

Impact Project

Impact Research Centre, The University of Melbourne,
153 Barry Street, Carlton, Victoria 3053 Australia.

Telephone: (03) 344 7417
Telex: AA 35185 UNIMEL
Facsimile: (03) 344 5104

(from overseas: 61 3 344 7417)
Telegrams: UNIMELB, Parkville
(from overseas: 61 3 344 5104)

INTERREGIONAL VARIATIONS IN THE BENEFITS AND COSTS OF PUBLIC HOUSING

by

Nisha Agrawal

*IMPACT Research Centre
University of Melbourne*

and

Industries Assistance Commission

General Paper No. G-89 Melbourne April 1989

The views expressed in this paper do not necessarily reflect
the opinions of the participating agencies, nor of
the Commonwealth Government.

ISSN 1031-9034

ISBN 0 642 10368 2

IMPACT is an economic and demographic research project which aims to improve the publicly accessible policy information system available to government, private and academic analysts. The Project is conducted by Commonwealth Government agencies in association with the University of Melbourne, La Trobe University, and the Australian National University.

ABSTRACT

Public housing programs provide subsidized shelter to approximately 300,000 families in Australia. These programs are administered by the States and vary considerably in their scale, purpose and impact. This paper provides the first estimates of the effects of the programs on the consumption patterns of participants in the various States. It also compares the interregional variations in the benefits and costs of these programs. The effects of public housing are compared with those of an alternative policy of equivalent-value unrestricted cash grants. All empirical results are based on unit record data from the 1981-82 Income and Housing Survey.

REFERENCES

- Adams, P.D., Ching-Fan Chung, and A.A. Powell (1988) "Australian Estimates of Working's Model Under Additive Preferences", *IMPACT Working Paper* No. O-61, August.
- Agrawal, Nisha (1988) "The Economic Effects of Public Housing in Australia", *Economic Record* (forthcoming).
- Bradbury, B., C. Rossiter and J. Vipond (1986) *Poverty, Before and After Housing*, Social Welfare Research Centre, University of New South Wales, Sydney.
- DeSalvo, J.S. (1971) "A Methodology for Evaluating Housing Programs", *Journal of Regional Science* 11, 173-185.
- DeSalvo, J.S. (1975) "Benefits and Costs of New York City's Middle Income Housing Program", *Journal of Political Economy* 83, 791-806.
- Flood, J. and J. Yates (1987) *Housing Subsidies Study*, AHRC Project No. 160, AGPS, Canberra.
- Hammond, C.M.H. (1987) *The Benefits of Subsidized Housing Programs: An Intertemporal Approach*, Cambridge University Press.
- Murray, M.P. (1975) "The Distribution of Tenant Benefits in Public Housing", *Econometrica* 43, 771-788.
- Olsen, E.O. (1972) "An Economic Analysis of Rent Control in New York City", *Journal of Political Economy* 80, 1081-1110.
- Olsen, E.O. and D.M. Barton (1983) "The Benefits and Costs of Public Housing in New York City", *Journal of Public Economics* 20, 299-332.
- Parkin, Andrew (1988) "Housing Policy", in Brian Gallagher (ed.) *Comparative State Policies*, Longman Cheshire.
- Social Welfare Policy Secretariat (1984) *Pensioner Fringe Benefits: Their Range, Cost and Values*, AGPS, Canberra.

CONTENTS

distribution of the costs and benefits of public housing across the Australian States.

The study finds that in 1981-82 the public housing programs differed dramatically in their effects across States. In all States except S.A., the programs typically resulted in an improvement in the housing of participants and also led to an increase in their consumption of other goods. In S.A., however, whilst the program led to a substantial increase in their consumption of other goods, it actually led to a minor decrease in their average consumption of housing. This result is contrary to the usually-stated goals of housing programs.

Participants in the public housing programs in all States received substantial benefits from these programs. However, in all cases, the costs of providing these benefits were even higher. These costs arose due to the distortion in the consumption patterns of beneficiaries caused by providing aid in kind rather than in cash. Thus, in all cases the benefits to the participants could be substantially increased by replacing public housing programs with cash grants. This policy might, however, reduce certain unmeasured benefits accruing to participants of public housing, such as those arising from improved security of tenure. In certain cases, i.e., for residents of N.S.W. and Queensland, it might also imply a tradeoff between increased benefits to participants and reduced benefits to society at large from the decline in the housing standards of the community.

I	INTRODUCTION	1
II	THEORETICAL FRAMEWORK	5
	Changes in Consumption Patterns	9
	Measuring Benefits	10
	Measuring Costs	13
	Comparing Alternative Program Effects	14
III	DATA AND METHODS OF PREDICTION AND ESTIMATION	15
	Data	15
	Predicting Market Rents for Public Housing Units	16
	Estimation of the Parameters of the Indifference Maps of Families in Public Housing	20
IV	EMPIRICAL RESULTS	23
	Average Effects of Public Housing Programs	23
	Interregional Variations in the Effects of Public Housing Programs	28
V	CONCLUSION	37
	REFERENCES	39

LIST OF TABLES

1.	Interregional Differences in Nature of Occupancy in 1981-82	3
2.	Predicted Market Rents for Public Housing Units in 1981-82	19
3.	Average Rent-Income Ratio for Different Types of Families Renting Privately in 1981-82	22
4.	Average Effects of Public Housing Programs in 1981-82	24
5.	Average Effects of Replacing Public Housing with Unrestricted Cash Grants in 1981-82	26
6.	Interregional Variations in the Effects of Public Housing Programs in 1981-82	29
7.	Two Sets of Estimates of the Average Rental Subsidies Provided by Various States to Public Housing Tenants in 1981-82	32
8.	Interregional Variations in the Effects of Replacing Public Housing with Unrestricted Cash Grants in 1981-82	34

LIST OF FIGURES

1.	The Effect of Public Housing and Cash Grants on Consumption Patterns	8
2.	A Comparison of the Effects of Public Housing and Cash Grants on Consumption Patterns of Participants in Different Regions	35

Finally, we come to the case of public tenants in S.A., represented by Point 3 in Figure 2. This case is unique in that the provision of public housing to this group (relative to the situation of no housing aid) leads to a *decrease* rather than an increase in the consumption of housing. In other words, the entire rental subsidy provided to tenants is being used to increase the consumption of other goods rather than of housing. This result is contrary to the often stated objective of housing policies, which is to improve the housing standards of the community, especially of its low income members. Thus, there is a strong case to be made for abolishing public housing in S.A. and replacing it with cash transfers. Since alone amongst all States, the program in S.A. causes a *deterioration* in housing standards, replacing it with cash grants is predicted to have the largest positive impact on the consumption of housing by its participants (relative to the impacts on participants in the other States).

