0.0070	-0.9715
PS01	0.0512	0.0418	0.0170	2.4625
PS02	0.0348	0.0238	0.0089	2.6654
PS03	0.0285	0.0168	0.0115	1.4575
PS04	0.0146	0.0015	0.0108	0.1436
PS05	-0.0052	-0.0202	0.0081	-2.5099
PS06	0.0055	-0.0085	0.0146	-0.5855
PS07	-0.0252	-0.0422	0.0128	-3.2974
PS08	0.0174	0.0046	0.0175	0.2607
PS09	(a)	-0.0145	0.0116	-1.2496
PS10	0.0449	0.0349	0.0138	2.5267
PS11	-0.0212	-0.0379	0.0217	-1.7471
RMS2	-0.0028	0.0139	0.0133	1.0461
RMS3	-0.0260	-0.0150	0.0075	-2.0006
RMS4	-0.0267	-0.0160	0.0071	-2.2418
RMS5	-0.0141	-0.0003	0.0091	-0.0280
RMS6	(a)	0.0174	0.0112	1.5532

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.13

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: CONTRACT RENT, DWELLINGS WITHOUT OCCUPANCY CHANGES

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	3.04 Pct	DF (error):	1,343
Standard error:	.28 Pct	Total (sample size):	1,362
R-squared:	.11	F Ratio:	8.7

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0340	-0.0081	0.0072	-1.1325
M2	0.0415	0.0031	0.0074	0.4191
M3	0.0428	0.0050	0.0060	0.8419
PART	0.0131	0.0131	0.0070	1.8808
MOVE	(a)	0.0	0.0	0.0
CSB	-0.0069	-0.0069	0.0055	-1.2459
PS01	-0.0217	-0.0116	0.0108	-1.0816
PS02	-0.0057	0.0060	0.0072	0.8234
PS03	-0.0105	0.0007	0.0103	0.0672
PS04	-0.0122	-0.0012	0.0070	-0.1702
PS05	-0.0144	-0.0037	0.0073	-0.5015
PS06	-0.0147	-0.0040	0.0125	-0.3209
PS07	-0.0150	-0.0043	0.0089	-0.4777
PS08	-0.0037	0.0082	0.0110	0.7419
PS09	(a)	0.0122	0.0090	1.3526
PS10	-0.0255	-0.0158	0.0108	-1.4634
PS11	0.0012	0.0136	0.0180	0.7529
RMS2	-0.0044	-0.0076	0.0127	-0.5965
RMS3	-0.0002	-0.0024	0.0068	-0.3481
RMS4	0.0048	0.0039	0.0060	0.6515
RMS5	0.0081	0.0081	0.0071	1.1490
RMS6	(a)	-0.0021	0.0076	-0.2720

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.14

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: CONTRACT RENT, DWELLINGS CURRENTLY OCCUPIED BY PARTICIPANTS

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	18
Predicted mean:	6.19 Pct	DF (error):	286
Standard error:	.85 Pct	Total (sample size):	304
R-squared:	.32	F Ratio:	7.6

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.1445	-0.0237	0.0284	-0.8342
M2	0.1709	0.0158	0.0268	0.5898
M3	0.1656	0.0079	0.0189	0.4170
PART	(a)	0.0	0.0	0.0
MOVE	0.0605	0.0605	0.0144	4.2114
CSB	-0.0072	-0.0072	0.0179	-0.4020
PS01	-0.0737	0.0001	0.0310	0.0019
PS02	-0.0653	0.0093	0.0191	0.4888
PS03	-0.1090	-0.0387	0.0266	-1.4568
PS04	-0.0862	-0.0136	0.0215	-0.6352
PS05	-0.0871	-0.0146	0.0196	-0.7454
PS06	-0.0550	0.0207	0.0382	0.5421
PS07	-0.1473	-0.0808	0.0250	-3.2364
PS08	-0.1249	-0.0562	0.0316	-1.7801
PS09	(a)	0.0812	0.0337	2.4062
PS10	-0.0632	0.0116	0.0433	0.2676
PS11	(a)	0.0812	0.0337	2.4062
RMS2	0.0187	0.0505	0.0408	1.2364
RMS3	-0.0541	-0.0405	0.0186	-2.1791
RMS4	-0.0431	-0.0267	0.0168	-1.5911
RMS5	-0.0300	-0.0104	0.0228	-0.4551
RMS6	(a)	0.0271	0.0238	1.1418

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.15

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: CONTRACT RENT, DWELLINGS CURRENTLY OCCUPIED BY NONPARTICIPANTS

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	4.23 Pct	DF (error):	2,116
Standard error:	.25 Pct	Total (sample size):	2,135
R-squared:	.24	F Ratio:	35.1

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0173	-0.0176	0.0072	-2.4366
M2	0.0277	-0.0019	0.0077	-0.2521
M3	0.0420	0.0195	0.0060	3.2801
PART	(a)	0.0	0.0	0.0
MOVE	0.0325	0.0325	0.0043	7.5588
CSB	-0.0073	-0.0073	0.0045	-1.6107
PS01	0.0201	0.0145	0.0103	1.4092
PS02	0.0205	0.0149	0.0059	2.5046
PS03	0.0230	0.0176	0.0079	2.2309
PS04	0.0063	-0.0007	0.0066	-0.1113
PS05	-0.0097	-0.0183	0.0055	-3.3252
PS06	-0.0023	-0.0103	0.0097	-1.0610
PS07	-0.0102	-0.0189	0.0081	-2.3280
PS08	0.0179	0.0120	0.0106	1.1331
PS09	(a)	-0.0077	0.0073	-1.0492
PS10	0.0192	0.0135	0.0088	1.5371
PS11	-0.0081	-0.0166	0.0137	-1.2095
RMS2	0.0001	0.0053	0.0091	0.5819
RMS3	-0.0093	-0.0065	0.0051	-1.2796
RMS4	-0.0107	-0.0082	0.0048	-1.7182
RMS5	-0.0006	0.0044	0.0058	0.7493
RMS6	(a)	0.0051	0.0068	0.7513

