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5 The Effect of Different Measures of Benefit on Estimates of the Distributive Consequences of Government Programs

Edgar O. Olsen and Kathy A. York

5.1 Introduction

Many different measures of the benefit of an in-kind transfer have been used in benefit-cost analysis. Perhaps the most common is the difference between the market value of the bundle of goods consumed under the program and the market value of the bundle that would have been consumed in its absence (e.g., Aaron 1970; E. Browning 1976, 1979; Fried et al. 1973). This measure ignores the fact that people are not indifferent between all bundles with the same market value; its advantage is that it requires less information than more sophisticated measures. Another common measure of benefit is Marshallian consumer's surplus (e.g., J. Browning 1979; Mayo et al. 1980, pp. 95–102; Olsen 1972). It is now widely known that this measure has no natural interpretation unless the income elasticity of demand for the subsidized good is zero. It is best viewed as an approximation to a measure such as Hicks's price equivalent variation. This equivalent variation is the unrestricted cash grant that would be as satisfactory to the recipient as its in-kind transfer. In recent years many attempts have been made to estimate this measure using estimated indifference maps with various degrees of generality (e.g., De Salvo 1975; Murray 1975; Olsen and Barton 1983; Rosen 1978).

The primary purpose of this paper is to provide empirical evidence concerning whether the more sophisticated measures provide markedly different conclusions about the distributive consequences of government programs. This is done for two programs known to have very different effects, namely, public housing and rent control. To estimate any of the

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three measures of benefit for either program, it is necessary to predict the market rent of the subsidized unit. Our prediction is, in essence, the mean rent of unsubsidized units with the same observed characteristics. The Marshallian and Hicksian measures also require estimates of the trade-offs individuals are willing to make among goods, so indifference maps are estimated for various types of families using data on families living in unsubsidized private rental housing. These indifference maps are assumed to be applicable to similar subsidized families. The various measures of benefit are then calculated for each household in the public housing and the rent control samples. For these two programs, each measure of benefit is regressed on household characteristics. We conclude that the approximations to a satisfactory measure of benefit, such as Hicks's price equivalent variation, will in some cases give a misleading impression of the distributive consequences of government programs.

5.2 Derivation of Benefit Formulas

Before providing the empirical evidence, we must specify more precisely our three benefit measures. We divide all commodities into two composites called housing services and nonhousing goods and assume that all consumers of the same race who live in the same area and buy all goods in uncontrolled markets face the same set of prices and that this set of prices would be the same in the absence of public housing and rent control.[1] In addition, we assume that no household's future consumption is affected by its participation in one of these programs during the current year.[2]

Consider then a family participating in one of the two housing programs. Its preferences are presumed to be representable by the indifference map in figure 5.1. Suppose that the family has an income Y and faces prices (P_m^h, P_m^x) in the private markets for housing services and nonhousing goods. In the program's absence, the family would choose a combination (Q_m^h, Q_m^x) of the two goods. Under the program, however, the family occupies a dwelling providing Q_g^h units of housing services and commanding a rent $P_g^h Q_g^h$. This implies a consumption of nonhousing goods given by the quantity

$$Q_g^x = \frac{Y - P_g^h Q_g^h}{P_m^x}. \tag{1}$$

Recall that the difference between the market value of the goods consumed under the program and the market value of the bundle consumed in its absence is usually called the subsidy S. That is,

$$S = P_m^h Q_g^h + P_m^x Q_g^x - Y.$$

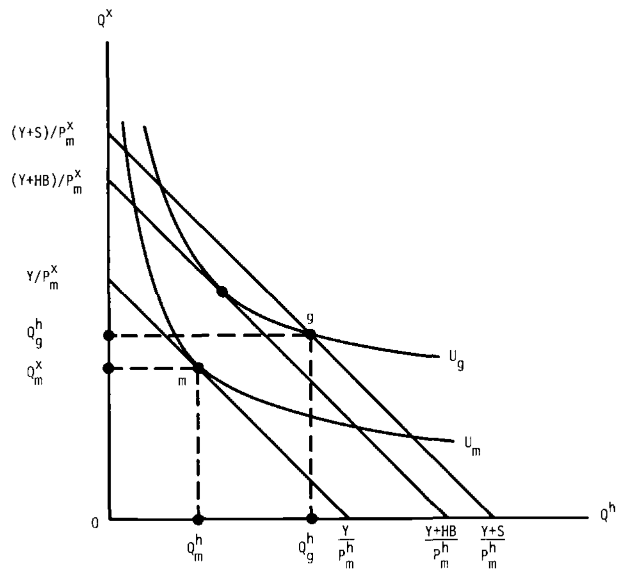

Fig. 5.1

Substituting the expression for Q_g^x from equation (1) then gives

$$(2) \qquad S = P_m^h Q_g^h - P_g^h Q_g^h,$$

so the subsidy is just the difference between the market and actual rent of the program unit. Since any combination of goods with the same market value as the bundle consumed under the program involves the same subsidy and since a family is not indifferent among all such combinations, the subsidy is not a satisfactory measure of benefit.

A measure that does not have this defect is Hicks's price equivalent variation. This is the unrestricted cash grant HB which, if given to the family in lieu of the opportunity to occupy the dwelling unit provided through the program, would yield the same level of well-being as the program. In general,

$$\text{HB} = V^{-1}(U_g, P_m^h, P_m^x) - Y,$$

where $V^{-1}(U_g, P_m^h, P_m^x)$ is the income that would allow the family to achieve at market prices the same level of well-being as attained under the program.