V CONCLUSION

This study provides some initial estimates of interregional differences in the economic effects of public housing programs in Australia. It also reveals the need for collecting and disseminating improved data in order to obtain more reliable estimates than the ones provided. Because of data limitations, the results from this study are necessarily tentative and the reader has been forewarned to interpret them with care. However, the study does provide some valuable (albeit tentative) insights regarding the

both housing services and other goods. However, the programs distort the beneficiaries' consumption patterns by forcing them to consume too much of housing and too little of other goods, relative to their preferences. Hence, if given a cash grant instead of a rental subsidy, public tenants in these areas would, on average, reduce their consumption of housing and increase their consumption of other goods.

Point 2 in Figure 2 captures the qualitative effects of public housing on participants in Victoria and W.A. For these persons, as for tenants in N.S.W. and Queensland, public housing leads to an increase in the average consumption of both housing and other goods. However, in contrast to the programs in N.S.W. and Queensland, the programs in Victoria and W.A. do not provide enough housing. In other words, they distort the consumption patterns of beneficiaries in the opposite direction: public tenants in Victoria and W.A. are forced to consume too little of housing and too much of other goods relative to their preferences. Thus, if the rental subsidy programs in these areas were replaced by cash grants, the consumption of housing would go up and that of other goods would go down. This would lead to a more efficient allocation of resources. In the case of Victoria, where the existing program leads to a considerably greater distortion in consumption patterns than it does in W.A. (as reflected in a benefit-cost ratio of only 0.6 in Victoria as compared with one of 0.8 in W.A.), such a change in policy would be especially beneficial.

INTERREGIONAL VARIATIONS IN THE BENEFITS AND COSTS OF PUBLIC HOUSING

by

Nisha Agrawal*

I INTRODUCTION

Housing policy in Australia is conducted under a two-tier system, where the Commonwealth acts largely as a funding agency, and the States administer most of the housing programs. Historically, the Commonwealth funding conditions have tended to be so broad and flexible as to permit wide variations in their implementation. As a result, the Australian States have developed rather different housing policies, varying markedly in their scale, purpose and impact (Parkin (1988)).

These variations in housing policies matter a great deal. The cost of housing (usually a household's biggest single financial outlay), its location and its standard, determine much of our level of social and economic well-being. This is especially so for lower income households; housing costs, for example, are central to discussions about poverty (Bradbury, Rossiter and Vipond (1986)).

* I am grateful to Alan Powell for helpful comments on an earlier draft of this paper.

In this paper we investigate interregional variations in the benefits and costs of public housing. Public housing is one of the main forms of housing aid to low-income families in Australia. It provides subsidized shelter to approximately 300,000 families¹ through dwellings rented from a Housing Commission or other State Housing Authority. The major Commonwealth program of rental housing assistance flows through the State housing authorities under the periodically renegotiated terms of the Commonwealth State Housing Agreement (CSHA). Under this Agreement, funds are made available to the States to provide housing assistance within broad guidelines agreed between the Commonwealth and the States.

The level of direct public housing provision varies markedly between States. Over the years, S.A. has tended to have relatively larger public housing programs than other States. As Table 1 indicates, 7.4 per cent of the population of S.A. lived in public housing in 1981-82. In contrast, in Victoria, public tenants accounted for only 1.9 per cent of the State's population in that year. As Parkin (1988) points out, the public housing policies of the States differ even more than these aggregate figures could possibly reveal. Policies differ on the criterion for eligibility for public

¹ The ABS distinguishes the terms 'household', 'family', and 'income unit' from one another. In this study we use these terms loosely and interchangeably to mean an ABS income unit which can be of one of the following types: (1) married couple (with or without dependent children), (2) single parent, and (3) one person.

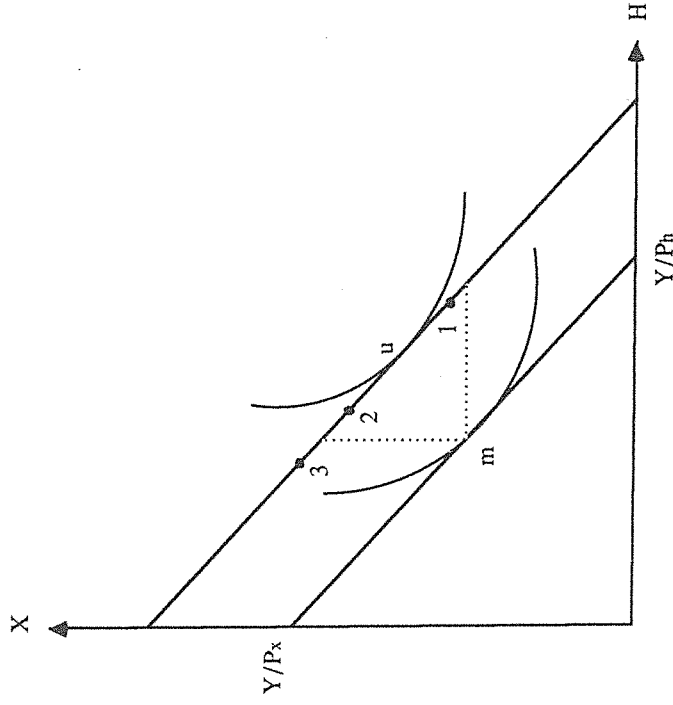


FIGURE 2
A Comparison of the Effects of Public Housing and
Cash Grants on Consumption Patterns of
Participants in Different Regions