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.16

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: CONTRACT RENT, DWELLINGS IN CENTRAL SOUTH BEND

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	17
Predicted mean:	4.33 Pct	DF (error):	1,299
Standard error:	.35 Pct	Total (sample size):	1,316
R-squared:	.22	F Ratio:	21.3

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0422	-0.0159	0.0099	-1.5990
M2	0.0553	0.0037	0.0107	0.3426
M3	0.0610	0.0122	0.0083	1.4690
PART	0.0267	0.0267	0.0076	3.5251
MOVE	0.0356	0.0356	0.0060	5.9386
CSB	(a)	0.0	0.0	0.0
PS01	-0.0175	-0.0010	0.0146	-0.0650
PS02	-0.0087	0.0087	0.0083	1.0557
PS03	-0.0005	0.0178	0.0116	1.5429
PS04	-0.0270	-0.0114	0.0101	-1.1296
PS05	-0.0382	-0.0237	0.0082	-2.8975
PS06	-0.0224	-0.0063	0.0144	-0.4333
PS07	-0.0453	-0.0314	0.0117	-2.6835
PS08	-0.0238	-0.0079	0.0150	-0.5237
PS09	(a)	0.0183	0.0131	1.4049
PS10	(a)	0.0183	0.0131	1.4049
PS11	(a)	0.0183	0.0131	1.4049
RMS2	0.0037	0.0125	0.0131	0.9571
RMS3	-0.0190	-0.0159	0.0070	-2.2550
RMS4	-0.0134	-0.0089	0.0070	-1.2762
RMS5	-0.0027	0.0044	0.0082	0.5411
RMS6	(a)	0.0078	0.0095	0.8264

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.17

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: CONTRACT RENT, DWELLINGS ELSEWHERE IN ST. JOSEPH COUNTY

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	4.36 Pct	DF (error):	1,104
Standard error:	.35 Pct	Total (sample size):	1,123
R-squared:	.30	F Ratio:	24.3

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0091	-0.0210	0.0101	-2.0779
M2	0.0218	-0.0020	0.0102	-0.1965
M3	0.0385	0.0230	0.0077	2.9749
PART	0.0122	0.0122	0.0111	1.0986
MOVE	0.0347	0.0347	0.0056	6.1544
CSB	(a)	0.0	0.0	0.0
PS01	0.0324	0.0249	0.0133	1.8721
PS02	0.0279	0.0200	0.0091	2.1893
PS03	0.0062	-0.0039	0.0104	-0.3751
PS04	0.0171	0.0081	0.0084	0.9633
PS05	-0.0041	-0.0153	0.0079	-1.9357
PS06	-0.0029	-0.0140	0.0127	-1.0984
PS07	-0.0129	-0.0250	0.0106	-2.3575
PS08	0.0237	0.0153	0.0137	1.1139
PS09	(a)	-0.0108	0.0079	-1.3708
PS10	0.0237	0.0153	0.0082	1.8665
PS11	-0.0035	-0.0146	0.0135	-1.0804
RMS2	0.0010	0.0051	0.0122	0.4165
RMS3	-0.0042	-0.0014	0.0070	-0.2047
RMS4	-0.0106	-0.0094	0.0060	-1.5627
RMS5	-0.0016	0.0019	0.0079	0.2400
RMS6	(a)	0.0039	0.0091	0.4223

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.18

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: CONTRACT RENT, DWELLINGS EVER OCCUPIED BY PARTICIPANTS

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	5.52 Pct	DF (error):	433
Standard error:	.64 Pct	Total (sample size):	452
R-squared:	.29	F Ratio:	9.4

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.1043	-0.0059	0.0184	-0.3221
M2	0.1138	0.0083	0.0184	0.4542
M3	0.1066	-0.0024	0.0144	-0.1679
PART	0.0232	0.0232	0.0124	1.8658
MOVE	0.0555	0.0555	0.0110	5.0446
CSB	0.0012	0.0012	0.0137	0.0896
PS01	-0.0630	-0.0068	0.0229	-0.2973
PS02	-0.0553	0.0016	0.0153	0.1065
PS03	-0.0833	-0.0292	0.0208	-1.4047
PS04	-0.0677	-0.0120	0.0177	-0.6775
PS05	-0.0771	-0.0224	0.0147	-1.5161
PS06	-0.0454	0.0125	0.0317	0.3949
PS07	-0.1093	-0.0577	0.0200	-2.8830
PS08	-0.0965	-0.0437	0.0247	-1.7672
PS09	(a)	0.0625	0.0270	2.3190
PS10	-0.0272	0.0326	0.0344	0.9458
PS11	(a)	0.0625	0.0270	2.3190
RMS2	0.0278	0.0513	0.0316	1.6259
RMS3	-0.0356	-0.0279	0.0144	-1.9393
RMS4	-0.0329	-0.0246	0.0132	-1.8558
RMS5	-0.0255	-0.0154	0.0172	-0.8958
RMS6	(a)	0.0165	0.0182	0.9072

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.19

PARAMETER ESTIMATES FOR THE GENERAL RENT-INFLATION MODEL: CONTRACT RENT, DWELLINGS NEVER OCCUPIED BY PARTICIPANTS

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	4.24 Pct	DF (error):	1,968
Standard error:	.26 Pct	Total (sample size):	1,987
R-squared:	.24	F Ratio:	33.2