Another measure that has been used more frequently in empirical research is Marshallian consumer's surplus. This measure is depicted in figure 5.2, where $D(Q^h)$ is the family's Marshallian (money-income-constant) demand curve for housing services. The price-quantity combinations of housing services for the family with and without the program

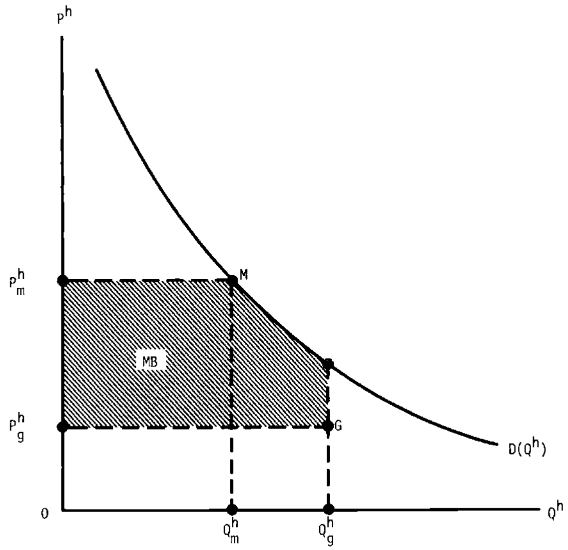

Fig. 5.2

are represented by points G and M in the diagram. The Marshallian benefit of the program MB is equal to the excess of consumer surplus at G over consumer surplus at M. Accordingly,

$$\text{(3)} \qquad \text{MB} = P_m^h Q_m^h + \int_{Q_m^h}^{Q_g^h} D(Q^h)dQ^h - P_g^h Q_g^h.$$

This is the shaded area in figure 5.2. If the income elasticity of demand for housing services were zero, then the money-income-constant and real-income-constant demand curves would coincide and the Marshallian and Hicksian measures of benefit would be the same (Blaug 1978, pp. 374–83). Otherwise, the Marshallian measure has no natural interpretation.

Neither the Marshallian nor the Hicksian measure of benefit may exceed the subsidy. A famous proposition in consumer's surplus analysis is that the Hicksian measure exceeds the Marshallian measure if the subsidized good is a normal good (Blaug 1978, pp. 374–83). However, the proof of this proposition assumes that the change in well-being results from a rotation of a linear budget constraint. Since neither public housing nor rent control change budget constraints in this way (Kraft and Olsen 1977, pp. 52–53; Olsen 1972, pp. 1083–84), the Marshallian measure need not be less than the Hicksian measure for these programs. This is easily seen by supposing that point G in figure 5.2 is directly below point M, in which case point g in figure 5.1 would be directly above point m. In this case the Marshallian measure of benefit, MB, is equal to the subsidy, S, but if housing service is a normal good, the Hicksian measure, HB, is less than the subsidy. We estimate that the Marshallian benefit exceeds the Hicksian benefit for about 80 percent of the households in rent controlled units and 6 percent of those in public housing units.

To estimate the Hicksian and Marshallian benefits accruing to a participant family, we posit that each family's preferences are representable by a Stone-Geary or displaced Cobb-Douglas utility function,

$$U = (Q^h - \beta^h)^\gamma (Q^x - \beta^x)^{1-\gamma}, \tag{4}$$

where β^h and β^x are usually interpreted as the family's subsistence levels of housing services and nonhousing goods, and γ is the marginal propensity to spend on housing services out of income. All parameters are allowed to vary across families.

Olsen and Barton (1983) show that the Hicksian benefit formula for the Stone-Geary utility function (4) is

$$\begin{aligned} \text{HB} = {} & [(P_m^h Q_g^h - P_m^h \beta^h)/\gamma]^\gamma \\ & [(P_m^x Q_g^x - P_m^x \beta^x)/(1-\gamma)]^{(1-\gamma)} \\ & + P_m^h \beta^h + P_m^x \beta^x - Y. \end{aligned} \tag{5}$$

The Marshallian demand function corresponding to the Stone-Geary utility function is

$$P^h = \gamma (Y - P^x \beta^x)/[Q^h - (1-\gamma)\beta^h]. \tag{6}$$

Substituting this into equation (3) and evaluating the integral gives the Marshallian benefit formula

$$\begin{aligned} \text{MB} = P_m^h Q_m^h - P_g^h Q_g^h + \gamma (Y - P_m^x \beta^x) \{ & \ln [P_m^h Q_g^h \\ & - (1-\gamma) P_m^h \beta^h] \\ & - \ln [P_m^h Q_m^h - (1-\gamma) P_m^h \beta^h] \}. \end{aligned} \tag{7}$$

The subsidy can be calculated from a knowledge of the market rent of the family's subsidized unit and its expenditure on housing under the program. Although the characteristics of the subsidized unit can be observed, its market rent must be estimated since it is not rented in the private, uncontrolled market. The housing expenditure of each subsidized family is directly observed. Estimation of the Hicksian and Marshallian benefit requires, in addition, a knowledge of the family's income and estimates of the parameters of its indifference map. Knowledge of the family's income and housing expenditure under the program and the estimate of the market rent of its subsidized unit determine the location of point g in figure 5.1. This information plus estimates of the parameters of the family's indifference map determine the graph of the indifference curve containing the consumption bundle under the program which together with the family's income determines its Hicksian benefit.[3] The Marshallian benefit depends on the same parameters and variables.

Expenditure on housing in the absence of the program $P_m^h Q_m^h$, which appears in the formula for Marshallian benefit, can be calculated from this information using the demand function (6).