TABLE 8

INTERREGIONAL VARIATIONS IN THE EFFECTS OF REPLACING PUBLIC HOUSING WITH UNRESTRICTED CASH GRANTS IN 1981-82

Variable	METROPOLITAN				
	N.S.W.	Victoria	Queensland.	S.A.	W.A.
(1) Mean annual market rents of public housing units	\$4068	\$2781	\$3384	\$2475	\$2695
(2) Mean annual housing expenditure of public housing families with cash grants in place of public housing	\$3367	\$3094	\$3111	\$2828	\$2818
(3) Percentage increase in aggregate consumption of housing services with cash grants in place of public housing (((2)-(1)) ÷ (1)) x 100	-17.2%	11.3%	-8.1%	14.3%	4.6%
(4) Mean annual expenditure on other goods by public housing families under the public housing programs	\$9335	\$8889	\$8774	\$8687	\$7593
(5) Mean annual expenditure on other goods by public housing families with cash grants in place of public housing	\$10035	\$8576	\$9047	\$8335	\$7470
(6) Percentage increase in aggregate consumption of other goods with cash grants in place of public housing (((5)-(4)) ÷ (4)) x 100	7.5%	-3.5%	3.1%	-4.1%	-1.6%

34

TABLE 1

INTERREGIONAL DIFFERENCES IN NATURE OF OCCUPANCY IN 1981-82

Nature of Occupancy	N.S.W.	Victoria	Queensland	S.A.	W.A.
1. Renting -- from Housing Commission	4.3	1.9	2.3	7.4	5.0
2. Renting -- from other landlord	16.5	15.4	17.3	11.6	16.6
3. Owner/occupier -- purchasing dwelling	24.5	26.5	22.5	26.5	27.1
4. Owner/occupier -- owns dwelling outright	27.2	29.1	30.5	27.4	23.0
5. Earning child (15+) living with parent(s)	12.7	11.6	12.5	12.0	11.0
6. Other*	14.8	15.6	14.9	15.1	17.3
Total	100.0	100.0	100.0	100.0	100.0

33

* This category consists of persons such as those living rent-free, renting from employer, or renting from another person in the same dwelling.

tenancy, on rents charged to public tenants in relation to income, on the design and location of public housing stock, on the openness of State Housing Authorities to tenant consultation, and so on. The analysis in this paper shows that these differences in housing policies can lead to substantial differences in the effects of public housing on tenants in the various States.

The analysis is undertaken using techniques developed by DeSalvo (1971, 1975), Olsen (1972), and Murray (1975). The methodology involves using an estimated indifference map to calculate the value of a government program to each direct beneficiary. It also enables us to examine the beneficiary's consumption pattern under alternative programs. This methodology has been previously applied to Australian data by the author to estimate the economic effects of public housing for Australia as a whole (see Agrawal (1988)). This paper extends the earlier study by disaggregating the nation-wide results by state, and examining the interregional differences in the effects of public housing programs.² As in the earlier study, the empirical results are based on unit record data from the 1981-82 Income and Housing Survey (IHS). The severe limitations of this database -- the only one available for a study such as this³ -- have been described in

² Due to data limitations described in Section III below, the study is restricted to a comparison of the effects of public housing programs on participants located in the metropolitan regions of the five mainland States only.

³ Note that the more recent databases, such as the 1984 Household Expenditure Survey and the 1986 Income Distribution Survey, are unsuitable for the present study since they do not identify public housing tenants.

Though N.S.W. led the other States in the level of benefits it provided to its public tenants, it did not rate as favourably if we examine the efficiency with which it delivered these benefits. Table 6 reveals that both Queensland and W.A. had higher average benefit-cost ratios for their public housing programs than did N.S.W. This implies that the housing policies in N.S.W. caused a greater distortion in the consumption patterns of their public housing tenants, and were therefore less efficient, than corresponding policies in either Queensland or W.A.

Table 8 reveals the nature of these distortions. It presents estimates of the effects of replacing housing aid in kind with equivalent aid in cash on the consumption patterns of beneficiaries. Again, the differences across the regions are quite stark. While such a policy would have led to a 17.2 per cent decrease in the consumption of housing in N.S.W., it would instead have led to a 14.3 per cent increase in S.A.

To examine the nature of these distortions in greater detail, we employ Figure 2. With the aid of Figure 2, we can reclassify the five States into three groups according to qualitative differences in the effects of housing policies on their beneficiaries' consumption patterns.

Point 1 in Figure 2 depicts the direction of the effects of public housing on recipients in N.S.W. and Queensland. In these regions, public housing leads to an increase in the consumption of

TABLE 7

TWO SETS OF ESTIMATES OF THE AVERAGE RENTAL
 SUBSIDIES PROVIDED BY VARIOUS STATES TO
 PUBLIC HOUSING TENANTS IN 1981-82

State	This study* (1)	Social Welfare Policy Secretariat (1984) (2)	Difference (2-1)/2
1 N.S.W.	\$1999	\$2351	15%
2 Victoria	\$1165	\$1360	14%
3 Queensland	\$1527	\$1849	17%
4 S.A.	\$1200	\$1262	5%
5 W.A.	\$1175	\$1270	7%

* Values for the State's metropolitan region only.

detail elsewhere (see Agrawal (1988). Here, the reader is cautioned that because of these limitations, the estimates obtained from this study are necessarily tentative and need to be interpreted with care.