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0165	-0.0197	0.0077	-2.5688
M2	0.0288	-0.0012	0.0081	-0.1475
M3	0.0435	0.0209	0.0062	3.3655
PART	(a)	0.0	0.0	0.0
MOVE	0.0317	0.0317	0.0045	7.0921
CSB	-0.0083	-0.0083	0.0047	-1.7742
PS01	0.0227	0.0167	0.0109	1.5286
PS02	0.0226	0.0166	0.0061	2.7059
PS03	0.0239	0.0180	0.0082	2.2049
PS04	0.0068	-0.0008	0.0067	-0.1246
PS05	-0.0092	-0.0184	0.0058	-3.1969
PS06	-0.0012	-0.0096	0.0099	-0.9726
PS07	-0.0127	-0.0223	0.0084	-2.6374
PS08	0.0200	0.0137	0.0111	1.2330
PS09	(a)	-0.0083	0.0075	-1.1069
PS10	0.0183	0.0119	0.0089	1.3297
PS11	-0.0084	-0.0175	0.0139	-1.2594
RMS2	-0.0014	0.0041	0.0093	0.4369
RMS3	-0.0108	-0.0077	0.0053	-1.4557
RMS4	-0.0108	-0.0077	0.0049	-1.5499
RMS5	-0.0003	0.0055	0.0060	0.9107
RMS6	(a)	0.0058	0.0071	0.8230

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.20

PARAMETER ESTIMATES FOR THE AUGMENTED RENT-INFLATION MODEL: GROSS RENT, DWELLINGS IN CENTRAL SOUTH BEND

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	5.54 Pct	DF (error):	1,297
Standard error:	.39 Pct	Total (sample size):	1,316
R-squared:	.26	F Ratio:	24.4

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0647	-0.0110	0.0114	-0.9595
M2	0.0886	0.0249	0.0125	1.9951
M3	0.0628	-0.0139	0.0098	-1.4132
PART1	0.0411	0.0411	0.0243	1.6941
PART2	0.0260	0.0260	0.0211	1.2348
PART3	0.0154	0.0154	0.0157	0.9845
MOVE	0.0328	0.0328	0.0064	5.1276
CSB	(a)	0.0	0.0	0.0
PS01	0.0259	0.0366	0.0156	2.3432
PS02	0.0002	0.0082	0.0088	0.9330
PS03	0.0077	0.0165	0.0123	1.3438
PS04	-0.0065	0.0009	0.0107	0.0861
PS05	-0.0271	-0.0217	0.0087	-2.4961
PS06	-0.0023	0.0055	0.0153	0.3612
PS07	-0.0458	-0.0424	0.0125	-3.3998
PS08	-0.0327	-0.0279	0.0160	-1.7449
PS09	(a)	0.0081	0.0139	0.5799
PS10	(a)	0.0081	0.0139	0.5799
PS11	(a)	0.0081	0.0139	0.5799
RMS2	-0.0218	0.0006	0.0139	0.0407
RMS3	-0.0378	-0.0194	0.0075	-2.5953
RMS4	-0.0362	-0.0174	0.0074	-2.3471
RMS5	-0.0155	0.0084	0.0087	0.9711
RMS6	(a)	0.0278	0.0101	2.7586

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.21

PARAMETER ESTIMATES FOR THE AUGMENTED RENT-INFLATION MODEL: GROSS RENT, DWELLINGS ELSEWHERE IN ST. JOSEPH COUNTY

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	21
Predicted mean:	5.82 Pct	DF (error):	1,102
Standard error:	.40 Pct	Total (sample size):	1,123
R-squared:	.36	F Ratio:	29.2

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0332	-0.0309	0.0114	-2.7033
M2	0.0714	0.0264	0.0118	2.2363
M3	0.0568	0.0045	0.0090	0.4951
PART1	-0.0862	-0.0862	0.0560	-1.5409
PART2	0.0598	0.0598	0.0326	1.8343
PART3	0.0080	0.0080	0.0200	0.4021
MOVE	0.0213	0.0213	0.0063	3.3683
CSB	(a)	0.0	0.0	0.0
PS01	0.0450	0.0325	0.0149	2.1844
PS02	0.0302	0.0162	0.0102	1.5913
PS03	0.0056	-0.0108	0.0117	-0.9275
PS04	0.0373	0.0240	0.0094	2.5600
PS05	-0.0019	-0.0191	0.0088	-2.1634
PS06	-0.0082	-0.0260	0.0142	-1.8281
PS07	-0.0135	-0.0319	0.0119	-2.6883
PS08	-0.0019	-0.0191	0.0153	-1.2485
PS09	(a)	-0.0170	0.0088	-1.9407
PS10	0.0529	0.0412	0.0092	4.4830
PS11	0.0247	0.0102	0.0151	0.6756
RMS2	-0.0168	-0.0002	0.0136	-0.0147
RMS3	-0.0213	-0.0058	0.0078	-0.7478
RMS4	-0.0235	-0.0086	0.0067	-1.2711
RMS5	-0.0217	-0.0062	0.0089	-0.7044
RMS6	(a)	0.0208	0.0102	2.0466

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.22

PARAMETER ESTIMATES FOR THE AUGMENTED RENT INFLATION MODEL: CONTRACT RENT, DWELLINGS IN CENTRAL SOUTH BEND

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	19
Predicted mean:	4.38 Pct	DF (error):	1,297
Standard error:	.36 Pct	Total (sample size):	1,316
R-squared:	.22	F Ratio:	19.1