5.3 The Data

The empirical results of this paper are based on data for a stratified random sample of about 35,000 housing units and their occupants from the 1965 New York City Housing and Vacancy Survey.[4] The data are of the sort collected in the Decennial Census of Population and Housing except that information was collected on whether the housing unit was in a public housing project or subject to rent control.

5.4 Predictions of Indifference Map Parameters

5.4.1 Marginal Propensity to Spend on Housing

A family with a Stone-Geary indifference map (4) and paying market prices for all goods will spend a fraction,

$$P^h Q^h / Y = \gamma + (1 - \gamma)\beta^h (P^h / Y) - \gamma \beta^x (P^x / Y), \tag{8}$$

of its income on housing. Since we do not directly observe the market prices facing households, we cannot estimate the parameters γ, β^h, and β^x in a straightforward way. So we proceed in two steps.

First, we rewrite equation (8) as

$$P^h Q^h / Y = \gamma + \alpha (1/Y), \tag{9}$$

where $\alpha = (1 - \gamma) P^h \beta^h - \gamma P^x \beta^x$. To allow for the possibility that market prices and the indifference map parameters differ systematically for different types of families, we write γ and α as functions of the variables for location, race, and family size defined in table 5.1. To allow for differences in the observed rent-income ratio among families with the same values of explanatory variables, we add to equation (9) an error term with mean zero. Since the observations are generated by random sampling, the explanatory variables in this regression are stochastic. If the error term is uncorrelated with these stochastic regressors, ordinary least squares (OLS) estimators are consistent. Table 5.1 presents the OLS estimates based on the 4,014 families in the sample living in unfurnished uncontrolled private rental housing for which the values of the required variables are reported.[5]

These results enable us to estimate the mean marginal propensity to spend on housing for different types of families. For example, the estimated mean for two-person black households living in Manhattan is .0356 (= .0978 + .0284 − .0517 − .0389). However, they do not enable us to

Table 5.1 Estimated Relationship between Rent-Income Ratio and Family Characteristics

Regressors	Descriptions of Regressors	Coefficients	t-scores
CONS	Constant	.0978	16.9
MANH	1 if unit in Manhattan; 0 otherwise	.0284	5.5
BLACK	1 if black; 0 otherwise	-.0517	-6.6
FS2	1 if family size is 2; 0 otherwise	-.0389	-6.0
FS3	1 if family size is 3; 0 otherwise	-.0382	-4.8
FS4	1 if family size is 4; 0 otherwise	-.0688	-8.5
FS5	1 if family size is at least 5; 0 otherwise	-.0115	-1.1
ININC	Inverse of annual income	832.3	50.0
MANHC	MANH*ININC	393.7	14.5
BLACKC	BLACK*ININC	78.7	2.5
FS2C	FS2*ININC	372.5	14.3
FS3C	FS3*ININC	434.6	10.7
FS4C	FS4*ININC	627.6	17.0
FS5C	FS5*ININC	229.9	4.6

R^2 = .77; standard error = .09; number of observations = 4014.

make estimates of the subsistence parameters. The second step in estimating the parameters of the indifference map involves using the estimates of α implicit in table 5.1 and independent estimates of subsistence expenditure on housing $P^h\beta^h$ to estimate $P^x\beta^x$.

5.4.2 Subsistence Parameters

If subsistence housing expenditure $P^h\beta^h$ is the same for all households of a particular type, if the population of households of each type in New York City contains a household at subsistence, and if the rents of all uncontrolled, privately owned apartments are accurately reported and reflect neither public nor private charity, then the sample minimum rent of such units for families of each type is a consistent estimator of $P^h\beta^h$, and its upward bias declines to zero as the sample size approaches the population size. Table 5.2 presents the sample minima for the 5,675 families reported to be living in uncontrolled, private rental housing for whom values of all required variables are available.

The erratic pattern of these minima suggests substantial violations of at least one of the assumptions underlying the use of the sample minimum as an estimate of $P^h\beta^h$. To obtain a more acceptable pattern, we first used the market rent prediction equations discussed in section 5.5 to estimate the difference in the price per unit of housing service in Manhattan and elsewhere in New York City. This is done by using the market rent equations for Manhattan and non-Manhattan to predict rents for all uncontrolled, private rental units in the city and by comparing the means of these predictions. We conclude that rents of units in Manhattan are 46

Table 5.2 Sample Minimum Annual Rents for Private, Uncontrolled Rental Housing

	Non-Manhattan		Manhattan	
FS	White	Black	White	Black
1	480 (429)	612 (45)	900 (564)	720 (39)
2	240 (1296)	516 (95)	372 (619)	660 (52)
3	684 (883)	648 (89)	900 (173)	1080 (20)
4	360 (692)	780 (73)	864 (84)	732 (23)
5+	300 (376)	625 (88)	1320 (23)	744 (12)

Number of cases in parentheses.

percent greater than rents of similar units elsewhere. This result is used to express non-Mahattan sample minima in Manhattan prices. We then regress the natural logarithm of these adjusted sample minima on the natural logarithm of family size separately for blacks and whites. The OLS estimates are 6.43 + .086 ln(FS) with R^2 = .11 for whites, and 6.66 + .086 ln(FS) with R^2 = .28 for blacks. These equations together with our estimate of the difference in the price per unit of housing service between Manhattan and other boroughs are used to calculate the predicted subsistence rents reported in table 5.3. While these estimates clearly leave much to be desired, we believe they are better than the sample minima.