The rest of the paper is set out as follows. The theoretical framework of the study is laid out in Section II. Section III contains a description of the data and of the methodology used to obtain the necessary values of variables. The empirical results are presented in Section IV. Finally, Section V concludes with a summary of the main results.

II THEORETICAL FRAMEWORK

In this study, a simple general equilibrium model is used to compare the allocation of resources in the presence of public housing with the long-run equilibrium allocations under two alternatives, namely, no public housing and unrestricted cash grants in place of public housing.⁴ To facilitate our study, we make the following assumptions:

- (1) there are two composite commodities called housing services and other goods;
- (2) the markets for these commodities are perfectly competitive and in long-run equilibrium;

⁴ This section draws heavily on Agrawal (1988).

- (3) the long-run supply curves in all markets are perfectly elastic;
- (4) information and transportation are costless.

These assumptions have two implications. First, that all consumers within an area face the same set of prices; and second, that this set would be the same under the three alternatives considered in this study. The second implication can be justified on the basis that less than four per cent of all families in Australia live in public housing, and that in the absence of the program these families would account for a smaller fraction of total consumption of housing services. Hence, even a relatively large increase in their consumption would have little effect on the total demand. We also assume that:

- (5) there is no difference in the quantities of other public services in the three cases and that the differences in taxes do not affect the tax payments of families in public housing;
- (6) public housing tenants receive no other subsidies in kind; and
- (7) occupants of public housing would choose the same job and work the same number of hours under all alternatives considered here, and are also unconcerned about the consumption of others.

It should be noted that these assumptions have been made to facilitate analysis and that some of the findings of our study could

previous studies assume that the value of the benefit to a family in public housing is equal to the value of the rental subsidy provided to that family, no comparable benefit estimates are available. However, a study by the Social Welfare Policy Secretariat (henceforth SWPS (1984)) does provide some roughly comparable estimates of the average rental subsidies provided by different States in 1981-82. For comparison, the two sets of estimates are presented in Table 7. In examining Table 7, it should be kept in mind that the SWPS estimates pertain to the entire area of each State whereas our estimates pertain to its metropolitan area only.

Table 7 indicates that our estimated values of the rental subsidies provided by each State are 5-17 per cent lower than corresponding values estimated by SWPS (1984). Since the value of the rental subsidy of a public dwelling is merely the difference between the value of the market rent of that dwelling (which has to be predicted) and the value of the rent collected for that dwelling (which can be obtained as data, say from the IHS), it would seem that as compared with the SWPS, we have underpredicted the market rental value of public dwellings in every State. It should be noted that the magnitudes of our underestimations are even greater than those suggested by the 5-17 per cent range in Table 7, because if we were to include the values of (presumably lower) ex-metropolitan rents in our study, our average values of rental subsidies would be even lower. Thus, this comparison with the SWPS study suggests that our estimates of the benefits and costs of public housing programs are somewhat biased in the downward direction.

Table 6 (continued)

Variable	N.S.W.	Victoria	Queensland	S.A.	W.A.
(7) Mean annual rent paid by public housing families	\$2069	\$1616	\$1857	\$1275	\$1520
(8) Percentage reduction in market price of housing services to public housing families [[2)-(7)] + (2)] x 100	49.1%	41.9%	45.1%	48.5%	43.6%
(9) Mean annual income of public housing families (5)+(7)	\$11404	\$10505	\$10631	\$9962	\$9113
(10) Mean annual increase in market value of goods consumed by these families [(2)+(5)] - [(1)+(4)]	\$1999	\$1165	\$1527	\$1200	\$1175
(11) Mean annual benefit to public housing families	\$1535	\$695	\$1215	\$839	\$947
(12) Mean annual subsidy (2) - (7)	\$1999	\$1165	\$1527	\$1200	\$1175
(13) Benefit - cost ratio (11) + (12)	0.77	0.60	0.80	0.70	0.81

depend critically on one or more of the assumptions. Assumptions (3), (6) and (7) are perhaps the most likely to be violated with unknown consequences for the present study.⁵

With the preceding assumptions, the situation of a public housing tenant under the three alternatives can be depicted in a two-dimensional diagram. Figure 1 contains several indifference curves of a family living in public housing. In the absence of the program, this family would have some income Y and could buy as much of each good as it could pay for at prices P_h and P_x . It would select some combination m of the two goods, spending $P_h H_m$ on housing and $P_x X_m$ on other goods. Under the public housing program, the family has been offered, and has accepted, a particular dwelling unit providing some quantity of housing service H_g . In order to occupy this unit, the family must pay a certain rent R_g (not labelled in the diagram). After paying this rent, the family has enough money left to spend $P_x X_g$ on other goods. It is important to realize that public housing does not change an eligible family's situation by rotating its budget line. In the two-good case, it effectively adds one point to a family's budget-space. Since the Public Housing Authority could offer a family a dwelling worse than it would otherwise occupy and charge a rent sufficiently low to induce the family to accept the offer, the basic assumptions of the

⁵ Research testing the validity of some of these assumptions is still in its infancy. As yet, no empirical estimates are available for Australia.