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0413	-0.0168	0.0108	-1.5646
M2	0.0544	0.0029	0.0117	0.2452
M3	0.0618	0.0140	0.0093	1.5095
PART1	0.0317	0.0317	0.0228	1.3885
PART2	0.0297	0.0297	0.0198	1.4980
PART3	0.0214	0.0214	0.0148	1.4484
MOVE	0.0355	0.0355	0.0060	5.8994
CSB	(a)	0.0	0.0	0.0
PS01	-0.0170	-0.0005	0.0147	-0.0361
PS02	-0.0084	0.0088	0.0083	1.0638
PS03	-0.0001	0.0181	0.0116	1.5585
PS04	-0.0269	-0.0115	0.0101	-1.1353
PS05	-0.0380	-0.0237	0.0082	-2.8905
PS06	-0.0221	-0.0062	0.0144	-0.4311
PS07	-0.0450	-0.0314	0.0117	-2.6792
PS08	-0.0237	-0.0079	0.0151	-0.5272
PS09	(a)	0.0181	0.0131	1.3852
PS10	(a)	0.0181	0.0131	1.3852
PS11	(a)	0.0181	0.0131	1.3852
RMS2	0.0039	0.0126	0.0131	0.9628
RMS3	-0.0189	-0.0159	0.0070	-2.2535
RMS4	-0.0134	-0.0089	0.0070	-1.2796
RMS5	-0.0026	0.0044	0.0082	0.5437
RMS6	(a)	0.0078	0.0095	0.8160

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.23

PARAMETER ESTIMATES FOR THE AUGMENTED RENT-INFLATION MODEL: CONTRACT RENT, DWELLINGS ELSEWHERE IN ST. JOSEPH COUNTY

Dependent Variable		Analysis of Variance	
Gross rent, av. annual change		DF (regression):	21
Predicted mean:	4.45 Pct	DF (error):	1,102
Standard error:	.35 Pct	Total (sample size):	1,123
R-squared:	.30	F Ratio:	22.2

		Significance Test		
Variable	Regression Coefficient	Standardized Coefficient	SE of Stand. Coef.	t
M1	0.0105	-0.0182	0.0102	-1.7834
M2	0.0179	-0.0072	0.0106	-0.6823
M3	0.0397	0.0254	0.0081	3.1566
PART1	-0.0598	-0.0598	0.0501	-1.1949
PART2	0.0675	0.0675	0.0292	2.3116
PART3	-0.0008	-0.0008	0.0179	-0.0449
MOVE	0.0353	0.0353	0.0057	6.2556
CSB	(a)	0.0	0.0	0.0
PS01	0.0330	0.0256	0.0133	1.9268
PS02	0.0274	0.0194	0.0091	2.1246
PS03	0.0068	-0.0032	0.0105	-0.3087
PS04	0.0175	0.0085	0.0084	1.0174
PS05	-0.0047	-0.0159	0.0079	-2.0033
PS06	-0.0046	-0.0158	0.0127	-1.2369
PS07	-0.0123	-0.0242	0.0106	-2.2815
PS08	0.0232	0.0148	0.0137	1.0768
PS09	(a)	-0.0107	0.0079	-1.3662
PS10	0.0240	0.0157	0.0082	1.9126
PS11	-0.0032	-0.0142	0.0135	-1.0545
RMS2	0.0015	0.0054	0.0122	0.4437
RMS3	-0.0037	-0.0010	0.0070	-0.1482
RMS4	-0.0105	-0.0095	0.0060	-1.5848
RMS5	-0.0015	0.0016	0.0079	0.2038
RMS6	(a)	0.0035	0.0091	0.3887

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

[a]Variable omitted from regression to avoid collinearity.

Table B.24

COMPARISON OF SUBSAMPLE PARAMETER ESTIMATES:
GROSS RENT, OCCUPANCY STATUS SUBSAMPLES

	Standardized Coefficient		Significance Test		
Variable	Occ. Change Sample	No Change Sample	Estimated Difference	SE of Difference	t
M1	-0.0213	-0.0133	-0.0080	0.0164	-0.4904
M2	0.0068	0.0391	-0.0323	0.0173	-1.8647
M3	0.0145	-0.0258	0.0403	0.0127	3.1601
PART	0.0205	0.0181	0.0024	0.0134	0.1782
MOVE	0.0	0.0	0.0	0.0	0.0
CSB	-0.0019	-0.0161	0.0142	0.0097	1.4577
PART1	0.0	0.0	0.0	0.0	0.0
PART2	0.0	0.0	0.0	0.0	0.0
PART3	0.0	0.0	0.0	0.0	0.0
PS01	0.0508	0.0143	0.0365	0.0215	1.6974
PS02	0.0135	0.0038	0.0097	0.0126	0.7728
PS03	0.0092	-0.0107	0.0199	0.0171	1.1676
PS04	0.0182	0.0015	0.0168	0.0138	1.2124
PS05	-0.0285	-0.0032	-0.0254	0.0120	-2.1050
PS06	-0.0115	-0.0052	-0.0062	0.0211	-0.2958
PS07	-0.0639	-0.0120	-0.0519	0.0168	-3.0852
PS08	-0.0051	-0.0376	0.0325	0.0221	1.4673
PS09	-0.0236	0.0056	-0.0292	0.0160	-1.8205
PS10	0.0592	0.0047	0.0545	0.0191	2.8503
PS11	-0.0183	0.0388	-0.0571	0.0309	-1.8495
RMS2	0.0054	-0.0194	0.0247	0.0204	1.2100
RMS3	-0.0149	-0.0115	-0.0035	0.0112	-0.3114
RMS4	-0.0206	0.0055	-0.0262	0.0103	-2.5514
RMS5	0.0060	-0.0008	0.0068	0.0126	0.5419
RMS6	0.0242	0.0261	-0.0019	0.0146	-0.1303