Substituting estimates of γ and α derived from table 5.1 and $P^h\beta^h$ from table 5.3 into the definition of α yields an estimate of $P^x\beta^x$. Specifically

$$P^x\hat{\beta}^x = [(1-\hat{\gamma})P^h\hat{\beta}^h - \hat{\alpha}]/\hat{\gamma}. \quad (10)$$

Table 5.3 Predicted Subsistence Rents

	Non-Manhattan		Manhattan	
FS	White	Black	White	Black
1	425	535	620	781
2	451	568	659	829
3	469	585	685	854
4	479	603	699	880
5+	489	615	713	899

The estimates of this parameter were implausibly large in absolute value for several family types with unusually small estimates of the marginal propensity to spend on housing. Rewriting equation (10) as

$$P^x \hat{\beta}^x = [(P^h \hat{\beta}^h - \hat{\alpha})/\hat{\gamma}] - P^h \hat{\beta}^h$$

makes clear that $P^x \hat{\beta}^x$ will be very sensitive to errors in estimating γ for γ near zero. Since we believe that our estimates of the marginal propensity are implausibly small for several family types, we decided to set it equal to .01 when the results in table 5.1 led to a smaller estimate.

Estimates of $P^x \beta^x$ were negative for all family types. This is typical of attempts to estimate the Stone-Geary indifference map with data on individual households (Cronin 1979; Hammond 1982, pp. 102–113; Olsen and Barton 1983, p. 311). In light of the theoretical and statistical reasons for expecting difficulties in estimating subsistence expenditures (Olsen and Barton 1983, p. 313), it is best to think of our estimates as yielding a reasonable approximation of the true indifference map over that part of consumption space containing the consumption bundles in our sample rather than as reliable estimates of subsistence.

The indifference maps estimated in this section are typical of families of each type living in unsubsidized housing. We want to use them to estimate benefits for subsidized families, so we assume that the preferences of families in public housing or rent-controlled units do not differ systematically from those of unsubsidized families. It has been suggested that the typical family in public housing has a stronger than average taste for housing and vice versa for the typical family in a controlled unit. However, a previous study using the same data and the procedures developed by Heckman (1979) concluded that selection bias is not an important objection to using the methods of this paper to estimate the benefits of the public housing program (Olsen and Barton 1983, pp. 314–15).

5.5 Predictions of Market Rent

To estimate benefits using any of the measures requires a prediction of the market rent of the housing unit occupied under the program. To make such predictions we first estimate a linear relationship between annual gross rent per room and the variables listed in table 5.4 together with the product of these variables and a racial dummy variable. The inclusion of the racial interaction terms permits the coefficients of the explanatory variables to be different for blacks and whites. Relationships are estimated separately for Manhattan and other parts of the city. The data are for unfurnished, uncontrolled, private rental housing for which the values of the variables involved are reported.[6]

Table 5.4 presents the results. In the Manhattan regression, the racial interaction for duplex built prior to 1947 does not appear because the two units in this category were occupied by blacks. Other variables were omitted because they had no variance in the sample. In the non-Manhattan regression, the variable for condition of the unit was deleted because it had the wrong sign and was statistically insignificant at conventional levels.

Although we would not, in most cases, reject the hypotheses that the coefficient of the individual racial interaction variables are zero at con-

Table 5.4 **Estimated Relationships between Annual Gross Rent per Room and Housing Characteristics**

	Manhattan Coefficients		Non-Manhattan Coefficients	
Descriptions of Explanatory Variables	Explanatory Variables	Racial Interactions	Explanatory Variables	Racial Interactions
Inverse of the number of rooms	1153.99**	−34.61	920.96**	86.22
1 if duplex built prior to 1947; 0 otherwise	−262.00	—	−174.34**	35.51
1 if duplex built in 1947–59; 0 otherwise	—	—	−91.21**	−13.30
1 if duplex built in 1960–65; 0 otherwise	—	—	−55.15**	−20.81
1 if duplex built prior to 1947 and converted to apartment; 0 otherwise	−196.69**	20.90	−111.87**	−54.14
1 if duplex built after 1947 and converted to apartment; 0 otherwise	−35.54	−345.58	−112.34**	—
1 if apartment built before 1901; 0 otherwise	−324.81**	169.17	−223.06**	91.00
1 if apartment built in 1901–29; 0 otherwise	−160.28**	−84.57	−163.03**	6.74
1 if apartment built in 1930–59; 0 otherwise	−159.90**	71.29	−58.22**	38.36
1 if dwelling in Queens; 0 otherwise	—	—	12.20**	37.03**
1 if dwelling in Richmond; 0 otherwise	—	—	31.38**	−83.13
1 if dwelling in Bronx; 0 otherwise	—	—	−4.30	27.85
Story of unit if less than 7; 0 otherwise	−17.14	17.35	−7.79*	0.76
Story of unit if building has elevator; 0 otherwise	31.10	−18.16	19.15**	−12.53
1 if story of unit is at least 7; 0 otherwise	123.79**	−96.45	89.22**	−94.78**
1 if unit is in sound condition; 0 otherwise	30.73	139.65	—	—
Percentage of rooms that are bedrooms	0.19	−0.04	0.48**	0.30
Constant	421.59**	−341.18	224.59**	−55.37
R^2	.53		.73	
Standard error	235		95	
Number of observations	1526		3827	

Each racial interaction variable is the variable BLACK times an explanatory variable. One asterisk indicates significance at the .05 level; two, significance at the .01 level.

ventional levels of significance, the hypothesis that they are all zero is rejected. The relative magnitudes of the coefficients are as expected in most cases. The main exceptions are for units occupied by blacks which accounted for less than 10 percent of the sample in each location.

To predict the market rent of a subsidized unit, we substitute its characteristics, including the race of its occupants, into the appropriate equation and multiply by the number of rooms. This procedure is satisfactory to the extent that the mean market rent of subsidized units is the same as the mean market rent of unsubsidized units with the same *observed* characteristics.