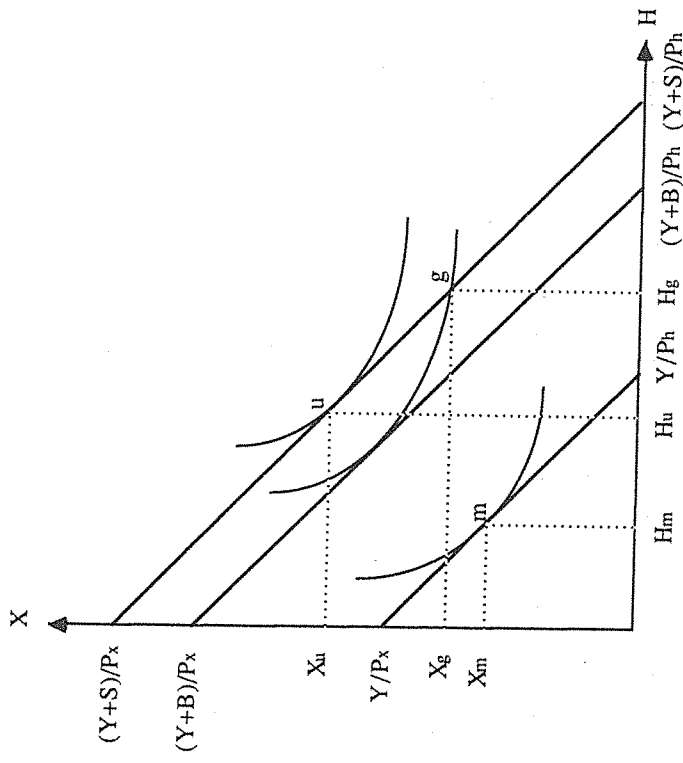


FIGURE 1

The Effects of Public Housing and Cash Grants on Consumption Patterns

TABLE 6 INTERREGIONAL VARIATIONS IN THE EFFECTS OF PUBLIC HOUSING PROGRAMS IN 1981-82

Variable	N.S.W.			Victoria			Queensland			S.A.			W.A.		
1) Mean annual housing expenditure of public housing families in absence of these programs	\$2782	\$2743	\$2663	\$2479	\$2442										
2) Mean annual market rent of their public housing units	\$4068	\$2781	\$3384	\$2475	\$2695										
3) Percentage increase in aggregate consumption of housing services by families	46.2%	1.4%	27.1%	-0.2%	10.4%										
	$\frac{[(2)-(1)] + (1)}{[(2)-(1)]} \times 100$														
4) Mean annual expenditure on other goods by public housing families in the absence of these programs	\$8622	\$7762	\$7968	\$7483	\$6671										
5) Mean annual expenditure on other goods by public housing families under these programs	\$9335	\$8889	\$8774	\$8687	\$7593										
6) Percentage increase in aggregate consumption of other goods by these families	8.3%	14.5%	10.1%	16.1%	13.8%										
	$\frac{[(5)-(4)] + (4)}{[(5)-(4)]} \times 100$														

... continued

Interregional Variations in the Effects of Public Housing Programs

Table 6 contains estimates of the effects of public housing programs disaggregated by the five regions distinguished in the study. Note that in the following discussions of the results, all references to a State always pertain to its metropolitan area only.

Table 6 reveals that in 1981-82, there were very striking interregional variations in the effects of public housing programs on the consumption patterns of beneficiaries. In N.S.W., for example, the provision of public housing led to a substantial increase (46.2 per cent) in the consumption of housing by public tenants, whereas in S.A. it instead led to a minor decrease (0.2 per cent). Though the consumption of other goods increased in all States, the magnitudes of the increases were quite different across regions, and ranged from 8.3 per cent in N.S.W. to a substantially higher 16.1 per cent in S.A.

There were also wide variations across regions in the levels of subsidies provided to tenant families and in the benefits the families derived from those subsidies. The average annual rental subsidy per family ranged from a low of \$1165 in Victoria to a high of \$1999 in N.S.W. The average annual benefits of public housing were also the lowest in Victoria (\$695) and the highest in N.S.W. (\$1535).

How do these estimates of benefits and costs compare with those obtained from previous studies? Unfortunately, since all

theory of consumer choice do not imply that public housing tenants occupy better housing than they would in the absence of the program. The only things that can be said a priori about the location of the point g are that it will be chosen only if it is above the indifference curve containing m , since the family has the alternative of renting in the private market, and it is below the horizontal line at height Y/P_x , since rents in public housing are positive.

If instead of public housing, the family depicted in Figure 1 were given an unrestricted cash grant, S , which would allow it to consume any combination of goods with the same market value as the combination consumed under the public housing program, then its income would be $(Y+S)$. It would then select the bundle u and consume H_u of housing and X_u of other goods. Although the family depicted in Figure 1 occupies better housing and consumes fewer other goods under the public housing program than with the cash grant, the opposite is also possible.

Changes in Consumption Patterns

In Figure 1, the public housing program leads to a change in the consumption of housing from H_m to H_g and a change in the consumption of other goods from X_m to X_g . Given our earlier

assumptions, these changes in quantities can be estimated by using information on changes in the expenditures on these goods.

To calculate the change in the consumption of housing services due to the program, we need to know the value of the market rent of each family's public housing unit and the family's expenditure on housing in the absence of the public housing program. Similarly, to calculate the change in the consumption of other goods due to the program, we need to know the amount each family in public housing spends on other goods and the family's expenditure on other goods in the absence of the program.

Since all income is allocated to either housing or other goods (which include savings), the expenditure on other goods by a family can be calculated given data on the family's income and the rent it pays for its dwelling. These data are available from the 1981-82 IHS. No data are available for the remaining values required: the market rent of the public housing unit and the family's expenditure on housing and other goods in the absence of the program. We predict the values of these variables. The methodology for making the predictions is discussed in Section III.

Measuring Benefits

In Figure 1, there is some unrestricted cash grant *B* which, if given to the family in place of its eligibility for public housing, would leave the family as well off as it is with public

relative to their preferences. In other words, of the \$1564 subsidy they received from public housing, tenants were forced to spend 42 per cent (or \$659) of this subsidy on housing and had only 58 per cent (or \$905) left to spend on other goods. Instead, if given a cash grant of equivalent value to the housing subsidy, they would have chosen to spend only 24 per cent on housing (see Table 3) and the remaining 76 per cent on other goods. This would have led, on average, to a 5.9 per cent decrease in the consumption of housing and a 2.2 per cent increase in the consumption of other goods.