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

Table B.25

COMPARISON OF SUBSAMPLE PARAMETER ESTIMATES: GROSS RENT, CURRENT PARTICIPATION STATUS SUBSAMPLES

	Standardized Coefficient		Significance Test		
Variable	Participant Sample	Nonpartic. Sample	Estimated Difference	SE of Difference	t
M1	-0.0047	-0.0195	0.0148	0.0292	0.5066
M2	0.0248	0.0248	0.0000	0.0278	0.0010
M3	-0.0201	-0.0052	-0.0148	0.0199	-0.7469
PART	0.0	0.0	0.0	0.0	0.0
MOVE	0.0316	0.0265	0.0051	0.0150	0.3387
CSB	-0.0146	-0.0070	-0.0075	0.0184	-0.4098
PART1	0.0	0.0	0.0	0.0	0.0
PART2	0.0	0.0	0.0	0.0	0.0
PART3	0.0	0.0	0.0	0.0	0.0
PS01	-0.0026	0.0389	-0.0416	0.0327	-1.2724
PS02	0.0298	0.0056	0.0242	0.0200	1.2103
PS03	-0.0313	0.0077	-0.0391	0.0277	-1.4105
PS04	0.0113	0.0082	0.0032	0.0224	0.1413
PS05	-0.0166	-0.0229	0.0062	0.0203	0.3071
PS06	-0.0022	-0.0099	0.0077	0.0393	0.1969
PS07	-0.0864	-0.0316	-0.0548	0.0263	-2.0850
PS08	-0.0377	-0.0245	-0.0132	0.0334	-0.3955
PS09	0.0601	-0.0155	0.0756	0.0343	2.2008
PS10	0.0156	0.0398	-0.0242	0.0440	-0.5508
PS11	0.0601	0.0041	0.0559	0.0366	1.5268
RMS2	0.0547	-0.0039	0.0587	0.0416	1.4095
RMS3	-0.0310	-0.0125	-0.0185	0.0192	-0.9610
RMS4	-0.0336	-0.0102	-0.0234	0.0174	-1.3402
RMS5	-0.0298	0.0043	-0.0341	0.0235	-1.4515
RMS6	0.0396	0.0223	0.0173	0.0247	0.7010

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

Table B.26

COMPARISON OF SUBSAMPLE PARAMETER ESTIMATES:
GROSS RENT, LOCATION SUBSAMPLES

	Standardized Coefficient		Significance Test		
Variable	CSB Sample	ROC Sample	Estimated Difference	SE of Difference	t
M1	-0.0079	-0.0343	0.0264	0.0155	1.7062
M2	0.0251	0.0304	-0.0053	0.0161	-0.3271
M3	-0.0172	0.0039	-0.0211	0.0124	-1.7068
PART	0.0252	0.0096	0.0156	0.0148	1.0498
MOVE	0.0331	0.0204	0.0127	0.0090	1.4169
CSB	0.0	0.0	0.0	0.0	0.0
PART1	0.0	0.0	0.0	0.0	0.0
PART2	0.0	0.0	0.0	0.0	0.0
PART3	0.0	0.0	0.0	0.0	0.0
PS01	0.0356	0.0318	0.0038	0.0215	0.1779
PS02	0.0079	0.0170	-0.0090	0.0135	-0.6691
PS03	0.0160	-0.0109	0.0270	0.0169	1.5921
PS04	0.0010	0.0230	-0.0220	0.0142	-1.5447
PS05	-0.0218	-0.0185	-0.0034	0.0124	-0.2704
PS06	0.0055	-0.0243	0.0298	0.0209	1.4254
PS07	-0.0424	-0.0333	-0.0091	0.0172	-0.5295
PS08	-0.0277	-0.0188	-0.0090	0.0222	-0.4043
PS09	0.0086	-0.0172	0.0258	0.0164	1.5702
PS10	0.0086	0.0413	-0.0326	0.0166	-1.9626
PS11	0.0086	0.0100	-0.0014	0.0205	-0.0664
RMS2	0.0002	-0.0006	0.0008	0.0195	0.0431
RMS3	-0.0194	-0.0063	-0.0131	0.0108	-1.2141
RMS4	-0.0174	-0.0083	-0.0090	0.0100	-0.9021
RMS5	0.0084	-0.0059	0.0143	0.0124	1.1542
RMS6	0.0281	0.0211	0.0070	0.0143	0.4883