5.6 Comparisons of Different Benefit Measures

The estimated indifference map parameters, predicted market rents, and information collected in the survey enable us to estimate the alternative measures of benefit given by equations (2), (5), and (7) for each of 1366 families in public housing and 5640 families in rent-controlled units.[7]

5.6.1 Mean Benefits and Correlation Coefficients

The mean values of the subsidy, the Marshallian benefit, and the Hicksian benefit of public housing and rent control, along with the mean values of other key variables, are given in table 5.5; the correlation coefficients between the different benefit measures are given in table 5.6.

For public housing the means of the Hicksian and Marshallian benefit measures differ inappreciably and their correlation coefficient is close to one. This suggests that the more sophisticated Hicksian equivalent variation contributes little above the contribution of the Marshallian consumer

Table 5.5 **Means of Alternative Measures of Benefits and Other Variables**

Description of Variable	Public Housing	Rent Control
Subsidy	$1,242	$ 395
Marshallian benefit	$1,114	$ 204
Hicksian benefit	$1,136	$ 107
Gross income	$4,488	$5,678
Predicted market rent	$2,084	$1,397
Actual rent	$ 842	$ 994
Estimated "subsistence" housing	$ 589	$ 543
Estimated "subsistence" nonhousing	−$27,145	−$17,631
Age of head of household	46	49
Estimated marginal propensity to spend on housing	0.06	0.07
Family size	3.75	2.74
Proportion black headed	0.39	0.15
Proportion female headed	0.24	0.26

All dollar magnitudes are annual.

Table 5.6 **Correlations between Different Benefit Measures**

	Public Housing	
	MB	HB
S	.952	.961
MB	—	.999
	Rent Control	
	MB	HB
S	.763	.603
MB	—	.956

surplus to our knowledge of the public housing program's distributive consequences. A comparison of the Hicksian benefit and the subsidy leads to somewhat different conclusions. The subsidy overstates the benefit accruing to an average family by approximately 9 percent. Still, the correlation of the Hicksian benefit and the subsidy is quite high.

Rent control is strikingly different from public housing not only with respect to mean benefit but also with respect to the relationships between different measures of benefit. The mean subsidy is more than three times as large as the mean Hicksian benefit, while the mean Marshallian benefit is almost twice as large. Furthermore, the correlations between the subsidy and the other two benefit measures are much lower than for public housing. These findings suggest that the different measures might lead to different conclusions concerning the distributive effects of rent control.

5.6.2 Regressions of Benefit Measures on Family Characteristics

To explore in more detail the effects of different benefit measures on perceptions of the distributive consequences of government programs, we regress each benefit measure on family characteristics. The results for public housing and rent control are reported in tables 5.7 and 5.8.

In the case of public housing, the three measures yield the same qualitative results. Mean benefit is greater for poorer and larger households and for households with a younger white head.[8] Among otherwise similar households, there is little difference in mean benefit between male- and female-headed households. The variation in benefit among households that are the same with respect to the observed characteristics is substantial no matter what measure of benefit is used.

However, substantial differences are present in the quantitative results based on the subsidy and those based on the other two measures. Among otherwise similar families, the estimated difference in the mean subsidy is about twice as large as the estimated difference in either the Marshallian

Table 5.7 **Estimated Relationships between Annual Benefit and Family Characteristics for Public Housing**

	Benefit Measure		
Family Characteristics	S	MB	HB
Gross annual income	−.050**	−.024**	−.027**
	(−7.013)	(−3.963)	(−4.311)
Family size	102.523**	46.235**	52.137**
	(13.560)	(7.232)	(7.795)
1 if head is black; 0 otherwise	−355.742**	−265.979**	−294.169**
	(−13.670)	(−12.088)	(−12.777)
1 if head is female; 0 otherwise	70.602*	5.650	14.597
	(2.038)	(.193)	(.476)
Age of head	−2.051*	−3.214**	−3.089**
	(−2.152)	(−3.988)	(−3.663)
Constant	1344.516**	1311.547**	1331.112**
	(18.375)	(21.199)	(20.563)
R^2	.22	.14	.15
Standard error	456	386	403

Numbers in parentheses are *t*-scores. One asterisk indicates significance at the .05 level; two, significance at the .01 level.

or Hicksian benefit for a given difference in income or family size. These discrepancies are easy to explain. Public housing is more stimulative of housing consumption than a cash grant (in an amount equal to the subsidy) for almost all participants (Olsen and Barton 1983, p. 322). As a participating family's income increases, its consumption of nonhousing goods increases but its housing consumption is unchanged. As a result, the program distorts its consumption pattern to a lesser extent (i.e., the Hicksian benefit approaches the subsidy). Larger families in public housing are assigned to larger units but are not required to pay greater rents, so housing consumption increases with family size but nonhousing consumption is unaffected. Therefore, the program is more distortive for larger families (i.e., the ratio of Hicksian benefit to subsidy is less). The implications of the alternative measures for perceived differences in mean benefit based on the age, race, or sex of the head of the household are smaller. For example, the estimated difference between the mean subsidy of a household headed by a person twenty years old and that of a household headed by a person seventy years old is $103 per year. The estimated difference in the Hicksian benefit is $155 per year.