These distortions lead to the substantial difference (\$398) between the mean benefit of housing programs to participant families (\$1166) and the market value of the subsidy provided to them (\$1564). They are responsible for the value of the benefit-cost ratio of public housing programs being only 0.75 instead of 1.0. Our analysis indicates that removing these distortions by replacing the public housing programs with unrestricted cash grants would increase the aggregate benefit of housing programs to these families by 34 per cent. However, it should be pointed out that this comparison does not take into account certain benefits, such as those arising from increased security of tenure, that accrue to public housing tenants. It also does not take into account the external benefits that might accrue to society as a whole from the improved housing of its members under the public housing programs.

TABLE 5

AVERAGE EFFECTS OF REPLACING PUBLIC HOUSING WITH
UNRESTRICTED CASH GRANTS IN 1981-82

Variable	Estimate*
(1) Mean annual market rents of public housing units	\$33322
(2) Mean annual housing expenditure of public housing families with cash grants in place of public housing	\$3126
(3) Percentage increase in aggregate consumption of housing services with cash grants in place of public housing $\frac{[(2)-(1)]}{(1)} \times 100$	-5.9%
(4) Mean annual expenditure on other goods by public housing families under the public housing programs	\$88660
(5) Mean annual expenditure on other goods by public housing families with cash grants in place of public housing	\$9056
(6) Percentage increase in aggregate consumption of other goods with cash grants in place of public housing $\frac{[(5)-(4)]}{(4)} \times 100$	2.2%

* Average for the metropolitan areas of the five mainland States.

housing. This is the concept adopted in this study of the benefit of the program to the family, and is the Hicksian price-equivalent variation measure. Obviously, the benefit of the program to the family depends on its preferences as well as its income and consumption pattern with the program. The observed consumption patterns of households under public housing programs, however, provide little information about their preferences since these programs typically confront households with one point outside their original budget space. As a result, the preferences of similar households not in public housing are estimated and imputed to these families. The benefits of the program can then be calculated as follows. We assume that the k th family has preferences which can be presented by a Cobb-Douglas utility function:

$$U_k = (H_k)^{\alpha_k} (X_k)^{(1-\alpha_k)} \quad (1)$$

where α_k is a parameter that can be different for different families. We selected the Cobb-Douglas functional form because recent econometric estimates by Adams, Chung and Powell (1988) indicate that this form might best represent current consumer preferences between housing services and other goods in Australia. Their study, based on Australian time-series data, reveals that while the exact value of the elasticity of substitution between housing services and other goods is difficult to determine, this magnitude is estimated to be very close to unity.

By maximizing U_k subject to the following budget constraint for a family living in area j :

$$Y_k = P_{h,j} H_k + P_{x,j} X_k \quad (2)$$

one may obtain the individual demand functions for H_k and X_k :

$$H_k = \alpha_k Y_k / P_{h,j} \quad (3)$$

$$X_k = (1 - \alpha_k) Y_k / P_{x,j} \quad (4)$$

If one substitutes these demand expressions for H_k and X_k into the utility function (1), one gets the expression for the maximum utility U_{k*} , obtainable at the given income and prices (i.e., the indirect utility function):

$$U_{k*} = [\alpha_k Y_k / P_{h,j}]^{\alpha_k} [(1 - \alpha_k) Y_k / P_{x,j}]^{(1 - \alpha_k)} \quad (5)$$

Similarly, the utility U_{kg} derived by the family from the consumption bundle $(H_{k,g}, X_{k,g})$ consumed under the program, can be expressed as:

$$U_{kg} = (H_{k,g})^{\alpha_k} (X_{k,g})^{(1 - \alpha_k)} \quad (6)$$

such a measure, as is done in this study, a great deal of estimation and imputation is required. As a result, not many alternative estimates are available against which we can check the reliability of those calculated in this study.

One exception is the estimate provided by Flood and Yates (1987). They calculated that, for Australia as a whole, the average annual subsidy-equivalent of public housing outlays in 1984-85 was about \$1500-\$1800 per occupied public dwelling. Thus, our estimate of an average annual subsidy of \$1564 per family in public housing in 1981-82, though not strictly comparable to theirs because of the differences in the timing and the scope of the two studies, lies within their range of estimates.

The benefits of the programs to the public housing families were found to be substantial, especially relative to their incomes. From their viewpoint, public housing was equivalent to a 11.0 per cent increase (of \$1166) in income. However, although the benefits to tenants were large relative to their incomes, they were small compared with the cost to society of providing these benefits. Even if we ignore other costs, such as the administrative ones, there is still a cost involved which is attributable to 'distortions' in the consumption patterns of public housing tenants. These distortions are revealed in Table 5, which presents the estimated effects of replacing each beneficiary's public housing subsidy by an equivalent-value unrestricted cash grant. The Table shows that, on average, public housing programs forced participants to consume too much of housing and too little of other goods,

AVERAGE EFFECTS OF PUBLIC HOUSING PROGRAMS
IN 1981-82

Variable	Estimate*
(1) Mean annual housing expenditure of public housing families in absence of these programs	\$26663
(2) Mean annual market rent of their public housing units	\$33323
(3) Percentage increase in aggregate consumption of housing services by families [[(2) - (1)] + (1)] x 100	24.7%
(4) Mean annual expenditure on other goods by public housing families in the absence of these programs	\$7955
(5) Mean annual expenditure on other goods by public housing families under these programs	\$8860
(6) Percentage increase in aggregate consumption of other goods by these families [[(5) - (4)] + (4)] x 100	11.4%
(7) Mean annual rent paid by public housing families	\$1757
(8) Percentage reduction in market price of housing services to public housing families [[(2) - (7)] + (2)] x 100	47.1%
(9) Mean annual income of public housing families (5)+(7)	\$10617
(10) Mean annual increase in market value of goods consumed by these families [(2)+(5)] - [(1)+(4)]	\$1564
(11) Mean annual benefit to public housing families	\$1166
(12) Mean annual subsidy (2) - (7)	\$1564
(13) Benefit - cost ratio (11) + (12)	0.75

* Average for the metropolitan areas of the five mainland States.