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

Table B.27

COMPARISON OF SUBSAMPLE PARAMETER ESTIMATES: GROSS RENT, EVER/NEVER PARTICIPATION STATUS SUBSAMPLES

	Standardized Coefficient		Significance Test		
Variable	Participant Sample	Nonpartic. Sample	Estimated Difference	SE of Difference	t
M1	0.0130	-0.0251	0.0381	0.0215	1.7710
M2	0.0127	0.0294	-0.0167	0.0217	-0.7725
M3	-0.0256	-0.0043	-0.0213	0.0170	-1.2570
PART	0.0232	0.0	0.0232	0.0134	1.7336
MOVE	0.0372	0.0252	0.0120	0.0128	0.9328
CSB	-0.0056	-0.0076	0.0020	0.0157	0.1260
PART1	0.0	0.0	0.0	0.0	0.0
PART2	0.0	0.0	0.0	0.0	0.0
PART3	0.0	0.0	0.0	0.0	0.0
PS01	0.0090	0.0391	-0.0300	0.0274	-1.0958
PS02	0.0125	0.0078	0.0048	0.0178	0.2680
PS03	-0.0280	0.0087	-0.0367	0.0241	-1.5232
PS04	0.0132	0.0068	0.0064	0.0205	0.3113
PS05	-0.0190	-0.0235	0.0045	0.0171	0.2625
PS06	0.0049	-0.0104	0.0153	0.0358	0.4265
PS07	-0.0861	-0.0296	-0.0565	0.0234	-2.4123
PS08	-0.0370	-0.0246	-0.0124	0.0292	-0.4249
PS09	0.0492	-0.0166	0.0658	0.0302	2.1830
PS10	0.0321	0.0392	-0.0071	0.0383	-0.1856
PS11	0.0492	0.0032	0.0461	0.0327	1.4071
RMS2	0.0488	-0.0055	0.0543	0.0355	1.5295
RMS3	-0.0268	-0.0135	-0.0133	0.0165	-0.8040
RMS4	-0.0339	-0.0095	-0.0244	0.0152	-1.6022
RMS5	-0.0195	0.0047	-0.0241	0.0196	-1.2297
RMS6	0.0314	0.0238	0.0076	0.0211	0.3599

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

Table B.28

COMPARISON OF SUBSAMPLE PARAMETER ESTIMATES:
CONTRACT RENT, OCCUPANCY STATUS SUBSAMPLES

	Standardized Coefficient		Significance Test		
Variable	Occ. Change Sample	No Change Sample	Estimated Difference	SE of Difference	t
M1	-0.0287	-0.0081	-0.0206	0.0155	-1.3311
M2	-0.0016	0.0031	-0.0046	0.0164	-0.2823
M3	0.0303	0.0050	0.0253	0.0120	2.1070
PART	0.0326	0.0131	0.0195	0.0124	1.5677
MOVE	0.0	0.0	0.0	0.0	0.0
CSB	-0.0068	-0.0069	0.0000	0.0089	0.0042
PART1	0.0	0.0	0.0	0.0	0.0
PART2	0.0	0.0	0.0	0.0	0.0
PART3	0.0	0.0	0.0	0.0	0.0
PS01	0.0418	-0.0116	0.0534	0.0201	2.6586
PS02	0.0238	0.0060	0.0178	0.0115	1.5527
PS03	0.0168	0.0007	0.0161	0.0155	1.0423
PS04	0.0015	-0.0012	0.0027	0.0129	0.2133
PS05	-0.0202	-0.0037	-0.0166	0.0109	-1.5206
PS06	-0.0085	-0.0040	-0.0045	0.0192	-0.2362
PS07	-0.0422	-0.0043	-0.0379	0.0156	-2.4318
PS08	0.0046	0.0082	-0.0036	0.0207	-0.1732
PS09	-0.0145	0.0122	-0.0267	0.0147	-1.8166
PS10	0.0349	-0.0158	0.0507	0.0175	2.8919
PS11	-0.0379	0.0136	-0.0514	0.0282	-1.8251
RMS2	0.0139	-0.0076	0.0215	0.0184	1.1677
RMS3	-0.0150	-0.0024	-0.0127	0.0101	-1.2512
RMS4	-0.0160	0.0039	-0.0199	0.0093	-2.1330
RMS5	-0.0003	0.0081	-0.0084	0.0115	-0.7249
RMS6	0.0174	-0.0021	0.0195	0.0135	1.4384

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

Table B.29

COMPARISON OF SUBSAMPLE PARAMETER ESTIMATES: CONTRACT RENT, CURRENT PARTICIPATION STATUS SUBSAMPLES

	Standardized Coefficient		Significance Test		
Variable	Participant Sample	Nonpartic. Sample	Estimated Difference	SE of Difference	t
M1	-0.0237	-0.0176	-0.0061	0.0293	-0.2084
M2	0.0158	-0.0019	0.0177	0.0279	0.6364
M3	0.0079	0.0195	-0.0116	0.0199	-0.5858
PART	0.0	0.0	0.0	0.0	0.0
MOVE	0.0605	0.0325	0.0281	0.0150	1.8692
CSB	-0.0072	-0.0073	0.0001	0.0185	0.0057
PART1	0.0	0.0	0.0	0.0	0.0
PART2	0.0	0.0	0.0	0.0	0.0
PART3	0.0	0.0	0.0	0.0	0.0
PS01	0.0001	0.0145	-0.0144	0.0326	-0.4412
PS02	0.0093	0.0149	-0.0055	0.0200	-0.2763
PS03	-0.0387	0.0176	-0.0563	0.0277	-2.0317
PS04	-0.0136	-0.0007	-0.0129	0.0224	-0.5748
PS05	-0.0146	-0.0183	0.0037	0.0204	0.1827
PS06	0.0207	-0.0103	0.0310	0.0394	0.7860
PS07	-0.0808	-0.0189	-0.0620	0.0263	-2.3591
PS08	-0.0562	0.0120	-0.0683	0.0333	-2.0485
PS09	0.0812	-0.0077	0.0888	0.0345	2.5741
PS10	0.0116	0.0135	-0.0019	0.0442	-0.0420
PS11	0.0812	-0.0166	0.0977	0.0364	2.6844
RMS2	0.0505	0.0053	0.0452	0.0418	1.0810
RMS3	-0.0405	-0.0065	-0.0340	0.0193	-1.7628
RMS4	-0.0267	-0.0082	-0.0185	0.0174	-1.0597
RMS5	-0.0104	0.0044	-0.0148	0.0236	-0.6261
RMS6	0.0271	0.0051	0.0220	0.0247	0.8914