In the case of rent control, the three measures yield similar qualitative results. Mean benefit is greater for poorer households and for households

Table 5.8 Estimated Relationships between Annual Benefit and Family Characteristics for Rent Control

	Benefit Measure		
Family Characteristics	S	MB	HB
Gross annual income	−.011** (−7.235)	−0.038** (−16.385)	−0.044** (−12.499)
Family size	−4.817 (−1.213)	−2.736 (−0.443)	−4.902 (−0.524)
1 if head is black; 0 otherwise	−245.995** (−15.377)	−806.917** (−32.437)	−1375.098** (−36.468)
1 if head is female; 0 otherwise	34.504* (2.484)	60.673** (2.809)	101.618** (3.104)
Age of head	4.112** (11.123)	2.561** (4.456)	0.794 (0.911)
Constant	293.101** (10.662)	405.470** (9.485)	510.802** (7.883)
R^2	.09	.20	.21
Standard error	416	647	981

Numbers in parentheses are *t*-scores. One asterisk indicates significance at the .05 level; two, significance at the .01 level.

with white or female heads.[9] Family size is neither an important nor a statistically significant determinant of any measure of benefit. The only qualitative difference is that age of the head of the household is statistically insignificant at conventional levels in the regression explaining Hicksian benefit but is highly significant in the other two regressions. Finally, all three regressions suggest that there is nothing approaching equal treatment of equals under rent control.

For this program both the subsidy and the Marshallian measure give misleading impressions of the magnitudes of the differences in the mean Hicksian benefit for various types of households. Among otherwise similar families, the estimated difference in the mean Hicksian benefit is four times as large as the estimated difference in the subsidy for a given difference in income. The difference in the Hicksian benefit to otherwise similar blacks and whites is more than five times as large as the difference in the subsidy and 70 percent larger than the difference in the Marshallian benefit. Large differences also exist for family size and the sex and age of the head of the household.

5.7 Comparisons of Two Hicksian Benefit Measures

Any indifference map that can be specified as a basis for calculating Hicksian benefit is a special case of some more general indifference map.

Since the more general indifference maps are typically more difficult to estimate and use in predicting benefit, it is desirable to know whether they lead to markedly different conclusions concerning the distributive consequences of government programs. We explore this question by estimating the benefits of public housing and rent control using a Cobb-Douglas indifference map, which is a special case of the Stone-Geary indifference map.

In the two-good case, the Cobb-Douglas indifference map has only one parameter that can be interpreted as the marginal propensity to spend on housing or the rent-income ratio of a household maximizing subject to a linear budget constraint. Since the mean value of this parameter can be different for families of different types, we regress the rent-income ratio of families living in unfurnished, uncontrolled, private rental housing on their characteristics. The results are reported in equation (11), where the numbers in parentheses are t-scores.

$$
\begin{aligned}
(11) \qquad P^hQ^h/Y = \underset{(38.0)}{.3242} + \underset{(0.67)}{.0048}\,\text{MANH} + \underset{(6.99)}{.0698}\,\text{BLACK} \\
- \underset{(-7.92)}{.0724}\,\text{FS2} - \underset{(-9.24)}{.0944}\,\text{FS3} - \underset{(-7.75)}{.0846}\,\text{FS4} \\
- \underset{(-7.15)}{.0902}\,\text{FS5}; \qquad R^2 = .04
\end{aligned}
$$

The huge decline in R^2 when the displacement parameters of the Stone-Geary indifference map are constrained to be equal to zero (compare equation [11] with table 5.1) suggests the possibility that the Cobb-Douglas and Stone-Geary indifference maps will yield markedly different conclusions concerning the distributive consequences of public housing and rent control.

The Cobb-Douglas indifference map has been used in a number of previous studies, for example, Clarkson (1976), De Salvo (1975), and Kraft and Olsen (1977). In an earlier study, Murray (1975, pp. 784–86) noted several differences in the distribution of Hicksian benefits among participants in the public housing program when a Cobb-Douglas rather than a generalized constant elasticity of substitution indifference map was used. Most notably he found that using a Cobb-Douglas indifference map to estimate benefit led to the conclusion that mean benefit varies directly with income among families in a single city. Our results reported in table 5.9 corroborate this finding. They also suggest that using a Cobb-Douglas indifference map to estimate the benefits of public housing will lead to a substantial understatement of the difference in mean benefits among otherwise similar blacks and whites.

In the case of rent control, the results based on a Cobb-Douglas indifference map lead us to be confident that mean benefit is smaller for female-headed households, while the more general displaced Cobb-

Table 5.9 Estimated Relationships between Two Hicksian Benefit Measures and Family Characteristics

	Public Housing		Rent Control	
Family Characteristics	Undisplaced Cobb-Douglas	Displaced Cobb-Douglas	Undisplaced Cobb-Douglas	Displaced Cobb-Douglas
Gross annual income	.064** (9.921)	−.027** (−4.311)	−.117** (−46.194)	−0.044** (−12.499)
Family size	52.078** (7.581)	52.137** (7.795)	37.680** (5.591)	−4.902 (−0.524)
1 if head is black; 0 otherwise	−73.956** (−3.128)	−294.169** (−12.777)	−430.917** (−15.870)	−1375.098** (−36.468)
1 if head is female; 0 otherwise	−27.237 (−.865)	14.597 (.476)	−166.972** (−7.083)	101.618** (3.104)
Age of head	−3.615** (−4.175)	−3.089** (−3.663)	−2.884** (−4.597)	0.794 (0.911)
Constant	677.887** (10.196)	1331.112** (20.563)	861.475** (18.463)	510.802** (7.883)
R^2	.24	.15	.29	.21
Standard error	414	403	706	981

Numbers in parentheses are *t*-scores. One asterisk indicates significance at the .05 level; two, significance at the .01 level.