Let YB_k denote the income level necessary to place the individual purchasing goods at market prices at the same level of utility as he/she would obtain by consuming $H_{k,g}$ and $X_{k,g}$ under the public housing program. To obtain the value of YB_k that would satisfy this requirement, we only need to substitute Y_k in expression (5) by YB_k , equate the resulting expression to expression (6), and solve that equation for YB_k :

$$YB_k = [P_{h,j} H_{k,g}/\alpha_k]^{\alpha_k} [P_{x,j} X_{k,g}/(1-\alpha_k)]^{(1-\alpha_k)} \quad (7)$$

This level of income is $(Y + B)$ in Figure 1. A family's initial income, Y_k , may be subtracted from the expression for YB_k to yield an expression for the family's net benefit, B_k (denoted benefit, hereafter) under the public housing program:

$$B_k = YB_k - Y_k \quad (8)$$

Measuring Costs

To provide public housing tenants with benefits, society must bear a cost. The cost incurred is equal to the excess of the cost of providing public housing units over the rent collected from public housing tenants. This cost can be separated into the direct subsidy (S in Figure 1), the administrative cost, and the marginal welfare cost of raising funds with distortive taxes. In addition, since

some units in the public housing program were directly constructed by the housing authority (rather than purchased from the private market) using subsidized funds available from the Commonwealth government, there may be some additional costs due to such production inefficiency as may occur with subsidized construction programs.⁶

In this paper, we are able to provide an estimate of the direct cost, *S*, only. The method used to estimate this cost has been adopted earlier in the Australian context by Flood and Yates (1987) and described by them as the service flow method. Using this method, the direct cost is measured as the difference between the annual cost of the flow of housing services provided to public housing tenants and the actual rent paid by these tenants. For convenience, the private rental sector is taken as a benchmark, so that costs of occupying public dwellings are compared with market rents.

Comparing Alternative Program Effects

If the family depicted in Figure 1 were given an unrestricted cash grant, *S*, equivalent in value to the difference between the market value of the combination consumed under the public housing program and the family's income, then its income

⁶ For example, Olsen and Barton (1983) estimated that in the U.S. it cost between \$1.10 and \$1.14 to produce a dollar's worth of housing services with public housing due to the production inefficiencies associated with construction subsidies.

IV EMPIRICAL RESULTS

The methodology and data described in previous sections are used to estimate the average effects of the public housing programs on participants' consumption patterns; the average costs of the programs; the average benefits to the participants; and the distribution of these benefits and costs across participants located in the various regions.

Average Effects of Public Housing Programs

Table 4 shows that, on average, public housing families located in the metropolitan regions of the five mainland States occupied substantially better housing and also consumed significantly more of other goods than they would have in the absence of the programs. According to our estimates, these housing programs led to a 24.7 per cent increase in the consumption of housing and to a 11.4 per cent increase in the consumption of other goods. Further, they reduced the average net price of housing for participants of the programs by 47.1 per cent, thereby yielding an average annual subsidy of \$1564 per tenant family.

How realistic is this figure for the average annual subsidy-equivalent of public housing? Unfortunately, this is difficult to answer. As pointed out by Flood and Yates (1987), government records only provide a measure of the expenditures on the aggregate stock of public housing in a given year, not of the market value of the flow of housing services provided in that year. To obtain

TABLE 3

AVERAGE RENT-INCOME RATIO FOR DIFFERENT TYPES OF FAMILIES
RENTING PRIVATELY IN 1981-82

Type of Family	Average Rent-Income Ratio*
Married couple, husband under 65 years of age, with-	
(1) no dependent children	.18
(2) one dependent child	.21
(3) two dependent children	.21
(4) three or more dependent children	.22
Married couple, husband aged 65 years or more, with-	
(5) no dependent children	.37
One parent, with-	
(6) one dependent child	.36
(7) two or more dependent children	.37
One person-	
(8) aged 15-64 years	.25
(9) aged 65 years or more	.36
Total (for all families)	.24

* Average for families located in the metropolitan areas of the five mainland States.

would be $(Y + S)$ in the figure. The k th family's demand equations (3) and (4) can be used to predict consumption patterns and benefits under this alternative. This can be done by simply replacing Y by $(Y + S)$ in equations (3) and (4).

III DATA AND METHODS OF PREDICTION AND ESTIMATION

Data

All empirical results of this paper are based on unit record data collected during the 1981-82 IHS by the Australian Bureau of Statistics (ABS). The income measure is total pre-tax income of an income unit (consisting of earned income plus transfer payments received in cash).

To examine the differences in the effects of public housing programs across regions, we distinguish families according to their area of residence. Each family identified in the IHS is located in one of the following twelve areas: a metropolitan and ex-metropolitan area for each of the five mainland states; the state of Tasmania; and the Northern Territory (N.T.) and the Australian Capital Territory (A.C.T.) combined. This study is based only on a selection of these regions. Tasmania has been excluded because its metropolitan and ex-metropolitan areas have not been separately identified in the Survey, thus making it difficult to obtain reasonable estimates of market rents for its public dwellings as required. The Territories were excluded because the data for this category are an aggregation of data for the two very dissimilar regions of the A.C.T.

and the N.T., and thus no meaningful policy conclusions could be derived for this combined category. Finally, the ex-metropolitan regions of the mainland states have been excluded because of the constraints imposed by the small sizes of the samples for these areas. Hence, the study is limited to a comparison of the variations in the effects of public housing programs across tenants located in the metropolitan regions of the five mainland states. These tenants account for two-thirds of all public tenants in Australia.