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

Table B.30

COMPARISON OF SUBSAMPLE PARAMETER ESTIMATES:
CONTRACT RENT, LOCATION SUBSAMPLES

	Standardized Coefficient		Significance Test		
Variable	CSB Sample	ROC Sample	Estimated Difference	SE of Difference	t
M1	-0.0159	-0.0210	0.0051	0.0142	0.3597
M2	0.0037	-0.0020	0.0057	0.0148	0.3835
M3	0.0122	0.0230	-0.0108	0.0114	-0.9490
PART	0.0267	0.0122	0.0145	0.0135	1.0747
MOVE	0.0356	0.0347	0.0009	0.0082	0.1092
CSB	0.0	0.0	0.0	0.0	0.0
PART1	0.0	0.0	0.0	0.0	0.0
PART2	0.0	0.0	0.0	0.0	0.0
PART3	0.0	0.0	0.0	0.0	0.0
PS01	-0.0010	0.0249	-0.0259	0.0198	-1.3071
PS02	0.0087	0.0200	-0.0112	0.0123	-0.9107
PS03	0.0178	-0.0039	0.0218	0.0156	1.3965
PS04	-0.0114	0.0081	-0.0195	0.0131	-1.4844
PS05	-0.0237	-0.0153	-0.0084	0.0114	-0.7358
PS06	-0.0063	-0.0140	0.0077	0.0192	0.4017
PS07	-0.0314	-0.0250	-0.0065	0.0158	-0.4103
PS08	-0.0079	0.0153	-0.0232	0.0204	-1.1377
PS09	0.0183	-0.0108	0.0291	0.0152	1.9105
PS10	0.0183	0.0153	0.0030	0.0154	0.1961
PS11	0.0183	-0.0146	0.0330	0.0188	1.7532
RMS2	0.0125	0.0051	0.0074	0.0179	0.4154
RMS3	-0.0159	-0.0014	-0.0144	0.0099	-1.4559
RMS4	-0.0089	-0.0094	0.0005	0.0092	0.0540
RMS5	0.0044	0.0019	0.0025	0.0114	0.2210
RMS6	0.0078	0.0039	0.0040	0.0132	0.3032

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

Table B.31

COMPARISON OF SUBSAMPLE PARAMETER ESTIMATES: CONTRACT RENT, EVER/NEVER PARTICIPATION STATUS SUBSAMPLES

	Standardized Coefficient		Significance Test		
Variable	Participant Sample	Nonpartic. Sample	Estimated Difference	SE of Difference	t
M1	-0.0059	-0.0197	0.0137	0.0199	0.6897
M2	0.0083	-0.0012	0.0095	0.0201	0.4750
M3	-0.0024	0.0209	-0.0233	0.0157	-1.4815
PART	0.0232	0.0	0.0232	0.0124	1.8658
MOVE	0.0555	0.0317	0.0238	0.0119	2.0076
CSB	0.0012	-0.0083	0.0096	0.0145	0.6582
PART1	0.0	0.0	0.0	0.0	0.0
PART2	0.0	0.0	0.0	0.0	0.0
PART3	0.0	0.0	0.0	0.0	0.0
PS01	-0.0068	0.0167	-0.0235	0.0254	-0.9248
PS02	0.0016	0.0166	-0.0150	0.0165	-0.9094
PS03	-0.0292	0.0180	-0.0472	0.0223	-2.1143
PS04	-0.0120	-0.0008	-0.0112	0.0190	-0.5889
PS05	-0.0224	-0.0184	-0.0039	0.0158	-0.2473
PS06	0.0125	-0.0096	0.0221	0.0332	0.6665
PS07	-0.0577	-0.0223	-0.0354	0.0217	-1.6311
PS08	-0.0437	0.0137	-0.0574	0.0271	-2.1176
PS09	0.0625	-0.0083	0.0708	0.0280	2.5305
PS10	0.0326	0.0119	0.0207	0.0356	0.5813
PS11	0.0625	-0.0175	0.0800	0.0303	2.6383
RMS2	0.0513	0.0041	0.0472	0.0329	1.4363
RMS3	-0.0279	-0.0077	-0.0202	0.0153	-1.3182
RMS4	-0.0246	-0.0077	-0.0169	0.0141	-1.1963
RMS5	-0.0154	0.0055	-0.0209	0.0182	-1.1472
RMS6	0.0165	0.0058	0.0107	0.0196	0.5491

SOURCE: Estimated by HASE staff from records of the rent-inflation analysis file for St. Joseph County.

NOTE: See Table B.1 for definitions of variables. See text for explanation of significance tests on standardized coefficients.

Appendix C

COMPARISON OF CURRENT AND EARLIER ESTIMATES OF GROSS RENT INFLATION

The first HASE report on rent inflation in St. Joseph County was published in September 1977.* It estimated that the annual rate of increase in gross rents for nonparticipants' dwellings between November 1974 and July 1976 was 5.02 percent (± 0.30). For that same population and period, the current estimate is 5.32 percent (± 0.68). The two estimates are statistically indistinct.

The close agreement is not surprising, inasmuch as the earlier estimate used the early portion of the data set on which the current estimates are based, linking tenant interview records for dwellings surveyed at waves 1 and 2 to obtain its rent-change observations. Rent inflation was also similarly modeled in the two studies.** The main substantive difference in the two analyses is that the earlier one deliberately excluded dwellings occupied by program participants so as to exclude program-induced inflation (if any) from the estimates used to revise the standard cost of adequate housing. In the current analysis, participants' dwellings were included, and a substantial effort was made to identify both direct and indirect program effects--a more feasible task with 3.75 years of data than with 1.75.***

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*Stucker, *Rent Inflation in St. Joseph County*.