Douglas leads to the opposite conclusion. The Cobb-Douglas results lead us to be confident that mean benefit varies directly with family size and inversely with the age of the head of the household, while the more general indifference map suggests no such relationships. Finally, the two indifference maps lead to very different impressions of the extent to which mean benefit varies with family income and race.

5.8 Conclusion

The evidence presented in this paper shows that the inferences made about the distributive consequences of a government program can depend importantly on the measure of benefit used and the specification of the underlying prediction equations. Additional studies involving other programs are desirable to judge the extent of the misimpressions created by using approximations to a satisfactory measure of benefit and highly restrictive indifference maps. In the meantime we should avoid these approximations (i.e., the subsidy and Marshallian consumer surplus) and the Cobb-Douglas indifference map whenever time and data permit. More general indifference maps, such as the Stone-Geary and Constant

Elasticity of Substitution, are easy to estimate and to use in estimating a satisfactory measure of benefit, such as Hicks's price equivalent variation. Finally, we should be modest in making claims about the effects of government programs on the distribution of well-being since any satisfactory measure of benefit will depend on individual preferences, and any indifference map that is simple enough to use is likely to provide at best a rough approximation to such preferences.

Notes

1. See Olsen (1972, pp. 1096–99) and Olsen and Barton (1983, pp. 3–5) for a detailed discussion of the assumptions underlying this analysis.

2. Since this is an unsatisfactory model of intertemporal choice, we did estimate intertemporal indifference maps under a number of sets of assumptions. In some cases estimates of the structural parameters could not be recovered from estimates of the reduced form parameters; in other cases the estimates were implausible. Since we have limited confidence in the intertemporal indifference maps estimated and since using them to estimate benefits would be difficult, we did not pursue this matter further. See Olsen and Barton (1983, pp. 14–15 and 38–39) for a discussion of some attempts to estimate intertemporal indifference maps using the data underlying this study, and Hammond (1982) for a policy analysis in which such indifference maps are estimated and used to calculate benefits of several government housing programs.

3. Since market prices are assumed to be the same for similar families and the same with and without the programs, we can define units of output for families of each type such that both prices are 1. Therefore, a knowledge of the differences in prices facing different types of families is not necessary for the purposes of this paper.

4. The stratification was intended to increase the efficiency with which rental vacancy rates could be estimated. Housing units in existence in 1960 and located in census enumeration districts ranking in the top 5 percent in terms of the vacancy rate were placed in one stratum. Other housing units in existence in 1960 were placed in another. Units built more recently were put in strata according to their age. A description of the sample design can be obtained from the authors. The probabilities of selection were used in calculating means but not in estimating stochastic relationships. For a discussion of the latter, see Olsen and Barton, (1983, pp. 328–30).

5. No public housing units and few rent-controlled units are furnished. These controlled units are excluded from our analysis of the distribution of benefits.

6. Units in single-family structures, with eight or more rooms, or in several unusual structure types were deleted from the sample. Few public housing or rent-controlled units have these characteristics, and these deletions reduced the sample used to estimate the market rent equation by only 6 percent.

7. For 3 percent of the rent control sample, the Hicksian and Marshallian measures could not be calculated because predicted market rent is less than our estimate of subsistence housing expenditure. The mean annual difference is $266. In these cases we set $P_m^h Q_g^h = P_m^h \beta^h + 1$. For almost 2 percent of the rent control sample and 1 percent of the public housing sample, the reported subsidized rent exceeds reported income. The annual differences are $157 and $202, respectively. Even though benefit could be calculated in these cases, we set $Y = P_g^h Q_g^h + 1$. Such problems seem inevitable in working with data on individual households.

8. Olsen and Barton (1983, p. 325), using the same data but somewhat different methods for estimating indifference maps and predicting market rents, found essentially no difference between the mean benefits of similar black and white households and households with younger and older heads.

9. The results in table 5.8 also differ from Olsen's (1972, p. 1094) results based on data from the 1968 New York City Housing and Vacancy Survey, a different Marshallian demand curve, and a different equation for predicting market rent. Most notably, Olsen concluded that blacks received somewhat larger benefits than whites. The most likely explanation for this discrepancy is his failure to allow for racial differences in the coefficients of the market rent equation.

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Comment Robert Hutchens

Economists interested in distributional issues have for some time wrestled with the problem of measuring the value of in-kind transfers. In essence the problem is that we do not exactly like what we can measure, and we cannot exactly measure what we like. On the one hand, we can obtain reasonably accurate measures of the market value of in-kind transfers, but for purposes of looking at distributional questions such measures are not entirely satisfactory. On the other hand, we would like to measure the cash equivalent of the transfers, but when we try to do this we have little confidence in the accuracy of our results.

The paper by Edgar Olsen and Kathy York demonstrates the seriousness of this problem. Their work analyzes the distribution of benefits from two government programs—rent control and public housing—in New York City. For each person in their sample they obtain three different measures of the program benefit: market value, Hicks's cash equivalent, and Marshallian consumer surplus. Their purpose is to determine whether the three different measures yield different conclusions about the distributional consequences of the programs. This is a useful approach. If several distributional studies find that Hicksian and Marshallian measures yield about the same conclusions as market value measures, then our problem would be solved. We could rely on the more easily obtained market value measure and safely ignore the more sophisticated measures. Alternatively, if it is found that the three measures yield vastly different conclusions, then we will at least know that our problem is indeed a serious one.