Predicting Market Rents for Public Housing Units

To predict the market rent of public housing units, we estimate the rent for a particular type of dwelling in the private market and then impute this value to a similar public dwelling. In the studies evaluating housing programs in the U.S., this is done typically by regressing market rent on a host of housing characteristics. For example, Hammond (1987) estimated the relationship between market rent and a number of housing characteristics including: age of structure; number of rooms; number of bedrooms; number of bathrooms; condition of unit; presence and type of airconditioning (central or other); type of stove (electric or gas); type of heating (central or other); presence of electrical outlets in each room; presence of elevator; number of flats in building; number of floors in building; type of neighbourhood; geographical region (South, West, etc.); area of location (metropolitan, rural, etc.). No such detailed data are available as yet in Australia. Apart from identifying the geographical location of a dwelling, the IHS provides information on only two

Since we have assumed that each family has a Cobb-Douglas indifference map, the only parameter value required is the rent-income ratio of the family. This information is available for the private renters in our sample. We estimated the value of the parameter according to family type. Families are divided into categories defined in terms of family size and the age and marital status of the household head. It is assumed that all families of the same type in public housing have the same rent-income ratio α . The value of α is determined as the mean value of the rent-income ratio for a particular type of family renting from the private market. It is then imputed to all families of this type that rent from the State Housing Authorities.⁷

Table 3 contains estimates of the rent-income ratio for the 9 types of families identified in this study. It reveals that this ratio varies considerably among different type of families. On average, single parents and older persons spend significantly higher proportions of their income on housing. The numbers reported in Table 3 are used to estimate the benefit accruing to each public housing family in our sample. They are also used to estimate the changes in the family's consumption patterns under alternative housing programs.

⁷ In making these calculations, we excluded from our sample a relatively small number of outlying observations for whom the rent-income ratios were greater than one.

the bias in this study is, however, unclear. For example, it has been suggested that, on average, public housing projects are located in worse neighbourhoods. If this argument is correct, it would suggest that we have overestimated the market rents of public housing units. On the other hand, Table 2 reveals that, initially at least, we underpredicted market rents for 14 of the 26 categories of dwellings. This would seem to indicate a bias in the opposite direction. Evidence presented in Section IV below further indicates that even our upwardly adjusted market rents have possibly underestimated the 'true' market rental values of public housing units.

Estimation of the Parameters of the Indifference Maps of Families in Public Housing

Individualized estimates of the parameters of the indifference maps had to be obtained to calculate the individualized benefits from the public housing programs for the families in our sample. As stated earlier, it is impossible to obtain this information directly for these tenants unless one has data on their pre-program consumption patterns. These data, however, were not available from the IHS. An alternative is to assume that the preferences of private renters currently on the waiting list for public housing are the same as those of existing public housing tenants, and to determine the preferences of the former and impute them to the latter. Data limitations, however, prevented us from doing this. Instead, we have assumed that the preferences of public housing tenants were the same as those of all private renters.

other characteristics: the number of bedrooms and the type of dwelling. Hence, for each region, we predicted market rents based on these characteristics alone.

The IHS classifies dwellings into one of the following six categories on the basis of its number of bedrooms: a bed-sitter flat, or a one to five-or-more bedroomed unit. Because the size of our sample is fairly small, we needed to aggregate these into the following three categories: one bedroomed (including bed-sitter flats), two bedroomed, and three-or-more bedroomed units.

Each dwelling can also be classified into one of the following six types of structures: a separate house; a low-rise flat; a semi-detached house; a high-rise flat; a mobile or improvised dwelling; or, a dwelling and non-dwelling combined. We excluded from our study dwellings belonging to the last two categories. The remaining four categories, we regrouped into the following two: houses and flats. Again, this was necessitated by our small sample size.

We calculated the average weekly rent paid by tenants renting from the private market in each of our five regions for each of the 6 types of dwellings categorized above (number of bedrooms (3) x type of dwelling (2)), and imputed these to dwellings rented from the relevant State Housing Authority. We found that for some of these categories, the predicted rent was too low, that is, it was lower than the actual rent paid by a public housing tenant for that type of unit. This implied, unrealistically, that some public housing

tenants renting that type of dwelling were receiving negative subsidies. Thus, rents for these categories had to be adjusted upwards. Since data from an alternative source were unavailable to aid in this adjustment process, we had to rely on the IHS data.

Rents that had been underpredicted were adjusted upwards until the figures implied that each public housing tenant was receiving at least one dollar in subsidy. In other words, for each type of dwelling, rents were adjusted upwards by the maximum negative subsidy being received by a public tenant of that type of dwelling. This required adjustments ranging from \$1.82 per week for a two-bedroom house in metropolitan W.A., to \$24.74 per week for a three-bedroomed flat in the same area. It is these adjusted rents that are reported in Table 2. Note that the results of this study will tend to be quite sensitive to the predicted market rents of public housing units. No sensitivity analysis has, however, been undertaken in this study.

In making our predictions, we have assumed that the market rent of public and private rental units are the same -- as long as the three characteristics of the units are the same. This assumption is likely to be violated since the list of characteristics included in the imputation is extremely limited and public housing units which are the same as private rental units with respect to these characteristics could be quite different in other respects. An overestimation (underestimation) of the market rents of public housing units is likely to lead to a bias towards an overestimation (underestimation) of the benefits of the programs. The direction of

TABLE 2
PREDICTED MARKET RENTS FOR PUBLIC HOUSING UNITS IN 1981-82

Type of Dwelling		Average Weekly Rent (dollars) in Metropolitan				
		N.S.W.	Victoria	Queensland	S.A.	W.A.
House						
(1)	with 1 bedroom	47.72	40.05	35.81	32.90	34.36
(2)	with 2 bedrooms	80.00*	52.33	61.00*	40.00*	46.00*
(3)	with 3 or more bedrooms	85.00*	66.00*	71.00*	53.00*	61.00*
Flat						
(4)	with 1 bedroom	63.23	39.67	36.91	34.35	40.02
(5)	with 2 bedrooms	67.00*	55.00*	-	-	37.04
(6)	with 3 or more bedrooms	80.00*	47.00*	-	-	55.00*

* For these categories, the average values for market rents obtained from the data have been adjusted upwards as described in the text.