**The earlier model cross-stratified dwellings by number of rooms and property type, then directly averaged within each stratum the exposure-weighted monthly inflation rate obtained by differencing the rents reported at the two interviews. The current model reaches a similar result by multiple regression, but includes additional variables indicating the dwelling's status with respect to occupancy change, occupancy by program participants, and location in central South Bend; because of the longer span of observations, it also distinguishes inflation rates by period.

***Although program effects were identified, they were too small and too localized to influence marketwide averages significantly. See Sec. IV, above.

Table C.1 compares current and earlier estimates of gross rent inflation for nonparticipants' dwellings over the period covered by the earlier study's data. Unfortunately, the close agreement in the overall rate is not repeated in rates by dwelling size or property type. The average absolute difference between the rates specific to dwelling size is 1.54 percentage points. The average absolute difference between the rates specific to property size is 2.11 percentage points.

The rates by dwelling size indicate that the two studies found different patterns in the data. The current estimates indicate that as a dwelling's size increases, its rate of rent inflation first drops, then rises; the earlier estimates reverse that pattern.

The rates by property type also differ systematically. The current estimates indicate less inflation for single-family houses at all rent levels than did the earlier estimates, and more inflation for high-rent multiple dwellings and high-rent rural dwellings.

As the reader can judge from the standard errors reported in the last two columns of the table, the confidence intervals for pairs of current and earlier estimates overlap substantially in every case; however, the samples were not independently chosen, so the usual significance test does not apply.* We judge that the two studies in fact yielded different answers, but we are unable to explain why.

One reason might be differences in the data set. The inclusion of longer observation intervals (e.g., wave 1-wave 3) in the current study may be averaging in 1976-77 rent changes that differed in pattern from the 1974-76 changes. Another reason may be differences in the models. The direct averaging technique of the earlier study weights outlying values equally with those close to the center of the distribution. The current study, using regression analysis, gives heavier weight to outliers by choosing a regression hyperplane that minimizes

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*The earlier study's rent-change observations are a subset of those used in the current study. Presumably, the wave 1-wave 2 record links are virtually identical in the two studies; however, the current study also used observations based on all four waves to estimate dwelling-size and property-type parameters, and some observations from all except wave 3-wave 4 record links to estimate Period 1 and Period 2 parameters.

Table C.1

COMPARISON OF CURRENT AND EARLIER ESTIMATES OF GROSS RENT INFLATION: NONPARTICIPANTS' DWELLINGS, NOVEMBER 1974-JULY 1976

Code	Dwelling Characteristic	Annual Rate of Increase (%) in Gross Rent			Standard Error of Estimate	
		Current Estimate	Earlier Estimate	Difference	Current Estimate[a]	Earlier Estimate
	By Dwelling Size					
2	1-2 rooms	6.03	4.93	1.10	1.12	1.72
3	3 rooms	4.79	5.14	- .35	.77	.79
4	4 rooms	4.79	6.69	-1.90	.78	.94
5	5 rooms	5.68	4.55	1.13	.83	1.04
6	6+ rooms	6.51	3.28	3.23	.89	1.78
	By Property Type					
	Low-rent Urban					
1	Single-family	9.33	11.53	-2.20	1.34	2.32
2	2-4 units	5.87	4.88	.99	.82	1.03
3	5+ units	5.99	5.99	--	.98	1.71
	Medium-rent Urban					
4	Single-family	6.41	7.26	- .85	.91	1.37
5	2-4 units	3.71	4.57	- .86	.81	.92
6	5+ units	3.69	2.33	1.36	1.24	1.07
	High-rent Urban					
7	Single-family	3.39	6.99	-3.60	1.02	1.67
8	2-4 units	4.32	.64	3.68	1.32	1.71
9	5+ units	4.21	.68	3.53	1.04	2.07
	Rural					
10	Low or medium rent	10.03	9.08	.95	1.17	1.94
11	High rent	7.86	2.66	5.20	1.64	4.55
	All Sizes and Types					
	All dwellings	5.32	5.02	.30	.68	.56

SOURCES: "Current estimates" were calculated from entries in Table 4.2 of this report. "Earlier estimates" are from James P. Stucker, *Rent Inflation in St. Joseph County, Indiana: 1974-77*, The Rand Corporation, N-1116-HUD, November 1979 (first issued as WN-9734-HUD, September 1977), Tables 2.6 and 2.7.

NOTE: "Current estimates" are weighted averages of estimated annual rates for Periods 1 and 2. The weights (14/12 for Period 1 and 7/12 for Period 2) are designed to span the period to which the "earlier estimates" apply: November 1974-July 1976.

[a]Standard errors on Period 1 annual rates. The standard errors on Period 2 rates are nearly identical; see Table 4.2.

squared deviations; but the outliers' influence was decreased by the use of the trimming procedure described in Sec. II. Although it is plausible that dwelling strata vary in the dispersion of observations, the observed outcome requires that variation to be systematic at least with size of dwelling. The inclusion of longer observation intervals in the current study would also tend to reduce the dispersion of calculated monthly inflation rates, but is not likely to have done so differentially by stratum. Finally, the current model includes three dwelling status variables absent from the earlier model; but the effects of those variables are reflected in both sets of estimates.

By crossfitting models and data sets, we could probably diagnose the discrepancy. Unfortunately, the earlier data file was not preserved, and the cost of reconstructing it solely for this purpose does not seem justified. On general grounds, we have more confidence in the current estimates (based on 2,135 observations for nonparticipants' dwellings) than on the earlier estimates (based on 621 observations).

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