The paper opens with a discussion of the mechanics of computing the different benefit measures. The authors confront three issues here. First,

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market rents are not observed for the households in subsidized (or controlled) units. Of course, without data on market rents the market value of the subsidy received by the household cannot be determined. Olsen and York resolve this by estimating a hedonic model of rents paid by households in unsubsidized units and then imputing rents to the subsidized units. In this paper then, the market value of the subsidy received by a household is a predicted quantity; it is equal to the predicted market rent minus actual rental payments. The second issue confronted by Olsen and York is lack of data on individual utility functions. Without knowledge of the shape of utility functions, the Hicksian and Marshallian measures cannot be computed. To resolve this the authors assume that the New Yorkers in their sample have a Stone-Geary utility function over two composite goods, housing and nonhousing. The parameters of the utility function may vary by race, family size, and whether or not the family lives in Manhattan. Although there were major difficulties in obtaining plausible empirical results for their utility function, the authors eventually settle on a set of parameters that in their view represents a reasonable approximation of the indifference map over the relevant choice set. The final mechanical issue involves calculating the Hicksian and Marshallian measures. Given information on the market value of the subsidy and the parameters of the utility function, this is a matter of inserting numbers into an appropriately specified mathematical formula.

When Olsen and York compute the three benefit measures for the families in their sample, they find rather striking differences in the resulting distributions. They first analyze means and the correlation coefficients. For public housing the three measures are highly correlated and yield similar mean benefits. For rent control, however, different results emerge. The means are substantially different, and the correlation coefficients are well below one. Next they regress the three different measures on family characteristics and find that each measure yields different regression coefficients. Finally, they analyze a Hicksian benefit measure that is based on a Cobb-Douglas rather than the Stone-Geary utility function. Once again distributional conclusions are sensitive to this change in specification.

We cannot then say that it makes no difference how in-kind benefits are measured. This work suggests that distributional conclusions can be quite sensitive to whether the in-kind benefits are measured at their market value, their Hicksian cash equivalent, or their Marshallian consumer surplus.

I will focus my comments on two aspects of the paper. The first concerns the empirical methods used in obtaining the three measures. The second concerns the distributional consequences of the different measures.

First, it is conceivable that the paper's conclusions are the result of inaccurate information and that in reality the market value measure is closely related to the Hicksian or Marshallian measure of the benefit. The empirical techniques employed in the paper rely on predicted market rents, predicted utility function parameters, and self-reported incomes. Even if one grants the assumption that all utility functions are Stone-Geary and that there are no other in-kind programs, reporting and prediction errors may cause the measured benefits to diverge significantly from the true benefits. Put another way, if the econometrician had all of the information that is available to the consumer, he may come to a different conclusion. This can be illustrated by considering the Hicks cash equivalent benefit. To compute a household's Hicks benefit the authors not only predict the parameters of the household's utility function, but also the size of the household's subsidy. They implicitly assume that errors in predicting the parameters of the utility function are uncorrelated with the subsidy. Suppose this is not true. In particular, suppose that people with tastes for housing that are stronger than the predicted tastes tend on average to obtain lower subsidies. This would seem plausible for rent control. If units with a large subsidy (a large discrepancy between market rents and controlled rents) are less adequately maintained, then people with strong tastes for housing may tend to avoid such units. In this case the estimated Hicks cash equivalent benefit would be biased as would the correlation between the Hicks benefit and the market value of the benefit. A similar story could be told for income reporting. If the people who tend to under report income also tend to live in units with large subsidies, then the Hicks benefit and the correlations computed here will be biased. My point is that it is conceivable that more accurate information on crucial variables or, alternatively, explicit modeling of the covariance structure of prediction errors could overturn the paper's results.

Such an argument can, however, be made for almost any empirical study and is not particularly compelling in this case. If in-kind transfers constrain the behavior of recipients, then a market value measure should diverge from a Hicksian cash equivalent measure. Given differences in income and tastes across a population, it would be surprising to observe a close relationship between the different measures. Although more accurate information on subsidies and utility function parameters could perhaps make the paper more convincing, the conclusion that the different measures have different distributional consequences is in my view quite reasonable.

This leads to the second point. Can anything more be said about the different distributional consequences of the different measures? Does knowledge of the distribution with in-kind benefits measured at their market value tell us anything about the distribution with in-kind benefits measured at their Hicksian cash equivalent? This paper is silent on such questions, and the authors may wish to pursue them in future research. Let me illustrate. Consider an in-kind transfer program that is income conditioned. It provides larger benefits to families with smaller cash incomes, yet does not affect the rank order of families in the income distribution. Suppose we wish to analyze inequality in the distribution of cash plus in-kind income in the population served by this program. For this purpose one might use either a market cost or cash equivalent measure of the in-kind benefits. How would the different measures affect an assessment of inequality in the distribution of cash plus in-kind income? It can be shown that under certain assumptions the market value measure leads to a more equal distribution of cash plus in-kind income than does the cash equivalent measure. That is, a market value measure will indicate the maximum equalizing effect of the in-kind transfer program. This is then a case where knowledge of the distribution based on market value measures gives us some information on the distribution based on cash equivalent measures.

This is, however, a theoretical result. It rests on assumptions like identical utility functions in the population and programs that do not affect the rank order of families in the income distribution. One would like to know whether the result holds in a world where such assumptions are often violated. Is it the case, for example, that a market cost measure of rent control subsidies makes rent control look more redistributive than a cash equivalent measure? Are other generalizations possible? We may find that a distribution based on the more accurate and easily obtained market value measure provides bounding information on the distribution based on cash equivalents. In a world with uncertainty about the shape of utility functions, it is likely that the best we can do is to put bounds on the distribution of cash equivalent benefits.

To conclude, I think Olsen and York have written a very useful paper. It deals nicely with very complicated issues; it points out how sensitive distributional conclusions are to the way in-kind benefits are measured. Finally, it raises fundamental questions about where we go from here.